

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION**

Washington, DC 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, 2018

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: 001-34674

Calix, Inc.

(Exact Name of Registrant as Specified in Its Charter)

Delaware

(State or Other Jurisdiction of
Incorporation or Organization)

2777 Orchard Parkway
San Jose, California
(Address of Principal Executive Offices)

Registrant's telephone number, including area code (408) 514-3000

68-0438710

(I.R.S. Employer
Identification No.)

95134
(Zip Code)

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

<u>Title of each class</u>	<u>Name of each exchange on which registered</u>
Common Stock, \$0.025 par value	The New York Stock Exchange

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 Section 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 if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a 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	<input type="checkbox"/>	Accelerated Filer	<input checked="" type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>	Smaller Reporting Company	<input type="checkbox"/>
Emerging Growth Company	<input type="checkbox"/>		

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 Common Stock held by non-affiliates of the registrant based upon the closing sale price on the New York Stock Exchange on June 29, 2018, the last business day of the Registrant's most recently completed second fiscal quarter, was approximately \$346 million. Shares held by each executive officer, director and by each other person (if any) who owns more than 10% of the outstanding common stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

As of February 25, 2019, the number of shares of the registrant's common stock outstanding was 54,040,657.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement for its 2019 annual meeting of stockholders are incorporated by reference in Items 10, 11, 12, 13 and 14 of Part III.

Calix, Inc.
Form 10-K
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SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This report includes forward-looking statements that involve substantial risks and uncertainties. All statements other than statements of historical facts contained in this report, including statements regarding Calix's future financial position, business strategy and plans and objectives of management for future operations, are forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as "believe," "could," "expect," "may," "estimate," "continue," "anticipate," "intend," "should," "plan," "predict," "will," "would," "project," "potential" or the negative of these terms or other similar expressions. Forward-looking statements include Calix's expectations concerning the outlook for its business, productivity, plans and goals for future operational improvements and capital investments, operational performance, future market conditions or economic performance and developments in the capital and credit markets and expected future financial performance.

Forward-looking statements involve a number of risks, uncertainties and assumptions, and actual results or events may differ materially from those projected or implied in those statements. Important factors that could cause such differences include:

- our ability to predict our revenue and reduce and control costs related to our products or service offerings, including larger scale turnkey network improvement projects that may span several quarters;
- our ability to increase our sales to larger communications service providers, or CSPs, globally;
- the capital spending patterns of CSPs, and any decrease or delay in capital spending by CSPs due to macro-economic conditions, regulatory uncertainties, or other reasons;
- the impact of government-sponsored programs on our customers and the impact to our customers of the recent U.S. government shutdown;
- intense competition;
- our ability to develop new products or enhancements that support technological advances and meet changing CSP requirements;
- our ability to ramp sales and achieve market acceptance of new our products and CSPs' willingness to deploy our new products;
- the concentration of our customer base as well as our dependence on a limited number of key customers;
- the length and unpredictability of our sales cycles and timing of orders;
- our lack of long-term, committed-volume purchase contracts with our customers;
- our exposure to the credit risks of our customers;
- fluctuations in our gross margin;
- the interoperability of our products with CSP networks;
- our dependence on sole-, single- and limited-source suppliers;
- our ability to manage our relationships with our third-party, including contract manufacturers, or CMs, original design manufacturers, or ODMs, logistics providers, component suppliers and development partners;
- our ability to forecast our manufacturing requirements and manage our inventory;
- our products' compliance with industry standards;
- our ability to expand our international operations;
- our ability to protect our intellectual property and the cost of doing so;
- the quality of our products, including any undetected hardware defects or bugs in our software;
- our ability to estimate future warranty obligations due to product failure rates;
- our ability to obtain necessary third-party technology licenses at reasonable costs;
- the regulatory and physical impacts of climate change and other natural events;
- the attraction and retention of qualified employees and key management personnel;
- our ability to build and sustain an adequate and secure information technology infrastructure; and
- our ability to maintain proper and effective internal controls.

Calix cautions you against placing undue reliance on forward-looking statements, which reflect our current beliefs and are based on information currently available to us as of the date a forward-looking statement is made. Forward-looking statements set forth in this Annual Report on Form 10-K speak only as of the date of its filing. We undertake no obligation to revise forward-looking statements to reflect future events, changes in circumstances or changes in beliefs. In the event that we do update any forward-looking statements, no inference should be made that we will make additional updates with respect to that statement, related matters or any other forward-looking statements.

PART I

ITEM 1. Business

Company Overview

Calix, Inc. (together with its subsidiaries, “Calix,” “we,” “our” or “us”) was incorporated in August 1999 and is a Delaware corporation. Calix is a leading global provider of cloud and software platforms, systems and services required to deliver the unified access network and smart premises of tomorrow. Our mission is to connect everyone and everything. Calix platforms empower our customers to build new business models, rapidly deploy new services and make the promise of the smart home and business a reality. Innovative communications service providers, or CSPs, rely on Calix platforms to help them master and monetize the complex infrastructure between their subscribers and the cloud. Our platforms and services help our customers build next generation networks by embracing a DevOps operating model, optimizing the subscriber experience by leveraging big data analytics and turning the complexity of the smart home and business into new revenue streams.

We are the pioneer in software defined access, or SDA, and our portfolio of solutions is designed to help CSPs meet emerging threats from web-scale players and reinvent how they serve their device-enabled subscribers. Our platforms enable our customers to capitalize on the opportunity that is being generated by the Internet of Things, or IoT, augmented and virtual reality applications and autonomous technologies. Our customers, who are embracing our strategic platforms, recognize that providing a sensational subscriber experience, via an infrastructure that is Always On, can be enhanced at a DevOps pace and is intelligent enough to run itself, enables them to compete in the future. We also provide cloud analytics designed to help service providers create and market new offerings that monetize their investments in the network. Finally, we strive to put our customers and their brands first to ensure that they will always have a central place in their subscribers’ lives. Our solution strategy is intended to help our customers build and reinforce their brand presence within their subscribers’ premises. We believe this must be an element of their strategy for sustaining and growing their businesses.

Our current customers include CSPs of almost every size and type. Our solutions may be used by any entity providing communications services to a subscriber. This universe includes local and competitive exchange carriers, cable multiple system operators, or cable MSOs, wireless internet service providers, or wireless ISPs, overbuilders such as municipalities and electric cooperatives, hospitality providers and others globally. We market and sell our portfolio to CSPs globally through our direct sales force as well as in partnership with a number of resellers. We have enabled over 1,500 customers to deploy passive optical, Active Ethernet and point-to-point Ethernet fiber access networks.

Industry Background and Trends

CSPs compete in a rapidly changing market to deliver a range of services to their residential and business subscribers. Subscribers purchase an array of services from providers, starting with basic voice and data through advanced broadband services such as high-speed Internet, Internet protocol television, or IPTV, mobile broadband, high-definition, ultra-high-definition and over-the-top video and online gaming from a variety of CSPs. Consumers are also rapidly adding devices that require high bandwidth, low latency services such as virtual and augmented reality as well as IoT devices that bring significant complexity to the premises network. It is likely that adoption of autonomous technologies such as self-driving cars will dramatically increase demand and complexity.

The rapid growth in new technologies is generating increased network traffic and putting pressure on CSPs to cost effectively upgrade and enhance their networks to meet demand. For example, Cisco Systems, Inc. estimates that global Internet Protocol, or IP, traffic on a monthly basis will increase from 122 exabytes in 2017 to 396 exabytes in 2022, representing a compound annual growth rate of 26%. By 2022, 81% of IP traffic will originate from non-personal computer devices. The impact of video service on network traffic will become even more pronounced with the introduction of ultra-high-definition video streaming. For example, an Internet-enabled high-definition television that draws 2 hours of content per day generates as much traffic as an entire typical household today. Combined with the growth of video viewing on smartphones and tablets, demands on the network will continue to accelerate. The proliferation of new devices (and usage patterns) creates a tremendous opportunity and increases the pressure on CSPs to offer new services and create revenue streams by mastering the complexity of the smart home and business for their subscribers.

The Emergence of Web-Scale Players as a Competitive Force

The level of competition among CSPs - wireline and wireless service providers, cable MSOs and other CSPs - has increased over the last decade as traditional service boundaries have fallen. All providers are now competing for the same residential and business subscribers using similar types of IP-based services. The explosion of new technologies in the subscriber premises creates significant new opportunities for all CSPs. Technology innovators of all types and sizes are moving aggressively to seize that opportunity. Perhaps the most significant recent change in the competitive dynamic across the communications

industry is the aggressive entrance of web-scale players into subscribers' homes and businesses via interactive smart home hubs and devices. These entrants, such as Amazon, Google and Microsoft, are extending their current platforms (e.g., data driven search, e-commerce) into subscriber premises with new devices and services that are helping to reshape the home environment. The simplicity of operating these devices, as well as their use of data, enables these web-scale players to rapidly deploy new services and command a central place in the subscriber's daily life. The level of insight that they generate by mining user data, coupled with their DevOps business model, positions them to offer and deploy services to subscribers at pace that traditional CSP operating and business models cannot match.

To address this challenge and establish control of the device-enabled subscriber, we believe CSPs must respond by leveraging analytical tools that utilize network data and subscriber behavioral data to tailor services that meet the individual subscribers' needs. These services include high-bandwidth packages, managed Wi-Fi, whole home Wi-Fi and smart home and business services. We believe these new services represent the CSP's greatest opportunity to create new revenue streams and higher average revenue per user, or ARPU, while reducing subscriber churn. CSPs must also mine network and subscriber data to streamline and automate subscriber facing functions such as customer service. These data-driven approaches can significantly reduce service costs, improve profitability and support investment in new services and technologies. Increasingly, companies in the communications space will embrace strategies that apply machine learning and artificial intelligence technologies that promise to dramatically improve the subscriber experience, build subscriber intimacy and loyalty, while increasing ARPU. By leveraging data to build a tighter bond with their subscribers and deliver high-value services, CSPs can more effectively meet the challenge presented by web-scale players.

The Rise of Smart Premises

We believe 2018 was the tipping point for the smart home market. IoT, virtual reality and other connected devices have become mainstream for many consumers and they are increasingly prevalent in subscriber premises. Worldwide, the smart speaker installed base is expected to reach more than 225 million units by 2020 according to Canalys. IDC anticipates a compound annual growth rate of 18.5% as the smart home market balloons to 939.7 million devices shipped in 2022. Finally, according to Statista, the average annual revenue per installed smart home amounts to \$186. Leading technology players such as Amazon and Apple recognize this new business opportunity, and they have created significant new smart premises offerings. This trend exacerbates the significant disruption to CSP business models already created by "over-the-top" services like Netflix, Facebook and YouTube.

To improve performance and coverage throughout their homes, many subscribers are purchasing Wi-Fi routers and gateways via consumer channels and introducing them into the home network. Since these consumer products do not provide carrier class management capabilities that enable remote diagnostics, management and troubleshooting, performance issues can create satisfaction issues for the subscriber and a cost burden for the service provider. The introduction of smart devices into the home is accelerating the scale and complexity of these management challenges for CSPs. According to Parks Associates, nearly 50% of smart home device owners reported issues setting up their devices. Increasingly, subscribers view any device that is connected to the home network as the purview and responsibility of their CSP regardless of what the device is or where they may have purchased it. When these issues arise, subscribers typically contact their CSPs for help.

Recognizing that many subscribers see the CSP as the logical source of insights and services that enable the smart home and business, innovative CSPs are developing strategies and business models that embrace these new technologies via carrier class premises systems. Over the last year, several of the largest and most innovative CSPs have announced strategies that incorporate the latest technologies such as voice interaction and IoT connectivity into their service offerings for subscribers. By leveraging cloud management technologies and developing a proactive strategy for smart device connectivity, voice interaction, security and premises system instrumentation, CSPs can position themselves as the critical enabler of the smart home and business. Winners will embrace software platforms that enable all of these capabilities and premises systems that provide a foundation for turning the current burden of the smart home into new services and revenue streams.

The Shift to a DevOps Business Model

Access networks directly and physically connect the residential or business subscriber to the CSP's data center, central office or similar facilities and create the on-ramp to the Internet. The access network is critical for service delivery as it governs the bandwidth capacity, service quality available to subscribers and ultimately the services and experience CSPs can provide to subscribers. Providing differentiated, high-quality, high-speed connectivity has become increasingly critical for CSPs to retain and expand their subscriber base and launch new revenue-generating services. To meet the demands of device-enabled subscribers, CSPs are starting to deploy access technologies that are software defined and leverage next generation Passive Optical Network, or PON, architectures such as NG-PON2, XGS-PON and 10G EPON. In doing so, they will address many of limitations of legacy access systems:

- Limited capacity of outdated access architectures - Network architectures have physical limitations in their ability to scale bandwidth, avoid latency issues and deliver the advanced broadband services subscribers demand today and are expected to increasingly demand in the future.
- Inflexible networks that constrain subscriber offerings – Networks were designed to support a narrow range of services, and as a result, they limit the ability of CSPs to deploy the advanced broadband services increasingly demanded by their subscribers.
- Expensive to deploy and operate – With a wide variety of equipment installed, networks require significant downtime and labor for maintenance and upgrades, thereby placing a significant and recurring capital and operating expense burden on CSPs.
- Back-office systems that inhibit deployment of new services - Traditional methods for operationalizing new products and services often require significant testing and lengthy back-office integration activities. This often places CSPs at a competitive disadvantage relative to emerging service providers that are leveraging agile management practices.

By replacing traditional hardware functions with SDA, as well as software defined networking, or SDN, CSPs can overcome these operational challenges and bring new products and services to market faster. Many CSPs are embracing SDA and SDN to help accelerate innovation, deploy automation, bring agility to their network and significantly reduce service disruptions. By embracing standards-based, modular software platforms that abstract software functions from hardware, CSPs can free themselves from a dependence on specific hardware technologies and upgrade their access network to enable a DevOps business model. The winning service providers of the future will embrace SDA platforms and transform their access networks into a competitive weapon. Ultimately, this new model will enable CSPs to manage a complete range of access systems across every deployment scenario (e.g., central office, head-end, cabinet, mounted on a pole) in a consistent manner. With this shift they will introduce services at a pace that can then match the speed of the web-scale players.

The Imperative to Develop Lean Operating Models

CSPs face a dual challenge in the coming years - mounting competitive pressure and the requirement to increase their investments in technologies that can deliver the new services that their subscribers demand. Most will need to make shifts in their operating models to thrive in the coming decade. They must implement a lean operating model that reduces the overall operating cost to run the network and deliver services to subscribers at an accelerated pace as well as at a significantly lowered cost. The adoption of new technologies that provide automation and intelligence, such as SDA, will help service providers adopt agile operating models and reduce the burden of network and back-office operations.

The Deployment of 5th Generation, or 5G, Networks

As subscribers adopt next generation mobile applications and technologies, the demand for higher bandwidth, lower latency and dramatically higher device densities is accelerating. Because existing LTE mobile networks are increasingly challenged to meet these demands, many CSPs are announcing and moving to deploy 5G mobile networks that promise dramatically greater performance and capabilities for mobile and fixed broadband services. 5G is significantly different from previous generations in the mobile evolution because it delivers higher bandwidth (10 Gbps per radio), lower latency (less than 1 msec) and supports a dramatically greater number of connections (1 million devices per km²). By leveraging higher frequency spectrum and more efficient data encoding, 5G offers CSPs a path to differentiate their services and shift the competitive landscape. CSPs are pursuing two major strategies to deploy 5G capabilities across their networks:

- **Upgrading existing LTE infrastructure** - By upgrading their existing LTE wireless networks with 5G radios, CSPs will realize 10 to 20 percent higher bandwidth for 5G mobile devices. This approach will offer a quick path to 5G services for some CSPs and may differentiate their mobile broadband services. However, this incremental strategy offers relatively limited improvements in wireless capacity.

- **Leveraging millimeter wavelength technology** - Leading CSPs will deploy thousands of millimeter wave 5G small cells to realize a 5- to 10-fold increase in capacity across their mobile and fixed broadband networks. This approach will enable CSPs to support virtually any next generation mobile, augmented or virtual reality, IoT or autonomous vehicle or device application. This will open up tremendous new business opportunities for early adopters. Due to the inherent range limitations of millimeter wave technology, 5G small cells must be deployed in very close proximity to subscriber devices. This will require the deployment of thousands of 5G small cells throughout a CSPs network to deliver services to subscribers.

With the adoption of 5G millimeter wavelength technology, CSPs will require transport that is both very capable and economically efficient. CSP cell networks will ultimately come to resemble high-density broadband access networks that leverage high-bandwidth, reliable fiber transport. To make the economics work, CSPs will ultimately need to embrace fiber efficient point-to-multi-point capabilities offered by NG-PON2 that include:

- Aggregated 10 gigabit services delivered over a single wave length;
- Channel bonding to increase capacity delivered for a single service; and
- Multiple wave lengths over a single PON to provide unmatched resiliency and low latency operations.

While 5G networks will be significantly more capable, the deployment of thousands of radio stations will introduce significant operational complexity for CSPs. As a result, 5G will accelerate the imperative for CSPs to adopt SDA technologies that simplify network operations and architectures. CSPs will also need to embrace advanced premises systems that exploit the capabilities delivered by 5G fixed wireless access networks to deliver an exceptional subscriber experience.

The Role of Governments in Supporting Technology Investment

As CSPs face increasing competitive pressure, they must accelerate their investments to upgrade their access networks and deploy new subscriber facing technologies. Governments around the world recognize the importance of expanding broadband networks and delivering advanced broadband services to more people and businesses. As a result, many governments have established stimulus programs or other incentives for broadband investment.

In the United States, programs like the Connect America Fund, or CAF, and E-Rate provide billions of dollars each year to CSPs in the form of capital investment incentives, grants and loans to encourage broadband network investment in unserved or underserved communities and schools. For example, in 2015, the CAF program was authorized to distribute \$1.5 billion per year through 2020 to offset the costs of installing and operating CSP operated broadband and voice networks for large service providers in the United States. In 2016, this program was extended to smaller service providers to distribute \$2.0 billion annually over the next 10 years to offset the costs of installing and operating CSP operated broadband and voice networks. In order to promote greater accountability, in 2019 the Federal Communications Commission established a uniform framework for measuring the speed and latency performance for recipients of CAF. CSPs who wish to continue leveraging this program must seek new solutions that enable them to report and demonstrate their ability to meet the requirements established by this new framework. In addition, the E-Rate program was authorized to offer \$1.5 billion in grants to build gigabit capable network connections to schools. The E-Rate program targeted at networks is funded at its current level indefinitely.

The Canadian Radio-television and Telecommunications Commission in 2016 created a fund targeted at increasing broadband coverage and speeds that made available up to \$750 million over the next five years, and the European Commission is pursuing similar goals via its Connecting Europe Facility and other programs.

There are also increasing investments being made by governments at the state level. Programs such as Minnesota’s Border-to-Border Grant Program (\$20 million in 2017), Tennessee’s Broadband Accessibility Act (\$45 million over three years) and New York’s Broadband for All Program (\$500 million over three years) have created grant programs that encourage investments in broadband to unserved areas. These state level programs will complement national programs and increase investment in unserved and underserved areas.

With the increasing importance of broadband connectivity and the evolution of the smart home and business market, we expect this investment focus to continue and potentially increase to accommodate higher service tiers. World-class connectivity and services are becoming essential capabilities for individuals, as well as businesses and nations, who strive to remain economically competitive in an increasingly global and connected marketplace.

Strategy Overview

We believe that many CSPs can and will evolve to providing the most relevant services and experience to their subscribers. Today, many CSPs command a privileged and strategic position in their subscribers’ premises. They provide a service that is becoming a necessity for most subscribers. With significant new technologies coming into the marketplace, the opportunities to generate new revenue streams are manifold. However, the journey from connectivity provider to essential provider of high

bandwidth Wi-Fi and services for the smart home and business will require significant transformation for most CSPs. Our strategy is to position Calix as the essential provider of platforms and services that enable this transformation. The principal elements of our strategy are:

Increase Focus on Our Strategic Platforms - Our strategy centers on increasing the market adoption of our three strategic platforms - Calix Cloud, EXOS (Experience eXtensible Operating System) and AXOS (Access eXtensible Operating System).

- Calix Cloud is a role-based analytics platform that leverages network data and subscriber behavioral data to deliver analytics and intelligence to communications professionals via role-specific dashboards. Calix Cloud provides the subscriber analytics that enable a CSP to deliver targeted marketing, services and experiences to build customer intimacy and loyalty. Calix Cloud currently includes Calix Marketing Cloud for CSP marketing teams and Calix Support Cloud for CSP customer support teams.
- EXOS is a carrier class smart home and business operating system that supports residential, business and mobile subscribers. EXOS, coupled with our market leading GigaSpire premises systems, provides a unique “service enablement platform” that is designed for mastering and monetizing the complexity of the subscriber edge. EXOS enables CSPs to elevate every aspect of their business by deploying smart home and business services and generate new revenue streams.
- AXOS is an operating system for access networks that allows a service provider to deliver all services on a single, elastic, converged access network that is always on, simple to operate and quick to deploy. AXOS, coupled with our E-Series systems, provides a unique platform for the software defined access network that enables CSPs to transform their business processes and deliver new services at DevOps speed. Armed with AXOS, CSPs can radically simplify their network operations, their network architectures and their business models.

Extend Portfolio of Calix Services – Our services team helps CSPs define their transformation strategy, build new skills, implement new technologies and deploy new subscriber services. Calix Services address a CSP’s entire network and service delivery lifecycle. We have recently extended the scope of our service offerings with new managed services for Remote Network Monitoring. These services allow CSPs to benefit directly from our experience working with thousands of service providers to optimize their operations and leverage our advanced analytics to radically improve the operational efficiency of their teams.

Engage Directly with Customers – Calix continues to invest in our direct sales capabilities to ensure that we engage deeply with our customers to help them understand the differentiable value that our platforms provide. As an innovator and a market leader, it is important that our sales and solution engineering resources continually drive the adoption of our strategic platforms. As we deploy new solutions, we are building the expertise of our team by adding specialized resources with deep expertise in areas such as marketing, smart home services and network operations. Our direct model is complemented with selective programs for Calix Channel Partners who have established local market expertise, demonstrated the ability to generate new market opportunities and supported sales of cutting-edge technologies.

Expand Customer Footprint Across Our Expanded Total Addressable Market – Our diverse and growing customer footprint is a critical source of our growth as we expand our portfolio and sell additional platforms to both new and existing customers. Our platforms are dramatically expanding our total addressable market, and as such we intend to build on our recent momentum in penetrating service provider segments where our current share is relatively low (e.g., cable MSOs, large CSPs and international markets) and continue to engage emerging providers who are creating entirely new customer segments (e.g., fiber overbuilders, utilities, municipalities and hospitality).

Pursue Strategic Relationships – We expect to continue to pursue strategic technology and distribution relationships, alliances and acquisitions that help us align with CSPs’ strategic priorities. We continue to invest to ensure interoperability across the ecosystems that support our customers’ most critical business processes through our Calix Compatible Program. This program has dozens of technology members and it is designed to enable our customers to rapidly deploy qualified solutions globally. We are also adding new ecosystem partners such as Infosys and Amazon Alexa Voice Services. By adding their solutions to our platform ecosystem, Calix is significantly enhancing the value that our platforms deliver to CSPs and their subscribers.

Portfolio Overview

By embracing open, modular, standards-based strategies, we provide intelligence and flexibility across a CSP’s entire network – from their data centers to their subscribers’ connected devices. Calix platforms are designed to provide our customers the agility that they need to offer the managed services that their subscribers demand. While we continue to support our non-AXOS and non-EXOS systems and our traditional cloud and software products, we are focused on driving the evolution and market penetration of our strategic platforms and services.

The Calix portfolio allows for a broad range of subscriber services to be provisioned and delivered over a single unified network. These systems can deliver voice and data services, advanced broadband services, mobile broadband, as well as high-definition video and online gaming. Our ultimate goal is to help CSPs radically simplify their network operations, network architectures and business operations as they offer new services. Our premises systems allow CSPs to master the complexity of the smart home and business and offer new services to their device-enabled subscribers. Furthermore, our goal is to help CSPs elevate every aspect of their business - their brand, their service quality, their subscriber experience and their revenue streams. All of these platforms and systems can be monitored, analyzed, managed and supported by Calix Cloud.

Representation of how Calix platforms and services support a CSP's entire network:



Calix Cloud Platform

Calix Cloud is an analytics platform that leverages network data and subscriber behavioral data to deliver intelligence to communications professionals via role specific dashboards. Calix Cloud provides customer support personnel with troubleshooting dashboards and tailored analytics that reduce call volumes, reduce call times and lower “truck rolls”. Calix Cloud provides marketing personnel with segmentation dashboards and tailored analytics that reduce churn, increase ARPU and improve marketing return on investment. Calix Cloud transforms insights into action for CSPs, enabling them to:

- **Analyze:** Calix Cloud allows CSPs a deeper understanding of their subscribers and their satisfaction. As a result, CSPs can directly address churn risk and improve marketing campaigns.
- **Engage:** Calix Cloud provides CSPs real-time insights into network issues, allowing CSPs to be responsive in resolving issues and offering solutions.
- **Grow:** Calix Cloud analytics combine multiple information sources to build a full picture of subscribers, which can enable higher marketing success rates.

Calix Cloud is currently composed of two subscription-based offerings that complement each other to provide a powerful platform that CSP employees utilize within their daily work flows to increase the effectiveness of their marketing campaigns, address support issues and improve the subscriber experience.

Representation that summarizes the primary benefits delivered by Calix Cloud:



Calix Marketing Cloud (CMC) – CMC enables marketers to move away from a one-size-fits-all approach to marketing and deliver personalized campaigns. CMC provides insights regarding subscriber behavior including website visits, social channel engagement, device usage and bandwidth consumption. CMC also helps CSPs identify subscribers who are experiencing service issues and exhibiting behaviors that correlate with higher churn rates (e.g., running speed tests). By delivering these insights through intuitive segmentation dashboards and tailored analytics, CMC helps CSPs deliver the right message, at the optimal time, via the optimal channel. CMC enables CSPs to adopt data-driven strategies to effectively compete with web-scale players.

Calix Support Cloud (CSC) – Recent Calix studies demonstrate that a large portion of support calls result from Wi-Fi performance issues. Since Wi-Fi related support calls take approximately three times as long to complete as the average support call, reducing these calls can significantly improve operational efficiency. CSC enables more informed and efficient conversations between CSP customer service representatives and their subscribers. Support personnel utilize troubleshooting dashboards and tailored analytics that are built directly into their work flows to quickly identify issues with network, devices and Wi-Fi performance. Once the issues are identified, many can be resolved via CSC with a simple click of a button. Recent enhancements to CSC include automation capabilities that can fix many common issues without any manual intervention. We intend to incorporate more advanced machine learning and artificial intelligence capabilities into CSC to help CSPs optimize their support processes and improve subscriber experiences.

We have recently augmented the capabilities of Calix Cloud to help CSPs analyze smart home device and service adoption and performance across their subscriber base. These capabilities provide the intelligence that is required to craft targeted campaigns for marketing smart home offerings and managing smart device performance in the subscriber premises. Complexity is an inherent characteristic of the smart home and business. We believe that the intelligence provide by the Calix Cloud is rapidly becoming a necessity for any CSP entering the smart home and business market.

Calix Cloud software is hosted in a cloud data center, and Calix offers an array of support, customer success and service offerings that are designed to ensure rapid deployment and easy adoption of Calix Cloud.

EXOS Platform

EXOS is a carrier class premises operating system and software platform that supports residential, business and mobile subscribers. EXOS is the first premises operating system that is designed to help CSPs elevate every aspect of their business by rapidly deploying new services for the smart home and business. EXOS incorporates a software model that is standards-based, fully abstracted from the hardware and always-on. Thanks to the unique architecture of EXOS, CSPs can offer new subscriber services and master the complexity of the subscriber edge. Armed with EXOS, CSPs can select and rapidly deploy smart home services such as cloud-enabled voice services, IoT services and parental controls. EXOS is the foundation of our Calix Smart Home and Business Solution that includes our recently launched GigaSpire premises gateway family, Calix Cloud and the Calix Solutions Exchange. When combined with these capabilities, EXOS offers a unique and powerful services enablement platform.

Representation that summarizes the primary benefits delivered by EXOS and the Calix Smart Home and Business Solution:



EXOS is architected to abstract software functionality from the underlying system-on-chip in premises gateways. The EXOS abstraction layer isolates applications and management software from the Linux kernel and low-level chipset functions, regardless of the hardware deployed for specific residential and business use cases. This architecture simplifies software updates and streamlines operational processes. The EXOS abstraction layer also ensures the delivery of a consistent subscriber experience regardless of the specific hardware deployed to subscribers. EXOS leverages Linux containers that provide complete flexibility to CSPs when they deploy application packages to create new revenue streams. The Linux containers also offer an ideal environment for third-party software vendors to add their applications to the EXOS ecosystem via the Calix Solutions Exchange. This “containerized” architecture also ensures that new applications may be deployed without the requirement to regression test the entire applications portfolio running on the system. This approach accelerates time to market for new services.

The EXOS management plane is decoupled and centralized, enabling CSPs to manage all applications simultaneously, even if applications are installed independently. The EXOS architecture ensures that subscribers receive an “always on” service and benefit from application updates without the need to “re-boot” their premises systems or schedule service visits. The Microservices Aggregation Platform, or MAP, that supports EXOS captures data from every system or activity across a subscriber base. As CSPs deploy EXOS they can leverage this data for performance analytics, subscriber experience insights, marketing, maintenance and the application of artificial intelligence for predictive modeling.

Because EXOS is fully abstracted from the underlying hardware, it provides CSPs with the flexibility to offer services on the hardware of their choice. Many of the largest CSPs develop their own, bespoke premises hardware for their subscribers. For CSPs who elect to develop their own hardware, EXOS is an ideal software platform for delivering smart home services faster than their competition. To meet the needs of service providers who desire a fully integrated solution, EXOS is available on the GigaSpire family of hardware. The GigaSpire is currently available in two models - the GigaSpire BLAST and the GigaSpire MAX.

