UNITED STATES
SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2019

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934 FOR THE TRANSITION PERIOD FROM TO**

Commission File Number 001-38324

Casa Systems, Inc.

(Exact name of Registrant as specified in its Charter)

Delaware **(State or other jurisdiction of incorporation or organization)**	**75-3108867** **(I.R.S. Employer Identification No.)**
100 Old River Road **Andover, Massachusetts** **(Address of principal executive offices)**	**01810** **(Zip Code)**

Registrant's telephone number, including area code: (978) 688-6706

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol	Name of each exchange on which registered
Common Stock, $0.001 par value per share	CASA	The Nasdaq Stock Market LLC

Securities registered pursuant to Section 12(g) of the Act:

None
(Title of class)

Indicate by check mark if the Registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. YES ☐ NO ☒

Indicate by check mark if the Registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act. YES ☐ NO ☒

Indicate by check mark whether the Registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. YES ☒ NO ☐

Indicate by check mark whether the Registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the Registrant was required to submit such files). YES ☒ NO ☐

Indicate by check mark whether the Registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☐	Accelerated filer	☒
Non-accelerated filer	☐	Small reporting company	☐
		Emerging growth company	☒

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the Registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). YES ☐ NO ☒

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the Registrant, based on the closing price of the shares of Common Stock on The Nasdaq Global Select Market on June 28, 2019 was approximately $203.5 million.

The number of shares of Registrant's Common Stock outstanding as of January 31, 2020 was 84,136,613.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Registrant's definitive proxy statement relating to its 2020 Annual Stockholders' Meeting expected to be filed pursuant to Regulation 14A within 120 days after the Registrant's fiscal year end of December 31, 2019 are incorporated by reference into Part III of this Annual Report on Form 10-K.

Table of Contents

		Page
PART I		
Item 1.	Business	4
Item 1A.	Risk Factors	17
Item 1B.	Unresolved Staff Comments	41
Item 2.	Properties	41
Item 3.	Legal Proceedings	41
Item 4.	Mine Safety Disclosures	42
PART II		
Item 5.	Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities	43
Item 6.	Selected Financial Data	44
Item 7.	Management's Discussion and Analysis of Financial Condition and Results of Operations	47
Item 7A.	Quantitative and Qualitative Disclosures About Market Risk	69
Item 8.	Financial Statements and Supplementary Data	71
Item 9.	Changes in and Disagreements With Accountants on Accounting and Financial Disclosure	114
Item 9A.	Controls and Procedures	115
Item 9B.	Other Information	115
PART III		
Item 10.	Directors, Executive Officers and Corporate Governance	116
Item 11.	Executive Compensation	116
Item 12.	Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters	116
Item 13.	Certain Relationships and Related Transactions, and Director Independence	116
Item 14.	Principal Accounting Fees and Services	116
PART IV		
Item 15.	Exhibits, Financial Statement Schedules	117
Item 16.	Form 10-K Summary	119

Cautionary Note Regarding Forward-Looking Statements

This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. All statements other than statements of historical fact contained in this Annual Report on Form 10-K, including statements regarding our future results of operations and financial position, business strategy and plans and objectives of management for future operations, are forward-looking statements. These statements involve known and unknown risks, uncertainties and other important factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements.

In some cases, you can identify forward-looking statements by terms such as "may," "might," "should," "expects," "plans," "anticipates," "would," "could," "intends," "target," "projects," "contemplates," "believes," "estimates," "predicts," "potential" or "continue" or the negative of these terms or other similar expressions. The forward-looking statements in this Annual Report on Form 10-K are only predictions. We have based these forward-looking statements largely on our current expectations and projections about future events and financial trends that we believe may affect our business, financial condition and results of operations. These forward-looking statements speak only as of the date of this Annual Report on Form 10-K and are subject to a number of risks, uncertainties and assumptions described in the "Risk Factors" section and elsewhere in this Annual Report on Form 10-K. Because forward-looking statements are inherently subject to risks and uncertainties, some of which cannot be predicted or quantified, you should not rely on these forward-looking statements as predictions of future events. The events and circumstances reflected in our forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements. Some of the key factors that could cause actual results to differ from our expectations include:

- our ability to integrate and generate potential synergies from our acquisition of NetComm Wireless Limited;
- our ability to anticipate technological shifts;
- our ability to generate positive returns on our research and development;
- changes in the rate of broadband service providers' deployment of, and investment in, ultra-broadband network capabilities;
- the lack of predictability of revenue due to lengthy sales cycles and the volatility in capital expenditure budgets of broadband service providers;
- our ability to maintain and expand gross profit and net income;
- the sufficiency of our cash resources and needs for additional financing;
- our ability to further penetrate our existing customer base and obtain new customers;
- changes in our pricing policies, whether initiated by us or as a result of competition;
- the amount and timing of operating costs and capital expenditures related to the operation and expansion of our business;
- the actual or rumored timing and success of new product and service introductions by us or our competitors or any other change in the competitive landscape of our industry, including consolidation among our competitors or customers;
- our ability to successfully expand our business domestically and internationally;
- insolvency or credit difficulties confronting our customers, which could adversely affect their ability to purchase or pay for our products and services, or confronting our key suppliers, which could disrupt our supply chain;
- our inability to fulfill our customers' orders due to supply chain delays, access to key commodities or technologies or events that impact our manufacturers or their suppliers;
- future accounting pronouncements or changes in our accounting policies;
- stock-based compensation expense;
- the cost and possible outcomes of any potential litigation matters;

- our overall effective tax rate, including impacts caused by the relative proportion of foreign to U.S. income, the amount and timing of certain employee stock-based compensation transactions, changes in the valuation of our deferred tax assets and any new legislation or regulatory developments;
- increases or decreases in our expenses caused by fluctuations in foreign currency exchange rates;
- general economic conditions, both domestically and in foreign markets;
- the costs and outcomes of legal actions and proceedings;
- our ability to obtain and maintain intellectual property protection for our products; and
- our use of proceeds from our initial public offering.

Except as required by applicable law, we do not plan to publicly update or revise any forward-looking statements contained herein, whether as a result of any new information, future events or otherwise.

PART I

Item 1. Business.

Overview

We offer end-to-end solutions for next-generation centralized, distributed and virtualized architectures for cable broadband, fixed-line broadband and wireless networks. Our products enable service provider customers to cost-effectively deliver broadband services to their consumer and enterprise customers. Our converged, software-centric network core products help our customers to dynamically increase network speed, add needed bandwidth capacity, reduce latency, and deliver new services to their subscribers, all with reduced network complexity and lower total cost of ownership than comparable hardware-based, siloed network infrastructure broadband solutions. Our LTE and 5G indoor and outdoor radio products and access device management software help our customers address the need to densify their networks as they meet the need for growing subscriber demand for downstream and upstream bandwidth.

We have a history of innovation and being the first to market with novel products at each generational shift in network technology. For example:

- We believe we pioneered the use of a software-centric approach to leverage the programmability of field programmable gate arrays, or FPGAs, and general-purpose processors for use in the cable industry.
- In the cable market we believe we were the first to provide a solution enabling cable service providers to deliver Internet Protocol, or IP, voice, digital video and data over a single port, which enables cable service providers to deliver multi-gigabit speeds to their subscribers.
- In the wireless market, we introduced our Apex Pebble, a residential femtocell, which helps to provide a faster and more reliable data experience for mobile users. We believe the device offers the innovation of an untethered Wi-Fi backhaul option in addition to the standard Ethernet connection that is required in traditional femtocells. This allows a user to place the device anywhere in his or her home where Wi-Fi is available without running or connecting additional cables to a home router.
- Our Apex Strand-mount Microcell provides wireless service providers with an additional installation option using an integrated DOCSIS modem, which provides input power and backhaul/fronthaul connectivity and helps to resolve the siting, power, and backhaul issues that accompany large-scale small cell deployments.
- Our Apex 5G Mini Macro is a high-powered 4T4R (4 transmit/4 receive) radio designed to meet coverage and capacity challenges in dense urban and suburban areas where large numbers of 5G NR, a new radio access technology developed by the 3rd Generation Partnership Project, or 3GPP, for the 5G mobile network, and LTE devices are present. Unlike macro-radio solutions mounted on traditional tower sites, the Apex 5G Mini Macro can be deployed cost-effectively at the street level, such as on utility poles, roof tops and lamp posts, thereby reducing costs associated with a traditional macro site.
- We believe that we are the first to deliver a virtualized Broadband Network Gateway, or BNG, that enables a multi-tenant solution at the network edge using low-cost, white box merchant silicon hardware.

We offer scalable solutions that can meet the evolving bandwidth needs of our customers and their subscribers. Our first installation in a service provider's network frequently involves deploying our broadband products in only a portion of the provider's network and with only a fraction of the capacity of our products enabled at the time of initial installation. Over time, our customers have generally expanded the use of our solutions to other areas of their networks to increase network capacity. Capacity expansions are accomplished either by deploying additional systems, line cards, or the sale of additional channels through the use of software. Sales of software-based capacity expansions generate higher gross margins than hardware-based deployments.

Our solutions are commercially deployed in over 70 countries by more than 475 customers, including regional service providers as well as some of the world's largest Tier 1 broadband service providers, serving millions of subscribers. Our principal customers include Charter/Time Warner Cable, Rogers, Videotron, Sprint, Verizon, AT&T, Bell Canada, Cable One and Mediacom in North America; Televisa/IZZI Mexico, Megacable Mexico, Cablevision Argentina, Net Brazil, America Móvil and Claro Colombia in Latin America; Liberty Global, Vodafone and DNA Oyj in Europe; and NBN, SCSK Corporation, Jupiter Communications, Beijing Gehua CATV Networks and China Mobile in Asia-Pacific.

Our revenue for the years ended December 31, 2019, 2018 and 2017 was $282.3 million, $297.1 million and $351.6 million, respectively. Our net (loss) income for the years ended December 31, 2019, 2018 and 2017 was ($48.2) million, $73.0 million and $88.5 million, respectively. As of December 31, 2019, 2018 and 2017, our total assets were $444.3 million, $474.6 million and $469.7 million, respectively.

Industry Background

Annual Increase in Demand for Downstream and Upstream Bandwidth

Demand for both downstream and upstream bandwidth from consumers and enterprises has grown substantially and is expected to continue to increase. Key drivers of increased bandwidth demand include:

- more users with more connected devices and applications;
- more time spent online by users;
- increased use of bandwidth-intensive streaming media services, such as Amazon Prime Video, Netflix, Hulu and YouTube; cloud applications, such as iCloud, Office 365/OneDrive, and Dropbox; and augmented and virtual reality applications;
- Internet of Things, or IoT, solutions, as already seen in connected homes, business and industries; connected devices such as Amazon Alexa or Google Assistant; machine-to-machine connectivity; car connectivity and smart cities;
- growth in online, interactive gaming;
- backhaul requirements of wireless service providers, including new entrants into the wireless space such as multiple system operators, or MSOs;
- the rise of data consumption by enterprises with strict latency requirements on mission-critical and public safety-related applications; and
- increasing shift away from asymmetric broadband services towards symmetrical, in part driven by the need for greater uplink bandwidth from home or office to the cloud.

Increasing Convergence of Service Offerings

Convergence is allowing consumers and enterprises to enjoy increased choice among broadband service providers. So-called “triple-play” and “quadruple-play” service offerings are being provided by cable service providers such as Charter and Comcast and diversified telecommunications companies such as AT&T and Verizon. Mobile-only network operators such as Sprint and T-Mobile are offering higher bandwidth wireless connectivity and, as a result, cable and fixed communications service providers are experiencing increased “cord cutting” as subscribers opt for mobile only voice and broadband services. To respond to increased competition, broadband service providers across all access technologies are facing increasing pressure to maintain high bandwidth availability over multiple converged access technologies, while developing differentiated service offerings with higher levels of performance at lower cost to consumers and enterprises.

Network Infrastructure Convergence for Greater Service Agility and Lower Total Cost of Ownership

Historically, broadband service providers have deployed hardware-centric, separate systems within their fixed broadband networks for video and data services and have operated discrete and siloed networks for fixed, Wi-Fi and mobile services. This traditional model requires service providers to maintain separate network infrastructure and personnel for each service. Operating hardware-centric, siloed network infrastructure for each service category is costly as it involves material space, power and personnel requirements. Moreover, hardware-centric networks can be expensive to update or replace. As network capacity and coverage have increased, the diversity of service offerings has grown, and technology upgrade cycles have become shorter, the need for cost-efficient network infrastructure and convergence is increasing.

New Infrastructure Technology Initiatives

As broadband service providers look to address these industry developments, they are undertaking three key technology initiatives to help build next-generation networks:

- *Densification.* Increasing demand for bandwidth and user expectations for ubiquitous, seamless and reliable connectivity require the addition of more access points for users to connect to broadband networks, also known as *network densification*. As a result, broadband service providers across all access technologies are shifting from centralized to more distributed architectures. Densification requires extending network connectivity and distributing access aggregation solutions closer to end users. For cable operators this entails deploying more access aggregation nodes and reducing the size of service groups per node. For wireless operators, particularly in 5G, this will lead to an emphasis on small-, versus traditional macro-, cells in new network deployments.

- *Network Convergence.* Traditionally service providers have deployed separate, siloed networks to deliver both fixed (cable, fiber or copper) and mobile broadband to their subscribers. To meet the demands of next generation networks, service providers are focused on converging siloed fixed and mobile core networks into a single converged 5G Core. The 5G Core will be the heart of the network and act as an anchor point for multi-access technologies. It will need to deliver a seamless service experience across fixed and wireless access technologies. 3GPP, the global wireless standards body, has defined a new 5G Core architecture that supports service delivery over wireless, fixed or converged networks.
- *Virtualization.* The introduction of network virtualization is a fundamental change in the way broadband service providers will deliver critical network functions. In virtual networks, software-enabled architectures are decoupled from underlying server hardware for increased efficiency, upgradability, configuration flexibility, service agility and scalability that are not feasible with proprietary hardware-based solutions. Once the networks have been virtualized, a service-based architecture that supports scalable network slicing can be launched.

Market Opportunity

We believe that our products are well-suited to address these trends and accordingly present us with a significant market opportunity across all access technologies. Historically, we have generated the significant majority of our revenue from the cable market with our converged cable access platform, or CCAP. In 2019, we became more diversified via expansion of our target markets to include wireless and fixed-line broadband solutions. We expect to continue to generate revenue in the future from growth in the cable market and increased revenue from sales of both wireless and fixed-line broadband solutions to new and existing customers. We believe there is an opportunity for us to take new market share as fixed and wireless networks continue to converge.

Key Benefits of Our Solutions

Highly Flexible, Service-Oriented, Software-Centric Architecture

Our software-centric, multi-service broadband platform, Axyom, is at the heart of all of our core network infrastructure products. We engineered our platform from the ground-up to be high performance, flexible and adaptable, and to allow our customers to seamlessly address the growing demand for bandwidth and connectivity and the competitive need for service agility. Axyom also enables our customers to efficiently manage their networks and provide their subscribers with additional services across all access technologies.

Our software-centric architecture enables us to efficiently virtualize core network and access functions, allowing these functions to be decoupled from underlying network hardware. As a result, our software-centric architecture allows for increased efficiency, upgradability, configuration flexibility, service agility and scalability, while increasing the potential service life of the underlying hardware. Our software-centric architecture allows us to leverage the programmability of FPGAs and general-purpose processors in our solutions.

Our Axyom platform provides us with the flexibility to adapt to changing industry standards and customer needs. We designed our Axyom software platform using what we refer to as Network Function Virtualization 2.0, or NFV 2.0, principles. These allow us to provide and control each needed network function through a distinct segment of software, which can be integrated or combined in a building block-style fashion with the segments of software responsible for each other network function. This allows us to offer network architectures that can be efficiently tailored to meet each customer’s specific requirements, both as they exist at the time of initial implementation and as they evolve over time. When possible, we also seek to implement new features and enhanced customization through the use of FPGAs, which can be reprogrammed in the field as service needs evolve. This software-centric approach enables our customers, in turn, to commercialize new features faster than they could with hardware-centric solutions.

Common Platform Capabilities to Address the Needs of Both Fixed and Wireless Networks

Our software-centric, multi-service platform enables a broad range of network services for fixed and wireless networks, allowing for the delivery of diverse consumer and enterprise applications. Both fixed and wireless networks share a common set of core and access network functions that enable network services, such as subscriber management, session management, transport security, access aggregation and radio frequency, or RF, management. Our Axyom software architecture allows each of these network functions to be provided and controlled by a distinct segment of software, which can be integrated or combined together in a building block-style fashion with the segments of software responsible for each other network function. This allows us to offer network architectures that can be efficiently tailored to meet each customer’s specific requirements, both as they exist at the time of initial implementation and as they evolve over time.

End-to-End Products on a Converged Core and Multi-Access Intelligent Edge

We believe that we are the only network infrastructure equipment supplier offering a full end-to-end portfolio of all-access broadband network solutions that extend from a truly cloud-native, converged network core to the customer premises. Our products help broadband service providers deploy more capacity at the network edge, closer to where end users and devices are accessing the network, thereby increasing available bandwidth and reducing latency to improve quality of service. In addition, our converged network core supports wireline and wireless access and avoids overlapping functions within the network. It therefore reduces long-term capital expenditures or operating expenses. Our convergence solutions may also enable operators to more consistently deliver services and execute policy across different access types.

Ability to Upgrade Networks Remotely with Rapid, Seamless Addition of Bandwidth Capacity

Our programmable architecture is designed to enable rapid and seamless expansion of network capacity with the purchase of additional software licenses. This approach helps broadband service providers respond flexibly to increased customer demands with rapid bandwidth and service provisioning.

Additionally, our programmable architecture allows us to deploy technology updates to our customers remotely without the expense, disruption or network downtime caused by hardware replacements or field visits by personnel, while minimizing network downtime. We can remotely turn on additional features or capacity in order to scale our solutions to meet the needs of our customers as they look to broaden the use and capabilities of our products. Similarly, we are often able to troubleshoot and assist our customers with technical issues through seamless software updates.

Reduced Network Complexity and Lower Total Cost of Ownership

Our converged software platform allows broadband service providers to significantly reduce the complexity, footprint requirements, and costs of their networks by reducing parallel and otherwise redundant network architecture. The large capacity increases that our solutions enable, and the ability of our solutions to deliver broadband services over a converged core mean fewer pieces of equipment in the network, and lower energy usage, operating costs and capital expenditures.

Our Growth Strategy

The key elements of our growth strategy are:

Continue to Innovate and Extend Technology Leadership Through R&D Investment

We believe that we offer market-leading broadband infrastructure products today. We intend to continue to enhance our existing products and develop new products in both our current and adjacent markets. For example, we have invested in and launched distributed access architecture solutions to allow our cable customers to densify their networks, providing higher bandwidth, which enhances user experience. Additionally, we have been investing in, and recently begun recognizing revenue from, our core and access products for 4G/LTE and 5G wireless networks.

Further Penetrate Existing Customers

Our customers often deploy our products in a specific region or for a specific application, which may only account for a portion of their overall network infrastructure needs. We plan to expand our footprint within the networks of existing customers as they realize the technological and financial benefits of our solutions, as well as sell our new products to them as they offer new broadband services to their subscribers.

Expand our Customer Base by Expanding the Breadth of Solutions Sold to Customers

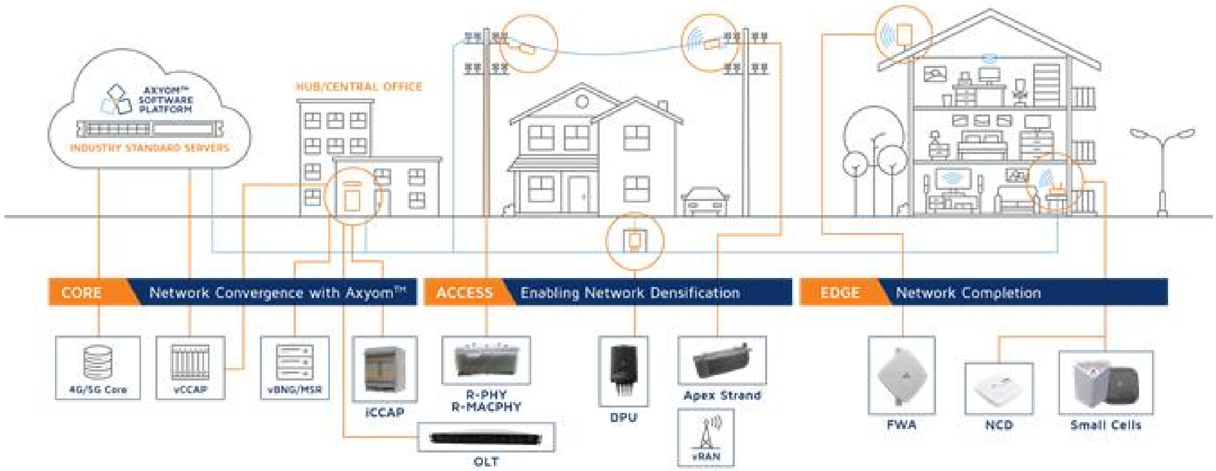
We intend to sell additional products and solutions to our growing installed base of broadband service providers, particularly as they increasingly offer converged services to their subscribers. We have invested in developing a virtualized platform that allows us to rapidly provide new applications and services to our customers. While we initially focused on providing solutions for cable service providers due to our founders' experience in the cable industry, the commonalities between fixed and wireless network architectures have allowed us to expand our solutions into the wireless market as cable service providers have increasingly sought to add wireless capabilities to their service offerings. Our wireless solutions have been purchased by several customers, including Tier 1 mobile network operators such as Sprint and China Mobile.

Invest in Our Platform through Selective Acquisitions

We may selectively pursue acquisitions that enhance our existing platform capabilities and are consistent with our overall growth strategy. For example, on July 1, 2019, we acquired NetComm Wireless Limited for cash consideration of approximately $162.0 million Australian dollars, or AUD ($112.7 million United States dollars, or USD, based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019). This acquisition enables us to expand our customer base, enhance our global footprint, extend our product portfolio to the far edge of the network, and further diversify our revenue sources.

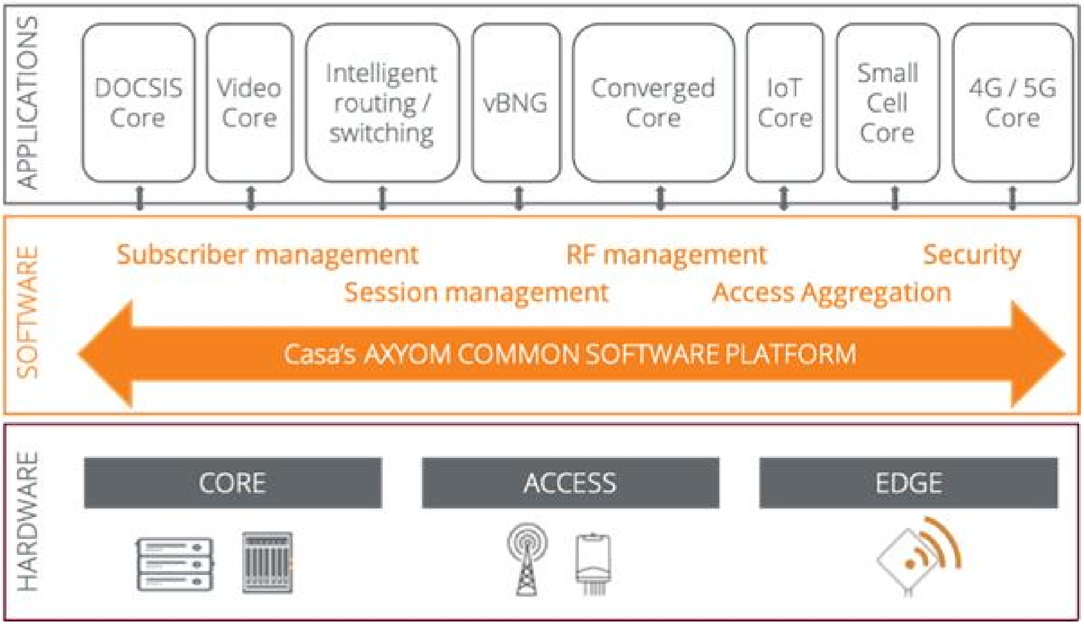
Products and Technology

We offer end-to-end physical, virtual and distributed infrastructure and customer premise network solutions that enable our customers to provide fixed and wireless broadband services to consumers and enterprises.



Axyom Software Platform

Our software-centric, multi-service product portfolio is built on our Axyom software, which enables a broad range of core and access network functions for fixed and wireless networks. These networks share a common set of core and access network functions that enable network services such as subscriber management, session management, transport security and RF management. Our Axyom software architecture allows each of these network functions to be provided and controlled, integrated or combined together, in a building block-style fashion with the segments of software responsible for each other network function. This allows us to offer network architectures that can be efficiently and rapidly tailored to meet each customer's specific requirements, both as they exist at the time of initial implementation and as they evolve over time. The commonalities between new fixed and wireless network architectures have allowed us to leverage our existing Axyom software and to expand our solutions into the wireless and fixed communications markets.



Our Axyom software platform is central to our multi-service, ultra-broadband delivery architecture, integrating multiple core and access network functions. Axyom is 5G-ready and is designed to provide high performance, programmability, scalability and flexibility. We designed Axyom using network function virtualization 2.0, or NFV 2.0, principles, which allow us to provide and control each needed network function through a distinct segment of software, which can be integrated or combined together in a building block-style fashion with the segments of software responsible for each other network function. Axyom has predominantly been integrated into our physical products to date and is increasingly being deployed in virtual environments.

Our Axyom software platform performs several critical network services:

- *Subscriber Management*. Enables dynamic management of subscriber authentication, provisioning, policy enforcement and allocation of network resources based on specific end-user service requirements to enhance quality of service.
- *Session Management.* Intelligently manages application layer data streams to enable service creation and delivery and enhance quality of service.
- *RF Management.* Efficiently manages RF signal generation (modulation/demodulation) while reducing noise to increase available RF spectrum and maximize data throughput over the network link in both fixed and wireless applications.
- *Access Aggregation.* Manages and combines high volume data streams, regardless of connection type, including fixed broadband, Wi-Fi, LTE and 5G.
- *Security.* Enables end-to-end secure connectivity between users, devices and networks without sacrificing performance.

Axyom can be deployed on a centralized basis on one of our hardware chassis, over distributed network hardware or as a virtualized solution, allowing operators to place network functions where they choose, whether close to the network edge or at a centralized location or data center.

Cable

Our solutions for cable service providers can be deployed in a centralized, distributed or virtual environment. While centralized deployments allow our customers to deploy all critical CCAP functions in a single location, distributed and virtual deployments enable our customers to densify the access network by distributing access deeper into the network, away from existing data centers.

Centralized Deployment

Integrated CCAP – C100G and C40G

- Our C100G CCAP combines cable modem termination system, or CMTS, functionality that enables IP data transport from data centers to end-users over cable networks, including voice over IP, or VoIP, and edge-quadrature amplitude modulation, or Edge-QAM, functionality to enable video delivery over cable networks in one integrated chassis. We believe our C100G CCAP was the first solution offering full CCAP functionality, allowing the delivery of voice, video and data on a single platform. Our C100G CCAP also features high downstream speeds of up to 10 gigabits per second, high upstream channel capacity, and low space and energy consumption requirements. Using our C100G CCAP, our customers whose networks are configured for DOCSIS 3.0 can adopt DOCSIS 3.1 through either a software upgrade or a simple line card addition, while continuing to service their end customers who use DOCSIS 3.0 modems. We are also able to increase capacity for our C100G CCAP through channel expansions, which are delivered via software-enabled increases in bandwidth capacity, regardless of whether it is configured for DOCSIS 3.0 or 3.1. We believe that our software-centric approach will enable us to seamlessly provide our customers with future updates as standards evolve.

- In addition to our C100G CCAP, we also offer our C40G CCAP, that provides per rack unit performance comparable to that of our C100G CCAP, but in a smaller form factor.

- Our CCAP enables three key applications over a single cable network:
  - *DOCSIS Core.* Provides high-speed delivery of IP data for broadband connectivity services, including VoIP.
  - *Video Core.* Delivers high speed video processing, including for HD and 4K.
  - *Intelligent Routing.* Intelligently manages network traffic to optimize service quality.

Distributed Deployment

- Distributed Access Architectures, or DAAs, offer a new approach for service providers that are looking to increase capacity in their networks. Our family of DAA solutions is designed to help service providers push capacity to the edge to improve the services their subscribers enjoy, extract more value from existing investments, and maintain smooth operations in the transition from centralized to distributed access architectures.

- Our family of DAA solutions includes:
  - Physical or virtual CCAP cores that deliver full CCAP, full spectrum DOCSIS 3.1 support, and are compliant with CableLabs' interoperability standards.
  - The CCAP Service Card, or CSC, deployable in our C100G or C40G chassis, which provides the complete DOCSIS and Edge-QAM MAC, or media access control, functions as well as traffic aggregation for the DAA nodes or shelves.
  - A range of DAA node and shelf form factors that perform complete DOCSIS and EQAM PHY or MAC/PHY functions. Our remote PHY, or R-PHY, solutions for cable networks retain software-driven network control and intelligence functions at the network core while placing physical layer functions remotely in a fiber node and the network edge. Our remote MAC/PHY, or R-MAC/PHY, solution for cable networks offers the capabilities of our R-PHY solution while also moving media access control functions from the network core to remotely deployed R-MAC/PHY nodes.
  - 10G Ethernet transport between the CCAP core and the DA nodes.

Virtual Deployment

- Service providers are adopting virtualized versions of network functions and adding software-defined networking control and orchestration to enable faster service creation and more nimble response to changes in service and bandwidth demand. In cable access networks, this trend is accompanied by fiber deep strategies which push required ultra-broadband bandwidth closer to subscribers. Our Distributed Access Architecture solutions and the Axyom virtual converged cable access platform, or vCCAP, create a secure, scalable, high-performance next generation cable access network.

- The Axyom vCCAP provides all the features of our C100G CCAP on commercial-off-the-shelf, or COTS, servers in a flexible architecture that enables independent scaling of control and data planes. Built on the Axyom modular software framework, our vCCAP is built for the cloud from the ground up and enables high performance and deployment flexibility in edge or core environments. Our virtual solutions also enable migration from physical network functions, or PNFs, to virtual network functions, or VNFs, with a common management interface to both.

Bandwidth Capacity Expansion

- *Software.* Our customers can add additional bandwidth capacity to their CCAP products by purchasing perpetual software license upgrades. In addition, our software platform permits additional features to be provisioned remotely, as compared to hardware-centric solutions, which require wholesale hardware replacements. As new standards and services evolve, and broadband networks become increasingly virtualized, we expect we will be able to deliver additional capabilities as software-only updates.
- *Line cards*. Additional bandwidth capacity may also be purchased in the form of our upstream and downstream line cards. Our line card expansion options allow our customers to rapidly add new service interfaces and physical connection capacity without the need for chassis replacements. In addition, our expansion cards can cost-effectively enable support for our distributed access solutions utilizing the same C100G CCAP chassis.

Wireless

Network Core

- *Virtual Evolved Packet Core (EPC).* Virtualizing the LTE EPC allows service providers to reduce network operating costs, improve network efficiency, and deploy new services faster. Our vEPC is built from the ground up, optimized for virtualized environments, and implements control and user plane separation, or CUPS. It can be deployed stand alone or in conjunction with our other core network products, such as our Security and Small Cell Gateways.
- *5G Core.* Our 5G core, converged to support fixed and wireless networks, is built to help service providers implement the shift from a single, one-size-fits-all core network toward a core that provides different logical networks (or “slices”) for different traffic requirements to support new use cases, including IoT, Enhanced Mobile Broadband, and Mission Critical Services. Our 5G core delivers several important features including:
  - higher Gbps per vCPU;
  - a solution deployable in containers with virtual machines, or VMs, or bare metal;
  - location-independent placement of the control and user plane in a CUPS architecture;
  - a smooth migration from 4G to 5G with efficient internal messaging between 4G and 5G network components; and
  - network slicing in a service-based architecture.
- Other elements of our core infrastructure network products include our Security Gateway, which enables secure encrypted access for subscribers roaming between trusted and untrusted networks, while providing high levels of density and performance, and our Wireless Gateway, which enables routing and security functions as well as traffic management, to provide secure connectivity for wireless endpoints and enable broadband services such as LTE over Wi-Fi, including Wi-Fi calling.

Small Cell solutions

- *Apex family of Small Cells.* Our portfolio of indoor and outdoor Apex small cell solutions consists of remotely deployable access points that provide cellular connectivity services at the network edge in conjunction with transport security functions to address coverage and capacity challenges. These solutions allow broadband service providers to more cost-effectively densify their networks while simultaneously improving coverage and enhancing throughput. Our small cell portfolio includes our:
  - Lifestyle residential small cell, the Apex Pebble, which uses the user's broadband connection rather than a cell tower connection to provide wireless service in areas outside of the operator's coverage areas. We believe that our Apex Pebble offers unique features that include:
    - attractive design that is intended to drive better acceptance by subscribers and thereby provide better RF coverage than utilitarian-looking small cells that are likely to be hidden away in places that reduce RF propagation; and
    - untethered Wi-Fi backhaul option, versus the ethernet backhaul requirement in comparable traditional femtocells, which allows a user to place the device anywhere in his or her home where Wi-Fi is available without running or connecting additional cables to a home router.
  - Apex enterprise small cell with 4G radio capability, which supports two LTE carriers, in a small form factor.
  - Apex Strand solution, designed for both MSOs and mobile network operators which supports two LTE carriers (licensed LTE bands or citizens band radio service, or CBRS), and takes advantage of existing hybrid-fiber cable, or HFC, strand to help solve the power, backhaul and siting issues that accompany large-scale small cell deployments.
  - Apex 5G Mini Macro, which offers support for licensed LTE/5G bands and eventually CBRS and C-Band, is designed for environments with a large number of subscribers or where a larger coverage area is required. Our 5G Mini Macro helps our wireless customers meet the coverage and capacity challenges in dense urban and suburban areas where large numbers of NR and LTE devices are present. Unlike macro-radio solutions, that are mounted on towers, the Apex 5G Mini Macro can be deployed cost-effectively at the street level, on utility poles, roof tops and lamp posts, thereby reducing the costs associated with a traditional macro site. The Apex 5G Mini Macro's All-in-One package includes the baseband unit and the radio remote unit with flexible external antenna configurations. It also supports open radio access network defined interfaces for centralized and virtualized radio access network deployments.
- *Axyom Element Management System (AEMS).* Our AEMS is designed to make small cell deployment and management more efficient. It includes key management tools that facilitate integration with existing networks and increase radio access network utilization, with zero-touch plug and play small cell deployment. We are currently looking to expand our AEMS to use cases beyond small cell deployment management, such as with our distributions point unit, or DPU, and fixed-wireless access solutions.

Fixed Wireless Access

- Our fixed wireless access products, which we added to our product set from our acquisition of NetComm, enable service providers to offer fixed, ultra-broadband services to their customers where the service provider does not own copper, fiber or coaxial cable to the customer premise. Connections are instead serviced by a 3GPP compliant wireless connection in a manner that optimizes overall network efficiency and provides a higher grade of broadband service than would typically be achieved via a typical mobile handset. Our fixed wireless products currently support 4G and, starting in 2020, are expected to support 5G, and can be delivered as a self-install indoor unit, or as a pro-install outdoor unit that is mounted to the side of the customer premise. Our portfolio is designed with a heavy emphasis on reducing the total cost of ownership for operators, achieved through class-leading hardware performance and build quality, which is further enhanced by our range of install accessories that optimize the installation process and overall install success rate.

Fixed-Line Broadband

Optical Access Solutions

- In connection with all of our centralized and distributed deployment solutions, we offer a portfolio of PON solutions for centralized and distributed PON architectures that enable service providers to move fiber closer to the network edge and deliver a broader range of ultra-broadband services more efficiently and at higher speed. Our PON solutions include next generation 10G EPON, XGS-PON and NG-PON2 alternatives, including optical line terminals and optical network units. We also offer a DOCSIS Provisioning over Ethernet system for seamless integration of our PON solutions with existing DOCSIS network protocols.

Virtualized Broadband Network Gateway Router and Multiservice Router

- Our Axyom virtualized broadband network gateway, or vBNG, router provides advanced subscriber management and routing capabilities in a cloud-native, virtualized solution. By separating the control and data plane functions, our vBNG enables elastic scaling and service agility, while allowing the service provider to put the control and data planes where they make most sense. Accordingly, our vBNG can be deployed in either centralized architectures (on the same server in the data center or central office) or distributed ones (at the network edge or node closer to the end user). Our vBNG is deployed as a service on our Axyom NFV Framework. It is convergence ready with built in AGF functions interfacing with our 5G core. We support data plane slicing based on service (converged/legacy) with dynamic control of the slice from the 5G core. At the 2019 Broadband World Forum, we demonstrated how our vBNG and 5G core could enable subscribers to use services seamlessly as they move between mobile and fixed connectivity. This solution won us the Broadband Forum Innovation Award for 5G in 2019.
- A dis-aggregated Multi-Service Router, or MSR, is included in our fixed line portfolio. The MSR is built on commercial off-the-shelf switching platforms that use merchant silicon. The MSR supports the BNG data plane on merchant silicon. It offers industry-leading throughput and capacity in one rack unit form factor. The MSR operates with the vBNG control plane separated on a server at some centralized location or integrated right within the switch CPU. Service providers therefore can pick and choose the type of data plane at each location based on scale and throughput needs. The MSR is also a full-fledged Provider Edge, or PE, router. It supports layer 2 multi-protocol layer switching and layer 3 virtual private networks with resource reservation protocol for traffic engineering and Fast Re-route, a technology to provide fast traffic recovery upon link or router failures for mission critical services. It also supports edge access functions. The MSR therefore offers the functionality of a BNG, PE Router, and Top-of-Rack switch all rolled into one.
- Our customers use Axyom vBNG to support their next-gen PON and multi-access edge computing deployments. We have demonstrated an end-to-end solution using our G.fast DPUs and 10G XGS-PON ONTs working with our XGS-PON OLT-A product connecting to a multi-tenant vBNG. This offers a smooth migration path for telecommunications providers from digital subscriber line technologies to G.fast to fiber-to-the-home, while maintaining the same vBNG edge functions. Multi-tenancy allows customers to slice the same hardware infrastructure at the edge to different access methods based on service needs.

Fiber-To-The-Distribution-Point ("FTTdp")

- Our FTTdp solutions, which we added to our product set from our acquisition of NetComm, allow service providers to connect the fiber running in the street or basement to the copper lead-ins at an end user's premises. The solution consists of a DPU which is installed outside of the home or in the basement of a multi-dwelling unit and a Network Connection Device, or NCD, which is installed inside the home. Our DPUs are reverse powered from the NCD when there is no power source available at the location of the DPU and where installing local power is costly and time consuming for the service provider. FTTdp solutions offer a cost and time-effective means to provide a fiber-to-the-home experience to the end-user and the operator, reducing time delays and cost overruns where the fiber penetration into buildings becomes problematic. Our portfolio focuses on operator cost optimization, with solutions ranging from software through to accessories that enhance the installation process.

Residential Broadband

- We sell residential broadband gateways for customer premises in the ANZ region. We added these devices to our product set from our acquisition of NetComm. These devices allow customers to connect to very high-speed digital subscriber line or asymmetric digital subscriber line services, or fiber services including fiber-to-the-node, -basement, and -home, services when available. Our fixed broadband devices range from entry level gateways to high-performance devices that support triple play services covering high-speed data transmission, multi HD/4K IPTV and over-the-top video streaming, as well as high quality VoIP phone calls. We combine the latest generations of Wi-Fi with our powerful CloudMesh portfolio of Wi-Fi mesh hardware, automated Wi-Fi optimization software and Wi-Fi analytics. These options ensure fast and reliable connections to multiple devices throughout the home and office, while also optimizing costs for the operator by reducing support call loading.

Machine-to-Machine (M2M) and Industrial Internet of Things (IIoT)

- Our M2M and IIoT routers, which we added to our product set from our acquisition of NetComm, provide businesses and governments with networking products that are enabled for 3G and 4G/LTE data communication. They are designed for applications such as retail, transportation, health, metering digital signage, security, banking and mining. These solutions enable remote diagnostics, real-time monitoring, and wireless access via the Internet. Our products are designed to withstand harsh environmental conditions and extreme temperatures. Dual file-system management enhances solution reliability, while integrated open-source software development kits enable customers to customize our products for specific use cases.

Our Customers

Our solutions are commercially deployed in over 70 countries by more than 475 customers, including some of the world's largest Tier 1 broadband service providers, serving millions of subscribers:

- in North America: Charter/Time Warner Cable, Rogers, Videotron, Sprint, Verizon, AT&T, Bell Canada, Cable One and Mediacom;
- in Latin America: Televisa/IZZI Mexico, Megacable Mexico, Cablevision Argentina, Net Brazil, America Móvile and Claro Colombia;
- in Europe: Liberty Global, Vodafone, Telefonica and DNA Oyj; and
- in Asia-Pacific: SCSK Corporation, Jupiter Communications, Beijing Gehua CATV Networks, China Mobile and NBN.

Sales and Marketing

We sell our products and services through our direct sales force and in partnership with our resellers and sales agents. Our sales force is supported by our sales engineering team, which has deep technical expertise and the capability for product presentations, product evaluations, trials and customer care. Each sales team is responsible for specific direct end-customer accounts and/or a geographic territory across the following regions: North America, Latin America, Asia-Pacific and Europe, Middle East and Africa.

Our products typically have a long sales cycle, requiring detailed discussions with prospective customers about their network requirements and technology roadmaps. To help us succeed in a market characterized by long sales cycles, we have developed strong customer relationships, which in turn provide us with insight into how our products will be deployed in our customers' networks. We involve product engineers in the sales process, enabling them to build relationships with customers that are valuable both during implementation and in post-sales customer support. These relationships also provide us with opportunities to leverage our familiarity with our customers' needs to make additional sales following the initial sale.

We also use resellers to market, sell and support our products and services, and we use sales agents to assist our direct global sales force with certain customers primarily located in the Latin America and Asia-Pacific regions.

Our marketing activities consist primarily of technology conferences, web marketing, trade shows, seminars and events, public relations, analyst relations, demand generation and direct marketing to build our brand, increase customer awareness, communicate our product advantages and generate qualified leads for our field sales force and resellers and sales agents.

Competition

The broadband service provider market is highly competitive and subject to rapidly changing technology trends and shifting customer needs.

We primarily compete with larger and more established companies in the broadband service provider market, such as Adtran, Cisco, CommScope, Ericsson, Huawei, Inseego, Nokia, and Samsung.

The principal factors upon which we compete are:

- product capabilities;
- performance;
- scalability, flexibility and adaptability to new standards;
- ability to innovate;
- time to market;
- customer support; and
- total cost of ownership relative to performance and features.

We believe that we compete favorably with respect to these factors. Nevertheless, many of our competitors have substantial competitive advantages, including greater name recognition, longer operating histories, and substantially greater financial, technical, research and development or other resources than we do.

Research and Development

Our research and development efforts are focused on developing new broadband products for the cable, fixed and wireless communications markets and enhancing our current products to meet the current and future needs of our customers. We aim to be first to market with deployable, innovative products. We are willing to invest early in research and development and take technological risks to meet this goal. We also seek to enhance our technological innovation through our partnerships with industry standard-setting organizations and groups, such as CableLabs, 3GPP, and Wi-Fi Alliance. These efforts position us to be able to advance industry standards while evolving our solutions to meet such new standards.

Manufacturing

We partner with multiple global contract manufacturing companies, to manufacture the hardware for our products using the designs, components and standards that we specify. We conduct final assembly and quality assurance testing at our in-house and outsourced manufacturing facilities. We believe our combination of in-house and outsourced manufacturing capabilities, assembly and quality assurance testing allows us to maintain consistent and quality product for our customers. We also believe that this manufacturing model enables us to respond quickly to technological changes and supports our engineering goal of being first to market with deployable products. We believe our inventory management enables us to offer shorter times between order and delivery to our customers as compared to our competitors.

Our use of multiple contract manufacturers allows us not to be substantially dependent on the availability of any single contract manufacturer. Our contract manufacturers purchase the materials and components for our products through a variety of major electronics suppliers. The majority of our materials and components for our solutions are generally available in adequate quantities from multiple suppliers.

Backlog

We do not have any long-term purchase commitments from customers. Customers generally order products on an as-needed basis with short lead and delivery times on a per-purchase-order basis. We maintain substantial finished goods inventory to ensure that products can generally be shipped shortly after receipt of an order.

A portion of our customer shipments in any fiscal period relate to orders received in prior fiscal periods. As of December 31, 2019 and 2018, we had backlog of $52.0 million and $28.6 million, respectively. The increase in backlog over that period was due principally to additional NetComm backlog of $28.6 million. Of the amount of backlog as of December 31, 2019, we expect that approximately $51.5 million will be shipped within the following twelve months. However, because our customers utilize purchase orders containing non-binding purchase commitments and customers may cancel, change or reschedule orders without penalty at any time prior to shipment, we have no assurance that we will be able to convert our backlog into shipped orders.

Intellectual Property

Our success depends to a significant degree upon our ability to protect our core technology and intellectual property. To accomplish this, we rely on a combination of trade secrets, patents, copyrights and trademarks, as well as contractual protections. To date, we have focused our efforts to protect our intellectual property primarily on trade secrets because the cable industry generally relies on non-patentable CableLabs standards and specifications that are jointly developed by market participants.

We limit access to and use of our proprietary software, technology and other confidential information through the use of internal and external controls, including nondisclosure agreements with employees, consultants, customers and vendors and other measures for maintaining trade secret protection. We generally license our software to customers pursuant to agreements that impose restrictions on the customers' ability to use the software, including prohibitions on reverse engineering and limitations on the use of copies. We also seek to avoid disclosure of our intellectual property by requiring employees and consultants with access to our proprietary information to execute nondisclosure and assignment of intellectual property agreements and by restricting access to our source code.

We also incorporate a number of third-party software programs into our solutions pursuant to license agreements. Our software is not substantially dependent on any third-party software, although in some cases it utilizes open source code.

Employees

We pride ourselves on our culture of innovation, which is driven by our management team of experienced executives and engineers with deep industry expertise. As of December 31, 2019, approximately 62% of our employees were engineers or had other technical backgrounds. With our talented and passionate engineering-led organization, we aim to be an industry visionary and are committed to delivering products based on next-generation technology before our competitors do. By providing customers with direct access to our engineers for product feedback and assistance, we believe our engineering expertise contributes to an enhanced customer experience.

As of December 31, 2019, we employed 997 full-time employees, of which 361 were located in the United States and 636 were located outside the United States. Our workforce as of December 31, 2019, consisted of 620 employees in engineering and research and development, 180 employees in sales and marketing, 89 employees in general and administrative, 73 employees in manufacturing and 35 employees in services and support. None of our employees are represented by unions. We consider our relationship with our employees to be good and have not experienced significant interruptions of operations due to labor disagreements.

Our Corporate Information

We were incorporated in the State of Delaware on February 28, 2003. Our principal executive offices are located at 100 Old River Road, Andover, Massachusetts 01810, and our telephone number at that address is (978) 688-6706.

Available Information

We maintain an internet website at www.casa-systems.com and make available free of charge through our website our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and amendments to those reports filed or furnished pursuant to Sections 13(a) and 15(d) of the Exchange Act of 1934, or the Exchange Act. We make these reports available through our website as soon as reasonably practicable after we electronically file such reports with, or furnish such reports to, the Securities and Exchange Commission, or the SEC. You can review our electronically filed reports and other information that we file with the SEC on the SEC's web site at http://www.sec.gov. We also make available, free of charge on our website, the reports filed with the SEC by our executive officers, directors and 10% stockholders pursuant to Section 16 under the Exchange Act as soon as reasonably practicable after copies of those filings are provided to us by those persons. In addition, we regularly use our website to post information regarding our business, product development programs and governance, and we encourage investors to use our website, particularly the information in the section entitled "Investor Relations," as a source of information about us.

The information on our website is not incorporated by reference into this Annual Report on Form 10-K and should not be considered to be a part of this Annual Report on Form 10-K. Our website address is included in this Annual Report on Form 10-K as an inactive technical reference only.

Item 1A. Risk Factors.

Our business is subject to numerous risks. The following important factors, among others, could cause our actual results to differ materially from those expressed in forward-looking statements made by us or on our behalf in this Annual Report on Form 10-K and other filings with the Securities and Exchange Commission, or the SEC, press releases, communications with investors, and oral statements. Actual future results may differ materially from those anticipated in our forward-looking statements. We undertake no obligation to update any forward-looking statements, whether as a result of new information, future events, or otherwise.

Risks Related to Our Business and Our Industry

If we do not successfully anticipate technological shifts, market needs and opportunities, and develop new products and product enhancements that meet those technological shifts, needs and opportunities, we may not be able to compete effectively.

The broadband service provider market, including fixed and wireless, is characterized by rapid technological shifts and increasingly complex customer requirements to achieve scalable networks that accommodate rapidly increasing consumer demand for bandwidth. To compete effectively, we must continue to develop new technologies and products that address emerging technological trends and changing customer needs. The process of developing new technology is complex and uncertain, and the development of new offerings requires significant upfront investment that may not result in material improvements to existing products or result in marketable new products or costs savings or revenue for an extended period of time, if at all.

We believe that our culture of innovation is a significant factor in our ability to develop new products. If we are not able to attract and retain employees that are able to contribute to our culture of innovation, our ability to identify emerging technological trends and changing customer needs and successfully develop new products to address them could be adversely impacted.

The success of new products and enhancements also depends on many other factors, including timely completion and introduction, differentiation from products offered by competitors and previous versions of our own products and, ultimately, market acceptance of these new products and enhancements. In addition, new technologies or standards could render our existing products obsolete or less attractive to customers. If we are unable to successfully introduce new products and enhancements, we would not be able to compete effectively and our business, financial condition, results of operations and prospects could be materially adversely affected.

Our success depends in large part on broadband service providers' continued deployment of, and investment in, ultra-broadband network capabilities that make use of our solutions.

Our product and solution suite is dedicated to enabling cable, wireless and fixed-line service providers to deliver voice, video and data services over newer and faster ultra-broadband networks. As a result, our success depends significantly on these service providers' continued deployment of, and investment in, their networks, which depends on a number of factors outside of our control. These factors include capital constraints, the presence of available capacity on legacy networks, perceived subscriber demand for ultra-broadband networks, competitive conditions within the broadband service provider industry and regulatory issues. If broadband service providers do not continue deploying and investing in their ultra-broadband networks in ways that involve our solutions, for these or other reasons, our business, financial condition, results of operations and prospects could be materially adversely affected.

We expect certain of our customers will continue to represent a substantial portion of our revenue.

Historically, certain of our customers have accounted for a significant portion of our revenue. For example, sales to Charter Communications, which purchased Time Warner Cable in 2016, accounted for 14%, 27%, and 37% of our revenue for the years ended December 31, 2019, 2018 and 2017, respectively; sales to Liberty Global Affiliates accounted for 11%, and 11% of our revenue for the years ended December 31, 2018 and 2017, respectively; sales to Videotron accounted for 14% of our revenue for the year ended December 31, 2018; and sales to Rogers accounted for 12% of our revenue for the years ended December 31, 2018. In addition, following our acquisition of NetComm Wireless Limited in Australia, which closed on July 1, 2019, the National Broadband Network represented 12% of our revenue for the year ended December 31, 2019. Based on their historical purchasing patterns, we expect that our large customers will continue to account for a substantial portion of our revenue in future periods. However, our customers generally make purchases from us on a purchase-order basis rather than pursuant to long-term contracts, and those that do enter long-term contracts typically have the right to terminate their contracts for convenience. As a result, we generally have no assurances that these large customers will continue to purchase our solutions. We may also see consolidation of our customer base, which could result in loss of customers. In addition, some of our large customers have used, and may in the future use, the sizes and relative importance of their orders to our business to require that we enter into agreements with more favorable terms than we would otherwise agree to and obtain price concessions. The loss of a significant customer, a significant delay or reduction in purchases by large customers or significant price concessions to one or more large customers, could have a material adverse effect on our business, financial condition, results of operations and prospects.

Timing of large orders and seasonality in our revenue may cause our quarterly revenue and results of operations to fluctuate and possibly decline materially from quarter to quarter.

Our customers tend to make large purchases from us when initiating or upgrading services based on our solutions, followed by smaller purchases for maintenance and ongoing support. In addition, for our cable products, purchases by existing customers of capacity expansions can also involve large individual orders that may represent a significant portion of our revenue for a fiscal quarter, which may also have a significant impact on our quarterly gross margin due to these capacity expansions generating higher gross margins than our initial hardware-based deployments. As a result of all of these factors, our quarterly revenue and results of operations, including our gross margin, may be significantly impacted by one or a small number of large individual orders. For example, any cancellation of orders or any acceleration or delay in anticipated product purchases or the acceptance of shipped products by a large customer could materially affect our revenue and results of operations in any quarterly period. We may be unable to sustain or increase our revenue from other new or existing customers to offset the discontinuation of purchases by one of our larger customers. As a result, our quarterly revenue and results of operations are difficult to estimate and may fluctuate or decline materially from quarter to quarter.

In addition, although this was not the case for the year ended December 31, 2019, historically there have been significant seasonal factors which may cause revenue to be greater for the first and fourth quarters of our fiscal year as compared to the second and third quarters. We believe that this seasonality results from a number of factors, including the procurement, budgeting and deployment cycles of many of our customers. These seasonal variations may cause our quarterly revenue and results of operations to fluctuate or decline materially from quarter to quarter.

Our sales to the broadband service provider market are volatile and our sales cycles can be long and unpredictable. As a result, our sales and revenue are difficult to predict and may vary substantially from period to period, which may cause our revenue and results of operations to fluctuate and possibly decline significantly.

Our sales to the broadband service provider market have been characterized by large and sporadic purchases and long sales cycles. Sales activity often depends upon the stage of completion of expanding network infrastructures, the availability of funding and the extent to which broadband service providers are affected by regulatory, economic and business conditions in the countries in which they operate.

In addition, the timing of our sales and revenue recognition is difficult to forecast because of the unpredictability of our products' sales cycles. A sales cycle is the period between initial contact with a prospective customer and the sale of our products to that customer. Customer orders often involve the purchase of multiple products. These orders are complex and difficult to obtain because prospective customers generally consider a number of factors over an extended period of time before committing to purchase the products and solutions we sell. Customers, especially in the case of our large customers, often view the purchase of our products as a significant and strategic decision and require considerable time to evaluate, test and qualify our products prior to making a purchase decision and placing an order. The length of time that customers devote to their evaluation, contract negotiation and budgeting processes varies significantly, but can often exceed 24 months. During the sales cycle, we expend significant time and money on sales and marketing activities and make investments in evaluation equipment, all of which are included in our selling, general and administrative expenses and lower our operating margins, particularly if no sale occurs.

Even if a customer decides to purchase our products, there are many factors affecting the timing of our recognition of revenue, which makes our revenue difficult to forecast. For example, the sale of our products may be subject to acceptance testing or there may be unexpected delays in a customer's internal procurement processes, particularly for some of our larger customers, for whom our products represent a very small percentage of their total procurement activity. These factors may result in our inability to recognize revenue for months or years following a sale. In addition, other factors that are specific to particular customers can affect the timing of their purchases and the variability of our revenue recognition, including the strategic importance of a particular project to a customer, budgetary constraints and changes in their personnel. For all of these reasons, it is difficult to predict whether a sale will be completed, the particular period in which a sale will be completed and the period in which revenue from a sale will be recognized. If our sales cycles lengthen, our revenue could be lower than expected, which could have a material adverse effect on our business, financial condition, results of operations and prospects.

We may not generate positive returns on our research and development investments.

Developing our products is expensive, and the investment in product development may involve a long payback cycle or may result in investments in technologies or standards that do not get adopted in the timeframe we anticipate, or at all. For the years ended December 31, 2019, 2018 and 2017, our research and development expenses were $83.3 million, or approximately 29.5% of our revenue, $71.0 million, or approximately 23.9% of our revenue, and $60.7 million, or approximately 17.3% of our revenue, respectively. We expect to continue to invest heavily in software and hardware development in order to expand the capabilities of our fixed and wireless broadband infrastructure solutions, introduce new products and features and build upon our technology leadership, and we expect that our research and development expenses will continue to increase in absolute dollars and as a percentage of revenue from 2019 to 2020. Our investments in research and development may not generate positive returns in a timely fashion or at all.

Our converged cable access platform, or CCAP, solutions currently represent a majority of our product sales; this concentration may limit our ability to increase our revenue, and our business would be adversely affected in the event we are unable to sell one or more of our products.

Historically, have generated the majority of our revenue from the cable market with our converged cable access platform, or CCAP. In 2019, we became more diversified via expansion of our target markets to include wireless and fixed-line broadband solutions and following our acquisition of NetComm, the share of wireless and fixed-line products in our revenue mix has increased. However, as our business expands increasingly into wireless and fixed-line broadband solutions, we remain heavily dependent upon the sales of our CCAP solutions. In the event we are unable to market and sell these products or any future product that represents a substantial amount of our revenue, our business, financial condition, results of operations and prospects could be materially adversely affected.

We have invested heavily in developing wireless and fixed-line broadband solutions, and we face risks in seeking to expand our platform into the wireless and fixed-line broadband markets.

We have invested heavily in developing wireless and fixed-line solutions that have only recently begun to generate revenue. We cannot guarantee that these investments, or any of our other investments in research and development, will ever generate material revenue or become profitable for us, and the failure of these investments to generate positive returns may adversely impact our business, financial condition, results of operations and prospects. The wireless market makes up a substantial portion of our total potential addressable market. In addition, expanding our offerings into the wireless and fixed-line broadband markets presents other significant risks and uncertainties, including potential distraction of management from other business operations that generate more substantial revenue, the dedication of significant research and development, sales and marketing, and other resources to this new business line at the expense of our other business operations and other risks that we may not have adequately anticipated.

We believe the broadband service provider industry is in the early stages of a major architectural shift toward the virtualization of networks and the use of networks with distributed architectures. If the architectural shift does not occur, if it does not occur at the pace we predict, or if the products and services we have developed are not attractive to our customers after such shift takes place, our revenues could decline.

We believe the broadband service provider industry is in the early stages of transitioning to the virtualization of networks and the use of networks with distributed architectures. We are developing products and services that we believe will be attractive to our customers and potential customers who make that shift. Our strategy depends in part on our belief that the industry shift to a software-centric cloud-based architecture and increasing densification will continue. In our experience, fundamental changes like this often take time to accelerate and the adoption rates of our customers may vary. As our customers determine their future network architectures and how to implement them, we may encounter delayed timing of orders, deferred purchasing decisions and reduced expenditures. These longer decision cycles and reduced expenditures may negatively impact our revenues or make it difficult for us to accurately predict our revenues, either of which could materially adversely affect our business, financial condition, results of operations and prospects. Moreover, it is possible that our customers may reverse or fail to expand upon current trends toward virtualization and distributed architectures, which could result in significantly reduced demand for the products that we have developed and currently plan to develop.

We face intense competition, including from larger, well-established companies, and we may lack sufficient financial or other resources to maintain or improve our competitive position.

The market for broadband infrastructure solutions is intensely competitive, and we expect competition to increase in the future from established competitors and new market entrants. This competition could result in increased pricing pressure, reduced profit margins, increased selling, general and administrative expenses and our failure to increase, or the loss of, market share, any of which could materially adversely affect our business, financial condition, results of operations and prospects.

In the broadband service provider market, we primarily compete with larger and more established companies, such as Adtran, Cisco, CommScope, Ericsson, Huawei, Inseego, Nokia and Samsung.

Many of our existing and potential competitors enjoy substantial competitive advantages, such as:

- greater name recognition and longer operating histories;
- larger sales and marketing budgets and resources;
- broader distribution and established relationships with customers;
- greater access to larger customer bases;
- greater customer support resources;
- greater manufacturing resources;
- the ability to leverage their sales efforts across a broader portfolio of products;
- the ability to leverage purchasing power with vendor subcomponents;
- the ability to incorporate additional functionality into their existing products;
- the ability to bundle offerings with other products and services;
- the ability to set more aggressive pricing policies;
- the ability to offer greater amounts of equity and more valuable equity as incentives for purchases of their products and services;
- lower labor and development costs;
- greater resources to fund research and development or otherwise acquire new product offerings;
- larger intellectual property portfolios; and
- substantially greater financial, technical, research and development or other resources.

Our ability to compete will depend upon our ability to provide a comparable or better solution than our competitors at a price that offers superior value. We may be required to make substantial additional investments in research, development, sales and marketing in order to respond to competition.

We also expect increased competition if our market continues to expand. Conditions in our market could change rapidly and significantly as a result of technological advancements or other factors. Current or potential competitors may be acquired by third parties that have greater resources available than we do. Our current or potential competitors might take advantage of the greater resources of the larger organizations resulting from these acquisitions to compete more vigorously or broadly with us. In addition, continued industry consolidation might adversely affect customers' perceptions of the viability of smaller and even medium-sized companies, such as us, and, consequently, customers' willingness to purchase from us. Further, certain large customers may develop broadband infrastructure solutions for internal use and/or to broaden their portfolios of internally developed resources, which could allow these customers to become new competitors in our market.

If we are unable to sell additional products to our existing customers, our revenue will be adversely affected.

To increase our revenue, we must sell additional products to our existing customers and add new customers. We expect that a substantial portion of our future sales will be follow-on sales to existing customers. For example, one of our sales strategies is to target sales of capacity expansions and implementation of wireless solutions at our current cable customers because they are familiar with the operational and economic benefits of our solutions. However, our existing customers may choose to use other providers for their infrastructure needs. If we fail to sell additional products to our existing customers, our business, financial condition, results of operations and prospects could be materially adversely affected.

We may have difficulty attracting new large customers or acquiring new customers due to the high costs of switching broadband equipment.

Broadband service providers typically need to make substantial investments when deploying network infrastructure, which can delay a purchasing decision. Once a broadband service provider has deployed infrastructure for a particular portion of its network, it is often difficult and costly to switch to another vendor's infrastructure. Unless we are able to demonstrate that our products offer significant performance, functionality or cost advantages that outweigh a customer's expense of switching from a competitor's product, it will be difficult for us to generate sales once that competitor's equipment has been deployed. Accordingly, if a customer has already deployed a competitor's product for its broadband infrastructure, it may be difficult for us to sell our products to that customer. If we fail to attract new large customers or acquire new customers, our business, financial condition, results of operations and prospects could be materially adversely affected.

We are exposed to the credit risk of some of our customers and to credit exposures in the event of turmoil in the credit markets, which could result in material losses.

Due to our reliance on significant customers, we are dependent on the continued financial strength of these customers. If one or more of our significant customers experience financial difficulties, it could result in uncollectible accounts receivable and our loss of such customers and anticipated revenue.

The majority of our sales are on an open credit basis, with typical payment terms of one year or less. We monitor individual customer payment capability in granting such open credit arrangements, seeking to limit such open credit to amounts we believe our customers can pay and maintain reserves we believe are adequate to cover exposure for doubtful accounts. However, there can be no assurance that our open credit customers will pay the amounts they owe to us or that the reserves we maintain will be adequate to cover such credit exposure. Our customers' failure to pay and/or our failure to maintain sufficient reserves could have a material adverse effect on our consolidated financial statements. In addition, in the event that turmoil in the credit markets makes it more difficult for some customers to obtain financing, those customers' ability to pay could be adversely impacted, which in turn could have a material adverse impact on our business and operations.

A portion of our sales is also derived through our resellers, which tend to have more limited financial resources than other customers and to present increased credit risk. Our resellers also typically have the ability to terminate their agreements with us for any reason upon advance written notice.

We are exposed to fluctuations in currency exchange rates, which could adversely affect our business, financial condition, results of operations and prospects.

Our sales agreements are primarily denominated in U.S. dollars. Therefore, a strengthening U.S. dollar could increase the real cost of our products to our customers outside of the U.S., and alternatively a decrease in the value of the U.S. dollar relative to foreign currencies could increase our product and operating costs in foreign locations. If we are not able to successfully hedge against the risks associated with the currency fluctuations, our business, financial condition, results of operations and prospects could be materially adversely affected.

We generate a significant amount of revenue from sales to customers outside of the United States and have increased geographic diversity of our revenues following the acquisition of NetComm Wireless Limited, and we are therefore subject to a number of risks associated with international sales and operations.

We have extensive international operations and generate a significant amount of revenue from sales to customers in Asia-Pacific, Europe and Latin America. Our ability to grow our business and our future success will depend to a significant extent on our ability to continue to expand our operations and customer base worldwide. To this end, in the third quarter of 2019, we completed the acquisition of NetComm Wireless Limited, an Australian public company.

As a result of our international reach, we must hire and train experienced personnel to staff and manage our foreign operations. To the extent that we experience difficulties in recruiting, training, managing and retaining an international staff, and specifically staff related to sales management and sales personnel, we may experience difficulties in sales productivity in foreign markets. We also enter into strategic relationships with resellers and sales agents in certain international markets where we do not have a local presence. If we are not able to maintain these relationships or to recruit additional companies to enter into reseller and sales agent relationships, our future success in these international markets could be limited. Business practices in the international markets that we serve may differ from those in the U.S. and may require us in the future to include terms other than our standard terms in customer contracts. To the extent that we may enter into customer contracts in the future that include non-standard terms related to payment, warranties or performance obligations, our business, financial condition, results of operations and prospects could be materially adversely affected.

Our international sales and operations are subject to a number of risks, including the following:

- greater risk of unexpected changes in regulatory practices, tariffs and tax laws and treaties;
- greater difficulty in enforcing contracts and accounts receivable collection and longer collection periods;

- increased expenses incurred in establishing and maintaining our international operations;
- fluctuations in exchange rates between the U.S. dollar and foreign currencies where we do business;
- greater difficulty and costs in recruiting local experienced personnel;
- wage inflation in certain growing economies;
- general economic and political conditions in these foreign markets;
- economic uncertainty around the world as a result of sovereign debt issues;
- communication and integration problems resulting from cultural and geographic dispersion;
- limitations on our ability to access cash resources in our international operations;
- ability to establish necessary business relationships and to comply with local business requirements;
- risks associated with trade restrictions and foreign legal requirements, including the importation, certification and localization of our products required in foreign countries;
- the uncertainty of protection for intellectual property rights in some countries;
- delays resulting from our need to comply with foreign cybersecurity laws;
- greater risk of a failure of our operations and employees to comply with both U.S. and foreign laws and regulations, including antitrust regulations; the U.S. Foreign Corrupt Practices Act of 1977, as amended, or the FCPA; privacy and data protection laws and regulations and any trade regulations ensuring fair trade practices; and
- heightened risk of unfair or corrupt business practices in certain geographies and of improper or fraudulent sales arrangements that may impact financial results and result in restatements of, or irregularities in, financial statements.

These and other factors could harm our ability to gain future international revenue and, consequently, materially adversely affect our business, financial condition, results of operations and prospects. Expanding our existing international operations and entering into additional international markets will require significant management attention and financial commitments. Our failure to successfully manage our international operations and the associated risks effectively could limit our future growth or materially adversely affect our business, financial condition, results of operations and prospects.

We have significant operations in China, where many of the risks listed above are particularly acute. Import tariffs and other restrictions imposed by the U.S government and related retaliatory action taken by China could significantly increase, among other things, which could cause an increase in the costs of raw materials, manufacturing of our equipment and costs for goods imported into the United States, all of which could have a material adverse effect on our business and results of operations. Any such trade barriers could reduce customer demand for our products if our customers have to pay increased prices for our products as a result of such policies. In addition, such policies may have a similar impact on other suppliers and certain other customers, which could increase the negative impact on our operating results or future cash flows. Although we have not experienced a significant increase in the cost of our operations, if we were to do so, our products could become less competitive than those of our competitors whose imports are not subject to these trade policies.

In 2019 and 2018, the Office of the United States Trade Representative, or USTR, imposed significant new tariffs on a wide variety of Chinese products, including certain of our products, pursuant to Section 301 of the Trade Act of 1974. USTR has imposed significant additional tariffs on Chinese products, effective at various dates from July 6, 2018 through September 1, 2019. Effective February 14, 2020, certain of these tariffs were reduced or suspended, however, there continues to be significant uncertainty in connection with tariff matters. In the event that any existing tariffs are increased, or any additional tariffs are imposed on our products, or that our products become subject to any other trade barriers or restrictions, our business, financial condition, our results of operations and commercial prospects could be materially and adversely affected.

We are subject to anti-corruption laws such as the FCPA.

We are subject to anti-corruption laws such as the FCPA, which generally prohibits U.S. companies and their employees and intermediaries from making corrupt payments to foreign officials for the purpose of obtaining or keeping business, securing an advantage or directing business to another individual or entity, and requires companies to maintain accurate books and records. Under the FCPA, U.S. companies may be held liable for the corrupt actions taken by directors, officers, employees, agents, or other strategic or local partners or representatives. We rely on non-employee third-party representatives and other intermediaries to develop international sales opportunities, and generally have less direct control over such third parties' actions taken on our behalf. If we or our intermediaries fail to comply with the requirements of the FCPA or similar legislation, governmental authorities in the United States and elsewhere could seek to impose civil and/or criminal fines and penalties, which could have a material adverse effect on our business, reputation, results of operations and financial condition. We intend to increase our international sales and business and, as such, the cost of complying with such laws, and the potential harm from our noncompliance, are likely to increase.

Failure to comply with anti-corruption laws, such as the FCPA and the United Kingdom Bribery Act 2010, or the Bribery Act, and similar laws associated with our activities outside the U.S., could subject us to penalties and other adverse consequences. Any violation of the FCPA, Bribery Act or similar laws could result in whistleblower complaints, adverse media coverage, investigations, loss of export privileges, severe criminal or civil sanctions suspension or debarment from U.S. government contracts, all of which could have a material adverse effect on our reputation, business, results of operations and prospects. In addition, responding to any enforcement action or related investigation may result in a materially significant diversion of management's attention and resources and significant defense costs and other professional fees.

We are subject to governmental export and import controls and similar restrictions that could impair our ability to compete in international markets or subject us to liability if we violate them.

Our products may be subject to various export controls and because we incorporate encryption technology into certain of our products, certain of our products may be exported from various countries only with the required export license or through an export license exception. Furthermore, certain export control and economic sanctions laws prohibit the shipment of certain products, technology, software and services to embargoed countries and sanctioned governments, entities, and persons. If we fail to comply with the applicable export control laws, customs regulations, economic sanctions or other applicable laws, we could be subject to monetary damages or the imposition of restrictions which could materially adversely affect our business, financial condition, results of operations and prospects and could also harm our reputation. Further, there could be criminal penalties for knowing or willful violations, including incarceration for culpable employees and managers. Obtaining the necessary export license or other authorization for a particular sale may be time-consuming and may result in the delay or loss of sales opportunities. We previously disclosed that we may have inadvertently violated certain technical provisions of the U.S. export control laws and regulations by failing to inform customers of their export control obligations and failing to make certain submissions to the Commerce Department's Bureau of Industry and Security, or BIS, in a timely and complete manner. However, we believe that the exports of our products were all to destinations and end users that would not have required licensing under the U.S. export control and sanctions laws. We voluntarily disclosed the potential technical violations to BIS, and, on March 27, 2018, we were notified by BIS that it would not be imposing a penalty regarding this matter.

In addition, various countries regulate the import of certain encryption technology and products, including through import permit and license requirements, and have enacted laws that could limit our ability to distribute our products or could limit our customers' ability to implement our products in those countries. Any change in export or import regulations, economic sanctions or related legislation, shift in the enforcement or scope of existing regulations or change in the countries, governments, persons or technologies targeted by such regulations could result in decreased use of our products by, or in our decreased ability to export or sell our products to, existing or potential customers with international operations or create delays in the introduction of our products into international markets. Any decreased use of our products or limitation on our ability to export or sell our products could materially adversely affect our business, financial condition, results of operations and prospects.

As the majority of the growth in our revenue and income from operations has occurred since 2013, it is difficult to evaluate our future prospects.

We were founded in 2003 and booked our first revenue in 2006. The majority of the growth in our revenue and income from operations has occurred during 2013 to 2017. It is difficult to evaluate our future prospects, including our ability to plan for and manage future growth. We have encountered and will continue to encounter risks and difficulties frequently experienced by rapidly growing companies in constantly evolving industries, including the risks described in this Annual Report on Form 10-K. Since 2018, our revenue has declined. If we do not address these risks successfully, our business, financial condition, results of operations and prospects could be materially adversely affected, and the market price of our common stock could decline.

Our products are necessary for the operation of our customers' broadband service operations. Product quality problems, warranty claims, services disruptions, or other defects, errors or vulnerabilities in our products or services could harm our reputation and materially adversely affect our business, financial condition, results of operations and prospects.

We assist our customers in the operation of their broadband service operations. Failures of our products could result in significant interruptions in our customers' capabilities to maintain their networks and operations. Further, unsatisfactory performance could cause us to lose revenue or market share, increase our service costs, cause us to incur substantial costs in analyzing, correcting or redesigning our products, cause us to lose significant customers, subject us to liability for damages and divert our resources from other tasks, any one of which could materially adversely affect our business, financial condition, results of operations and prospects.

In addition, sophisticated hardware and operating system software and applications that we produce or procure from third parties may contain defects in design or manufacture, including "bugs" and other problems that could unexpectedly interfere with the operation of our networks, system, or products. Such defects could result in warranty claims or claims by customers for losses that they sustain or, in some cases, could allow customers to claim damages. In the past, we have had to replace certain components of products that we had shipped or provide remediation in response to the discovery of defects or bugs from failures in software protocols.

Limitation of liability provisions in our standard terms and conditions of sale, and those of our resellers and sales agents, may not be enforceable under some circumstances or may not fully or effectively protect us from end-customer claims and related liabilities and costs. In some cases, including with respect to indemnification obligations under many of our agreements with customers and resellers, our contractual liability may be uncapped. The sale and support of our products also entail the risk of product liability claims. We maintain insurance to protect against certain types of claims associated with the use of our products, but our insurance coverage may not adequately cover any such claims. In addition, even claims that ultimately are unsuccessful could result in expenditures of funds in connection with litigation and divert management's time and other resources.

Our products must interoperate with operating systems, software applications and hardware, and comply with industry standards, that are developed by others, and if we are unable to devote the necessary resources for our products to interoperate with such software and hardware and comply with such standards, we may lose or fail to increase market share and experience a weakening demand for our products.

Generally, our products comprise only a part of and must interoperate with our customers' existing infrastructure, specifically their networks, servers, software and operating systems, which may be manufactured by a wide variety of vendors and original equipment manufacturers. Our products must also comply with industry standards, such as Data Over Cable Service Interface Specification, or DOCSIS, 3.0 and 3.1, and standards promulgated by the 3rd Generation Partnership Project, or 3GPP, a standards organization which develops protocols for mobile technology, which are established by third parties, in order to interoperate with such servers, storage, software and other networking equipment such that all systems function efficiently together. We may depend on other vendors to support prevailing industry standards. Also, some industry standards may not be widely adopted or implemented uniformly and competing standards and other approaches may emerge that may be preferred by our customers.

In addition, when new or updated versions of these industry standards, software systems or applications are introduced, we must sometimes develop updated versions of our software so that our products will interoperate properly. We may not accomplish these development efforts quickly, cost-effectively or at all. These development efforts require capital investment and the devotion of engineering resources. If we fail to maintain compatibility with these systems and applications, our customers may not be able to adequately utilize our products, and we may lose or fail to increase market share and experience a weakening in demand for our products, among other consequences, which could materially adversely affect our business, financial condition, results of operations and prospects.

Our ability to sell our products is highly dependent on the quality of our support and services offerings, and our failure to offer high-quality support and services could have a material adverse effect on our business, financial condition, results of operations and prospects.

Once our products are deployed within our customers' networks, our customers depend on our support organization to resolve any issues relating to our products. Our provision of high-quality support is critical for the successful marketing and sale of our products. If we do not assist our customers in deploying our products effectively, do not succeed in helping our customers resolve post-deployment issues quickly or do not provide adequate ongoing support, it could adversely affect our ability to sell our products to existing customers and could harm our reputation with potential customers. In addition, our standard sales contracts require us to provide minimum service requirements to our customers on an ongoing basis and our failure to satisfy these requirements could expose us to claims under these contracts. Our failure to maintain high-quality support and services, including compliance with our contractual minimum service obligations, could have a material adverse effect on our business, financial condition, results of operations and prospects.

We base our inventory requirements on our forecasts of future sales. If these forecasts are materially inaccurate, we may procure inventory that we may be unable to use in a timely manner or at all.

We and our contract manufacturers procure components and build our products based on our forecasts. These forecasts are based on estimates of future demand for our products, which are in turn based on historical trends and analyses from our sales and marketing organizations, adjusted for overall market conditions. To the extent our forecasts are materially inaccurate or if we otherwise do not need such inventory, we may under- or over-procure inventory, and such inaccuracies in our forecasts could subject us to contractual damages and otherwise materially adversely affect our business, financial condition, results of operations and prospects.

Because we depend on third-party manufacturers to build our hardware, we are susceptible to manufacturing delays and pricing fluctuations that could prevent us from delivering customer orders on time, if at all, or on a cost-effective basis, which may result in the loss of sales and customers.

We depend on third-party contract manufacturers to manufacture our product hardware. A significant portion of our cost of revenue consists of payments to these third-party contract manufacturers. Our reliance on these third-party contract manufacturers reduces our control over the manufacturing process, quality assurance, product costs and product supply and timing, which exposes us to risk. To the extent that our products are manufactured at facilities in foreign countries, we may be subject to additional risks associated with complying with local rules and regulations in those jurisdictions. If we are unable to manage our relationships with our third-party contract manufacturers effectively, or if these third-party manufacturers suffer delays or disruptions for any reason, experience increased manufacturing lead times, capacity constraints or quality control problems in their manufacturing operations or fail to meet our future requirements for timely delivery, our ability to ship products to our customers would be severely impaired, and our business, financial condition, results of operations and prospects could be materially adversely affected.

Our contract manufacturers typically fulfill our supply requirements on the basis of individual orders. We do not have long-term contracts with our third-party manufacturers that guarantee capacity, the continuation of particular pricing terms or the extension of credit limits. Accordingly, they are not obligated to continue to fulfill our supply requirements, which could result in supply shortages and increases in the prices for manufacturing services on short notice. We may not be able to develop alternate contract manufacturers in a timely manner, or at all. If we add or change contract manufacturers or change any manufacturing plant locations within a contract manufacturer network, we would add additional complexity and risk to our supply chain management.

In addition, we may be subject to significant challenges in ensuring that quality, processes and costs, among other issues, are consistent with our expectations and those of our customers. A new contract manufacturer or manufacturing location may not be able to scale its production of our products at the volumes or quality we require. This could also adversely affect our ability to meet our scheduled product deliveries to our customers, which could damage our customer relationships and cause the loss of sales to existing or potential customers, late delivery penalties, delayed revenue or an increase in our costs which could adversely affect our gross margins. This could also result in increased levels of inventory subjecting us to increased excess and obsolete charges that could have a negative impact on our results of operations.

Because some of the key components in our products come from limited sources of supply, we are susceptible to supply shortages or supply changes, which could disrupt or delay our scheduled product deliveries to our customers and may result in the loss of sales and customers.

Our products rely on key components that our contract manufacturers purchase on our behalf from a limited number of suppliers, including Altera, Analog Devices, Bell Power, Broadcom, Intel, Marvell, Maxim, Mini-Circuits, Qorvo, Qualcomm, Quectel, TTM Technologies and Xilinx. We do not have guaranteed supply contracts with any of our component suppliers, and our suppliers could delay shipments or cease manufacturing such products or selling them to us at any time. The development of alternate sources for those components is time-consuming, difficult and costly. If we are unable to obtain a sufficient quantity of these components on commercially reasonable terms or in a timely manner, sales of our products could be delayed or halted entirely, or we may be required to redesign our products. For example, as a result of travel restrictions and the extension of the lunar new year holidays due to the recent outbreak of a novel strain of coronavirus originating in Wuhan, China, certain of our inventory shipments from China may be delayed. These events could result in lost sales and damage to our customer relationships, which would adversely impact our business, financial condition, results of operations and prospects. In the event of a shortage or supply interruption from our component suppliers, we may not be able to develop alternate or second sources in a timely manner, on commercially reasonable terms or at all. In addition, certain of our customer contracts require us to notify our customers of any discontinuation of the products that we supply to them and to provide support for discontinued products, and lack of supply from our suppliers could leave us unable to fulfill our customer support obligations. Adverse changes to our relationships with our sole suppliers could result in lost sales and damage to our customer relationships, which would adversely impact our business, financial condition, results of operations and prospects.

We rely on resellers and sales agents to sell our products into certain international markets, and the loss of such resellers and sales agents could delay or harm our ability to deliver our products to our customers.

We rely upon resellers and sales agents to coordinate sales and distribution of our products in certain international markets. We provide our resellers and sales agents with specific training and programs to assist them in selling our products, but these steps may not be effective. In addition, our resellers and sales agents may be unsuccessful in marketing, selling and supporting our products and services. If we are unable to develop and maintain effective sales incentive programs for our resellers and sales agents, we may not be able to incentivize these resellers and sales agents to sell our products to customers. Any of our resellers and sales agents could elect to consolidate or enter into a strategic partnership with one of our competitors, which could reduce or eliminate our future opportunities with that reseller or sales agent. Our agreements with our resellers and sales agents may generally be terminated for any reason by either party with advance notice. We may be unable to retain these resellers and sales agents or secure additional or replacement resellers and sales agents. The replacement of one or more of our significant resellers or sales agents requires extensive training, and any new or expanded relationship with a reseller or sales agent may take several months or more to achieve productivity. Any of these events could materially adversely affect our business, financial condition, results of operations and prospects.

Our operations have experienced rapid growth in recent years, and if we do not appropriately manage any future growth or are unable to improve our systems and processes, our business, financial condition, results of operations and prospects will be adversely affected.

We have experienced rapid growth in the scope and complexity of our operations in recent years and are investing in growing our suite of products for cable, fixed-line and wireless service providers. This has placed a strain on our management, administrative, operational and financial infrastructure. Our headcount has increased from 680 as of December 31, 2017 to 743 as of December 31, 2018 and to 997 as of December 31, 2019, which includes an additional 186 employees related to the NetComm acquisition, and we expect to continue to increase our headcount. As we have grown, we have had to manage an increasingly larger and more complex array of internal systems and processes to scale with all aspects of our business, including our software development, contract manufacturing and purchasing, logistics and fulfillment and sales, maintenance and support. Our success will depend in part upon our ability to manage our growth effectively. To do so, we must continue to increase the productivity of our existing employees and continue to hire, train and manage new employees as needed. To manage domestic and international growth of our operations and personnel, we will need to continue to improve our operational, financial and management controls and our reporting processes and procedures and implement more extensive and integrated financial and business information systems. We may not be able to successfully implement these or other improvements to our systems and processes in an efficient or timely manner, and we may discover deficiencies in their capabilities or effectiveness. Our failure to improve our systems and processes, or their failure to operate effectively and in the intended manner, may result in disruption of our current operations and customer relationships, our inability to manage the growth of our business and our inability to accurately forecast our revenue, expenses and earnings.

If we are unable to hire, retain, train and motivate qualified personnel and senior management, including in particular our founders, our business, financial condition, results of operations and prospects could be adversely affected.

Our future success depends, in part, on our ability to continue to attract and retain highly skilled personnel, particularly software engineering and sales personnel. Competition for highly skilled personnel is often intense, particularly in the greater Boston region where we are headquartered, and we may not be able to attract and retain the highly skilled employees that we need to support our business. Many of the companies with which we compete for experienced personnel have greater resources than we have to provide more attractive compensation packages and other amenities. Research and development personnel are aggressively recruited by startup and growth companies, which are especially active in many of the technical areas and geographic regions in which we conduct product development. In addition, in making employment decisions, particularly in the high-technology industry, job candidates often consider the value of the stock-based compensation they are to receive in connection with their employment. Declines in the market price of our stock could adversely affect our ability to attract, motivate or retain key employees. If we are unable to attract or retain qualified personnel, or if there are delays in hiring required personnel, our business, financial condition, results of operations and prospects could be materially adversely affected.

Also, to the extent we hire personnel from competitors, or from certain customers or other third parties whose employees we have agreed not to solicit, we may be subject to allegations that such personnel have been improperly solicited, that such personnel have divulged proprietary or other confidential information or that former employers own certain inventions or other work product. Such claims could result in litigation.

Our future performance also depends on the continued services and continuing contributions of our founders and senior management to execute our business plan and to identify and pursue new opportunities and product innovations. Our employment arrangements with our employees do not require that they continue to work for us for any specified period, and therefore, they could terminate their employment with us at any time. In particular, the loss of Jerry Guo, our President and Chief Executive Officer, and Weidong Chen, our Chief Technology Officer, could have a material adverse impact on our business. Further, the loss of other members of our senior management team, sales and marketing team or engineering team, or any difficulty attracting or retaining other highly qualified personnel in the future, could significantly delay or prevent the achievement of our development and strategic objectives, which could materially adversely affect our business, financial condition, results of operations and prospects. Except with respect to Mr. Guo, we do not maintain "key person" life insurance on our officers, directors or key employees.

If we do not effectively expand and train our direct sales force, we may be unable to increase sales to our existing customers or add new customers, and our business will be adversely affected.

We depend on our direct sales force to increase sales with existing customers and to obtain new customers. As such, we have invested and will continue to invest substantially in our sales organization. In recent periods, we have been adding personnel to our sales function as we focus on growing our business, entering new markets and increasing our market share. There is significant competition for sales personnel with the skills and technical knowledge that we require. Our ability to achieve significant revenue growth will depend, in large part, on our success in recruiting, training, retaining and integrating sufficient numbers of sales personnel to support our growth, particularly in international markets. In addition, we have significantly increased the number of personnel in our sales and marketing departments in recent periods, with headcount growing from 122 as of December 31, 2017 to 142 as of December 31, 2018 and to 180 as of December 31, 2019, which includes an additional 39 sales and marketing employees related to the NetComm acquisition. New hires require significant training and may take significant time before they achieve full productivity. Our recent hires and planned hires may not become productive as quickly as we expect, and we may be unable to hire, retain or integrate into our corporate culture sufficient numbers of qualified individuals in the markets where we do business or plan to do business. If we are unable to hire, integrate and train a sufficient number of effective sales personnel, or the sales personnel we hire are not successful in obtaining new customers or increasing sales to our existing customer base, our business, financial condition, results of operations and prospects could be materially adversely affected.

Adverse economic conditions or reduced broadband infrastructure spending may adversely affect our business, financial condition, results of operations and prospects.

Our business depends on the overall demand for broadband connectivity. Weak domestic or global economic conditions, fear or anticipation of such conditions or a reduction in broadband infrastructure spending even if economic conditions improve, could materially adversely affect our business, financial condition, results of operations and prospects in a number of ways, including longer sales cycles, lower prices for our products and services, reduced sales and lower or no growth. Continued turmoil in the geopolitical environment in many parts of the world may also affect the overall demand for our products and services. Deterioration in global economic or political conditions could materially adversely affect our business, financial condition, results of operations and prospects in the future. A prolonged period of economic uncertainty or a downturn may also significantly affect the availability of capital and the terms and conditions of financing arrangements, including the overall cost of financing as well as the financial health or creditworthiness of our customers. Circumstances may arise in which we need, or desire, to raise additional capital, and such capital may not be available on commercially reasonable terms, or at all.

Breaches of our cybersecurity systems and measures could degrade our ability to conduct our business operations and deliver products and services to our customers, delay our ability to recognize revenue, compromise the integrity of our products, result in significant data losses and the theft of our intellectual property, damage our reputation, expose us to liability to third parties and require us to incur significant additional costs to maintain the security of our networks and data.

We increasingly depend upon our IT systems to conduct virtually all of our business operations, ranging from our internal operations and product development activities to our marketing and sales efforts and communications with our customers and business partners. Certain persons and entities may attempt to penetrate our network and systems, or of the systems hosting our website, and may otherwise seek to misappropriate our proprietary or confidential information or cause interruptions of our service. Because the techniques used by such persons and entities to access or sabotage networks and systems change frequently and may not be recognized until launched against a target, we may be unable to anticipate these techniques. We have also outsourced a number of our business functions to third parties, including our manufacturers and logistics providers, and our business operations also depend, in part, on the success of these third parties' own cybersecurity measures. Additionally, we depend upon our employees and independent contractors to appropriately handle confidential data and deploy our IT resources in a safe and secure fashion that does not expose our network systems to security breaches and the loss of data. Accordingly, if any of our cybersecurity systems, processes or policies, or those of any of our manufacturers, logistics providers, customers or independent contractors, fail to protect against unauthorized access, sophisticated hacking or terrorism and the mishandling, misuse, or misappropriation of data by employees, contractors or other persons or entities, our ability to conduct our business effectively could be damaged in a number of ways, including:

- sensitive data regarding our business, including intellectual property, personal information and other confidential and proprietary data, could be stolen;
- our electronic communications systems, including email and other methods, could be disrupted, and our ability to conduct our business operations could be seriously damaged until such systems can be restored;
- our ability to process customer orders and electronically deliver products and services could be degraded, and our distribution channels could be disrupted, resulting in delays in revenue recognition, damage to our relationships with customers and prospective customers and damage to our reputation;
- defects and security vulnerabilities could be introduced into our software, products, network and systems, thereby damaging our reputation and perceived reliability and security of our products and potentially making the systems of our customers vulnerable to data loss and cyber incidents; and
- personally, identifiable data relating to various parties, including end users, employees and business partners could be compromised.

Should any of the above events occur, we could be subject to significant claims for liability from our customers, employees or others and regulatory investigations or actions from governmental agencies. In addition, our ability to protect our intellectual property rights could be compromised and our reputation and competitive position could be significantly harmed. Any regulatory, contractual or other actions, litigations, investigations, fines, penalties and liabilities relating to any actual or alleged misuse or misappropriation of personal data or other confidential or proprietary information could be significant in terms of monetary exposure and reputational impact and necessitate changes to our business operations that may be disruptive to us. Additionally, we could incur significant costs in order to upgrade our cybersecurity systems, processes, policies and procedures and remediate damages. Consequently, our financial performance and results of operations could be materially adversely affected.

If we are unable to obtain, maintain or protect our intellectual property rights, our competitive position could be harmed or we could be required to incur significant expenses to enforce our rights.

Our success depends, in part, on our ability to protect our proprietary technology. We rely on trade secret, patent, copyright and trademark laws and confidentiality agreements with employees and third parties to protect and enforce our rights to our proprietary technology, all of which offer only limited protection.

In order to protect our proprietary information, we rely in significant part on confidentiality arrangements with our employees, licensees, independent contractors, advisers and customers. These arrangements may not be effective to prevent disclosure of confidential information, including trade secrets, and may not provide an adequate remedy in the event of unauthorized disclosure of confidential information. In addition, if others independently discover our trade secrets, we would not be able to assert trade secret rights against such parties. Effective trade secret protection may not be available in every country in which our services are available or where we have employees or independent contractors. The loss or unavailability of trade secret protection could make it easier for third parties to compete with our products by copying functionality. In addition, any changes in, or unexpected interpretations of, the trade secret and employment laws in any jurisdiction in which we operate may compromise our ability to enforce our intellectual property rights. Costly and time-consuming litigation could be necessary to enforce and determine the scope of our proprietary rights, and failure to obtain or maintain trade secret protection could adversely affect our competitive business position.

We also rely on patents to protect certain aspects of our proprietary technology in the United States. The process of obtaining patent protection is expensive and time-consuming, and we may not be able to prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. We may choose not to seek patent protection for certain innovations and may choose not to pursue patent protection in certain jurisdictions. Further, we cannot guarantee that any of our pending patent applications will result in the issuance of patents or that any patents that do issue from such applications will have adequate scope to provide us with a competitive advantage. There is no assurance that all potentially relevant prior art relating to our patents and patent applications has been found. To the extent that additional patents are issued from our patent applications, which is not certain, third parties may challenge their validity, enforceability or scope, which may result in such patents being narrowed or invalidated. If third parties have prepared and filed patent applications in the United States that also claim technology to which we have rights, we may have to participate in interference proceedings in the United

States Patent and Trademark Office to determine priority of invention for patent applications filed before March 16, 2013, or in derivation proceedings to determine inventorship for patent applications filed after such date. In addition, patents have a limited lifespan. In the United States, the natural expiration of a patent is generally 20 years after its effective filing date. Even if patents covering our products are obtained by us or by our licensors, once such patents expire, we may be vulnerable to competition from similar products. Moreover, the rights granted under any issued patents may not provide us with adequate protection or competitive advantages, and, as with any technology, competitors may be able to develop similar or superior technologies to our own now or in the future.

Despite our efforts, the steps we have taken to protect our proprietary rights may not be adequate to preclude misappropriation of our proprietary information or infringement of our intellectual property rights, and our ability to police such misappropriation or infringement is uncertain, particularly in countries outside of the United States. Competitors may use our technologies in jurisdictions where we have not obtained or are unable to adequately enforce intellectual property protection to develop their own products. We are also restricted from asserting our intellectual property rights against certain customers under our contracts with them.

Detecting and protecting against the unauthorized use of our products, technology and proprietary rights is expensive, difficult and, in some cases, impossible. Litigation may be necessary in the future to enforce or defend our intellectual property rights, to protect our trade secrets or to determine the validity and scope of the proprietary rights of others. Such litigation could result in substantial costs and diversion of management resources, either of which could materially adversely affect our business, financial condition, results of operations and prospects, and there is no guarantee that we would be successful. Furthermore, many of our current and potential competitors have the ability to dedicate substantially greater resources to protecting their technology or intellectual property rights than we do. Accordingly, despite our efforts, we may not be able to prevent third parties from infringing upon or misappropriating our intellectual property, which could result in a substantial loss of our market share. Even if we did succeed in enforcing our intellectual property through litigation, this may be costly and divert management resources.

Finally, certain of our license agreements with our third-party licensors provide for joint ownership of developments or inventions that we create that are related to the subject matter of the license. Other agreements to which we are subject, including member agreements with standards bodies and research and development consortia, may require us to disclose and/or grant licenses to technology that is related to the subject matter of the standards body or the consortium and included in our contributions to specifications established by these bodies. These agreements could result in third parties having ownership or license rights to important intellectual property that we otherwise may have elected to maintain exclusive ownership of.

If our trademarks and trade names are not adequately protected, then we may not be able to build name recognition in our markets of interest and our business may be adversely affected.

We have not applied for trademark registration for our name and logo in all geographic markets. In those markets where we have applied for trademark registration, failure to secure those registrations could adversely affect our ability to enforce and defend our trademark rights and result in indemnification claims. Our registered or unregistered trademarks or trade names, as well as the registered or unregistered trademarks or trade names used by our resellers or distributors associated with our products, may be challenged, infringed, circumvented or declared generic or determined to be infringing on other marks. Any claim of infringement by a third party, even those claims without merit, could cause us to incur substantial costs defending against such claim, could divert management attention from our business and could require us to cease use of such intellectual property in certain geographic markets. Over the long term, if we, or our resellers or distributors, are unable to establish name recognition based on our trademarks and trade names, then our business may be adversely affected.