As the first carrier-class Wi-Fi 6 (802.11ax) systems, both GigaSpire models provide unsurpassed bandwidth throughput and wireless coverage across the subscriber premises. By integrating the latest Multi-User, Multiple-input and Multiple-output (MU-MIMO) technology, the GigaSpire is capable of supporting up to eight simultaneous, symmetrical data streams to dramatically expand network capacity and improve efficiency. The latest security capabilities are integrated into the GigaSpire at both the hardware and software levels. With Physical Unclonable Functions (PUF) integrated into the chipset, the GigaSpire can create a digital “fingerprint” for each system that can't be replicated or “spoofed”. These capabilities ensure network authentication at the gateway. The advanced instrumentation built into the GigaSpire also provides telemetry, performance and behavioral analytics that CSPs can leverage through the Calix Cloud to ensure that performance is optimized across the network and at the device level.

The GigaSpire MAX is a smart home service enablement platform designed to master the complexity of the subscriber edge and provide universal IoT support. The GigaSpire MAX integrates the latest IoT protocols - Zigbee, Z-Wave, combo Bluetooth Low-Energy and Bluetooth Classic. This integration enables a CSP to offer the IoT services of their choice from the major IoT

brands or through their own branded IoT bundles and packages. The GigaSpire MAX offers fully integrated Alexa Voice Services, or AVS. With AVS, CSPs can offer the world's leading cloud-enabled voice service and deliver an experience that meets growing subscriber expectations for voice interaction. As their subscribers interact directly with the EXOS powered GigaSpire Smart Home system, the CSP's brand is brought into a central place in the subscriber's experience - reinforcing the CSP's brand as the provider of advanced smart home services.

Representation of the EXOS-powered GigaSpire family:



AXOS Platform

AXOS is a software platform built for the specific needs of the access network. The AXOS platform is an architecture built to leverage the best of data center software design and network virtualization across the challenging and variable environment of the access network. With an always-on architecture and consistent provisioning services, a CSP can leverage AXOS to deliver all services on a single, elastic, converged access network that is always on. By supporting all existing and next generation PON architectures (anyPON), any silicon chipset (anyPHY) and any CSP operating model (anySDN), AXOS provides unmatched flexibility to our customers. Over 200 Calix customers are already deploying AXOS to simplify their operations, network and business models.

Representation that summarizes the primary benefits delivered by AXOS:



We believe AXOS offers a revolutionary way for CSPs to operate their access networks and accelerate their business transformation. AXOS achieves this because it is architected with discrete software modules that operate on top of a unique hardware abstraction layer that preserves software independence from the underlying hardware. This architecture simplifies upgrades to non-events, supports stateful, self-healing operation and facilitates virtualization of processes and services. All

components within AXOS utilize standards based YANG data models to represent the operational functions and the NETCONF protocol that enable AXOS-powered systems to fit into any open SDN orchestration and control framework. Open, published APIs also allow customers to directly program unique network applications and services.

With AXOS, CSPs can collapse and automate networks functions such as subscriber management and routing to streamline deployment of services and simplify operations. This functionality is supported via software modules including AXOS Rpm (Routing Protocol module), AXOS SMm (Subscriber Management module) and connectors such as SMx (Service Management Connector), AXOS DPx (virtualized DOCSIS connector), AXOS OFx (OpenFlow connector) and AXOS Sandbox - an SDA virtual environment for system design and testing. The recently announced AXOS Intelligent Access Edge solution includes the AXOS Rpm and SMm as well as the new Advanced Routing Protocol Module (ARm) that provides CSPs with the flexibility to bring Layer 3 functionality-including multiprotocol label switching, or MPLS, routed networking-to their new or existing Layer 2 access network. This revolutionary new solution will simplify network architectures and reduce total cost of ownership. This solution will include a new line card for the E9-2 Intelligent Edge System that will aggregate Layer 2 OLTs and deliver the functionality and benefits of the Layer 3 Access network to the access edge.

The AXOS platform removes the complexity of network deployments by reducing the need to utilize middleware to integrate costly hardware and software. AXOS offers CSPs a path to the simplified, intelligent, unified access network that can accelerate time-to-revenue, increase service velocity, eliminate service disruptions and reduce total cost of ownership. As a result, CSPs can simplify their business models and focus investment and resources on revenue generating services and functions.

AXOS is currently implemented in our E-Series family of modular, non-blocking systems including the E9-2, E7-2, E3-2, E3-16F, E5-16F and E5 business systems. By offering AXOS on the entire E-Series family of systems, Calix enables our customers to meet a wide variety of deployment scenarios. The Calix Access system portfolio is designed for high availability and purpose-built for the demands of access network deployments. Our access systems are built and tested to meet or exceed network equipment-building system standards, which are a set of safety, spatial and environmental design guidelines for communications equipment. Our products are highly compatible and designed to be easily integrated into the existing operational and management infrastructure of CSP access networks.

Representation of the AXOS E-Series systems portfolio and where they are typically placed in the CSP network:



Traditional Products

Calix continues to support and sell our portfolio of non-AXOS and non-EXOS systems as well as traditional software and Compass Cloud products that are widely deployed in customer networks. For many CSPs, the process of operationalizing new systems and transitioning to new products can be lengthy. We expect that these products will continue to be utilized in our customers' networks for many years to come. These products include:

- **Calix GigaFamily** – The Calix GigaFamily includes our first generation of carrier-class Wi-Fi gateways. It includes the Calix GigaCenter and 804 mesh systems. These systems provide 802.11ac Wi-Fi and whole home Wi-Fi services. When deployed in conjunction with the Calix Cloud, the GigaFamily systems provide the complete set of capabilities required for a fully managed Wi-Fi offering that delivers optimized Wi-Fi services to subscribers.

- **Compass Cloud** – Consists of Flow Analyze Plus (a tool that provides an in-depth view of the traffic in CSP networks on a real-time basis), Consumer Connect Plus (a tool that enables service providers to remotely activate new broadband devices and manage home networks, creating new revenue sources, improved customer satisfaction and reduced service delivery costs) and Service Verify (a tool that gives service providers the tools to comprehensively validate quality of service commitments for their business subscribers).
- **Non-AXOS E-Series Access Systems and Nodes:** – A small subset of our E-Series access systems and access nodes that are designed to support an array of advanced IP-based service and run our EXA operating system. These systems are not supported by AXOS.
- **Calix C-Series Multiservice Access Systems** – Designed to support a wide array of basic voice and data services offered by CSPs while also supporting advanced, high-speed, packet-based services such as Gigabit Ethernet, GPON, digital subscriber line, or DSL (including very high-speed DSL 2, or VDSL2) and advanced applications.
- **Calix B-Series Access Nodes** – Consist of chassis-based nodes that are designed to support an array of advanced IP-based services offered by CSPs, including Ethernet transport and aggregation, as well as voice, data and video services over both fiber- and copper-based network architectures.
- **P-Series Optical Network Terminals and Residential Gateways** – A broad range of non-EXOS customer premises solutions, including optical network terminals, or ONTs, and residential gateways for residential and business use in conjunction with our E-Series, C-Series and B-Series systems.

Calix Services

The Calix Services team helps CSPs define their strategy, implement new solutions and manage their networks. CSPs choose Calix platforms because of their ability to simplify network management and support an agile service delivery model. Calix Services spans the entirety of the network and service delivery lifecycle. Our expertise, developed over many years of building cutting-edge software platforms and providing critical services to our customers, positions us to be the vendor of choice. Today, the Calix Services team delivers services to CSPs of every size and every type. We are continually expanding our portfolio of service offerings to ensure that our customers realize the full potential of our platforms.

- **Calix Professional Services** – Calix offers defined service packages to accelerate network design and deployment, optimize performance and scalability and apply field-proven best practices, processes and tools. Use Cases for Calix Professional Services include the collapse of multiple network silos into a single software defined access architecture, the seamless migration to next-generation PON architectures, the deployment of managed whole home Wi-Fi services and smart home services and facilitated OSS/BSS integration services. These offerings optimize CSP end-to-end processes from operations to technology deployment to service lifecycle management.
- **Calix Managed Services** – Our managed services feature a cloud-based remote monitoring service that monitors a CSP's end-to-end access network (24 hours a day, 7 days a week) to ensure issues are automatically identified and assessed. This service leverages machine learning technology developed through thousands of Calix Support Services engagements with CSPs to correlate alarms, filter extraneous events and identify critical issues. The service provides incident notifications to CSP team members that include the nature, location and severity of events to help reduce mean time-to-repair.
- **Calix Support Services** – Calix offers three tiers of support services - Standard, Essential, and Vantage - that ensure software updates, the agility of operational workflows, service uptime and customer experience. Calix support tiers are designed to provide optimal support to our customers who are adopting our strategic platforms - Calix Cloud, EXOS, and AXOS. Our highest support tier, Vantage, includes our Remote Monitoring service and support from a Calix service director who partners with customers to implement strategies that ensure delivery of an exceptional subscriber experience.
- **Calix Education Services** – Calix offers an array of self-service and instructor-led, remote and onsite learning and certifications solutions to help CSPs build the skills required to successfully execute deployments and effectively run next generation networks. Calix offers specific learning paths that are designed to help CSPs enhance the skills of their teams and maximize the value that they derive when they deploy our strategic platforms.
- **Calix Success Services** – To ensure that our customers maximize the return on their investments in our software solutions, we offer Calix Success Services. The primary focus of the Success Services engagements is the use of the data and analytics delivered through our Calix Cloud Platform to transform our customers' business processes. Our Success Services team members leverage their domain expertise in marketing, customer support and operations to help our customers achieve their business objectives. These engagements are typically multi-year (aligned to our cloud subscription terms).

Representation of the Calix Services portfolio:



We can help you design, plan and implement your network strategy. We also provide support and managed services, and training programs that will help you build the skills of your teams



Professional Services
Build for the future with services that will help you plan, deploy, integrate, and optimize your network, services, and operations



Managed Services
Add the seamless extension to your operations that you've always wanted



Support Services
Enhance your network and services support teams with unparalleled services



Education Services
Develop and train your teams so you can provide new and innovative experiences for your subscribers



Success Services
Leverage industry best practices to transform your business process through data and analytics

Customers

We operate a differentiated customer engagement model that focuses on direct alignment with our customers through sales, service and support. In order to allocate our product development and sales efforts efficiently, we believe that it is critical to target markets, customers and applications deliberately. We have traditionally targeted CSPs, which own, build and upgrade their own access networks and value strong relationships with their systems and software suppliers.

The United States Incumbent Local Exchange Carrier, or ILEC, market is composed of three distinct “tiers” of carriers, which we categorize based on their subscriber line counts and geographic coverage. Tier 1 CSPs are very large with wide geographic footprints. They have greater than seven million subscriber lines, and they generally correspond with the former Regional Bell Operating Companies. Tier 2 CSPs also operate typically within a wide geographic footprint but are smaller in scale with subscriber line counts that range from approximately half a million to approximately seven million subscriber lines. Their service coverage areas are predominantly regional in scope, and therefore they are often known as Regional Local Exchange Carriers. Tier 3 CSPs consist primarily of over 1,000 predominantly local operators (often called IOCs) typically focused on a single community or a cluster of communities, although they also include a growing number of municipalities, electric cooperatives, fiber overbuilders and wireless ISPs. These entities range in size from a few hundred to approximately half a million subscriber lines.

To date, we have focused primarily on CSPs in the North American market. Our existing customers’ networks serve over 100 million subscriber lines. Our customers span Tiers 1, 2 and 3, including Allo Communications; CenturyLink, Inc., or CenturyLink; CityFibre Holdings Limited; City of Beverly Hills; Emirates Integrated Telecommunications Company, or du; Cox Communications; Frontier Communications Corporation; Windstream Holdings, Inc., or Windstream; and Verizon Communications, Inc.

We have a few large customers who have represented a significant portion of our sales in any given period. CenturyLink accounted for 18% of total revenue in 2018, 31% in 2017 and 21% in 2016. Windstream accounted for less than 10% of our revenue in 2018 and 2017 and 15% of our revenue in 2016.

Sales to customers outside the United States represented approximately 12% of our total revenue in 2018, 11% in 2017 and 9% in 2016. Historically, our sales outside the United States were predominantly to customers in the Middle East, Canada, Europe and Caribbean.

Customer Engagement Model

We design, market and sell our Calix Cloud and software platforms, systems and Calix Services predominantly through our direct sales force, supported by marketing and product management personnel. We have expanded this model to include a small number of select channel partners in North America and dozens of international channel partners, who are part of our Fiber Forward Partner Program. Our sales effort is organized either by named accounts or regional responsibilities. Account teams comprise sales managers, supported by solution engineers and account managers, who work to target and sell to existing and prospective CSPs. The sales process includes analyzing CSPs’ existing networks and identifying how they can utilize our products and services within their networks. Even in circumstances where a channel partner is involved, our sales and marketing personnel are often selling side-by-side with the channel partner. We believe that our direct customer engagement

approach provides us with significant differentiation in the customer sales process by aligning us more closely with our customers' changing needs.

Research and Development

Continued investment in research and development is critical to our business. Our research and development team is composed of engineers with expertise in software, optics, wireless and hardware. Our teams of engineers are located in our San Jose and Petaluma facilities located in California; our Minneapolis, Minnesota facility and our Nanjing, China facility. We also outsource a portion of our software development to domestic and international third parties. Our research and development efforts are also extended by our co-development partnerships with third-party developers such as Infosys whereby we are able to utilize their substantially larger product development teams to bring cutting edge, software-based products to market while creating new revenue opportunities for both parties. Our research and development team is responsible for designing, developing and enhancing our Cloud and software platforms and systems, performing product and quality assurance testing and ensuring the compatibility of our products with third-party hardware and software products. We have made significant investments in the Calix portfolio. We intend to continue to dedicate significant resources to research and development to develop, enhance and deliver new platform features and capabilities, including investment in innovative technologies that support our business strategy.

Manufacturing

We rely substantially on CMs, ODMs and other third-party partners for the supply and distribution of our products. We work closely with these third parties to provide system design, source and procure materials, manufacture and deliver our products. Our manufacturing organization consists primarily of supply chain managers, new product introduction personnel and test engineers. We tightly integrate our supply chain management and new product introduction activities with the activities outsourced to these third parties. We have made changes to our supply chain management to align to our platform strategy and, more recently, in response to the imposition by the U.S. government of tariffs on goods imported from China. Such changes include increased leveraging of CM and ODM partners for systems design and management of raw materials used for manufacture and transition of global supply chain operations and activities to new geographies to mitigate the impact of the U.S. tariffs. Our relationships with our CMs and ODMs allow us to decrease new product introduction time, conserve working capital, reduce product costs and minimize delivery lead times while maintaining high product quality. Order fulfillment is performed by Pegasus Logistics Group, Inc. located in Texas. We also qualify and utilize other vendors for various portions of our supply chain from time to time, including order fulfillment of our circuit boards, optics and cabinets. This model allows us to operate with lower inventory levels while maintaining the ability to scale quickly to handle increased order volume.

Product reliability is essential for our customers, who place a premium on continuity of service for their subscribers. We perform rigorous in-house quality control testing to help ensure the reliability of our systems. Our internal manufacturing organization designs, develops and implements complex test processes to help ensure the quality and reliability of our products.

Our activities with our CM and ODM partners involve complexity and certain risks, including the potential absence of adequate capacity, the unavailability of or interruptions in access to certain process technologies and the reduced control over delivery schedules, manufacturing yields, quality and costs. As such, we may experience production problems or manufacturing delays. Additionally, shortages in components that we use in our systems are possible and our ability to predict the availability of such components may be limited. Our systems include components that are proprietary in nature and only available from a single source, as well as some components that are generally available from only a limited number of suppliers. Furthermore, lead times associated with certain components are lengthy and preclude rapid changes in product specifications or delivery schedules. In some cases, significant time would be required to establish relationships with alternate suppliers or providers of proprietary components. We generally do not have long-term contracts that guarantee the supply of components or manufacturing services. Our ability to deliver products in a timely manner to our customers would be adversely impacted materially if we needed to qualify replacements for any of the components used in our systems. If we experience any difficulties in managing our relationships with our CMs, ODMs or other third party partners, or any interruption in either our own operations or those of our partners, or if a supplier is unable to meet our needs, we may encounter supply delays that could impede our ability to meet our customers' requirements and harm our business, operating results and financial condition.

Seasonality

Fluctuations in our revenue occur due to many factors, including the varying budget cycles and seasonal buying patterns of our customers. More specifically, our customers tend to spend less in the first fiscal quarter as they are finalizing their annual capital spending budgets, and in certain regions, customers are also challenged by winter weather conditions that inhibit outside fiber deployment.

Intellectual Property

Our success depends upon our ability to protect our core technology and intellectual property. To accomplish this, we rely on a combination of intellectual property rights, including patents, trade secrets, copyrights and trademarks as well as customary contractual protections. In addition, we generally control access to and the use of our proprietary technology and other confidential information. This protection is accomplished through a combination of internal and external controls, including contractual protections with employees, contractors, customers and partners, and through a combination of U.S. and international intellectual property laws.

As of December 31, 2018, we held 124 U.S. patents and had 7 pending U.S. patent applications. One of the U.S. patents is also covered by granted international patents in three countries. As of December 31, 2018, we had no pending international patent applications. U.S. patents generally have a term of twenty years from filing. We have added to our patent portfolio since our inception. The remaining terms on the individual patents vary from one to 19 years.

We rely on intellectual property laws as well as nondisclosure agreements, licensing arrangements and confidentiality provisions to establish and protect our proprietary rights. U.S. patent, copyright and trade secret laws afford us only limited protection, and the laws of some foreign countries do not protect proprietary rights to the same extent. Our pending patent applications may not result in issued patents, and the issued patents may not be enforceable. Any infringement of proprietary rights could result in significant litigation costs. Further, any failure by us to adequately protect our proprietary rights could result in competitors offering similar products, resulting in the loss of our competitive advantage and decreased sales.

We believe that the frequency of assertions of patent infringement continues to increase in our industry. In particular, patent holders, including entities and organizations that purchase or hold patents to monetize such rights, assert patent infringement claims as a competitive tactic as well as a source of revenue. Any claim of infringement from a third party, even claims without merit, could cause us to incur substantial costs defending against such claims and could distract our management from operating our business. Furthermore, a party making such a claim, if successful, could secure a judgment that requires us to pay substantial damages. A judgment could also include an injunction or other court order that could prevent us from selling our products. In addition, we might be required to seek a license for the use of such intellectual property, which may not be available on commercially reasonable terms or at all. Alternatively, we may be required to develop non-infringing technology, which would require significant effort and expense and may ultimately not be successful.

Competition

The communications equipment market is highly competitive. Competition in this market is based on any one or a combination of the following factors:

- functionality;
- price;
- existing business and customer relationships;
- the ability of products and services, including turnkey professional services capabilities, to meet customers' immediate and future network requirements;
- product quality;
- installation capability;
- service and support;
- scalability; and
- manufacturing capability.

We compete with a number of companies within markets that we serve, and we anticipate that competition will intensify. Suppliers with which we compete include ADTRAN, Inc., or ADTRAN; Arris Group, Inc. (being acquired by CommScope Inc.); Casa Systems; Ciena Corporation; Cisco Systems Inc.; DASAN Zhong Solutions, Inc.; Huawei Technologies Co. Ltd.; Juniper Networks Inc.; Nokia Corporation and ZTE Corporation. There are also a number of smaller companies with which we compete in various geographic or vertical markets. While most of these smaller competitors lack broad national scale and product portfolios, they can offer strong competition on a deal-by-deal basis. As we expand into adjacent markets, we expect to encounter new competitors. Many of our competitors have substantially greater name recognition, manufacturing capacity and technical, financial and marketing resources as well as better established relationships with CSPs than we do. Many of our competitors have greater resources to develop products or pursue acquisitions and more experience in developing or acquiring new products and technologies and in creating market awareness for their products and technologies. In addition, a number of

our competitors have the financial resources to offer competitive products at below market pricing levels that could prevent us from competing effectively.

Employees

As of December 31, 2018, we employed a total of 802 employees, of which 623 employees were located in the United States. Our United States employees are not represented by a labor union with respect to their employment with us. Our French employee is subject to a collective bargaining arrangement. We have not experienced any work stoppages, and we consider our relations with our employees to be good.

Corporate Information

Calix, Inc., a Delaware corporation, was founded in August 1999. Our principal executive offices are located at 2777 Orchard Parkway, San Jose, California 95134, and our telephone number is (408) 514-3000. Our website address is www.calix.com. We do not incorporate the information on or accessible through our website into this Annual Report on Form 10-K, and you should not consider any information on, or that can be accessed through, our website as part of this Annual Report on Form 10-K. Calix®, the Calix logo design, E3®, E5®, E7®, E9 TM, Calix Cloud SM, Compass®, Consumer Connect SM, Fiber Forward TM and other trademarks or service marks of Calix appearing in this Annual Report on Form 10-K are the property of Calix. Trade names, trademarks and service marks of other companies appearing in this Annual Report on Form 10-K are the property of the respective holders. The SEC maintains a website at www.sec.gov that contains reports, proxy statements and other information regarding issuers that file electronically with the SEC. We post on the Investor Relations page of our website, www.calix.com, a link to our filings with the SEC free of charge, as soon as reasonably practical after they are filed electronically with the SEC.

ITEM 1A. Risk Factors

We have identified the following additional risks and uncertainties that may affect our business, financial condition and/or results of operations. Investors should carefully consider the risks described below, together with the other information set forth in this Annual Report on Form 10-K, before making any investment decision. The risks described below are not the only ones we face. Additional risks not currently known to us or that we currently believe are immaterial may also significantly impair our business operations. Our business could be harmed by any of these risks. The trading price of our common stock could decline due to any of these risks, and investors may lose all or part of their investment.

Risks Related to Our Business and Industry

Our markets are rapidly changing, which makes it difficult to predict our future revenue and plan our expenses appropriately.

We compete in markets characterized by rapid technological change, changing needs of CSPs, evolving industry standards and frequent introductions of new products and services. We invest significant amounts to pursue innovative technologies that we believe would be adopted by CSPs. In addition, on an ongoing basis we expect to reposition our product and service offerings and introduce new products and services as we encounter rapidly changing CSP requirements and increasing competitive pressures. If we cannot increase sales of our new products and services, keep pace with rapid technological developments to meet our customers' needs and compete with evolving industry standards or if the technologies we choose to invest in fail to meet customer needs or are not adopted by customers, the use of our products and our revenue could decline, making it difficult to forecast our future revenue and plan our operating expenses appropriately.

Adverse global economic conditions and geopolitical issues, including the U.S. tariffs imposed on imports from China, could have a negative effect on our business, results of operations and financial condition and liquidity.

As a global company, our performance is affected by global economic conditions as well as geopolitical issues. In recent years concerns about the global economic outlook have adversely affected market and business conditions in general. Macroeconomic weakness and uncertainty also make it more difficult for us to accurately forecast revenue, gross margin and expenses. Geopolitical issues, such as the ones resulting in the recent tariffs imposed by both the U.S. and China and the increasing tensions among China, the U.S., Canada and other countries, create uncertainty for global commerce. Sustained uncertainty about, or worsening of, global economic conditions and geopolitical issues may cause our customers to reduce or delay spending and could intensify pricing pressures. Any or all of these factors could negatively affect demand for our products and our business, financial condition and result of operations. Additional risks associated with the impact of the U.S. tariffs on our business and result of operations are described in the below risk factor captioned, “*Substantially all of the products we currently sell in the United States are manufactured in China. The imposition by the federal government of tariffs on goods imported from China has significantly increased the cost of our products manufactured in China and imported into the United States which may have a material adverse effect on our business, gross margins and results of operations.*”

We have a history of losses, and we may not be able to generate positive operating income and positive cash flows in the future.

We have experienced net losses in each year of our existence. We incurred net losses of \$19.3 million in 2018, \$83.0 million in 2017 and \$27.4 million in 2016. As of December 31, 2018, we had an accumulated deficit of \$684.9 million.

We expect to continue to incur significant expenses and cash outlays for research and development associated with our platforms and systems, including our cloud and services operations, investments in innovative technologies, expansion of our product portfolio, sales and marketing, customer support and general and administrative functions as we expand our business and operations and target new customer segments, primarily larger CSPs including cable MSOs. Given our anticipated growth and the intense competitive pressures we face, we may be unable to control our operating costs.

We cannot guarantee that we will achieve profitability in the future. We will have to generate and sustain significant and consistent increased revenue, while continuing to control our expenses, in order to achieve and then maintain profitability. We may also incur significant losses in the future for a number of reasons, including the risks discussed in this “Risk Factors” section and other factors that we cannot anticipate. If we are unable to generate positive operating income and positive cash flows from operations, our liquidity, results of operations and financial condition will be adversely affected. If we are unable to generate cash flows to support our operational needs, we may need to seek other sources of liquidity, including additional borrowings, to support our working capital needs. In addition, we may choose to seek other sources of liquidity even if we believe we have generated sufficient cash flows to support our operational needs. There is no assurance that any other sources of liquidity may be available to us on acceptable terms or at all. If we are unable to generate sufficient cash flows or obtain other sources of liquidity, we will be forced to limit our development activities, reduce our investment in growth initiatives and institute cost-cutting measures, all of which would adversely impact our business and growth.

Our quarterly and annual operating results may fluctuate significantly, which may make it difficult to predict our future performance and could cause the market price of our stock to decline.

A number of factors, many of which are outside of our control, may cause or contribute to significant fluctuations in our quarterly and annual operating results. These fluctuations may make financial planning and forecasting difficult. Comparing our operating results on a period-to-period basis may not be meaningful, and you should not rely on our past results as an indication of our future performance. If our revenue or operating results fall below the expectations of investors or securities analysts, or below any guidance we may provide to the market, the market price of our stock would likely decline. Moreover, we may experience delays in recognizing revenue under applicable revenue recognition rules. For example, revenue associated with large turnkey network improvement projects, which include projects that are funded by the CAF program, is generally deferred until customer acceptance is received and may be subject to delays, rework requirements and unexpected costs, among other uncertainties. Certain government-funded contracts, such as those funded by U.S. Department of Agriculture’s Rural Utility Service, or RUS, also include acceptance and administrative requirements that delay revenue recognition. The extent of these delays and their impact on our revenue can fluctuate considerably depending on the number and size of purchase orders under these contracts for a given time period. Furthermore, our customers who rely on government-funded programs may delay or reduce purchase activities due to the recent prolonged U.S. government shutdown, which could have a negative impact on our result of operations. In addition, unanticipated decreases in our available liquidity due to fluctuating operating results could limit our growth and delay implementation of our expansion plans.

In addition to the other risk factors listed in this “Risk Factors” section, factors that have in the past and may continue to contribute to the variability of our operating results include:

- our ability to predict our revenue and reduce and control product costs, including larger scale turnkey network improvement projects that may span several quarters;
- the impact of global economic conditions;
- the impact of current and future tariffs that may impact our products, including the U.S. tariffs on goods imported from China;
- our ability to increase our sales to larger CSPs globally;
- the capital spending patterns of CSPs and any decrease or delay in capital spending by CSPs due to macro-economic conditions, regulatory uncertainties or other reasons;
- the impact of government-sponsored programs on our customers and the impact to our customers of the recent U.S. government shutdown on such programs;
- intense competition;
- our ability to develop new products or enhancements that support technological advances and meet changing CSP requirements;

- our ability to ramp sales and achieve market acceptance of our new products and CSPs' willingness to deploy our new products;
- the concentration of our customer base as well as our dependence on a limited number of key customers;
- the length and unpredictability of our sales cycles and timing of orders;
- our lack of long-term, committed-volume purchase contracts with our customers;
- our exposure to the credit risks of our customers;
- fluctuations in our gross margin;
- the interoperability of our products with CSP networks;
- our dependence on sole-, single- and limited-source suppliers;
- our ability to manage our relationships with our third-party vendors, including CMs, ODMs, logistics providers, component suppliers and development partners;
- our ability to forecast our manufacturing requirements and manage our inventory;
- our products' compliance with industry standards;
- our ability to expand our international operations;
- our ability to protect our intellectual property and the cost of doing so;
- the quality of our products, including any undetected hardware defects or bugs in our software;
- our ability to estimate future warranty obligations due to product failure rates;
- our ability to obtain necessary third-party technology licenses at reasonable costs;
- the regulatory and physical impacts of climate change and other natural events;
- the attraction and retention of qualified employees and key management personnel;
- our ability to build and sustain an adequate and secure information technology infrastructure; and
- our ability to maintain proper and effective internal controls.

Our gross margin may fluctuate over time, and our current level of gross margin may not be sustainable.

Our current level of gross margin may not be sustainable and may be adversely affected by numerous factors, including:

- changes in customer, geographic or product mix, including the mix of configurations within each product group;
- the pursuit or addition of new large customers;
- increased price competition, including the impact of customer discounts and rebates;
- the impact of current and future tariffs that may impact our products, including the U.S. tariffs on goods imported from China;
- our ability to reduce and control product costs;
- an increase in revenue mix toward services, which typically have lower margins;
- changes in component pricing;
- changes in pricing with our third-party manufacturing partners;
- charges incurred due to inventory holding periods if parts ordering does not correctly anticipate product demand;
- introduction of new products and new technologies, which may involve higher component costs;
- our ability to scale our services business in order to gain desired efficiencies;
- changes in shipment volume;
- changes in or increased reliance on distribution channels;
- potential liabilities associated with increased reliance on third-party vendors;
- increased expansion efforts into new or emerging markets;

- increased warranty costs;
- excess and obsolete inventory and inventory holding charges;
- expediting costs incurred to meet customer delivery requirements; and
- potential costs associated with contractual obligations.

Substantially all of the products we currently sell in the United States are manufactured in China. The imposition by the federal government of tariffs on goods imported from China has significantly increased the cost of our products manufactured in China and imported into the United States which may have a material adverse effect on our business, gross margins and results of operations.