Assertions by third parties of infringement or other violations by us of their intellectual property rights, or other lawsuits asserted against us, could result in significant costs and materially adversely affect our business, financial condition, results of operations and prospects.

Patent and other intellectual property disputes are common in the broadband infrastructure industry and have resulted in protracted and expensive litigation for many companies. Many companies in the broadband infrastructure industry, including our competitors and other third parties, as well as non-practicing entities, own large numbers of patents, copyrights, trademarks and trade secrets, which they may use to assert claims of patent infringement, misappropriation or other violations of intellectual property rights against us. From time to time, they have or may in the future also assert such claims against our customers whom we typically indemnify against claims that our products infringe, misappropriate or otherwise violate the intellectual property rights of third parties.

As the number of products and competitors in our market increases and overlaps occur, claims of infringement, misappropriation and other violations of intellectual property rights may increase. Any claim of infringement, misappropriation or other violations of intellectual property rights by a third party, even those without merit, could cause us to incur substantial costs defending against the claim, distract our management from our business and require us to cease use of such intellectual property, which may impact important elements of our business. In addition, some claims for patent infringement may relate to subcomponents that we purchase from third parties. If these third parties are unable or unwilling to indemnify us for these claims, we could be substantially harmed.

The patent portfolios of most of our competitors are larger than ours. This disparity may increase the risk that our competitors may sue us for patent infringement and may limit our ability to counterclaim for patent infringement or settle through patent cross-licenses. In addition, future assertions of patent rights by third parties, and any resulting litigation, may involve patent holding companies or other adverse patent owners who have no relevant product revenue and against whom our own patents may therefore provide little or no deterrence or protection. We cannot guarantee that we are not infringing or otherwise violating any third-party intellectual property rights.

The third-party asserters of intellectual property claims may be unreasonable in their demands, or may simply refuse to settle, which could lead to expensive settlement payments, prolonged periods of litigation and related expenses, additional burdens on employees or other resources, distraction from our business, supply stoppages and lost sales. Moreover, in recent years, individuals and groups that are non-practicing entities, commonly referred to as “patent trolls,” have purchased patents and other intellectual property assets for the purpose of making claims of infringement in order to extract settlements. In the past, we have received threatening letters or notices and have been the subject of claims that our solutions and underlying technology infringe or violate the intellectual property rights of others. Responding to such claims, regardless of their merit, can be time-consuming, costly to defend in litigation, divert management’s attention and resources, damage our reputation and brand, and cause us to incur significant expenses.

An adverse outcome of a dispute may require us to pay substantial damages including treble damages if we are found to have willfully infringed a third party’s patents; cease making, licensing or using solutions that are alleged to infringe or misappropriate the intellectual property of others; expend additional development resources to attempt to redesign our products or services or otherwise to develop non-infringing technology, which may not be successful; enter into potentially unfavorable royalty or license agreements in order to obtain the right to use necessary technologies or intellectual property rights; and indemnify our partners and other third parties. Any damages or royalty obligations we may become subject to as a result of an adverse outcome, and any third-party indemnity we may need to provide, could materially adversely affect our business, financial condition, results of operations and prospects. Royalty or licensing agreements, if required or desirable, may be unavailable on terms acceptable to us, or at all, and may require significant royalty payments and other expenditures. Further, there is little or no information publicly available concerning market or fair values for license fees, which can lead to overpayment of license or settlement fees. In addition, some licenses may be non-exclusive, and therefore our competitors may have access to the same technology licensed to us. Suppliers subject to third-party intellectual property claims also may choose or be forced to discontinue or alter their arrangements with us, with little or no advance notice to us. Any of these events could materially adversely affect our business, financial condition, results of operations and prospects.

Litigation could distract management, increase our expenses or subject us to material money damages and other remedies.

We are subject to four putative class action lawsuits alleging federal securities law violations in connection with our initial public offering and our subsequent follow-on offering, and may be involved from time to time in various additional legal proceedings, including, but not limited to, actions relating to breach of contract or intellectual property infringement that might necessitate changes to our business or operations. Regardless of whether any claims against us have merit, or whether we are ultimately held liable or subject to payment of damages, claims may be expensive to defend and may divert management's time away from our operations. If any legal proceedings were to result in an unfavorable outcome, it could have a material adverse effect on our business, financial position and results of operations. Any adverse publicity resulting from actual or potential litigation may also materially and adversely affect our reputation, which in turn could adversely affect our results.

Unavailability, termination or breach of licenses to third-party software and other intellectual property could materially harm our business.

Many of our products and services include software or other intellectual property licensed from third parties, and we otherwise use software and other intellectual property licensed from third parties in our business. We exercise no control over our third-party licensors, and the failure or unsuitability of their software or other intellectual property exposes us to risks that we will have little ability to control. For example, a licensor may have difficulties keeping up with technological changes or may stop supporting the software or other intellectual property that it licenses to us; our licensors may also have the ability to terminate our licenses if the licensed technology becomes the subject of a claim of intellectual property infringement. Also, it will be necessary in the future to renew licenses, expand the scope of existing licenses or seek new licenses, relating to various aspects of these products and services or otherwise relating to our business, which may result in increased license fees. Any new licenses may not be available on acceptable terms, if at all. In addition, a third party may assert that we or our customers are in breach of the terms of a license, which could, among other things, give such third party the right to terminate a license or seek damages from us, or both. The inability to obtain or maintain certain licenses or other rights or to obtain or maintain such licenses or rights on favorable terms, or the need to engage in litigation regarding these matters, could result in delays in releases of products and services and could otherwise disrupt our business, until equivalent technology can be identified, licensed or developed, if at all, and integrated into our products and services or otherwise in the conduct of our business. Moreover, the inclusion in our products and services of software or other intellectual property licensed from third parties on a nonexclusive basis may limit our ability to differentiate our products from those of our competitors. Any of these events could have a material adverse effect on our business, financial condition, results of operations and prospects.

Our products contain third-party open source software components, and failure to comply with the terms of the underlying open source software licenses could restrict our ability to sell our products.

Our products contain software modules licensed to us by third-party authors under “open source” licenses. Use and distribution of open source software may entail greater risks than use of third-party commercial software, as open source licensors generally do not provide warranties or other contractual protections regarding infringement claims or the quality of the code. Some open source licenses contain requirements that we make available source code for modifications or derivative works we create based upon the type of open source software that we use. If we combine our software with open source software in a certain manner, we could, under certain open source licenses, be required to release portions of the source code of our software to the public. This would allow our competitors to create similar products with lower development effort and time and ultimately could result in a loss of product sales for us.

Although we monitor our use of open source software to avoid subjecting our products to undesirable conditions, we do not have a formal open source policy in place that gives our developers written guidance on what open source licenses we deem “safe.” Further, even where we believe an open source license may have acceptable conditions, the terms of many open source licenses have not been interpreted by U.S. courts, and these licenses could be construed in a way that could impose unanticipated conditions or restrictions on our ability to commercialize our products. Moreover, we cannot assure you that our informal processes for controlling our use of open source software in our products will be effective or that our compliance with open source licenses, including notice and attribution requirements, are adequate. If we are held to have breached the terms of an open source software license, we could be required to seek licenses from third parties to continue offering our products on terms that are not economically feasible, to re-engineer our products, to discontinue the sale of our products if re-engineering could not be accomplished on a timely or commercially reasonable basis or to make generally available, in source code form, our proprietary code. We also could face infringement claims. Any of the foregoing could materially adversely affect our business, financial condition, results of operations and prospects.

Our failure to adequately protect personal data and to comply with related laws and regulations could result in material liability.

A wide variety of provincial, state, national, foreign, and international laws and regulations apply to the collection, use, retention, protection, disclosure, transfer (including across national boundaries), and other processing of personal data. These data protection and privacy-related laws and regulations are evolving and being tested in courts and may result in ever-increasing regulatory and public scrutiny and escalating levels of enforcement and sanctions.

Any failure by us to comply with applicable laws and regulations, or to protect such data, could result in enforcement action against us, including fines, imprisonment of company officials, public censure, claims for damages by end customers and other affected persons and entities, damage to our reputation and loss of goodwill, and other forms of injunctive or operations-limiting relief, any of which could have a material adverse effect on our operations, financial performance, and business.

Definitions of personal data and personal information, and requirements relating to the same under applicable laws and regulations within the European Union, the United States, Australia, and elsewhere, change frequently and are subject to new and different interpretations by courts and regulators. Because the interpretation and application of laws and other obligations relating to privacy and data protection are uncertain, it is possible that existing or future laws, regulations, and other obligations may be interpreted and applied in a manner that is inconsistent with our data management practices. We may be required to expend significant resources to modify our products and otherwise adapt to these changes, which we may be unable to do on commercially reasonable terms or at all, and our ability to develop new products and features could be limited. These developments could harm our business, financial condition and results of operations. Even if not subject to legal challenge, the perception of privacy concerns, whether or not valid, may harm our reputation and inhibit adoption of our products by current and prospective customers.

Failure to comply with governmental laws and regulations could materially adversely affect our business, financial condition, results of operations and prospects.

Our business is subject to regulation by various federal, state, local and foreign governmental agencies, including agencies responsible for monitoring and enforcing employment and labor laws, workplace safety, product safety, environmental laws, consumer protection laws, anti-bribery laws, import/export controls, foreign investment, federal securities laws and tax laws and regulations. In certain jurisdictions, these regulatory requirements may be more stringent than those in the United States. From time to time, we may receive inquiries from such governmental agencies or we may make voluntary disclosures regarding our compliance with applicable governmental regulations or requirements. Noncompliance with applicable government regulations or requirements could subject us to sanctions, mandatory product recalls, enforcement actions, disgorgement of profits, fines, damages, civil and criminal penalties or injunctions. If any governmental sanctions are imposed, or if we do not prevail in any possible civil or criminal litigation, our business, financial condition, results of operations and prospects could be materially adversely affected. In addition, responding to any action will likely result in a significant diversion of management’s attention and resources and an increase in professional fees. Enforcement actions and sanctions could materially adversely affect our business, financial condition, results of operations and prospects.

We may invest in or acquire other businesses, which could require significant management attention, disrupt our business, dilute stockholder value and adversely affect our business, financial condition, results of operations and prospects.

As part of our growth strategy, we may make investments in or acquire complementary companies, products or technologies. For example, on July 1, 2019, we announced that we closed the acquisition of NetComm Wireless Limited in Australia for cash consideration of AUD $162.0 million (USD $112.7 million, based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019). We do not have significant experience in making investments in other companies nor have we made a significant number of acquisitions to date, and as a result, our ability as an organization to evaluate and/or complete investments or acquire and integrate other companies, products or technologies in a successful manner is unproven. We may not be able to find suitable future investment or acquisition candidates, and we may not be able to complete such investments or acquisitions on favorable terms, if at all. Our acquisition of NetComm Wireless Limited may not achieve the objectives we have outlined for our stockholders or strengthen our competitive position. If we complete additional investments or acquisitions, we may not ultimately strengthen our competitive position or achieve our goals, and any investments or acquisitions we complete could be viewed negatively by our customers, investors and securities analysts.

In addition, current and future investments and acquisitions may result in unforeseen operating difficulties and expenditures. For example, if we are unsuccessful at integrating any acquisitions or retaining key talent from those acquisitions, or the technologies associated with such acquisitions, into our company, the business, financial condition, results of operations and prospects of the combined company could be materially adversely affected. Any integration process may require significant time and resources, and we may not be able to manage the process successfully. We may not successfully evaluate or utilize the acquired technology or personnel or accurately forecast the financial effects of an acquisition transaction, including accounting charges. We may have to pay cash, incur debt or issue equity securities to pay for any such investment or acquisition, each of which could adversely affect our financial condition or the market price of our common stock. The sale of equity or issuance of debt to finance any such acquisitions could result in dilution to our stockholders. The incurrence of indebtedness would result in increased fixed obligations and could also include covenants or other restrictions that would impede our ability to manage our operations. Moreover, if the investment or acquisition becomes impaired, we may be required to take an impairment charge, which could adversely affect our financial condition or the market price of our common stock.

Our international operations may give rise to potentially adverse tax consequences.

We are expanding our international operations and staff to better support our growth into the international markets. We generally conduct our international operations through wholly owned subsidiaries and report our taxable income in various jurisdictions worldwide based upon our business operations in those jurisdictions. Our corporate structure and associated transfer pricing policies contemplate the business flows and future growth into the international markets, and consider the functions, risks and assets of the various entities involved in the intercompany transactions. The amount of taxes we pay in different jurisdictions will depend to a significant degree on the application of the tax laws of the various jurisdictions to our international business activities, changes in tax rates, new or revised tax laws or interpretations of existing tax laws and policies and our ability to operate our business in a manner consistent with our corporate structure and intercompany arrangements, any or all of which could result in additional tax liabilities or increases in, or in the volatility of, our effective tax rate.

The taxing authorities of the jurisdictions in which we operate may challenge our methodologies for pricing intercompany transactions, which are required to be computed on an arm's-length basis pursuant to the intercompany arrangements or disagree with our determinations as to the income and expenses attributable to specific jurisdictions. If such a challenge or disagreement were to occur, and our position was not sustained, we could be required to pay additional taxes, interest and penalties, which could result in one-time tax charges, higher effective tax rates, reduced cash flows and lower overall profitability of our operations; in addition, it is uncertain whether any such adverse effects could be mitigated by corresponding adjustments in other jurisdictions with respect to the items affected. Our financial statements could fail to reflect adequate reserves to cover such a contingency.

Further changes in the tax laws of foreign jurisdictions could arise, including as a result of the base erosion and profit shifting project undertaken by the Organization for Economic Co-operation and Development, or the OECD. The OECD, which represents a coalition of member countries, has issued recommendations that, in some cases, make substantial changes to numerous long-standing tax positions and principles; many of these changes have been adopted or are under active consideration by OECD members and/or other countries.

Portions of our operations are subject to a reduced tax rate under various tax holidays and rulings. We also utilize tax rulings and other agreements to obtain certainty in treatment of certain tax matters. These tax holidays and rulings expire in whole or in part from time to time and may be extended when certain conditions are met or terminated if certain conditions are not met. The impact of any changes in conditions would be the loss of certainty in treatment thus potentially impacting our effective income tax rate.

Recent changes to the U.S. tax laws impact the tax treatment of foreign earnings by, among other things, creating limits on the ability of taxpayers to claim and utilize foreign tax credits, imposing minimum effective rates of current tax on certain classes of foreign income, and imposing additional taxes in connection with specified payments to related foreign recipients, among other items. While some of these changes may be adverse on a going forward basis, others may provide benefits that may be applicable to us. Due to our existing international business activities, which we anticipate expanding, any additional guidance such as U.S Treasury regulations and administrative interpretations may increase our worldwide effective tax rate and adversely affect our financial condition and operating results.

We are also subject to the examination of our tax returns by the U.S. Internal Revenue Service, or IRS, and other tax authorities. The final determination of tax audits and any related disputes could be materially different from our historical income tax provisions and accruals and could have an adverse effect on our financial statements for the period or periods for which the applicable final determinations are made.

Taxing authorities may successfully assert that we should have collected or in the future should collect sales and use, value added or similar taxes, and we could be subject to liability with respect to past or future sales, which could adversely affect our operating results.

We do not collect sales and use, value added or similar taxes in all jurisdictions in which we have sales, and we have been advised that such taxes are not applicable to our products and services in certain jurisdictions. Sales and use, value added, and similar tax laws and rates vary greatly by jurisdiction. Certain jurisdictions in which we do not collect such taxes may assert that such taxes are applicable, which could result in tax assessments, penalties and interest, to us or our end-customers for the past amounts, and we may be required to collect such taxes in the future. If we are unsuccessful in collecting such taxes from our end-customers, we could be held liable for such costs. Such tax assessments, penalties and interest, or future requirements may adversely affect our operating results.

If we needed to raise additional capital to expand our operations and invest in new products, our failure to do so on favorable terms could reduce our ability to compete and could materially adversely affect our business, financial condition, results of operations and prospects.

We expect that our existing cash and cash equivalents will be sufficient to meet our anticipated cash needs for at least the next 12 months. However, if we need to raise additional funds to expand our operations and invest in new products, we may not be able to obtain additional debt or equity financing on favorable terms, if at all. If we raise additional equity financing, our stockholders may experience significant dilution of their ownership interests, and the market price of our common stock could decline.

Our business is subject to the risks of fire, power outages, floods and other catastrophic events and to interruption by manmade problems such as terrorism.

Our corporate headquarters and the operations of our key manufacturing vendors, as well as many of our customers, are located in areas exposed to risks of natural disasters such as fires and floods. A significant natural disaster, such as a fire, flood or other catastrophic events such as a disease outbreak, could have a material adverse effect on our or their business, which could in turn materially adversely affect our business, financial condition, results of operations and prospects. For example, as a result of travel restrictions and the extension of the lunar new year holidays due to the recent outbreak of a novel strain of coronavirus originating in Wuhan, China, certain of our inventory shipments from China may be delayed. In the event our manufacturing or logistics abilities are hindered by any of the events discussed above, shipments could be delayed, which could result in missed financial targets, such as revenue and shipment targets, for a particular quarter. Further, if a natural disaster occurs in a region from which we derive a significant portion of our revenue, customers in that region may delay or forego purchases of our products, which could materially adversely affect our business, financial condition, results of operations and prospects. In addition, acts of terrorism could cause disruptions in our business or the business of our manufacturers, logistics providers, partners or customers or the economy as a whole. All of the aforementioned risks may be compounded if our disaster recovery plans and those of our manufacturers, logistics providers or partners prove to be inadequate. To the extent that any of the above results in delays or cancellations of customer orders, or delays in the manufacture, deployment or shipment of our products, our business, financial condition, results of operations and prospects would be adversely affected.

The coronavirus outbreak could negatively impact our international operations.

In December 2019, a novel strain of coronavirus has been reported in China and other countries. We, and certain of our suppliers and sub-suppliers, have significant operations in China and Asia and may experience business disruptions as a result of the coronavirus outbreak. The extent to which the coronavirus impacts our results will depend on future developments that are highly uncertain and cannot be accurately predicted, including new information which may emerge concerning the severity of the coronavirus and the actions required to contain the coronavirus or remedy its impact, among others.

Regulations affecting broadband infrastructure could reduce demand for our products.

Laws and regulations governing the Internet and electronic commerce are emerging but remain largely unsettled, even in the areas where there has been some legislative action. Regulations may focus on, among other things, assessing access or settlement charges, or imposing tariffs or regulations based on the characteristics and quality of products, either of which could restrict our business or increase our cost of doing business. Government regulatory policies are likely to continue to have a major impact on the pricing of existing and new network services and, therefore, are expected to affect demand for those services and the communications products, including our products, supporting those services.

Any changes to existing laws or the adoption of new regulations by federal or state regulatory authorities or any legal challenges to existing laws or regulations affecting IP networks could materially adversely affect the market for our products. Moreover, customers may require us, or we may otherwise deem it necessary or advisable, to alter our products to address actual or anticipated changes in the regulatory environment. Our inability to alter our products or address any regulatory changes could have a material adverse effect on our consolidated financial position, results of operations or cash flows.

We have outstanding debt that could limit our ability to make expenditures and investments in the conduct of our business and adversely impact our ability to obtain future financing.

We have outstanding debt. We may be unable to generate cash sufficient to pay when due the principal of, interest on or other amounts due in respect of our indebtedness. We may be required to dedicate significant cash flows from operations to make such payments, which could limit our ability to make other expenditures and investments in the conduct of our business. Our indebtedness may also reduce our flexibility in planning for or reacting to changes in our business and market conditions. Our indebtedness also exposes us to interest rate risk, since our debt obligations generally bear interest at variable rates. In addition, we may incur additional indebtedness in the future to meet future financing needs. If we add new debt, the risks described above could increase.

The elimination of LIBOR could adversely affect our business, results of operations or financial condition.

In July 2017, the head of the United Kingdom Financial Conduct Authority announced plans to phase out the use of LIBOR by the end of 2021. Although the impact is uncertain at this time, the elimination of LIBOR could have an adverse impact on our business, results of operations, or financial condition. We may incur significant expenses to amend our LIBOR-indexed loans, derivatives, and other applicable financial or contractual obligations, including our credit facilities, to a new reference rate, which may differ significantly from LIBOR. Accordingly, the use of an alternative rate could result in increased costs, including increased interest expense on our credit facilities, and increased borrowing and hedging costs in the future. Additionally, the elimination of LIBOR may adversely impact the value of and the expected return on our existing derivatives. At this time, no consensus exists as to what rate or rates may become acceptable alternatives to LIBOR and we are unable to predict the effect of any such alternatives on our business, results of operations or financial condition.

Our credit facility contains restrictive and financial covenants that may limit our operating flexibility.

Our credit facility contains certain restrictive covenants that either limit our ability to, or require a mandatory prepayment in the event we, incur additional indebtedness and liens, merge with other companies or consummate certain changes of control, acquire other companies, engage in new lines of business, change business locations, make certain investments, make any payments on any subordinated debt, transfer or dispose of assets, amend certain material agreements, and enter into various specified transactions. We, therefore, may not be able to engage in any of the foregoing transactions unless we obtain the consent of our lenders or prepay the outstanding amount under the credit facility. In addition to certain financial reporting requirements, the credit facility also contains a net leverage ratio covenant that may significantly reduce our available borrowings under such facilities. As of December 31, 2019, we were in default of the net leverage ratio covenant. Our obligations under the credit facility are secured by substantially all of our assets, excluding intellectual property and certain investments in foreign subsidiaries. Furthermore, our future working capital, borrowings or equity financing could be unavailable to repay or refinance the amounts outstanding under the credit facility. In the event of a liquidation, our lenders would be repaid all outstanding principal and interest prior to distribution of assets to unsecured creditors, and the holders of our common stock would receive a portion of any liquidation proceeds only if all of our creditors, including our lenders, were first repaid in full.

Risks Related to Our Common Stock

Our results of operations are likely to vary significantly from period to period and be unpredictable. If we fail to meet the expectations of analysts or investors, the market price of our common stock could decline substantially.

Our results of operations have historically varied from period to period, and we expect that this trend will continue. As a result, you should not rely upon our past financial results for any period as indicators of future performance. Our results of operations in any given period can be influenced by a number of factors, many of which are outside of our control and may be difficult to predict, including the factors described above as well as:

- changes in our pricing policies, whether initiated by us or as a result of competition;
- the amount and timing of operating costs and capital expenditures related to the operation and expansion of our business;
- changes in the growth rate of the broadband services market;
- the actual or rumored timing and success of new product and service introductions by us or our competitors or any other change in the competitive landscape of our industry, including consolidation among our competitors or customers;

- our ability to successfully expand our business geographically;
- insolvency or credit difficulties confronting our customers, which could adversely affect their ability to purchase or pay for our products and services, or confronting our key suppliers, including our sole source suppliers, which could disrupt our supply chain;
- our inability to fulfill our customers' orders due to supply chain delays, access to key commodities or technologies or events that impact our manufacturers or their suppliers;
- the cost and possible outcomes of any legal actions or proceedings against us, including those described under "Part I, Item 3 – Legal Proceedings";
- our overall effective tax rate, including impacts caused by any changes in the valuation of our deferred tax assets and any new legislation or regulatory developments;
- increases or decreases in our expenses caused by fluctuations in foreign currency exchange rates; and
- general economic conditions, both domestically and in foreign markets.

Any one of the factors above or the cumulative effect of several of the factors described above may result in significant fluctuations in our financial and other results of operations. This variability and unpredictability could result in our failure to meet expectations of securities analysts or investors for a particular period. If we fail to meet or exceed such expectations for these or any other reasons, the market price of our common stock could decline substantially, and we could face costly lawsuits, including securities class action suits, such as those described in "Part I, Item 3 – Legal Proceedings."

An active trading market for our common stock may not be sustained.

Our common stock began trading on the Nasdaq Global Select Market on December 15, 2017. Given the limited trading history of our common stock, there is a risk that an active trading market for our shares may not be sustained, which could put downward pressure on the market price of our common stock and thereby affect the ability of our stockholders to sell their shares at attractive prices, at the times that they would like to sell them, or at all.

The market price of our common stock may be volatile, which could result in substantial losses for investors.

The market price of our common stock could be subject to significant fluctuations. Some of the factors that may cause the market price of our common stock to fluctuate include:

- actual or anticipated changes in our earnings or fluctuations in our results of operations or in the expectations of securities analysts;
- price and volume fluctuations in the overall stock market from time to time;
- volatility in the market price and trading volume of comparable companies;
- announcements of technological innovations, new products, strategic alliances, or significant agreements by us or by competitive vendors;
- announcements by our customers regarding significant increases or decreases in capital expenditures;
- departure of key personnel;
- litigation involving us or that may be perceived as having an impact on our business;
- changes in general economic, industry and market conditions and trends;
- investors' general perception of us;
- the cost and possible outcomes of any legal actions or proceedings against us, including those described under "Part I, Item 3 – Legal Proceedings";
- sales of large blocks of our stock; and
- announcements regarding further industry consolidation.

In the past, following periods of volatility in the market price of a company's securities, securities class action litigation has often been brought against that company. As described in "Part I, Item 3 – Legal Proceedings," we and certain of our current and former executive officers and current and former members of our board of directors have been named as defendants in several putative class action lawsuits. Because of the potential volatility of our stock price, we may become the target of additional securities litigation in the future. Securities litigation could result in substantial costs and divert management's attention and resources from our business.

We have broad discretion in the use of our cash reserves and may not use them effectively.

Subject to restrictions in the agreements governing our indebtedness, our management has broad discretion to use our cash reserves and could use our cash reserves in ways that do not improve our results of operations or enhance the value of our common stock. The failure by our management to apply these funds effectively could adversely affect our ability to operate and grow our business. Pending their use, we may invest our cash reserves in a manner that does not produce income or that loses value.

If securities or industry analysts cease publishing research or reports about us, our business or our market, or if they publish negative evaluations of our stock or the stock of other companies in our industry, the price of our stock and trading volume could decline.

The trading market for our common stock will be influenced by the research and reports that industry or securities analysts may publish about us, our business, our market or our competitors. If one or more of the industry analysts covering our business downgrade their evaluations of our stock or the stock of other companies in our industry, the price of our stock could decline. If one or more of these analysts cease to cover our stock, we could lose visibility in the market for our stock, which in turn could cause our stock price to decline.

Because we do not expect to declare any dividends on our common stock for the foreseeable future, investors in our common stock may never receive a return on their investment.

Although we declared special dividends on five occasions prior to our initial public offering, we do not anticipate that we will declare any cash dividends to holders of our common stock in the foreseeable future, and investors should not rely on an investment in our common stock to provide dividend income. Instead, we plan to retain any earnings to maintain and expand our existing operations. Accordingly, investors must rely on sales of their common stock after price appreciation, which may never occur, as the only way to realize any return on their investment. As a result, investors seeking cash dividends should not purchase our common stock.

Any future determination to declare dividends will be made at the discretion of our board of directors and will depend on a number of factors, including future earnings, capital requirements, financial conditions, future prospects, contractual restrictions and covenants and other factors that our board of directors may deem relevant. Our credit facility contains covenants that limit our ability to pay dividends on our capital stock.

Insiders have substantial control over us, which could limit your ability to influence the outcome of key transactions, including a change of control.

As of January 31, 2020, our directors, executive officers and 10% stockholders beneficially owned, in the aggregate, approximately 62.6% of our outstanding common stock. As a result, these stockholders could have significant influence over the outcome of matters submitted to our stockholders for approval, including the election of directors and any merger, consolidation or sale of all or substantially all of our assets, and over the management and affairs of our company. This concentration of ownership may have the effect of delaying or preventing a change in control of our company and might affect the market price of our common stock.

A significant portion of our total outstanding shares may be sold into the public market at any time, which could cause the market price of our common stock to drop significantly, even if our business is doing well.

Sales of a significant number of shares of our common stock in the public market could occur at any time. These sales, or the market perception that the holders of a large number of shares intend to sell shares, could reduce the market price of our common stock.

In addition to our outstanding common stock, as of January 31, 2020, there were 8,082,879 shares subject to outstanding options, 1,281,720 shares subject to outstanding restricted stock unit awards, or RSUs, and an additional 10,927,442 shares reserved for future issuance under our equity incentive plans. Because we have registered most shares of common stock that may be issued under our equity incentive plans pursuant to a Registration Statement on Form S-8, any such registered shares that we issue can be freely sold in the public market upon issuance, subject to the restrictions imposed on our affiliates under Rule 144.

Moreover, holders of an aggregate of approximately 37,129,787 shares of our common stock as of January 31, 2020, have rights, subject to certain conditions, to require us to file registration statements covering their shares or to include their shares in registration statements that we may file for ourselves or other stockholders. Upon registration, such shares would be able to be freely sold in the public market.

Anti-takeover provisions in our restated certificate of incorporation and our amended and restated bylaws, as well as provisions of Delaware law, might discourage, delay or prevent a change in control of our company or changes in our management and, therefore, depress the trading price of our common stock.

Our restated certificate of incorporation and amended and restated bylaws and Delaware law contain provisions that may discourage, delay or prevent a merger, acquisition or other change in control that stockholders may consider favorable, including transactions in which you might otherwise receive a premium for your shares of our common stock. These provisions may also prevent or delay attempts by our stockholders to replace or remove our management. Our corporate governance documents include provisions:

- establishing a classified board of directors with staggered three-year terms so that not all members of our board are elected at one time;
- providing that directors may be removed by stockholders only for cause and only with a vote of the holders of at least 75% of the issued and outstanding shares of common stock;
- limiting the ability of our stockholders to call and bring business before special meetings and to take action by written consent in lieu of a meeting;
- requiring advance notice of stockholder proposals for business to be conducted at meetings of our stockholders and for nominations of candidates for election to our board of directors;
- authorizing blank check preferred stock, which could be issued with voting, liquidation, dividend and other rights superior to our common stock; and
- limiting the liability of, and providing indemnification to, our directors and officers.

As a Delaware corporation, we are also subject to provisions of Delaware law, including Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders holding more than 15% of our outstanding common stock from engaging in certain business combinations with us. Any provision of our restated certificate of incorporation or amended and restated bylaws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

The existence of the foregoing provisions and anti-takeover measures could limit the price that investors might be willing to pay in the future for shares of our common stock. They could also deter potential acquirers of our company, thereby reducing the likelihood that you could receive a premium for your common stock in an acquisition.

Our restated certificate of incorporation provides that the Court of Chancery of the State of Delaware will be the exclusive forum for substantially all disputes between us and our stockholders. Our restated certificate of incorporation further provides that the federal district courts of the United States are the sole and exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act. These choice of forum provisions could limit our stockholders' ability to obtain a more favorable judicial forum for disputes with us or our directors, officers or employees.

Our restated certificate of incorporation provides that the Court of Chancery of the State of Delaware is the exclusive forum for any derivative action or proceeding brought on our behalf; any action asserting a breach of fiduciary duty; any action asserting a claim against us arising pursuant to the Delaware General Corporation Law, our certificate of incorporation or our bylaws; or any action asserting a claim against us that is governed by the internal affairs doctrine. We do not intend to have this choice of forum provision apply to, and this choice of forum provision will not apply to, actions arising under the Securities Exchange Act of 1934, as amended, or the Exchange Act.

Our restated certificate of incorporation further provides that, unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States shall, to the fullest extent permitted by law, be the sole and exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act of 1933, as amended, or the Securities Act. On December 19, 2018, the Delaware Court of Chancery, in *Sciabacucchi v. Salzberg*, *et al.*, C.A. No. 2017-0931-JTL (Del. Ch. Dec. 19, 2018), held that such federal forum selection provisions are invalid under Delaware law, and such decision is currently on appeal.

These choice of forum provisions may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and other employees. Alternatively, if a court were to find the choice of forum provisions contained in our certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could materially adversely affect our business, financial condition, results of operations and prospects.

We are an "emerging growth company," and the reduced disclosure requirements applicable to emerging growth companies may make our common stock less attractive to investors.

We are an "emerging growth company," as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act, and may remain an emerging growth company until the last day of our fiscal year following the fifth anniversary of our initial public offering, subject to specified conditions. For so long as we remain an emerging growth company, we are permitted, and intend, to rely on exemptions from certain disclosure requirements that are applicable to other public companies that are not emerging growth companies. These exemptions include being permitted to provide reduced disclosure regarding executive compensation and exemptions from the requirements to hold non-binding advisory votes on executive compensation and golden parachute payments, not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002 related to our internal control over financial reporting, and not being required to comply with any requirement that may be adopted by the Public Company Accounting Oversight Board regarding a supplement to the auditor's report providing additional information about the audit and the financial statements. We cannot predict whether investors will find our common stock less attractive if we rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

Further, Section 102(b)(1) of the JOBS Act exempts emerging growth companies from being required to comply with new or revised financial accounting standards until private companies (that is, companies that have not filed a pending registration statement under the Securities Act, had a Securities Act registration statement declared effective or do not have a class of securities registered under the Exchange Act are required to comply with the new or revised financial accounting standards. The JOBS Act provides that a company can elect to opt out of the extended transition period and comply with the requirements that apply to non-emerging growth companies, but any such election to opt out is irrevocable. We have elected not to opt out of such extended transition period, which means that when a standard is issued or revised, and it has different application dates for public or private companies, we will adopt the new or revised standard at the time private companies adopt the new or revised standard, provided that we continue to be an emerging growth company. This may make comparison of our financial statements with the financial statements of another public company that is not an emerging growth company, or an emerging growth company that has opted out of using the extended transition period, difficult or impossible because of the potential differences in accounting standards used.

We will remain an emerging growth company until the last day of the fiscal year following the fifth anniversary of our initial public offering, which is December 31, 2021 or such earlier time that we are no longer an emerging growth company. We would cease to be an emerging growth company if we have more than $1.07 billion in annual revenue, we have more than $700 million in market value of our stock held by non-affiliates, or we issue more than $1 billion of non-convertible debt securities over a three-year period.

We are subject to new U.S. foreign investment regulations which may impose additional burdens on or may limit certain investors' ability to purchase our common stock, potentially making our common stock less attractive to investors.

In October 2018, the U.S. Department of Treasury announced a pilot program to implement part of the Foreign Investment Risk Review Modernization Act, or FIRRMA, effective November 10, 2018. The pilot program expands the jurisdiction of the Committee on Foreign Investment in the United States, or CFIUS, to include certain direct or indirect foreign investments in a defined category of U.S. companies, including companies involved in manufacturing communications equipment. Among other things, FIRRMA empowers CFIUS to require certain foreign investors to make mandatory filings and permits CFIUS to charge filing fees related to such filings. Such filings are subject to review by CFIUS. Any such restrictions on the ability to purchase shares of our common stock that have the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock and could also affect the price that some investors are willing to pay for our common stock.

Our management team has limited experience managing a public company.

Most members of our management team have limited experience managing a publicly traded company, interacting with public company investors and complying with the increasingly complex laws pertaining to public companies. Our management team may not successfully or efficiently manage our transition to being a public company subject to significant regulatory oversight and reporting obligations under the federal securities laws and the scrutiny of securities analysts and investors. These new obligations and constituents will require significant attention from our management team and could divert their attention away from the day-to-day management of our business, which could materially adversely affect our business, financial condition, results of operations and prospects.

The requirements of being a public company may strain our resources, divert management's attention and affect our ability to attract and retain qualified board members.

As a public company, we are subject to the reporting requirements of the Exchange Act, the listing requirements of the Nasdaq Stock Market and other applicable securities rules and regulations. Compliance with these rules and regulations have increased our legal and financial compliance costs, made some activities more difficult, time-consuming or costly, and increased demand on our systems and resources, and will continue to do so, particularly after we are no longer an emerging growth company. Among other things, the Exchange Act requires that we file annual, quarterly and current reports with respect to our business and results of operations and maintain effective disclosure controls and procedures and internal control over financial reporting. We will continue to require significant resources and management oversight in order to maintain and, if required, improve our disclosure controls and procedures and internal control over financial reporting to meet this standard. As a result, management's attention may be diverted from other business concerns, which could harm our business and results of operations. Although we have already hired additional employees to comply with these requirements, we may need to hire even more employees in the future, which will increase our costs and expenses. We are required to conduct annual evaluations of the effectiveness of our internal control over financial reporting, including to identify and remediate any deficiencies in those internal controls. We may not be able to complete our evaluation, testing and any required remediation in a timely fashion. During the evaluation and testing process, if we identify one or more material weaknesses in our internal control over financial reporting that we are unable to remediate before the end of the same fiscal year in which the material weakness is identified, we will be unable to assert that our internal controls are effective. If we are unable to assert that our internal control over financial reporting is effective in any future reporting period, or if our auditors are unable to attest to management's report on the effectiveness of our internal controls, which will be required after we are no longer an emerging growth company, we could lose investor confidence in the accuracy and completeness of our financial reports, which would cause the price of our common stock to decline..

In addition, changing laws, regulations and standards relating to corporate governance and public disclosure are increasing legal and financial compliance costs and making some activities more time-consuming. We have invested and will continue to invest resources to comply with evolving laws, regulations and standards, and this investment has resulted and may continue to result in increased selling, general and administrative expense and a diversion of management's time and attention from revenue-generating activities to compliance activities. If our efforts to comply with new laws, regulations and standards differ from the activities intended by regulatory or governing bodies, regulatory authorities may initiate legal proceedings against us and our business may be harmed.

As a result of being a public company, it is more expensive for us to obtain director and officer liability insurance, and in the future we may be required to accept reduced coverage or incur substantially higher costs to obtain coverage. These factors could also make it more difficult for us to attract and retain qualified members of our board of directors and qualified executive officers.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Facilities

Our corporate headquarters is located in Andover, Massachusetts and consists of approximately 122,000 square feet of space. We own the property constituting our corporate headquarters, subject to an $8.0 million mortgage loan. The annual interest rate on the loan is 3.5%, and the loan is repayable in 60 monthly installments of principal and interest based on a 20-year amortization schedule. The remaining amount of unpaid principal under the loan is due on the maturity date of July 1, 2020. The loan terms include annual affirmative, negative and financial covenants, including a requirement that we maintain a minimum debt service ratio. We were in compliance with all annual covenants of the mortgage loan as of December 31, 2019. As of December 31, 2019, outstanding borrowings under the mortgage loan were $6.6 million.

We lease additional facilities in Lawrence, Massachusetts and Limerick, Ireland that we use for manufacturing, testing, logistics, and customer support, a facility in Salem, New Hampshire that we use for logistics, facilities in Guangzhou, China, that we use for manufacturing, testing, logistics, research and development and technical support, facilities in Sydney and Melbourne, Australia that we use for logistics, customer support and research and development and facilities in Valencia, Spain, Pak Shek Kok, Hong Kong, Shenzhen and Hefei, China and Sunrise, Florida that we use primarily for research and development.

We believe that our current facilities are adequate to meet our current needs. We anticipate expanding our facilities as we add employees and enter new geographic markets. We believe that suitable additional or alternative space will be available on acceptable terms as needed to accommodate future growth.

Item 3. Legal Proceedings.

From time to time, we are a party to various litigation matters and subject to claims that arise in the ordinary course of business including, for example, patent infringement lawsuits by non-practicing entities. In addition, third parties may from time to time assert claims against us in the form of letters and other communications.

On May 29, 2019 and July 3, 2019, two putative class action lawsuits, Shen v. Chen et al. and Baig v. Chen et al., were filed in the Massachusetts Superior Court against us, certain of our current and former executive officers and directors, Summit Partners, our largest investor, and the underwriters from our December 15, 2017 initial public offering, which we refer to as our IPO. These complaints purport to be brought on behalf of all purchasers of our common stock in and/or traceable to our IPO. The complaints generally allege that (i) each of the defendants violated Section 11 and/or Section 12(a)(2) of the Securities Act of 1933, as amended, (the "Securities Act"), because documents related to our IPO including its registration statement and prospectus were materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants and Summit Partners acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On August 13, 2019, the Court consolidated these actions and referred the consolidated actions to the Business Litigation Session of the Massachusetts Superior Court (the "BLS"). On September 3, 2019, the BLS accepted the consolidated action into its session for further proceedings. On November 12, 2019, Plaintiffs filed an Amended Shareholder Class Action Complaint, purportedly on behalf of all purchasers of our common stock in and/or traceable to our IPO, which contains substantially similar allegations and asserts the same claims as the two initial complaints, described above. Plaintiffs seek compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, and equitable and injunctive relief. On January 14, 2020, Defendants filed motions to dismiss the amended complaint.

On August 9, 2019, a third putative class action lawsuit, Donald Hook v. Casa Systems, Inc. et al., was filed in the Supreme Court of New York, New York County, against us, certain of our current and former executive officers and directors, Summit Partners, our largest investor, and the underwriters from our IPO. The complaint purports to be brought on behalf of all purchasers of our common stock in and/or traceable to our IPO and generally alleges that (i) each of the defendants violated Section 11 and/or Section 12(a)(2) of the Securities Act of 1933, as amended, or the Securities Act, because documents related to our IPO including its registration statement and prospectus were materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants and Summit Partners acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On November 22, 2019, Plaintiff filed an Amended Complaint, purportedly on behalf of all purchasers of our common stock in and/or traceable to our IPO, which contains substantially similar allegations as the initial complaint, described above, and asserts claims for violations of Sections 11 and 15 of the Securities Act. Plaintiff seeks compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, disgorgement, and equitable and injunctive relief. On January 21, 2020, Defendants filed motions to dismiss the amended complaint.

On August 13, 2019, a fourth putative class action lawsuit, Panther Partners, Inc. v. Guo et al., was filed in the Supreme Court of New York, New York County, against us, certain of our current and former executive officers and directors, and the underwriters from our April 30, 2018 follow-on offering of common stock, which we refer to as our Follow-on Offering. The complaint purports to be brought on behalf of all purchasers of our common stock in our Follow-on Offering and generally alleges that (i) each of the defendants, other than Abraham Pucheril, violated Section 11 of the Securities Act, and each of the defendants violated Section 12(a)(2) of the Securities Act, because documents related to our Follow-on Offering, including our registration statement and prospectus, was materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On November 22, 2019, Plaintiff filed an Amended Class Action Complaint, purportedly on behalf of all purchasers of our common stock in our Follow-on Offering, which contains substantially similar allegations and asserts the same claims as the initial complaint, described above. Plaintiff seeks compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, and equitable and injunctive relief. On January 21, 2020, Defendants filed motions to dismiss the amended complaint.

No amounts have been accrued for any of the putative class action lawsuits referenced above in the year ended December 31, 2019, as we do not believe the likelihood of a material loss is probable. Although the ultimate outcome of these matters cannot be predicted with certainty, the resolution of any of these matters could have a material impact on our results of operations in the period in which such matter is resolved.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Market Information

Our common stock trades on the Nasdaq Global Select Market under the symbol "CASA". Trading of our common stock on the Nasdaq Global Select Market commenced on December 15, 2017 in connection with our initial public offering, or IPO. Prior to that time, there was no established public trading market for our common stock.

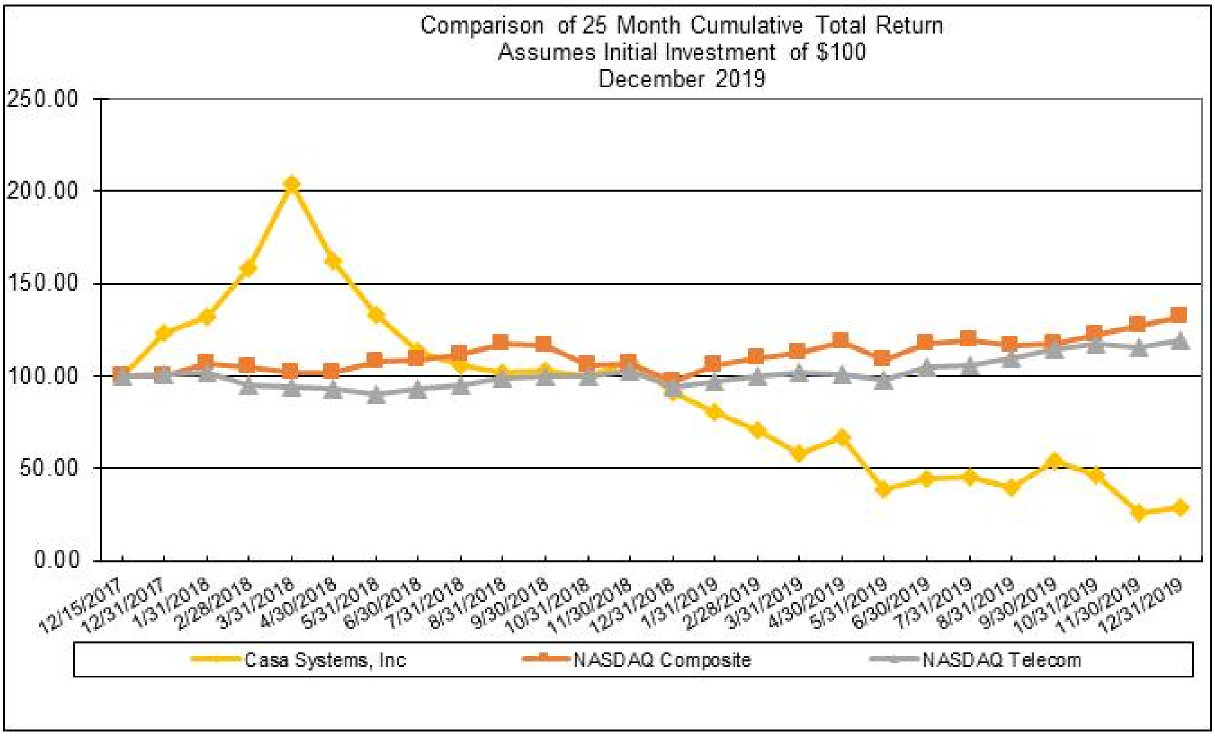
Holders of Record

As of January 31, 2020, there were 18 holders of record of our common stock. Because many of our shares are held by brokers and other institutions on behalf of stockholders, we are not able to estimate the number of stockholders represented by these record holders.

Performance Graph

This performance graph shall not be deemed to be "soliciting material" or to be "filed" with the U.S. Securities and Exchange Commission, or the SEC, for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or the Exchange Act, or otherwise subject to liabilities under that section, and shall not be deemed to be incorporated by reference into any of our filings under the Securities Act of 1933, as amended, or the Exchange Act, except to the extent that we specifically incorporate it by reference into such filing.

The following graph compares the cumulative total return to stockholders for our common shares for the period from December 15, 2017 (the date our common stock began trading on the Nasdaq Global Select Market) through December 31, 2019 with the Nasdaq Composite Index. The comparison assumes an investment of $100 is made on December 15, 2017 in our common shares and in each of the indices and in the case of the indices it also assumes reinvestment of all dividends. The performance shown is not necessarily indicative of future performance.



Recent Sales of Unregistered Equity Securities

None.

Issuer Repurchases of Equity Securities

The following table sets forth information with respect to repurchases of shares of our common stock during the three-month period ended December 31, 2019.

Period	Total Number of Shares Purchased		Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs		Approximate Dollar Value of Shares that May Yet Be Purchased Under the Plans or Programs (1)
	(In thousands)			(In thousands)		(In thousands)
October 1 - October 31, 2019	—	$	—	—	$	75,000
November 1 - November 30, 2019	130	$	3.37	130	$	74,562
December 1 - December 31, 2019	365	$	3.69	365	$	73,215

(1) On February 21, 2019, we announced that our board of directors authorized the repurchase of up to $75.0 million of our common stock under a stock repurchase program. During the three-month period ended December 31, 2019, we repurchased approximately $1.8 million of the shares authorized under the program and intend for such shares to remain in treasury. The stock repurchase program has no expiration date, does not require us to purchase a minimum number of shares, and may be suspended, modified or discontinued at any time without prior notice.

Securities Authorized for Issuance Under Equity Compensation Plans

The information required by this item with respect to our equity compensation plans is expected to be incorporated by reference to our proxy statement for the 2020 Annual Meeting of Stockholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2019.

Use of Proceeds

On December 19, 2017, we closed our initial public offering of common stock under a registration statement on Form S-1 (File No. 333-221658) that was declared effective by the SEC on December 14, 2017. The net offering proceeds to us from the offering, after deducting underwriting discounts of $6.3 million and offering expenses payable by us totaling $4.1 million, were approximately $79.3 million. No offering discounts, commissions or expenses were paid directly or indirectly to any of our directors or officers (or their associates) or persons owning 10.0% or more of any class of our equity securities or to any other affiliates. There has been no material change in the planned use of proceeds from our initial public offering as described in our final prospectus filed with the SEC on December 15, 2017 pursuant to Rule 424(b)(4) promulgated under the Securities Act. As of December 31, 2019, we had not used any of the net offering proceeds and we have invested the proceeds into an investment portfolio with the primary objective of preserving principal and providing liquidity without significantly increasing risk.

Item 6. Selected Financial Data.

The selected consolidated statements of operations data for the years ended December 31, 2019, 2018 and 2017 and the consolidated balance sheet data as of December 31, 2019 and 2018 are derived from our audited financial statements appearing in Item 8, “Financial Statements and Supplementary Data,” of this Annual Report on Form 10-K. The selected consolidated statements of operations data for the year ended December 31, 2016 and 2015, and the consolidated balance sheet data as of December 31, 2017, 2016 and 2015 are derived from audited financial statements not included in this Annual Report on Form 10-K. Our historical results are not necessarily indicative of the results to be expected in the future.

The following selected consolidated financial data below should be read in conjunction with Item 7, "Management's Discussion and Analysis of Financial Condition and Results of Operations," our consolidated financial statements, and the accompanying notes appearing in Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K to fully understand factors that may affect the comparability of the information presented below.

	Year Ended December 31,				
	2019	2018	2017	2016	2015
	(in thousands, except per share amounts)				
Consolidated Statement of Operations Data:					
Revenue:					
Product	$ 241,377	$ 256,989	$ 311,896	$ 279,223	$ 247,588
Service	40,920	40,138	39,679	36,905	24,862
Total revenue	282,297	297,127	351,575	316,128	272,450
Cost of revenue(1):					
Product	113,059	74,350	88,538	89,340	74,349
Service	6,706	4,811	4,973	8,477	5,265
Total cost of revenue	119,765	79,161	93,511	97,817	79,614
Gross profit	162,532	217,966	258,064	218,311	192,836
Operating expenses:					
Research and development(1)	83,331	70,974	60,677	49,210	37,155
Selling, general and administrative(1)	88,320	68,026	61,165	54,329	52,610
Total operating expenses	171,651	139,000	121,842	103,539	89,765
(Loss) income from operations	(9,119)	78,966	136,222	114,772	103,071
Other income (expense), net	(15,296)	(13,028)	(13,404)	921	(1,408)
(Loss) income before provision for (benefit from) income taxes	(24,415)	65,938	122,818	115,693	101,663
Provision for (benefit from) income taxes	23,791	(7,068)	34,318	27,025	33,742
Net (loss) income	$ (48,206)	$ 73,006	$ 88,500	$ 88,668	$ 67,921
Cash dividends declared per common share or common share equivalent	$ —	$ —	$ 1.7576	$ 2.9197	$ —
Net (loss) income attributable to common stockholders:					
Basic	$ (48,206)	$ 73,006	$ 11,849	$ (35,119)	$ 27,302
Diluted	$ (48,206)	$ 73,006	$ 11,849	$ (35,119)	$ 30,402
Net (loss) income per share attributable to common stockholders:					
Basic	$ (0.57)	$ 0.87	$ 0.34	$ (1.07)	$ 0.86
Diluted	$ (0.57)	$ 0.79	$ 0.26	$ (1.07)	$ 0.78
Weighted-average shares used to compute net (loss) income per share attributable to common stockholders:					
Basic	83,853	83,539	35,359	32,864	31,740
Diluted	83,853	91,877	44,972	32,864	38,809

(1) Includes stock-based compensation expense related to stock options, stock appreciation rights and restricted stock units granted to employees and non-employee consultants as follows:

	Year Ended December 31,				
	2019	2018	2017	2016	2015
	(in thousands)				
Cost of revenue	$ 216	$ 249	$ 306	$ 237	$ 143
Research and development expense	1,569	1,864	2,864	2,306	1,843
Selling, general and administrative expense	8,036	6,781	5,966	5,761	5,335
Total stock-based compensation expense	$ 9,821	$ 8,894	$ 9,136	$ 8,304	$ 7,321

	As of December 31,				
	2019	2018	2017	2016	2015
			(in thousands)		
Consolidated Balance Sheet Data:					
Cash and cash equivalents	$ 113,638	$ 280,587	$ 260,820	$ 343,946	$ 92,496
Working capital(1)	213,977	328,400	324,710	286,652	162,981
Total assets	444,312	474,649	469,697	583,035	283,097
Long-term debt, including current portion, net of unamortized debt issuance costs	293,280	295,459	297,615	299,751	7,795
Total liabilities	405,748	399,793	419,541	557,259	103,160
Convertible preferred stock	—	—	—	97,479	97,479
Total stockholders' equity (deficit)	38,564	74,856	50,156	(71,703)	82,458

(1) We define working capital as current assets less current liabilities.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

The following discussion of our financial condition and results of operations should be read together with our consolidated financial statements and related notes and other financial information included elsewhere in this Annual Report on Form 10-K. The following discussion contains forward-looking statements that reflect our plans, estimates and beliefs. Our actual results could differ materially from those discussed in the forward-looking statements. Factors that could cause or contribute to these differences include those discussed below and elsewhere in this Annual Report on Form 10-K, particularly in the section titled "Risk Factors."

Overview

Our solutions are conceived, designed, and built to solve problems faced by our broadband service provider customers as they transform their networks to meet the growing demand for bandwidth and the introduction of new services. We offer converged solutions for next-generation centralized, distributed and virtualized architectures for cable broadband, fixed-line broadband and wireless networks. Our innovative products enable customers to cost-effectively and dynamically increase network speed, add bandwidth capacity and new services for consumers and enterprises, reduce network complexity and reduce operating and capital expenditures.

We have a history of innovation and being the first to market with novel products at each generational shift in network technology. For example:

- We believe we pioneered the use of a software-centric approach to leverage the programmability of field programmable gate arrays, or FPGAs, and general-purpose processors for use in the cable industry.
- In the cable market we believe we were the first to provide a solution enabling cable service providers to deliver Internet Protocol, or IP, voice, digital video and data over a single port, which enables cable service providers to deliver multi-gigabit speeds to their subscribers.
- In the wireless market, we introduced our Apex Pebble, a residential femtocell, which helps to provide a faster and more reliable data experience for mobile users. We believe the device offers the innovation of an untethered Wi-Fi backhaul option in addition to the standard Ethernet connection that is required in traditional femtocells. This allows a user to place the device anywhere in his or her home where Wi-Fi is available without running or connecting additional cables to a home router.
- Our Apex Strand-mount Microcell provides wireless service providers with an additional installation option using an integrated DOCSIS modem, which provides input power and backhaul/fronthaul connectivity and helps to resolve the siting, power, and backhaul issues that accompany large-scale small cell deployments.
- Our Apex 5G Mini Macro is a high-powered 4T4R (4 transmit/4 receive) radio designed to meet coverage and capacity challenges in dense urban and suburban areas where large numbers of 5G NR, a new radio access technology developed by 3GPP for the 5G mobile network, and LTE devices are present. Unlike macro-radio solutions mounted on traditional tower sites, the Apex 5G Mini Macro can be deployed cost-effectively at the street level, such as on utility poles, roof tops and lamp posts, thereby reducing costs associated with a traditional macro site.
- We believe that we are the first to deliver a virtualized BNG that enables a multi-tenant solution at the network edge using low-cost, white box merchant silicon hardware.

We offer scalable solutions that can meet the evolving bandwidth needs of our customers and their subscribers. Our first installation in a service provider's network frequently involves deploying our broadband products in only a portion of the provider's network and with only a fraction of the capacity of our products enabled at the time of initial installation. Over time, our customers have generally expanded the use of our solutions to other areas of their networks to increase network capacity. Capacity expansions are accomplished either by deploying additional systems, line cards, or the sale of additional channels through the use of software. Sales of software-based capacity expansions generate higher gross margins than hardware-based deployments.

Our solutions are commercially deployed in over 70 countries by more than 475 customers, including regional service providers as well as some of the world's largest Tier 1 broadband service providers, serving millions of subscribers.

Our Business Model

We derive revenue from sales of our products and services. To date, the majority of our product revenue has come from sales of our broadband products, particularly our C100G CCAP solution, to cable operators worldwide. We generate service revenue primarily from sales of maintenance and support services, which end customers typically purchase in conjunction with our products, and, to a lesser extent, from sales of professional services and extended warranty services.

We offer end-to-end physical, virtual and distributed infrastructure, and customer on-premise network solutions that enable our customers to provide fixed and wireless broadband services to consumers and enterprises.

Our growth strategy focuses on the following key areas:

Continue to Innovate and Extend Technology Leadership Through R&D Investment

We believe that we offer market-leading broadband infrastructure products today. We intend to continue to enhance our existing products and develop new products in both our current and adjacent markets. For example, we have invested in and launched distributed access architecture solutions to allow our cable customers to densify their networks, providing higher bandwidth, which enhances user experience. Additionally, we have been investing in, and recently begun recognizing revenue from, our core and access products for 4G/LTE and 5G wireless networks.

Further Penetrate Existing Customers

Our customers often deploy our products in a specific region or for a specific application, which may only account for a portion of their overall network infrastructure needs. We plan to expand our footprint within the networks of existing customers as they realize the technological and financial benefits of our solutions, as well as sell our new products to them as they offer new broadband services to their subscribers.

Expand our Customer Base by Expanding the Breadth of Solutions Sold to Customers

We intend to sell additional products and solutions to our growing installed base of broadband service providers, particularly as they increasingly offer converged services to their subscribers. We have invested in developing a virtualized platform that allows us to rapidly provide new applications and services to our customers. While we initially focused on providing solutions for cable service providers due to our founders' experience in the cable industry, the commonalities between fixed and wireless network architectures have allowed us to expand our solutions into the wireless market as cable service providers have increasingly sought to add wireless capabilities to their service offerings. Our wireless solutions have been purchased by several customers, including Tier 1 mobile network operators such as Sprint and China Mobile.

Invest in Our Platform through Selective Acquisitions

We may selectively pursue acquisitions that enhance our existing platform capabilities and are consistent with our overall growth strategy. For example, on July 1, 2019, we acquired NetComm Wireless Limited for cash consideration of approximately $162.0 million Australian dollars, or AUD ($112.7 million United States dollars, or USD), based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019). This acquisition enables us to expand our customer base, enhance our global footprint, extend our product portfolio to the far edge of the network, and further diversify our revenue sources. As discussed in further detail below, the NetComm acquisition had a material impact on our business and is expected to have a material impact on our future performance.

We market and sell our products and services through our direct global sales force, supported by sales agents, and through resellers. A majority of our revenue is derived from direct sales, which generate higher gross margins than sales made through resellers. Our sales organization includes systems engineers with deep technical expertise that provide pre-sales technical support. These systems engineers also assist with post-sales support. Our resellers receive an order from an end customer prior to placing an order with us, and we confirm the identification of or are aware of the end customer prior to accepting such orders. We use sales agents to assist our direct global sales force in the sales process with certain customers primarily located in Latin America and Asia-Pacific. If a sales agent is engaged in the sales process, we receive the order directly from and sell the products and services directly to the end customer, and we pay a commission to the sales agent, calculated as a percentage of the related customer payment.

Each of our sales teams is responsible for a geographic territory and/or has responsibility for a number of major direct end-customer accounts. We have a diverse, global customer base and our revenue by geographic region fluctuates from period to period based on the timing of customer projects. The percentages of our revenue derived from customers in each geographic region were as follows:

	Year Ended December 31,		
	2019	2018	2017
Revenue by geographic region:			
North America	49.6%	49.1%	57.4%
Latin America	8.5%	10.9%	11.5%
Europe, Middle East and Africa	13.5%	27.4%	17.5%
Asia-Pacific	28.4%	12.6%	13.6%
Total	100.0%	100.0%	100.0%

The increase in percentage of revenues in the Asia-Pacific region was primarily driven by revenue generated from our acquisition of NetComm on July 1, 2019, which has significant revenues from Australia.

Key Components of Our Results of Operations

Revenue

We generate product revenue from sales of next-generation centralized, distributed and virtualized architectures for cable broadband, fixed-line broadband and wireless networks. Our products enable service provider customers to cost-effectively deliver broadband services to their consumer and enterprise customers.

Our acquisition of NetComm on July 1, 2019 expanded our product offerings to include fixed wireless access and fiber-to-the-distribution-point (“FTTdp”) devices. Accordingly, the year ending December 31, 2020 will include a full year of incremental revenues as compared to the year ended December 31, 2019, which includes such revenues only for the six month period from July 1, 2019 through December 31, 2019.

We generate service revenue from sales of initial maintenance and support services contracts, which are typically purchased by end customers in conjunction with our products, and from our customers’ subsequent annual renewals of those contracts. We offer maintenance and support services under renewable, fee-based contracts, which include telephone support and unspecified software upgrades and updates provided on a when-and-if-available basis. To a lesser extent, we generate service revenue from sales of professional services, such as installation and configuration, and extended warranty services.

The sale of our software products generally includes a 90-day warranty on the software and a one-year warranty on the hardware component of the products, which includes repair or replacement of the applicable hardware. We record a warranty accrual for the initial software and hardware warranty included with our product sales and do not defer revenue. In addition, in conjunction with customers’ renewals of maintenance and support services contracts, we offer an extended warranty for periods typically of one to three years for agreed-upon fees, which we record as service revenue.

Cost of Revenue

Our cost of product revenue consists primarily of the costs of procuring goods, such as CCAP chassis, Axyom hardware, components for our fixed wireless access and fiber-to-the-distribution-point (“FTTdp”) devices, cable access products and line cards embedded with FPGAs from our contract manufacturers and other suppliers. In addition, cost of product revenue includes salary and benefit expenses, including stock-based compensation, for manufacturing and supply-chain management personnel, allocated facilities-related costs, estimated warranty costs, third-party logistics costs, and estimated costs associated with excess and obsolete inventory.

Our cost of service revenue includes salary and benefit expenses, including stock-based compensation, for our maintenance and support services and professional services personnel, fees incurred for subcontracted professional services provided to our customers, and allocated facilities-related costs.

Gross Profit

Our product gross profit and gross margin have been, and may in the future be, influenced by several factors, including changes in the volume of our software-centric broadband products sold, product configuration, sales of capacity expansions, geographic location of our customers, pricing due to competitive pressure, estimated warranty costs, inventory obsolescence, and favorable and unfavorable changes in inventory production volume and component costs. As some products mature, the average selling prices of those products may decline. In addition, gross margins on fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices are lower than our legacy broadband hardware products. Our service gross profit and gross margin have been, and may in the future be, influenced by the amount and timing of renewals of maintenance and support services contracts by customers, pricing due to competitive pressure and, to a lesser extent, the amount of professional services ordered by customers and performed by us. We expect that our gross margin will decline for the year ended December 31, 2020 as compared to the year ended December 31, 2019 due to lower margins generated on FTTdp products and changes in the percentage of revenue attributable to our software-centric broadband products and capacity expansions.

Operating Expenses

Our operating expenses consist of research and development and selling, general and administrative expenses.

Research and Development Expenses

Research and development expenses consist primarily of salary and benefit expenses, including stock-based compensation, for our employees engaged in research, design and development activities. Research and development expenses also include project-specific engineering services purchased from external vendors, prototype costs, depreciation expense, amortization of purchased intellectual property, allocated facilities-related costs and travel expenses.

We expect that, except for the effect of including a full year of expenses associated with our acquisition of NetComm on July 1, 2019, our research and development costs will remain consistent in absolute dollars in the near term as we continue to make significant investments to enhance our existing software products and develop new software products and technologies, including our new wireless solutions.

Selling, General and Administrative Expenses

Selling, general and administrative expenses include salary and benefit expenses, including stock-based compensation, for employees and costs for contractors engaged in sales, marketing, general and administrative activities. Selling, general and administrative expenses also include commissions, calculated as a percentage of the related customer payment, to sales agents that assist us in the sales process with certain customers primarily located in the Latin America and Asia-Pacific regions. These sales agent commissions fluctuate from period to period based on the amount and timing of sales to the customers subject to sales agent commissions. Selling, general and administrative expenses also include marketing activities, such as trade shows, marketing programs and promotional materials, as well as allocated facilities-related costs.

We expect that, except for the effect of including a full year of expenses associated with our acquisition of NetComm on July 1, 2019, our selling, general and administrative expenses will remain consistent in absolute dollars in the near term as we continue to make investments in our sales and marketing organizations and expand our marketing programs and efforts to increase the market awareness and sales of our products and services.

Other Income (Expense), Net

Other income (expense), net consists of interest income from our investments in short-term financial instruments, such as certificates of deposit and money market mutual funds, and interest expense associated with our term loan facility, the mortgage on our corporate office and debt maintenance costs related to our revolving credit facility. Other income (expense), net also includes realized and unrealized gains and losses from foreign currency transactions. We hedge certain significant transactions denominated in currencies other than the U.S. dollar, and we expect to continue to do so to minimize our exposure to foreign currency fluctuations.

Provision for (Benefit from) Income Taxes

We are subject to income taxes in the United States and the foreign jurisdictions in which we do business. These foreign jurisdictions have statutory tax rates different from those in the United States. Our effective tax rates will vary depending on the relative proportion of foreign to U.S. income, the utilization of foreign tax credits and research and development tax credits, changes in corporate structure, the amount and timing of certain employee stock-based compensation transactions, changes in the valuation of our deferred tax assets and changes in tax laws and interpretations. We plan to regularly assess the likelihood of outcomes that could result from the examination of our tax returns by the U.S. Internal Revenue Service and other tax authorities to determine the adequacy of our income tax reserves and expense. Should actual events or results differ from our then-current expectations, charges or credits to our provision for income taxes may become necessary. Any such adjustments could have a significant effect on our results of operations.

On December 22, 2017, the Tax Cuts and Jobs Act, or the TCJA, was enacted which, among other things, lowered the U.S. corporate income tax rate to 21% from 35%, repealed the domestic production activity deductions, limited the deductibility of certain executive compensation and interest expense, and established a modified territorial system that required a mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries. Beginning in 2018, the TCJA also required a minimum tax on certain future earnings generated by foreign subsidiaries while providing for future tax-free repatriation of such earnings through a 100% dividends-received deduction.

While the intent of TCJA was to provide for a territorial tax system, effective for taxable years beginning after January 1, 2018, taxpayers are subjected to the global intangible low-taxed income provisions, or GILTI provisions. The GILTI provisions require us to currently recognize in U.S. taxable income, a deemed dividend inclusion of foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. During the years ended December 31, 2019 and 2018, we recorded an income tax charge of $0.9 and $4.4 million, respectively, related to GILTI. We have made an accounting policy election, as allowed by the SEC and FASB, to recognize the impacts of GILTI within the period incurred. Therefore, no U.S. deferred taxes are provided on GILTI inclusions of future foreign subsidiary earnings.

Results of Operations

The following tables set forth our consolidated results of operations in dollar amounts and as percentage of total revenue for the periods shown:

	Year Ended December 31,		
	2019	2018	2017
		(in thousands)	
Revenue:			
Product	$ 241,377	$ 256,989	$ 311,896
Service	40,920	40,138	39,679
Total revenue	282,297	297,127	351,575
Cost of revenue(1):			
Product	113,059	74,350	88,538
Service	6,706	4,811	4,973
Total cost of revenue	119,765	79,161	93,511
Gross profit	162,532	217,966	258,064
Operating expenses:			
Research and development(1)	83,331	70,974	60,677
Selling, general and administrative(1)	88,320	68,026	61,165
Total operating expenses	171,651	139,000	121,842
(Loss) income from operations	(9,119)	78,966	136,222
Other income (expense), net	(15,296)	(13,028)	(13,404)
(Loss) income before provision for (benefit from) income taxes	(24,415)	65,938	122,818
Provision for (benefit from) income taxes	23,791	(7,068)	34,318
Net (loss) income	$ (48,206)	$ 73,006	$ 88,500

(1) Includes stock-based compensation expense related to stock options, stock appreciation rights and restricted stock units granted to employees and non-employee consultants as follows:

	Year Ended December 31, 2019		2018		2017	
	(in thousands)					
Cost of revenue	$	216	$	249	$	306
Research and development expense		1,569		1,864		2,864
Selling, general and administrative expense		8,036		6,781		5,966
Total stock-based compensation expense	$	9,821	$	8,894	$	9,136

	Year Ended December 31, 2019	2018	2017
	(as a percentage of total revenue)		
Revenue:			
Product	86%	86%	89%
Service	14	14	11
Total revenue	100	100	100
Cost of revenue:			
Product	40	25	25
Service	2	2	1
Total cost of revenue	42	27	27
Gross profit	58	73	73
Operating expenses:			
Research and development	30	24	17
Selling, general and administrative	31	23	17
Total operating expenses	61	47	35
(Loss) income from operations	(3)	27	39
Other income (expense), net	(5)	(4)	(4)
(Loss) income before provision for (benefit from) income taxes	(9)	22	35
Provision for (benefit from) income taxes	8	(2)	10
Net (loss) income	(17)%	25%	25%

Percentages in the table above are based on actual values. As a result, some totals may not sum due to rounding.

Year Ended December 31, 2019 Compared to Year Ended December 31, 2018

Revenue

	Year Ended December 31, 2019			2018			Change	
		Amount	% of Total		Amount	% of Total	Amount	%
	(dollars in thousands)							
Revenue:								
Product	$	241,377	85.5%	$	256,989	86.5%	$ (15,612)	(6.1)%
Service		40,920	14.5%		40,138	13.5%	782	1.9%
Total revenue	$	282,297	100.0%	$	297,127	100.0%	$ (14,830)	(5.0)%
Revenue by geographic region:								
North America	$	139,917	49.6%	$	146,008	49.1%	$ (6,091)	(4.2)%
Latin America		24,043	8.5%		32,283	10.9%	(8,240)	(25.5)%
Europe, Middle East and Africa		38,154	13.5%		81,343	27.4%	(43,189)	(53.1)%
Asia-Pacific		80,183	28.4%		37,493	12.6%	42,690	113.9%
Total revenue	$	282,297	100.0%	$	297,127	100.0%	$ (14,830)	(5.0)%

The decrease in product revenue was primarily due to a decrease in sales of our cable products to existing customers in North America, Latin America, Asia-Pacific and Europe, Middle East and Africa as a result of a decrease in the deployment of our software-centric broadband products in their networks, which we believe was primarily due to the timing of customer expenditures on network upgrades. These decreases were partially offset by increases in sales of our wireless products, as well as sales of NetComm fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices from July 1, 2019 through December 31, 2019. These NetComm sales also caused revenue in the Asia-Pacific region to increase year over year as NetComm's generates significant revenue from the region, especially within Australia.

The increase in service revenue was primarily due to a $1.0 million increase in professional services revenue associated with customer deployments of our Axyom products.

Cost of Revenue and Gross Profit

	Year Ended December 31, 2019	Year Ended December 31, 2018	Change Amount	Change %
	(dollars in thousands)			
Cost of revenue:				
Product	$ 113,059	$ 74,350	$ 38,709	52.1%
Service	6,706	4,811	1,895	39.4%
Total cost of revenue	$ 119,765	$ 79,161	$ 40,604	51.3%

	Year Ended December 31, 2019		2018		Change	
	Amount	Gross Margin	Amount	Gross Margin	Amount	Gross Margin (bps)
	(dollars in thousands)					
Gross profit:						
Product	$ 128,318	53.2%	$ 182,639	71.1%	$ (54,321)	(1,790)
Service	34,214	83.6%	35,327	88.0%	(1,113)	(440)
Total gross profit	$ 162,532	57.6%	$ 217,966	73.4%	$ (55,434)	(1,580)

The increase in cost of product revenue and decrease in product gross margin was primarily due to sales of lower margin NetComm fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices from July 1, 2019 through December 31, 2019. Product cost of revenue also includes $1.8 million of amortization of developed technology acquired with the acquisition of NetComm.

The increase in cost of service revenue and decrease in service gross margin was primarily due to increased utilization of third-party service providers.

Research and Development

	Year Ended December 31, 2019	Year Ended December 31, 2018	Change Amount	Change %
	(dollars in thousands)			
Research and development	$ 83,331	$ 70,974	$ 12,357	17.4%
Percentage of revenue	29.5%	23.9%		

The increase in research and development expense was primarily due to an $11.7 million increase in personnel-related costs as a result of the increase in the headcount of our research and development personnel from 430 to 620, which was primarily driven by the acquisition of NetComm as well as to support the development of our new wireless and software-centric broadband products and to enhance our existing software-centric broadband products, a $0.6 million increase in facilities and infrastructure expenses, and a $0.5 million increase in depreciation expense for research and development related assets.

Selling, General and Administrative

	Year Ended December 31,		Change	
	2019	2018	Amount	%
	(dollars in thousands)			
Selling, general and administrative	$ 88,320	$ 68,026	$ 20,294	29.8%
Percentage of revenue	31.3%	22.9%		

The increase in selling, general and administrative expense was due primarily to a $8.2 million increase in personnel-related costs due to the addition of NetComm's sales force and general and administrative employees, a $3.5 million increase in expenses related to our acquisition of NetComm, a $1.7 million increase in depreciation and amortization expense related to acquired assets, a $1.3 million increase in marketing costs related to trade show and event expenses, a $1.2 million increase in facilities expense primarily due to additional leases from the NetComm acquisition, and a $0.5 million increase in software maintenance expenses.

Other Income (Expense), Net

	Year Ended December 31,		Change	
	2019	2018	Amount	%
	(dollars in thousands)			
Other income (expense), net	$ (15,296)	$ (13,028)	$ (2,268)	17.4%
Percentage of revenue	(5.4)%	(4.4)%		

The change in other income (expense) was primarily due to a $1.9 million decrease in interest income due to a decrease in our portfolio of cash equivalents following our acquisition of NetComm in July 2019, a $0.8 million increase in interest expense due to increases in our term loan interest rates and a $0.8 million decrease in other income related to a one time government grant received in 2018, partially offset by a $1.2 million increase in foreign currency gains primarily due to an increase in the Euro to U.S. dollar and Chinese Yuan to U.S. dollar exchange rates, partially offset by a decrease in the Australian dollar to U.S. dollar exchange rate, during the year ended December 31, 2019.

Provision for (benefit from) Income Taxes

	Year Ended December 31,		Change	
	2019	2018	Amount	%
	(dollars in thousands)			
Provision for (benefit from) income taxes	$ 23,791	$ (7,068)	$ 30,859	(436.6)%
Effective tax rate	(97.4)%	(10.7)%		

The 86.7% decrease in our effective tax rate includes the recording of a valuation allowance of $35.2 million, in addition to changes in geographical mix of earnings and related foreign tax rate differential, a reduction in the recognized excess tax benefits related to the vesting of restricted stock and the exercise of non-qualified stock options and incentive stock options as compared to prior years, a decrease in the beneficial impact of the research and development tax credits and an increase in uncertain tax positions.

Year Ended December 31, 2018 Compared to Year Ended December 31, 2017

Revenue

	Year Ended December 31, 2018 Amount	2018 % of Total	2017 Amount	2017 % of Total	Change Amount	Change %
	(dollars in thousands)					
Revenue:						
Product	$ 256,989	86.5%	$ 311,896	88.7%	$ (54,907)	(17.6)%
Service	40,138	13.5%	39,679	11.3%	459	1.2%
Total revenue	$ 297,127	100.0%	$ 351,575	100.0%	$ (54,448)	(15.5)%
Revenue by geographic region:						
North America	$ 146,008	49.1%	$ 201,856	57.4%	$ (55,848)	(27.7)%
Latin America	32,283	10.9%	40,347	11.5%	(8,064)	(20.0)%
Europe, Middle East and Africa	81,343	27.4%	61,458	17.5%	19,885	32.4%
Asia-Pacific	37,493	12.6%	47,914	13.6%	(10,421)	(21.7)%
Total revenue	$ 297,127	100.0%	$ 351,575	100.0%	$ (54,448)	(15.5)%

The decrease in product revenue was primarily due to a decrease in sales of our products to existing customers in North America, Latin America and Asia-Pacific as a result of a decrease in the deployment of our software-centric broadband products in their networks, which we believe was primarily due to the timing of customer expenditures on network upgrades. These decreases were partially offset by an increase in sales of our software-enabled capacity expansions to customers in Europe, Middle East and Africa.

The increase in service revenue was primarily due to a $1.0 million increase in maintenance and support services revenue due to customers renewing their maintenance and support service contracts, partially offset by a $0.5 million decrease in professional services revenue due to a decrease in customer projects requiring our assistance.

Cost of Revenue and Gross Profit

	Year Ended December 31, 2018	2017	Change Amount	Change %
	(dollars in thousands)			
Cost of revenue:				
Product	$ 74,350	$ 88,538	$ (14,188)	(16.0)%
Service	4,811	4,973	(162)	(3.3)%
Total cost of revenue	$ 79,161	$ 93,511	$ (14,350)	(15.3)%

The decrease in cost of product revenue was primarily due to a decrease in sales of our hardware-based broadband products for customer network upgrades.

The decrease in cost of service revenue was primarily due to a decrease in subcontracted professional services.

	Year Ended December 31, 2018 Amount	2018 Gross Margin	2017 Amount	2017 Gross Margin	Change Amount	Change Gross Margin (bps)
	(dollars in thousands)					
Gross profit:						
Product	$ 182,639	71.1%	$ 223,358	71.6%	$ (40,719)	(50)
Service	35,327	88.0%	34,706	87.5%	621	50
Total gross profit	$ 217,966	73.4%	$ 258,064	73.4%	$ (40,098)	-

The decrease in product gross margin was primarily due to a decrease in the proportion of our product revenue derived from higher margin software-based capacity expansions.

The increase in service gross margin was due to an increase in maintenance and support services revenue and a decrease in lower-margin professional services revenue.

Research and Development

	Year Ended December 31,		Change	
	2018	2017	Amount	%
	(dollars in thousands)			
Research and development	$ 70,974	$ 60,677	$ 10,297	17.0%
Percentage of revenue	23.9%	17.3%		

The increase in research and development expense was due to a $4.6 million increase in prototype development costs for new broadband products, a $3.2 million increase in personnel-related costs (including the effect of a $1.0 million decrease in stock based compensation expense) as a result of the increase in the headcount of our research and development personnel from 399 to 430 to support the development of our new wireless and software-centric broadband products and to enhance our existing software-centric broadband products, a $1.4 million increase in depreciation expense for research and development related assets, a $0.5 million increase in software maintenance fees and a $0.4 million increase in facilities and infrastructure expenses.

Selling, general and administrative

	Year Ended December 31,		Change	
	2018	2017	Amount	%
	(dollars in thousands)			
Selling, general and administrative	$ 68,026	$ 61,165	$ 6,861	11.2%
Percentage of revenue	22.9%	17.4%		

The increase in sales and marketing expense was due to a $4.4 million increase in personnel-related costs due to an increase in headcount and a $0.2 million increase in marketing costs related to trade show and event expenses, which were partially offset by a $2.9 million decrease in sales agent commissions.

The increase in general and administrative expense was primarily due to a $1.8 million increase in professional fees to support the requirements of being a public company, a $1.7 million increase in legal and accounting fees, $0.8 million of costs related to our follow-on public offering in April 2018, a $0.7 million increase in stock-based compensation expense, a $0.3 million increase in other taxes and a $0.1 million increase in depreciation expense for general and administrative related assets, partially offset by a $0.4 million decrease in personnel-related costs due to a decrease in bonuses.

Other Income (Expense), Net

	Year Ended December 31,		Change	
	2018	2017	Amount	%
	(dollars in thousands)			
Other income (expense), net	$ (13,028)	$ (13,404)	$ 376	2.8%
Percentage of revenue	(4.4)%	(3.8)%		

The increase in other income (expense) was primarily due to a $3.8 million increase in interest income due to an increase in interest rates and an increase in our portfolio of cash equivalents and a $0.7 million increase in other income, partially offset by a $2.3 million increase in interest expense attributable to an increase of interest rates on our term loan facility and a $1.8 million increase in foreign currency losses due to a decrease in the Euro to U.S. dollar exchange rate during the year ended December 31, 2018.

(Benefit from) Provision for Income Taxes

	Year Ended December 31,		Change	
	2018	2017	Amount	%
	(dollars in thousands)			
(Benefit from) provision for income taxes	$ (7,068)	$ 34,318	$ (41,386)	(120.6)%
Effective tax rate	-10.7%	27.9%		

The 38.6% decrease in our effective tax rate includes the recognized excess tax benefits related to the vesting of restricted stock and the exercise of non-qualified stock options and incentive stock options, as well as the impact of the research and development tax credits, which increased in 2018 mainly due to the excess tax benefits from share-based compensation.

Liquidity and Capital Resources

Since our inception, we have primarily funded our operations through issuances of shares of our convertible preferred stock and cash flows from operations. In addition, on December 20, 2016, we entered into a credit agreement that included a term loan facility under which we borrowed $300.0 million and in December 2017, we closed our initial public offering, or IPO, of 6,900,000 shares of common stock and received net proceeds of $79.3 million, after deducting underwriting discounts, commissions and offering costs.

On July 1, 2019, we acquired 100% of the equity interests in NetComm for cash consideration of $162.0 million Australian dollars, or AUD ($112.7 million USD, based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019), using amounts included in restricted cash in the consolidated balance sheet as of June 30, 2019. In addition, we recognized advisory fee expenses of $1.5 million, which became due and payable upon the closing of the acquisition.

The following tables set forth our cash, cash equivalents and marketable securities and working capital as of December 31, 2019, 2018 and 2017 as well as our net cash flows for the years ended December 31, 2019, 2018 and 2017:

	As of December 31,		
	2019	2018	2017
	(in thousands)		
Consolidated Balance Sheet Data:			
Cash and cash equivalents	$ 113,638	$ 280,587	$ 260,820
Working capital	213,977	328,400	324,710

	Year Ended December 31,		
	2019	2018	2017
	(in thousands)		
Consolidated Cash Flow Data:			
Net cash (used in) provided by operating activities	$ (39,022)	$ 98,545	$ 95,008
Net cash (used in) provided by investing activities	(118,022)	(7,966)	7,575
Net cash used in financing activities	(9,527)	(68,351)	(172,661)

As of December 31, 2019, we had cash and cash equivalents of $113.6 million and net accounts receivable of $93.7 million. We maintain a $25.0 million revolving credit facility, under which $23.7 million was available and $1.3 million of availability was used as collateral for two stand-by letters of credit as of December 31, 2019. However, based on the financial covenants described under the heading "Term Loan and Revolving Credit Facilities," we are effectively restricted from utilizing the revolving credit facility.

Of our total cash and cash equivalents of $113.6 million as of December 31, 2019, $91.4 million was held by our foreign subsidiaries. The TCJA established a modified territorial system requiring a mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries. In December 2017, we recorded a charge related to a one-time deemed repatriation of accumulated earnings of foreign subsidiaries. Our accounting for the impacts of the TCJA was complete as of December 31, 2018 and we had not recorded any material adjustments to the provisional amounts recorded in 2017 related to the TCJA. As a result, applicable U.S. corporate income taxes have been provided on substantially all of our accumulated earnings of foreign subsidiaries. Beginning in 2018, the TCJA also required a minimum tax on certain future earnings generated by foreign subsidiaries while providing future tax-free repatriation of such earnings through a 100% dividends-received deduction.

While the intent of TCJA was to provide for a territorial tax system, effective for taxable years beginning after January 1, 2018, taxpayers are subjected to the GILTI provisions. The GILTI provisions require us to currently recognize in U.S. taxable income, a deemed dividend inclusion of foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. During the years ended December 31, 2019 and 2018 we recorded an income tax charge $0.9 million and $4.4 million, respectively, related to GILTI. We have made an accounting policy election, as allowed by the SEC and FASB, to recognize the impacts of GILTI within the period incurred. Therefore, no U.S. deferred taxes are provided on GILTI inclusions of future foreign subsidiary earnings.

We believe our existing cash and cash equivalents will be sufficient to meet our working capital and capital expenditure needs and debt service obligations for at least the next 12 months. Our future capital requirements may vary materially from those currently planned and will depend on many factors, including our rate of revenue growth, the timing and extent of spending on research and development efforts and other business initiatives, purchases of capital equipment to support our growth, the expansion of sales and marketing activities, expansion of our business through acquisitions or our investments in complementary products, technologies or businesses, the use of working capital to purchase additional inventory, the timing of new product introductions, market acceptance of our products and overall economic conditions. To the extent that current and anticipated future sources of liquidity are insufficient to fund our future business activities and requirements, we may be required to seek additional equity or debt financing. In the event additional financing is required from outside sources, we may not be able to raise it on terms acceptable to us or at all.

From our inception through December 31, 2019, our board of directors has declared a special dividend on five separate occasions and has approved cash payments to the holders of our stock options, stock appreciation rights, or SARs, and restricted stock units, or RSUs, as equitable adjustments in connection with these special dividends. The dividend payments totaled $0.9 million and $206.4 million in the years ended December 31, 2018 and 2017, respectively. No dividend payments were made during the year ended December 31, 2019. The equitable adjustment payments totaled $2.6 million, $7.3 million and $40.2 million in the years ended December 31, 2019, 2018 and 2017, respectively. As of December 31, 2019, there were $0.7 million of equitable adjustment payments that had been approved by our board of directors that had not yet been paid to the holders of our stock options, SARs and RSUs. These equitable adjustment payments will be paid to the holders of the applicable equity awards as they vest through 2021. We do not anticipate declaring cash dividends in the foreseeable future. Any future determination to declare dividends will be subject to the discretion of our board of directors and applicable law, and will depend on various factors, including our results of operations, financial condition, prospects and any other factors deemed relevant by our board of directors.

Cash Flows

Operating Activities

Our primary source of cash from operating activities has been from cash collections from our customers. We expect cash inflows from operating activities to be affected by increases in sales and timing of collections and by purchases and shipments of inventory. Our primary uses of cash from operating activities have been for personnel costs and investment in sales and marketing and research and development. We expect cash outflows from operating activities to increase as a result of further investment in research and development and sales and marketing and increases in personnel costs as we continue to enhance our products and introduce new products in an effort to continue to expand our business.

During the year ended December 31, 2019, cash used in operating activities was $39.0 million, primarily resulting from our net loss of $48.2 million, net non-cash expenses of $45.3 million, and by net cash used in changes in our operating assets and liabilities of $36.1 million. The net cash used in changes in our operating assets and liabilities during the year ended December 31, 2019 was primarily due to a $21.3 million increase in inventory due to anticipated growth in our business that did not materialize; an $9.5 million decrease in deferred revenue primarily due to a decrease in order volume during the year; a $7.8 million decrease in accrued expenses due to the timing of payments; and a $3.7 million increase in prepaid expenses and other assets. These outflows of cash were partially offset by a $2.7 million increase in accrued income taxes; a $1.9 million decrease in accounts receivable due to timing of vendor payments; and a $1.5 million increase in accounts payable.

During the year ended December 31, 2018, cash provided by operating activities was $98.5 million, primarily resulting from our net income of $73.0 million, net non-cash gains of $0.7 million, and by net cash provided by changes in our operating assets and liabilities of $24.9 million. The net cash provided by changes in our operating assets and liabilities during the year ended December 31, 2018 was primarily due to a $34.7 million decrease in accounts receivable due to a decrease in sales and timing of the related collections; a $6.1 million increase in accrued expenses due to the timing of payments; and a $4.2 million increase in accounts payable primarily attributable to timing of our payments for purchases of inventory. These inflows of cash were partially offset by a $11.1 million increase in inventory due to anticipated growth in our business; a $5.1 million decrease in deferred revenue primarily due to recognition of $6.2 million of revenue upon the product acceptance by a customer in Asia-Pacific, partially offset by the deferral of revenue for customer acceptance; a $3.1 million decrease in accrued income taxes primarily due to federal research and development tax credits generated in 2018 which we will carryback to reduce its long-term taxes payable related to the deemed repatriation tax under the TCJA; and a $1.1 million increase in prepaid expenses and other current assets.

During the year ended December 31, 2017, cash provided by operating activities was $95.0 million, primarily resulting from our net income of $88.5 million and net non-cash charges of $32.4 million, both partially offset by net cash used by changes in our operating assets and liabilities of $25.9 million. The net cash used by changes in our operating assets and liabilities during the year ended December 31, 2017 was primarily due to a $25.7 million increase in accounts receivable due to an increase in sales and timing of the related collections; a $25.6 million decrease in deferred revenue primarily due to recognition of $14.4 million of revenue upon the product acceptance by a customer in Asia-Pacific and recognition of $8.5 million of revenue upon the expiration of a trade-in right for a customer in North America; a $6.5 million decrease in accounts payable primarily attributable to timing of our payments for purchases of inventory; and a $3.2 million decrease in accrued income taxes due to the timing of payments. These uses of cash were partially offset by a $21.9 million decrease in inventory due to shipments of our software-centric broadband products to customers; a $10.2 million increase in accrued expenses and other current liabilities, which included an increase of $8.4 million for accrued customer incentives; and a $3.5 million decrease in prepaid expenses and other current assets.

Investing Activities

Prior to the NetComm acquisition on July 1, 2019, our investing activities have consisted primarily of expenditures for lab and computer equipment and software to support the development of new products and increase our manufacturing capacity to meet customer demand for our products. In addition, our investing activities include expansion of and improvements to our facilities. As our business expands, we expect that we will continue to invest in these areas.

Net cash used in investing activities during the year ended December 31, 2019 was $118.0 million and consisted of consideration paid for the NetComm acquisition, net of cash acquired, of $109.4 million and $8.6 million of purchases of property and equipment.

Net cash used in investing activities during the year ended December 31, 2018 was $8.0 million and consisted of purchases of property and equipment.

Net cash provided by investing activities during the year ended December 31, 2017 was $7.6 million and consisted of $14.6 million of proceeds from maturities of marketable securities, partially offset by $7.0 million for purchases of property and equipment.

Financing Activities

Net cash used in financing activities during the year ended December 31, 2019 was $9.5 million and consisted of debt principal repayments of $6.8 million, dividend and equitable adjustment payments of $2.6 million and repurchases of common stock of $1.8 million, payment of taxes on behalf of our employees related to net share settlement of equity awards of $1.0 million, partially offset by proceeds from the exercise of stock options of $2.7 million.

Net cash used in financing activities during the year ended December 31, 2018 was $68.3 million and consisted of repurchases of common stock of $75.1 million, dividend and equitable adjustment payments of $7.3 million, debt principal repayments of $3.3 million and offering costs of $1.1 million, partially offset by proceeds from the exercise of stock options of $14.7 million and profit disgorgement of $3.8 million by certain selling stockholders in our follow-on public offering.

Net cash used in financing activities during the year ended December 31, 2017 was $172.7 million and consisted primarily of dividend and equitable adjustment payments of $246.6 million, payment of taxes on behalf of our employees related to net share settlement of equity awards of $4.0 million, principal repayments of our term loan facility and commercial mortgage of $3.3 million and payments of initial public offering costs of $2.4 million, partially offset by proceeds received from our initial public offering, net of underwriting discounts and commissions, of $83.4 million and proceeds from the exercise of stock options of $0.3 million.

Commercial Mortgage Loan

In July 2015, we entered into an $8.0 million commercial mortgage loan agreement. The annual interest rate on the loan is 3.5%, and the loan is repayable in 60 monthly installments of principal and interest based on a 20-year amortization schedule. The loan is secured by the land and building, which are our corporate offices, purchased in March 2015, and contains annual affirmative, negative and financial covenants, including maintenance of a minimum debt service ratio. We were in compliance with all the covenants of the mortgage loan as of December 31, 2019 and 2018. As of December 31, 2019 and 2018, the outstanding principal amount under the mortgage loan was $6.6 million and $7.0 million, respectively.

Term Loan and Revolving Credit Facilities

On December 20, 2016, we entered into a credit agreement with JPMorgan Chase Bank, N.A., as administrative agent, various lenders and JPMorgan Chase Bank, N.A. and Barclays Bank PLC, as joint lead arrangers and joint bookrunners, providing for:

- a term loan facility of $300.0 million; and
- a revolving credit facility of up to $25.0 million in revolving credit loans and letters of credit.

As of December 31, 2019 and 2018, we had borrowings of $291.0 million and $294.0 million, respectively, outstanding under the term loan facility and as of December 31, 2019 we did not have any outstanding borrowings under the revolving credit facility; however, we had used $1.3 million under the revolving credit facility for two stand-by letters of credit, one which serves as collateral to one of our customers pursuant to a contractual obligation and one which is used as collateral for operating leases in Australia. As of December 31, 2018, we did not have any outstanding borrowings under the revolving credit facility. In addition, we may, subject to certain conditions, including the consent of the administrative agent and the institutions providing such increases, increase the facilities by an unlimited amount so long as we are in compliance with specified leverage ratios, or otherwise by up to $70.0 million.

Borrowings under the facilities bear interest at a floating rate, which can be either a Eurodollar rate plus an applicable margin or, at our option, a base rate (defined as the highest of (x) the JPMorgan Chase, N.A. prime rate, (y) the federal funds effective rate, plus one-half percent (0.50%) per annum and (z) a one-month Eurodollar rate plus 1.00% per annum) plus an applicable margin. The applicable margin for borrowings under the term loan facility is 4.00% per annum for Eurodollar rate loans (subject to a 1.00% per annum interest rate floor) and 3.00% per annum for base rate loans. As a result of the completion of our initial public offering in December 2017, the applicable margin for borrowings under the revolving credit facility is 1.75% per annum for Eurodollar rate loans and 0.75% per annum for base rate loans, subject to reduction based on our maintaining of specified net leverage ratios. The interest rates payable under the facilities are subject to an increase of 2.00% per annum during the continuance of any payment default.

For Eurodollar rate loans, we may select interest periods of one, three or six months or, with the consent of all relevant affected lenders, twelve months. Interest will be payable at the end of the selected interest period, but no less frequently than every three months within the selected interest period. Interest on any base rate loan is not set for any specified period and is payable quarterly. We have the right to convert Eurodollar rate loans into base rate loans and the right to convert base rate loans into Eurodollar rate loans at our option, subject, in the case of Eurodollar rate loans, to prepayment penalties if the conversion is effected prior to the end of the applicable interest period. As of December 31, 2019, the interest rate on our borrowings under the term loan facility was 5.80% per annum, which was based on a one-month Eurodollar rate of 1.80% per annum plus the applicable margin of 4.00% per annum for Eurodollar rate loans. As of December 31, 2018, the interest rate on the term loans was 6.52% per annum, which was based on a one-month Eurodollar rate at the applicable floor of 2.52% per annum plus the applicable margin of 4.00% per annum for Eurodollar rate loans.