Recently, the federal government imposed significant tariffs on goods imported from China in connection with China's intellectual property practices with proposed additional tariffs of \$200 billion or more covering a broader list of goods imported from China. Substantially all of the products that we sell in the United States are currently manufactured in China. Accordingly, we expect that these U.S. tariffs as currently implemented would have significant cost impact to us to the extent we are not able to mitigate the impact of the tariffs. Although we are actively working to modify our supply chain operations to avoid the impact of these tariffs, if we are not able to successfully modify our supply chain operations as planned, the tariffs could have a material adverse impact on our product margins, result of operations and cash flows. Furthermore, transition of global supply chain operations is complex, require significant resources and carry numerous risks of disruptions to the manufacture and supply of our products, delays in implementation of our transition plans and significant unanticipated costs, including exacerbation of the risks associated with our reliance upon third-party manufacturing and supply partners. Furthermore, there is no assurance that we can secure our desired rates for the manufacture and supply of our products with new supply chain partners and may face higher costs as a result. Disruptions, delays or unanticipated costs associated with the supply of our products due to our transition efforts could impair our ability to meet customer requirements, result in cancellation of orders and harm our relationships with our customers, all of which could materially impact our revenues, gross margin and result of operations. Additional risks associated with our reliance upon third-party manufacturing and supply partners are described in the below risk factors captioned "*We utilize domestic and international third-party vendors to assist in the design, development and manufacture of certain of our products, and to provide logistics services in the distribution of our products. If these vendors fail to provide these services, we could incur additional costs and delays or lose revenue*" and "*If we fail to forecast our manufacturing requirements accurately or fail to properly manage our inventory with our contract manufacturers, we could incur additional costs, experience manufacturing delays and lose revenue.*"

The imposition of any additional tariffs or trade restrictions that may be implemented by the United States or other countries in connection with a global trade war, could increase the cost of our products manufactured in China or other countries, which in turn could adversely affect the demand for these products and have a material adverse effect on our business, gross margins and results of operations.

Our business is dependent on the capital spending patterns of CSPs, and any decrease or delay in capital spending by CSPs in response to economic conditions, seasonality, uncertainties associated with the implementation of regulatory reform or otherwise would reduce our revenue and harm our business.

Demand for our products depends on the magnitude and timing of capital spending by CSPs as they construct, expand, upgrade and maintain their access networks. Any future economic downturn may cause a slowdown in telecommunications industry spending, including in the specific geographies and markets in which we operate. In response to reduced consumer spending, challenging capital markets or declining liquidity trends, capital spending for network infrastructure projects of CSPs could be delayed or canceled. In addition, capital spending is cyclical in our industry, sporadic among individual CSPs and can change on short notice. As a result, we may not have visibility into changes in spending behavior until nearly the end of a given quarter.

CSP spending on network construction, maintenance, expansion and upgrades is also affected by reductions in their budgets, delays in their purchasing cycles, access to external capital (such as government grants and loan programs or the capital markets) and seasonality and delays in capital allocation decisions. For example, our CSP customers tend to spend less in the first quarter as they are still finalizing their annual budgets and in certain regions customers are also challenged by winter weather conditions that inhibit outside fiber deployment, resulting in weaker demand for our products in the first quarter of our fiscal year. Also, softness in demand across any of our customer markets, including due to macro-economic conditions beyond our control or uncertainties associated with the implementation of regulatory reform, has in the past and could in the future lead to unexpected slowdown in capital expenditures by service providers.

Many factors affecting our results of operations are beyond our control, particularly in the case of large CSP orders and network infrastructure deployments involving multiple vendors and technologies where the achievement of certain thresholds for acceptance is subject to the readiness and performance of the CSP or other providers and changes in CSP requirements or installation plans. Further, CSPs may not pursue investment for our new platforms or infrastructure upgrades that require our

access systems and software. Infrastructure improvements may be delayed or prevented by a variety of factors including cost, regulatory obstacles (including uncertainties associated with the implementation of regulatory reforms), mergers, lack of consumer demand for advanced communications services and alternative approaches to service delivery. Reductions in capital expenditures by CSPs, particularly CSPs that are significant customers, may have a material negative impact on our revenue and results of operations and slow our rate of revenue growth. As a consequence, our results for a particular period may be difficult to predict, and our prior results are not necessarily indicative of results in future periods.

Government-sponsored programs and the recent U.S. federal government shutdown could impact the timing and buying patterns of CSPs, which may cause fluctuations in our operating results.

We sell to CSPs, which include U.S.-based IOCs, which have revenue that is particularly dependent upon interstate and intrastate access charges and federal and state subsidies. The FCC and some states may consider changes to such payments and subsidies, and these changes could reduce IOC revenue. Furthermore, many IOCs use or expect to use government-supported loan programs or grants, such as RUS loans and grants, to finance capital spending. These government-supported loan programs and grants generally include conditions such as deployment criteria, domestic preference provisions and other requirements that apply to the project and selected equipment as conditions for funding. Changes to the terms or administration of these programs, including uncertainty from government and administrative change, potential funding limitations that impact our ability to meet program requirements or funding delays due to the recent U.S. federal government shutdown could reduce the ability of IOCs to access capital or secure funding under government-funded programs to purchase our products and services and thus reduce our revenue opportunities.

Many of our customers were awarded grants or loans under government stimulus programs such as the Broadband Stimulus programs under the American Recovery and Reinvestment Act of 2009 and the funds distributed under the FCC's CAF program, and have purchased and will continue to purchase products from us or other suppliers while such programs and funding are available. However, customers may substantially curtail purchases as funding winds down or as planned purchases are completed.

In addition to the impact of the recent U.S. federal government shutdown, any further government shutdowns or any changes in government regulations and subsidies could cause our customers to change their purchasing decisions, which could have an adverse effect on our operating results and financial condition.

We face intense competition that could reduce our revenue and adversely affect our financial results.

The market for our products is highly competitive, and we expect competition from both established and new companies to increase. Our competitors include companies such as ADTRAN, Inc., or ADTRAN; Arris Group, Inc. (being acquired by CommScope Inc.); Casa Systems; Ciena Corporation; Cisco Systems Inc.; DASAN Zhong Solutions, Inc.; Huawei Technologies Co. Ltd.; Juniper Networks Inc.; Nokia Corporation and ZTE Corporation, among others.

Our ability to compete successfully depends on a number of factors, including:

- the successful development of new products;
- our ability to anticipate CSP and market requirements and changes in technology and industry standards;
- our ability to differentiate our products from our competitors' offerings based on performance, cost-effectiveness or other factors;
- our ongoing ability to successfully integrate acquired product lines and customer bases into our business;
- our ability to meet increased customer demand for professional services associated with network improvement projects;
- our ability to gain customer acceptance of our products; and
- our ability to market and sell our products.

The broadband access equipment market has undergone and continues to undergo consolidation, as participants have merged, made acquisitions or entered into partnerships or other strategic relationships with one another to offer more comprehensive solutions than they individually had offered. Examples include Arris' acquisition of Pace plc in January 2016; Nokia's acquisition of Alcatel-Lucent in January 2016; the merger of DASAN Zhong Solutions with DASAN Network Solutions in September 2016; and CommScope's acquisition of Arris that is expected to close in the first half of 2019. We expect this trend to continue as companies attempt to strengthen or maintain their market positions in an evolving industry.

Many of our current or potential competitors have longer operating histories, greater name recognition, larger customer bases and significantly greater financial, technical, sales, marketing and other resources than we do and are better positioned to acquire and offer complementary products and services. Many of our competitors have broader product lines and can offer bundled solutions, which may appeal to certain customers. Our competitors may also invest additional resources in developing

more compelling product offerings. Potential customers may also prefer to purchase from their existing suppliers rather than a new supplier, regardless of product performance or features, because the products that we and our competitors offer require a substantial investment of time and funds to qualify and install.

Some of our competitors may offer substantial discounts or rebates to win new customers or to retain existing customers. If we are forced to reduce prices in order to secure customers, we may be unable to sustain gross margin at desired levels or achieve profitability. Competitive pressures could result in increased pricing pressure, reduced profit margin, increased sales and marketing expenses and failure to increase, or the loss of, market share, any of which could reduce our revenue and adversely affect our financial results.

An increase in revenue mix towards services will adversely affect our gross margin.

In response to greater customer demand for certain professional and support services for our products, we continue to invest and grow our services business. Our services include professional services associated with turnkey network improvement projects, product support services, managed services to help our customers manage and optimize their networks and education and certification services, all of which typically have a lower gross margin than product purchases. For example, revenue recognized from turnkey network improvement projects whereby we supply products and related professional services such as network planning, product installation, testing and network turn up may be delayed because of the timing of completion and acceptance of a project or milestone, including third-party delays that may be outside our control. We also rely upon third-party subcontractors to assist with some of our professional and support services projects, which generally result in higher costs and increased risk of cost overruns, which can negatively impact our gross margin. Moreover, if we are unable to achieve desired efficiencies and scale as we ramp and develop our services business, we may incur higher than expected costs, which can further adversely impact our gross margin.

Product development is costly, and if we fail to develop new products or enhancements that meet changing CSP requirements, we could experience lower sales.

Our industry is characterized by rapid technological advances, frequent new product introductions, evolving industry standards and unanticipated changes in subscriber requirements. Our future success will depend significantly on our ability to anticipate and adapt to such changes, and to offer, on a timely and cost-effective basis, products and features that meet changing CSP demands and industry standards. We intend to continue to invest in developing new products and enhancing the functionality of our platforms, including to reach a broader set of customers. Developing our products is expensive and complex and involves uncertainties, including pricing risks from sourcing sufficient quantities of custom components from limited suppliers on terms which may not be commercially acceptable for us. We may not have sufficient resources to successfully manage lengthy product development cycles. Our research and development expenses were \$90.0 million, or 20% of our revenue, in 2018, \$127.5 million, or 25% of our revenue, in 2017 and \$106.9 million, or 23% of our revenue, in 2016. We believe that we must continue to dedicate a significant amount of resources to our research and development efforts, including increased reliance on third-party development partners, to maintain our competitive position. These investments may take several years to generate positive returns, if ever. In addition, we may experience design, manufacturing, marketing and other difficulties that could delay or prevent the development, introduction or marketing of new products and enhancements. If we fail to meet our development targets, demand for our products will decline.

In addition, the introduction of new or enhanced products also requires that we manage the transition from older products to these new or enhanced products in order to minimize disruption in customer ordering patterns, fulfill ongoing customer commitments and ensure that adequate supplies of new products are available for delivery to meet anticipated customer demand. If we fail to maintain compatibility with other software or equipment found in our customers' existing and planned networks, we may face substantially reduced demand for our products, which would reduce our revenue opportunities and market share. Moreover, as customers complete infrastructure deployments, they may require greater levels of service and support than we have provided in the past. We may not be able to provide products, services and support to compete effectively for these market opportunities. If we are unable to anticipate and develop new products or enhancements to our existing products on a timely and cost-effective basis, we could experience lower sales, which would harm our business.

Our new products are early in their life cycles and subject to uncertain market demand. If our customers are unwilling to install our new products or deploy our new services, or we are unable to achieve market acceptance of our new products, our business and financial results will be harmed.

Our new products are early in their life cycles and subject to uncertain market demand. They also may face obstacles in manufacturing, deployment and competitive response. Potential customers may choose not to invest the additional capital required for initial system deployment of new products. In addition, demand for new products is dependent on the success of our customers in deploying and selling advanced services to their subscribers. Our products support a variety of advanced broadband services, such as high-speed Internet, Internet protocol television, mobile broadband, high-definition video and online gaming. If we are unable to ramp sales of our new products, or if subscriber demand for our services does not grow as

expected or declines, or our customers are unable or unwilling to deploy and market these services, demand for our products may decrease or fail to grow at rates we anticipate.

Our customer base is concentrated, and there are a limited number of potential customers for our products. The loss of any of our key customers, a decrease in purchases by our key customers, pricing pressures or our inability to grow our customer base would adversely impact our revenue and results of operations and any delays in payment by a key customer could negatively impact our cash flows and working capital.

Historically, a large portion of our sales has been to a limited number of customers. For example, one customer accounted for 18% of our revenue in 2018, 31% of our revenue in 2017 and 21% of our revenue in 2016, and another customer accounted for 15% of our revenue in 2016. However, we cannot anticipate the level of purchases in the future by these customers. Customer purchases may be delayed or impacted due to financial difficulties, spending cuts or corporate consolidations. For example, one of our large customers completed a large acquisition at the end of 2017, which continues to disrupt its normal expenditure plans, including prolonged delays and reduction in purchases of our products and services as it continues to finalize its transition activities and corporate strategies. We have experienced and expect to continue to experience delays or declines in purchases by certain CSPs due to deterioration and weakness in their financial condition. For example, Windstream, another one of our larger customers, recently filed a voluntary petition for relief under Chapter 11 of the U.S. Bankruptcy Code after it was found in default of certain debt instruments. Any decrease or delay in purchases and/or capital expenditure plans of any of our key customers, or our inability to grow our sales with existing customers, may have a material negative impact on our revenue and results of operations.

We anticipate that a large portion of our revenue will continue to depend on sales to a limited number of customers. In addition, some larger customers may demand discounts and rebates or desire to purchase their access systems and software from multiple providers. As a result of these factors, our future revenue opportunities may be limited, and we may face pricing pressures, which in turn could adversely impact our margins and our profitability. The loss of, reduction in or pricing discounts associated with, orders from any key customer would significantly reduce our revenue and harm our business. Furthermore, delays in payment and/or extended payment terms from any of our key or larger customers could have a material negative impact on our cash flows and working capital to support our business operations.

Furthermore, in recent years, the CSP market has undergone substantial consolidation. Industry consolidation generally has negative implications for equipment suppliers, including a reduction in the number of potential customers, a decrease in aggregate capital spending and greater pricing leverage on the part of CSPs over equipment suppliers. Continued consolidation of the CSP industry and among ILEC and IOC customers, who represent a large part of our business, could make it more difficult for us to grow our customer base, increase sales of our products and maintain adequate gross margin.

Our sales cycles can be long and unpredictable, and our sales efforts require considerable time and expense. As a result, our sales are difficult to predict and may vary substantially from quarter to quarter, which may cause our operating results to fluctuate significantly.

The timing of our revenue is difficult to predict. Our sales efforts often involve educating CSPs about the use and benefits of our products. CSPs typically undertake a significant evaluation process, which frequently involves not only our products but also those of our competitors and results in a lengthy sales cycle. Sales cycles for larger customers are relatively longer and require considerably more time and expense. We spend substantial time, effort and money in our sales efforts without any assurance that our efforts will produce sales. In addition, product purchases are frequently subject to budget constraints, multiple approvals and unplanned administrative, processing and other delays. The timing of revenue related to sales of products and services that have installation requirements may be difficult to predict due to interdependencies that may be beyond our control, such as CSP testing and turn-up protocols or other vendors' products, services or installations of equipment upon which our products and services rely. Such delays may result in fluctuations in our quarterly revenue. If sales expected from a specific customer for a particular quarter are not realized in that quarter or at all, we may not achieve our revenue forecasts and our financial results would be adversely affected.

Our focus on CSPs with relatively small networks limits our revenue from sales to any one customer and makes our future operating results difficult to predict.

A large portion of our sales efforts continue to be focused on CSPs with relatively small networks, cable MSOs and selected international CSPs. Our current and potential customers generally operate small networks with limited capital expenditure budgets. Accordingly, we believe the potential revenue from the sale of our products to any one of these customers is limited. As a result, we must identify and sell products to new customers each quarter to continue to increase our sales. In addition, the spending patterns of many of our customers are characterized by small and sporadic purchases. As a consequence, we have limited backlog and will likely continue to have limited visibility into future operating results.

We do not have long-term, committed-volume purchase contracts with our customers, and therefore have no guarantee of future revenue from any customer.

We typically have not entered into long-term, committed-volume purchase contracts with our customers, including our key customers which account for a material portion of our revenue. As a result, any of our customers may cease to purchase our products at any time. In addition, our customers may attempt to renegotiate terms of sale, including price and quantity. If any of our key customers stop purchasing our access platforms, systems and software for any reason, our business and results of operations would be harmed.

Our efforts to increase our sales to CSPs globally, including cable MSOs, may be unsuccessful.

Our sales and marketing efforts have been focused on CSPs in North America. Part of our long-term strategy is to increase sales to CSPs globally, including cable MSOs. We have devoted and continue to devote substantial technical, marketing and sales resources to these larger CSPs, who have lengthy equipment qualification and sales cycles, without any assurance of generating sales. In particular, sales to these larger CSPs may require us to upgrade our products to meet more stringent performance criteria and interoperability requirements, develop new customer-specific features or adapt our products to meet international standards. Implementing these requirements and features is costly and could negatively impact our operating results, financial condition and cash flows. Moreover, if we are unable to obtain materials at favorable costs, our margins and profitability could be adversely impacted. For example, we work with large CSPs in testing and laboratory trials for our NG-PON2 technology and MSO applications. We have invested and expect to continue to invest considerable time, effort and expenditures, including investment in product research and development, related to these opportunities without any assurance that our efforts will produce orders or revenue. If we are unable to successfully increase our sales to larger CSPs, our operating results, financial condition, cash flows and long-term growth may be negatively impacted.

We are exposed to the credit risks of our customers; if we have inadequately assessed their creditworthiness, we may have more exposure to accounts receivable risk than we anticipate. Failure to collect our accounts receivable in amounts that we anticipate could adversely affect our operating results and financial condition.

In the course of our sales to customers, we may encounter difficulty collecting accounts receivable and could be exposed to risks associated with uncollectible accounts receivable. We maintain an allowance for doubtful accounts for estimated losses resulting from the inability or unwillingness of our customers to make required payments. However, these allowances are based on our judgment and a variety of factors and assumptions.

We perform credit evaluations of our customers' financial condition. However, our evaluation of the creditworthiness of customers may not be accurate if they do not provide us with timely and accurate financial information, or if their situations change after we evaluate their credit. While we attempt to monitor these situations carefully, adjust our allowances for doubtful accounts as appropriate and take measures to collect accounts receivable balances, we have written down accounts receivable and written off doubtful accounts in prior periods and may be unable to avoid additional write-downs or write-offs of doubtful accounts in the future. Such write-downs or write-offs could negatively affect our operating results for the period in which they occur and could harm our financial condition.

Our products must interoperate with many software applications and hardware products found in our customers' networks. If we are unable to ensure that our products interoperate properly, our business will be harmed.

Our products must interoperate with our customers' existing and planned networks, which often have varied and complex specifications, utilize multiple protocol standards, include software applications and products from multiple vendors and contain multiple generations of products that have been added over time. As a result, we must continually ensure that our products interoperate properly with these existing and planned networks. To meet these requirements, we must undertake development efforts that require substantial capital investment and employee resources. We may not accomplish these development goals quickly or cost-effectively, if at all. If we fail to maintain compatibility with other software or equipment found in our customers' existing and planned networks, we may face substantially reduced demand for our products, which would reduce our revenue opportunities and market share.

We have entered into interoperability arrangements with a number of equipment and software vendors for the use or integration of their technology with our products. These arrangements give us access to and enable interoperability with various products that we do not otherwise offer. If these relationships fail, we may have to devote substantially more resources to the development of alternative products and processes and our efforts may not be as effective as the combined solutions under our current arrangements. In some cases, these other vendors are either companies that we compete with directly or companies that have extensive relationships with our existing and potential customers and may have influence over the purchasing decisions of those customers. Some of our competitors have stronger relationships with some of our existing and other potential interoperability partners, and as a result, our ability to have successful interoperability arrangements with these companies may be harmed. Our failure to establish or maintain key relationships with third-party equipment and software vendors may harm our ability to successfully sell and market our products.

The quality of our support and services offerings is important to our customers, and if we fail to continue to offer high quality support and services, we could lose customers, which would harm our business.

Once our products are deployed within our customers' networks, they depend on our support organization to resolve any issues relating to those products. A high level of support is critical for the successful marketing and sale of our products. Furthermore, our services to customers have increasingly broadened to include network design and services to deploy our products within our customers' networks, such as our professional services associated with turnkey network improvement projects for our customers. If we do not effectively assist our customers in deploying our products, succeed in helping them quickly resolve post-deployment issues or provide effective ongoing support, it could adversely affect our ability to sell our products to existing customers and harm our reputation with potential new customers. As a result, our failure to maintain high quality support and services could result in the loss of customers, which would harm our business.

Our products are highly technical and may contain undetected hardware defects or software bugs, which could harm our reputation and adversely affect our business.

Our products, including our cloud and software platforms and systems, are highly technical and, when deployed, are critical to the operation of many networks. Our products have contained and may contain undetected defects, bugs or security vulnerabilities, which risks may be exacerbated as we continue to expand our cloud and software portfolio. Some defects in our products may only be discovered after a product has been installed and used by customers and may in some cases only be detected under certain circumstances or after extended use. Any errors, bugs, defects or security vulnerabilities discovered in our products after commercial release could result in loss of revenue or delay in revenue recognition, loss of customers and increased service and warranty and retrofit costs, any of which could adversely affect our business, operating results and financial condition. In addition, we could face claims for product liability, tort or breach of warranty. Our contracts with customers contain provisions relating to warranty disclaimers and liability limitations, which may not be upheld. Defending a lawsuit, regardless of its merit, is costly and may divert management's attention and adversely affect the market's perception of us and our products. In addition, if our business liability insurance coverage proves inadequate or future coverage is unavailable on acceptable terms or at all, our business, operating results and financial condition could be adversely impacted.

Privacy concerns relating to our products and services could affect our business practices, damage our reputation and deter customers from purchasing our products and services.

Government and regulatory authorities in the United States and around the world have implemented and are continuing to implement broader and more stringent laws and regulations concerning data protection. For example, in July 2016, the European Commission adopted the EU-U.S. Privacy Shield to replace Safe Harbor as a compliance mechanism for the transfer of personal data from the European Union to the United States. In addition, the General Data Protection Regulation adopted by the EU Parliament became effective in May 2018 to harmonize data privacy laws across Europe. Among other requirements, the GDPR imposes specific duties and requirements upon companies that collect, process or control personal data of EU residents. Although we currently do not have material operations or business in the EU, the GDPR regulations could cause us to incur substantial costs in order to expand our business or deliver certain services in the EU. Furthermore, the GDPR imposes penalties for noncompliance of up to the greater of €20 million or 4% of a company's worldwide revenue; accordingly, any non-compliance with the GDPR could result in a material adverse effect on our business, financial condition and results of operations. Similarly, in June 2018, California passed the California Consumer Privacy Act which provides new data privacy rights for consumers and new operational requirements for companies effective in 2020. The interpretation and application of these data protection laws and regulations are often uncertain and in flux, and it is possible that they may be interpreted and applied in a manner that is inconsistent with our data practices. Complying with emerging and changing laws could cause us to incur substantial costs or require us to change our business practices in a manner adverse to our business.

Concerns about or regulatory actions involving our practices with regard to the collection, use, disclosure, or security of customer information or other privacy related matters, even if unfounded, could damage our reputation and adversely affect operating results. While we strive to provide transparency about our collection, use, disclosure and security over any personal data and to comply with all applicable data protection laws and regulations, the failure or perceived failure to comply may result in inquiries and other proceedings or actions against us by government entities or others, or could cause us to lose customers, which could potentially have an adverse effect on our business.

We are subject to cybersecurity and privacy risks.

Our information systems and data centers (including third-party data centers) contain sensitive information that help us operate our business efficiently, interface with and provide software solutions to customers, maintain financial accuracy and accurately produce our financial statements. In addition, we host sensitive data in data centers, including subscriber data, in the course of providing services and solutions to customers. Malicious hackers may attempt to gain access to our network or data centers; steal proprietary information related to our business, products, employees, and customers; or interrupt our systems and services or those of our customers or others. The theft, loss, or misuse of personal data collected, used, stored or transferred by us to run our business could result in significantly increased security and remediation costs or costs related to defending legal claims. If

we do not allocate and effectively manage the resources necessary to build and sustain the proper technology infrastructure, we could be subject to cyberattacks, transaction errors, processing inefficiencies, the loss of customers, business disruptions or the loss of or damage to intellectual property through security breaches. If our data management systems, including those of our third-party data centers, do not effectively and securely collect, store, process and report relevant data for the operation of our business, whether due to cyberattacks, equipment malfunction or constraints, software deficiencies or human error, our ability to effectively plan, forecast and execute our business plan and comply with laws and regulations will be impaired, perhaps materially. Any such impairment could materially and adversely affect our financial condition, results of operations, cash flows, the timeliness with which we internally and externally report our operating results and our business and reputation.

While we have applied multiple layers of security to control access to our information technology systems and use encryption and authentication technologies to secure the transmission and storage of data, these security measures may be compromised as a result of third-party security breaches, employee error, malfeasance, faulty password management or other irregularity, and result in persons obtaining unauthorized access to our data or accounts. Third parties may attempt to fraudulently induce employees into disclosing user names, passwords or other sensitive information, which may in turn be used to access our information technology systems.

While we seek to apply best practice policies and devote significant resources to network security, data encryption and other security measures to protect our information technology and communications systems and data, these security measures cannot provide absolute security. We or our third-party hosting providers may experience a system breach and be unable to protect sensitive data. The costs to us to eliminate or alleviate network security problems, bugs, viruses, worms, malicious software programs and security vulnerabilities could be significant, and our efforts to address these problems may not be successful and could result in unexpected interruptions, delays and cessation of service which may harm our business operations.

Although our systems have been designed around industry-standard architectures to reduce downtime in the event of outages or catastrophic occurrences, they remain vulnerable to damage or interruption from earthquakes, floods, fires, power loss, telecommunication failures, terrorist attacks, cyberattacks, viruses, denial-of-service attacks, human error, hardware or software defects or malfunctions, and similar events or disruptions. Some of our systems are not fully redundant, and our disaster recovery planning is not sufficient for all eventualities. Our systems are also subject to break-ins, sabotage and intentional acts of vandalism. Despite any precautions we may take, the occurrence of a natural disaster, a decision by any of our third-party hosting providers to close a facility we use without adequate notice for financial or other reasons, a data breach or other unanticipated problems at our hosting facilities could cause system interruptions and delays which may result in loss of critical data and lengthy interruptions in our services.

Our estimates regarding future warranty or product obligations may change due to product failure rates, shipment volumes, field service obligations and rework costs incurred in correcting product failures. If our estimates change, the liability for warranty or product obligations may be increased, impacting future cost of revenue.

Our products are highly complex, and our product development, manufacturing and integration testing may not be adequate to detect all defects, errors, failures and quality issues. Quality or performance problems for products covered under warranty could adversely impact our reputation and negatively affect our operating results and financial position. The development and production of new products with high complexity often involves problems with software, components and manufacturing methods. If significant warranty or other product obligations arise due to reliability or quality issues arising from defects in software, faulty components or improper manufacturing methods, our operating results and financial position could be negatively impacted by:

- cost associated with fixing software or hardware defects;
- high service and warranty expenses;
- high inventory obsolescence expense;
- delays in collecting accounts receivable;
- payment of liquidated damages for performance failures; and
- declining sales to existing customers.

We do not have manufacturing capabilities, and therefore we depend upon a small number of CMs and ODMs. We do not have supply contracts with all of these CMs and ODMs. Consequently, our operations could be disrupted if we encounter problems with any of these CMs or ODMs.

We do not have internal manufacturing capabilities and rely upon a small number of CMs and ODMs to build our products. Our reliance on a small number of CMs and ODMs makes us vulnerable to possible capacity constraints and reduced control over component availability, delivery schedules, manufacturing yields and costs.

We do not have supply contracts with some of our CMs and ODMs. Consequently, these CMs are not obligated to supply products to us for any specific period, in any specific quantity or at any certain price. In addition, we are dependent upon our CMs' and ODMs' quality systems and controls and the adherence of such systems and controls to applicable standards. If our CMs and ODMs fail to maintain levels of quality manufacture suitable for us or our customers, we may incur higher costs and our relationships with our customers may be harmed.

The revenue that our CMs generate from our orders represent a relatively small percentage of their overall revenue. As a result, fulfilling our orders may not be considered a priority if such manufacturers are constrained in their ability to fulfill all of their customer obligations in a timely manner. In addition, a substantial part of our manufacturing is done in our CM's and ODM's facilities that are located outside of the United States. We believe that the location of these facilities outside of the United States increases supply risk, including the risk of supply interruptions or reductions in manufacturing quality or controls. Moreover, regulatory changes or government actions relating to export or import regulations, economic sanctions or related legislation, or the possibility of such changes or actions, may create uncertainty or result in changes to or disruption in our operations with our CMs. Additional risks associated with the transition of our supply chain operations to mitigate the impact of substantial tariffs are described in the below risk factor captioned "*Substantially all of the products we currently sell in the United States are manufactured in China. The imposition by the federal government of tariffs on goods imported from China has significantly increased the cost of our products manufactured in China and imported into the United States which may have a material adverse effect on our business, gross margins and results of operations.*"

If any of our CMs or ODMs were unable or unwilling to continue manufacturing our products in required volumes and at high quality levels, we would have to identify, qualify and select acceptable alternative contract manufacturers. An alternative CM may not be available to us when needed or may not be in a position to satisfy our production requirements at commercially reasonable prices and quality. Any significant interruption in manufacturing would require us to reduce our supply of products to our customers, which in turn would reduce our revenue and harm our relationships with our customers.

We and our business partners, including our CMs and suppliers, depend on sole-source, single-source and limited-source suppliers for some key components. If we and our business partners are unable to source these components on a timely or cost-effective basis, we will not be able to deliver our products to our customers.

We and our business partners, including our CMs and suppliers, depend on sole-source, single-source and limited-source suppliers for some key components of our products. For example, certain of our application-specific integrated circuit processors and resistor networks are purchased from sole-source suppliers.

Any of the sole-source, single-source and limited-source suppliers upon whom we or our business partners rely could stop producing our components, cease operations, or enter into exclusive arrangements with our competitors. We may also experience shortages or delay of critical components as a result of growing demand in the industry or other sectors. For example, growth in electronic and IoT devices, wireless products, automotive electronics and artificial intelligence all drive increased demand for certain components, such as chipsets and memory products, which may result in lower availability and increased prices for such components. The cost of components may also be impacted by regulatory requirements.