The revolving credit facility also requires payment of quarterly commitment fees at a rate of 0.25% per annum on the difference between committed amounts and amounts actually borrowed under the facility and customary letter of credit fees.

The term loan facility matures on December 20, 2023 and the revolving credit facility matures on December 20, 2021. The term loan facility is subject to amortization in equal quarterly installments, which commenced on March 31, 2017, of principal in an annual aggregate amount equal to 1.0% of the original principal amount of the term loans of $300.0 million, with the remaining outstanding balance payable at the date of maturity.

Voluntary prepayments of principal amounts outstanding under the term loan facility are permitted at any time; however, if a prepayment of principal is made with respect to a Eurodollar loan on a date other than the last day of the applicable interest period, we are required to compensate the lenders for any funding losses and expenses incurred as a result of the prepayment. Prior to the revolving credit facility maturity date, funds borrowed under the revolving credit facility may be borrowed, repaid and reborrowed, without premium or penalty.

In addition, we are required to make mandatory prepayments under the facilities with respect to (i) 100% of the net cash proceeds from certain asset dispositions (including casualty and condemnation events) by us or certain of our subsidiaries, subject to certain exceptions and reinvestment provisions, (ii) 100% of the net cash proceeds from the issuance or incurrence of any additional debt by us or certain of our subsidiaries, subject to certain exceptions, and (iii) 50% of our excess cash flow, as defined in the credit agreement, subject to reduction upon our achievement of specified performance targets.

The facilities are secured by, among other things, a first priority security interest, subject to permitted liens, in substantially all of our assets and all of the assets of certain of our subsidiaries and a pledge of certain of the stock of certain of our subsidiaries, in each case subject to specified exceptions. The facilities contain customary affirmative and negative covenants, including certain restrictions on our ability to pay dividends, and, with respect only to the revolving credit facility, a financial covenant requiring us to maintain a specified total net leverage ratio, in the event that on the last day of any fiscal quarter, we have utilized more than 30% of our borrowing capacity under the revolving credit facility (subject to certain exceptions). The facility contains a cross-default provision, whereby, if repayment of borrowings under the revolving credit facility are accelerated due to a default of the net leverage ratio covenant, repayment of the outstanding term loan balance could also be accelerated. Because the financial covenant under the revolving credit facility only applies if outstanding utilization thereunder exceed 30% of the total borrowing capacity on the last day of each fiscal quarter, this cross-default provision has the effect of limiting our ability to utilize more than 30% of our total borrowing capacity under the revolving credit facility of $25.0 million if both our net leverage ratio exceeds the maximum permitted by the agreement and we would not otherwise be able to reduce our outstanding utilization of the revolving credit facility to below the 30% testing threshold prior to the last day of any quarter. Our net leverage ratio exceeded the maximum on December 31, 2019; however, as our utilization of the revolving credit facility did not exceed the 30% testing threshold on December 31, 2019, we were not in default the revolving credit facility as a result of our net leverage ratio exceeding the maximum permitted amount. We were in compliance with all other applicable covenants of the facilities as of December 31, 2019 and with all applicable covenants as of December 31, 2018. We do not expect to require the use of the revolving credit facility to fund operations during the next 12 months.

Stock Repurchase Program

On February 21, 2019, we announced a stock repurchase program under which we were authorized to repurchase up to $75.0 million of our common stock. During the year ended December 31, 2019, we repurchased 0.5 million shares of our common stock for approximately $1.8 million, before commissions. As of December 31, 2019, approximately $73.2 million remained authorized for repurchases of our common stock under the stock repurchase program. The stock repurchase program has no expiration date, does not require us to purchase a minimum number of shares, and may be suspended, modified or discontinued at any time without prior notice.

Contractual Obligations and Commitments

The following table summarizes our contractual obligations and commitments as of December 31, 2019.

	Payments Due by Period				
	Total	Less than 1 Year	1 to 3 Years	3 to 5 Years	More than 5 Years
	(in thousands)				
Debt obligations—Term loans(1)	$ 358,165	$ 20,091	$ 39,559	$ 298,515	$ —
Debt obligations—Commercial mortgage(2)	6,780	6,780	—	—	—
Operating leases(3)	4,330	2,723	1,602	5	—
Total	$ 369,275	$ 29,594	$ 41,161	$ 298,520	$ —

(1) Amounts in the table reflect the contractually required principal and interest payable pursuant to outstanding borrowings under our term loan facility. For purposes of this table, the interest due under the term loan facility was calculated using an assumed interest rate of 5.80% per annum, which was the interest rate in effect as of December 31, 2019.

(2) Amounts in the table reflect the contractually required principal and interest payable pursuant to outstanding borrowings under our commercial mortgage.
(3) Amounts in the table reflect payments due for our lease of manufacturing, warehouse and office space in the United States, China, Hong Kong, Spain, Australia and the United Kingdom under non-cancelable operating leases that expire through 2023. We also have a lease in Ireland that expires in 2026, but provides us the right to terminate in 2021.

We enter into purchase agreements with our contract manufacturers and suppliers, generally with terms of a year or more. We have no minimum purchase requirements under these agreements.

The contractual obligations table above excludes $2.2 million of long-term taxes payable related to the mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries under the TCJA.

Critical Accounting Policies and Significant Judgments and Estimates

Our management's discussion and analysis of financial condition and results of operations is based on our consolidated financial statements included elsewhere in this Annual Report on Form 10-K, which have been prepared in accordance with accounting principles generally accepted in the United States of America, or GAAP. In preparing our consolidated financial statements, we make estimates, assumptions and judgments that can have a significant effect on our reported revenue, results of operations and net income or loss, as well as on the value of certain assets and liabilities on our balance sheet during and as of the reporting periods. These estimates, assumptions and judgments are necessary because future events and their effects on our results and the value of our assets cannot be determined with certainty and are made based on our historical experience and on other assumptions that we believe to be reasonable under the circumstances. We evaluate our estimates and assumptions on an ongoing basis. These estimates may change as new events occur or additional information is obtained, and we may periodically be faced with uncertainties, the outcomes of which are not within our control and may not be known for a prolonged period of time. As the use of estimates is inherent in the financial reporting process, actual results could differ from those estimates.

While our significant accounting policies are described in more detail in Note 2 to our consolidated financial statements included elsewhere in this Annual Report on Form 10-K, we believe that the following accounting policies are those most critical to the judgments and estimates used in the preparation of our consolidated financial statements.

Revenue Recognition

Effective January 1, 2019, we adopted ASC Topic 606, Revenue from Contracts with Customers, or "ASC 606", using the modified retrospective transition method. This method was applied to contracts that were not complete as of the date of initial application. The following is a summary of new and/or revised significant accounting policies affected by our adoption of ASC 606, which relate primarily to revenue and cost recognition.

We generate revenue from sales of our products, along with associated maintenance, support and extended hardware warranty services, and, to a lesser extent, from sales of professional services. We also generate revenue from sales of additional line cards and software-based capacity expansions. Maintenance and support services include telephone support, bug fixes and unspecified software upgrades and updates provided on a when-and-if-available basis and/or extended hardware warranty.

In our consolidated statements of operations and comprehensive (loss) income, revenue from sales of broadband products, Axyom products and fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices are classified as product revenue, and revenue from maintenance and support and professional services is classified as service revenue.

In accordance with ASC 606, revenue is recognized when a customer obtains control of promised products or services. The amount of revenue recognized reflects the consideration that we expect to be entitled to receive in exchange for these products or services. To achieve the core principle of this standard, we apply the following five steps:

1) Identify the contract with a customer - We consider binding contracts and/or purchase orders to be customer contracts, provided collection is probable. Collectability is assessed based on a number of factors that generally include information supplied by credit agencies, references and/or analysis of customer accounts and payment history. We combine contracts with customers if those contracts were negotiated as a single deal or contain price dependencies.

2) Identify the performance obligations in the contract - Performance obligations are identified as products and services that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the product or service either on its own or together with other resources that are readily available from third parties or from us, and are distinct in the context of the contract, whereby the transfer of the products or services is separately identifiable from other promises in the contract.

3) Determine the transaction price - The transaction price is determined based on the consideration to which we expect to be entitled in exchange for transferring products or services to the customer. Variable consideration is included in the transaction price if, in our judgment, it is probable that no significant future reversal of cumulative revenue under the contract will occur.

4) Allocate the transaction price to performance obligations in the contract - The transaction price is allocated to performance obligations based on a relative standalone selling price ("SSP").

5) Recognize revenue when or as we satisfy a performance obligation - Revenue from product sales is recognized upon delivery to the customer, which is generally when control of the asset has passed to the customer.

Performance Obligations

The majority of our contracts with customers contain multiple performance obligations including products and maintenance services, and on a limited basis, professional services. For these contracts, we account for individual performance obligations separately if they are considered distinct. Our broadband products, Axyom products, maintenance services and professional services are considered distinct performance obligations. When multiple performance obligations exist in a customer contract, the transaction price is allocated to the separate performance obligations on a relative SSP basis. Determination of SSP requires judgment and is based on the best evidence available which may include the standalone selling price of products when sold on a standalone basis to similar customers in similar circumstances, or in the absence of standalone sales, taking into consideration our historical pricing practices by customer type, selling method (i.e. resellers or direct), and geographic-specific market factors.

Product revenue

Our broadband products have both software and non-software (i.e., hardware) components that function together to deliver the products' essential functionality. Broadband hardware products generally cannot be used apart from the embedded software and are considered one distinct performance obligation. Revenue on broadband hardware products with embedded software is recognized at a point in time when control of the products is transferred to the customer, which is typically when risk of loss has transferred and the right to payment is enforceable. This is generally when the product has shipped or been delivered, based on agreed-upon shipping terms. We also earn revenue from the sale of software-enabled capacity expansions. Revenue on software-enabled capacity expansions are distinct performance obligations as they are separately identifiable and provide additional bandwidth capacity on hardware products already purchased by the customer. Revenue is recognized on software-enabled capacity expansions when control is transferred, which is typically when risk of loss has transferred and the right to payment is enforceable. This is generally when the software-based capacity expansions are made available to the customer.

In addition, we also generate revenue from the sale of our Axyom software platform and related delivery platform hardware including indoor and outdoor Apex small cells. Perpetual licenses and hardware are distinct performance obligations as they are separately identifiable, and the customer can benefit from the licenses and hardware on their own. Revenue is recognized at a point in time when control of the products is transferred to the customer, which is typically when risk of loss has transferred and the right to payment is enforceable. Generally, this occurs when software licenses are made available to customers and hardware products are shipped or delivered, based on agreed-upon shipping terms.

We also generate revenue from the sale of fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices, the product line acquired via our acquisition of NetComm on July 1, 2019. The arrangements consist of a single hardware element making it a distinct performance obligation as they are separately identifiable, and the customer can benefit from the hardware on their own. Revenue is generally recognized at a point in time when control of the asset is transferred to the customer. Generally, this occurs when hardware products are shipped or delivered, based on agreed-upon shipping terms.

When customer contracts require acceptance of product and services, we consider the nature of the acceptance provisions to determine if they are substantive or considered a formality that does not impact the timing of revenue recognition. When acceptance provisions are considered substantive, we will defer revenue on all performance obligations in the contract subject to acceptance until acceptance has been received. We do not defer revenue when acceptance provisions are deemed perfunctory.

Maintenance and Support Services Revenue and Professional Services Revenue

Our broadband and Axyom products are sold with maintenance and support services, a distinct performance obligation, that includes the stand-ready obligation to provide telephone support, bug fixes and unspecified software upgrades and updates provided on a when-and-if-available basis and/or extended hardware warranty. Our fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices generally do not have a support component. After the initial sale, customers may purchase annual renewals of support contracts. Our telephone support and unspecified upgrades and updates are delivered over time and therefore revenue is recognized ratably over the contract term, which is typically one year, but can be as long as three to five years. We also generate revenue from sales of professional services, such as installation, configuration and training. Professional services are a distinct performance obligation since our products are functional without these services and can generally be performed by the customer or a third party. Professional services are generally delivered over time, with revenue recognized as services are performed, which is generally based on labor hours incurred during the period compared to the total estimated labor hours.

The sale of our products generally includes a 90-day warranty on the software and a one-year warranty on the hardware component of the products, which includes repair or replacement of the applicable hardware. These warranties are to ensure the products perform in accordance with our specifications and are therefore not a performance obligation. We record a warranty accrual for the initial software and hardware warranty included with product sales and do not defer revenue.

Resellers and Sales Agents

We market and sell our products through our direct global sales force, supported by sales agents, and through resellers. Our resellers receive an order from an end customer prior to placing an order with us, and we confirm the identification of or are aware of the end customer prior to accepting such an order. We invoice the reseller an amount that reflects a reseller discount and record revenue based on the amount of the discounted transaction value. Our resellers do not stock inventory received from us.

When we transact with a reseller, the contract is with the reseller and not with the end customer. Whether we transact business with and receive the order from a reseller or directly from an end customer, our revenue recognition policy and resulting pattern of revenue recognition for the order are the same.

We also use sales agents that assist in the sales process with certain customers primarily located in the Latin America and Asia-Pacific regions. Sales agents are not resellers. If a sales agent is engaged in the sales process, then we receive the order directly from and sell the products and services directly to the end customer, and we pay a commission to the sales agent, calculated as a percentage of the related transaction value. Accounting considerations related to sales agent commissions are discussed in the "Costs to Obtain or Fulfill a Contract" section below.

We have assessed whether we are the principal (i.e., reports revenues on a gross basis) or agent (i.e., reports revenues on a net basis) by evaluating whether we have control of the good or service before it is transferred to the customer. Generally, we control the promised good or service before transferring it to the customer and act as the principal in the transaction. Accordingly, we report revenues on a gross basis.

Costs to Obtain or Fulfill a Contract

We capitalize commission expenses paid to internal sales personnel and sales agent commissions that are incremental to obtaining customer contracts, for which the related revenue is recognized over a future period. These costs are incurred on initial sales of product, maintenance and professional services and maintenance and support contract renewals. We defer these costs and amortize them over the period of benefit, which we generally consider to be the contract term or length of the longest delivery period as contract capitalization costs in the consolidated balance sheets. Commissions paid relating to contract renewals are deferred and amortized on a straight-line basis over the related renewal period as commissions paid on renewals are commensurate with commissions paid on initial sales transactions. We periodically review the carrying amount of capitalized contract costs to determine whether events or changes in circumstances have occurred that could impact the period of benefit.

We also pay commissions on maintenance and support contract renewals. Commissions paid on renewals are commensurate with commissions paid on the initial maintenance and support contracts. These commissions are deferred and amortized on a straight-line basis over the related renewal period. Costs to obtain a contract for professional services contracts are expensed as incurred in accordance with the practical expedient as the contractual period of our professional services contracts are one year or less.

Deferred Revenue

Amounts billed in excess of revenue recognized are recorded as deferred revenue. Deferred revenue includes customer deposits, amounts billed for maintenance and support services contracts in advance of services being performed, amounts for trade-in right liabilities and amounts related to contracts that have been deferred as a result of not meeting the required revenue recognition criteria as of the end of the reporting period. Deferred revenue expected to be recognized as revenue more than one year subsequent to the balance sheet date is reported within long-term liabilities in the consolidated balance sheets.

We defer recognition of direct costs, such as cost of goods and services, until recognition of the related revenue. Such costs are classified as current assets if the related deferred revenue is classified as current, and such costs are classified as non-current assets if the related deferred revenue is classified as non-current.

Other Revenue Recognition Policies

Our customary payment terms are generally one year or less. We have elected to apply the practical expedient that allows an entity to not adjust the promised amount of consideration in customer contracts for the effect of a significant financing component when the period between the transfer of product and services and payment of the related consideration is less than one year. If we provide extended payment terms that represent a significant financing component, we adjust the amount of promised consideration for the time value of money using our discounted rate and recognize interest income separately from the revenue recognized on contracts with customers. For the year ended December 31, 2019, we recorded $160 in interest income in the consolidated statements of operations and comprehensive (loss) income.

In limited instances, we have offered future rebates to customers based on a fixed or variable percentage of actual sales volumes over specified periods. The future rebates earned based on the customer's purchasing from us in one period may be used as credits to be applied by them against accounts receivable due to us in later periods. We account for these future rebates as variable consideration and reduce the transaction price to the extent it is probable that a significant reversal of cumulative revenue recognized will not occur when the variable consideration is resolved. The reduction of the transaction price is estimated based on historical activity and other relevant factors and is recognized when we recognize revenue for the transfer of goods and services to the customer on which the future rebate was earned. Other forms of contingent revenue or variable consideration are infrequent.

When a customer contract includes future trade-in rights, which are distinct performance obligations, we account for the customer contract by recognizing the revenue on the products transferred, deferring revenue allocated to the future product based on a relative standalone selling price, and an asset for the value of the trade-in product to be recovered from the customer upon delivery of the future product. We assess and update these estimates each reporting period, and updates to these estimates may result in either an increase or decrease in the amount of the future product liability and product return asset. We recognize revenue allocated to the future product when the product has shipped or been delivered, and control has transferred. As of December 31, 2019, there were no future product liabilities or product return assets.

We exclude any taxes assessed by a governmental authority that are directly imposed on a revenue-producing transaction (e.g., sales, use and value added taxes) from its transaction price.

Billings to customers for reimbursement of out-of-pocket expenses, including travel, lodging and meals, are recorded as revenue, and the associated costs incurred by us for those items are recorded as cost of revenue. Revenue related to the reimbursement of out-of-pocket costs are accounted for as variable consideration.

We account for any shipping and handling activities as a fulfillment cost rather than an additional promised service. Shipping and handling billed to customers is recorded as an offset to cost of revenue.

Contract Balances

Contract liabilities consist of deferred revenue and include payments received in advance of performance under the contract. Such amounts are recognized as revenue when we satisfy our performance obligations, consistent with the above methodology. For the year ended December 31, 2019, we recognized $22,273 of revenue that was included in deferred revenue as of January 1, 2019.

We receive payments from customers based upon contractual billing terms. Accounts receivable are recorded when the right to consideration becomes unconditional. Contract assets include amounts related to our contractual right to consideration for both completed and partially completed performance obligations that may not have been invoiced. As of December 31, 2019, we included contract assets of $47 in prepaid expenses and other current assets in the accompanying consolidated balance sheets.

Transaction Price Allocated to the Remaining Performance Obligations

As of December 31, 2019, the aggregate remaining amount of revenue expected to be recognized related to unsatisfied or partially unsatisfied performance obligations is $30,068. We expect approximately 85% of this amount to be recognized in the next twelve months with the remainder to be recognized over the next two to five years.

Disaggregation of Revenue

We disaggregate our revenue by product and service in the consolidated statements of operations and comprehensive (loss) income. Performance obligations related to product revenue are recognized at a point in time, while performance obligations related to service revenue are recognized over time. We also disaggregate our revenue based on geographic locations of its customers, as determined by the customer's shipping address.

Inventories

Inventories are valued at the lower of cost or market value. Cost is computed using the first-in first-out convention. Inventories are composed of hardware and related component parts of finished goods. We establish provisions for excess and obsolete inventories after evaluating historical sales, future demand, market conditions, expected product life cycles, and current inventory levels to reduce such inventories to their estimated net realizable value. Such provisions are made in the normal course of business and charged to cost of revenue in our consolidated statements of operations and comprehensive (loss) income.

Deferred inventory costs are included within inventory in our consolidated balance sheets. Deferred inventory costs represent the cost of products that have been delivered to the customer for which revenue associated with the arrangement has been deferred as a result of not meeting all of the required revenue recognition criteria, such as receipt of customer acceptance. Until the revenue recognition criteria are met, we retain the right to a return of the underlying inventory. Deferred inventory costs are recognized as cost of revenue in our consolidated statements of operations and comprehensive (loss) income when the related revenue is recognized.

Goodwill and Acquired Intangible Assets

Goodwill represents the excess purchase price over the estimated fair value of net assets acquired as of the acquisition date. We test goodwill for impairment on an annual basis and between annual tests when impairment indicators are identified, and goodwill is written down when impaired. Goodwill has been recognized in connection with the acquisition of NetComm on July 1, 2019 (refer to Note 3).

We perform its annual goodwill impairment test during its fourth quarter. For its annual goodwill impairment test, we operate under one reporting unit and the fair value of its reporting unit has been determined based on our enterprise value. As part of the annual goodwill impairment test, we have the option to perform a qualitative assessment to determine whether further impairment testing is necessary. Examples of events and circumstances that might indicate that the reporting unit's fair value is less than its carrying amount include macro-economic conditions such as deterioration in the entity's operating environment or industry or market considerations; entity-specific events such as increasing costs, declining financial performance, or loss of key personnel; or other events such as a sustained decrease in the stock price on either an absolute basis or relative to peers. If, as a result of its qualitative assessment, it is more likely than not (i.e., greater than 50% chance) that the fair value of our reporting unit is less than its carrying amount, the quantitative impairment test will be required. Otherwise, no further testing will be required. The Company completed its qualitative assessment and concluded that as of December 31, 2019, it is not more likely than not that the fair value of the Company's reporting unit is less than its carrying amount.

Product Warranties

Substantially all of our products are covered by a warranty for software and hardware for periods ranging from 90 days to one year. In addition, in conjunction with customers' renewals of maintenance and support contracts, we offer an extended warranty for periods typically of one to three years for agreed-upon fees. In the event of a failure of a hardware product or software covered by these warranties, we must repair or replace the software or hardware or, if those remedies are insufficient, provide a refund at our discretion. Our warranty reserve, which is included in accrued expenses and other current liabilities in our consolidated balance sheets, reflects estimated material, labor and other costs related to potential or actual software and hardware warranty claims for which we expect to incur an obligation. Our estimates of anticipated rates of warranty claims and the costs associated therewith are primarily based on historical information and future forecasts. We periodically assess the adequacy of the warranty reserve and adjust the amount as necessary. If the historical data used to calculate the adequacy of the warranty reserve are not indicative of future requirements, additional or reduced warranty reserves may be required.

Income Taxes

We account for income taxes using the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial statement and tax basis of assets and liabilities, as measured by enacted tax rates anticipated to be in effect when these differences reverse. This method also requires the recognition of future tax benefits to the extent that realization of such benefits is more likely than not. Deferred tax expense or benefit is the result of changes in the deferred tax assets and liabilities. We assess the likelihood that our deferred tax assets will be recovered from future taxable income and, to the extent we believe, based upon the weight of available evidence, that it is more likely than not that all or a portion of the deferred tax assets will not be realized, we establish a valuation allowance through a charge to income tax expense. We evaluate the potential for recovery of deferred tax assets by estimating the future taxable profits expected and considering prudent and feasible tax planning strategies. As of December 31, 2019, we determined that it is more likely than not that a portion of our net U.S. deferred tax assets will not be realized, and thus have recognized a valuation allowance of $39,124 against our net U.S. deferred tax assets that are not expected to be realized, an increase of $35,198 during the year ended December 31, 2019 (see Note 9).

We record a liability for potential payments of taxes to various tax authorities related to uncertain tax positions and other tax matters. The recorded liability is based on a determination of whether and how much of a tax benefit in our tax filings or positions is more likely than not to be realized. The amount of the benefit that may be recognized in the financial statements is the largest amount that has a greater than 50% likelihood of being realized upon ultimate settlement. To the extent that the assessment of such tax positions changes, the change in estimate is recorded in the period in which the determination is made. We establish a liability, which is included in accrued income taxes in our consolidated balance sheets, for tax-related uncertainties based on estimates of whether, and the extent to which, additional taxes will be due. These liabilities are established when we believe that certain positions might be challenged despite our belief that the tax return positions are fully supportable. We adjust the recorded liability in light of changing facts and circumstances. Our provision for income taxes includes the impact of the recorded liability and changes thereto.

We recognize interest and penalties related to uncertain tax positions within other income (expense) in our consolidated statements of operations and comprehensive income. Accrued interest and penalties are included in accrued income taxes in our consolidated balance sheets.

On December 22, 2017, the TCJA was enacted which, among other things, lowered the U.S. corporate income tax rate to 21% from 35%, repealed the domestic production activity deductions, limited the deductibility of certain executive compensation and interest expense, and established a modified territorial system requiring a mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries. Beginning in 2018, the TCJA also requires a minimum tax on certain future earnings generated by foreign subsidiaries while providing for future tax-free repatriation of such earnings through a 100% dividends-received deduction.

While the intent of TCJA was to provide for a territorial tax system, effective for taxable years beginning after January 1, 2018, taxpayers are subjected to the GILTI provisions. The GILTI provisions require us to currently recognize in U.S. taxable income a deemed dividend inclusion of foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary’s tangible assets. During the years ended December 31, 2019 and 2018, we recorded an income tax charge of $0.9 million and $4.4 million, respectively, related to GILTI. We have made an accounting policy election, as allowed by the SEC and FASB, to recognize the impacts of GILTI within the period incurred. Therefore, no U.S. deferred taxes are provided on GILTI inclusions of future foreign subsidiary earnings.

Stock-Based Compensation

We measure stock options and other stock-based awards granted to employees and directors based on the fair value on the date of the grant and recognize compensation expense of those awards, net of estimated forfeitures, over the requisite service period, which is generally the vesting period of the respective award. Generally, we issue stock options with only service-based vesting conditions and record the expense for these awards using the straight-line method.

For stock-based awards granted to non-employee consultants, compensation expense is recognized over the period during which services are rendered by such non-employee consultants until completed. At the end of each financial reporting period prior to completion of the service, the fair value of these awards is remeasured using the then-current fair value of our common stock and updated assumption inputs in the Black-Scholes option-pricing model.

We have also granted SARs to certain employees, which require us to pay in cash upon exercise an amount equal to the product of the excess of the per share fair market value of our common stock on the date of exercise over the exercise price, multiplied by the number of shares of common stock with respect to which the SAR is exercised. Because these awards may require us to settle the awards in cash, they are accounted for as a liability in our consolidated balance sheets. The liability related to these awards, as well as related compensation expense, is recognized over the period during which services are rendered until completed. Changes in the fair value of the SAR liability are estimated using the Black-Scholes option pricing model and are recorded in our consolidated statements of operations and comprehensive (loss) income. After vesting is completed, we will continue to remeasure the fair market value of the liability until the award is either exercised or canceled, with changes in the fair value of the liability recorded in our consolidated statements of operations and comprehensive (loss) income.

We estimate the fair value of each stock option and SAR grant using the Black-Scholes option-pricing model, which uses as inputs the fair value of our common stock and assumptions we make for the volatility of our common stock, the expected term of the award, the risk-free interest rate for a period that approximates the expected term of our stock options and our expected dividend yield.

Determination of Fair Value of Common Stock on Grant Dates prior to our Initial Public Offering

Given the absence of an active market for our common stock prior to our initial public offering, the estimated fair value of our common stock was determined by our board of directors at the time of each award grant based upon several factors, including our consideration of input from management, our most recently available third-party valuations of common stock and our board of directors' assessment of additional objective and subjective factors that it believed were relevant and which may have changed from the date of the most recent valuation through the date of the grant. These third-party valuations were performed in accordance with the guidance outlined in the American Institute of Certified Public Accountants' Accounting and Valuation Guide, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation* using either the hybrid method or the option-pricing method, or OPM, which used a combination of income and market approaches to estimate our enterprise value. Cash is added and interest-bearing debt is subtracted from the estimated enterprise value in order to estimate the underlying equity value. The hybrid method is a probability-weighed expected return method, or PWERM, where the equity value in one or more of the scenarios is allocated using an OPM. The OPM treats common stock and preferred stock as call options on the total equity value of a company, with exercise prices based on the value thresholds at which the allocation among the various holders of a company's securities changes. Under this method, the common stock has value only if the funds available for distribution to stockholders exceed the value of the preferred stock liquidation preferences at the time of a liquidity event, such as a strategic sale or merger. The PWERM is a scenario-based methodology that estimates the fair value of common stock based upon an analysis of future values for us, assuming various outcomes. The common stock value is based on the probability-weighted present value of expected future investment returns considering each of the possible outcomes available as well as the rights of each class of stock. The future value of the common stock under each outcome is discounted back to the valuation date at an appropriate risk-adjusted discount rate and probability weighted to arrive at an indication of value for the common stock.

Stock-Based Award Grants in Connection with and Following Our Initial Public Offering

Our board of directors approved, effective upon the commencement of trading of our common stock on the Nasdaq Global Select Market, grants of options to purchase an aggregate of 625,000 shares of common stock, with an exercise price per share equal to the estimated fair market value of our common stock on such date of grant, which our board of directors determined to be equal to the initial public offering price of our common stock, to certain of our employees and restricted stock units for an aggregate of 34,614 shares of common stock to one of our non-employee directors.

Following our initial public offering, the exercise price per share of stock-based award grants will be set at the closing price of our common stock on the Nasdaq Global Select Market on the applicable date of grant, which our board of directors believes represents the fair value of our common stock.

Emerging Growth Company Status

The Jumpstart Our Business Startups Act of 2012, or the JOBS Act, provides that an "emerging growth company" can take advantage of the extended transition period afforded by the JOBS Act for the implementation of new or revised accounting standards. However, we have elected not to "opt out" of such extended transition period, which means that when a standard is issued or revised and it has different application dates for public or private companies, we will adopt the new or revised standard at the time private companies adopt the new or revised standard, provided that we continue to be an emerging growth company. The JOBS Act provides that our decision to take advantage of the extended transition period for complying with new or revised accounting standards is irrevocable.

Off-Balance Sheet Arrangements

As of December 31, 2019, 2018 and 2017, we did not have any off-balance sheet arrangements, as defined in Item 303(a)(4)(ii) of Regulation S-K, such as the use of unconsolidated subsidiaries, structured finance, special purpose entities or variable interest entities.

Recent Accounting Pronouncements

Refer to the "Summary of Significant Accounting Policies" footnote within our consolidated financial statements included elsewhere in this Annual Report on Form 10-K for our analysis of recent accounting pronouncements that are applicable to our business.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

Market risk is the risk of loss to future earnings, values or future cash flows that may result from changes in the price of a financial instrument. The value of a financial instrument may change as a result of changes in interest rates, exchange rates, commodity prices, equity prices and other market changes. We are exposed to market risk related to changes in foreign currency exchange rates and interest rates. We do not use derivative financial instruments for speculative or trading purposes. However, we have entered into, and in the future expect to continue to enter into, exchange rate hedging arrangements to manage certain of the risks described below.

Foreign Currency Exchange Risk

We have accounts receivables denominated in foreign currencies, and our operations outside of the United States incur their operating expenses in foreign currencies. The majority of our product sales and inventory purchases are denominated in U.S. dollars. For our subsidiaries in Ireland and Australia, the U.S. dollar is the functional currency. For each of our other foreign subsidiaries, the functional currency is the local currency. During the years ended December 31, 2019, 2018 and 2017, we incurred foreign currency transaction gains (losses) of $0.3 million, $(0.9) million and $0.9 million, respectively, primarily related to unrealized and realized foreign currency gains (losses) for accounts receivable denominated in foreign currencies and operating expenses that are denominated in local currencies. These foreign currency transaction gains (losses) were recorded as a component of other income (expense), net in our consolidated statements of operations and comprehensive (loss) income. We believe that a 10% change in the exchange rates between the U.S. dollar and euro and between the U.S. dollar and Australian dollar would not materially impact our operating results or financial position. We entered into foreign currency exchange contracts during the year ended December 31, 2019 that mature in the first quarter of 2020, and we expect to continue to hedge certain significant transactions denominated in currencies other than the U.S. dollar in the future.

Interest Rate Sensitivity

Our cash and cash equivalents as of December 31, 2019 consisted of cash maintained in FDIC-insured operating accounts as well as investments in money market mutual funds and certificates of deposit. We also have policies requiring us to invest in high-quality issuers, limit our exposure to any individual issuer, and ensure adequate liquidity. Our primary exposure to market risk for our cash and cash equivalents is interest income sensitivity, which is primarily affected by changes in the general level of U.S. interest rates. However, we do not believe a sudden change in the interest rates for our cash and cash equivalents would have a material impact on our financial condition, results of operations or cash flows.

We have a credit agreement that provides us with a term loan facility of $300.0 million and a revolving credit facility of up to $25.0 million in revolving credit loans and letters of credit. Borrowings under the facilities bear interest at a floating rate, which can be either a Eurodollar rate plus an applicable margin or, at our option, a base rate (defined as the highest of (x) the JPMorgan Chase, N.A. prime rate, (y) the federal funds effective rate, plus one-half percent (0.50%) per annum and (z) a one-month Eurodollar rate plus 1.00% per annum) plus an applicable margin. The applicable margin for borrowings under the term loan facility is 4.00% per annum for Eurodollar rate loans (subject to a 1.00% per annum interest rate floor) and 3.00% per annum for base rate loans. As a result of the completion of our initial public offering in December 2017, the applicable margin for borrowings under the revolving credit facility is 1.75% per annum for Eurodollar rate loans and 0.75% per annum for base rate loans, subject to reduction based on our maintaining of specified net leverage ratios.

As of December 31, 2019, we had borrowings of $291.0 million outstanding under the term loan facility, bearing interest at a rate of 5.80% per annum, which was based on a one-month Eurodollar rate of 1.80% per annum plus the applicable margin of 4.00% per annum for Eurodollar rate loans. Changes in interest rates could cause interest charges on our term loan facility to fluctuate. Based on the amount of borrowings outstanding as of December 31, 2019, an increase of 10%, or approximately 18 basis points, in the one-month Eurodollar rate as of December 31, 2019 would cause pre-tax decreases to our earnings and cash flows of approximately $0.5 million per year, assuming that such rate were to remain in effect for a year. A decrease of 10%, or approximately 18 basis points, in the one-month Eurodollar rate as of December 31, 2019 would cause pre-tax increases to our earnings and cash flows of approximately $0.5 million, assuming that such rate were to remain in effect for a year.

As of December 31, 2019, we were not exposed to interest rate risk under the revolving credit facility as a result of having no outstanding borrowings under the facility.

Inflation Risk

We do not believe that inflation has had a material effect on our business. However, if global demand for the base materials utilized in our suppliers' components were to significantly increase for the components we purchase from our suppliers to manufacture our products, our costs could become subject to significant inflationary pressures, and we may not be able to fully offset such higher costs through price increases. Our inability or failure to do so could harm our business, operating results and financial condition.

Item 8. Financial Statements and Supplementary Data.

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Audited Consolidated Financial Statements	Page
Report of Independent Registered Public Accounting Firm	72
Consolidated Balance Sheets	73
Consolidated Statements of Operations and Comprehensive (Loss) Income	74
Consolidated Statements of Convertible Preferred Stock and Stockholders’ Equity (Deficit)	75
Consolidated Statements of Cash Flows	76
Notes to Consolidated Financial Statements	77

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of Casa Systems, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Casa Systems, Inc. and its subsidiaries (the “Company”) as of December 31, 2019 and December 31, 2018, and the related consolidated statements of operations and comprehensive (loss) income, of convertible preferred stock and stockholders’ equity (deficit), and of cash flows for each of the three years in the period ended December 31, 2019, including the related notes (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019 in conformity with accounting principles generally accepted in the United States of America.

Change in Accounting Principles

As discussed in Note 2 to the consolidated financial statements, the Company changed the manner in which it accounts for revenue from contracts with customers in 2019.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s consolidated financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits of these consolidated financial statements in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
February 27, 2020

We have served as the Company's auditor since 2014.

CASA SYSTEMS, INC.

CONSOLIDATED BALANCE SHEETS
(Amounts in thousands, except per share amounts)

	December 31, 2019	December 31, 2018
Assets		
Current assets:		
Cash and cash equivalents	$ 113,638	$ 280,587
Accounts receivable, net of provision for doubtful accounts of $20 and $410 as of December 31, 2019 and 2018, respectively	93,100	81,782
Inventory	93,604	50,997
Prepaid expenses and other current assets	4,884	3,755
Prepaid income taxes	3,217	390
Total current assets	308,443	417,511
Property and equipment, net	35,910	29,879
Accounts receivable, net of current portion	575	2,388
Deferred tax assets	69	21,578
Goodwill	50,347	—
Intangible assets, net	41,148	—
Other assets	7,820	3,293
Total assets	$ 444,312	$ 474,649
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	$ 25,890	$ 17,776
Accrued expenses and other current liabilities	34,567	36,992
Accrued income taxes	—	958
Deferred revenue	25,485	31,206
Current portion of long-term debt, net of unamortized debt issuance costs	8,524	2,179
Total current liabilities	94,466	89,111
Accrued income taxes, net of current portion	12,381	4,923
Deferred tax liabilities	8,993	—
Deferred revenue, net of current portion	4,583	12,479
Long-term debt, net of current portion and unamortized debt issuance costs	284,756	293,280
Other non-current liabilities	569	—
Total liabilities	405,748	399,793
Commitments and contingencies (Note 17)		
Stockholders' equity:		
Preferred stock, $0.001 par value; 5,000 shares authorized as of December 31, 2019 and 2018, respectively; no shares issued and outstanding as of December 31, 2019 and 2018, respectively	—	—
Common stock, $0.001 par value; 500,000 shares authorized as of December 31, 2019 and 2018, respectively; 84,333 and 82,961 shares issued as of December 31, 2019 and 2018, respectively	84	83
Treasury stock, at cost; 495 shares at December 31, 2019	(1,795)	—
Additional paid-in capital	169,561	156,939
Accumulated other comprehensive loss	(2,222)	(1,158)
Accumulated deficit	(127,064)	(81,008)
Total stockholders' equity	38,564	74,856
Total liabilities and stockholders' equity	$ 444,312	$ 474,649

The accompanying notes are an integral part of these consolidated financial statements.

CASA SYSTEMS, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE (LOSS) INCOME
(Amounts in thousands, except per share amounts)

	Year Ended December 31, 2019	Year Ended December 31, 2018	Year Ended December 31, 2017
Revenue:			
Product	$ 241,377	$ 256,989	$ 311,896
Service	40,920	40,138	39,679
Total revenue	282,297	297,127	351,575
Cost of revenue:			
Product	113,059	74,350	88,538
Service	6,706	4,811	4,973
Total cost of revenue	119,765	79,161	93,511
Gross profit	162,532	217,966	258,064
Operating expenses:			
Research and development	83,331	70,974	60,677
Selling, general and administrative	88,320	68,026	61,165
Total operating expenses	171,651	139,000	121,842
(Loss) income from operations	(9,119)	78,966	136,222
Other income (expense):			
Interest income	4,406	6,259	2,439
Interest expense	(20,522)	(19,763)	(17,466)
Gain (loss) on foreign currency, net	298	(911)	886
Other income, net	522	1,387	737
Total other income (expense), net	(15,296)	(13,028)	(13,404)
(Loss) income before provision for (benefit from) income taxes	(24,415)	65,938	122,818
Provision for (benefit from) income taxes	23,791	(7,068)	34,318
Net (loss) income	(48,206)	73,006	88,500
Other comprehensive income (loss) —foreign currency translation adjustment, net of tax	(1,064)	(1,352)	1,933
Comprehensive (loss) income	$ (49,270)	$ 71,654	$ 90,433
Cash dividends declared per common share or common share equivalent	$ —	$ —	$ 1.7576
Net (loss) income attributable to common stockholders:			
Basic	$ (48,206)	$ 73,006	$ 11,849
Diluted	$ (48,206)	$ 73,006	$ 11,849
Net (loss) income per share attributable to common stockholders:			
Basic	$ (0.57)	$ 0.87	$ 0.34
Diluted	$ (0.57)	$ 0.79	$ 0.26
Weighted-average shares used to compute net (loss) income per share attributable to common stockholders:			
Basic	83,853	83,539	35,359
Diluted	83,853	91,877	44,972

The accompanying notes are an integral part of these consolidated financial statements.

CASA SYSTEMS, INC.
CONSOLIDATED STATEMENTS OF CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' EQUITY (DEFICIT)
(Amounts in thousands, except per share amounts)

	Series A, B and C Convertible Preferred Stock		Common Stock		Treasury Stock		Additional Paid-in Capital	Accumulated Other Comprehensive (Loss) Income	Retained Earnings (Accumulated Deficit)	Total Stockholders' Equity (Deficit)
	Shares	Amount	Shares	Amount	Shares	Amount				
Balances at January 1, 2017	4,038	$ 97,479	33,184	$ 33	—	$ —	$ —	$ (1,739)	$ (69,997)	$ (71,703)
Conversion of convertible preferred stock into common stock upon initial public offering	(4,038)	(97,479)	40,382	40	—	—	97,439	—	—	97,479
Issuance of common stock upon initial public offering, net of underwriting discounts and commissions and offering costs incurred of $10,373	—	—	6,900	7	—	—	79,320	—	—	79,327
Exercise of stock options and common stock issued upon vesting of equity awards, net of shares withheld for employee taxes	—	—	577	1	—	—	(3,772)	—	—	(3,771)
Foreign currency translation adjustment, net of tax of $0	—	—	—	—	—	—	—	1,933	—	1,933
Cash dividends declared ($1.7576 per share of common stock, $17.5764 per share of convertible preferred stock and $1.7576 per share to holders of stock-based awards)	—	—	—	—	—	—	(52,365)	—	(97,420)	(149,785)
Stock-based compensation	—	—	—	—	—	—	8,176	—	—	8,176
Net income	—	—	—	—	—	—	—	—	88,500	88,500
Balances at December 31, 2017	—	—	81,043	81	—	—	128,798	194	(78,917)	50,156
Exercise of stock options and common stock issued upon vesting of equity awards, net of shares withheld for employee taxes	—	—	7,090	7	—	—	14,709	—	—	14,716
Foreign currency translation adjustment, net of tax of $(343)	—	—	—	—	—	—	—	(1,352)	—	(1,352)
Follow-on offering selling stockholders profit disgorgement, net of offering costs of $41	—	—	—	—	—	—	3,770	—	—	3,770
Stock repurchase program	—	—	(5,172)	(5)	—	—	—	—	(75,097)	(75,102)
Stock-based compensation	—	—	—	—	—	—	9,662	—	—	9,662
Net income	—	—	—	—	—	—	—	—	73,006	73,006
Balances at December 31, 2018	—	—	82,961	83	—	—	156,939	(1,158)	(81,008)	74,856
Exercise of stock options and common stock issued upon vesting of equity awards, net of shares withheld for employee taxes	—	—	1,372	1	—	—	1,678	—	—	1,679
Foreign currency translation adjustment, net of tax of $261	—	—	—	—	—	—	—	(1,064)	—	(1,064)
Effect of adopted accounting standards (Note 2)	—	—	—	—	—	—			2,150	2,150
Repurchases of treasury shares	—	—	—	—	495	(1,795)	—	—	—	(1,795)
Stock-based compensation	—	—	—	—	—	—	10,944	—	—	10,944
Net loss	—	—	—	—	—	—	—	—	(48,206)	(48,206)
Balances at December 31, 2019	—	$ —	84,333	$ 84	495	$ (1,795)	$ 169,561	$ (2,222)	$ (127,064)	$ 38,564

The accompanying notes are an integral part of these consolidated financial statements.

CASA SYSTEMS, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS
(Amounts in thousands)

	Year Ended December 31,		
	2019	2018	2017
Cash flows from operating activities:			
Net (loss) income	$ (48,206)	$ 73,006	$ 88,500
Adjustments to reconcile net (loss) income to net cash (used in) provided by operating activities:			
Depreciation and amortization	14,722	9,454	7,738
Stock-based compensation	9,821	8,894	9,136
Deferred income taxes	19,641	(11,517)	11,422
Excess and obsolete inventory valuation adjustment	545	(5,883)	4,115
Increase (decrease) in provision for doubtful accounts	560	(282)	6
Changes in operating assets and liabilities:			
Accounts receivable	1,881	34,716	(25,726)
Inventory	(21,276)	(11,051)	21,859
Prepaid expenses and other assets	(3,679)	(1,084)	3,519
Prepaid income taxes	16	146	(486)
Accounts payable	1,554	4,197	(6,475)
Accrued expenses and other current liabilities	(7,827)	6,124	10,243
Accrued income taxes	2,724	(3,088)	(3,212)
Deferred revenue	(9,498)	(5,087)	(25,631)
Net cash (used in) provided by operating activities	(39,022)	98,545	95,008
Cash flows (used in) provided by investing activities:			
Purchases of property and equipment	(8,591)	(7,966)	(7,014)
Acquisition of a business, net of cash acquired	(109,431)	—	—
Proceeds from maturities of marketable securities	—	—	14,589
Net cash (used in) provided by investing activities	(118,022)	(7,966)	7,575
Cash flows used in financing activities:			
Proceeds from initial public offering, net of underwriting discounts and commissions	—	—	83,421
Principal repayments of debt	(6,820)	(3,304)	(3,292)
Proceeds from exercise of stock options	2,687	14,730	274
Payments of dividends and equitable adjustments	(2,590)	(7,325)	(246,634)
Follow-on offering selling stockholders profit disgorgement	—	3,811	—
Repurchases of common stock	(1,795)	(75,102)	—
Payments of initial public offering costs	—	(1,148)	(2,384)
Employee taxes paid related to net share settlement of equity awards	(1,009)	(13)	(4,046)
Net cash used in financing activities	(9,527)	(68,351)	(172,661)
Effect of exchange rate changes on cash and cash equivalents	(378)	(1,442)	1,344
Net (decrease) increase in cash, cash equivalents and restricted cash	(166,949)	20,786	(68,734)
Cash, cash equivalents and restricted cash at beginning of year	281,606	260,820	329,554
Cash, cash equivalents and restricted cash at end of year (1)	$ 114,657	$ 281,606	$ 260,820
Supplemental disclosures of cash flow information:			
Cash paid for interest	$ 18,885	$ 18,348	$ 16,275
Cash paid for income taxes	$ 4,334	$ 7,268	$ 26,297
Supplemental disclosures of non-cash investing and financing activities:			
Purchases of property and equipment included in accounts payable	$ 727	$ 1,255	$ 1,018
Deferred offering costs included in accounts payable and accrued expenses and other current liabilities	$ —	$ —	$ 1,193
Unpaid dividends and equitable adjustments included in accrued expenses and other current liabilities	$ 731	$ 3,336	$ 10,661
Release of customer incentives included in accounts receivable and accrued expenses and other current liabilities	$ 5,735	$ 8,556	$ 15,468

(1) See Note 2 of the accompanying notes for a reconciliation of the ending balance of cash, cash equivalents and restricted cash shown in these consolidated statements of cash flows.

The accompanying notes are an integral part of these consolidated financial statements.

1. Nature of Business and Basis of Presentation

Casa Systems, Inc. (the "Company") was incorporated under the laws of the State of Delaware on February 28, 2003. The Company is a global communications technology company headquartered in Andover, Massachusetts and has wholly owned subsidiaries in China, France, Canada, Ireland, Spain, Colombia, the Netherlands, Hong Kong, Australia, Germany, the United Kingdom and New Zealand.

The Company offers converged solutions for next-generation centralized, distributed and virtualized architectures for cable broadband, fixed-line broadband and wireless networks. The Company's solutions enable customers to cost-effectively and dynamically increase network speed, add bandwidth capacity and new services for consumers and enterprises, reduce network complexity and reduce operating and capital expenditures.

The Company is subject to a number of risks similar to other companies of comparable size and other companies selling and providing services to the communications industry. These risks include, but are not limited to, the level of capital spending by the communications industry, a lengthy sales cycle, dependence on the development of new products and services, unfavorable economic and market conditions, competition from larger and more established companies, limited management resources, dependence on a limited number of contract manufacturers and suppliers, the rapidly changing nature of the technology used by the communications industry and reliance on resellers and sales agents. Failure by the Company to anticipate or to respond adequately to technological developments in its industry, changes in customer or supplier requirements, changes in regulatory requirements or industry standards, or any significant delays in the development or introduction of products could have a material adverse effect on the Company's operating results, financial condition and cash flows.