In addition, purchase volumes of such components may be too low for Calix to be considered a priority customer by these suppliers, and we may not be able to negotiate commercially reasonable terms for our business needs. As a result, these suppliers could stop selling to us and our business partners at commercially reasonable prices, or at all. Any such interruption or delay may force us and our business partners to seek similar components from alternative sources, which may not be available, or result in higher than anticipated prices for such components. Switching suppliers could also require that we redesign our products to accommodate new components and could require us to re-qualify our products with our customers, which would be costly and time consuming. Any interruption in the supply of sole-source, single-source or limited-source components for our products would adversely affect our ability to meet scheduled product deliveries to our customers, could result in lost revenue or higher expenses and would harm our business.

We utilize domestic and international third-party vendors to assist in the design, development and manufacture of certain of our products, and to provide logistics services in the distribution of our products. If these vendors fail to provide these services, we could incur additional costs and delays or lose revenue.

From time to time we enter into ODM and development agreements for the design, development and/or manufacture of certain of our products in order to enable us to offer products on an accelerated basis. For example, a third party assisted in the design and currently manufactures portions of our E-Series systems and nodes family. We also rely upon limited third party vendors for logistics services to distribute our products. If any of these third-party vendors stop providing their services, for any reason, we would have to obtain similar services from alternative sources, which may not be available on commercially reasonable terms, if at all. We also have limited control over disruptions that may occur at the facilities of these third-party partners, such as supply interruptions or manufacturing quality that may occur at ODM facilities and strikes or systems failures that may interrupt transportation and logistics services. In addition, switching development firms or manufacturers could require us to extend our development timeline and/or re-qualify our products with our customers, which would also be costly and time-

consuming. Any interruption in the development, supply or distribution of our products would adversely affect our ability to meet scheduled product deliveries to our customers and could result in lost revenue or higher costs, which would negatively impact our margins and operating results and harm our business.

If we fail to forecast our manufacturing requirements accurately or fail to properly manage our inventory with our contract manufacturers, we could incur additional costs, experience manufacturing delays and lose revenue.

We bear inventory risk under our CM arrangements and our ODM agreements. Lead times for the materials and components that we order through our manufacturers vary significantly and depend on numerous factors, including the specific supplier, contract terms and market demand for a component at a given time. Lead times for certain key materials and components incorporated into our products are currently lengthy, requiring our manufacturers to order materials and components several months in advance of manufacture.

If we overestimate our production requirements, our manufacturers may purchase excess components and build excess inventory. If our manufacturers, at our request, purchase excess components that are unique to our products or build excess products, we could be required to pay for these excess parts or products and their storage costs. Historically, we have reimbursed our primary contract manufacturers for a portion of inventory purchases when our inventory has been rendered excess or obsolete. Examples of when inventory may be rendered excess or obsolete include manufacturing and engineering change orders resulting from design changes or in cases where inventory levels greatly exceed projected demand. If we incur payments to our manufacturers associated with excess or obsolete inventory, this may have an adverse effect on our gross margins, financial condition and results of operations.

We have experienced unanticipated increases in demand from customers, which resulted in delayed shipments and variable shipping patterns. If we underestimate our product requirements, our manufacturers may have inadequate component inventory, which could interrupt manufacturing of our products, increase our cost of product revenue associated with expedite fees and air freight and/or result in delays or cancellation of sales.

As the market for our products evolves, changing customer requirements may adversely affect the valuation of our inventory.

Customer demand for our products can change rapidly in response to market and technology developments. Demand can be affected not only by customer- or market-specific issues, but also by broader economic and/or geopolitical factors. We may, from time to time, adjust inventory valuations downward in response to our assessment of demand from our customers for specific products or product lines. The related excess inventory charges may have an adverse effect on our gross margin, financial condition and results of operations.

If we fail to comply with evolving industry standards, sales of our existing and future products would be adversely affected.

The markets for our products are characterized by a significant number of standards, both domestic and international, which are evolving as new technologies are developed and deployed. As we expand into adjacent markets and increase our international footprint, we are likely to encounter additional standards. Our products must comply with these standards in order to be widely marketable. In some cases, we are compelled to obtain certifications or authorizations before our products can be introduced, marketed or sold in new markets or to customers that we have not historically served. For example, our ability to maintain Operations System Modification for Intelligent Network Elements certification for our products will affect our ongoing ability to continue to sell our products to Tier 1 CSPs.

In addition, our ability to expand our international operations and create international market demand for our products may be limited by regulations or standards adopted by other countries that may require us to redesign our existing products or develop new products suitable for sale in those countries. Although we believe our products are currently in compliance with domestic and international standards and regulations in countries in which we currently sell, we may not be able to design our products to comply with evolving standards and regulations in the future. This ongoing evolution of standards may directly affect our ability to market or sell our products. Further, the cost of complying with the evolving standards and regulations or the failure to obtain timely domestic or foreign regulatory approvals or certification could prevent us from selling our products where these standards or regulations apply, which would result in lower revenue and lost market share.

We may be unable to successfully expand our international operations. In addition, we may be subject to a variety of international risks that could harm our business.

We currently generate most of our sales from customers in North America and have more limited experience marketing, selling and supporting our products and services outside North America or managing the administrative aspects of a worldwide operation. Our ability to expand our international operations is dependent on our ability to create or maintain international market demand for our products. In addition, as we expand our operations internationally, our support organization will face additional challenges including those associated with delivering support, training and documentation in languages other than English. If we invest substantial time and resources to expand our international operations and are unable to do so successfully and in a timely manner, our business, financial condition and results of operations may suffer.

In the course of expanding our international operations and operating overseas, we will be subject to a variety of risks, including:

- differing regulatory requirements, including tax laws, trade laws, data privacy laws, labor regulations, tariffs, export quotas, custom duties or other trade restrictions;
- liability or damage to our reputation resulting from corruption or unethical business practices in some countries;
- exposure to effects of fluctuations in currency exchange rates if, over time, international customer contracts are increasingly denominated in local currencies;
- longer collection periods and difficulties in collecting accounts receivable;
- greater difficulty supporting and localizing our products;
- different or unique competitive pressures as a result of, among other things, the presence of local equipment suppliers;
- challenges inherent in efficiently managing an increased number of employees over large geographic distances, including the need to implement appropriate systems, policies and compensation, benefits and compliance programs;
- limited or unfavorable intellectual property protection;
- risk of change in international political or economic conditions, terrorist attacks or acts of war; and
- restrictions on the repatriation of earnings.

We engage resellers to promote, sell, install and support our products to some customers in North America and internationally. Their failure to do so or our inability to recruit or retain appropriate resellers may reduce our sales and thus harm our business.

We engage some value-added resellers, or VARs, who provide sales and support services for our products. We compete with other telecommunications systems providers for our VARs' business and many of our VARs are free to market competing products. Our use of VARs and other third-party support partners and the associated risks of doing so are likely to increase as we expand sales outside of North America. If a VAR promotes a competitor's products to the detriment of our products or otherwise fails to market our products and services effectively, we could lose market share. In addition, the loss of a key VAR or the failure of VARs to provide adequate customer service could have a negative effect on customer satisfaction and could cause harm to our business. If we do not properly recruit and train VARs to sell, install and service our products, our business, financial condition and results of operations may suffer.

The results of the United Kingdom's referendum on withdrawal from the European Union may have a negative effect on global economic conditions, financial markets and our business.

In June 2016, a majority of voters in the United Kingdom elected to withdraw from the European Union in a national referendum, commonly referred to as Brexit. In March 2017, the United Kingdom began the process to exit the European Union, with the terms of the withdrawal subject to a negotiation period anticipated to last at least two years. In January 2019, the EU Parliament rejected a bill proposed by the United Kingdom's prime minister outlining the terms of the United Kingdom's withdrawal, resulting in further uncertainty associated with Brexit. The referendum has created significant uncertainty about the future relationship between the United Kingdom and the European Union, including with respect to the laws and regulations that will apply as the United Kingdom determines which European Union laws to replace or replicate in the event of a withdrawal. The referendum has also given rise to calls for the governments of other European Union member states to consider withdrawal. These developments, or the perception that any of them could occur, have had and may continue to have a material adverse effect on global economic conditions and the stability of global financial markets, and may significantly reduce global market liquidity and restrict the ability of key market participants to operate in certain financial markets. Any of these factors could depress economic activity and restrict our access to capital, or the access to capital of our

customers or partners, which could have a material adverse effect on our operations in the United Kingdom, and generally on our business, financial condition and results of operations and reduce the price of our securities.

We may have difficulty evolving and scaling our business and operations to meet customer and market demand, which could result in lower profitability or cause us to fail to execute on our business strategies.

In order to grow our business, we will need to continually evolve and scale our business and operations to meet customer and market demand. Evolving and scaling our business and operations places increased demands on our management as well as our financial and operational resources to effectively:

- manage organizational change;
- manage a larger organization;
- accelerate and/or refocus research and development activities;
- expand our manufacturing, supply chain and distribution capacity;
- increase our sales and marketing efforts;
- broaden our customer-support and services capabilities;
- maintain or increase operational efficiencies;
- scale support operations in a cost-effective manner;
- implement appropriate operational and financial systems; and
- maintain effective financial disclosure controls and procedures.

If we cannot evolve and scale our business and operations effectively, we may not be able to execute our business strategies in a cost-effective manner and our business, financial condition, profitability and results of operations could be adversely affected.

We may not be able to protect our intellectual property, which could impair our ability to compete effectively.

We depend on certain proprietary technology for our success and ability to compete. We rely on intellectual property laws as well as nondisclosure agreements, licensing arrangements and confidentiality provisions to establish and protect our proprietary rights. U.S. patent, copyright and trade secret laws afford us only limited protection, and the laws of some foreign countries do not protect proprietary rights to the same extent. Our pending patent applications may not result in issued patents, and our issued patents may not be enforceable. Any infringement of our proprietary rights could result in significant litigation costs. Further, any failure by us to adequately protect our proprietary rights could result in our competitors offering similar products, resulting in the loss of our competitive advantage and decreased sales.

It may become more difficult to adequately protect our intellectual property as we expand our reliance on third parties for the design, development and/or manufacture of our products. While our contracts with such third parties contain provisions relating to intellectual property rights, indemnification and liability, they may not be adequately enforced. Our third-party providers may also be subject to unauthorized third-party copying or use of our proprietary rights.

Despite our efforts to protect our proprietary rights, attempts may be made to copy or reverse engineer aspects of our products or to obtain and use information that we regard as proprietary. Accordingly, we may be unable to protect our proprietary rights against unauthorized third-party copying or use. Furthermore, policing the unauthorized use of our intellectual property is difficult and costly. Litigation may be necessary in the future to enforce our intellectual property rights, to protect our trade secrets or to determine the validity and scope of the proprietary rights of others. Litigation could result in substantial costs, diversion of resources and harm to our business.

We could become subject to litigation regarding intellectual property rights that could harm our business.

We may be subject to intellectual property infringement claims that are costly to defend and could limit our ability to use some technologies in the future. The risk of such claims could increase as we expand our product portfolio and increasingly rely on more technologies. Third parties may assert patent, copyright, trademark or other intellectual property rights to technologies or rights that are important to our business. Such claims may originate from non-practicing entities, patent holding companies or other adverse patent owners who have no relevant product revenue, and therefore, our own issued and pending patents may provide little or no deterrence to suit from these entities.

We have received in the past and expect that in the future we may receive communications from competitors and other companies alleging that we may be infringing their patents, trade secrets or other intellectual property rights; offering licenses to such intellectual property; threatening litigation or requiring us to act as a third-party witness in litigation. In addition, we have agreed, and may in the future agree, to indemnify our customers for expenses or liabilities resulting from certain claimed infringements of patents, trademarks or copyrights of third parties. Such indemnification may require us to be financially

responsible for claims made against our customers, including costs of litigation and damages awarded, which could negatively impact our results of operations. Any claims asserting that our products infringe the proprietary rights of third parties, with or without merit, could be time-consuming, result in costly litigation and divert the efforts of our engineering teams and management. These claims could also result in product shipment delays or require us to modify our products or enter into royalty or licensing agreements. Such royalty or licensing agreements, if required, may not be available to us on acceptable terms, if at all.

Our use of open source software could impose limitations on our ability to commercialize our products.

We incorporate open source software into our products. Although we closely monitor our use of open source software, the terms of many open source software licenses have not been interpreted by the courts, and there is a risk that such licenses could be construed in a manner that could impose unanticipated conditions or restrictions on our ability to sell our products. In such event, we could be required to make our proprietary software generally available to third parties, including competitors, at no cost, to seek licenses from third parties in order to continue offering our products, to re-engineer our products or to discontinue the sale of our products in the event re-engineering cannot be accomplished on a timely basis or at all, any of which could adversely affect our revenue and operating expenses.

If we or our ODMs are unable to obtain necessary third-party technology licenses, our ability to develop new products or product enhancements may be impaired.

While our current licenses of third-party technology generally relate to commercially available off-the-shelf technology, we or our ODMs may from time to time be required to license additional technology from third parties to develop new products or product enhancements. These third-party licenses may be unavailable to us or our ODMs on commercially reasonable terms, if at all. The inability to obtain necessary third-party licenses may force us to or our ODMs to obtain substitute technology of lower quality or performance standards or at greater cost or may increase the time-to-market of our products or product enhancements, any of which could harm the competitiveness of our products and result in lost revenue.

Our ability to incur debt and the use of our funds could be limited by borrowing base restrictions and restrictive covenants in our loan and security agreement for our revolving credit facility.

The Loan Agreement we entered into in August 2017 with Silicon Valley Bank, or SVB, provides for a revolving credit facility based on a customary accounts receivable borrowing base, subject to certain exceptions and exclusions, such that borrowings available to us are limited by eligible accounts receivable (as defined in the Loan Agreement). We are dependent on our existing cash, cash equivalents and borrowings available under our Loan Agreement to provide adequate funds for ongoing operations, planned capital expenditures and working capital requirements for at least the next twelve months. If our financial position deteriorates, our borrowing capacity under the credit facility may be reduced, which would adversely impact our business and growth. In addition, the Loan Agreement includes affirmative and negative covenants and requires that we maintain a specified minimum liquidity ratio and maintenance of Adjusted EBITDA (as defined in the Loan Agreement, as amended). The negative covenants also include, among others, restrictions on our and our subsidiaries' transferring collateral, making changes to the nature of our business or the business of the applicable subsidiary, incurring additional indebtedness, engaging in mergers or acquisitions, paying dividends or making other distributions, making investments, engaging in transactions with affiliates, making payments in respect of subordinated debt, creating liens and selling assets, in each case subject to certain exceptions. Failure to maintain these restrictive covenants and requirements can limit the amount of borrowings that are available to us, increase the cost of borrowings under the facility, and/or require us to make immediate payments to reduce borrowings. Since entering into the Loan Agreement, we have had to request waiver or amendment of certain financial covenants in order to avoid a default under the terms of the Loan Agreement and to maintain our ability to borrow under the Loan Agreement. For the month ended November 30, 2017, we were not able to maintain the minimum Adjusted Quick Ratio (as defined in the Loan Agreement, as amended), or AQR, at the level required in the Loan Agreement, which constituted an event of default. Although SVB waived this event of default effective as of November 30, 2017 and, therefore, this default did not terminate our ability to borrow under the Loan Agreement, we were required to pay an amendment fee and amend certain covenants under the Loan Agreement and, in February 2018, we entered into an amendment to the Loan Agreement that, among other things, amended certain affirmative financial covenants, including reductions to the required minimum level of the AQR and the inclusion of an additional financial covenant related to the maintenance of Adjusted EBITDA. In August 2018, we entered into a Second Amendment to the Loan Agreement to, among other things, provide for the extension of the maturity date of the senior secured revolving credit facility to August 7, 2020 and further amend certain financial covenants, including covenants with respect to the AQR and the Adjusted EBITDA. In February 2019, we entered into a Third Amendment to the Loan Agreement to reduce the required minimum level of the AQR for the first half of 2019 and the required minimum Adjusted EBITDA for the first fiscal quarter of 2019. Although we were compliant with the financial covenants under the Loan Agreement at December 31, 2018, we have in the past been unable to meet the financial covenants required in the Loan Agreement. Given our current financial position and history of operating losses, it is possible that we may fail to meet the minimum levels required by the financial covenants in a future period, which would constitute an event of default under the Loan Agreement. In particular, if we are unable to generate positive cash flows on a continued basis,

we could fall below the minimum AQR requirement, which would constitute an event of default under the Loan Agreement. Under such circumstances we may be forced to immediately repay amounts outstanding under the Loan Agreement. Events beyond our control could have a material adverse impact on our results of operations, financial condition or liquidity, in which case we may not be able to meet our financial covenants. The Loan Agreement covenants may also affect our ability to obtain future financing and to pursue attractive business opportunities and our flexibility in planning for, and reacting to, changes in business conditions. These covenants could place us at a disadvantage compared to some of our competitors, who may have fewer restrictive covenants and may not be required to operate under these restrictions.

Our failure or the failure of our manufacturers to comply with environmental and other legal regulations could adversely impact our results of operations.

The manufacture, assembly and testing of our products may require the use of hazardous materials that are subject to environmental, health and safety regulations, or materials subject to laws restricting the use of conflict minerals. Our failure or the failure of our contract manufacturers, ODMs and OEMs to comply with any of these requirements could result in regulatory penalties, legal claims or disruption of production. In addition, our failure or the failure of our manufacturers to properly manage the use, transportation, emission, discharge, storage, recycling or disposal of hazardous materials could subject us to increased costs or liabilities. Existing and future environmental regulations and other legal requirements may restrict our use of certain materials to manufacture, assemble and test products. Any of these consequences could adversely impact our results of operations by increasing our expenses and/or requiring us to alter our manufacturing processes.

Regulatory and physical impacts of climate change and other natural events may affect our customers and our contract manufacturers, resulting in adverse effects on our operating results.

As emissions of greenhouse gases continue to alter the composition of the atmosphere, affecting large-scale weather patterns and the global climate, any new regulation of greenhouse gas emissions may result in additional costs to our customers and our contract manufacturers. In addition, the physical impacts of climate change and other natural events, including changes in weather patterns, drought, rising ocean and temperature levels, earthquakes and tsunamis may impact our customers, suppliers and contract manufacturers, and our operations. These potential physical effects may adversely affect our revenue, costs, production and delivery schedules, and cause harm to our results of operations and financial condition.

We have in the past pursued, and may in the future continue to pursue, acquisitions which involve a number of risks and uncertainties. If we are unable to address and resolve these risks and uncertainties successfully, such acquisitions could disrupt our business and result in higher costs than we anticipate.

We acquired Occam in 2011 and Ericsson's fiber access assets in 2012. We may in the future acquire other businesses, products or technologies to expand our product offerings and capabilities, customer base and business. We have evaluated and expect to continue to evaluate a wide array of potential strategic transactions. We have limited experience making such acquisitions or integrating these businesses after such acquisitions. Unanticipated costs to us from these historical transactions as well as both anticipated and unanticipated costs to us related to any future transactions could exceed amounts that are covered by insurance and could have a material adverse impact on our financial condition and results of operations. For example, the Occam acquisition resulted in litigation with defense costs that were in excess of available directors and officers liability insurance coverage, including costs for which coverage was denied by our insurance carriers. In addition, the anticipated benefit of any acquisitions may never materialize or the process of integrating acquired businesses, products or technologies may create unforeseen operating difficulties and expenditures.

Some of the areas where we have experienced and may in the future experience acquisition-related risks include:

- expenses and distractions, including diversion of management time related to litigation;
- expenses and distractions related to potential claims resulting from any possible future acquisitions, whether or not they are completed;
- retaining and integrating employees from acquired businesses;
- issuance of dilutive equity securities or incurrence of debt;
- integrating various accounting, management, information, human resource and other systems to permit effective management;
- incurring possible write-offs, impairment charges, contingent liabilities, amortization expense of intangible assets or impairment of goodwill and intangible assets with finite useful lives;
- difficulties integrating and supporting acquired products or technologies;
- unexpected capital expenditure requirements;
- insufficient revenue to offset increased expenses associated with acquisitions; and

- opportunity costs associated with committing capital to such acquisitions.

If our goodwill becomes impaired, we may be required to record a significant charge to our results of operations. We review our goodwill for impairment annually or when events or changes in circumstances indicate the carrying value may not be recoverable, such as a sustained or significant decline in stock price and market capitalization. If the carrying value of goodwill was deemed to be impaired, an impairment loss equal to the amount by which the carrying amount exceeds the estimated fair value would be recognized. Any such impairment could materially and adversely affect our financial condition and results of operations.

Foreign acquisitions would involve risks in addition to those mentioned above, including those related to integration of operations across different cultures and languages, currency risks and the particular economic, political and regulatory risks associated with specific countries. We may not be able to address these risks and uncertainties successfully, or at all, without incurring significant costs, delays or other operating problems.

Our inability to address or anticipate any of these risks and uncertainties could disrupt our business and could have a material impact on our financial condition and results of operations.

Our use of and reliance upon development resources in China may expose us to unanticipated costs or liabilities.

We operate a wholly foreign owned enterprise in Nanjing, China, where a dedicated team of engineers performs product development, quality assurance, cost reduction and other engineering work. Our reliance upon development resources in China may not enable us to achieve meaningful product cost reductions or greater resource efficiency. Further, our development efforts and other operations in China involve significant risks, including:

- difficulty hiring and retaining appropriate engineering resources due to intense competition for such resources and resulting wage inflation;
- the knowledge transfer related to our technology and exposure to misappropriation of intellectual property or confidential information, including information that is proprietary to us, our customers and third parties;
- heightened exposure to changes in the economic, security and political conditions of China;
- fluctuation in currency exchange rates and tax risks associated with international operations;
- development efforts that do not meet our requirements because of language, cultural or other differences associated with international operations, resulting in errors or delays; and
- uncertainty with regards to tariffs imposed by the federal government on products imported from China and future actions the federal government may take with respect to international trade agreements and U.S. tax provisions related to international commerce that could adversely affect our international operations.

Difficulties resulting from the factors above and other risks related to our operations in China could expose us to increased expense, impair our development efforts, harm our competitive position and damage our reputation.

Our customers are subject to government regulation, and changes in current or future laws or regulations that negatively impact our customers could harm our business.

The FCC has jurisdiction over all of our U.S. customers. FCC regulatory policies that create disincentives for investment in access network infrastructure or impact the competitive environment in which our customers operate may harm our business. For example, future FCC regulation affecting providers of broadband Internet access services could impede the penetration of our customers into certain markets or affect the prices they may charge in such markets. Similarly, changes to regulatory tariff requirements or other regulations relating to pricing or terms of carriage on communication networks could slow the development or expansion of network infrastructures. Consequently, such changes could adversely affect the sale of our products and services. Furthermore, many of our customers are subject to FCC rate regulation of interstate telecommunications services and are recipients of CAF capital incentive payments, which are intended to subsidize broadband and telecommunications services in areas that are expensive to serve. Changes to these programs, rules and regulations that could affect the ability of IOCs to access capital, and which could in turn reduce our revenue opportunities, remain possible.

In addition, many of our customers are subject to state regulation of intrastate telecommunications services, including rates for such services, and may also receive funding from state universal service funds. Changes in rate regulations or universal service funding rules, either at the U.S. federal or state level, could adversely affect our customers' revenue and capital spending plans. Moreover, various international regulatory bodies have jurisdiction over certain of our non-U.S. customers. Changes in these domestic and international standards, laws and regulations, or judgments in favor of plaintiffs in lawsuits against CSPs based on changed standards, laws and regulations could adversely affect the development of broadband networks and services. This, in turn, could directly or indirectly adversely impact the communications industry in which our customers operate.

Many jurisdictions, including international governments and regulators, are also evaluating, implementing and enforcing regulations relating to cyber security, privacy and data protection, which can affect the market and requirements for networking and communications equipment. To the extent our customers are adversely affected by laws or regulations regarding their business, products or service offerings, our business, financial condition and results of operations would suffer.

We are subject to governmental export and import controls that could subject us to liability or impair our ability to compete in additional international markets.

Our products are subject to U.S. export and trade controls and restrictions. International shipments of certain of our products may require export licenses or are subject to additional requirements for export. In addition, the import laws of other countries may limit our ability to distribute our products, or our customers' ability to buy and use our products, in those countries. Changes in our products or changes in export and import regulations or duties may create delays in the introduction of our products in international markets, prevent our customers with international operations from deploying our products or, in some cases, prevent the export or import of our products to certain countries altogether. Any change in export or import regulations, duties or related legislation, shift in approach to the enforcement or scope of existing regulations, or change in the countries, persons or technologies targeted by such regulations, could negatively impact our ability to sell, profitably or at all, our products to existing or potential international customers.

If we lose any of our key personnel, or are unable to attract, train and retain qualified personnel, our ability to manage our business and continue our growth would be negatively impacted.

Our success depends, in large part, on the continued contributions of our key management, engineering, sales and marketing personnel, many of whom are highly skilled and would be difficult to replace. None of our senior management or key technical or sales personnel are bound by a written employment contract to remain with us for a specified period. In addition, we do not currently maintain key person life insurance covering our key personnel. If we lose the services of any key personnel, our business, financial condition and results of operations may suffer.

Competition for skilled personnel, particularly those specializing in engineering and sales, is intense. We cannot be certain that we will be successful in attracting and retaining qualified personnel, or that newly hired personnel will function effectively, both individually and as a group. If we are unable to effectively recruit, hire and utilize new employees to align with our company objectives, execution of our business strategy and our ability to react to changing market conditions may be impeded, and our business, financial condition and results of operations may suffer.

Volatility or lack of performance in our stock price may also affect our ability to attract and retain our key personnel. Our executive officers and employees hold a substantial number of shares of our common stock and vested stock options. Employees may be more likely to leave us if the shares they own or the shares underlying their equity awards decline in value, or if the exercise prices of stock options that they hold are significantly above the market price of our common stock. If we are unable to retain our employees, our business, operating results and financial condition will be harmed.

If we fail to maintain proper and effective internal controls, our ability to produce accurate financial statements on a timely basis could be impaired, which would adversely affect our operating results, our ability to operate our business and our stock price.

Ensuring that we have adequate internal financial and accounting controls and procedures in place to produce accurate financial statements on a timely basis is a costly and time-consuming effort that needs to be re-evaluated frequently. We have in the past discovered, and may in the future discover, areas of our internal financial and accounting controls and procedures that need improvement.

Our management is responsible for establishing and maintaining adequate internal control over financial reporting to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of financial statements for external purposes in accordance with U.S. generally accepted accounting principles. Our management does not expect that our internal control over financial reporting will prevent or detect all error and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system's objectives will be met. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud, if any, within our company will have been detected.

We are required to comply with Section 404 of the Sarbanes-Oxley Act, or SOX, which requires us to expend significant resources in developing the required documentation and testing procedures. We cannot be certain that the actions we have taken and are taking to improve our internal controls over financial reporting will be sufficient to maintain effective internal controls over financial reporting in subsequent reporting periods or that we will be able to implement our planned processes and procedures in a timely manner. In addition, new and revised accounting standards and financial reporting requirements may occur in the future and implementing changes required by new standards, requirements or laws may require a significant expenditure of our management's time, attention and resources which may adversely affect our reported financial results. If we

are unable to produce accurate financial statements on a timely basis, investors could lose confidence in the reliability of our financial statements, which could cause the market price of our common stock to decline and make it more difficult for us to finance our operations and growth.

We incur significant costs as a result of operating as a public company, which may adversely affect our operating results and financial condition.

As a public company, we incur significant accounting, legal and other expenses, including costs associated with our public company reporting requirements. We also anticipate that we will continue to incur costs associated with corporate governance requirements, including requirements and rules under SOX and the Dodd-Frank Wall Street Reform and Consumer Protection Act, or Dodd-Frank, among other rules and regulations implemented by the SEC, as well as listing requirements of the New York Stock Exchange, or NYSE. Furthermore, these laws and regulations could make it difficult or costly for us to obtain certain types of insurance, including director and officer liability insurance, and we may be forced to accept reduced policy limits and coverage or incur substantially higher costs to obtain the same or similar coverage. The impact of these requirements could also make it difficult for us to attract and retain qualified persons to serve on our Board of Directors, our board committees or as executive officers.

New laws and regulations as well as changes to existing laws and regulations affecting public companies, including the provisions of SOX and the Dodd-Frank Act and rules adopted by the SEC and the NYSE, would likely result in increased costs to us as we respond to their requirements. We continue to invest resources to comply with evolving laws and regulations, and this investment may result in increased general and administrative expense.

Risks Related to Ownership of Our Common Stock

Our stock price may continue to be volatile, and the value of an investment in our common stock may decline.

The trading price of our common stock has been, and is likely to continue to be, volatile, which means that it could decline substantially within a short period of time and could fluctuate widely in response to various factors, some of which are beyond our control. These factors include those discussed in the “Risk Factors” section of this Annual Report on Form 10-K and others such as:

- quarterly variations in our results of operations or those of our competitors;
- failure to meet any guidance that we have previously provided regarding our anticipated results;
- changes in earnings estimates or recommendations by securities analysts;
- failure to meet securities analysts’ estimates;
- announcements by us or our competitors of new products, significant contracts, commercial relationships, acquisitions or capital commitments;
- developments with respect to intellectual property rights;
- our ability to develop and market new and enhanced products on a timely basis;
- our commencement of, or involvement in, litigation and developments relating to such litigation;
- changes in governmental regulations; and
- a slowdown in the communications industry or the general economy.

In recent years, the stock market in general, and the market for technology companies in particular, has experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of those companies. Broad market and industry factors may seriously affect the market price of our common stock, regardless of our actual operating performance. In addition, in the past, following periods of volatility in the overall market and the market price of a particular company’s securities, securities class action litigation has often been instituted against these companies. This litigation, if instituted against us, could result in substantial costs and a diversion of our management’s attention and resources.