In December 2017, the Company closed its initial public offering ("IPO") of 6,900 shares of its common stock at an offering price of $13.00 per share, including 900 shares pursuant to the underwriters' option to purchase additional shares of the Company's common stock. The Company received net proceeds of $79,327, after deducting underwriting discounts and commissions of $6,279 and offering costs of $4,094. Upon the closing of the IPO, all 4,038 shares of the Company's then-outstanding preferred stock automatically converted on a ten-for-one basis into an aggregate of 40,382 shares of the Company's common stock. Upon conversion of the preferred stock, the Company reclassified $97,439 from temporary equity to additional paid-in capital and $40 from temporary equity to common stock.

On April 30, 2018, the Company closed its follow-on public offering in which certain stockholders sold 7,350 shares of the Company's common stock at a price of $25.00 per share, before deducting underwriting discounts and commissions (the "follow-on offering"). The Company did not sell any common stock in the follow-on offering and did not receive any of the proceeds from the sale of the Company's common stock by the selling stockholders. In connection with the sale of the Company's common stock in the follow-on offering, certain of the selling stockholders disgorged $3,770 of profits recognized from the sale, after deducting $41 of offering costs, to the Company in accordance with Section 16(b) of the Securities Exchange Act of 1934, as amended, which was recorded as an increase in additional paid-in capital. The Company incurred $856 of transaction costs in connection with the follow-on offering, of which $815 was recorded in selling, general and administrative expenses in the accompanying consolidated statements of operations.

On July 1, 2019, the Company acquired 100% of the equity interests in NetComm Wireless Limited ("NetComm") for cash consideration of $161,963 Australian dollars ("AUD") ($112,674 United States dollars ("USD"), based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019) and NetComm became a wholly-owned subsidiary of the Company (the "Acquisition"). NetComm is a global leader in the development of fixed wireless and distribution point broadband solutions, and with the Acquisition, the Company now offers a broad, highly competitive portfolio of 4G and 5G fixed wireless access products and customer premise equipment for vDSL2 and G.fast services for service providers.

The Company is an "emerging growth company," as defined in the Jumpstart Our Business Startups Act of 2012 (the "JOBS Act"), and may remain an emerging growth company until the last day of the fiscal year following the fifth anniversary of the initial public offering, subject to specified conditions. The JOBS Act provides that an emerging growth company can take advantage of the extended transition period afforded by the JOBS Act for the implementation of new or revised accounting standards. The Company has elected not to "opt out" of such extended transition period, which means that when a standard is issued or revised and it has different application dates for public or private companies, the Company will adopt the new or revised standard at the time private companies adopt the new or revised standard, provided that the Company continues to be an emerging growth company. The JOBS Act provides that the decision to take advantage of the extended transition period for complying with new or revised accounting standards is irrevocable.

The accompanying consolidated financial statements have been prepared in accordance with accounting principles generally accepted in the United States of America ("GAAP") and include the accounts and results of operations of the Company and its wholly owned subsidiaries. All intercompany transactions and balances have been eliminated in consolidation.

2. Summary of Significant Accounting Policies

Use of Estimates

The preparation of financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosures of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenue and expenses during the reporting periods.

Significant estimates and judgments relied upon by management in preparing these consolidated financial statements include revenue recognition, provision for doubtful accounts, reserves for excess and obsolete inventory, valuation of inventory and deferred inventory costs, the expensing and capitalization of software-related research and development costs, amortization and depreciation periods, recoverability of net deferred tax assets, valuations of uncertain tax positions, provision for (benefit from) income taxes, warranty allowances, the valuation of the Company's common stock and other equity instruments, and stock-based compensation expense.

Although the Company regularly reassesses the assumptions underlying these estimates, actual results could differ materially from these estimates. Changes in estimates are recorded in the period in which they become known. The Company bases its estimates on historical experience and various other assumptions that it believes to be reasonable under the circumstances existing at the time such estimates are made.

Cash, Cash Equivalents and Restricted Cash

Cash and cash equivalents include all highly liquid investments maturing within three months from the date of purchase. As of December 31, 2019 and 2018, the Company's cash and cash equivalents consisted of investments in certificates of deposit and money market mutual funds.

Restricted cash, which was included in other assets as of December 31, 2019 and 2018, consisted of a certificate of deposit of $1,019 in each period pledged as collateral for a stand-by letter of credit required to support a contractual obligation.

The following table is a reconciliation of cash, cash equivalents and restricted cash included in the accompanying consolidated balance sheets that sum to the total cash, cash equivalents and restricted cash included in the accompanying consolidated statements of cash flows.

	December 31, 2019	December 31, 2018
Cash and cash equivalents	$ 113,638	$ 280,587
Restricted cash included in other assets	1,019	1,019
	$ 114,657	$ 281,606

Accounts Receivable

Accounts receivable are presented net of a provision for doubtful accounts, which is an estimate of amounts that may not be collectible. Accounts receivable for arrangements with customary payment terms, which are one year or less, are recorded at invoiced amounts and do not bear interest. The Company generally does not require collateral, but the Company may, in certain instances based on its credit assessment, require full or partial prepayment prior to shipment.

In limited instances, for certain customers and/or for certain transactions, the Company provides extended payment arrangements to allow the customer to pay for the purchased equipment in monthly, other periodic or lump-sum payments over a period of one to five years. In certain circumstances, the receivables may be collateralized by the underlying assets over the payment period. Payments due beyond 12 months from the balance sheet date are recorded as non-current assets.

Accounts receivable as of December 31, 2019 and 2018 consisted of the following:

	December 31, 2019	December 31, 2018
Current portion of accounts receivable, net:		
Accounts receivable, net	$ 91,273	$ 79,526
Accounts receivable, extended payment arrangements	1,827	2,256
	93,100	81,782
Accounts receivable, net of current portion:		
Accounts receivable, extended payment arrangements	575	2,388
	$ 93,675	$ 84,170

The Company performs ongoing credit evaluations of its customers and, if necessary, provides a provision for doubtful accounts and expected losses. When assessing and recording its provision for doubtful accounts, the Company evaluates the age of its accounts receivable, current economic trends, creditworthiness of the customers, customer payment history, and other specific customer and transaction information. The Company writes off accounts receivable against the provision when it determines a balance is uncollectible and no longer actively pursues collection of the receivable. Adjustments to the provision for doubtful accounts are recorded as selling, general and administrative expenses in the consolidated statements of operations and comprehensive (loss) income. A summary of changes in the provision for doubtful accounts for the years ended December 31, 2019, 2018 and 2017 is as follows:

	Year Ended December 31, 2019	2018	2017
Provision for doubtful accounts at beginning of year	$ 410	$ 692	$ 690
Provisions and recoveries	560	—	6
Write-offs	(950)	(282)	(4)
Provision for doubtful accounts at end of year	$ 20	$ 410	$ 692

As of December 31, 2019 and 2018, the Company concluded that all amounts due under extended payment term arrangements were collectible and no reserve for credit losses was recorded. During the years ended December 31, 2019, 2018 and 2017, the Company did not provide a reserve for credit losses and did not write off any uncollectible receivables due under extended payment term arrangements.

Inventories

Inventories are valued at the lower of cost or market value. Cost is computed using the first-in first-out convention. Inventories are composed of hardware and related component parts of finished goods. The Company establishes provisions for excess and obsolete inventories after evaluating historical sales, future demand, market conditions, expected product life cycles, and current inventory levels to reduce such inventories to their estimated net realizable value. Such provisions are made in the normal course of business and charged to cost of revenue in the consolidated statements of operations and comprehensive (loss) income.

Deferred inventory costs are included within inventory in the consolidated balance sheets. Deferred inventory costs represent the cost of products that have been delivered to the customer for which revenue associated with the arrangement has been deferred as a result of not meeting all of the required revenue recognition criteria, such as receipt of customer acceptance. Until the revenue recognition criteria are met, the Company retains the right to a return of the underlying inventory. Deferred inventory costs are recognized as cost of revenue in the consolidated statements of operations and comprehensive (loss) income when the related revenue is recognized.

Property and Equipment

Property and equipment is stated at historical cost less accumulated depreciation. Depreciation is computed using the straight-line method over the estimated useful lives of the assets. Leasehold improvements are recorded at cost with any reimbursement from the landlord being accounted for as deferred rent, which is amortized using the straight-line method over the lease term. Costs for trial systems held and used by the Company's customers pursuant to evaluation agreements are also included within property and equipment. Trial systems held and used by the Company's customers are depreciated over the estimated useful life of such assets, which is two years.

Whenever a trial system is sold to a customer and the selling price is recorded as revenue, the related net book value of the trial system sold is removed from property and equipment and recorded as a cost of revenue. Maintenance and repairs expenditures are charged to expense as incurred.

Estimated useful lives of the respective property and equipment assets are as follows:

	Estimated Useful Life
Computers and purchased software	3 years
Leasehold improvements	Shorter of lease term or 7 years
Furniture and fixtures	7 years
Machinery and equipment	3 – 5 years
Building	40 years
Building improvements	5 – 40 years
Trial systems at customers' sites	2 years

Upon retirement or sale, the cost of assets disposed of and the related accumulated depreciation are removed from the accounts and any resulting gain or loss is included in (loss) income from operations.

Impairment of Long-Lived Assets

The Company evaluates its long-lived assets, which consist primarily of property and equipment, for impairment whenever events or changes in circumstances indicate that the carrying amount of such assets may not be recoverable. Factors that the Company considers in deciding when to perform an impairment review include significant underperformance of the business in relation to expectations, significant negative industry or economic trends and significant changes or planned changes in the use of the assets. Recoverability of assets to be held and used is measured by a comparison of the carrying amount of an asset to the future undiscounted net cash flows expected to be generated by the asset. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the asset exceeds the fair value of the asset, less the cost to sell. No events or changes in circumstances existed to require an impairment assessment during the years ended December 31, 2019, 2018 and 2017.

Deferred Offering Costs

Deferred offering costs of $4,094, consisting of legal, professional accounting and other third-party fees related to the IPO, were reclassified to additional paid-in capital as a reduction of the proceeds upon the closing of the IPO in December 2017. Deferred offering costs of $1,148 and $2,384 were paid during the years ended December 31, 2018 and 2017, respectively. No deferred offering costs were paid during the year ended December 31, 2019.

Concentration of Risks

Financial instruments that potentially subject the Company to concentrations of credit risk consist principally of cash and cash equivalents and accounts receivable. Cash and cash equivalents consist of demand deposits, savings accounts, commercial paper, money market mutual funds, and certificates of deposit with financial institutions, which may exceed Federal Deposit Insurance Corporation limits. The Company has not experienced any losses related to its cash and cash equivalents and does not believe that it is subject to unusual credit risk beyond the normal credit risk associated with commercial banking relationships.

Significant customers are those that represent 10% or more of revenue or accounts receivable and are set forth in the following tables:

	Revenue			Accounts Receivable, Net	
	Year Ended December 31,			December 31,	
	2019	2018	2017	2019	2018
Customer A	14%	27%	37%	11%	13%
Customer B	*	11%	11%	*	15%
Customer C	*	12%	*	14%	18%
Customer D	*	14%	*	*	28%
Customer E	*	*	*	19%	*
Customer F	12%	*	*	*	*

* Less than 10% of total

Customer B was a related party until October 19, 2018, Liberty Global Affiliates (see Note 16).

Certain of the components and subassemblies included in the Company's products are obtained from a single source or a limited group of suppliers. Although the Company seeks to reduce dependence on those limited sources of suppliers and manufacturers, the partial or complete loss of certain of these sources could have a material adverse effect on the Company's operating results, financial condition and cash flows and damage its customer relationships.

Goodwill and Acquired Intangible Assets

Goodwill represents the excess purchase price over the estimated fair value of net assets acquired as of the acquisition date. The Company tests goodwill for impairment on an annual basis and between annual tests when impairment indicators are identified, and goodwill is written down when impaired. Goodwill has been recognized in connection with the acquisition of NetComm on July 1, 2019 (refer to Note 3).

The Company performs its annual goodwill impairment test during its fourth quarter. For its annual goodwill impairment test, the Company operates under one reporting unit and the fair value of its reporting unit has been determined based on the Company's enterprise value. As part of the annual goodwill impairment test, the Company has the option to perform a qualitative assessment to determine whether further impairment testing is necessary. Examples of events and circumstances that might indicate that the reporting unit's fair value is less than its carrying amount include macro-economic conditions such as deterioration in the entity's operating environment or industry or market considerations; entity-specific events such as increasing costs, declining financial performance, or loss of key personnel; or other events such as a sustained decrease in the stock price on either an absolute basis or relative to peers. If, as a result of its qualitative assessment, it is more likely than not (i.e., greater than 50% chance) that the fair value of the Company's reporting unit is less than its carrying amount, the quantitative impairment test will be required. Otherwise, no further testing will be required. The Company completed its qualitative assessment and concluded that as of December 31, 2019, it is not more likely than not that the fair value of the Company's reporting unit is less than its carrying amount.

The Company's intangible assets subject to amortization are amortized using the straight-line method over their estimated useful lives, ranging from three to ten years. The Company evaluates the recoverability of intangible assets periodically by taking into account events or circumstances that may warrant revised estimates of useful lives or that indicate the asset may be impaired. The Company considered potential impairment indicators of acquired intangible assets at December 31, 2019 and noted no indicators of impairment.

Product Warranties

Substantially all of the Company's products are covered by a warranty for software and hardware for periods ranging from 90 days to one year. In addition, in conjunction with customers' renewals of maintenance and support contracts, the Company offers an extended warranty for periods typically of one to three years for agreed-upon fees. In the event of a failure of a hardware product or software covered by these warranties, the Company must repair or replace the software or hardware or, if those remedies are insufficient, and at the discretion of the Company, provide a refund. The Company's warranty reserve, which is included in accrued expenses and other current liabilities in the consolidated balance sheets, reflects estimated material, labor and other costs related to potential or actual software and hardware warranty claims for which the Company expects to incur an obligation. The Company's estimates of anticipated rates of warranty claims and the costs associated therewith are primarily based on historical information and future forecasts. The Company periodically assesses the adequacy of the warranty reserve and adjusts the amount as necessary. If the historical data used to calculate the adequacy of the warranty reserve are not indicative of future requirements, additional or reduced warranty reserves may be required.

A summary of changes in the amount reserved for warranty costs for the years ended December 31, 2019, 2018 and 2017 is as follows:

	Year Ended December 31,		
	2019	2018	2017
Warranty reserve at beginning of year	$ 926	$ 1,246	$ 1,256
Provisions	3,603	1,886	1,829
Acquired warranty reserve	1,867	—	—
Charges	(3,948)	(2,206)	(1,839)
Warranty reserve at end of year	$ 2,448	$ 926	$ 1,246

The increase in the warranty charges and reserve for the year ended December 31, 2019 is primarily due to warranty obligations obtained with the acquisition of NetComm on July 1, 2019.

Revenue Recognition

Effective January 1, 2019, the Company adopted ASC Topic 606, Revenue from Contracts with Customers ("ASC 606") using the modified retrospective transition method. This method was applied to contracts that were not complete as of the date of initial application. The following is a summary of new and/or revised significant accounting policies affected by the Company's adoption of ASC 606, which relate primarily to revenue and cost recognition. Refer to Note 2, Summary of Significant Accounting Policies, in the Company's Annual Report on Form 10-K for the year ended December 31, 2018 for the policies in effect for revenue and cost recognition prior to January 1, 2019.

The Company generates revenue from sales of its products, along with associated maintenance, support and extended hardware warranty services, and, to a lesser extent, from sales of professional services. The Company also generates revenue from sales of additional line cards and software-based capacity expansions. Maintenance and support services include telephone support, bug fixes and unspecified software upgrades and updates provided on a when-and-if-available basis and/or extended hardware warranty.

In the Company's consolidated statements of operations and comprehensive (loss) income, revenue from sales of broadband products, Axyom products and fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices are classified as product revenue, and revenue from maintenance and support and professional services is classified as service revenue.

In accordance with ASC 606, revenue is recognized when a customer obtains control of promised products or services. The amount of revenue recognized reflects the consideration that the Company expects to be entitled to receive in exchange for these products or services. To achieve the core principle of this standard, the Company applies the following five steps:

1) *Identify the contract with a customer* - The Company considers binding contracts and/or purchase orders to be customer contracts, provided collection is probable. Collectibility is assessed based on a number of factors that generally include information supplied by credit agencies, references and/or analysis of customer accounts and payment history. The Company combines contracts with customers if those contracts were negotiated as a single deal or contain price dependencies.

2) *Identify the performance obligations in the contract* - Performance obligations are identified as products and services that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the product or service either on its own or together with other resources that are readily available from third parties or from the Company, and are distinct in the context of the contract, whereby the transfer of the products or services is separately identifiable from other promises in the contract.

3) *Determine the transaction price* - The transaction price is determined based on the consideration to which the Company expects to be entitled in exchange for transferring products or services to the customer. Variable consideration is included in the transaction price if, in the Company's judgment, it is probable that no significant future reversal of cumulative revenue under the contract will occur.

4) *Allocate the transaction price to performance obligations in the contract* - The transaction price is allocated to performance obligations based on a relative standalone selling price ("SSP").

5) *Recognize revenue when or as the Company satisfies a performance obligation* - Revenue from product sales is recognized upon delivery to the customer, which is generally when control of the asset has passed to the customer.

Performance Obligations

The majority of the Company's contracts with customers contain multiple performance obligations including products and maintenance services, and on a limited basis, professional services. For these contracts, the Company accounts for individual performance obligations separately if they are considered distinct. The Company's broadband products, Axyom products, maintenance services and professional services are considered distinct performance obligations. When multiple performance obligations exist in a customer contract, the transaction price is allocated to the separate performance obligations on a relative SSP basis. Determination of SSP requires judgment and is based on the best evidence available which may include the standalone selling price of products when sold on a standalone basis to similar customers in similar circumstances, or in the absence of standalone sales, taking into consideration the Company's historical pricing practices by customer type, selling method (i.e. resellers or direct), and geographic-specific market factors.

Product revenue

The Company’s broadband products have both software and non-software (i.e., hardware) components that function together to deliver the products’ essential functionality. Broadband hardware products generally cannot be used apart from the embedded software and is considered one distinct performance obligation. Revenue on broadband hardware products with embedded software is recognized at a point in time when control of the products is transferred to the customer, which is typically when risk of loss has transferred and the right to payment is enforceable. This is generally when the product has shipped or been delivered, based on agreed-upon shipping terms. The Company also earns revenue from the sale of software-enabled capacity expansions. Revenue on software-enabled capacity expansions are distinct performance obligations as they are separately identifiable and provide additional bandwidth capacity on hardware products already purchased by the customer. Revenue is recognized on software-enabled capacity expansions when control is transferred, which is typically when risk of loss has transferred and the right to payment is enforceable. This is generally when the software-based capacity expansions are made available to the customer.

The Company also generates revenue from the sale of its Axyom software platform and related delivery platform hardware including indoor and outdoor Apex small cells. Perpetual licenses and hardware are distinct performance obligations as they are separately identifiable, and the customer can benefit from the licenses and hardware on its own. Revenue is recognized at a point in time when control of the products is transferred to the customer, which is typically when risk of loss has transferred and the right to payment is enforceable. Generally, this occurs when software licenses are made available to customers and hardware products are shipped or delivered, based on agreed-upon shipping terms.

The Company also generates revenue from the sale of its fixed wireless access and fiber-to-the-distribution-point (“FTTdp”) devices, the product line acquired via the acquisition of NetComm on July 1, 2019. The arrangements consist of a single hardware element making it a distinct performance obligation as they are separately identifiable, and the customer can benefit from the hardware on their own. Revenue is generally recognized at a point in time when control of the asset is transferred to the customer. Generally, this occurs when hardware products are shipped or delivered, based on agreed-upon shipping terms.

When customer contracts require acceptance of product and services, the Company considers the nature of the acceptance provisions to determine if they are substantive or considered a formality that does not impact the timing of revenue recognition. When acceptance provisions are considered substantive, the Company will defer revenue on all performance obligations in the contract subject to acceptance until acceptance has been received. The Company does not defer revenue when acceptance provisions are deemed a formality.

Maintenance and Support Services and Professional Services Revenue

The Company’s broadband and Axyom products are sold with maintenance and support services, a distinct performance obligation, that includes the stand-ready obligation to provide telephone support, bug fixes and unspecified software upgrades and updates provided on a when-and-if-available basis and/or extended hardware warranty. The Company’s fixed wireless access and fiber-to-the-distribution-point (FTTdp) devices generally do not have a support component. After the initial sale, customers may purchase annual renewals of support contracts. The Company’s telephone support and unspecified upgrades and updates are delivered over time and therefore revenue is recognized ratably over the contract term, which is typically one year, but can be as long as five years. The Company also generates revenue from sales of professional services, such as installation, configuration and training. Professional services are a distinct performance obligation since the Company’s products are functional without these services and can generally be performed by the customer or a third party. Professional services are generally delivered over time, with revenue recognized as services are performed, which is generally based on labor hours incurred during the period compared to the total estimated labor hours.

The sale of the Company’s products generally includes a 90-day warranty on the software and a one-year warranty on the hardware component of the products, which includes repair or replacement of the applicable hardware. These warranties are to ensure the products perform in accordance with the Company’s specifications and are therefore not a performance obligation. The Company records a warranty accrual for the initial software and hardware warranty included with product sales and does not defer revenue.

Resellers and Sales Agents

The Company markets and sell its products through its direct global sales force, supported by sales agents, and through resellers. The Company’s resellers receive an order from an end customer prior to placing an order with the Company, and the Company confirms the identification of or is aware of the end customer prior to accepting such order. The Company invoices the reseller an amount that reflects a reseller discount and records revenue based on the amount of the discounted transaction value. The Company’s resellers do not stock inventory received from the Company.

When the Company transacts with a reseller, the contract is with the reseller and not with the end customer. Whether the Company transacts business with and receives the order from a reseller or directly from an end customer, its revenue recognition policy and resulting pattern of revenue recognition for the order are the same.

The Company also uses sales agents that assist in the sales process with certain customers primarily located in the Latin America and Asia-Pacific regions. Sales agents are not resellers. If a sales agent is engaged in the sales process, the Company receives the order directly from and sells the products and services directly to the end customer, and the Company pays a commission to the sales agent, calculated as a percentage of the related transaction value. Accounting considerations related to sales agent commissions are discussed in the "Costs to Obtain or Fulfill a Contract" section below.

The Company has assessed whether it is the principal (i.e., reports revenues on a gross basis) or agent (i.e., reports revenues on a net basis) by evaluating whether it has control of the good or service before it is transferred to the customer. Generally, the Company controls the promised good or service before transferring it to the customer and acts as the principal in the transaction. Accordingly, the Company reports revenues on a gross basis.

Costs to Obtain or Fulfill a Contract

The Company capitalizes commission expenses paid to internal sales personnel and sales agent commissions that are incremental to obtaining customer contracts, for which the related revenue is recognized over a future period. These costs are incurred on initial sales of product, maintenance and professional services and maintenance and support contract renewals. The Company defers these costs and amortizes them over the period of benefit, which the Company generally considers to be the contract term or length of the longest delivery period as contract capitalization costs in the consolidated balance sheets. Commissions paid relating to contract renewals are deferred and amortized on a straight-line basis over the related renewal period as commissions paid on renewals are commensurate with commissions paid on initial sales transactions. The Company periodically reviews the carrying amount of capitalized contract costs to determine whether events or changes in circumstances have occurred that could impact the period of benefit.

The Company also pays commissions on maintenance and support contract renewals. Commissions paid on renewals are commensurate with commissions paid on the initial maintenance and support contracts. These commissions are deferred and amortized on a straight-line basis over the related renewal period. Costs to obtain a contract for professional services contracts are expensed as incurred in accordance with the practical expedient as the contractual period of the Company's professional services contracts are one year or less.

As of January 1, 2019 and December 31, 2019, the Company had short-term capitalized contract costs of $209 and $585, respectively, which are included in prepaid expenses and other current assets and had long-term capitalized contract costs of $128 and $70, respectively, which are included in other assets in the accompanying consolidated balance sheets. During the year ended December 31, 2019, amortization expense associated with capitalized contract costs was $695 which was recorded to selling, general and administrative expenses in the accompanying consolidated statements of operations and comprehensive (loss) income.

Deferred Revenue

Amounts billed in excess of revenue recognized are recorded as deferred revenue. Deferred revenue includes customer deposits, amounts billed for maintenance and support services contracts in advance of services being performed, amounts for trade-in right liabilities and amounts related to contracts that have been deferred as a result of not meeting the required revenue recognition criteria as of the end of the reporting period. Deferred revenue expected to be recognized as revenue more than one year subsequent to the balance sheet date is reported within long-term liabilities in the consolidated balance sheets.

The Company defers recognition of direct costs, such as cost of goods and services, until recognition of the related revenue. Such costs are classified as current assets if the related deferred revenue is classified as current, and such costs are classified as non-current assets if the related deferred revenue is classified as non-current.

Other Revenue Recognition Policies

The Company's customary payment terms are generally one year or less. The Company has elected to apply the practical expedient that allows an entity to not adjust the promised amount of consideration in customer contracts for the effect of a significant financing component when the period between the transfer of product and services and payment of the related consideration is less than one year. If the Company provides extended payment terms that represent a significant financing component, the Company adjusts the amount of promised consideration for the time value of money using its discounted rate and recognizes interest income separate from the revenue recognized on contracts with customers. During the year ended December 31, 2019, the Company recorded $160 in interest income in its consolidated statements of operations and comprehensive (loss) income.

In limited instances, the Company has offered future rebates to customers based on a fixed or variable percentage of actual sales volumes over specified periods. The future rebates earned based on the customer's purchasing from the Company in one period may be used as credits to be applied by them against accounts receivable due to the Company in later periods. The Company accounts for these future rebates as variable consideration and reduces the transaction price to the extent it is probable that a significant reversal of cumulative revenue recognized will not occur when the variable consideration is resolved. The reduction of the transaction price is estimated based on historical activity and other relevant factors and is recognized when the Company recognizes revenue for the transfer of goods and services to the customer on which the future rebate was earned. Other forms of contingent revenue or variable consideration are infrequent.

When a customer contract includes future trade-in rights, which are distinct performance obligations, the Company accounts for the customer contract by recognizing the revenue on the products transferred, deferring revenue allocated to the future product based on a relative standalone selling price, and an asset for the value of the trade-in product to be recovered from the customer upon delivery of the future product. The Company assesses and updates these estimates each reporting period, and updates to these estimates may result in either an increase or decrease in the amount of the future product liability and product return asset. The Company recognizes revenue allocated to the future product when the product has shipped or been delivered, and control has transferred. As of December 31, 2019, there were no future product liabilities or product return assets.

The Company excludes any taxes assessed by a governmental authority that are directly imposed on a revenue-producing transaction (e.g., sales, use and value added taxes) from its transaction price.

Billings to customers for reimbursement of out-of-pocket expenses, including travel, lodging and meals, are recorded as revenue, and the associated costs incurred by the Company for those items are recorded as cost of revenue. Revenue related to the reimbursement of out-of-pocket costs are accounted for as variable consideration.

The Company accounts for any shipping and handling activities as a fulfilment cost rather than an additional promised service. Shipping and handling billed to customers is recorded as an offset to cost of revenue.

Contract Balances

Contract liabilities consist of deferred revenue and include payments received in advance of performance under the contract. Such amounts are recognized as revenue when the Company satisfies its performance obligations, consistent with the above methodology. For the year ended December 31, 2019, the Company recognized $22,273 of revenue that was included in deferred revenue as of January 1, 2019.

The Company receives payments from customers based upon contractual billing terms. Accounts receivable are recorded when the right to consideration becomes unconditional. Contract assets include amounts related to the Company's contractual right to consideration for both completed and partially completed performance obligations that may not have been invoiced. As of January 1, 2019 and December 31, 2019, contract assets of $28 and $50, respectively, were included in prepaid expenses and other current assets in the accompanying consolidated balance sheets.

Transaction Price Allocated to the Remaining Performance Obligations

As of December 31, 2019, the aggregate remaining amount of revenue expected to be recognized related to unsatisfied or partially unsatisfied performance obligations is $30,068. The Company expects approximately 85% of this amount to be recognized in the next twelve months with the remainder to be recognized over the next two to five years.

Disaggregation of Revenue

The Company disaggregates its revenue by product and service in the consolidated statements of operations and comprehensive (loss) income. Performance obligations related to product revenue are recognized at a point in time, while performance obligations related to service revenue are recognized over time. The Company also disaggregates its revenue based on geographic locations of its customers, as determined by the customer's shipping address.

Transition Disclosures

In accordance with the modified retrospective method transition requirements, the Company has presented the financial statement line items impacted and adjusted to compare to presentation under ASC Topic 605, *Revenue Recognition* ("ASC 605" for each of the interim and annual periods during the first year of adoption of ASC 606:

	As of December 31, 2019		
Balance Sheet	**As Reported under ASC 606**	**Adjustments**	**Without adoption of ASC 606**
Assets:			
Accounts receivable	$ 93,100	$ 47	$ 93,147
Inventory	93,604	186	93,790
Prepaid expenses and other current assets	4,884	54	4,938
Prepaid income taxes	3,217	330	3,547
Accounts receivable, net of current portion	575	23	598
Deferred tax assets	69	1,757	1,826
Other assets	7,820	(69)	7,751
Total assets	$ 444,312	$ 2,328	$ 446,640
Liabilities:			
Accrued expenses and other current liabilities	$ 34,567	$ (491)	$ 34,076
Deferred revenue	25,485	8,194	33,679
Deferred revenue, net of current portion	4,583	1,856	6,439
Total liabilities	405,748	9,559	415,307
Stockholders' Equity:			
Accumulated deficit	(127,064)	(7,231)	(134,295)
Total stockholders' equity	38,564	(7,231)	31,333
Total liabilities and stockholders' equity	$ 444,312	$ 2,328	$ 446,640

Total reported assets under ASC 606 as of December 31, 2019 were $2,328 less than the total assets without the adoption of ASC 606 largely due to decreases in deferred tax assets, prepaid income taxes and deferred inventory costs related to contracts for which deferred revenue was adjusted to retained earnings, partially offset by increases in prepaid expenses and other current assets and other assets related to contract costs capitalized under ASC 606 that would have been expensed when incurred under ASC 605.

Total reported liabilities under ASC 606 as of December 31, 2019 were $9,559 less than the total liabilities without the adoption of ASC 606 primarily driven by the adjustment of deferred revenue related to a customer contract for which revenue was recognized based on receipt of cash payments under ASC 605 that would have been recognized upon product acceptance under ASC 606, offset by an increase in accrued partner commissions in accrued expenses and other current liabilities. These partner commissions were previously being recognized in the period in which cash was received and revenue was recognized. Upon the adoption of ASC 606, partner commissions are reflected as a cost to obtain a contract and they are expensed consistent with the pattern of revenue recognition on this contract.

	Year Ended December 31, 2019		
Statement of Operations and Comprehensive (Loss) Income	**As Reported under ASC 606**	**Adjustments**	**Without adoption of ASC 606**
Revenue:			
Product	$ 241,377	$ (6,201)	$ 235,176
Service	40,920	197	41,117
Total revenue	282,297	(6,004)	276,293
Cost of revenue:			
Product	113,059	182	113,241
Gross profit	162,532	(6,186)	156,346
Operating expenses:			
Selling, general and administrative	88,320	231	88,551
Loss from operations	(9,119)	(6,417)	(15,536)
Other income (expense):			
Interest income	4,406	(159)	4,247
Loss before provision for (benefit from) income taxes	(24,415)	(6,576)	(30,991)
Provision for (benefit from) income taxes	23,791	(1,495)	22,296
Net loss	(48,206)	(5,081)	(53,287)
Comprehensive loss	$ (49,270)	$ (5,081)	$ (54,351)
Net loss per share attributable to common stockholders:			
Basic	$ (0.57)	$ (0.07)	$ (0.64)
Diluted	$ (0.57)	$ (0.07)	$ (0.64)

During the year ended December 31, 2019, the adoption of ASC 606 resulted in a net increase to product revenue due to certain contracts for which product revenue was recognized upon delivery that would have been deferred without the adoption of ASC 606 due to the lack of vendor-specific objective evidence.

	Year Ended December 31, 2019		
Statement of Cash Flows	**As Reported under ASC 606**	**Adjustments**	**Without adoption of ASC 606**
Cash flows used in operating activities:			
Net loss	$ (48,206)	$ (5,081)	$ (53,287)
Deferred income taxes	19,641	(1,166)	18,475
Changes in operating assets and liabilities:			
Accounts receivable	1,881	159	2,040
Inventory	(21,276)	182	(21,094)
Prepaid expenses and other assets	(3,679)	(322)	(4,001)
Prepaid income taxes	16	(330)	(314)
Accrued expenses and other current liabilities	(7,827)	554	(7,273)
Deferred revenue	(9,498)	6,004	(3,494)
Net cash used in operating activities	$ (39,022)	$ —	$ (39,022)

During the year ended December 31, 2019, the adoption of ASC 606 resulted in offsetting changes in operating assets and liabilities and had no impact on net cash flow from operations.

Stock-Based Compensation

The Company measures stock options and other stock-based awards granted to employees and directors based on the fair value on the date of the grant and recognizes compensation expense of those awards, net of estimated forfeitures, over the requisite service period, which is generally the vesting period of the respective award. Generally, the Company issues stock options with only service-based vesting conditions and records the expense for these awards using the straight-line method.

For stock-based awards granted to non-employee consultants, compensation expense is recognized over the period during which services are rendered by such non-employee consultants until completed. At the end of each financial reporting period prior to completion of the service, the fair value of these awards is remeasured using the then-current fair value of the Company's common stock and updated assumption inputs in the Black-Scholes option-pricing model.

The Company classifies stock-based compensation expense in its consolidated statements of operations and comprehensive (loss) income in the same manner in which the award recipient's payroll costs are classified or in which the award recipient's service payments are classified.

The Company recognizes compensation expense for only the portion of awards that are expected to vest. In developing a forfeiture rate estimate, the Company has considered its historical experience to estimate pre-vesting forfeitures for service-based awards. The impact of a forfeiture rate adjustment will be recognized in full in the period of adjustment, and if the actual forfeiture rate is materially different from the Company's estimate, the Company may be required to record adjustments to stock-based compensation expense in future periods.

The fair value of each stock option grant is estimated on the date of grant using the Black-Scholes option pricing model. The Company was a private company until December 14, 2017 and lacks sufficient company-specific historical and implied volatility information for its stock. Therefore, it estimates its expected stock volatility based on the historical volatility of publicly traded peer companies and expects to continue to do so until such time as it has adequate historical data regarding the volatility of its own traded stock price. The expected term of the Company's stock options has been determined utilizing the "simplified" method for awards that qualify as "plain-vanilla" options. The expected term of stock options granted to non-employees is equal to the contractual term of the option award. The risk-free interest rate is determined by reference to the U.S. Treasury yield curve in effect at the time of grant of the award for time periods approximately equal to the expected term of the award. Expected dividend yield is based on the fact that the Company does not have a history of declaring or paying cash dividends, except for the special cash dividends declared in November 2014, June 2016, December 2016, May 2017 and November 2017 and in those circumstances the board of directors approved cash dividends to be paid to holders of the Company's stock options, stock appreciation rights ("SARs") and restricted stock units ("RSUs") upon vesting as an equitable adjustment to the holders of such instruments.

The Company has also granted SARs to certain employees, which require the Company to pay in cash upon exercise an amount equal to the product of the excess of the per share fair market value of the Company's common stock on the date of exercise over the exercise price, multiplied by the number of shares of common stock with respect to which the SAR is exercised. Because these awards may require the Company to settle the awards in cash, they are accounted for as a liability in the Company's consolidated balance sheets. The liability related to these awards, as well as related compensation expense, is recognized over the period during which services are rendered until completed. Changes in the fair value of the SAR liability are estimated using the Black-Scholes option pricing model and are recorded in the consolidated statements of operations and comprehensive (loss) income. After vesting is completed, the Company will continue to remeasure the fair market value of the liability until the award is either exercised or canceled, with changes in the fair value of the liability recorded in the consolidated statements of operations and comprehensive (loss) income.

Research and Development Costs

The Company expenses research and development costs as incurred. Costs incurred to develop software to be licensed to customers are expensed prior to the establishment of technological feasibility of the software and are capitalized thereafter until commercial release of the software. The Company has not historically capitalized software development costs as the establishment of technological feasibility typically occurs shortly before the commercial release of its software, which is embedded in its products. As such, all software development costs related to software for license to customers are expensed as incurred and included within research and development expense in the accompanying consolidated statements of operations and comprehensive (loss) income.

Advertising Costs

Advertising costs are expensed as incurred and are included in selling, general and administrative expense in the accompanying consolidated statements of operations and comprehensive (loss) income. Advertising expenses were not significant for any periods presented.

Foreign Currency Translation

For the Company's subsidiaries in Ireland and Australia, the U.S. dollar is the functional currency. For each of the Company's other foreign subsidiaries, the functional currency is its local currency. Assets and liabilities of these foreign subsidiaries are translated into U.S. dollars using period-end exchange rates, and revenues and expenses are translated into U.S. dollars using average exchange rates in effect during each period. The effects of these foreign currency translation adjustments are included in accumulated other comprehensive (loss) income, a separate component of stockholders' equity (deficit).

Foreign currency transaction gains (losses) are included in the consolidated statements of operations and comprehensive (loss) income as a component of other income (expense) and totaled $298, $(911) and $886 for the years ended December 31, 2019, 2018 and 2017, respectively.

Fair Value Measurements

Certain assets and liabilities are carried at fair value under GAAP. Fair value is defined as the price that would be received for an asset or the exit price that would be paid to transfer a liability in the principal or most advantageous market in an orderly transaction between market participants on the measurement date. Valuation techniques used to measure fair value must maximize the use of observable inputs and minimize the use of unobservable inputs. Financial assets and liabilities carried at fair value are to be classified and disclosed in one of the following three levels of the fair value hierarchy, of which the first two are considered observable and the last is considered unobservable:

Level 1— Quoted prices in active markets for identical assets and liabilities.

Level 2— Observable inputs (other than Level 1 quoted prices), such as quoted prices in active markets for similar assets or liabilities at the measurement date; quoted prices in markets that are not active for identical or similar assets and liabilities; or other inputs that are observable or can be corroborated by observable market data.

Level 3— Unobservable inputs that involve management judgment and are supported by little or no market activity, including pricing models, discounted cash flow methodologies and similar techniques.

The categorization of a financial instrument within the valuation hierarchy is based on the lowest level of input that is significant to the fair value measurement.

The Company's cash equivalents, marketable securities, foreign currency forward contracts and SARs are carried at fair value, determined according to the fair value hierarchy described above (see Note 7). The fair values of accounts receivable, accounts payable and accrued expenses and other current liabilities approximate their fair values due to the short-term nature of these assets and liabilities, with the exception of amounts recorded by the Company as "accounts receivable, non-current," which represent amounts billed to customers for which payment has not yet become due and for which an offsetting amount of deferred revenue has been recorded. The carrying values of the Company's debt obligations (see Note 10) as of December 31, 2019 and 2018 approximated their fair values because the debt bears interest at rates the Company would be required to pay on the issuance of debt with similar terms, based on an analysis of recent market conditions and other Company-specific factors.

Income Taxes

The Company accounts for income taxes using the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial statement and tax basis of assets and liabilities, as measured by enacted tax rates anticipated to be in effect when these differences reverse. This method also requires the recognition of future tax benefits to the extent that realization of such benefits is more likely than not. Deferred tax expense or benefit is the result of changes in the deferred tax assets and liabilities. The Company assesses the likelihood that its deferred tax assets will be recovered from future taxable income and, to the extent it believes, based upon the weight of available evidence, that it is more likely than not that all or a portion of the deferred tax assets will not be realized, a valuation allowance is established through a charge to income tax expense. Potential for recovery of deferred tax assets is evaluated by estimating the future taxable profits expected and considering prudent and feasible tax planning strategies. As of December 31, 2019, the Company determined that it is more likely than not that a portion of its net U.S. deferred tax assets will not be realized, and thus has recognized a valuation allowance of $39,124 against our net U.S. deferred tax assets that are not expected to be realized, an increase of $35,198 during the year ended December 31, 2019 (see Note 9).

The Company records a liability for potential payments of taxes to various tax authorities related to uncertain tax positions and other tax matters. The recorded liability is based on a determination of whether and how much of a tax benefit taken by the Company in its tax filings or positions is "more likely than not" to be realized. The amount of the benefit that may be recognized in the financial statements is the largest amount that has a greater than 50% likelihood of being realized upon ultimate settlement. To the extent that the assessment of such tax positions changes, the change in estimate is recorded in the period in which the determination is made. The Company establishes a liability, which is included in accrued income taxes in the consolidated balance sheets, for tax-related uncertainties based on estimates of whether, and the extent to which, additional taxes will be due. These liabilities are established when the Company believes that certain positions might be challenged despite the Company's belief that the tax return positions are fully supportable. The recorded liability is adjusted in light of changing facts and circumstances. The provision for (benefit from) income taxes includes the impact of the recorded liability and changes thereto.

The Company recognizes interest and penalties related to uncertain tax positions within other income (expense) in the accompanying consolidated statements of operations and comprehensive (loss) income. Accrued interest and penalties are included in accrued income taxes in the consolidated balance sheets.

On December 22, 2017, the Tax Cuts and Jobs Act (the "TCJA") was enacted which, among other things, lowered the U.S. corporate income tax rate to 21% from 35%, repealed the domestic production activity deductions, limited the deductibility of certain executive compensation and interest expense, and established a modified territorial system requiring a mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries. Beginning in 2018, the TCJA also requires a minimum tax on certain future earnings generated by foreign subsidiaries while providing for future tax-free repatriation of such earnings through a 100% dividends-received deduction.

While the intent of TCJA was to provide for a territorial tax system, effective for taxable years beginning after January 1, 2018, taxpayers are subjected to the global intangible low-taxed income ("GILTI") provisions. The GILTI provisions require the Company to currently recognize in U.S. taxable income a deemed dividend inclusion of foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. During the years ended December 31, 2019 and 2018, the Company recorded an income tax charge of $0.9 million and $4.4 million, respectively related to GILTI. The Company has made an accounting policy election, as allowed by the SEC and FASB, to recognize the impacts of GILTI within the period incurred. Therefore, no U.S. deferred taxes are provided on GILTI inclusions of future foreign subsidiary earnings.

Comprehensive (Loss) Income

Comprehensive (loss) income includes net (loss) income as well as other changes in stockholders' equity (deficit) that result from transactions and economic events other than those with stockholders. Comprehensive (loss) income for the periods presented consists of net income and the change in the cumulative foreign currency translation adjustment.

Net (Loss) Income per Share

The Company follows the two-class method when computing net (loss) income per share as the Company has issued shares that meet the definition of participating securities. The two-class method determines net (loss) income per share for each class of common and participating securities according to dividends declared or accumulated and participation rights in undistributed earnings. The two-class method requires income available to common stockholders for the period to be allocated between common and participating securities based upon their respective rights to receive dividends as if all income for the period had been distributed.

Basic net (loss) income per share attributable to common stockholders is computed by dividing the net (loss) income attributable to common stockholders by the weighted-average number of shares of common stock outstanding for the period. Diluted net (loss) income attributable to common stockholders is computed by adjusting net (loss) income attributable to common stockholders to reallocate undistributed earnings based on the potential impact of dilutive securities. Diluted net (loss) income per share attributable to common stockholders is computed by dividing the diluted net (loss) income attributable to common stockholders by the weighted-average number of shares of common stock outstanding for the period, including potential dilutive common shares. For purpose of this calculation, outstanding stock-based awards and convertible preferred stock are considered potential dilutive common shares.

Impact of Recently Adopted Accounting Standards

In May 2014, the FASB issued ASC 606, which supersedes existing revenue recognition guidance under GAAP. The core principle of this standard is that an entity should recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services.

The Company adopted ASC 606 on January 1, 2019, using the modified retrospective method. Under this method of adoption, the Company recognized the cumulative effect of initially applying the new revenue standard as an adjustment to the opening balance of accumulated deficit. Comparative prior year periods were not adjusted.

As a result of applying the modified retrospective method to adopt ASC 606, the following adjustments were made to the consolidated balance sheet as of January 1, 2019:

	December 31, 2018 As reported	Adjustments	January 1, 2019 As adjusted
Assets:			
Accounts receivable	$ 81,782	$ (153)	$ 81,629
Inventory	50,997	(368)	50,629
Prepaid expenses and other current assets	3,755	209	3,964
Accounts receivable, net of current portion	2,388	(75)	2,313
Deferred tax assets	21,578	(592)	20,986
Other assets	3,293	128	3,421
Total assets	$ 474,649	$ (851)	$ 473,798
Liabilities:			
Accrued expenses and other current liabilities	$ 36,992	$ 1,045	$ 38,037
Deferred revenue	31,206	(2,190)	29,016
Deferred revenue, net of current portion	12,479	(1,856)	10,623
Total liabilities	399,793	(3,001)	396,792
Stockholders' equity:			
Accumulated deficit	(81,008)	2,150	(78,858)
Total stockholders' equity	74,856	2,150	77,006
Total liabilities and stockholders' equity	$ 474,649	$ (851)	$ 473,798

Upon adoption of ASC 606 on January 1, 2019, the Company recorded a decrease to accumulated deficit of $2,150 as a result of the transition. The impact of the adoption primarily relates to the cumulative effect of a $4,046 total decrease in deferred revenue and deferred revenue, net of current portion primarily related to a customer contract for which revenue was recognized based on receipt of cash payments under ASC 605 that would have been recognized upon product acceptance under ASC 606; a $1,045 increase in accrued expenses and other current liabilities related to partner commissions that were previously being recognized in the period in which cash was received and revenue was recognized, but would have been reflected as a cost to obtain a contract and expensed consistent with the pattern of revenue recognition on the contract; a $368 decrease in inventory related to the adjustment of deferred cost of goods sold on deferred revenue also adjusted as part of the adoption; a $337 total increase in prepaid expenses and other current assets and other assets for short term and long term capitalized contract costs on open contracts as of the adoption date; a $228 total decrease in accounts receivable and accounts receivable, net of current portion related to a contract with a significant financing component; and a $592 decrease in deferred tax assets related to the above items.

In August 2016, the FASB issued ASU 2016-15, Statement of Cash Flows: Classification of Certain Cash Receipts and Cash Payments ("ASU 2016-15"), to address diversity in practice in how certain cash receipts and cash payments are presented and classified in the statement of cash flows. The standard is now effective for all entities and the Company has concluded that the adoption of ASU 2016-15 does not have an effect on its consolidated financial statements.

In October 2016, the FASB issued ASU 2016-16, *Income Taxes (Topic 740): Intra-Entity Transfer of Assets Other than Inventory* ("ASU 2016-16"), which requires the recognition of the income tax consequences of an intra-entity transfer of an asset, other than inventory, when the transfer occurs. The standard is now effective for all entities and the Company has concluded that the adoption of ASU 2016-16 does not have an effect on its consolidated financial statements.