If securities or industry analysts do not publish research or reports about our business or if they issue an adverse or misleading opinion regarding our stock, our stock price 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 publish about us or our business. If any of the analysts who cover us issue an adverse or misleading opinion regarding our stock, our stock price would likely decline. If several of these analysts cease coverage of our company or fail to publish reports on us regularly, we could lose visibility in the financial markets, which in turn could cause our stock price or trading volume to decline.

Provisions in our charter documents and under Delaware law could discourage a takeover that stockholders may consider favorable and may lead to entrenchment of our management and Board of Directors.

Our amended and restated certificate of incorporation and amended and restated bylaws contain provisions that could have the effect of delaying or preventing changes in control or changes in our management or our Board of Directors. These provisions include:

- a classified Board of Directors with three-year staggered terms, which may delay the ability of stockholders to change the membership of a majority of our Board of Directors;
- no cumulative voting in the election of directors, which limits the ability of minority stockholders to elect director candidates;
- the exclusive right of our Board of Directors to elect a director to fill a vacancy created by the expansion of the Board of Directors or the resignation, death or removal of a director, which prevents stockholders from being able to fill vacancies on our Board of Directors;
- the ability of our Board of Directors to issue shares of preferred stock and to determine the price and other terms of those shares, including preferences and voting rights, without stockholder approval, which could be used to significantly dilute the ownership of a hostile acquirer;
- a prohibition on stockholder action by written consent, which forces stockholder action to be taken at an annual or special meeting of our stockholders;
- the requirement that a special meeting of stockholders may be called only by the chairman of the Board of Directors, the chief executive officer or the Board of Directors, which may delay the ability of our stockholders to force consideration of a proposal or to take action, including the removal of directors; and
- advance notice procedures that stockholders must comply with in order to nominate candidates to our Board of Directors or to propose matters to be acted upon at a stockholders' meeting, which may discourage or deter a potential acquirer from conducting a solicitation of proxies to elect the acquirer's own slate of directors or otherwise attempting to obtain control of us.

We are also subject to certain anti-takeover provisions under Delaware law. Under Delaware law, a corporation may not, in general, engage in a business combination with any holder of 15% or more of its capital stock unless the holder has held the stock for three years or, among other things, the Board of Directors has approved the transaction.

We may need additional capital in the future to finance our business.

We may need to raise additional capital to fund operations in the future. Our working capital needs and cash use have continued to increase to support our growth initiatives, and we may need additional capital if our current plans and assumptions change. In addition, the recently implemented U.S. tariffs are expected to have significant negative impact on our cash flows until we are able to mitigate the impact of the tariffs whether through re-engineering of our supply chain or otherwise. Delays in our mitigation plans or unanticipated expenditures associated with these mitigation efforts would further negatively impact our cash flows and result of operations. Failure to maintain certain restrictive covenants and requirements under the Loan Agreement could result in limiting the amount of borrowings that are available to us, increase the cost of borrowings under the credit facility, and/or cause us to make immediate payments to reduce borrowings or result in an event of default. If future financings involve the issuance of equity securities, our then-existing stockholders would suffer dilution. If we raise additional debt financing, we may be subject to restrictive covenants that limit our ability to conduct our business. If we are unable to generate positive operating income and positive cash flows from operations, our liquidity, results of operations and financial condition will be adversely affected. Furthermore, if we are unable to generate sufficient cash flows to support our operational needs, we may need to seek additional sources of liquidity, including borrowings, to support our working capital needs. In addition, we may choose to seek other sources of liquidity even if we believe we have generated sufficient cash flows to support our operational needs. There is no assurance that any other sources of liquidity may be available to us on acceptable terms or at all. If we are unable to generate sufficient cash flows or obtain other sources of liquidity, we will be forced to limit our development activities, reduce our investment in growth initiatives and institute cost-cutting measures, all of which would adversely impact our business and growth.

We do not currently intend to pay dividends on our common stock and, consequently, our stockholders' ability to achieve a return on their investment will depend on appreciation in the price of our common stock.

We do not currently intend to pay any cash dividends on our common stock for the foreseeable future. We currently intend to invest our future earnings, if any, to fund our growth. Additionally, the terms of our credit facility restrict our ability to pay dividends under certain circumstances. Therefore, our stockholders are not likely to receive any dividends on our common stock for the foreseeable future.

ITEM 1B. Unresolved Staff Comments

None.

ITEM 2. Properties

We currently lease approximately 205,900 square feet of office space worldwide. Information concerning our principal leased properties as of December 31, 2018 is set forth below:

Location	Principal Use	Square Footage	Lease Expiration Date
San Jose, California	Corporate headquarters, product design, research and development, administration	65,000	December 2025
Petaluma, California	Sales, marketing, product design, service and repair engineering, distribution, research and development	58,000	March 2019
Nanjing, China	Research and development	40,000	February 2021
Minneapolis, Minnesota	Product design, research and development, service and repair engineering	28,500	March 2019
Richardson, Texas	Service and test engineering	14,400	January 2022

We believe that our facilities are in good condition and are generally suitable to meet our needs for the foreseeable future. We believe that prior to expiration of our current office space leases that we can renew or obtain suitable lease space on commercially reasonable terms for our business needs. In addition, we may continue to seek additional space as needed, and we believe this space will be available on commercially reasonable terms.

In August 2018, we entered a new office space lease in Petaluma, California for 22,000 square feet, which is expected to commence in March 2019 for a term of 64 months.

ITEM 3. Legal Proceedings

From time to time, we are involved in various legal proceedings arising from the normal course of business. We are not currently a party to any legal proceedings that, if determined adversely to us, in our opinion, are currently expected to individually or in the aggregate have a material adverse effect on our business, operating results or financial condition taken as a whole.

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

Comparative Stock Prices

Our common stock has been trading on the New York Stock Exchange, under the trading symbol “CALX” since our initial public offering on March 24, 2010. Prior to this time, there was no public market for our common stock.

Number of Common Stock Holders

As of February 25, 2019, the approximate number of holders of our common stock was 363 (not including beneficial owners of stock held in street name).

Dividends

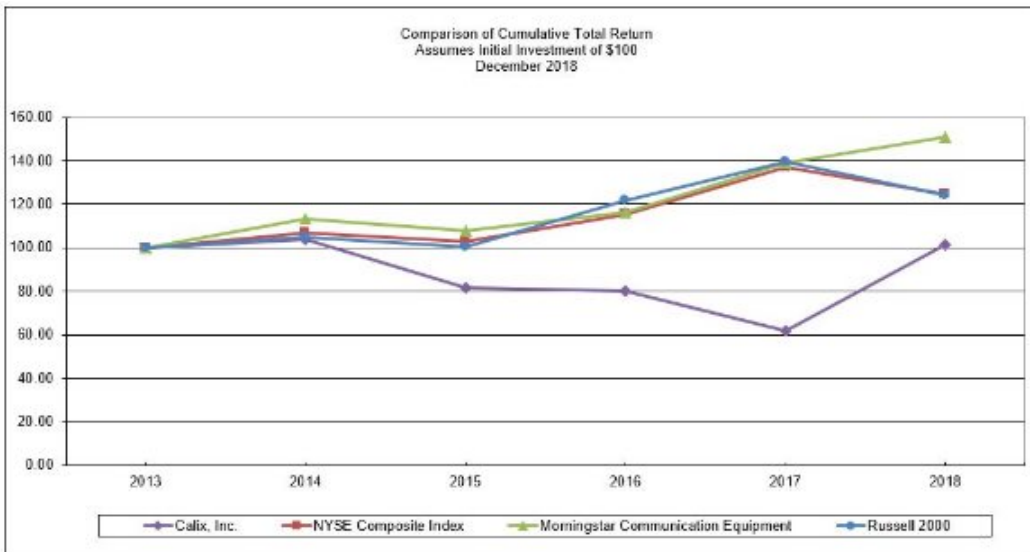
We have never declared or paid any cash dividends on our common stock, and we do not currently intend to pay any cash dividends on our common stock in the foreseeable future. In addition, our credit facility requires SVB’s consent before dividends can be declared. See Note 5, “*Credit Agreements*” of Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K.

Recent Sales of Unregistered Securities

None.

Performance Graph

The following graph shows a comparison of the cumulative total stockholder return on our common stock with the cumulative total returns of the Russell 2000 Index and the Morningstar Communication Equipment Index. The graph tracks the performance of a \$100 investment in our common stock and in each of the indexes during the last five fiscal years ended December 31, 2018. Data for the Russell 2000 Index and the Morningstar Communication Equipment Index assume reinvestment of dividends. Stockholder returns over the indicated period are based on historical data and should not be considered indicative of future stockholder returns.



This performance graph shall not be deemed “soliciting material” or to be “filed” with the SEC for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to the liabilities under that Section, and shall not be deemed to be incorporated by reference into any filing of Calix, Inc. under the Securities Act of 1933, as amended.

ITEM 6. Selected Financial Data

The following selected consolidated financial data should be read in conjunction with our consolidated financial statements and the related notes thereto, of this Annual Report on Form 10-K, the section titled “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and the other financial information and data appearing elsewhere in this Annual Report on Form 10-K. The selected financial data included in this section is not intended to replace and is not a substitute for, the consolidated financial statements and related notes in this Annual Report on Form 10-K.

We derived the statements of operations data for the years ended December 31, 2018, 2017 and 2016 and the balance sheet data as of December 31, 2018 and 2017 from our audited consolidated financial statements and related notes thereto of this Annual Report on Form 10-K. We derived the statements of operations data for the years ended December 31, 2015 and 2014 and the balance sheet data as of December 31, 2016, 2015 and 2014 from our audited consolidated financial statements and related notes which are not included in this Annual Report on Form 10-K. Historical results for any prior period are not necessarily indicative of future results for any period.

	Years Ended December 31,				
	2018	2017	2016	2015	2014
	(In thousands, except per share data)				
Statement of Operations Data:					
Revenue	\$ 441,320	\$ 510,367	\$ 458,787	\$ 407,163	\$ 401,227
Cost of revenue ⁽¹⁾	243,938	337,477	257,569	217,034	223,438
Gross profit	197,382	172,890	201,218	190,129	177,789
Operating expenses:					
Research and development ⁽¹⁾	89,963	127,541	106,869	89,714	80,311
Sales and marketing ⁽¹⁾	86,432	82,781	83,675	78,563	76,283
General and administrative ⁽¹⁾	40,500	39,875	41,592	38,454	31,371
Restructuring charges	5,705	4,249	—	—	—
Amortization of intangible assets	—	—	1,701	10,208	10,208
Gain on sale of product line	(6,704)	—	—	—	—
Litigation settlement gain	—	—	(4,500)	—	—
Total operating expenses	215,896	254,446	229,337	216,939	198,173
Loss from operations	(18,514)	(81,556)	(28,119)	(26,810)	(20,384)
Interest and other income (expense), net	(254)	(233)	1,064	712	151
Loss before provision for income taxes	(18,768)	(81,789)	(27,055)	(26,098)	(20,233)
Provision for income taxes	530	1,243	347	535	581
Net loss	\$ (19,298)	\$ (83,032)	\$ (27,402)	\$ (26,633)	\$ (20,814)
Net loss per common share:					
Basic and diluted	\$ (0.37)	\$ (1.66)	\$ (0.56)	\$ (0.52)	\$ (0.41)
Weighted-average number of shares used to compute net loss per common share:					
Basic and diluted	52,609	50,155	48,730	51,489	50,808
⁽¹⁾ Includes stock-based compensation as follows:					
Cost of revenue	\$ 1,248	\$ 749	\$ 672	\$ 709	\$ 1,120
Research and development	5,969	4,869	5,125	4,797	5,056
Sales and marketing	5,787	3,433	4,586	4,712	5,601
General and administrative	4,469	3,317	3,902	3,587	4,240
	\$ 17,473	\$ 12,368	\$ 14,285	\$ 13,805	\$ 16,017

	December 31,				
	2018	2017	2016	2015	2014
	(In thousands)				
Balance Sheet Data:					
Cash, cash equivalents, restricted cash and marketable securities	\$ 50,274	\$ 39,775	\$ 78,107	\$ 73,590	\$ 111,679
Working capital	31,079	34,123	97,926	115,561	131,693
Total assets	317,080	295,070	355,475	323,886	370,221
Common stock and additional paid-in capital	877,555	852,475	837,931	820,080	803,101
Total stockholders' equity	151,934	144,963	212,964	235,785	272,591

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

The Management's Discussion and Analysis of Financial Condition and Results of Operations contains forward-looking statements regarding future events and our future results that are subject to the safe harbors created under the Securities Act of 1933 (the "Securities Act") and the Securities Exchange Act of 1934 (the "Exchange Act"). All statements other than statements of historical facts are statements that could be deemed forward-looking statements. These statements are based on current expectations, estimates, forecasts and projections about the industry in which we operate and the beliefs and assumptions of our management. In some cases, forward-looking statements can be identified by the use of words such as "believe," "expect," "may," "estimate," "continue," "anticipate," "intend," "should," "plan," "predict," "will," "project," "potential," or the negative thereof or other comparable terminology. In addition, any statements that refer to projections of our future financial performance, our anticipated growth and trends in our business and industry and other characterizations of future events or circumstances are forward-looking statements. Readers are cautioned that these forward-looking statements are only predictions and are subject to risks, uncertainties and assumptions that are difficult to predict, including those identified in the Risk Factors discussed in Item 1A, in the discussion below, as well as in other sections of this Annual Report on Form 10-K. Therefore, actual results may differ materially and adversely from those expressed in any forward-looking statements. All forward-looking statements and reasons why results may differ included in this report are made as of the date hereof, and we assume no obligation to update these forward-looking statements or reasons why actual results might differ.

Overview

We are a leading global provider of cloud and software platforms, systems and software for fiber- and copper-based network architectures and a pioneer in software defined access and cloud products focused on access networks and the subscriber. Our portfolio allows for a broad range of subscriber services to be provisioned and delivered over a single unified network. Our access systems can deliver voice and data services, advanced broadband services, mobile broadband, as well as high-definition video and online gaming. Our most recent generation of premises systems enable CSPs to address the complexity of the smart home and business and offer new services to their device enabled subscribers. We have designed all of these platforms and related systems so that they can be monitored, analyzed, managed and supported by Calix Cloud.

We market our cloud and software platforms, systems and services to CSPs globally through our direct sales force as well as select resellers. Our customers range from smaller, regional CSPs to some of the world's largest CSPs. We have enabled over 1,500 customers to deploy passive optical, Active Ethernet and point-to-point Ethernet fiber access networks.

Our revenue decreased to \$441.3 million for 2018 from \$510.4 million for 2017 and \$458.8 million for 2016. Our revenue and revenue growth will depend on our ability to sell and license our cloud and software platforms, systems and services to existing customers as well as our ability to attract new customers, particularly larger CSPs, in the U.S. and internationally.

During 2018, we recognized revenue based on Accounting Standard Update No., or ASU, 2014-09, "Revenue from Contracts with Customers (Topic 606)", but revenue for the year ended December 31, 2017 was recognized based on Topic 605. Revenue in 2018 was \$1.7 million higher than it would have been under the previous accounting standard. For additional information on the impact of the new accounting standard on our revenue, see Note 1 of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K.

Revenue fluctuations result from many factors, including, but not limited to: increases or decreases in customer orders for our products and services, market, financial or other factors that may delay or materially impact customer purchasing decisions, contractual terms with customers that result in delayed revenue recognition and varying budget cycles and seasonal buying patterns of our customers. More specifically, our customers tend to spend less in the first quarter as they are finalizing their annual budgets, and in certain regions, customers are challenged by winter weather conditions that inhibit fiber deployment in outside infrastructure. Our revenue is also dependent upon our customers' timing of purchases, capital expenditure plans and decisions to upgrade their network or adopt new technologies, including expenditure plans for turnkey solutions projects, which are generally non-recurring in nature. In particular, since the end of 2017, we experienced significantly lower order volumes by

our largest customer due to the timing of their recent acquisition and lower amounts of CAF deployment services in 2018. Specifically, this customer represented 18% of total revenue in 2018 compared with 31% in the prior year. We expect that this acquisition may continue to disrupt the customer's expenditure plans and result in continued delays and lower levels of purchases of our products and services.

Cost of revenue is strongly correlated to revenue and tends to fluctuate due to all of the above factors that could impact revenue. Factors that impacted our cost of revenue for the year ended December 31, 2018, and that we expect would impact cost of revenue in future periods, also include: changes in the mix of products delivered, customer location and regional mix, changes in product warranty and incurrence of retrofit costs, changes in the cost of our inventory, including higher costs due to materials shortages, supply constraints or unfavorable changes in trade policies, tariffs and inventory write-downs. Cost of revenue also includes fixed expenses related to our internal operations, which could impact our cost of revenue as a percentage of revenue if there are large fluctuations in revenue.

During the year ended December 31, 2018, our gross profit and gross margin were positively impacted by the customer mix shift, the sale of our new platform offerings and a decrease in our services revenue, which carries a lower than corporate average gross margin, as a mix of total revenue. Overall, our gross profit and gross margin fluctuate based on timing of factors such as new product introductions or upgrades to existing products, changes in customer mix, changes in the mix of products demanded and sold (and any related write-downs of existing inventory) and may be negatively impacted by increases in mix of revenue towards professional services, increases in mix of revenue from channel sales rather than direct sales or other unfavorable customer or product mix, shipment volumes and any related volume discounts, changes in our product and services costs, pricing decreases or discounts, customer rebates and incentive programs due to competitive pressure or materials shortages, supply constraints, tariffs or unfavorable changes in trade policies.

Our operating expenses have fluctuated based on the following factors: changes in headcount and personnel costs, which comprise a significant portion of our operating expenses; timing of variable compensation expenses due to fluctuations in shipment volumes; timing of research and development expenses, including investments in innovative solutions and new customer segments, prototype builds and outsourced development projects; investments in our business and information technology infrastructure; and fluctuations in stock-based compensation expenses due to timing of equity grants or other factors affecting vesting. During the year ended December 31, 2018 as compared to 2017, our total operating expenses decreased largely due to the restructuring actions we took in 2017 and early 2018. In March 2017, we adopted a restructuring plan to realign our business to increase focus towards investments in software platforms and to reduce the expense structure in our traditional systems business. We incurred restructuring charges of \$4.2 million in 2017 under this plan. In the first quarter of 2018, we established a new restructuring plan to further align our business resources based on the production releases of our platform offerings and incurred restructuring charges of \$5.7 million during 2018. Our restructuring activities were completed in the second quarter of 2018.

Our net loss was \$19.3 million in 2018, \$83.0 million in 2017 and \$27.4 million in 2016. Since our inception, we have incurred significant losses, and as of December 31, 2018, we had an accumulated deficit of \$684.9 million. Further, as a result of the fluctuations described above and a number of other factors, many of which are outside our control, our annual operating results fluctuate from period to period. Comparing our operating results on a period-to-period basis may not be meaningful, and you should not rely on our past results as an indication of our future performance.

Product Line Divestiture

In February 2018, we sold our outdoor cabinet product line to Clearfield, Inc. for \$10.4 million in cash as well as the assumption by Clearfield of related product warranty liabilities and open purchase order commitments with our contract manufacturer. The divestiture of this non-strategic product line reflects our continued focus on execution on our platforms and business strategy.

Critical Accounting Policies and Estimates

Our financial statements are prepared in accordance with U.S. GAAP. These accounting principles require us to make certain estimates and judgments that can affect the reported amounts of assets and liabilities as of the date of the financial statements, as well as the reported amounts of revenue and expenses during the periods presented. We base our estimates, assumptions and judgments on historical experience and on various other factors that are believed to be reasonable under the circumstances. To the extent there are material differences between these estimates and actual results, our financial statements may be affected. We evaluate our estimates, assumptions and judgments on an ongoing basis.

We believe the following critical accounting policies affect our significant judgments and estimates used in the preparation of our financial statements.

Revenue Recognition

Revenue is recognized when a performance obligation is satisfied, which occurs when control of the promised goods or services is transferred to the customer, in an amount that reflects the consideration the we expect to be entitled to in exchange for those goods or services.

A performance obligation is a promise in a contract to transfer a distinct good or service to the customer and is the unit of account. A contract's transaction price is allocated to each distinct performance obligation and recognized as revenue when, or as, the performance obligation is satisfied. Our hardware products contain both software and non-software components that function together to deliver the products' essential functionality and therefore constitutes a single performance obligation as the promise to transfer the individual software and non-software components is not separately identifiable and, therefore, not distinct. Our contracts may include multiple performance obligations. For such arrangements, we allocate the contract's transaction price to each performance obligation using the relative stand-alone selling price of each distinct good or service in the contract. We generally determine stand-alone selling prices based on the prices charged to customers or our best estimate of stand-alone selling price. Our estimate of stand-alone selling price is established considering multiple factors including, but not limited to, geographies, market conditions, competitive landscape, internal costs, gross margin objectives, characteristics of targeted customers and pricing practices. The determination of estimated stand-alone selling price is made through consultation with and formal approval by management, taking into consideration the go-to-market strategy.

For certain revenue arrangements involving delivery of both systems and professional services, each is considered a distinct performance obligation. Systems revenue is recognized at a point in time when management has determined that control over systems has transferred to the customer, which is generally when legal title has transferred to the customer. For the same revenue arrangements, we believe that control of the associated professional services is transferred to the customer over time. As such, professional services revenue is recognized over the period in which the services are provided using a cost input measure. We recognize revenue when control of the systems and services has been transferred to the customer, which may be earlier than system installation or customer acceptance, in accordance with the agreed-upon specifications in the contract.

Inventory Valuation

Inventory, which primarily consists of finished goods purchased from CMs or ODMs, is stated at the lower of cost (determined by the first-in, first-out method) and net realizable value. Inbound shipping costs and tariffs are included in the cost of inventory. In addition, we, from time to time, procure component inventory primarily as a result of manufacturing discontinuation of critical components by suppliers. We regularly monitor inventory quantities on-hand and record write-downs for excess and obsolete inventory based on our estimate of demand for our products, potential obsolescence of technology, product life cycle and whether pricing trends or forecasts indicate that the carrying value of inventory exceeds our estimated selling price. These factors are impacted by market and economic conditions, technology changes and new product introductions and require estimates that may include elements that are uncertain. Actual demand may differ from forecasted demand and may have a material effect on gross profit. If inventory is written down, a new cost basis is established that cannot be increased in future periods. The sale of previously reserved inventory has not had a material impact on our gross margin.

Recent Accounting Pronouncements Not Yet Adopted

Leases

In February 2016, the FASB issued ASU 2016-02, "*Leases (Topic 842)*", which requires recognition of an asset and liability for lease arrangements longer than twelve months. ASU 2016-02 became effective for us beginning in the first quarter of 2019. The standard can be adopted using either a modified retrospective approach, whereby we would recognize and measure leases at the beginning of the earliest period presented, or the effective date approach, whereby we would initially account for the impact of the adoption with a cumulative-effect adjustment to the January 1, 2019 financial statements. The effective date approach eliminates the need to restate amounts presented prior to January 1, 2019. We adopted the new standard effective January 1, 2019 using the effective date approach. Upon adoption of the standard, our assets and liabilities increased by approximately \$16 million as the new standard requires recognition of right-of-use assets and lease liabilities for operating leases, but the new standard does not impact our Statements of Comprehensive Loss or Cash Flows.

Results of Operations for Years Ended December 31, 2018 , 2017 and 2016

Revenue

Our revenue is comprised of the following:

- Systems – includes revenue from the sale of access and premises systems, software platform licenses and cloud-based software subscriptions.
- Services – includes revenue from professional services, customer support, software- and cloud-based maintenance, extended warranty subscriptions, training and managed services.

The following table sets forth our revenue (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Revenue:							
Systems	\$ 405,923	\$ 421,890	\$ 428,584	\$ (15,967)	(4)%	\$ (6,694)	(2)%
Services	35,397	88,477	30,203	(53,080)	(60)%	58,274	193 %
	<u>\$ 441,320</u>	<u>\$ 510,367</u>	<u>\$ 458,787</u>	<u>\$ (69,047)</u>	<u>(14)%</u>	<u>\$ 51,580</u>	<u>11 %</u>
Percent of total revenue:							
Systems	92%	83%	93%				
Services	8%	17%	7%				
	<u>100%</u>	<u>100%</u>	<u>100%</u>				

Our revenue is principally derived in the United States. Revenue generated in the United States represented approximately 88% of our total revenue in 2018 , 89% in 2017 and 91% in 2016 .

2018 compared to 2017 : The decrease in revenue during 2018 compared with 2017 was due to lower services revenue of \$53.1 million primarily driven by a lower level of CAF-related professional services and the substantial completion of services associated with a significant turnkey network improvement project during the first quarter of 2017 and to lower systems revenue of \$16.0 million , also impacted by a lower level of CAF projects and a decline in sales of our traditional systems. This was partially offset by greater traction with our AXOS and Calix Cloud platforms.

We had one customer that accounted for more than 10% of our total revenue in 2018 and 2017 and two customers that each accounted for more than 10% of our total revenue in 2016. See Note 1 to the Consolidated Financial Statements set forth in this report for more details on concentration of revenue for the periods presented.

2017 compared to 2016 : The increase in revenue during 2017 compared with 2016 resulted from an increase in services revenue by \$58.3 million, or 193%, primarily driven by the substantial completion of services associated with a significant turnkey network improvement project during the first quarter of 2017 and the completion of the vast majority of sites from previously-awarded CAF projects by the fourth quarter of 2017. Our product revenue decreased by \$6.7 million mainly due to lower shipments to one of our large Tier 2 customers relative to the prior year period related to a significant turnkey network improvement project in 2016, which was completed in the first half of 2017.

Cost of Revenue, Gross Profit and Gross Margin

The following table sets forth our cost of revenue (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Cost of revenue:							
Systems	\$ 216,529	\$ 236,137	\$ 228,976	\$ (19,608)	(8)%	\$ 7,161	3%
Services	27,409	101,340	28,593	(73,931)	(73)%	72,747	254%
	<u>\$ 243,938</u>	<u>\$ 337,477</u>	<u>\$ 257,569</u>	<u>\$ (93,539)</u>	<u>(28)%</u>	<u>\$ 79,908</u>	<u>31%</u>

2018 compared to 2017 : The decrease in cost of revenue of \$93.5 million during 2018 as compared to 2017 was primarily attributable to a decrease in cost of service revenue by \$73.9 million , as we experienced higher levels of service activities in 2017 as well as higher costs attributed to rework, delays, unanticipated costs and overruns (including third party costs) for our turnkey network improvement projects in 2017. Our cost of systems revenue also decreased by \$19.6 million as compared with 2017 mainly due to lower systems revenue partially offset by improved regional and new product mix, which have higher gross margins.

2017 compared to 2016 : The increase in cost of revenue of \$79.9 million during 2017 as compared to 2016 was primarily attributable to an increase in cost of services revenue by \$72.7 million, as we experienced higher levels of service activities as well as higher costs attributed to rework, delays, unanticipated costs and overruns (including third party costs) for our turnkey network improvement projects. Our cost of product revenue increased by \$7.2 million during 2017 compared with 2016 primarily due to a product mix shift to lower margin products, partially offset by the lower volume of revenue. Cost of product revenue also included an increase in inventory write-downs of \$2.9 million attributed to slow moving inventories, partially offset by a decrease in warranty and retrofit costs of \$1.2 million primarily related to certain retrofit charges for two specific product families.

The following table sets forth our gross profit and gross margin (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Gross profit:							
Systems	\$ 189,394	\$ 185,753	\$ 199,608	\$ 3,641	2 %	\$ (13,855)	(7)%
Services	7,988	(12,863)	1,610	20,851	(162)%	(14,473)	(899)%
	<u>\$ 197,382</u>	<u>\$ 172,890</u>	<u>\$ 201,218</u>	<u>\$ 24,492</u>	14 %	<u>\$ (28,328)</u>	(14)%
Gross margin:							
Systems	47 %	44 %	47 %				
Services	23 %	(15) %	5 %				
	45 %	34 %	44 %				

2018 compared to 2017 : Gross profit increased by \$24.5 million to \$197.4 million during 2018 from \$172.9 million during 2017 . Gross margin increased to 45 % during 2018 from 34 % during 2017 . The increase in gross profit and gross margin during 2018 was primarily due to the completion of a turnkey network improvement project and CAF-related projects in 2017, where project rework and cost overruns resulted in negative gross margin, and a decrease in our services revenue, which carries a lower than average gross margin, as a mix of total revenue. Services gross margin improved in 2018 primarily due to process improvements and efficiencies implemented in 2017. Systems gross margin increased due to strength in sales to our smaller regional customers and to an increasing mix of new products that have higher margins than some of our older traditional products. The improvement in system gross margin was partially offset by U.S. tariff and tariff-related costs of \$3.2 million in the fourth quarter of 2018.

Given the recently enacted U.S. tariffs, we are working aggressively with partners and suppliers to re-engineer our supply chain and move production outside of China in addition to other supply chain improvements. We anticipate the cost impact of the current U.S. tariffs to be significant going forward, including in the next several quarters, but expect that we would be able to mitigate the impact of these tariffs through our supply chain re-engineering efforts with the cost impact diminishing beginning after the first half of 2019. We further anticipate that if we are successful in mitigating the impact of these tariffs within our planned timing, we would be able to avoid raising prices to our customers to cover tariff increases. Regardless of our mitigation plans, we expect these U.S. tariffs as well as the costs to realign our global supply chain will negatively impact overall gross margin.

2017 compared to 2016 : Gross profit decreased by \$28.3 million to \$172.9 million during 2017 from \$201.2 million during 2016. Gross margin decreased to 34 % during 2017 from 44 % during 2016. The decrease in gross profit and gross margin during 2017 was primarily due to an increase in revenue mix toward service revenue as we grew our professional services business, an increased level of activities in our turnkey network improvement projects and higher costs attributed to services rework and overruns. The rework costs and overruns generally relate to projects that were started in 2016 that incurred higher than anticipated costs from third party contractors, project delays, third party dependencies, quality issues associated with subcontracted work, rework to meet customer requirements and longer than anticipated time to complete. The vast majority of these 2016 projects were completed by the end of 2017.

Operating Expenses

Research and Development Expenses

Research and development expenses represent the largest component of our operating expenses and include personnel costs, outside contractor and consulting services, depreciation on lab equipment, costs of prototypes and overhead allocations. The following table sets forth our research and development expenses (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Research and development	\$ 89,963	\$ 127,541	\$ 106,869	\$ (37,578)	(29)%	\$ 20,672	19%
Percent of total revenue	20%	25%	23%				

2018 compared to 2017 : The decrease in research and development expenses during 2018 compared with 2017 was primarily due to the leverage of our software platforms enabling us to lower our level of investment and introduce new products faster. In addition, during 2017 and the first quarter of 2018, we restructured our business to increase our focus towards investments in software platforms and to reduce the expense structure of our traditional systems business. As a result, our personnel for research and development decreased during 2018 as compared 2017, which lowered compensation and employee benefits by \$21.9 million. The decrease was also due to lower expenses for outside services of \$8.2 million and lower expenditures relating

to prototype and expendable equipment of \$5.4 million. We expect our investments in research and development will be relatively consistent in absolute dollars from our current post-restructuring levels over the near term.

2017 compared to 2016 : The increase in research and development expenses during 2017 compared with 2016 was primarily due to an increase in expenses for outside contractors by \$15.0 million and expenditures relating to prototype and expendable equipment used for research and development activities by \$0.8 million, primarily for development services including investments in our cloud and software platforms and next generation systems to pursue broader growth opportunities. Our personnel for research and development also increased in 2017 as compared to 2016, which resulted in higher compensation and employee benefits (other than bonuses) of \$4.8 million. This increase was partially offset by lower employee bonuses of \$0.6 million in 2017 as compared to 2016.

Sales and Marketing Expenses

Sales and marketing expenses consist of personnel costs, employee sales commissions, marketing programs, software tools and travel-related expenses. The following table sets forth our sales and marketing expenses (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Sales and marketing	\$ 86,432	\$ 82,781	\$ 83,675	\$ 3,651	4%	\$ (894)	(1)%
Percent of total revenue	20%	16%	18%				

2018 compared to 2017 : Sales and marketing expenses increased by \$3.7 million during 2018 compared with 2017 primarily due to an increase in stock-based compensation of \$2.4 million and an increase in marketing programs of \$1.4 million to promote our software and cloud platforms.

We expect to continue our investments in sales and marketing in order to extend our market reach and grow our business in support of our key strategic initiatives.

2017 compared to 2016 : Sales and marketing expenses decreased by \$0.9 million during 2017 compared with 2016 primarily due to decreases in personnel costs of \$1.7 million as headcount decreased and a decrease in stock-based compensation of \$1.2 million. These decreases were partially offset by an increase in marketing expenses of \$1.4 million as we invested more in ConneXions, our annual user conference, and other industry and marketing events and an increase in software tools of \$0.9 million.

General and Administrative Expenses

General and administrative expenses consist primarily of personnel costs related to our executive, finance, human resources, information technology and legal organization, outside consulting services, insurance, allocated facilities and fees for professional services. Professional services consist of outside audit, legal, accounting and tax services. The following table sets forth our general and administrative expenses (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
General and administrative	\$ 40,500	\$ 39,875	\$ 41,592	\$ 625	2%	\$ (1,717)	(4)%
Percent of total revenue	9%	8%	9%				

2018 compared to 2017 : The increase in general and administrative expenses of \$0.6 million during 2018 compared with 2017 was primarily due to an increase in stock-based compensation of \$1.2 million partially offset by an overall decrease in professional service fees of \$0.6 million. We incurred professional services fees for ongoing activities to migrate our on-premise enterprise resource planning system to a cloud model at the same levels as the prior year.

Our general and administrative expenses as a percentage of total revenue remained relatively flat from year to year. We expect our general and administrative expenses to decrease as a percentage of revenue over time.

2017 compared to 2016 : The decrease in general and administrative expenses during 2017 compared with 2016 included legal fees and expenses related to the Occam litigation of \$6.4 million that did not recur in 2017 as the litigation was settled in 2016. The decrease was partially offset by increases in professional services of \$2.5 million primarily related to outside consulting services for migrating of our on-premise enterprise resource planning infrastructure to a cloud model, compensation and employee benefits of \$1.0 million, primarily due to increase in headcount and severance benefits of \$0.5 million related to our separation agreement with our former Chief Financial Officer and an increase in legal expenses of \$0.5 million. The increase in compensation and employee benefits includes reductions in employee bonuses of \$0.7 million and stock-based compensation of \$0.6 million during 2017 as compared to 2016.

Restructuring Charges

We adopted a restructuring plan in March 2017. This restructuring plan realigned our business, increasing our focus towards investments in software platforms and cloud products, while reducing our expense structure in the traditional systems business. We began to take actions under this plan beginning in March 2017 and recognized \$4.2 million of restructuring charges during 2017, consisting of severance and other one-time termination benefits. Actions pursuant to this restructuring plan were complete as of December 31, 2017.

In the first quarter of 2018, we established a new restructuring plan to further realign our business resources based on the production releases of our platform offerings. We incurred restructuring charges of \$5.7 million during 2018, consisting primarily of severance and other termination related benefits. Actions pursuant to this restructuring plan were complete as of June 30, 2018. Please refer to Note 4, “Balance Sheet Details – Accrued Restructuring Charges” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K.

Gain on Sale of Product Line

During 2018, we recognized a gain of \$6.7 million relating to the sale of our outdoor cabinet product line to Clearfield, Inc. for \$10.4 million. Please refer to Note 13, “Product Line Divestiture” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K.

Interest and Other Income (Expense), Net

The following table sets forth our interest and other income (expense), net (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Interest and other income (expense), net	\$ (254)	\$ (233)	\$ 1,064	\$ (21)	9%	\$ (1,297)	(122)%

2018 compared to 2017 : Interest and other income (expense) was relatively flat in 2018 compared with 2017 .

2017 compared to 2016 : The decrease in interest and other income (expense), net during 2017 compared with 2016 is primarily due to a reduction in interest income resulting from lower levels of marketable securities investments in 2017, an increase in interest expense resulting from initiating line of credit borrowings in 2017 and a decrease in foreign currency gain (loss).

Provision for Income Taxes

The provision for income taxes primarily consist of state and foreign income taxes. The following table sets forth our provision for income taxes (dollars in thousands):

	Years Ended December 31,			2018 vs 2017 Change		2017 vs 2016 Change	
	2018	2017	2016	\$	%	\$	%
Provision for income taxes	\$ 530	\$ 1,243	\$ 347	\$ (713)	(57)%	\$ 896	258%
Effective tax rate	(2.8)%	(1.5)%	(1.3)%				

2018 compared to 2017 : The provision for income taxes decreased by \$0.7 million from \$1.2 million in 2017 to \$0.5 million in 2018 . The decrease was primarily due to a write-off of a foreign entity’s deferred tax assets in 2017.

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as the “Tax Cuts and Jobs Act” , or the Tax Act. The significant impacts from the Tax Act include a net, one-time transition tax of \$1.1 million on unrepatriated earnings of foreign subsidiaries, which was offset by our current net operating loss, and a tax expense of \$84.4 million related to the revaluation of our deferred tax assets and liabilities due to the reduction of the U.S. corporate tax rate from 34% to 21%, which was offset by a reduction in our valuation allowance.

As of December 31, 2018 , we had unrecognized tax benefits of \$22.0 million , none of which would affect our effective tax rate if recognized.

2017 compared to 2016 : Income tax expense increased by \$0.9 million from \$0.3 million in 2016 to \$1.2 million in 2017 . The increase was primarily due to the write-off of a foreign entity’s deferred tax assets in 2017.

Liquidity and Capital Resources

We have funded our operations and investing activities primarily through cash generated from operations, borrowing on our line of credit and sales of our common stock. As of December 31, 2018, we had cash and cash equivalents of \$49.6 million, which consisted of deposits held at banks and money market mutual funds held at major financial institutions. This includes \$3.7 million of cash held by our foreign subsidiaries primarily in China. As of December 31, 2018, our liability for taxes that would be payable as a result of repatriation of undistributed earnings of our foreign subsidiaries to the United States was not significant and limited to withholding taxes considering our existing net operating loss carryovers.

The following table presents the cash inflows and outflows by activity during 2018, 2017 and 2016 (in thousands):

	Years Ended December 31,		
	2018	2017	2016
Net cash provided by (used in) operating activities	\$ 3,560	\$ (62,772)	\$ 24,419
Net cash provided by (used in) investing activities	(76)	19,734	12,083
Net cash provided by (used in) financing activities	7,492	31,990	(9,243)

Operating Activities

Our operating activities provided cash of \$3.6 million in 2018, used cash of \$62.8 million in 2017 and provided cash of \$24.4 million in 2016. The increase in net cash provided by operating activities during 2018 as compared to 2017 was due primarily to a favorable change of \$60.4 million in our net operating results after adjustment of non-cash charges and a \$5.9 million increase in net cash inflow resulting from changes in operating assets and liabilities. In 2018, cash provided by operating activities increased as we reduced our operating expenses while investing in inventory to support our supply chain realignment efforts.

In 2018, cash inflows from changes in operating assets and liabilities primarily consisted of an increase in accounts payable of \$4.6 million primarily due to increased inventory purchases related to our supply chain realignment efforts, a decrease in prepaid expenses and other assets of \$3.6 million due to the return of an advance previously made to a CM and an increase in accrued liabilities of \$2.8 million due primarily to accrued incentive compensation. Cash outflows from changes in operating assets and liabilities primarily consisted of an increase in inventory of \$20.6 million associated with our supply chain realignment efforts and a decrease in deferred revenue of \$1.4 million. Non-cash charges were \$20.3 million, the majority of which consist of stock-based compensation expense and depreciation, partially offset by a \$6.7 million gain on sale of our outdoor cabinet product line.

The increase in net cash used in operating activities during 2017 as compared to 2016 was due primarily to an unfavorable change of \$60.8 million in our operating results after adjustment of non-cash charges and a \$26.4 million decrease in net cash inflow resulting from changes in operating assets and liabilities. In 2017, cash used in operating activities increased as we continued to invest in research and development to pursue broader market and customer opportunities. Furthermore, during this period we continued to experience losses due to higher costs, delays, overruns and other inefficiencies associated with our professional services business for turnkey network improvement projects (including CAF projects). These turnkey network improvement projects generally involve greater working capital needs at the outset as services and products are supplied, while revenue and cash collections occur after projects are accepted or agreed-upon milestones are reached. In 2017, cash outflows from changes in operating assets and liabilities primarily consisted of an increase in net accounts receivable of \$29.1 million, mainly due to the delayed payments by a large customer until early January 2018, and a decrease in accrued liabilities of \$20.2 million primarily due to a decrease in customer advance payments for turnkey services projects for one of our customers and partly due to the timing of our payments of payroll, sales commissions and other expenses. Cash outflows from changes in operating assets and liabilities primarily consisted of a decrease in deferred cost of revenue of \$32.4 million, partly offset by a decrease in deferred revenue of \$14.4 million mainly due to recognition of associated costs related to turnkey network improvement projects that are either accepted or for which agreed-upon milestones are reached, a decrease in inventory of \$13.0 million due to higher inventory turnover, an increase in accounts payable of \$11.8 million primarily due to the timing of inventory receipts and payments to our contract manufacturers and a decrease in prepaid expenses and other assets of \$2.8 million. Non-cash charges were \$23.6 million, the majority of which consist of stock-based compensation expense, amortization expenses and depreciation.

Investing Activities

In 2018, net cash used in investing activities of \$0.1 million consisted of capital expenditures of \$10.4 million for purchases of test equipment, computer equipment and software, partially offset by the receipt of \$10.4 million related to proceeds from the sales of our outdoor cabinet product line.

In 2017, our net cash provided by investing activities of \$19.7 million consisted of net sales and maturities of marketable securities of \$27.8 million partially offset by capital expenditures of \$8.0 million for purchases of test equipment, computer equipment and software.

In 2016, our net cash provided by investing activities of \$12.1 million consisted of net maturities of marketable securities of \$21.9 million, partially offset by capital expenditures of \$9.8 million for purchases of test equipment, computer equipment and software.

Financing Activities

In 2018, net cash provided by financing activities of \$7.5 million primarily consisted of proceeds from the issuance of common stock under our employee stock purchase plans of \$7.3 million.

In 2017, net cash provided by financing activities of \$32.0 million primarily consisted of net proceeds from our line of credit of \$30.0 million and the proceeds from the issuance of common stock under our employee stock purchase plans of \$4.9 million, partially offset by the payment of payroll taxes for the vesting of awards under our 2010 Equity Incentive Award Plan of \$2.8 million and payments to originate our line of credit with SVB of \$0.2 million.

In 2016, net cash used in financing activities of \$9.2 million consisted of the repurchases of common stock of \$12.8 million and the payment of payroll taxes for the vesting of awards under our 2010 Equity Incentive Award Plan of \$2.1 million, partially offset by the proceeds from the issuance of common stock under our ESPP of \$5.7 million.

Stock Repurchase Program

On April 26, 2015, our Board of Directors approved a program to repurchase up to \$40 million of our common stock from time to time. This stock repurchase program commenced in May 2015 and concluded in March 2016. During the year ended December 31, 2016, we repurchased a total of 1,789,287 shares of common stock for \$12.8 million at an average price of \$7.16 per share.

Working Capital and Capital Expenditure Needs

Our material cash commitments include contractual obligations under our Loan Agreement, normal recurring trade payables, compensation-related and expense accruals, operating leases and non-cancelable firm purchase commitments. We believe that our outsourced approach to manufacturing provides us significant flexibility in both managing inventory levels and financing our inventory. In the event that our revenue plan does not meet our expectations, we may be required to eliminate or curtail expenditures to mitigate the impact on our working capital.

In August 2017, we entered into the Loan Agreement for a senior secured revolving credit facility with SVB, which provides for a revolving credit facility of up to \$30.0 million based on a customary accounts receivable borrowing base, subject to certain exceptions for accounts originating outside the United States and certain specific accounts, which could reduce the amount available to us under the credit facility. The Loan Agreement includes affirmative and negative covenants and requires us to maintain a liquidity ratio at minimum levels specified in the Loan Agreement. For the month ended November 30, 2017, we were not able to maintain the minimum AQR (as defined in the Loan Agreement, as amended) at the level required in the Loan Agreement, which constituted an event of default. Although SVB waived this event of default effective as of November 30, 2017 and, therefore, this default did not change our ability to borrow under the Loan Agreement, we were required to amend certain covenants under the Loan Agreement and, in February 2018, we entered into an amendment to the Loan Agreement that, among other things, amended certain affirmative financial covenants, including reductions to the required minimum level of the AQR and the inclusion of an additional financial covenant related to the maintenance of Adjusted EBITDA (as defined in the Loan Agreement, as amended). In August 2018, we entered into a second amendment to the Loan Agreement that, among other things, extended the maturity date from August 7, 2019 to August 7, 2020, amended certain financial covenants, including covenants with respect to the AQR and the Adjusted EBITDA, and changed the compliance requirements for the AQR covenant from a monthly basis to a quarterly basis. In February 2019, we entered into a third amendment to the Loan Agreement to reduce the required minimum level of the AQR for the first half of 2019 and the required minimum Adjusted EBITDA for the first fiscal quarter of 2019 to accommodate the increased costs and use of cash that we anticipate for the first half of 2019 related to activities to mitigate the impact of the U.S. tariffs. As of December 31, 2018, we were in compliance with these covenants. Although we were compliant with the financial covenants under the Loan Agreement at December 31, 2018, given our current financial position and history of operating losses, it is possible that we may fail to meet the minimum levels required by the financial covenants in a future period. In particular, if we are unable to generate positive cash flows on a continued basis, we could fall below the minimum AQR requirement, which would constitute an event of default under the Loan Agreement.

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As of December 31, 2018, we borrowed the full principal amount under this line of credit of \$30 million. Please refer to Note 5, “*Credit Agreements*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for more details on this credit facility.

We established a new restructuring plan in early 2018 to further realign our business resources based on the production releases of our platform offerings. These actions were completed as of June 30, 2018 and resulted in annualized savings of over \$20 million.

In February 2018, we sold our outdoor cabinet product line to Clearfield, Inc. for \$10.4 million in cash as well as the assumption by Clearfield of the related product warranty liabilities and open purchase order commitments with our contract manufacturer. See Note 13, “*Product Line Divestiture*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K.

During 2018 we entered into financing arrangements to purchase research and development equipment for approximately \$5.1 million. Each agreement is to be paid over 36 months with a weighted average interest rate of 6.2%.

We believe, based on our current operating plan and expected operating cash flows, that our existing cash and cash equivalents, along with available borrowings under our SVB line of credit, will be sufficient to meet our anticipated cash needs for at least the next twelve months. We expect to continue to draw on the SVB line of credit from time to time to support our working capital needs. Our future capital requirements will depend on many factors including our rate of revenue growth; timing of customer payments and payment terms, particularly of larger customers; the timing and extent of spending to support development efforts, particularly research and development related to growth initiatives such as our software defined access portfolio, our ability to partner with third parties to outsource our research and development projects; our ability to manage product cost, including the cost impact of the current U.S. tariffs as well as our ability to mitigate the cost impact through supply chain re-engineering as currently planned, the possibility of additional tariffs that may impact our product costs and higher component costs associated with new technologies; our ability to implement efficiencies and maintain product margin levels; the expansion of sales and marketing activities; the timing of introductions and customer adoption of new products and enhancements to existing products; the slowdowns or declines in customer purchases of traditional systems; acquisition of new capabilities or technologies; and the continued market acceptance of our products. If we are unable to execute to our current operating plan or generate positive operating income and positive cash flows, our liquidity, results of operations and financial condition will be adversely affected and we may fail to comply with the covenants in the Loan Agreement, in which case we may not be able to borrow under the SVB line of credit. In particular, until we are able to mitigate the cost impact of the U.S. tariffs, these tariffs will have a material adverse impact on our cash flows. Re-engineering of our supply chain to mitigate the impact of the tariffs requires significant effort, may take longer to complete than anticipated and may require higher expenditures than planned. Moreover, there remains uncertainty as to the scope of the tariffs and whether additional tariffs or other measures may be imposed that could have further cost impact to us. We may need to seek other sources of liquidity, including the sale of equity or incremental borrowings, to support our working capital needs. In addition, we may choose to seek other sources of liquidity even if we believe we have generated sufficient cash flows to support our operational needs. There is no assurance that any other sources of liquidity may be available to us on acceptable terms or at all. If we are unable to generate sufficient cash flows or obtain other sources of liquidity, we will be forced to limit our development activities, reduce our investment in growth initiatives and institute cost-cutting measures, all of which may adversely impact our business and growth.

Contractual Obligations and Commitments

Our principal commitments as of December 31, 2018 consisted of our contractual obligations under the Loan Agreement, operating leases for office space and non-cancelable outstanding purchase obligations. The following table summarizes our contractual obligations at December 31, 2018 (in thousands):

	Payments Due by Period				
	Total	Less Than 1 Year	1-3 Years	3-5 Years	More Than 5 Years
Line of credit, including interest ⁽¹⁾	\$ 33,366	\$ 2,100	\$ 31,266	\$ —	\$ —
Equipment financing arrangements ⁽²⁾	4,987	1,863	3,124	—	—
Operating lease obligations ⁽³⁾	23,799	3,750	7,286	6,712	6,051
Non-cancelable purchase commitments ⁽⁴⁾	57,770	41,955	8,390	7,425	—
Total	\$ 119,922	\$ 49,668	\$ 50,066	\$ 14,137	\$ 6,051

⁽¹⁾ Line of credit contractual obligations include projected interest payments over the term of the Loan Agreement, assuming interest rate in effect for the outstanding borrowings as of December 31, 2018 of 7% and payment of the borrowings on August 7, 2020, the

contractual maturity date of the credit facility. See Note 5, “*Credit Agreements*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our contractual obligations relating to our line of credit.

⁽²⁾ Represents loan payments, including interest, for equipment financing arrangements. See Note 5, “*Credit Agreements*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our equipment financing arrangements.

⁽³⁾ Future minimum operating lease obligations in the table above include primarily payments for our office space in San Jose and Petaluma, California; Minneapolis, Minnesota; Nanjing, China; and Richardson, Texas, which expire at various dates through 2025. See Note 6, “*Commitments and Contingencies*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our operating leases.

⁽⁴⁾ Represents outstanding purchase commitments for inventory and services to be delivered by our suppliers, including CMs, ODMs and engineering service providers. See Note 6, “*Commitments and Contingencies*” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our outstanding purchase commitments.

Off-Balance Sheet Arrangements

As of December 31, 2018 and 2017, we did not have any off-balance sheet arrangements.

ITEM 7A. Quantitative and Qualitative Disclosures About Market Risk

Interest Rate Risk

The primary objectives of our investment activity are to preserve principal, provide liquidity and maximize income without significantly increasing risk. By policy, we do not enter into investments for trading or speculative purposes. As of December 31, 2018, we had cash and cash equivalents of \$49.6 million, which were held primarily in cash and money market funds. Due to the nature of these money market funds, we believe that we do not have any material exposure to changes in the fair value of our cash equivalents as a result of changes in interest rates.

Our exposure to interest rate risk also relates to the amount of interest we must pay on our borrowings under our revolving credit facility pursuant to our Loan Agreement with SVB. Borrowings under the Loan Agreement will bear interest through maturity at a variable annual rate based upon an annual rate of either a prime rate or a LIBOR rate, plus an applicable margin between 0.5% to 1.5% for prime rate advances and between 2.0% and 3.0% for LIBOR advances based on our maintenance of an applicable liquidity ratio. As of December 31, 2018, we had \$30.0 million outstanding under the Loan Agreement.

Foreign Currency Exchange Risk

Our primary foreign currency exposures are described below.

Economic Exposure

The direct effect of foreign currency fluctuations on our sales and expenses has not been material because our sales and expenses are primarily denominated in U.S. dollars, or USD. However, we are indirectly exposed to changes in foreign currency exchange rates to the extent of our use of foreign contract manufacturers whom we pay in USD. Increases in the local currency rates of these vendors in relation to USD could cause an increase in the price of products that we purchase. Additionally, if the USD strengthens relative to other currencies, such strengthening could have an indirect effect on our sales to the extent it raises the cost of our products to non-U.S. customers and thereby reduces demand. A weaker USD could have the opposite effect. The precise indirect effect of currency fluctuations is difficult to measure or predict because our sales are influenced by many factors in addition to the impact of such currency fluctuations.

Translation Exposure

Our sales contracts are primarily denominated in USD and, therefore, the majority of our revenue is not subject to foreign currency risk. We are directly exposed to changes in foreign exchange rates to the extent such changes affect our expenses related to our foreign assets and liabilities with our subsidiaries in Brazil, China and the United Kingdom, whose functional currencies are the Brazilian Real, or BRL, Chinese Renminbi, or RMB, and British Pounds Sterling, or GBP, respectively.

Our operating expenses are incurred primarily in the United States, with a small portion of expenses incurred in Brazil associated with the administration of the entity, in China associated with our research and development operations that are maintained there and in the United Kingdom for our international sales and marketing activities. Our operating expenses are generally denominated in the functional currencies of our subsidiaries in which the operations are located.

The percentages of our operating expenses denominated in the following currencies for the indicated fiscal years were as follows:

	Years Ended December 31,		
	2018	2017	2016
USD	89%	89%	88%
RMB	7	7	7
GBP	4	3	4
BRL	—	1	1
	<u>100%</u>	<u>100%</u>	<u>100%</u>

If the currency exchange rates in 2018 had been the same as in 2017, our 2018 operating expenses would have decreased by approximately \$0.8 million. If the U.S. dollar had appreciated or depreciated by 10% relative to RMB, GBP and BRL, our operating expenses for 2018 would have decreased or increased by \$2.4 million, or approximately 1%. We do not currently enter into forward exchange contracts to hedge exposure denominated in foreign currencies or any derivative financial instruments. In the future, we may consider entering into hedging transactions to help mitigate our foreign currency exchange risk.

Foreign exchange rate fluctuations may also adversely impact our financial position as the assets and liabilities of our foreign operations are translated into USD in preparing our Consolidated Balance Sheets. The effect of foreign exchange rate fluctuations on our consolidated financial position for the year ended December 31, 2018 was a net translation loss of approximately \$0.6 million. This loss is recognized as an adjustment to stockholders' equity through accumulated other comprehensive loss.

Transaction Exposure

We have certain assets and liabilities, primarily receivables and accounts payable (including inter-company transactions) that are denominated in currencies other than the relevant entity's functional currency. In certain circumstances, changes in the functional currency value of these assets and liabilities create fluctuations in our reported consolidated financial position, cash flows and results of operations. Transaction gains and losses on these foreign currency denominated assets and liabilities are recognized each period within other income (expense), net in our Consolidated Statements of Comprehensive Loss. During the year ended December 31, 2018, we recognized a net gain related to these foreign exchange assets and liabilities of approximately \$0.4 million.

ITEM 8. Financial Statements and Supplementary Data

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Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors
Calix, Inc.:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of Calix, Inc. and subsidiaries (the Company) as of December 31, 2018 and 2017, the related consolidated statements of comprehensive loss, stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018 based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying *Item 9A, Controls and Procedures*. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting 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 in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements 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. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed 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. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) 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 (3) 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. Also, 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.

/s/ KPMG LLP

We have served as the Company's auditor since 2016.

San Francisco, California
March 1, 2019

CALIX, INC.
CONSOLIDATED BALANCE SHEETS
(In thousands, except par value)

	December 31,	
	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 49,646	\$ 39,775
Restricted cash	628	—
Accounts receivable, net	67,026	80,392
Inventory	50,151	31,529
Prepaid expenses and other current assets	7,306	10,759
Total current assets	174,757	162,455
Property and equipment, net	24,945	15,681
Goodwill	116,175	116,175
Other assets	1,203	759
	\$ 317,080	\$ 295,070
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	\$ 40,209	\$ 35,977
Accrued liabilities	57,869	49,279
Deferred revenue	15,600	13,076
Line of credit	30,000	30,000
Total current liabilities	143,678	128,332
Long-term portion of deferred revenue	17,496	20,645
Other long-term liabilities	3,972	1,130
Total liabilities	165,146	150,107
Commitments and contingencies (See Note 6)		
Stockholders' equity:		
Preferred stock, \$0.025 par value; 5,000 shares authorized; no shares issued and outstanding as of December 31, 2018 and 2017	—	—
Common stock, \$0.025 par value; 100,000 shares authorized; 59,285 shares issued and 53,955 shares outstanding as of December 31, 2018, and 56,839 shares issued and 51,509 shares outstanding as of December 31, 2017	1,482	1,421
Additional paid-in capital	876,073	851,054
Accumulated other comprehensive loss	(753)	(169)
Accumulated deficit	(684,882)	(667,357)
Treasury stock, 5,330 shares as of December 31, 2018 and 2017	(39,986)	(39,986)
Total stockholders' equity	151,934	144,963
	\$ 317,080	\$ 295,070

See accompanying notes to consolidated financial statements.

CALIX, INC.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(In thousands, except per share data)

	Years Ended December 31,		
	2018	2017	2016
Revenue:			
Systems	\$ 405,923	\$ 421,890	\$ 428,584
Services	35,397	88,477	30,203
Total revenue	441,320	510,367	458,787
Cost of revenue:			
Systems ⁽¹⁾	216,529	236,137	228,976
Services ⁽¹⁾	27,409	101,340	28,593
Total cost of revenue	243,938	337,477	257,569
Gross profit	197,382	172,890	201,218
Operating expenses:			
Research and development ⁽¹⁾	89,963	127,541	106,869
Sales and marketing ⁽¹⁾	86,432	82,781	83,675
General and administrative ⁽¹⁾	40,500	39,875	41,592
Restructuring charges	5,705	4,249	—
Amortization of intangible assets	—	—	1,701
Gain on sale of product line	(6,704)	—	—
Litigation settlement gain	—	—	(4,500)
Total operating expenses	215,896	254,446	229,337
Loss from operations	(18,514)	(81,556)	(28,119)
Interest and other income (expense), net:			
Interest income (expense), net	(632)	(160)	152
Other income (expense), net	378	(73)	912
Total interest and other income (expense), net	(254)	(233)	1,064
Loss before provision for income taxes	(18,768)	(81,789)	(27,055)
Provision for income taxes	530	1,243	347
Net loss	\$ (19,298)	\$ (83,032)	\$ (27,402)
Net loss per common share:			
Basic and diluted	\$ (0.37)	\$ (1.66)	\$ (0.56)
Weighted-average number of shares used to compute net loss per common share:			
Basic and diluted	52,609	50,155	48,730
Net loss	\$ (19,298)	\$ (83,032)	\$ (27,402)
Other comprehensive income (loss), net of tax:			
Unrealized gain on available-for-sale marketable securities, net	—	6	88
Foreign currency translation adjustments, net	(584)	481	(549)
Total other comprehensive income (loss), net of tax	(584)	487	(461)
Comprehensive loss	\$ (19,882)	\$ (82,545)	\$ (27,863)

(1) Includes stock-based compensation as follows:

Cost of revenue:			
Systems	\$ 885	\$ 473	\$ 465
Services	363	276	207
Research and development	5,969	4,869	5,125
Sales and marketing	5,787	3,433	4,586
General and administrative	4,469	3,317	3,902

See accompanying notes to consolidated financial statements.

CALIX, INC.

CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(In thousands)

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Treasury Stock	Total Stockholders' Equity
	Shares	Amount					
Balance at December 31, 2015	49,509	\$ 1,326	\$ 818,754	\$ (195)	\$ (556,923)	\$ (27,177)	\$ 235,785
Stock-based compensation	—	—	14,285	—	—	—	14,285
Exercise of stock options	3	—	17	—	—	—	17
Issuance of vested performance restricted stock units and restricted stock units, net of taxes withheld	659	17	(2,118)	—	—	—	(2,101)
Stock issued under employee stock purchase plan	1,010	25	5,625	—	—	—	5,650
Net loss	—	—	—	—	(27,402)	—	(27,402)
Other comprehensive loss	—	—	—	(461)	—	—	(461)
Repurchases of common stock	(1,789)	—	—	—	—	(12,809)	(12,809)
Balance at December 31, 2016	49,392	1,368	836,563	(656)	(584,325)	(39,986)	212,964
Stock-based compensation	—	—	12,368	—	—	—	12,368
Exercise of stock options	11	—	62	—	—	—	62
Issuance of vested performance restricted stock units and restricted stock units, net of taxes withheld	994	24	(2,788)	—	—	—	(2,764)
Stock issued under employee stock purchase plans	1,112	29	4,849	—	—	—	4,878
Net loss	—	—	—	—	(83,032)	—	(83,032)
Other comprehensive income	—	—	—	487	—	—	487
Balance at December 31, 2017	51,509	1,421	851,054	(169)	(667,357)	(39,986)	144,963
Stock-based compensation	—	—	17,473	—	—	—	17,473
Exercise of stock options	57	1	383	—	—	—	384
Issuance of vested performance restricted stock units and restricted stock units, net of taxes withheld	913	22	(96)	—	—	—	(74)
Stock issued under employee stock purchase plans	1,476	38	7,259	—	—	—	7,297
Cumulative effect of accounting change	—	—	—	—	1,773	—	1,773
Net loss	—	—	—	—	(19,298)	—	(19,298)
Other comprehensive loss	—	—	—	(584)	—	—	(584)
Balance at December 31, 2018	<u>53,955</u>	<u>\$ 1,482</u>	<u>\$ 876,073</u>	<u>\$ (753)</u>	<u>\$ (684,882)</u>	<u>\$ (39,986)</u>	<u>\$ 151,934</u>

See accompanying notes to consolidated financial statements.

CALIX, INC.

 CONSOLIDATED STATEMENTS OF CASH FLOWS
 (In thousands)

	Years Ended December 31,		
	2018	2017	2016
Operating activities:			
Net loss	\$ (19,298)	\$ (83,032)	\$ (27,402)
Adjustments to reconcile net loss to net cash provided by (used in) operating activities:			
Stock-based compensation	17,473	12,368	14,285
Depreciation and amortization	9,187	10,178	8,319
Loss on retirement of property and equipment	326	280	—
Amortization of intangible assets	—	813	5,805
Amortization of premium (discount) relating to available-for-sale securities	—	(6)	382
Gain on sale of product line	(6,704)	—	—
Changes in operating assets and liabilities:			
Accounts receivable, net	13,858	(29,056)	(4,185)
Inventory	(20,639)	13,016	3,122
Prepaid expenses and other assets	3,579	35,210	(31,042)
Accounts payable	4,596	11,759	4,236
Accrued liabilities	2,791	(20,184)	34,913
Deferred revenue	(1,426)	(14,370)	16,398
Other long-term liabilities	(183)	252	(412)
Net cash provided by (used in) operating activities	<u>3,560</u>	<u>(62,772)</u>	<u>24,419</u>
Investing activities:			
Purchases of property and equipment	(10,426)	(8,026)	(9,839)
Purchases of marketable securities	—	(8,732)	(16,478)
Sales of marketable securities	—	5,051	—
Maturities of marketable securities	—	31,441	38,400
Proceeds from sale of product line	10,350	—	—
Net cash provided by (used in) investing activities	<u>(76)</u>	<u>19,734</u>	<u>12,083</u>
Financing activities:			
Proceeds from exercise of stock options	384	62	17
Proceeds from employee stock purchase plans	7,297	4,878	5,650
Payments for repurchases of common stock	—	—	(12,809)
Taxes paid for awards vested under equity incentive plan	(74)	(2,764)	(2,101)
Proceeds from line of credit	557,915	171,268	—
Repayments of line of credit	(557,915)	(141,268)	—
Payments to originate the line of credit	(115)	(186)	—
Net cash provided by (used in) financing activities	<u>7,492</u>	<u>31,990</u>	<u>(9,243)</u>
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(477)	464	(526)
Net increase (decrease) in cash, cash equivalents and restricted cash	10,499	(10,584)	26,733
Cash, cash equivalents and restricted cash at beginning of period	39,775	50,359	23,626
Cash, cash equivalents and restricted cash at end of period	<u>\$ 50,274</u>	<u>\$ 39,775</u>	<u>\$ 50,359</u>
Supplemental disclosures of cash flow information:			
Interest paid	\$ 649	\$ 313	\$ 127
Income taxes paid	\$ 561	\$ 915	\$ 965
Non-cash investing activities:			
Changes in accounts payable and accrued liabilities related to purchases of property and equipment	\$ 8,459	\$ (55)	\$ (478)

See accompanying notes to consolidated financial statements.

CALIX, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Description of Business and Significant Accounting Policies

Company

Calix, Inc. (together with its subsidiaries, “Calix” or the “Company”) was incorporated in August 1999 and is a Delaware corporation. The Company is a leading global provider of the cloud and software platforms, systems and services required to deliver the unified access network and smart premises of tomorrow. The Company’s platforms and services help its customers build next generation networks by embracing a DevOps operating model, optimize the subscriber experience by leveraging big data analytics and turn the complexity of the smart home and business into new revenue streams. The Company’s cloud and software platforms, systems and services enable communication service providers (“CSPs”) to provide a wide range of revenue-generating services, from basic voice and data to advanced broadband services, over legacy and next-generation access networks. The Company focuses on CSP access networks, the portion of the network that governs available bandwidth and determines the range and quality of services that can be offered to subscribers.

Basis of Presentation

The accompanying consolidated financial statements have been prepared in accordance with the requirements of the U.S. Securities and Exchange Commission (“SEC”). In the opinion of management, the consolidated financial statements include all normal and recurring adjustments that are considered necessary for the fair presentation of the Company’s financial position and operating results. All significant intercompany balances and transactions have been eliminated in consolidation.

Applicable Accounting Guidance

Any reference in these notes to applicable accounting guidance (“guidance”) is meant to refer to the authoritative U.S. generally accepted accounting principles (“GAAP”) as found in the Financial Accounting Standards Board (“FASB”) Accounting Standards Codification (“ASC”).

Use of Estimates

The preparation of financial statements is in conformity with U.S. GAAP, which requires management to make estimates and assumptions that affect the amounts reported in the consolidated financial statements and accompanying notes. For the Company, these estimates include, but are not limited to: allowances for doubtful accounts and sales returns, excess and obsolete inventory, allowances for obligations to its contract manufacturers, valuation of stock-based compensation, useful lives assigned to long-lived assets, standard and extended warranty costs and contingencies. Actual results could differ from those estimates, and such differences could be material to the Company’s financial position and results of operations.

Revenue Recognition

Revenue is recognized when a performance obligation is satisfied, which occurs when control of the promised goods or services is transferred to the customer, in an amount that reflects the consideration the Company expects to be entitled to in exchange for those goods or services.

A performance obligation is a promise in a contract to transfer a distinct good or service to the customer and is the unit of account. A contract’s transaction price is allocated to each distinct performance obligation and recognized as revenue when, or as, the performance obligation is satisfied. The Company’s hardware products contain both software and non-software components that function together to deliver the products’ essential functionality and therefore constitutes a single performance obligation as the promise to transfer the individual software and non-software components is not separately identifiable and, therefore, not distinct. The Company’s contracts may include multiple performance obligations. For such arrangements, the Company allocates the contract’s transaction price to each performance obligation using the relative stand-alone selling price of each distinct good or service in the contract. The Company generally determines stand-alone selling prices based on the prices charged to customers or its best estimate of stand-alone selling price. The Company’s estimate of stand-alone selling price is established considering multiple factors including, but not limited to, geographies, market conditions, competitive landscape, internal costs, gross margin objectives, characteristics of targeted customers and pricing practices. The determination of estimated stand-alone selling price is made through consultation with and formal approval by management, taking into consideration the go-to-market strategy.

For certain revenue arrangements involving delivery of both systems and professional services, each is considered a distinct performance obligation. Systems revenue is recognized at a point in time when management has determined that control over systems has transferred to the customer, which is generally when legal title has transferred to the customer. For the same revenue arrangements, management believes that the output of the associated professional services is transferred to the

customer over time. As such, professional services revenue is recognized over the period in which the services are provided using a cost input measure. The Company recognizes revenue when control of the systems and services has been transferred to the customer, which may be earlier than system installation or customer acceptance, in accordance with the agreed-upon specifications in the contract.

The Company derives revenue from contracts with customers primarily from the following and categorizes its revenue as follows:

- Systems include revenue from the sale of access and premises systems, software platform licenses and cloud-based software subscriptions.
- Services include revenue from professional services, customer support, software- and cloud-based maintenance, extended warranty subscriptions, training and managed services.

Cost of Revenue

Cost of revenue consists primarily of finished goods inventory purchased from the Company's contract manufacturers, payroll and related expenses associated with managing the relationships with contract manufacturers, depreciation of manufacturing test equipment, warranty and retrofit costs, excess and obsolete inventory costs, shipping charges and amortization of certain intangible assets. It also includes contractor and other costs of services incurred directly related to the delivery of services to customers.

Warranty and Retrofit

The Company offers limited warranties for its hardware products for a period of one, three or five years, depending on the product type. The Company recognizes estimated costs related to warranty activities as a component of cost of revenue upon product shipment or upon identification of a specific product failure. Under certain circumstances, the Company also provides fixes on specifically identified performance failures for products that are outside of the standard warranty period and recognizes estimated costs related to retrofit activities as a component of cost of revenue upon identification of such product failures. The Company recognizes estimated warranty and retrofit costs when it is probable that a liability has been incurred and the amount of loss is reasonably estimable. The estimates are based upon historical and projected product failure and claim rates, historical costs incurred in correcting product failures and information available related to any specifically identified product failures. Judgment is required in estimating costs associated with warranty and retrofit activities, and the Company's estimates are limited to information available to the Company at the time of such estimates. In some cases, such as when a specific product failure is first identified or a new product is introduced, the Company may initially have limited information and limited historical failure and claim rates upon which to base its estimates, and such estimates may require revision in future periods. The recorded amount is adjusted from time to time for specifically identified warranty and retrofit exposure. Actual warranty and retrofit expenses are charged against the Company's estimated warranty and retrofit liability when incurred. Factors that affect the Company's warranty and retrofit liability include the number of active installed units and historical and anticipated rates of warranty and retrofit claims and cost per claim.

Stock-Based Compensation

Stock-based compensation expense associated with stock options, restricted stock units ("RSUs"), performance restricted stock units ("PRSUs") and purchase rights under the Amended and Restated Employee Stock Purchase Plan (the "ESPP") and the Amended and Restated 2017 Nonqualified Employee Stock Purchase Plan (the "Nonqualified ESPP") is measured at the grant date based on the fair value of the award, and is recognized, net of forfeitures, as expense over the remaining requisite service period (generally the vesting period) on a straight-line basis.

The fair value of stock option and employee stock purchase right under the ESPP is estimated at the grant date using the Black-Scholes option valuation model. The fair value of RSUs and employee stock purchase right under the Nonqualified ESPP is based on closing market price of the Company's common stock on the date of grant.

Stock-based compensation expense associated with PRSUs with graded vesting features and which contain both a performance and a service condition is measured based on the closing market price of the Company's common stock on the date of grant, and is recognized, net of forfeitures, as expense over the requisite service period using the graded vesting attribution method.

Stock-based compensation expense associated with performance-based stock options with graded vesting features and which contain both a performance and a service condition is measured based on fair value of stock options estimated at the grant date using the Black-Scholes option valuation model, and is recognized, net of forfeitures, as expense over the requisite service period using the graded vesting attribution method.

Compensation expense associated with PRSUs and performance-based stock option awards with graded vesting features and which contain both a performance and a service condition is only recognized if the Company has determined that it is probable

that the performance condition will be met. The Company reassesses the probability of vesting at each reporting period and adjusts compensation expense based on its probability assessment.

Loss Contingencies

From time to time, the Company is involved in legal proceedings arising from the normal course of business activities. The Company evaluates the likelihood of an unfavorable outcome of legal proceedings to which it is a party and accrues a loss contingency when the loss is probable and reasonably estimable. Assessing legal contingencies involves significant judgment and estimates, and the outcome of litigation is inherently uncertain and subject to numerous factors outside the Company's control. Significant judgment is required when the Company assesses the likelihood of any adverse judgments or outcomes, including the potential range of possible losses, and whether losses are probable and reasonably estimable.

Because of uncertainties related to these matters, the Company bases its estimates of whether a loss contingency is probable or reasonably possible, as well as the reasonable range of possible losses associated with each loss contingency, only on the information available at the time. As additional information becomes available, and at least quarterly, the Company reassesses the potential liability on each significant matter and may revise its estimates. These revisions could have a material impact on the Company's business, operating results or financial condition. The actual outcome of these legal proceedings may materially differ from the Company's estimates of potential liability, which could have a material adverse effect on the Company's business, operating results or financial condition.

Credit Risk and Inventory Supplier Concentrations

Financial instruments that potentially subject the Company to significant concentrations of credit risk consist primarily of cash and cash equivalents and accounts receivable. Cash equivalents consist of money market funds, which are invested through financial institutions in the United States. Deposits in these financial institutions may, at times, exceed federally insured limits. The Company has not experienced any losses in such accounts. The Company also has approximately \$3.7 million of cash held by its foreign subsidiaries in Brazil, China and the United Kingdom. Management believes that the financial institutions that hold the Company's cash and cash equivalents are financially sound and, accordingly, minimal credit risk exists with respect to these cash and cash equivalents.

Concentrations of credit risk in relation to customers with an accounts receivable balance of 10% or greater of total accounts receivable and customers with net revenue of 10% or greater of total revenue are presented below for the periods indicated.

	Percentage of Accounts Receivable		Percentage of Revenue		
	December 31,		Years Ended December 31,		
	2018	2017	2018	2017	2016
CenturyLink	16%	42%	18%	31%	21%
Windstream	*	*	*	*	15%

* Less than 10% of total accounts receivable or revenue.

The Company depends primarily on a small number of outside contract manufacturers ("CMs") and original design manufacturers ("ODMs") for the bulk of its finished goods inventory. In particular, the Company relied on Flex Ltd for the manufacture of a large percentage of its products through 2018. The Company generally purchases its products through purchase orders with its suppliers. While the Company seeks to maintain a sufficient supply of its products, the Company's business and results of operations could be adversely affected by a stoppage or delay in receiving such products, the receipt of defective parts, an increase in price of such products or the Company's inability to obtain lower prices from its CMs and other suppliers in response to competitive pressures.

Fair Value of Financial Instruments

The carrying amounts of cash and cash equivalents, marketable securities, trade receivables, accounts payable, line of credit and other accrued liabilities approximate their fair value due to their relatively short-term nature.

Cash, Cash Equivalents, Restricted Cash and Marketable Securities

Cash equivalents and marketable securities are stated at amounts that approximate fair value based on quoted market prices.

Restricted cash is cash that is legally restricted as to withdrawal or usage. As of December 31, 2018, the Company had \$0.6 million in restricted cash related to a letter of credit for our San Jose lease.

The Company has invested its excess cash primarily in money market funds and highly liquid marketable securities such as corporate debt instruments, commercial paper and U.S. government agency securities. The Company considers all investments with maturities of three months or less when purchased to be cash equivalents. Marketable securities represent highly liquid corporate debt instruments, commercial paper and U.S. government agency securities with maturities greater than 90 days at date of purchase. Marketable securities with maturities greater than one year are classified as current because management considers all marketable securities to be available for current operations.

The Company's investments have been classified and accounted for as available-for-sale. Such investments are recorded at fair value and unrealized holding gains and losses are reported as a separate component of comprehensive loss in the stockholders' equity until realized. Realized gains and losses on sales of marketable securities, if any, are determined on the specific identification method and are reclassified from accumulated other comprehensive loss to results of operations as "Other income (expense), net". The Company had no investments as of December 31, 2018 and 2017.

Allowance for Doubtful Accounts

The Company maintains an allowance for doubtful accounts for estimated losses resulting from the inability of its customers to make required payments. The Company records a specific allowance based on an analysis of individual past-due balances. Additionally, based on historical write-offs and the Company's collection experience, the Company records an additional allowance based on a percentage of outstanding receivables. The Company performs credit evaluations of its customers' financial condition. These evaluations require judgment and are based on a variety of factors including, but not limited to, current economic trends, payment history and a financial review of the customer. Actual collection losses may differ from management's estimates, and such differences could be material to our financial position and results of operations.

Inventory Valuation

Inventory, which primarily consists of finished goods purchased from CMs or ODMs, is stated at the lower of cost (determined by the first-in, first-out method) or market value. Inbound shipping costs and U.S. tariffs are included in cost of inventory. In addition, the Company, from time to time, procures component inventory primarily as a result of manufacturing discontinuation of critical components by suppliers. The Company regularly monitors inventory quantities on hand and records write-downs for excess and obsolete inventories based on the Company's estimate of demand for its products, potential obsolescence of technology, product life cycles and whether pricing trends or forecasts indicate that the carrying value of inventory exceeds its estimated selling price. These factors are impacted by market and economic conditions, technology changes and new product introductions and require significant estimates that may include elements that are uncertain. Actual demand may differ from forecasted demand and may have a material effect on gross profit. If inventory is written down, a new cost basis is established that cannot be increased in future periods. Shipments from suppliers or CMs before the Company receives them are recorded as in-transit inventory when title and the significant risks and rewards of ownership have passed to the Company.

Contract Costs

The Company capitalizes all incremental costs incurred to obtain a contract with a customer that it would not have incurred if the contract had not been obtained, provided it expects to recover the costs. The Company capitalizes certain sales commissions related primarily to extended warranty and Calix Cloud products for which the expected amortization period is greater than one year.

The Company expects that sales commissions as a result of obtaining customer contracts are recoverable, and therefore the Company defers and capitalizes them as contract costs. Capitalized commissions are amortized as sales and marketing expenses over the period that the related revenue is recognized, which typically range from three to ten years for extended warranty and cloud offerings. The Company classifies the unamortized portion of deferred commissions as current or noncurrent based on the timing of when the Company expects to recognize the expense. The current and noncurrent portions of deferred commissions are included in prepaid expenses and other current assets and other assets, respectively, in the Company's Consolidated Balance Sheets.

As of December 31, 2018, the unamortized balance of deferred commissions was \$0.8 million. For the year ended December 31, 2018, the amount of amortization was \$0.1 million, and there was no impairment loss in relation to the costs capitalized.

Property and Equipment

Property and equipment are stated at cost, less accumulated depreciation, and are depreciated using the straight-line method over the estimated useful life of each asset. Generally, computer equipment is depreciated over two years; purchased software is depreciated over three years; test equipment is depreciated over three years; furniture and fixtures are depreciated over seven years; and leasehold improvements are depreciated over the shorter of the respective lease term or the estimated useful life of the asset. Maintenance and repairs are charged to expense as incurred.

Goodwill

Goodwill was recorded as a result of the Company's acquisitions of Occam Networks, Inc. ("Occam") in February 2011 and Optical Solutions, Inc. in February 2006. The Company records goodwill when consideration paid in a business acquisition exceeds the fair value of the net tangible assets and the identified intangible assets acquired. Goodwill is not amortized but instead is subject to an annual impairment test or more frequently if events or changes in circumstances indicate that it may be impaired. The Company evaluates goodwill on an annual basis as of the end of the second quarter of each fiscal year. Management has determined that it operates as a single reporting unit and, therefore, evaluates goodwill impairment at the enterprise level.

In an annual impairment test, the Company first assesses qualitative factors to determine whether it is necessary to perform the two-step quantitative goodwill impairment test. In assessing the qualitative factors, management considers the impact of these key factors: macro-economic conditions, industry and market environment, overall financial performance of the Company, cash flow from operating activities, market capitalization and stock price. If the Company determines as a result of the qualitative assessment that it is more likely than not (that is, a likelihood of more than 50 percent) that the fair value of a reporting unit is less than its carrying amount, then the quantitative test is required. Otherwise, no further testing is required.

In a quantitative test, the Company compares its fair value to its carrying value including goodwill. The Company determines its fair value using both an income approach and a market approach. Under the income approach, the Company determines fair value based on estimated future cash flows, discounted by an estimated weighted-average cost of capital, which reflects the overall level of inherent risk of the Company and the rate of return an outside investor would expect to earn. Under the market-based approach, the Company utilizes information regarding the Company as well as publicly available industry information to determine earnings multiples that are used to value the Company. If the carrying value of the Company exceeds its fair value, the Company will determine the amount of impairment loss by comparing the implied fair value of goodwill with the carrying value of goodwill. An impairment charge is recognized for the excess of the carrying value of goodwill over its implied fair value.

At the end of the second quarter of 2018, the Company completed its annual goodwill impairment test. Based on its assessment of the above qualitative factors, management concluded that the fair value of the Company was more likely than not greater than its carrying amount as of June 30, 2018. As such, it was not necessary to perform the two-step quantitative goodwill impairment test at the time.

There have been no significant events or changes in circumstances subsequent to the 2018 annual impairment test that would more likely than not indicate that the carrying value of goodwill may have been impaired as of December 31, 2018. Therefore, there was no impairment to the carrying value of the Company's goodwill as of December 31, 2018. There were no impairment losses for goodwill in the years ended December 31, 2017 or 2016.

Deferred Revenue

Deferred revenue results from transactions where the Company billed the customer for products or services and when cash payments are received or due prior to transferring control of the promised goods or services to the customer.

Revenue allocated to remaining performance obligations represent contract revenue that has not yet been recognized, which includes deferred revenue and amounts that will be invoiced and recognized as revenue in future periods. This amount was \$33.1 million as December 31, 2018, and the Company expects to recognize 47% of such revenue over the next year and the remainder thereafter.

Payment terms to customers typically range from net 30 to net 90 days and vary by the size and location of customer and the products or services offered. The period between the transfer of control of the promised good or service to a customer and when payment is due is not significant.

Income Taxes

The Company evaluates its tax positions and estimates its current tax exposure along with assessing temporary differences that result from different book to tax treatment of items not currently deductible for tax purposes. These differences result in deferred tax assets and liabilities on the Company's Consolidated Balance Sheets, which are estimated based upon the difference between the financial statement and tax bases of assets and liabilities using the enacted tax rates that will be in effect when these differences reverse. In general, deferred tax assets represent future tax benefits to be received when certain expenses previously recognized in the Company's Consolidated Statements of Comprehensive Loss become deductible expenses under applicable income tax laws or loss or credit carryforwards are utilized. Accordingly, realization of the Company's deferred tax assets is dependent on future taxable income against which these deductions, losses and credits can be utilized.

The Company must assess the likelihood that the Company's deferred tax assets will be recovered from future taxable income, and to the extent the Company believes that recovery is not more likely than not, the Company must establish a valuation allowance. Management judgment is required in determining the Company's provision for income taxes, the Company's deferred tax assets and liabilities and any valuation allowance recorded against the Company's net deferred tax assets. Excluding foreign operations, the Company recorded a full valuation allowance at each balance sheet date presented because, based on the available evidence, the Company believes it is more likely than not that it will not be able to utilize all of its deferred tax assets in the future. The Company intends to maintain the full valuation allowance until sufficient evidence exists to support the reversal of the valuation allowance.

Newly Adopted Accounting Standards

Revenue from Contracts with Customers

In May 2014, the FASB issued Accounting Standards Update No. ("ASU") 2014-09, "*Revenue from Contracts with Customers (Topic 606)*", which provides guidance for revenue recognition. ASU 2014-09 supersedes the revenue recognition requirements in Topic 605, "*Revenue Recognition*", and most industry-specific guidance. Additionally, it supersedes some cost guidance included in Subtopic 605-35, "*Revenue Recognition-Construction-Type and Production-Type Contracts*", and creates new Subtopic 340-40, "*Other Assets and Deferred Costs-Contracts with Customers*." The Company determines revenue recognition through the following steps: identification of the contract, or contracts, with a customer; identification of the performance obligations in the contract; determination of the transaction price; allocation of the transaction price to the performance obligations in the contract; and recognition of revenue when, or as, the Company satisfies a performance obligation. The standard's core principle is that a company will recognize revenue when it transfers promised goods or services to customers in an amount that reflects the consideration to which the company expects to be entitled in exchange for those goods or services. In doing so, companies will need to use more judgment and make more estimates than under the previous guidance. These may include identifying performance obligations in the contract, estimating the amount of variable consideration to include in the transaction price and allocating the transaction price to each separate performance obligation. The new standard permits adoption by using either (i) a full retrospective approach for all periods presented in the period of adoption or (ii) a modified retrospective approach with the cumulative effect of initially applying the new standard recognized at the date of initial application and providing certain additional disclosures.

On January 1, 2018, the Company adopted Topic 606 and Subtopic 340-40 using the modified retrospective transition method applied to those contracts which were not completed as of January 1, 2018. Accordingly, results for reporting periods beginning after January 1, 2018 are presented under Topic 606, while results for prior periods have not been restated and continues to be reported under the accounting standards in effect for those periods. The Company recognized the cumulative effect of initially applying the standards as an adjustment to the opening balance of accumulated deficit of \$1.8 million as of January 1, 2018, with the impact primarily relating to deferring the costs of obtaining contracts (sales commissions) and the upfront recognition of software license revenue. The impact to revenue of applying Topic 606 for the year ended December 31, 2018 was an increase of \$1.7 million.

Practical Expedients

The Company expenses sales commissions as sales and marketing expenses when incurred if the expected amortization period is one year or less. This applies generally to all transactions other than extended warranty contracts and Calix Cloud products.

The Company does not disclose the value of unsatisfied performance obligations for (i) contracts with an original expected length of one year or less and (ii) contracts for which the Company recognizes revenue at the amount to which it has the right to invoice for services performed.

The Company does not adjust the promised amount of consideration for the effects of a significant financing component if the Company expects, at contract inception, that the period between when the Company transfers a promised good or service to a customer and when the customer pays for that good or service will be one year or less.

Cumulative Effect of Adoption

The cumulative effect of changes made to the Consolidated January 1, 2018 Balance Sheet was as follows (in thousands):

	Balance at December 31, 2017	Adjustments	Balance at January 1, 2018
Accounts receivable, net	\$ 80,392	\$ 491	\$ 80,883
Prepaid expenses and other current assets	10,759	(245)	10,514
Other assets	759	698	1,457
Total assets	295,070	944	296,014
Deferred revenue	13,076	(829)	12,247
Total liabilities	150,107	(829)	149,278
Accumulated deficit	(667,357)	1,773	(665,584)
Total liabilities and stockholders' equity	295,070	944	296,014

The impact of adopting the new revenue standard on the Company's consolidated financial statements as of and for the year ended December 31, 2018 were as follows (in thousands):

Consolidated Balance Sheet

As of December 31, 2018	As Reported	Adjustments	Balances Without Adoption of Topic 606
Accounts receivable, net	\$ 67,026	\$ (1,095)	\$ 65,931
Prepaid expenses and other current assets	7,306	953	8,259
Other assets	1,203	(567)	636
Total assets	317,080	(709)	316,371
Accrued liabilities	57,869	(880)	56,989
Deferred revenue	33,096	2,801	35,897
Total liabilities	165,146	1,921	167,067
Accumulated deficit	(684,882)	(2,630)	(687,512)
Total liabilities and stockholders' equity	317,080	(709)	316,371

Consolidated Statement of Comprehensive Loss

Year Ended December 31, 2018	As Reported	Adjustments	Balances Without Adoption of Topic 606
Revenue:			
Systems	\$ 405,923	\$ (3,253)	\$ 402,670
Services	35,397	1,559	36,956
Total revenue	441,320	(1,694)	439,626
Cost of revenue:			
Systems	216,529	(1,052)	215,477
Services	27,409	274	27,683
Total cost of revenue	243,938	(778)	243,160
Gross profit	197,382	(916)	196,466
Sales and marketing	86,432	(59)	86,373
Net loss	(19,298)	(857)	(20,155)

Cloud Computing Costs

In August 2018, the FASB issued ASU 2018-15, "Intangibles (Topic 350): Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract", which aligns the requirements for capitalizing implementation costs incurred in a hosting arrangement that is a service contract with the requirements for capitalizing implementation costs incurred to develop or obtain internal-use software. This new standard also requires customers to expense the capitalized implementation costs of a hosting arrangement that is a service contract over the term of the hosting arrangement. This new standard becomes effective for the Company in the first quarter of 2020, with early adoption permitted.

This new standard can be applied either retrospectively or prospectively to all implementation costs incurred after the date of adoption. The Company adopted the standard prospectively in the fourth quarter of 2018, resulting in the capitalization of \$1.2 million in implementation costs related to the Company's SaaS-based enterprise resource planning infrastructure project.

Statement of Cash Flows

In November 2016, the FASB issued ASU 2016-18, an update to “*Statement of Cash Flows (Topic 230)*”, to provide guidance on classification and presentation of changes in restricted cash on the statement of cash flows. ASU 2016-18 requires that an entity’s reconciliation of the beginning-of-period and end-of-period total amounts shown on the statement of cash flows to include restricted cash within cash and cash equivalents. The Company adopted ASU 2016-18 in 2018. Prior to 2018, the Company did not have restricted cash. As of December 31, 2018, the Company classified \$0.6 million as restricted cash in our Consolidated Balance Sheets. The adoption of ASU 2016-18 did not have a material impact on our Consolidated Statements of Cash Flows.

Recent Accounting Pronouncements Not Yet Adopted

Leases

In February 2016, the FASB issued ASU 2016-02, “*Leases (Topic 842)*”, which requires recognition of an asset and liability for lease arrangements longer than twelve months. ASU 2016-02 will be effective for the Company beginning in the first quarter of 2019. The standard can be adopted using either a modified retrospective approach, whereby the Company would recognize and measure leases at the beginning of the earliest period presented, or the effective date approach, whereby the Company would initially account for the impact of the adoption with a cumulative-effect adjustment to the January 1, 2019 financial statements. The effective date approach will eliminate the need to restate amounts presented prior to January 1, 2019. The Company adopted the new standard effective January 1, 2019 using the effective date approach. Upon adoption of the standard, the Company's assets and liabilities will increase by approximately \$16 million as the new standard requires recognition of right-of-use assets and lease liabilities for operating leases, but the new standard does not impact its Statements of Comprehensive Loss or Cash Flows.