Impact of Recently Issued Accounting Standards

In February 2016, the FASB issued ASU 2016-02, *Leases* ("ASU 2016-02"), which will require lessees to recognize most leases on their balance sheets as a right-of-use asset with a corresponding lease liability, and lessors to recognize a net lease investment. Additional qualitative and quantitative disclosures will also be required. In November 2019, the FASB issued ASU 2019-10, *Financial Instruments-Credit Losses (Topic 326), Derivatives and Hedging (Topic 815), and Leases (Topic 842): Effective Dates* ("ASU 2019-10") to defer the effective dates of ASU 2016-02. This guidance is now effective for private companies, and emerging growth companies that choose to take advantage of the extended transition periods, for annual reporting periods beginning after December 15, 2020, and interim periods within fiscal years beginning after December 15, 2021. Early application continues to be permitted. In July 2018, the FASB issued ASU 2018-10, *Codification Improvements to Topic 842: Leases* ("ASU 2018-10"), which affects narrow aspects of the guidance issued in the amendments in ASU 2016-02. ASU 2018-10 has the same effective dates and transition requirements as ASU 2016-02. In July 2018, the FASB issued update ASU 2018-11, *Leases (Topic 842), Targeted Improvements* ("ASU 2018-11"), which provided for an additional (and optional) transition method with which to adopt the new lease standard in ASU 2016-02. The additional method allows entities to apply the new leases standard at the adoption date and recognize a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption. Additionally, in December 2018, the FASB issued update ASU 2018-20, *Leases (Topic 842) – Narrow-Scope Improvements for Lessors* ("ASU 2018-20"), which addresses stakeholders' concerns about the operability challenges encountered in determining certain lessor costs paid by lessees directly to third parties by requiring lessors to exclude from variable payments, and thus from lease revenue, lessor costs paid by a lessee directly to a third party. The amendments in ASU 2018-20 also clarify that costs excluded from the consideration in a contract that are paid directly to a third party by a lessor and reimbursed by the lessee are lessor costs to be accounted for as variable payments. The Company is currently assessing the potential impact that the adoption of ASU 2016-02, ASU 2018-10, ASU 2018-11, ASU 2018-20 and ASU 2019-10 will have on its consolidated financial statements. The Company is in the process of reviewing existing lease agreements to assess the impact this guidance may have on the consolidated financial statements. The Company currently expects that most of its operating lease commitments will be subject to the new standard and will affect the consolidated balance sheet by recognizing new right-of-use assets and operating lease liabilities upon the adoption of ASU 2016-02, which will increase the total assets and total liabilities that it reports relative to such amounts prior to adoption.

In June 2016, the FASB issued ASU 2016-13, *Measurement of Credit Losses on Financial Instruments* ("ASU 2016-13"). This guidance requires that financial assets measured at amortized cost be presented at the net amount expected to be collected. The measurement of expected credit losses is based on historical experience, current conditions and reasonable and supportable forecasts that affect the collectibility. In November 2019, the FASB issued ASU 2019-10 to defer the effective dates of ASU 2016-13. This guidance is now effective for private companies, and emerging growth companies that choose to take advantage of the extended transition periods, for annual reporting periods beginning after December 15, 2020, and interim periods within fiscal years beginning after December 15, 2021. Additionally, in November 2018, the FASB issued ASU 2018-19, *Codification Improvements to Topic 326, Financial Instruments—Credit Losses* ("ASU 2018-19"), which mitigates transition complexity by requiring that for nonpublic business entities the amendments in ASU 2016-13 are effective for fiscal years beginning after December 15, 2021, including interim periods within those fiscal years. The amendments in ASU 2018-19 also clarify that receivables arising from operating leases are not within the scope of Subtopic 326-20, but instead, should be accounted for in accordance with Topic 842, Leases. Additionally, in April 2019, the FASB issued ASU 2019-04, *Codification Improvements to Topic 326, Financial Instruments—Credit Losses, Topic 815, Derivatives and Hedging, and Topic 825, Financial Instruments* ("ASU 2019-04"), which provides clarification guidance for ASU 2016-13 and ASU 2017-12 (as defined below). In May 2019, the FASB issued update ASU 2019-05, *Financial Instruments—Credit Losses (Topic 326): Targeted Transition Relief* ("ASU 2019-05"), which provides an option to irrevocably elect the fair value option for certain financial assets previously measured at amortized cost basis. The Company is currently assessing the potential impact that the adoption of ASU 2016-13, ASU 2018-19, ASU 2019-04, ASU 2019-05 and ASU 2019-10 will have on its consolidated financial statements.

In August 2017, the FASB issued ASU 2017-12, *Derivatives and Hedging—Targeted Improvements to Accounting for Hedging Activities* ("ASU 2017-12"), which aims to improve the financial reporting of hedging relationships to better portray the economic results of an entity's risk management activities in its financial statements. The standard is effective for public companies for annual periods beginning after December 15, 2018, including interim periods within those fiscal years. The standard is effective for private companies, and emerging growth companies that choose to take advantage of the extended transition periods, for annual periods beginning after December 15, 2019, and interim reporting periods within annual periods beginning after December 15, 2020. Additionally, in April 2019, the FASB issued ASU 2019-04, which provides clarification guidance for ASU 2016-13 and ASU 2017-12. The Company does not expect the adoption of ASU 2017-12 and ASU 2019-04 will have an impact on its consolidated financial statements as it does not apply hedge accounting.

In June 2018, the FASB issued ASU 2018-07, *Compensation – Stock Compensation (Topic 718)* ("ASU 2018-07"), which expands the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. The amendments specify that Topic 718 applies to all share-based payment transactions in which a grantor acquires goods or services to be used or consumed in a grantor's own operations by issuing share-based payment awards. The standard is effective for public companies for annual periods beginning after December 15, 2018, including interim periods within those fiscal years. The standard is effective for private companies, and emerging growth companies that choose to take advantage of the extended transition periods, for annual periods beginning after December 15, 2019, and interim reporting periods within annual periods beginning after December 15, 2020. Early adoption is permitted, but no earlier than an entity's adoption date of ASC 606. The Company is currently assessing the potential impact that the adoption of ASU 2018-07 will have on its consolidated financial statements.

In August 2018, the FASB issued ASU 2018-13, *Fair Value Measurement* ("ASU 2018-13"), which modifies the disclosure requirements on fair value measurements in Topic 820, Fair Value Measurement, regarding transfers between levels of financial instruments, amounts of unrealized gains and losses included in other comprehensive (loss) income for Level 3 fair value measurements and the information used to determine the fair value of Level 3 fair value measurements. The standard is effective for both public and private companies and emerging growth companies that chose to take advantage of the extended transition periods, for annual periods beginning after December 15, 2019, including interim periods within those fiscal years. Early adoption is permitted. The Company is currently assessing the potential impact that the adoption of ASU 2018-13 will have on its consolidated financial statements.

3. Business Acquisition

On July 1, 2019, the Company acquired 100% of the equity interests in NetComm for cash consideration of $161,963 AUD ($112,674 USD, based on an exchange rate of USD $0.700 per AUD $1.00 on July 1, 2019) and NetComm became a wholly-owned subsidiary of the Company. The Acquisition was accounted for under the acquisition method. The total purchase price is allocated to the tangible and intangible assets acquired and the liabilities assumed based on their estimated fair values. The excess of the purchase price over those fair values is recorded as goodwill. The fair value assigned to the tangible and intangible assets acquired and liabilities assumed are based on estimates and assumptions provided by management. Goodwill is not amortized but instead is tested for impairment at least annually.

NetComm is a global leader in the development of fixed wireless and distribution point broadband solutions. With the Acquisition, the Company now offers a broad, highly competitive portfolio of 4G and 5G fixed wireless access products and customer premise equipment for vDSL2 and G.fast services for service providers. This factor contributed to a purchase price in excess of fair value of NetComm's net tangible and intangible assets, leading to the recognition of goodwill.

The total purchase price was preliminarily allocated to NetComm's net tangible and intangible assets based upon their estimated fair values as of the date of Acquisition. NetComm's cash and cash equivalents balance at the Acquisition date was $3,243; as such, total consideration net of cash acquired is $109,431. NetComm's existing debt of approximately $3,507 as of the Acquisition date has been accounted for as an assumed liability. As of July 1, 2019, all contractual amounts receivable were expected to be collected. Based upon the purchase price and the valuation, the allocation of the total purchase price is as follows:

		Preliminary Purchase Price Allocation
Assets acquired		
Fair value of tangible assets:		
Accounts receivable	$	18,142
Inventory		24,138
Prepaid expenses and other current assets		2,240
Property, plant and equipment		8,010
Deferred tax assets		365
Other assets		13
Goodwill		50,347
Identifiable intangible assets		44,000
Total assets acquired	$	147,255
Liabilities assumed		
Accounts payable	$	(9,719)
Accrued expenses		(13,178)
Accrued income taxes		(140)
Deferred tax liabilities		(10,791)
Current portion of long-term debt		(3,507)
Other liabilities		(489)
Total liabilities assumed	$	(37,824)
Net assets acquired	$	109,431

The fair value of receivables acquired totaled $18,142 and as of the acquisition date all amounts of contractual cash flows are expected to be collected.

The preliminary allocation of the purchase price and the estimated useful lives associated with certain assets is as follows:

	Amount	Estimated Useful Life
Net tangible assets	$ 15,084	—
Identifiable intangible assets:		
Developed technology	25,000	7 years
Customer relationships	18,000	10 years
Trade name	1,000	3 years
Goodwill	50,347	—
Total purchase price	$ 109,431	

Intangible assets of $44,000 have been allocated to identifiable intangible assets consisting of developed technology, amortized over seven years using a straight-line amortization method; customer relationships, amortized over ten years using a straight-line amortization method; and a trade name, amortized over three years using a straight-line amortization method. The weighted average life of the identifiable intangible assets recognized from the Acquisition was 8.2 years. The intangibles acquired in the Acquisition are not deductible for tax purposes. Intangible assets recorded in the consolidated balance sheet at December 31, 2019 consists of the following:

	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Developed technology	25,000	(1,786)	23,214
Customer relationships	18,000	(900)	17,100
Trade name	1,000	(166)	834
	$ 44,000	$ (2,852)	$ 41,148

The Company recorded total amortization expense of $2,852, of which $1,786 and $1,066 were included in product cost of revenue and selling, general and administrative expense, respectively, for the year ended December 31, 2019, in the consolidated statements of operations and comprehensive (loss) income.

Estimated amortization expense for intangible assets is summarized as follows:

Year Ending December 31,	
2020	$ 5,704
2021	5,704
2022	5,542
2023	5,372
2024	5,372
Thereafter	13,454
	$ 41,148

The Acquisition accounting resulted in goodwill of $50,347. Various factors contributed to the establishment of the goodwill, including: the strategic benefit of expanding the breadth of the Company's product offerings; the value of NetComm's highly trained work force; the expected revenue growth over time that is attributable to increased market penetration from future products and customers, and cross-selling by the sales force; and the synergies expected to result from reducing redundant infrastructure such as corporate costs and field operations. The goodwill acquired in the Acquisition is not deductible for tax purposes.

The results of operations of NetComm have been included in the Company's consolidated statements of operations and comprehensive (loss) income since the completion of the Acquisition on July 1, 2019. For the year ended December 31, 2019, NetComm contributed $75,769 to the Company's consolidated net revenues and $1,424 in after tax losses to the Company's consolidated net loss. Transactions costs of $3,494 are included in selling, general and administrative expenses in the consolidated statements of operations and comprehensive (loss) income for the year ended December 31, 2019.

The unaudited pro forma financial information shown below summarizes the combined results of operations for the Company and NetComm as if the closing of the Acquisition had occurred on January 1, 2017, the first day of the Company's fiscal year 2018. The unaudited pro forma financial information includes adjustments that are directly attributable to the business combination and are factually supportable. The adjustments primarily reflect the amortization of acquired intangible assets, the conversion of NetComm's financial results from International Financial Reporting Standards to U.S. GAAP, transaction costs related to the Acquisition, as well as the pro forma tax impact for such adjustments at the statutory rate. The pro forma financial information also reflects a $3,200 adjustment for the amortization of the step up of inventory fair value that is directly attributable to the business combination, but is not expected to have a continuing impact on the results of operations.

The unaudited pro forma results below do not reflect the expected realization of cost savings following the Acquisition or anticipated costs the Company will incur to realize such synergies. These savings are expected to result from streamlining of product development initiatives, alignment of overlapping functional areas, such as sales and marketing and certain general and administrative functions. Although management expects that cost savings will result from the Acquisition, there can be no assurance that these cost savings will be achieved. Accordingly, these unaudited pro forma results are presented for informational purposes only and are not necessarily indicative of what the actual results of operations of the combined company would have been if the Acquisition had occurred on January 1, 2017, nor are they indicative of future results of operations.

The unaudited pro forma combined results of the Company and NetComm are as follows:

	Year Ended December 31,		
	2019	2018	2017
Net revenue	$ 375,306	$ 436,791	$ 465,786
Net (loss) income	(47,898)	68,808	76,432

4. Inventory

Inventory as of December 31, 2019 and 2018 consisted of the following:

	December 31,	
	2019	2018
Raw materials	$ 24,000	$ 6,524
Work in process	17	571
Finished goods:		
Manufactured finished goods	70,923	45,594
Deferred inventory costs	4,263	1,073
	99,203	53,762
Valuation adjustment for excess and obsolete inventory	(5,599)	(2,765)
	$ 93,604	$ 50,997

The increase in gross inventory balances was primarily due to inventory acquired with the acquisition of NetComm on July 1, 2019. The increase in the reserve for excess and obsolete inventory was primarily due to the overall increase in inventory balances.

5. Property and Equipment

Property and equipment as of December 31, 2019 and 2018 consisted of the following:

	December 31, 2019	December 31, 2018
Computers and purchased software	$ 22,294	$ 15,706
Leasehold improvements	4,380	1,340
Furniture and fixtures	2,794	1,949
Machinery and equipment	40,002	21,979
Land	3,091	3,091
Building	4,765	4,765
Building improvements	6,776	5,245
Trial systems at customers' sites	6,039	7,116
	90,141	61,191
Less: Accumulated depreciation and amortization	(54,231)	(31,312)
	$ 35,910	$ 29,879

During the years ended December 31, 2019, 2018 and 2017, the Company transferred trial systems (into) from inventory into (from) property and equipment with values of $(502), $(357) and $877, respectively, net of transfers of trial systems to cost of revenue. In addition, the Company transferred $(261), $371 and $2,566 of equipment from inventory into property and equipment during the years ended December 31, 2019, 2018 and 2017, respectively.

Total depreciation and amortization expense on property and equipment totaled $11,870, $9,454 and $7,738 for the years ended December 31, 2019, 2018 and 2017, respectively.

6. Accrued Expenses and Other Current Liabilities

Accrued expenses and other current liabilities as of December 31, 2019 and 2018 consisted of the following:

	December 31, 2019	December 31, 2018
Accrued compensation and related taxes	$ 18,540	$ 18,301
Accrued warranty (see Note 2)	2,448	926
Dividends and equitable adjustments payable (see Note 11)	750	3,336
Accrued customer incentives	233	5,368
Other accrued expenses	12,596	9,061
	$ 34,567	$ 36,992

7. Fair Value Measurements

The Company's cash equivalents include certificates of deposit and money market mutual funds, which are valued using Level 1 or Level 2 inputs in the fair value hierarchy. The Company's marketable securities consist of certificates of deposit, which are valued using Level 2 inputs in the fair value hierarchy. The Company's foreign currency forward contracts are valued using Level 2 inputs in the fair value hierarchy. The Company's SARs are valued using as Level 3 inputs in the fair value hierarchy based on management's judgment and the assumptions set forth in Note 13 as there is no market activity to derive an estimate of their fair value. Changes in the fair value of SARs are recorded in operating expenses in the consolidated statements of operations and comprehensive (loss) income.

The following tables present information about the fair value of the Company's financial assets and liabilities as of December 31, 2019 and 2018 and indicate the level of the fair value hierarchy utilized to determine such fair values:

	Fair Value Measurements as of December 31, 2019 Using:			
	Level 1	Level 2	Level 3	Total
Assets:				
Certificates of deposit	$ —	$ 10,933	$ —	$ 10,933
Certificates of deposit—restricted cash	—	1,019	—	1,019
Money market mutual funds	53,763	—	—	53,763
Foreign currency forward contracts	—	23	—	23
	$ 53,763	$ 11,975	$ —	$ 65,738
Liabilities:				
SARs	$ —	$ —	$ 264	$ 264
Foreign currency forward contracts	—	50	—	50
	$ —	$ 50	$ 264	$ 314

	Fair Value Measurements as of December 31, 2018 Using:			
	Level 1	Level 2	Level 3	Total
Assets:				
Certificates of deposit	$ —	$ 19,873	$ —	$ 19,873
Certificates of deposit—restricted cash	—	1,019	—	1,019
Money market mutual funds	252,963	—	—	252,963
Foreign currency forward contracts	—	254	—	254
	$ 252,963	$ 21,146	$ —	$ 274,109
Liabilities:				
SARs	$ —	$ —	$ 1,387	$ 1,387
Foreign currency forward contracts	—	252	—	252
	$ —	$ 252	$ 1,387	$ 1,639

During the years ended December 31, 2019, 2018 and 2017 there were no transfers between Level 1, Level 2 and Level 3.

The liability for SARs in the table above consists of the fair value of the SARs granted to the Company's employees. The fair values of the SARs are based on significant inputs not observable in the market, which represents a Level 3 measurement within the fair value hierarchy. The Company's valuation of these SARs utilized the Black-Scholes option-pricing model, which incorporates assumptions and estimates to determine their fair values (see Note 13). The Company assesses these assumptions and estimates on a quarterly basis as additional information impacting the assumptions is obtained. Changes in the fair value of the SARs liability are recognized as stock-based compensation expense in the consolidated statements of operations and comprehensive (loss) income.

The following table provides a summary of changes in the fair values of the Company's SARs liability, for which fair value is determined by Level 3 inputs:

	Year Ended December 31,		
	2019	2018	2017
Fair value at beginning of the year	$ 1,387	$ 2,155	$ 1,195
Change in fair value	(1,123)	(768)	960
Exercises	—	—	—
Fair value at end of year	$ 264	$ 1,387	$ 2,155

The Company's cash, cash equivalents and restricted cash as of December 31, 2019 and 2018 consisted of the following:

	December 31,	
	2019	2018
Cash	$ 48,942	$ 7,751
Cash equivalents and restricted cash:		
Certificates of deposit	10,933	19,873
Certificates of deposit—restricted cash	1,019	1,019
Money market mutual funds	53,763	252,963
Total cash equivalents and restricted cash	65,715	273,855
Total cash, cash equivalents and restricted cash	$ 114,657	$ 281,606

8. Derivative Instruments

The Company has certain international customers that are billed in foreign currencies. To mitigate the volatility related to fluctuations in the foreign exchange rates for accounts receivable denominated in foreign currencies, the Company enters into foreign currency forward contracts. As of December 31, 2019, the Company had foreign currency forward contracts outstanding with notional amounts totaling 500 Euros and 900 USD related to the Company's Australian subsidiary. These contracts mature during the first quarter of 2020. As of December 31, 2018, the Company had foreign currency forward contracts outstanding with notional amounts totaling 25,741 Euros maturing during the second and third quarters of 2019.

The Company's foreign currency forward contracts economically hedge certain risk but are not designated as hedges for financial reporting purposes, and accordingly, all changes in the fair value of these derivative instruments are recorded as unrealized foreign currency transaction gains or losses and are included in the consolidated statements of operations and comprehensive (loss) income as a component of other income (expense). The Company records all derivative instruments in the consolidated balance sheet at their fair values. As of December 31, 2019 and 2018, the Company recorded an asset of $23 and $254, respectively, and as of December 31, 2019 and 2018, the Company recorded a liability of $50 and $252, respectively, related to outstanding foreign currency forward contracts, which were included in prepaid expenses and other current assets and in accrued expenses and other current liabilities, respectively, in the consolidated balance sheets.

9. Income Taxes

Income before the provision for (benefit from) income taxes for the years ended December 31, 2019, 2018 and 2017 consisted of the following:

	Year Ended December 31,		
	2019	2018	2017
United States	$ (40,055)	$ 10,527	$ 77,410
Foreign	15,640	55,411	45,408
	$ (24,415)	$ 65,938	$ 122,818

The provision for (benefit from) income taxes for the years ended December 31, 2019, 2018 and 2017 consisted of the following:

	Year Ended December 31,		
	2019	2018	2017
Current income tax provision:			
Federal	$ 4,698	$ (3,457)	$ 17,498
State	(121)	(181)	589
Foreign	(427)	8,087	4,809
Total current income tax provision	4,150	4,449	22,896
Deferred income tax provision (benefit):			
Federal	18,387	(10,699)	12,468
State	5,100	(1,108)	(1,024)
Foreign	(3,846)	290	(22)
Total deferred income tax (benefit) provision	19,641	(11,517)	11,422
Total income tax (benefit) provision	$ 23,791	$ (7,068)	$ 34,318

A reconciliation of the U.S. federal statutory rate to the Company's effective income tax rate for the years ended December 31, 2019, 2018 and 2017 is as follows:

	Year Ended December 31,		
	2019	2018	2017
Federal statutory income tax rate	21.0%	21.0%	35.0%
State taxes, net of federal tax benefit	9.8	(0.8)	0.6
Research and development tax credits	10.3	(15.6)	(3.5)
Permanent differences	(1.6)	1.1	0.5
Domestic manufacturing deduction	—	—	(0.9)
Foreign tax rate differential	10.2	(6.6)	(7.0)
Equitable adjustment payments	1.7	(1.8)	(6.0)
Excess tax benefit from stock-based transactions	3.3	(25.2)	(1.6)
Foreign taxes withheld	(9.6)	3.3	—
Impact of deferred tax rate decrease under TCJA	—	—	3.3
TCJA one-time deemed repatriation of accumulated earnings of foreign subsidiaries	—	—	7.1
Global intangible low-taxed income	(4.1)	6.7	—
Withholding tax on repatriation of accumulated earnings of foreign subsidiaries	(0.1)	0.1	1.1
Valuation allowance on deferred tax assets	(144.2)	6.0	—
Other, net	2.3	1.1	—
Foreign derived intangible income	3.9	—	—
Research and development costs	(4.3)	—	—
Provision to return	11.1	—	—
Uncertain tax positions	(7.1)	—	(0.7)
Effective income tax rate	(97.4)%	(10.7)%	27.9%

The income tax effect of each type of temporary difference and carryforward as of December 31, 2019 and 2018 was as follows:

	December 31, 2019	December 31, 2018
Deferred tax assets:		
Stock compensation	$ 3,827	$ 2,689
Tax credit carryforwards	9,900	7,599
Capitalized research and development costs	21,376	12,157
Inventory valuation	1,756	698
Accrued liabilities and reserves	5,207	2,473
Deferred revenue	1,520	3,147
Interest expense	2,149	480
Intellectual property rights	999	—
Other	544	452
Total deferred tax assets	47,278	29,695
Valuation Allowance	(39,124)	(3,926)
Deferred tax assets, net of valuation allowance	8,154	25,769
Deferred tax liabilities:		
Depreciation	(1,159)	(1,266)
Amortization	(12,727)	—
Deferred costs	—	(134)
Withholding tax on unremitted earnings	(2,604)	(2,572)
Prepaid expenses	(588)	(219)
Total deferred tax liabilities	(17,078)	(4,191)
Net deferred tax assets	$ (8,924)	$ 21,578

The Company has determined that it is more likely than not that a portion of its net U.S. deferred tax assets will not be realized. As of December 31, 2019, the Company recorded a valuation allowance of $39,124 against its net U.S. deferred tax assets, an increase of $35,198 during the year ended December 31, 2019. The change in valuation allowance is primarily due the fact that the Company does not anticipate sufficient taxable income or tax liability to utilize its U.S. deferred tax assets in in the foreseeable future. The Company will continue to monitor the realizability of its net U.S. deferred tax assets taking into account multiple factors, including recent operating results, future taxable income projections and feasible tax planning strategies. The Company intends to maintain a valuation allowance on all of its net U.S. deferred tax assets until there is sufficient evidence to support the reversal of all or some portion of the valuation allowances. The release of all, or a portion of the valuation allowance would result in the recognition of certain deferred tax assets and a decrease to income tax expense for the period the release is recorded.

On December 22, 2017, the TCJA was enacted which, among other things, lowered the U.S. corporate income tax rate to 21% from 35%, repealed the domestic production activity deductions, limited the deductibility of certain executive compensation and interest expense, and established a modified territorial system requiring a mandatory deemed repatriation tax on undistributed earnings of foreign subsidiaries. Beginning in 2018, the TCJA also requires a minimum tax on certain future earnings generated by foreign subsidiaries while providing for future tax-free repatriation of such earnings through a 100% dividends-received deduction.

While the intent of TCJA was to provide for a territorial tax system, effective for taxable years beginning after January 1, 2018, taxpayers are subjected to the GILTI provisions. The GILTI provisions require the Company to currently recognize in U.S. taxable income a deemed dividend inclusion of foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. During the years ended December 31, 2019 and 2018, the Company recorded income tax charges $942 and $4,410, respectively, related to GILTI. The Company has made an accounting policy election, as allowed by the SEC and FASB, to recognize the impacts of GILTI within the period incurred. Therefore, no U.S. deferred taxes are provided on GILTI inclusions of future foreign subsidiary earnings.

As of December 31, 2019, the Company had available state research and development tax credit carryforwards of $9,403 which begin to expire in 2030. Management believes that it is more likely than not that the Company will not realize the benefit of its state research and development tax credits and thus has recorded a valuation allowance against these tax credit carryforwards. As of December 31, 2019, the Company had foreign research and development tax credit carryforwards of $12,335, which do not expire. Management has recorded an uncertain tax position of $11,193 related these credits

As of December 31, 2019, substantially all of the Company's unremitted earnings have been taxed through either the deemed repatriation tax or as GILTI income. Of the total amount of undistributed earnings, $25,966 is not indefinitely reinvested and the Company has recorded a $2,597 deferred tax liability related to its withholding taxes associated with such undistributed earnings. The remaining unremitted earnings of the Company's foreign subsidiaries are indefinitely reinvested.

Interest and penalties related to uncertain tax positions are recorded in the consolidated statements of operations and comprehensive income within other income (expense) and totaled $1,278, $211 and $14 for the years ended December 31, 2019, 2018 and 2017, respectively. The liability recorded for potential penalties and interest was $1,646 and $369 as of December 31, 2019 and 2018, respectively. The Company had a total recorded liability of $10,211 and $3,038 related to uncertain tax positions, inclusive of penalties and interest, as of December 31, 2019 and 2018, respectively, which is included in accrued income taxes, net of current portion in the consolidated balance sheets. As of December 31, 2019, the amount of uncertain tax benefits that, if recognized, would impact the effective income tax rate is $2,835.

The aggregate changes in the balance of gross uncertain tax positions, which excludes interest and penalties, for the years ended December 31, 2019, 2018 and 2017 were as follows:

Balance at January 1, 2017	$	318
Settlement/decreases related to tax positions taken during prior years		—
Increases related to tax positions taken during prior years		—
Increases related to tax positions taken during the current year		1,377
Balance at December 31, 2017		1,695
Settlement/decreases related to tax positions taken during prior years		—
Increases related to tax positions taken during prior years		241
Increases related to tax positions taken during the current year		810
Balance at December 31, 2018		2,746
Settlement/decreases related to tax positions taken during prior years		(49)
Increases related to tax positions taken during prior years		18,434
Increases related to tax positions taken during the current year		364
Balance at December 31, 2019	$	21,495

The significant increase in tax positions taken during prior years relates to primarily to acquired positions of $12,653, and transfer pricing positions of $5,781.

The Company and its subsidiaries file income tax returns in the U.S. federal jurisdiction as well as various states and foreign jurisdictions. The Company and certain subsidiaries have tax years that remain open and are subject to examination by tax authorities in the following major taxing jurisdictions: United States for tax years 2016 through 2019, Ireland for tax years 2015 through 2019, China for tax years 2009 through 2019 (for transfer pricing adjustments, the statute of limitation in China is ten years) and Australia for tax years 2015 through 2019. The Company files income tax returns on a combined, unitary, or stand-alone basis in multiple state and local jurisdictions, which generally have statutes of limitations from three to four years. If any issues addressed in the Company's tax audits are resolved in a manner not consistent with management's expectations, the Company would be required to adjust its provision for income tax in the period such resolution occurs. Although timing of the resolution and/or closure of audits is highly uncertain, the Company does not believe it is reasonably possible that its unrecognized tax benefits will materially change in the next 12 months.

10. Debt

The aggregate principal amount of debt outstanding as of December 31, 2019 and 2018 consisted of the following:

	December 31,			
	2019		2018	
Term loans	$	291,000	$	294,000
Mortgage loan		6,644		6,958
Total principal amount of debt outstanding	$	297,644	$	300,958

Current and non-current debt obligations reflected in the consolidated balance sheets as of December 31, 2019 and 2018 consisted of the following:

	December 31, 2019	December 31, 2018
Current liabilities:		
Term loans	$ 3,000	$ 3,000
Mortgage loan	6,644	314
Current portion of principal payment obligations	9,644	3,314
Unamortized debt issuance costs, current portion	(1,120)	(1,135)
Current portion of long-term debt, net of unamortized debt issuance costs	$ 8,524	$ 2,179
Non-current liabilities:		
Term loans	$ 288,000	$ 291,000
Mortgage loan	—	6,644
Non-current portion of principal payment obligations	288,000	297,644
Unamortized debt issuance costs, non-current portion	(3,244)	(4,364)
Long-term debt, net of current portion and unamortized debt issuance costs	$ 284,756	$ 293,280

Term Loan and Revolving Credit Facilities

On December 20, 2016, the Company entered into a credit agreement with JPMorgan Chase Bank, N.A., as administrative agent, various lenders and JPMorgan Chase Bank, N.A. and Barclays Bank PLC providing for (i) a term loan facility of $300,000 and (ii) a revolving credit facility of up to $25,000 in revolving credit loans and letters of credit.

As of December 31, 2019 and 2018, $291,000 and $294,000 in principal amount, respectively, were outstanding under the term loan facility (the "Term Loans") and as of December 31, 2019 we did not have any outstanding borrowings under the revolving credit facility; however, the Company had used $1,343 under the revolving credit facility for two stand-by letters of credit, one which served as collateral to one of the Company's customers pursuant to a contractual obligation and one which is used as collateral for operating leases in Australia. The Company did not have any outstanding borrowings under the revolving credit facility as of December 31, 2018. In addition, the Company may, subject to certain conditions, including the consent of the administrative agent and the institutions providing such increases, increase the facilities by an unlimited amount so long as the Company is in compliance with specified leverage ratios, or otherwise by up to $70,000.

Borrowings under the facilities bear interest at a floating rate, which can be either a Eurodollar rate plus an applicable margin or, at the Company's option, a base rate (defined as the highest of (x) the JPMorgan Chase, N.A. prime rate, (y) the federal funds effective rate, plus one-half percent (0.50%) per annum and (z) a one-month Eurodollar rate plus 1.00% per annum) plus an applicable margin. The applicable margin for borrowings under the term loan facility is 4.00% per annum for Eurodollar rate loans (subject to a 1.00% per annum interest rate floor) and 3.00% per annum for base rate loans. As a result of the completion of the Company's IPO in December 2017, the applicable margin for borrowings under the revolving credit facility is 1.75% per annum for Eurodollar rate loans and 0.75% per annum for base rate loans, subject to reduction based on the Company's maintaining of specified net leverage ratios. The interest rates payable under the facilities are subject to an increase of 2.00% per annum during the continuance of any payment default.

For Eurodollar rate loans, the Company may select interest periods of one, three or six months or, with the consent of all relevant affected lenders, twelve months. Interest will be payable at the end of the selected interest period, but no less frequently than every three months within the selected interest period. Interest on any base rate loan is not set for any specified period and is payable quarterly. The Company has the right to convert Eurodollar rate loans into base rate loans and the right to convert base rate loans into Eurodollar rate loans at its option, subject, in the case of Eurodollar rate loans, to prepayment penalties if the conversion is effected prior to the end of the applicable interest period. As of December 31, 2019, the interest rate on the Term Loans was 5.80% per annum, which was based on a one-month Eurodollar rate of 1.80% per annum plus the applicable margin of 4.00% per annum for Eurodollar rate loans. As of December 31, 2018, the interest rate on the Term Loans was 6.52% per annum, which was based on a one-month Eurodollar rate of 2.52% per annum plus the applicable margin of 4.00% per annum for Eurodollar rate loans.

Upon entering into the term loan facility, the Company incurred debt issuance costs of $7,811, which were initially recorded as a reduction of the debt liability and are amortized to interest expense using the effective interest method from the issuance date of the Term Loan until the maturity date. Principal payments of $3,000 were made under the term loan facility during each of the years ended December 31, 2019, 2018 and 2017. Interest expense, including the amortization of debt issuance costs, totaled $19,728, $19,146 and $16,800 for the years ended December 31, 2019, 2018 and 2017, respectively.

The revolving credit facility also requires payment of quarterly commitment fees at a rate of 0.25% per annum on the difference between committed amounts and amounts actually borrowed under the facility and customary letter of credit fees. For the years ended December 31, 2019, 2018 and 2017, interest expense related to the fee for the unused amount of the revolving credit facility totaled $59 $62 and $61, respectively.

The Term Loans mature on December 20, 2023, and the revolving credit facility matures on December 20, 2021. The Term Loans are subject to amortization in equal quarterly installments, which commenced on March 31, 2017, of principal in an annual aggregate amount equal to 1.0% of the original principal amount of the Term Loans of $300,000, with the remaining outstanding balance payable at the date of maturity.

Voluntary prepayments of principal amounts outstanding under the term loan facility are permitted at any time; however, if a prepayment of principal is made with respect to a Eurodollar loan on a date other than the last day of the applicable interest period, the Company is required to compensate the lenders for any funding losses and expenses incurred as a result of the prepayment. Prior to the revolving credit facility maturity date, funds borrowed under the revolving credit facility may be borrowed, repaid and reborrowed, without premium or penalty.

In addition, the Company is required to make mandatory prepayments under the facilities with respect to (i) 100% of the net cash proceeds from certain asset dispositions (including casualty and condemnation events) by the Company or certain of its subsidiaries, subject to certain exceptions and reinvestment provisions, (ii) 100% of the net cash proceeds from the issuance or incurrence of any additional debt by the Company or certain of its subsidiaries, subject to certain exceptions, and (iii) 50% of the Company’s excess cash flow, as defined in the credit agreement, subject to reduction upon its achievement of specified performance targets.

The facilities are secured by, among other things, a first priority security interest, subject to permitted liens, in substantially all of the Company’s assets and all of the assets of certain of its subsidiaries and a pledge of certain of the stock of certain of its subsidiaries, in each case subject to specified exceptions. The facilities contain customary affirmative and negative covenants, including certain restrictions on the Company’s ability to pay dividends, and, with respect to the revolving credit facility, a financial covenant requiring the Company to maintain a specified total net leverage ratio in the event that on the last day of any fiscal quarter the Company has utilized more than 30% of its borrowing capacity under the facility. The Company’s net leverage ratio exceeded the maximum on December 31, 2019; however, as the Company’s utilization of the revolving credit facility did not exceed the 30% testing threshold on December 31, 2019, the Company was not in default the revolving credit facility as a result of the Company’s net leverage ratio exceeding the maximum permitted amount. The Company was in compliance with all other applicable covenants of the facilities as of December 31, 2019 and with all applicable covenants as of December 31, 2018.

Commercial Mortgage Loan

On July 1, 2015, the Company entered into a commercial mortgage loan agreement in the amount of $7,950 (the “Mortgage Loan”). Borrowings under the Mortgage Loan bear interest at a rate of 3.5% per annum and are repayable in 60 monthly installments of $46, consisting of principal and interest based on a 20-year amortization schedule. The remaining amount of unpaid principal under the Mortgage Loan is due on the maturity date of July 1, 2020. Upon entering into the Mortgage Loan, the Company incurred debt issuance costs of $45, which were initially recorded as a direct deduction from the debt liability and are amortized to interest expense using the effective interest method from issuance date of the loan until the maturity date.

The Company made principal payments under the Mortgage Loan of $314, $303 and $292 during the years ended December 31, 2019, 2018 and 2017, respectively. Interest expense, including the amortization of debt issuance costs, totaled $249, $260 and $272 for the years ended December 31, 2019, 2018 and 2017, respectively.

The Mortgage Loan is secured by the land and building purchased in March 2015 and subjects the Company to various affirmative, negative and financial covenants, including maintenance of a minimum debt service ratio. The Company was in compliance with all covenants of the Mortgage Loan as of December 31, 2019 and 2018.

As of December 31, 2019, aggregate minimum future principal payments of the Company's debt are summarized as follows:

Year Ending December 31,		
2020	$	9,644
2021		3,000
2022		3,000
2023		3,000
2024		279,000
Thereafter		-
	$	297,644

11. Stockholders' Equity

Upon the closing of the Company's IPO on December 19, 2017, all shares of the Company's then-outstanding preferred stock automatically converted on a ten-for-one basis into an aggregate of 40,382 shares of the Company's common stock. In addition, the Company filed a restated certificate of incorporation, which authorized the issuance of preferred stock with rights and preferences, including voting rights, designated from time to time by the board of directors. As of December 31, 2019, there were 5,000 shares of preferred stock authorized with a par value of $0.001 per share, and no shares of preferred stock issued or outstanding.

Special Dividends to Holders of Common and Preferred Stock

November 2017 Special Dividend

On November 30, 2017, the board of directors declared a special dividend to the holders of common stock and preferred stock of record on that date, contingent upon the closing of the Company's IPO. The cash dividend declared to stockholders was $0.5802 per share of common stock, $5.8020 per share of Series B convertible preferred stock (the "Series B Preferred Stock") and $5.8020 per share of Series C convertible preferred stock (the "Series C Preferred Stock"). Related to this special dividend declared in November 2017, the Company paid $865 and $42,137 of dividends to the common and preferred stockholders during the years ended December 31, 2018 and 2017, respectively, and no dividend payments with respect to this special dividend were payable as of December 31, 2019 and 2018.

In connection with this special dividend declared in November 2017, the board of directors also approved, contingent upon the payment of the November 2017 special dividend, cash payments to be made to holders of the Company's stock options, SARs and RSUs as an equitable adjustment to the holders of such instruments in accordance with the provisions of the Company's equity incentive plans. The equitable adjustment payments to the holders of the stock options, SARs and RSUs are equal to $0.5802 per share multiplied by the net number of shares subject to outstanding equity awards after applying the treasury stock method. The cash payments to such holders will be made as their equity awards vest through fiscal year 2021. During the years ended December 31, 2019, 2018 and 2017, the Company paid $426, $1,132 and $5,193, respectively, to the holders of such vested equity awards. As of December 31, 2019 and 2018, equitable adjustment payments to be made as equity awards vest through fiscal year 2021, net of estimated forfeitures, totaled $177 and $603, respectively, and were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheets.

The cash dividends declared to the holders of common stock, Series B Preferred Stock and Series C Preferred Stock totaled $19,572, $1,039 and $22,391, respectively, and the equitable adjustment to the holders of stock options, SARs and RSUs, net of estimated forfeitures, totaled $6,928. The $49,930 aggregate amount of such dividends and equitable adjustments was recorded as a charge to additional paid-in capital during the year ended December 31, 2017.

May 2017 Special Dividend

On May 10, 2017, the board of directors declared and the stockholders approved a special dividend to the holders of common stock and preferred stock of record on that date. The cash dividend declared to stockholders was $1.1774 per share of common stock, $11.7744 per share of Series B Preferred Stock and $11.7744 per share of Series C Preferred Stock. Related to this special dividend declared in May 2017, the Company paid 87,133 of dividends to the common and preferred stockholders during the year ended December 31, 2017. No dividend payments with respect to this special dividend were payable as of December 31, 2019 and 2018.

In connection with the special dividend declared in May 2017, the board of directors also approved cash payments to be made to holders of the Company’s stock options, SARs and RSUs as an equitable adjustment to the holders of such instruments in accordance with the provisions of the Company’s equity incentive plans. The equitable adjustment payments to the holders of the stock options, SARs and RSUs are equal to $1.1774 per share multiplied by the net number of shares subject to outstanding equity awards after applying the treasury stock method. The cash payments to such holders will be made as their equity awards vest through fiscal year 2021. During the years ended December 31, 2019, 2018 and 2017, the Company paid $618, $1,492 and $10,431 to the holders of such vested equity awards. As of December 31, 2019 and 2018, equitable adjustment payments to be made as equity awards vest through fiscal year 2021, net of estimated forfeitures, totaled $182 and $800, respectively, and were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheets.

The cash dividends declared to the holders of common stock, Series B Preferred Stock and Series C Preferred Stock totaled $39,585, $2,108 and $45,440, respectively, and the equitable adjustment to the holders of stock options, SARs and RSUs, net of estimated forfeitures, totaled $12,723. The $99,856 aggregate amount of such dividends and equitable adjustments was recorded as a charge to additional paid-in capital (until reduced to zero) and a charge to accumulated deficit during the year ended December 31, 2017.

December 2016 Special Dividend

On December 21, 2016, the board of directors declared, and on December 29, 2016 the stockholders approved, a special dividend to the holders of common stock and preferred stock of record on December 27, 2016. The cash dividend declared to stockholders was $2.3306 per share of common stock, $23.3058 per share of Series B Preferred Stock and $23.3058 per share of Series C Preferred Stock. Related to this special dividend declared in December 2016, the Company paid $77,153 of dividends to the common and preferred stockholders during the year ended December 31, 2017. No dividend payments with respect to this special dividend were payable as of December 31, 2019 and 2018.

In connection with the special dividend declared in December 2016, the board of directors also approved cash payments to be made to holders of the Company’s stock options, SARs and RSUs as an equitable adjustment to the holders of such instruments in accordance with the provisions of the Company’s equity incentive plans. The equitable adjustment payments to the holders of stock options, SARs and RSUs are equal to $2.3306 per share multiplied by the net number of shares subject to outstanding equity awards after applying the treasury stock method. The cash payments to such holders will be made as their equity awards vest through fiscal year 2020. During the years ended December 31, 2019, 2018 and 2017, the Company paid $1,286, $3,105 and $23,395, respectively, to the holders of such vested equity awards. As of December 31, 2019 and 2018, equitable adjustment payments to be made as equity awards vest through fiscal year 2020, net of estimated forfeitures, totaled $335 and $1,621, respectively, and were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheet.

June 2016 Special Dividend

On June 17, 2016, the board of directors declared and the stockholders approved a special dividend to the holders of common stock and preferred stock of record on that date. The cash dividend declared to stockholders was $0.5891 per share of common stock, $5.8910 per share of Series B Preferred Stock, and $5.8910 per share of Series C Preferred Stock. Related to this special dividend declared in June 2016, the Company paid no dividends to the common and preferred stockholders during the years ended December 31, 2019, 2018 and 2017, and no dividend payments with respect to this special dividend were payable as of December 31, 2019 or 2018.

In connection with the special dividend declared in June 2016, the board of directors also approved cash payments to be made to holders of the Company’s stock options, SARs and RSUs as an equitable adjustment to the holders of such instruments in accordance with the provisions of the Company’s equity incentive plans. The equitable adjustment payments to the holders of stock options, SARs and RSUs are equal to $0.5891 per share multiplied by the net number of shares subject to outstanding equity awards after applying the treasury stock method. The cash payments to such holders will be made as their equity awards vest through fiscal year 2020. During the years ended December 31, 2019, 2018 and 2017, the Company paid $259, $684 and $1,075, respectively to the holders of such vested equity awards. As of December 31, 2019 and 2018, equitable adjustment payments to be made as equity awards vest through fiscal year 2020, net of estimated forfeitures, totaled $37 and $296 and were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheet.

November 2014 Special Dividend

On November 30, 2014, the board of directors declared and the stockholders approved a special dividend to the holders of common stock and preferred stock of record on that date. The cash dividend declared to stockholders was $0.3835 per share of common stock, $3.8346 per share of Series B Preferred Stock and $3.8346 per share of Series C Preferred Stock. Related to this special dividend declared in November 2014, the Company paid no dividends to the common and preferred stockholders during the years ended December 31, 2019, 2018 and 2017, and no dividend payments with respect to this special dividend were payable as of December 31, 2019 or 2018.

In connection with the special dividend declared in November 2014, the board of directors also approved cash payments to be made to holders of the Company's stock options and SARs as an equitable adjustment to the holders of such instruments in accordance with the provisions of the Company's equity incentive plans. The equitable adjustment payments to the holders of stock options and SARs are equal to $0.3835 per share multiplied by the net number of shares subject to outstanding equity awards after applying the treasury stock method. The cash payments to the holders of stock options and SARs were made as equity awards vested through fiscal year 2018. During the years ended December 31, 2019, 2018 and 2017, the Company paid $1, $43 and $117, respectively, to the holders of stock options and SARs for vested equity awards. As of December 31, 2018, equitable adjustment payments to be made as equity awards vested through fiscal year 2018, net of estimated forfeitures, totaled $20, and were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheets. No equitable adjustment payments in connection with these awards remained outstanding as of December 31, 2019.

12. Common Stock

Upon the closing of the IPO on December 19, 2017, the Company filed a restated certificate of incorporation, which authorized the Company to issue 500,000 shares of $0.001 par value common stock. Each share of common stock entitles the holder to one vote on all matters submitted to a vote of the Company's stockholders. Common stockholders are entitled to receive dividends, as may be declared by the board of directors, if any, subject to the preferential dividend rights of the preferred stock. Through December 31, 2019, except for the special cash dividends declared on November 30, 2014, June 17, 2016, December 21, 2016, May 10, 2017 and November 30, 2017 (see Note 11), no dividends have been declared by the board of directors.

As of December 31, 2019, the Company had reserved 20,630 shares of common stock for the exercise of outstanding stock options, the vesting of outstanding RSUs, and the number of shares remaining available for grant under the Company's 2017 Stock Incentive Plan (see Note 13).

Stock Split

On December 1, 2017, the Company effected a five-for-one stock split of its issued and outstanding shares of common stock and a proportional adjustment to the existing conversion ratio of each series of the Company's Convertible Preferred Stock (see Note 11). Accordingly, all share and per share amounts for all periods presented in the accompanying consolidated financial statements and notes thereto have been adjusted retroactively, where applicable, to reflect this stock split and adjustment of the preferred stock conversion ratios.

Stock Repurchase Program

On February 21, 2019, the Company announced a stock repurchase program authorizing it to repurchase up to $75,000 of the Company's common stock. During the year ended December 31, 2019, the Company repurchased 495 shares for $1,785, before commissions. As of December 31, 2019, $73,215 remained authorized for repurchases of the Company's common stock under this stock repurchase program.

On August 14, 2018, the Company announced a stock repurchase program authorizing it to repurchase up to $75,000 of the Company's common stock. During the year ended December 31, 2018, the Company repurchased and retired 5,172 shares for $75,000, before commissions. Stock repurchases under this program are now complete.

13. Stock-based Compensation

2003 Stock Incentive Plan

The Company's 2003 Stock Incentive Plan, as amended (the "2003 Plan"), provided for the grant of qualified incentive stock options, nonqualified stock options, restricted stock or other stock-based awards to the Company's employees, officers, directors, advisers and outside consultants. The number of shares authorized for grant under the 2003 Plan, as amended, was 32,500 shares. The 2003 Plan was administered by the board of directors, or at the discretion of the board of directors, by a committee of the board or by one or more executive officers of the Company. The exercise prices, vesting and other restrictions were determined at the discretion of the board of directors, or their committee or by one or more executive officers of the Company, if so delegated.

The 2003 Plan was terminated in August 2011, and the remaining 2,140 shares available for issuance under the plan at that time were transferred to the Company's 2011 Stock Incentive Plan (the "2011 Plan"). The shares of common stock underlying any awards that are forfeited, canceled, repurchased or are otherwise terminated by the Company under the 2003 Plan will be added back to the shares of common stock available for issuance under the Company's 2017 Stock Incentive Plan (the "2017 Plan").

2011 Stock Incentive Plan

The 2011 Plan provided for the Company to sell or issue common stock or restricted common stock, or to grant qualified incentive stock options, nonqualified stock options, SARs, RSUs or other stock-based awards to the Company's employees, officers, directors, advisers and outside consultants. The 2011 Plan was administered by the board of directors, or at the discretion of the board of directors, by a committee of the board. The exercise prices, vesting and other restrictions were determined at the discretion of the board of directors, or their committee if so delegated, except that the exercise price per share of stock options could not be less than 100% of the fair market value of common stock on the date of grant and the term of the stock option could not be greater than ten years. The stock options generally vest over a four-year period and expire ten years from the date of grant. Certain options provide for accelerated vesting if there is a change in control (as defined in the stock option agreements).

The 2011 Plan was terminated for the purpose of making new grants in December 2017, and the remaining 2,855 shares available for issuance under the 2011 Plan at that time were transferred to the 2017 Plan. Awards outstanding under the 2011 Plan at the time of the 2011 Plan's termination will continue to be governed by their existing terms. The shares of common stock underlying any awards that are forfeited, canceled, repurchased or are otherwise terminated by the Company under the 2011 Plan will be added back to the shares of common stock available for issuance under the 2017 Plan.

2017 Stock Incentive Plan

On November 17, 2017, the Company's board of directors adopted, and on November 30, 2017, the Company's stockholders approved, the 2017 Plan, which became effective immediately prior to the effectiveness of the registration statement for the IPO. The 2017 Plan provides for the grant of incentive stock options, nonqualified stock options, stock appreciation rights, restricted stock awards, restricted stock units and other stock-based awards. The number of shares initially reserved for issuance under the 2017 Plan is the sum of 7,161 shares, plus the number of shares (up to 18,746 shares) equal to the sum of (i) the number of shares remaining available for issuance under the 2003 Plan and 2011 Plan upon the effectiveness of the 2017 Plan and (ii) the number of shares of common stock subject to outstanding awards under the 2003 Plan and 2011 Plan that expire, terminate or are otherwise surrendered, canceled, forfeited or repurchased by the Company at their original issuance price pursuant to a contractual repurchase right. The number of shares of common stock that may be issued under the 2017 Plan will automatically increase on each January 1, beginning with the fiscal year ending December 31, 2019 and continuing for each fiscal year until, and including, the fiscal year ending December 31, 2027, equal to the least of (i) 20,000 shares, (ii) 4% of the outstanding shares of common stock on such date and (iii) an amount determined by the Company's board of directors. The shares of common stock underlying any awards that are forfeited, canceled, repurchased or are otherwise terminated by the Company under the 2017 Plan will be added back to the shares of common stock available for issuance under the 2017 Plan. The total number of shares authorized for issuance under the 2017 Plan was 13,565 shares as of December 31, 2019, of which 10,727 shares remained available for future grant.

Stock Option Valuation

The fair value of each option award is estimated on the date of grant using the Black-Scholes option-pricing model that uses the assumptions noted in the table below. Expected volatility for the Company's common stock was determined based on an average of the historical volatility of a peer group of similar public companies. The expected term of options granted was calculated using the simplified method, which represents the average of the contractual term of the option and the weighted-average vesting period of the option. The Company uses the simplified method because it does not have sufficient historical option exercise data to provide a reasonable basis upon which to estimate the expected term. The expected dividend yield is based on the fact that the Company does not have a history of paying cash dividends, except for the special dividends declared in November 2014, June 2016, December 2016, May 2017 and November 2017 (see Note 11), and in those circumstances, the board of directors approved cash dividends to be paid to holders of the Company's stock options and SARs upon vesting as an equitable adjustment to the holders of such instruments. The risk-free rate for periods within the expected life of the option is based upon the U.S. Treasury yield curve in effect at the time of grant.

In determining the exercise prices for options granted prior to the Company's IPO, the Company's board of directors considered the fair value of the common stock as of the measurement date. The fair value of the common stock was determined by the board of directors at each award grant date based upon a variety of factors, including the results obtained from an independent third-party valuation of the Company's common stock, the Company's financial position and historical financial performance, the status of technological developments within the Company's products, the composition and ability of the current management team, an evaluation or benchmark of the Company's competition, the current business climate in the marketplace, the illiquid nature of the common stock, the effect of the rights and preferences of the holders of the Company's convertible preferred stock, and the prospects of a liquidity event, among others. Subsequent to the completion of the IPO, the Company uses the closing price of its common stock as reported on the Nasdaq Global Select Market on the applicable date of grant to determine the fair value of the shares of common stock underlying stock options.

The assumptions used in the Black-Scholes option-pricing model were as follows:

	Year Ended December 31,		
	2019	2018	2017
Risk-free interest rate	1.6%-2.5%	2.7%–3.0%	2.0%–2.2%
Expected term (in years)	6.1-6.2	6.0–6.2	6.0–6.2
Expected volatility	28.8%–30.6%	30.6%–32.6%	33.0%–38.5%
Expected dividend yield	0.0%	0.0%	0.0%

Stock Options

A summary of option activity under the 2003 Plan, the 2011 Plan and the 2017 Plan for the year ended December 31, 2019 is as follows:

	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term	Aggregate Intrinsic Value
			(in years)	
Outstanding at January 1, 2019	9,566	$ 7.29	6.35	$ 61,561
Granted	213	6.52		
Exercised	(1,129)	2.38		
Forfeited	(400)	11.69		
Outstanding at December 31, 2019	8,250	$ 7.73	5.65	$ 4,235
Options exercisable at December 31, 2019	6,983	$ 6.65	5.22	$ 4,218
Vested or expected to vest at December 31, 2019	8,186	$ 7.69	5.63	$ 4,233

The weighted-average grant-date fair value of options granted during the years ended December 31, 2019, 2018 and 2017 was $2.13, $7.59 and $4.74 per share, respectively. Cash proceeds received upon the exercise of options were $2,687, $14,730 and $274 during the years ended December 31, 2019, 2018 and 2017, respectively. The intrinsic value of stock options exercised during the years ended December 31, 2019, 2018 and 2017 was $6,970, $105,787 and $1,915, respectively. The aggregate intrinsic value is calculated as the difference between the exercise price of the stock options and the fair value of the Company's common stock for those stock options that had exercise prices lower than the fair value of the Company's common stock.

Restricted Stock Units

On February 5, 2019, February 19, 2019, May 16, 2019, June 11, 2019, July 30, 2019, September 11, 2019, and December 11, 2019 the Company granted 714, 229, 68, 105, 134, 130, and 8 RSUs, respectively, under the 2017 Plan. On March 8, 2018, June 6, 2018, June 14, 2018, September 27, 2018, November 27, 2018, December 14, 2018, the Company granted 103, 7, 83, 185, 20 and 22 RSUs, respectively, under the 2017 Plan. On January 31, 2017 and May 15, 2017, the Company granted 176 and 15 RSUs, respectively, under the 2011 Plan. On December 15, 2017, the Company granted 35 RSUs under the 2017 Plan. On March 26, 2016 and January 23, 2015, the Company granted 244 and 2,103 RSUs, respectively, under the 2011 Plan. The RSUs vest ratably over a one- to four-year period from the date of grant. The grant-date fair value of each RSU award is being recorded as stock-based compensation expense on a straight-line basis, net of estimated forfeitures, over the requisite service period for the RSUs, which is generally one to four years. The fair value of each RSU on the date of grant is the estimated fair value of the underlying common stock on the date of the grant. A summary of RSU activity under the 2011 Plan and the 2017 Plan for the year ended December 31, 2019 is as follows:

	Number of Shares	Weighted-Average Grant Date Fair Value	Aggregate Fair Value
Unvested balance at January 1, 2019	759	$ 13.40	
Granted	1,389	10.08	
Vested	(320)	10.67	$ 3,659
Forfeited	(175)	10.92	
Unvested balance at December 31, 2019	1,653	$ 11.38	

The Company withheld 77, 1 and 310 shares of common stock in settlement of employee tax withholding obligations due upon the vesting of RSUs during the years ended December 31, 2019, 2018 and 2017, respectively.

Stock Appreciation Rights

In January 2017, the Company granted 110 SARs that allow the holder the right, upon exercise, to receive in cash the amount of the difference between the fair market value of the Company's common stock at the date of exercise and the price of the underlying common stock at the date of grant of each SAR. The price of the underlying common stock on the date of grant was $12.24 per share and the grant-date fair value was $4.52 per SAR. No SARs were granted during each of the years ended December 31, 2019 and 2018. The SARs vest over a four-year period from the date of grant and expire ten years from the date of grant. As of December 31, 2019, 220 SARs were outstanding, inclusive of grants made prior to 2017, of which 218 SARs were vested and exercisable, with a fair value of $1.21 per SAR, and 2 SARs were not yet vested. During the year ended December 31, 2019, 20 SARs were forfeited. The fair value of the SAR liability as of December 31, 2019 and 2018 was $264 and $1,387, respectively (see Note 7), and was included in accrued expenses and other current liabilities in the accompanying consolidated balance sheets.

Stock-Based Compensation Expense

The Company recorded stock-based compensation expense of $9,821, $8,894 and $9,136 during the years ended December 31, 2019, 2018 and 2017, respectively, which is based on the number of stock options, RSUs and SARs ultimately expected to vest. As of December 31, 2019, there was $18,413 of unrecognized compensation cost related to outstanding stock options, RSUs and SARs, which is expected to be recognized over a weighted-average period of 2.53 years.

Stock-based compensation expense related to stock options, RSUs and SARs for the years ended December 31, 2019, 2018 and 2017 was classified in the consolidated statements of operations and comprehensive (loss) income as follows:

	Year Ended December 31,		
	2019	2018	2017
Cost of revenue	$ 216	$ 249	$ 306
Research and development expenses	1,569	1,864	2,864
Selling, general and administrative	8,036	6,781	5,966
	$ 9,821	$ 8,894	$ 9,136

14. Net (Loss) Income per Share

Basic and diluted net (loss) income per share attributable to common stockholders was calculated as follows:

	Year Ended December 31, 2019	2018	2017
Numerator:			
Net (loss) income	$ (48,206)	$ 73,006	$ 88,500
Cumulative dividends on convertible preferred stock	—	—	(5,674)
Dividends declared on convertible preferred stock	—	—	(70,977)
Net (loss) income attributable to common stockholders, basic and diluted	$ (48,206)	$ 73,006	$ 11,849
Denominator:			
Weighted-average shares used to compute net (loss) income per share attributable to common stockholders, basic	83,853	83,539	35,359
Dilutive effect of stock options	—	8,086	9,141
Dilutive effect of restricted stock units	—	252	472
Weighted-average shares used to compute net (loss) income per share attributable to common stockholders, diluted	83,853	91,877	44,972
Net (loss) income per share attributable to common stockholders:			
Basic	$ (0.57)	$ 0.87	$ 0.34
Diluted	$ (0.57)	$ 0.79	$ 0.26

The following potential common shares, presented based on amounts outstanding at each period end, were excluded from the computation of diluted net (loss) income per share attributable to common stockholders for the periods presented because including them would have been anti-dilutive:

	Year Ended December 31, 2019	2018	2017
Options to purchase common stock	4,641	2,213	2,281
Unvested restricted stock units	1,516	168	35

15. Segment Information

The Company operates as one operating segment. Operating segments are defined as components of an enterprise for which separate financial information is regularly evaluated by the Company's chief operating decision maker, or decision-making group, in deciding how to allocate resources and assess performance. The Company has determined that its chief operating decision maker is its President and Chief Executive Officer. The Company's chief operating decision maker reviews the Company's financial information on a consolidated basis for purposes of allocating resources and assessing financial performance. Since the Company operates as one operating segment, all required financial segment information can be found in these consolidated financial statements.

The following table summarizes the Company's revenue based on the customer's location, as determined by the customer's shipping address:

	Year Ended December 31,		
	2019	2018	2017
North America:			
United States	$ 103,451	$ 104,124	$ 143,540
Canada	36,466	41,884	58,316
Total North America	139,917	146,008	201,856
Latin America	24,043	32,283	40,347
Europe, Middle East and Africa:			
Germany	13,773	45,864	13,396
Other	24,381	35,479	48,062
Total Europe, Middle East and Africa	38,154	81,343	61,458
Asia-Pacific			
Australia	42,218	24,354	18,348
Other	37,965	13,139	29,566
Total Asia-Pacific	80,183	37,493	47,914
Total revenue(1)	$ 282,297	$ 297,127	$ 351,575

(1) Other than the United States, Canada, Germany and Australia, no individual countries represented 10% or more of the Company's total revenue for any of the periods presented.

The Company's property and equipment, net by location was as follows:

	December 31,	
	2019	2018
United States	$ 25,583	$ 25,088
China	3,277	2,623
Australia	4,041	—
Other	3,009	2,168
Total property and equipment, net	$ 35,910	$ 29,879

16. Related Parties

Transactions Involving Liberty Global Ventures Holding B.V. and its Affiliates

Liberty Global Ventures Holding B.V. was a principal stockholder of the Company through its ownership of common stock. Affiliates of Liberty Global Ventures Holding B.V. ("Liberty Global Affiliates") are customers of the Company. Liberty Global Affiliates ceased being a principal stockholder as of October 19, 2018, when it disposed a portion of its ownership of the Company's stock. During the periods in which it was a related party in the years ended December 31, 2018 and 2017, the Company recognized revenue of $22,252 and $39,370, respectively, from transactions with Liberty Global Affiliates and amounts received in cash from Liberty Global Affiliates totaled $30,432 and $38,273, respectively.

Consulting Agreement with Bill Styslinger

In March 2012, the Company entered into a consulting agreement with Bill Styslinger, a member of its board of directors, for the provision of sales management, corporate strategy and advisory services, which was initially scheduled to expire on January 31, 2014. The Company extended the term of the consulting agreement on two occasions, and the consulting agreement expired on December 31, 2016. Under the consulting agreement, Mr. Styslinger was granted stock options which entitled him to equitable adjustment payments (see Note 11).

In connection with the special dividends declared in December 2016 and May 2017, the Company paid Mr. Styslinger $1,075 as equitable adjustments in the year ended December 31, 2017. The Company made no payments to Mr. Styslinger as equitable adjustments in the years ended December 31, 2019 and 2018.

In addition, during both the years ended December 31, 2018 and 2017, the Company recognized selling, general and administrative expenses of $205 for Mr. Styslinger's services as a non-employee director. As of December 31, 2018, $14 was due to Mr. Styslinger for his services as a non-employee director. No amount was due to Mr. Styslinger for his services as a non-employee director as of December 31, 2019.

Employment of Rongke Xie

Rongke Xie, who serves as Deputy General Manager of Guangzhou Casa Communication Technology LTD ("Casa China"), a subsidiary of the Company, is the sister of Lucy Xie, the Company's Senior Vice President of Operations and a member of the Company's board of directors. Casa China paid Rongke Xie $117, $143 and $160 in total compensation in the years ended December 31, 2019, 2018 and 2017, respectively, for her services as an employee.

In addition, during the years ended December 31, 2019 and 2018, the Company granted to Rongke Xie 8 and 5 RSUs, respectively, which vest in annual installments over a four-year period. The grant-date fair value of the award totaled $100 and $100, respectively, which will be recorded as stock-based compensation expense over the vesting period of the award. During the years ended December 31, 2019 and 2018, the Company recognized selling, general and administrative expenses of $46 and $13 related to these awards, respectively.

17. Commitments and Contingencies

Operating Leases

The Company leases manufacturing, warehouse and office space in the United States, China, Hong Kong, Spain, Australia and the United Kingdom under non-cancelable operating leases that expire through 2023. The Company also has a lease in Ireland that expires in 2026, but provides the Company the right to terminate in 2021. Rent expense for the years ended December 31, 2019, 2018 and 2017 was $2,459, $1,029 and $933, respectively. Rent expense is recorded on a straight-line basis, and, as a result, as of December 31, 2019 and 2018, the Company had a deferred rent liability of $212 and $184, respectively, which is included in accrued expenses and other current liabilities in the accompanying consolidated balance sheets.

Future minimum lease payments under non-cancelable operating leases as of December 31, 2019 were as follows:

Year Ending December 31,		
2020	$	2,723
2021		1,488
2022		114
2023		5
2024		—
Thereafter		—
	$	4,330

Indemnification

The Company has, in the ordinary course of business, agreed to defend and indemnify certain customers against third-party claims asserting infringement of certain intellectual property rights, which may include patents, copyrights, trademarks or trade secrets.

As permitted under Delaware law, the Company indemnifies its officers, directors and employees for certain events or occurrences that happen by reason of their relationship with or position held at the Company.

As of December 31, 2019 and 2018, the Company had not experienced any losses related to these indemnification obligations and no material claims were outstanding. The Company does not expect significant claims related to these indemnification obligations and, consequently, concluded that the fair value of these obligations is negligible, and no related liabilities were recorded in its consolidated financial statements.

Litigation

On May 29, 2019 and July 3, 2019, two putative class action lawsuits, Shen v. Chen et al. and Baig v. Chen et al., were filed in the Massachusetts Superior Court against the Company, certain of its current and former executive officers and directors, Summit Partners, the Company’s largest investor, and the underwriters from the Company’s December 15, 2017 initial public offering (the “IPO”) (collectively, the “defendants”). These complaints purport to be brought on behalf of all purchasers of the Company’s common stock in and/or traceable to the IPO. The complaints generally allege that (i) each of the defendants violated Section 11 and/or Section 12(a)(2) of the Securities Act of 1933, as amended, (the “Securities Act”), because documents related to the Company’s IPO including its registration statement and prospectus were materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants and Summit Partners acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On August 13, 2019, the Court consolidated these actions and referred the consolidated actions to the Business Litigation Session of the Massachusetts Superior Court (the “BLS”). On September 3, 2019, the BLS accepted the consolidated action into its session for further proceedings. On November 12, 2019, the plaintiffs filed an amended shareholder class action complaint, purportedly on behalf of all purchasers of the Company’s common stock in and/or traceable to the IPO, which contains substantially similar allegations and asserts the same claims as the two initial complaints, described above. Plaintiffs seek compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, and equitable and injunctive relief. On January 14, 2020, the defendants filed motions to dismiss the amended complaint.

On August 9, 2019, a third putative class action lawsuit, Donald Hook v. Casa Systems, Inc. et al., was filed in the Supreme Court of New York, New York County, against the Company, certain of its current and former executive officers and directors, Summit Partners, and the underwriters from the IPO. The complaint purports to be brought on behalf of all purchasers of the Company’s common stock in and/or traceable to the IPO and generally alleges that (i) each of the defendants violated Section 11 and/or Section 12(a)(2) of the Securities Act of 1933, as amended, or the Securities Act, because documents related to the IPO including its registration statement and prospectus were materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants and Summit Partners acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On November 22, 2019, the plaintiff filed an amended complaint, purportedly on behalf of all purchasers of the Company’s common stock in and/or traceable to the IPO, which contains substantially similar allegations as the initial complaint, described above, and asserts claims for violations of Sections 11 and 15 of the Securities Act. The plaintiff seeks compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, disgorgement, and equitable and injunctive relief. On January 21, 2020, the defendants filed motions to dismiss the amended complaint.

On August 13, 2019, a fourth putative class action lawsuit, Panther Partners, Inc. v. Guo et al., was filed in the Supreme Court of New York, New York County, against the Company, certain of its current and former executive officers and directors, and the underwriters from the Company’s April 30, 2018 follow-on offering of common stock, (the “Follow-on Offering”). The complaint purports to be brought on behalf of all purchasers of the Company’s common stock in the Follow-on Offering and generally alleges that (i) each of the defendants, other than Abraham Pucheril, violated Section 11 of the Securities Act, and each of the defendants violated Section 12(a)(2) of the Securities Act, because documents related to the Company’s Follow-on Offering, including its registration statement and prospectus, was materially misleading by containing untrue statements of material fact and/or omitting to state material facts necessary to make such statements not misleading and (ii) the individual defendants acted as controlling persons within the meaning and in violation of Section 15 of the Securities Act. On November 22, 2019, the plaintiff filed an amended class action complaint, purportedly on behalf of all purchasers of the Company’s common stock in the Follow-on Offering, which contains substantially similar allegations and asserts the same claims as the initial complaint, described above. The plaintiff seeks compensatory damages, costs and expenses, including counsel and expert fees, rescission or a rescissory measure of damages, and equitable and injunctive relief. On January 21, 2020, the defendants filed motions to dismiss the amended complaint

No amounts have been accrued for any of the putative class action lawsuits referenced above as of December 31, 2019 as the Company does not believe the likelihood of a material loss is probable. Although the ultimate outcome of these matters cannot be predicted with certainty, the resolution of this matter could have a material impact on the Company's results of operations in the period in which such matter is resolved.

18. Employee Benefit Plan

The Company has a Section 401(k) defined contribution savings plan for its employees. The plan covers substantially all employees in the United States who meet minimum age and service requirements and allows participants to defer a portion of their annual compensation on a pre-tax basis, subject to certain limitations. Company contributions to the plan may be made at the discretion of the board of directors. Effective January 1, 2014, the Company commenced matching contributions in the amount of 50% of the employee's contributions of up to 6% of eligible wages. The Company made matching contributions to the plan of $1,762, $1,630 and $1,484 in the years ended December 31, 2019, 2018 and 2017, respectively.

19. Selected Quarterly Financial Information (Unaudited)

The following tables set forth selected unaudited quarterly consolidated statements of (loss) income data for each of the quarters in the years ended December 31, 2019 and 2018:

	Three Months Ended							
	Dec. 31, 2019	Sept. 30, 2019	June 30, 2019	Mar. 31, 2019	Dec. 31, 2018	Sept. 30, 2018	June 30, 2018	Mar. 31, 2018
	(in thousands)							
Revenue:								
Product	$ 101,182	$ 71,319	$ 42,223	$ 26,653	$ 57,446	$ 60,817	$ 58,537	$ 80,189
Service	11,712	10,497	9,878	8,833	10,379	10,689	10,185	8,885
Total revenue	112,894	81,816	52,101	35,486	67,825	71,506	68,722	89,074
Cost of revenue:								
Product	52,076	40,578	10,976	9,429	16,738	13,272	18,560	25,780
Services	1,302	2,024	1,820	1,560	1,408	1,303	761	1,339
Total cost of revenue	53,378	42,602	12,796	10,989	18,146	14,575	19,321	27,119
Gross profit	59,516	39,214	39,305	24,497	49,679	56,931	49,401	61,955
Operating expenses:								
Research and development	22,508	24,158	18,260	18,405	17,345	16,403	16,696	20,530
Selling, general and administrative	27,002	23,823	17,302	20,193	15,502	17,905	16,163	18,456
Total operating expenses	49,510	47,981	35,562	38,598	32,847	34,308	32,859	38,986
Income (loss) from operations	10,006	(8,767)	3,743	(14,101)	16,832	22,623	16,542	22,969
Other income (expense), net	(3,535)	(5,343)	(3,010)	(3,408)	(3,578)	(2,731)	(3,319)	(3,400)
Income (loss) before provision for (benefit from) income taxes	6,471	(14,110)	733	(17,509)	13,254	19,892	13,223	19,569
Provision for (benefit from) income taxes	32,131	(5,612)	(558)	(2,170)	(1,662)	995	(8,194)	1,793
Net (loss) income	$ (25,660)	$ (8,498)	$ 1,291	$ (15,339)	$ 14,916	$ 18,897	$ 21,417	$ 17,776
Net (loss) income per share attributable to common stockholders:								
Basic	$ (0.31)	$ (0.10)	$ 0.02	$ (0.18)	$ 0.18	$ 0.22	$ 0.26	$ 0.22
Diluted	$ (0.31)	$ (0.10)	$ 0.01	$ (0.18)	$ 0.17	$ 0.21	$ 0.23	$ 0.19

The net loss for the three months ended December 31, 2019 is primarily due to the recording of valuation allowances against our U.S. deferred tax assets of $35,198.

Item 9. Changes in and Disagreements With Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, has evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a- 15(e) and 15d- 15(e) under the Securities Exchange Act of 1934, as amended, or the Exchange Act), as of the end of the period covered by this Annual Report on Form 10-K. The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act, means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the Securities and Exchange Commission's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company's management, including its principal executive and principal financial officers, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure. Our management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and our management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on the evaluation of our disclosure controls and procedures as of the end of the period covered by this Annual Report on Form 10-K, our principal executive officer and principal financial officer have concluded that as of such date, our disclosure controls and procedures were effective.

Management's Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rule 13a-15(f) or 15d-15(f) promulgated under the Exchange Act as a process designed by, or under the supervision of, the company's principal executive and principal financial officers and effected by the company's board of directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles and includes those policies and procedures that:

- Pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the company;
- Provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and,
- Provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Our management assessed the effectiveness of our internal control over financial reporting as of December 31, 2019. In making this assessment, our management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in Internal Control-Integrated 2013 Framework. Based on this assessment, our management concluded that, as of December 31, 2019, our internal control over financial reporting is effective based on those criteria.

This Annual Report on Form 10-K does not include an attestation report of our independent registered public accounting firm due to a transition period established by rules of the SEC for "emerging growth companies".

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting during our most recently completed fiscal quarter that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance

The complete response to this Item regarding the backgrounds of our executive officers and directors and other information required by Items 401, 405 and 407 of Regulation S-K is expected to be incorporated by reference herein to our definitive proxy statement for our 2020 Annual Meeting of Stockholders.

Code of Business Conduct and Ethics

We have adopted a written code of business conduct and ethics that applies to our directors, officers and employees, including our principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions. A copy of the code is available on our website, www.casa-systems.com. In addition, we intend to post on our website all disclosures that are required by law or the Nasdaq Listing Rules concerning any amendments to, or waivers from, any provision of the code.

Item 11. Executive Compensation

The information required by this Item is expected to be incorporated by reference herein to our definitive proxy statement for our 2020 Annual Meeting of Stockholders.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters

The information required by this Item is expected to be incorporated by reference herein to our definitive proxy statement for our 2020 Annual Meeting of Stockholders.

Item 13. Certain Relationships and Related Transactions, and Director Independence

The information required by this Item is expected to be incorporated by reference herein to our definitive proxy statement for our 2020 Annual Meeting of Stockholders.

Item 14. Principal Accounting Fees and Services

The information required by this Item is expected to be incorporated by reference herein to our definitive proxy statement for our 2020 Annual Meeting of Stockholders.

PART IV

Item 15. Exhibits, Financial Statement Schedules.

(l) Financial Statements

Our consolidated financial statements are set forth in Part II, Item 8 of this Annual Report on Form 10-K and are incorporated herein by reference.

(2) Financial Statement Schedules

All financial schedules have been omitted because the required information is either presented in the consolidated financial statements or the notes thereto or is not applicable or required.

(3) Exhibits

		Incorporated by Reference				
Exhibit Number	Description of Exhibit	Form	File No.	Date of Filing	Exhibit Number	Filed Herewith
2.1	Deed, dated as of February 21, 2019, between Casa Systems, Inc. and NetComm Wireless Limited	8-K	001-38324	2/21/2019	10.1	
3.1	Restated Certificate of Incorporation of the Registrant	8-K	001-38324	12/19/2017	3.1	
3.2	By-laws of the Registrant	8-K	001-38324	12/19/2017	3.2	
4.1	Specimen Stock Certificate evidencing the shares of common stock	S-1/A	333-221658	12/4/2017	4.1	
4.2	Description of Securities of the Registrant					✓
10.1#	Form of Indemnification Agreement between the Registrant and its executive officers and directors	S-1	333-221658	11/17/2017	10.1	
10.2#	2003 Stock Incentive Plan, as amended	S-1	333-221658	11/17/2017	10.2	
10.3#	Form of Incentive Stock Option Agreement under 2003 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.3	
10.4#	Form of Nonstatutory Stock Option Agreement under 2003 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.4	
10.5#	Form of Restricted Stock Agreement under 2003 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.5	
10.6#	2011 Stock Incentive Plan, as amended	S-1	333-221658	11/17/2017	10.6	
10.7#	Form of Incentive Stock Option Agreement under 2011 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.7	
10.8#	Form of Nonstatutory Stock Option Agreement under 2011 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.8	
10.9#	Form of Restricted Stock Agreement under 2011 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.9	
10.10#	Form of Restricted Stock Unit Agreement under 2011 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.10	
10.11#	Form of Stock Appreciation Rights Agreement under 2011 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.11	
10.12#	2017 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.12	
10.13#	Form of Stock Option Agreement under 2017 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.13	

10.14#	Form of Restricted Stock Unit Agreement under 2017 Stock Incentive Plan	S-1	333-221658	11/17/2017	10.14	
10.18	Mortgage, Security Agreement and Financing Statement, dated July 1, 2015, between Casa Properties LLC and Middlesex Savings Bank	S-1	333-221658	11/17/2017	10.18	
10.19	Registration Rights Agreement, dated April 26, 2010, between the Registrant and the investors party thereto	S-1	333-221658	11/17/2017	10.19	
10.20	Credit Agreement, dated as of December 20, 2016, by and among the Registrant and JPMorgan Chase Bank, N.A., as agent, and the other agents, arrangers and lenders party thereto	S-1	333-221658	11/17/2017	10.20	
10.21	Letters, dated as of February 1, 2017 and April 14, 2017, from the Registrant to the lenders party to the Credit Agreement	S-1	333-221658	11/17/2017	10.21	
10.22	Security Agreement, dated as of December 20, 2016, by and among the Registrant, each of the subsidiaries of the Registrant party thereto, and JPMorgan Chase Bank, N.A., as Collateral Agent	S-1	333-221658	11/17/2017	10.22	
10.23†	Master Purchase Agreement, dated October 31, 2013, between Time Warner Cable Enterprises LLC and Casa Systems, Inc., as amended	S-1	333-221658	11/17/2017	10.23	
10.24#	Employment Agreement, dated November 17, 2017, by and between the Registrant and Jerry Guo	S-1	333-221658	11/17/2017	10.24	
10.25#	Employment Agreement, dated November 17, 2017, by and between the Registrant and Lucy Xie	S-1	333-221658	11/17/2017	10.25	
10.26#	Employment Agreement, dated November 17, 2017, by and between the Registrant and Weidong Chen	S-1	333-221658	11/17/2017	10.26	
10.28#	Offer Letter, dated October 10, 2017, by and between the Registrant and Scott Bruckner					✓
21.1	Subsidiaries of the Registrant					✓
23.1	Consent of PricewaterhouseCoopers LLP, Independent Registered Public Accounting Firm					✓
31.1	Certification of Principal Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.					✓
31.2	Certification of Principal Financial Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.					✓
32.1*	Certification of Principal Executive Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.					
32.2*	Certification of Principal Financial Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.					
101.INS	XBRL Instance Document					
101.SCH	XBRL Taxonomy Extension Schema Document					
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document					

101.DEF	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB	XBRL Taxonomy Extension Label Linkbase Document
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document

Management contracts or compensatory plans or arrangements required to be filed as an exhibit hereto pursuant to Item 15(b) of Form 10-K.

† Confidential treatment requested as to certain portions, which portions have been omitted and filed separately with the Securities and Exchange Commission.

* Furnished herewith.

Item 16. Form 10-K Summary.

Not applicable.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this Report to be signed on its behalf by the undersigned, thereunto duly authorized**,** in the Town of Andover, Commonwealth of Massachusetts, on this 27th day of February, 2020**.**

CASA SYSTEMS, INC.

By: /s/ Jerry Guo

Jerry Guo

President, Chief Executive Officer and Chairman

Pursuant to the requirements of the Securities Exchange Act of 1934, as amended, this Report has been signed below by the following persons on behalf of the Registrant in the capacities and on the dates indicated.

Name	Title	Date
/s/ Jerry Guo **Jerry Guo**	President, Chief Executive Officer and Chairman (Principal Executive Officer)	February 27, 2020
/s/ Scott Bruckner **Scott Bruckner**	Interim Chief Financial Officer (Principal Financial Officer)	February 27, 2020
/s/ Matthew Slepian **Matthew Slepian**	Corporate Controller (Principal Accounting Officer)	February 27, 2020
/s/ Lucy Xie **Lucy Xie**	Senior Vice President of Operations and Director	February 27, 2020
/s/ Susana D'Emic **Susana D'Emic**	Director	February 27, 2020
/s/ Bruce R. Evans **Bruce R. Evans**	Director	February 27, 2020
/s/ Michael T. Hayashi **Michael T. Hayashi**	Director	February 27, 2020
/s/ Daniel S. Mead **Daniel S. Mead**	Director	February 27, 2020
/s/ Bill Styslinger **Bill Styslinger**	Director	February 27, 2020

DESCRIPTION OF SECURITIES REGISTERED UNDER SECTION 12 OF THE EXCHANGE ACT

The following description of registered securities of Casa Systems, Inc. (“us,” “our,” “we” or the “Company”) is intended as a summary only and does not purport to be complete. It is subject to and qualified in its entirety by reference to the Company’s Restated Certificate of Incorporation (the “Certificate of Incorporation”), the Company’s By-laws (the “By-laws”), and the applicable provisions of the Delaware General Corporation Law (the “DGCL”). The Certificate of Incorporation and the By-laws are incorporated by reference as Exhibit 3.1 and Exhibit 3.2, respectively, to the Annual Report on Form 10-K of which this Exhibit 4.2 is a part.

Authorized Capital Stock

Our authorized capital stock consists of 500,000,000 shares of common stock, par value $0.001 per share (the “Common Stock”), and 5,000,000 shares of preferred stock, par value $0.001 per share (the “Preferred Stock”). Our common stock is registered under Section 12(b) of the Securities Exchange Act of 1934 (the “Exchange Act”).

Common Stock

Voting Rights. Holders of our Common Stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders and do not have cumulative voting rights. Any matter other than the election of directors to be voted upon by the stockholders at any meeting at which a quorum is present shall be decided by the vote of the holders of shares of stock having a majority in voting power of the votes cast by the holders of all of the shares of stock present or represented at the meeting and voting affirmatively or negatively on the matter, except when a different vote is required by law, the Certificate of Incorporation or the By-laws. An election of directors by our stockholders shall be determined by a plurality of the votes cast by the stockholders entitled to vote on the election.

Dividends. Holders of Common Stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend rights of any series of Preferred Stock that we may designate and issue in the future.

Liquidation, Dissolution and Winding Up. In the event of our liquidation or dissolution, the holders of Common Stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding Preferred Stock.

Other Rights. Holders of Common Stock have no preemptive, subscription, redemption or conversion rights and there are no sinking fund provisions applicable to our Common Stock. The rights, preferences and privileges of holders of Common Stock are subject to and may be adversely affected by the rights of the holders of shares of any series of Preferred Stock that we may designate and issue in the future.

Provisions of Our Certificate of Incorporation and By-laws and the Delaware General Corporation Law That May Have Anti-Takeover Effects

Delaware Law. We are subject to Section 203 of the DGCL. Subject to certain exceptions, Section 203 prevents a publicly held Delaware corporation from engaging in a “business combination” with any “interested stockholder” for three years following the date that the person became an interested stockholder, unless the interested stockholder attained such status with the approval of our board of directors or unless the business combination is approved in a prescribed manner. A “business combination” includes, among other things, a merger or consolidation involving us and the “interested stockholder” and the sale of more than 10% of our assets. In general, an “interested stockholder” is any entity or person beneficially owning 15% or more of our outstanding voting stock and any entity or person affiliated with or controlling or controlled by such entity or person.

Preferred Stock. Under the terms of our Certificate of Incorporation, our board of directors is authorized to direct us to issue shares of Preferred Stock in one or more series without stockholder approval. Our board of directors has the discretion to determine the rights, preferences, privileges and restrictions, including voting rights, dividend rights, conversion rights, redemption privileges and liquidation preferences, of each series of Preferred Stock. The purpose of authorizing our board of directors to issue Preferred Stock and determine its rights and preferences is to eliminate delays associated with a stockholder vote on specific issuances. The issuance of Preferred Stock, while providing flexibility in connection with possible acquisitions, future financings and other corporate purposes, could have the effect of making it more difficult for a third party to acquire, or could discourage a third party from seeking to acquire, a majority of our outstanding voting stock.

Staggered Board; Removal of Directors. Our Certificate of Incorporation and our By-laws divide our board of directors into three classes with staggered three-year terms. In addition, a director may be removed only for cause and only by the affirmative vote of the holders of at least 75% of the votes that all our stockholders would be entitled to cast in an election of directors. Any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, may be filled only by vote of a majority of our directors then in office. The classification of our board of directors and the limitations on the removal of directors and filling of vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of our company.

Supermajority Voting. The DGCL provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or bylaws, unless a corporation's certificate of incorporation or bylaws, as the case may be, requires a greater percentage. Our By-laws may be amended or repealed by a majority vote of our board of directors or the affirmative vote of the holders of at least 75% of the votes that all our stockholders would be entitled to cast in an election of directors. In addition, the affirmative vote of the holders of at least 75% of the votes which all our stockholders would be entitled to cast in an election of directors is required to amend, repeal, or adopt any provisions inconsistent with, any of the provisions of the Certificate of Incorporation described above.

Stockholder Action; Special Meeting of Stockholders; Advance Notice Requirements for Stockholder Proposals and Director Nominations. Our Certificate of Incorporation provides that any action required or permitted to be taken by our stockholders must be effected at a duly called annual or special meeting of such stockholders and may not be effected by any consent in writing by such stockholders. Our Certificate of Incorporation and our By-laws also provide that, except as otherwise required by law, special meetings of our stockholders can only be called by our board of directors. In addition, By-laws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of candidates for election to our board of directors. Stockholders at an annual meeting may only consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors, or by a stockholder of record on the record date for the meeting, who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities. These provisions also could discourage a third party from making a tender offer for our Common Stock, because even if such third party acquired a majority of our outstanding voting stock, it would be able to take action as a stockholder, such as electing new directors or approving a merger, only at a duly called stockholders meeting and not by written consent.

Exclusive Forum Selection. Our Certificate of Incorporation provides that unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall, to the fullest extent permitted by law, be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of fiduciary duty owed by any director, officer or other employee or stockholder of our company to us or our stockholders, (3) any action asserting a claim arising pursuant to any provision of the DGCL or as to which the DGCL confers jurisdiction on the Court of Chancery or (4) any action asserting a claim governed by the internal affairs doctrine. This choice of forum provision will not apply to actions arising under the Exchange Act. Our Certificate of Incorporation further provides that, unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States of America shall, to the fullest extent permitted by law, be the sole and exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act. Although our Certificate of Incorporation contains the forum selection provision described above, there is uncertainty as to whether a court would enforce this provision or conclude that such provision applies to a particular claim or action.

Exhibit 10.28

October 10, 2017 – R1

Mr. Scott Bruckner
[ ]

Dear Scott,

On behalf of Casa Systems, Inc. (the "Company"), I am pleased to set forth the terms of your employment with the Company:

1. You will be employed to serve on a regular, full-time basis as Senior Vice President of Strategy and Corporate Development effective ~~December 4, 2017~~ Nov. 11, 2017 {SB} In this role, you will initially report to Jerry Guo and will impact the organization's corporate development by leading and performing planning and structuring of transactions, negotiations, opportunity identifications and valuations towards achieving growth through mergers & acquisitions, integrations, and divestitures, plus such other duties as may from time to time be assigned to you by the Company.

   This role will not be a remote position. As such, you will be expected to relocate within the first six months of employment with Casa Systems, Inc. to the MA/NH area (within a reasonable commutable distance to/from the Andover facility) to perform this role.

2. Your starting base salary rate will be $17,307.70 paid bi-weekly, which annualized is equivalent to $450,000.20, subject to taxes and other withholdings as required by law. Such salary may be adjusted from time to time in accordance with normal business practice and in the sole discretion of the Company.

3. You will be eligible for an annual performance incentive bonus. Your annual on-target incentive will be 100% of your base annual salary (equivalent to $450,000.20), if all targets are achieved and prorated based on your date of hire, less applicable taxes, deductions, and withholdings. Your actual bonus payout will depend upon Casa Systems financial performance results and the assessment of your individual performance.

4. Your eligibility to be considered for, and the payment of, any incentive is conditional upon you remaining an active employee of the Company, and not having served out notice to terminate your employment prior to receiving payment. Any incentive due to you will be paid on or around the first quarter of the following year.

5. You may participate in any and all bonus and benefit programs that the Company establishes and makes available to its employees from time to time, provided that you are eligible under (and subject to all provisions of) the plan documents governing those programs. The benefits made available by the Company, and the rules, terms and conditions for participation in such programs, may be changed by the Company at any time without advance notice.

6. Subject to the approval of the Board of Directors of the Company and prior to January 15, 2017, the Company will grant to you an initial stock option (the "Option") under the Company's Stock Incentive Plan (the "Option Plan") for the purchase of an aggregate of 75,000 shares of common stock of the Company at a price per share equal to the fair market value at the time of Board approval. The Option shall be subject to all terms, vesting schedules and other provisions set forth in the Option Plan and in a separate option agreement (the "Option Agreement"). Subject to the terms of the Option Agreement, upon the one-year anniversary from the date of the Option grant, 25% of the total Option shall vest and vesting will continue thereafter till the fourth anniversary of the Option grant when all of the Options will have been vested.

7. Starting in 2019, and subject to the approval of the Board of Directors of the Company, the Company will grant to you an annual award for four years (2019, 2020, 2021 and 2022) of Restricted Stock Units ("RSU") under the Company's Stock Incentive Plan with a target valuation of $600,000 ("RSU"). The number of RSUs shall be calculated on the date of grant in accordance with the Company's option valuation practices. The RSUs shall be subject to all terms, vesting schedules and other provisions set forth in the Company's Stock Incentive Plan and in a separate RSU agreement (the "RSU Agreement"). Subject to the terms of the RSU Agreement, upon the one-year anniversary from the date of the RSU grant, 25% of the total RSUs shall vest and vesting will continue thereafter till the fourth anniversary of the RSU grant when all of the RSUs will have been vested.

8. You will be eligible for a maximum of fifteen (15) days of vacation per calendar year subject to proration to your date of hire and to be taken at such times as may be approved by the Company. The number of vacation days for which you are eligible shall accrue at the rate of 4.62 hours per pay period that you are employed during such calendar year.

9. You will be required to execute an Assignment, Invention and Non-Disclosure Agreement and a Non- Competition and Non-Solicitation Agreement in the forms attached as a condition of employment.

10. You represent that you are not bound by any employment contract, restrictive covenant or other restriction preventing you from entering into employment with or carrying out your responsibilities for the Company, or which is in any way inconsistent with the terms of this letter.

11. In accordance with federal law, you will be required to provide the Company with documentation of your identity and eligibility to work in the United States. You agree to provide to the Company, within three days following your hire date, such documentation, as required by the Immigration Reform and Control Act of 1986. Please refer to the I-9 Form enclosed for a list of acceptable documentation. You may need to obtain a work visa in order to be eligible to work in the United States. If that is the case, your employment with the Company will be conditioned upon your obtaining a work visa in a timely manner as determined by the Company.

12. This letter shall not be construed as an agreement, either expressed or implied, to employ you for any stated term, and shall in no way alter the Company's policy of "employment at will", under which both you and the Company remain free to terminate the employment relationship, with or without cause, at any time, with or without notice. Similarly, nothing in this letter shall be construed as an agreement, either express or implied, to pay you any compensation or grant you any benefit beyond the end of your employment with the Company.

If you agree with the initial terms of your employment with the Company as set forth in this letter, please sign in the space provided below, enter your start date, and return a copy by email to [ ] in Human Resources. If you choose not to accept this offer by **Thursday, October 12, 2017,** the offer will be revoked.

Please plan on being available at 9:30AM on your first day of employment for orientation in Andover with [ ], Human Resources Administrator. Your manager will be available following orientation to assist you with your initial introduction and assimilation to Casa Systems.

Very Truly Yours,

By: /s/ Lucy Xie________________
Name: Lucy Xie
Title: Senior Vice President

The foregoing correctly sets forth the initial terms of my at-will employment by Casa Systems, Inc.

/s/ Scott Bruckner____________________________ Date:__Oct 18, 2017___________
Name: Scott Bruckner

Start Date: __~~December 4, 2017~~ Nov. 11, 2017 {SB}__

Enclosures: Assignment, Invention and Non-Disclosure Agreement
Non-Competition and Non-Solicitation Agreement
Benefits Summary
I-9 Form

Exhibit 21.1

Subsidiaries of Casa Systems, Inc.

Name of Subsidiary	Jurisdiction of Incorporation or Organization
Casa Communications Limited	Ireland
Casa Communications Technology S.L.	Spain
Casa Properties LLC	Delaware
Casa Systems B.V.	Netherlands
Casa Systems Canada Ltd.	Quebec, Canada
Casa Systems SAS	France
Casa Systems Securities Corporation	Massachusetts
Guangzhou Casa Communication Technology LTD	China
Casa Communications SAS	Colombia
Casa Technologies Limited	Hong Kong
Casa technologies Pty Ltd	Australia
Casa Communications Holdings Pty Ltd	Australia
NetComm Wireless Limited	Australia
Call Direct Cellular Solutions 2003 Pty Ltd	Australia
C10 Communications Pty Ltd	Australia
NetComm Wireless Limited (NZ)	New Zealand
NetComm Wireless Limited Canada	Canada
NetComm Wireless Limited (UK)	United Kingdon
NetComm Wireless, Inc.	United States of America
NetComm Germany	Germany

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statement on Form S-8 (Form 333-222073) of Casa Systems Inc. of our report dated February 27, 2020, relating to the consolidated financial statements, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
February 27, 2020

Exhibit 31.1

CERTIFICATION PURSUANT TO
RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Jerry Guo, certify that:

1. I have reviewed this Annual Report on Form 10-K of Casa Systems, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the Registrant as of, and for, the periods presented in this report;

4. The Registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the Registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the Registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the Registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the Registrant's internal control over financial reporting that occurred during the Registrant's most recent fiscal quarter (the Registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the Registrant's internal control over financial reporting; and

5. The Registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the Registrant's auditors and the audit committee of the Registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the Registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the Registrant's internal control over financial reporting.

Date: February 27, 2020

By: /s/ Jerry Guo
Jerry Guo
President, Chief Executive Officer and Chairman

Exhibit 31.2

CERTIFICATION PURSUANT TO RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934, AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Scott Bruckner, certify that:

1. I have reviewed this Annual Report on Form 10-K of Casa Systems, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the Registrant as of, and for, the periods presented in this report;

4. The Registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the Registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the Registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the Registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the Registrant's internal control over financial reporting that occurred during the Registrant's most recent fiscal quarter (the Registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the Registrant's internal control over financial reporting; and

5. The Registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the Registrant's auditors and the audit committee of the Registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the Registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the Registrant's internal control over financial reporting.

Date: February 27, 2020

By: /s/ Scott Bruckner
Scott Bruckner
Interim Chief Financial Officer

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K of Casa Systems, Inc. (the “Company”) for the period ended December 31, 2019, as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Jerry Guo, as President, Chief Executive Officer and Chairman of the Company, hereby certify, as of the date hereof, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge, the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, and the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company at the dates and for the periods indicated.

Date: February 27, 2020

By: /s/ Jerry Guo
Jerry Guo
President, Chief Executive Officer and Chairman

Exhibit 32.2

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K of Casa Systems, Inc. (the “Company”) for the period ended December 31, 2019, as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Scott Bruckner, as Interim Chief Financial Officer of the Company, hereby certify, as of the date hereof, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge, the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, and the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company at the dates and for the periods indicated.

Date: February 27, 2020	By:	/s/ Scott Bruckner
		Scott Bruckner
		Interim Chief Financial Officer