2. Cash and Cash Equivalents

Cash and cash equivalents consisted of the following (in thousands):

	December 31,	
	2018	2017
Cash and cash equivalents:		
Cash	\$ 45,806	\$ 35,999
Money market funds	3,840	3,776
	<u>\$ 49,646</u>	<u>\$ 39,775</u>

The carrying amounts of the Company’s money market funds approximate their fair values due to their nature, duration and short maturities.

3. Fair Value Measurements

The Company measures its cash equivalents and marketable securities at fair value on a recurring basis. Fair value is an exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. As such, fair value is a market-based measurement that should be determined based on assumptions that market participants would use in pricing an asset or liability. The Company utilizes the following three-tier value hierarchy which prioritizes the inputs used in measuring fair value:

Level 1 – Observable inputs that reflect quoted prices (unadjusted) for identical assets or liabilities in active markets.

Level 2 – Observable inputs other than quoted prices included in Level 1 for similar instruments in active markets, quoted prices for identical or similar instruments in markets that are not active, and model-driven valuations in which all significant inputs and significant value drivers are observable in active markets.

Level 3 – Unobservable inputs to the valuation derived from fair valuation techniques in which one or more significant inputs or significant value drivers are unobservable. The fair value hierarchy also requires the Company to maximize the use of observable inputs, when available, and to minimize the use of unobservable inputs when determining inputs and determining fair value.

As of December 31, 2018 and 2017, the Company had money market funds of \$3.8 million for each period, and each was classified as a Level 1 financial asset. The fair values of money market funds classified as Level 1 were derived from quoted market prices as active markets for these instruments exist. The Company had no Level 2 or Level 3 financial assets.

4. Balance Sheet Details

Accounts receivable, net consisted of the following (in thousands):

	December 31,	
	2018	2017
Accounts receivable	\$ 67,396	\$ 81,793
Allowance for doubtful accounts	(370)	(579)
Product return reserve ⁽¹⁾	—	(822)
	\$ 67,026	\$ 80,392

(1) With adoption of Topic 606 on January 1, 2018, the product return reserve is considered a contract liability and has been reclassified to accrued liabilities.

The table below summarizes the changes in allowance for doubtful accounts and product return reserve for the periods indicated (in thousands):

	Balance at Beginning of Year	Additions Charged to Costs or Expenses or Revenue	Deductions and Write Offs	Balance at End of Year
Year Ended December 31, 2018				
Allowance for doubtful accounts	\$ 579	\$ (5)	\$ (204)	\$ 370
Product return reserve	822	771	(713)	880
Year Ended December 31, 2017				
Allowance for doubtful accounts	\$ 518	\$ 103	\$ (42)	\$ 579
Product return reserve	938	3,682	(3,798)	822
Year Ended December 31, 2016				
Allowance for doubtful accounts	\$ 501	\$ 232	\$ (215)	\$ 518
Product return reserve	663	3,679	(3,404)	938

Inventory consisted of the following (in thousands):

	December 31,	
	2018	2017
Raw materials	\$ 10,815	\$ 1,211
Finished goods	39,336	30,318
	\$ 50,151	\$ 31,529

Property and equipment, net consisted of the following (in thousands):

	December 31,	
	2018	2017
Test equipment	\$ 39,148	\$ 39,952
Computer equipment and purchased software	34,697	32,175
Furniture and fixtures	1,976	2,714
Leasehold improvements	3,559	6,029
	79,380	80,870
Accumulated depreciation and amortization	(54,435)	(65,189)
	\$ 24,945	\$ 15,681

Depreciation and amortization expenses were \$9.2 million, \$10.2 million and \$8.3 million for the years ended December 31, 2018, 2017 and 2016, respectively.

Accrued liabilities consisted of the following (in thousands):

	December 31,	
	2018	2017
Accrued compensation and related benefits	\$ 19,811	\$ 15,563
Accrued warranty and retrofit	8,547	8,708
Accrued customer rebates/prepayments	6,103	1,432
Accrued professional and consulting fees	6,060	9,604
Accrued excess and obsolete inventory at CMs or ODMs	2,667	2,430
Current portion of equipment financing arrangements	1,778	—
Accrued business events	1,696	1,272
Accrued non-income related taxes	1,288	1,778
Accrued freight	1,187	593
Accrued insurance	917	827
Product return reserve ⁽¹⁾	880	—
Accrued restructuring charges	28	1,417
Accrued other	6,907	5,655
	<u>\$ 57,869</u>	<u>\$ 49,279</u>

(1) With adoption of Topic 606 on January 1, 2018, the product return reserve is considered a contract liability and has been reclassified from accounts receivable.

Changes in the Company's accrued warranty and retrofit liability were as follows (in thousands):

	Years Ended December 31,		
	2018	2017	2016
Balance at beginning of period	\$ 8,708	\$ 12,214	\$ 9,564
Provision for warranty and retrofit charged to cost of revenue	5,215	8,720	9,898
Utilization of reserve	(5,376)	(12,226)	(6,816)
Adjustments to pre-existing reserve	—	—	(432)
Balance at end of period	<u>\$ 8,547</u>	<u>\$ 8,708</u>	<u>\$ 12,214</u>

Accrued Restructuring Charges

The Company adopted a restructuring plan in March 2017. This restructuring plan realigned the Company's business, increasing its focus towards its investments in software defined access and cloud products, while reducing its expense structure in its traditional systems business. The Company began to take actions under this plan beginning in March 2017 and recognized \$4.2 million of restructuring charges for the year ended December 31, 2017, consisting primarily of severance and other one-time termination benefits. Actions pursuant to this restructuring plan were complete as of December 31, 2017.

The Company established a new restructuring plan in February 2018 to further align its business resources based on the production releases of its platform offerings. The Company incurred restructuring charges of approximately \$5.7 million for the year ended December 31, 2018, consisting primarily of severance and other termination related benefits.

The following table summarizes the activities pursuant to the above restructuring plans (in thousands):

	Severance and Related Benefits	Facilities	Total
Balance at December 31, 2016	\$ —	\$ —	\$ —
Restructuring charges for the year	3,807	442	4,249
Cash payments	(2,832)	—	(2,832)
Balance at December 31, 2017	<u>\$ 975</u>	<u>\$ 442</u>	<u>\$ 1,417</u>
Restructuring charges for the year	5,203	502	5,705
Cash payments	(6,178)	(916)	(7,094)
Balance at December 31, 2018	<u>\$ —</u>	<u>\$ 28</u>	<u>\$ 28</u>

Contract Asset

The primary contract asset is revenue recognized on professional services contracts where the services are transferred to the customer over time, less any progress billings and advanced payments, and is classified within accounts receivable. Amounts are billed in accordance with the agreed-upon contractual terms. The opening balance at January 1, 2018 was \$1.5 million of which \$0.2 million remained in our Consolidated Balance Sheet at December 31, 2018. The closing balance at December 31, 2018 was \$5.9 million of which we expect to bill substantially all of the balance during 2019. The increase in the contract asset was driven by the timing of professional services contracts with a major customer at the end of fiscal 2018.

Contract Liability

Deferred revenue consisted of the following (in thousands):

	December 31,	
	2018	2017
Current:		
Product and services	\$ 11,600	\$ 9,125
Extended warranty	4,000	3,951
	<u>15,600</u>	<u>13,076</u>
Non-current:		
Product and services	440	18
Extended warranty	17,056	20,627
	<u>17,496</u>	<u>20,645</u>
	<u>\$ 33,096</u>	<u>\$ 33,721</u>

The decrease in the deferred revenue balance for the year ended December 31, 2018 is primarily driven by \$11.9 million of revenue recognized that was included in the deferred revenue balance at the beginning of the year offset by cash payments received or due in advance of satisfying our performance obligations.

5. Credit Agreements*Line of Credit*

On August 7, 2017, the Company entered into a loan and security agreement (the “Loan Agreement”) with Silicon Valley Bank (“SVB”). The Loan Agreement provides for a senior secured revolving credit facility with SVB, pursuant to which SVB agreed to make revolving advances available to the Company in a principal amount of up to \$30.0 million based on a customary accounts receivable borrowing base, subject to certain exceptions for accounts originating outside the United States and certain specific accounts, which could reduce the amount available to the Company under the credit facility.

The credit facility includes affirmative and negative covenants applicable to the Company and its subsidiaries. Furthermore, the Loan Agreement requires the Company to maintain a liquidity ratio at minimum levels set forth in more detail in the Loan Agreement. The credit facility also includes events of default, the occurrence and continuation of which would provide SVB with the right to demand immediate repayment of any principal and unpaid interest under the credit facility, and to exercise remedies against the Company and the collateral securing the loans under the credit facility. For the month ended November 30, 2017, the Company was not able to maintain the minimum Adjusted Quick Ratio (“AQR”), (as defined in the Loan Agreement) at the level required in the Loan Agreement, which constituted an event of default. Although SVB waived this event of default effective as of November 30, 2017 and, therefore, this default did not change the Company’s ability to borrow under the Loan Agreement, the Company was required to amend certain covenants under the Loan Agreement. In February 2018, the Company entered into an amendment to the Loan Agreement that, among other things, amended certain affirmative financial covenants, including reductions to the required minimum level of the AQR and the inclusion of an additional financial covenant related to the maintenance of Adjusted EBITDA (as defined in the Loan Agreement, as amended). In August 2018, the Company entered into a second amendment to the Loan Agreement that, among other things, extended the maturity date from August 7, 2019 to August 7, 2020, amended certain financial covenants, including covenants with respect to the AQR and the Adjusted EBITDA, and changed the compliance requirements for the AQR covenant from a monthly basis to a quarterly basis. As of December 31, 2018, the Company was in compliance with these requirements.

As of December 31, 2018 and December 31, 2017, the Company had borrowings outstanding of \$30.0 million, representing the full amount available under the line of credit. Our interest rate on the letter of credit was 7.0% as of December 31, 2018 and 5.8% as of December 31, 2017.

Equipment Financing Arrangements

During 2018, the Company entered into financing arrangements to purchase lab and test equipment for approximately \$5.1 million . Each agreement is to be paid over 36 months with a weighted average interest rate of 6.2% .

6. Commitments and Contingencies

Lease Commitments

The Company leases office space under non-cancelable operating leases. Certain of the Company's operating leases contain renewal options and rent acceleration clauses. Future minimum payments under the non-cancelable operating leases consisted of the following as of December 31, 2018 (in thousands):

<u>Year Ending December 31,</u>	<u>Minimum Future Lease Payments</u>
2019	\$ 3,750
2020	3,817
2021	3,468
2022	3,300
2023	3,411
Thereafter	6,053
Total	\$ 23,799

The Company leases its headquarters office space in San Jose, California under a lease agreement that expires in December 2025. In March 2018, the Company entered into this lease agreement for approximately 65,000 square feet, which commenced in September 2018. The future minimum lease payments under the lease are \$16.1 million and are included in the table above.

In June 2018, the Company entered into a co-location license agreement to lease data center space in West Jordan, Utah for a term of 84 months . The future minimum lease payments under the lease are \$2.9 million and are included in the table above.

In August 2018, the Company entered into a new office lease agreement for 22,000 square feet in Petaluma, California as its current office lease in Petaluma, California expires in February 2019. The lease is expected to commence in March 2019 for a term of 64 months . The future minimum lease payments of \$2.8 million are included in the table above.

The above table also includes future minimum lease payments for the Company's office facilities in Minneapolis, Minnesota; Nanjing, China; Richardson, Texas; and the current office in Petaluma, California, which expire at various dates through 2022.

For the years ended December 31, 2018 , 2017 and 2016 , total rent expense of the Company was \$3.4 million , \$3.7 million and \$3.5 million , respectively.

Purchase Commitments

The Company's CMs place orders for component inventory in advance based upon the Company's build forecasts in order to reduce manufacturing lead times and ensure adequate component supply. The components are used by the CM to build the products included in the build forecasts. The Company generally does not take ownership of the components held by CMs. The Company places purchase orders with its CMs in order to fulfill its monthly finished product inventory requirements. The Company incurs a liability when the CMs convert the component inventory to a finished product and takes ownership of the inventory when transferred to the designated shipping warehouse. In the event of termination of services with a CM, the Company has purchased, and may be required to purchase in the future, the remaining components inventory held by the CM as well as any outstanding orders pursuant to the contractual provisions with such CM. As of December 31, 2018 , the Company had approximately \$42.0 million of outstanding purchase commitments for inventories to be delivered by its suppliers, including CMs and ODMs, within one year.

The Company has from time to time, and subject to certain conditions, reimbursed its CMs for component inventory purchases when this inventory has been rendered excess or obsolete, for example due to manufacturing and engineering change orders resulting from design changes, manufacturing discontinuation of parts by its suppliers, or in cases where inventory levels greatly exceed projected demand. The estimated excess and obsolete inventory liabilities related to such manufacturing and engineering change orders and other factors, which are included in accrued liabilities in the accompanying balance sheets, were \$2.7 million and \$2.4 million as of December 31, 2018 and 2017 , respectively. The Company records the related charges in cost of systems revenue in its Consolidated Statements of Comprehensive Loss.

In March 2018, the Company entered into an agreement with a vendor for engineering services pursuant to which the Company will be obligated to make future minimum payments of \$15.8 million through 2022.

Contingencies

The Company evaluates the circumstances regarding outstanding and potential litigation and other contingencies on a quarterly basis to determine whether there is at least a reasonable possibility that a loss exists requiring accrual or disclosure, and if so, whether an estimate of the possible loss or range of loss can be made. When a loss is probable and reasonably estimable, the Company accrues for such amount based on its estimate of the probable loss considering information available at that time. When a loss is reasonably possible, the Company discloses the estimated possible loss or range of loss in excess of amounts accrued if material. Except as otherwise disclosed below, the Company does not believe that there was a reasonable possibility that a material loss may have been incurred during the period presented with respect to the matters disclosed.

Litigation

From time to time, the Company is involved in various legal proceedings arising from the normal course of business activities. The Company is not currently a party to any legal proceedings that, if determined adversely to the Company, in management's opinion, are currently expected to individually or in the aggregate have a material adverse effect on the Company's business, operating results or financial condition taken as a whole.

Indemnifications

The Company from time to time enters into contracts that require it to indemnify various parties against claims from third parties. These contracts primarily relate to (i) certain real estate leases, under which the Company may be required to indemnify property owners for environmental and other liabilities, and other claims arising from the Company's use of the applicable premises, (ii) agreements with the Company's officers, directors and certain employees, under which the Company may be required to indemnify such persons for liabilities arising out of their relationship with the Company, (iii) contracts under which the Company may be required to indemnify customers against third-party claims that a Company product infringes a patent, copyright or other intellectual property right and (iv) agreements under which the Company may be required to indemnify the counterparty for certain claims that may be brought against them arising from the Company's acts or omissions with respect to the transactions contemplated by such agreements.

Because any potential obligation associated with these types of contractual provisions are not quantified or stated, the overall maximum amount of the obligation cannot be reasonably estimated. Historically, the Company has not been required to make payments under these obligations, and no liabilities have been recorded for these obligations in the accompanying Consolidated Balance Sheets.

7. Stockholders' Equity

Preferred Stock

The Board of Directors has the authority, without action by stockholders with the exception of stockholders who hold board positions, to designate and issue up to 5.0 million shares of preferred stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof. These rights, preferences and privileges could include dividend rights, conversion rights, voting rights, terms of redemption, liquidation preferences, sinking fund terms and the number of shares constituting any series or the designation of such series, any or all of which may be greater than the rights of common stock. The issuance of the Company's preferred stock could adversely affect the voting power of holders of common stock and the likelihood that such holders will receive dividend payments and payments upon liquidation. In addition, the issuance of preferred stock could have the effect of delaying, deferring or preventing a change in control of the Company or other corporate action. Since the Company's initial public offering, the Board of Directors has not designated any rights, preference or powers of any preferred stock and no shares of preferred stock have been issued.

Common Stock

Holders of the Company's common stock are entitled to receive dividends, if any, as may be declared from time to time by the Board of Directors out of legally available funds. No dividends have been declared or paid as of December 31, 2018. In the event of the Company's liquidation, dissolution or winding up, holders of the Company's common stock will be entitled to share ratably in the net assets legally available for distribution to stockholders after the payment of all of the Company's debts and other liabilities and the satisfaction of any liquidation preference granted to the holders of any then outstanding shares of preferred stock.

Equity Incentive Plans

As of December 31, 2018, the Company maintained two equity incentive plans, the 2002 Stock Plan (“2002 Plan”) and the 2010 Equity Incentive Award Plan (“2010 Plan”). These plans were approved by the Company’s stockholders at the time of adoption. Under the 2002 Plan, the Company granted stock options at a price not less than 100% of the fair market value of the common stock on the date of grant. The majority of the stock options granted under the 2002 Plan vested over 4 years and expire in 10 years.

The 2010 Plan allows the Company to grant stock options, restricted stock awards (“RSAs”), RSUs, PRSUs, stock appreciation rights, dividend equivalents, deferred stock and stock payments to employees, directors and consultants of the Company. A total of 4.7 million shares of common stock were initially reserved for future issuance under the 2010 Plan, which became effective upon the completion of the Company’s initial public offering of common stock. In addition, on the first day of each year beginning in 2011 and ending in 2020, the 2010 Plan provides for an annual automatic increase to the shares reserved for issuance equal to the lesser of: i) 2% of the outstanding shares at the end of the previous year or ii) 666,666 shares. No more than 17.2 million shares of Common Stock may be issued upon the exercise of Incentive Stock Options. Pursuant to the automatic annual increase, a total of 5.3 million additional shares had been reserved as of December 31, 2018 under the 2010 Plan since 2011.

Upon the effectiveness of the 2010 Plan, equity awards were granted only under the 2010 Plan and shares of common stock previously reserved for issuance under the prior plan became available for issuance under the 2010 Plan. To date, awards granted under the 2010 Plan consist of stock options, RSAs, RSUs and PRSUs.

Stock options granted under the 2010 Plan are granted in general at a price not less than 100% of the fair market value of the common stock on the date of grant. Stock options issued under the 2010 Plan through 2016 generally vest 25% on the first anniversary of the vesting commencement date and on a monthly basis thereafter for a period of an additional three years. Stock options granted during 2017 vest 25% on the first anniversary of the vesting commencement date and on a quarterly basis thereafter for a period of an additional three years. The options have a maximum term of ten years.

Each RSU granted under the 2010 Plan represents a right to receive one share of the Company’s common stock (subject to adjustment for certain specified changes in the capital structure of the Company) upon the completion of a specific period of continued service. The majority of RSUs granted vest over four years.

In February 2016, the Company granted 0.6 million shares of PRSUs to its executives. These particular performance-based awards contained a one -year performance period and a subsequent two -year service period. The performance target was based on the Company’s revenue during the performance period and accounted for as a performance condition. In February 2017, the Compensation Committee of the Company’s Board of Directors determined that the performance condition related to PRSUs granted to executives in 2016 was met based on the Company’s actual revenue recognized during 2016. As such, each PRSU award vested in respect to 50% of the PRSUs subject to the award in February 2017; 25% in February 2018 and 25% in February 2019, subject to the executive’s continuous service with the Company from the grant date through the remaining vesting date.

In August 2017, the Company granted 1.2 million shares of performance-based stock option awards to its executives. These performance-based stock option awards contained a one -year performance period and a subsequent three -year service period. The performance target was based on a combination of the Company’s fiscal year 2017 revenue and non-GAAP operating income and was accounted for as a performance condition. In February 2018, the Compensation Committee of the Company’s Board of Directors concluded that the performance target was not met and all such performance-based stock options were forfeited and canceled.

In October 2017, in connection with the hiring of its Chief Financial Officer, the Company made an “inducement” award of non-qualified stock options to purchase 0.3 million shares of the Company’s common stock with an exercise price of \$5.05 per share, equal to the grant date fair value based upon the closing price of the Company’s common stock. The stock option was granted outside the terms of the Company’s 2010 Equity Incentive Award Plan (under the employee inducement award exemption under the New York Stock Exchange Listed Company Manual Rule 303A.08). The stock option will vest and become exercisable over four years from the date of grant, with 25% of the shares vesting on the one -year anniversary of the grant date and the remaining shares vesting quarterly thereafter over the next three years, subject to continued employment with the Company.

In December 2017, the Company granted 1.6 million shares of performance-based stock option awards to its executives. These performance-based stock option awards contain a one -year performance period and a subsequent two -year service period. The performance target is based on the Company’s non-GAAP operating income during the performance period and accounted for as a performance condition. After the one-year performance period, if the performance target is met and subject to certification by the Compensation Committee of the Company’s Board of Directors, each performance-based stock option award shall vest with respect to 50% of the earned shares on January 1, 2019 and 6.25% of the earned shares quarterly thereafter, subject to the executive’s continuous service with the Company from the grant date through the respective vesting dates. If the performance

target is not met, all such performance-based stock options shall be immediately forfeited and canceled. In November 2018, the Compensation Committee of the Company's Board of Directors modified the performance target. Subsequently, in February 2019, the Compensation Committee of the Company's Board of Directors concluded that the revised performance target was met based on the actual non-GAAP net income achieved for 2018. As such, each stock option was earned subject to the executive's continuous service with the Company from the grant date through the remaining vesting dates.

Stock Options

The following table summarizes the activity of stock options under the Company's equity incentive plans (in thousands, except per share data):

Stock Options	Number of Shares	Weighted-Average Exercise Price Per Share	Weighted-Average Remaining Contractual Life (in years)	Aggregate Intrinsic Value ⁽¹⁾
Outstanding as of December 31, 2017	5,756	\$ 7.38		
Granted	230	6.77		
Exercised	(57)	6.70		
Canceled	(1,487)	7.22		
Outstanding as of December 31, 2018	4,442	\$ 7.40	7.3	\$ 12,377
Vested and expected to vest as of December 31, 2018	4,333	\$ 7.43	7.3	\$ 12,006
Options exercisable as of December 31, 2018	1,903	\$ 9.04	5.4	\$ 3,300

(1) Amounts represent the difference between the exercise price and the fair market value of common stock at December 31, 2018 of \$9.75 per share for all in the money options outstanding.

During the years ended December 31, 2018, 2017 and 2016, total intrinsic value of stock options exercised was \$148 thousand, \$10 thousand and \$5 thousand, respectively. Total cash received from employees as a result of stock option exercises in 2018, 2017 and 2016 was \$0.4 million, \$62 thousand and \$17 thousand, respectively. Total fair values of stock options vested during 2018, 2017 and 2016 were \$2.7 million, \$2.1 million and \$1.9 million, respectively.

Restricted Stock Units and Performance Restricted Stock Units

The following table summarizes the activities of the Company's RSUs and PRSUs under the Company's equity incentive plans (in thousands, except per share data):

	RSUs		PRSUs	
	Number of Shares	Weighted-Average Grant Date Fair Value Per Share	Number of Shares	Weighted-Average Grant Date Fair Value Per Share
Outstanding at December 31, 2017	1,726	\$ 7.53	150	\$ 7.42
Granted	174	6.66	—	—
Vested	(835)	7.57	(87)	7.42
Canceled	(277)	7.65	—	—
Outstanding at December 31, 2018	788	\$ 7.26	63	\$ 7.42

Upon vesting of certain RSUs and PRSUs, the Company withheld shares with value equivalent to the employees' minimum statutory obligation for the applicable income and other employment taxes and remitted the cash to the appropriate taxing authorities. The number of shares withheld was based on the value of the RSUs or PRSUs on their vesting date as determined by the Company's closing stock price. The withheld shares are reserved for future grant and issuance under the 2010 Plan.

Employee Stock Purchase Plans

The Company maintains two employee stock purchase plans - the Amended and Restated Employee Stock Purchase Plan (the "ESPP") and the Amended and Restated 2017 Nonqualified Employee Stock Purchase Plan (the "Nonqualified ESPP").

The ESPP allows eligible employees to purchase shares of the Company's common stock through payroll deductions of up to 15% of their annual compensation subject to certain Internal Revenue Code limitations. In addition, no participant may purchase more than 2,000 shares of common stock in each offering period.

The offering periods under the ESPP are six-month periods commencing on May 15th and November 15th of each year. The price of common stock purchased under the ESPP is 85% of the lower of the fair market value of the common stock on the commencement date and end date of each six-month offering period.

The ESPP provides for the issuance of a maximum of 7.3 million shares of common stock. For the year ended December 31, 2018, shares totaling 0.9 million were purchased and issued. As of December 31, 2018, there were 1.5 million shares available for issuance.

On March 30, 2017, the Company's Board of Directors, upon recommendation of the Compensation Committee, approved the adoption of the Nonqualified ESPP. The Nonqualified ESPP was approved by the Company's stockholders on May 17, 2017, with the initial offering period commencing July 1, 2017. Under the Nonqualified ESPP, eligible employees can purchase shares of the Company's common stock through payroll deductions of up to 25% of their annual compensation. Eligible employees have the right to (a) purchase the maximum number of whole shares of common stock that can be purchased with the elected payroll deductions during each offering period for which the employee is enrolled at a purchase price equal to the closing price of the Company's common stock on the last day of such offering period and (b) receive an equal number of shares of the Company's common stock that are subject to a risk of forfeiture in the event the employee terminates employment within the one year period immediately following the purchase date. The Nonqualified ESPP provides two six-month offering periods, from June 21 through December 20 and December 21 through June 20 of each year. At the annual meeting of the Company's stockholders on May 16, 2018, the stockholders approved to amend certain terms and increase the number of shares of common stock issuable under the Nonqualified ESPP by 2.5 million shares. The maximum number of shares of common stock authorized for issuance under the Nonqualified ESPP as of December 31, 2018 is 3.5 million shares, with a maximum of 0.5 million shares allocated per purchase period. For the year ended December 31, 2018, shares totaling 0.3 million were purchased and issued, with an additional equal number of shares issued subject to a risk of forfeiture. As of December 31, 2018, there were 2.8 million shares available for future issuance.

Stock-Based Compensation

Stock-based compensation expense associated with stock options, RSUs, PRSUs and purchase rights under the Company's ESPP and Nonqualified ESPP is measured at the grant date based on the fair value of the award, and is recognized, net of forfeitures, as expense over the remaining requisite service period on a straight-line basis. During the years ended December 31, 2018, 2017 and 2016, the Company recorded stock-based compensation expense of \$17.5 million, \$12.4 million and \$14.3 million, respectively.

The following table summarizes the weighted-average grant date fair values of the Company's stock-based awards granted in the periods indicated:

	Years Ended December 31,		
	2018	2017	2016
Stock options	\$ 3.41	\$ 3.19	\$ 3.58
RSUs	N/A	\$ 6.75	\$ 6.91
PRSUs	N/A	N/A	\$ 7.42
ESPP	\$ 2.21	\$ 1.76	\$ 1.92
Nonqualified ESPP	\$ 7.34	\$ 6.90	N/A

The Company values the RSUs and employee stock purchase rights under the Nonqualified ESPP at the closing market price of the Company's common stock on the date of grant.

Stock-based compensation expense associated with PRSUs and performance-based stock option awards with graded vesting features and which contain both a performance and a service condition is only recognized if the Company has determined that it is probable that the performance condition will be met. The Company reassesses the probability of vesting at each reporting period and adjusts compensation expense based on its probability assessment. The probability of meeting the performance condition related to the performance-based stock option awards granted in December 2017 was assessed as probable as of December 31, 2018. As a result, the Company recognized a cumulative stock-based compensation expense of \$6.9 million in the fourth quarter of 2018, based on a fair value assessment as of the date of modification.

The Company estimates the fair value of stock options and employee stock purchase right under the ESPP at the grant date using the Black-Scholes option-pricing model. This model requires the use of the following assumptions:

- (i) Expected volatility of the Company’s common stock – The Company computes its expected volatility assumption based on a blended volatility (50% historical volatility and 50% implied volatility from traded options on the Company’s common stock). The selection of a blended volatility assumption was based upon the Company’s assessment that a blended volatility is more representative of the Company’s future stock price trend as it weighs the historical volatility with the future implied volatility.
- (ii) Expected life of the option award – Represents the weighted-average period that the stock options are expected to remain outstanding. The Company’s computation of expected life utilizes the simplified method in accordance with Staff Accounting Bulletin No. 110 (“SAB 110”) due to the lack of sufficient historical exercise data to provide a reasonable basis upon which to estimate expected term. The mid-point between the vesting date and the expiration date is used as the expected term under this method.
- (iii) Expected dividend yield – Assumption is based on the Company’s history of not paying dividends and no future expectations of dividend payouts.
- (iv) Risk-free interest rate – Based on the U.S. Treasury yield curve in effect at the time of grant with maturities approximating the grant’s expected life.

The following table summarizes the weighted-average assumptions used in estimating the grant-date fair value of stock options and of each employee’s purchase right under the ESPP in the periods indicated:

Stock Options	Years Ended December 31,		
	2018	2017	2016
Expected volatility	50%	52%	53%
Expected life (years)	6.11	5.88	6.25
Expected dividend yield	—	—	—
Risk-free interest rate	2.83%	2.10%	1.60%

ESPP	Years Ended December 31,		
	2018	2017	2016
Expected volatility	42%	45%	46%
Expected life (years)	0.50	0.49	0.52
Expected dividend yield	—	—	—
Risk-free interest rate	2.21%	1.24%	0.47%

In addition, the Company applies an estimated forfeiture rate to awards granted and records stock-based compensation expense only for those awards that are expected to vest. Forfeiture rates are estimated at the time of grant based on the Company’s historical experience. Further, to the extent the Company’s actual forfeiture rate is different from management’s estimate, stock-based compensation is adjusted accordingly.

As of December 31, 2018 , unrecognized stock-based compensation expenses by award type, net of estimated forfeitures, and their expected weighted-average recognition periods are summarized in the following table (in thousands).

	December 31, 2018		
	Stock Option	RSU	ESPPs
Unrecognized stock-based compensation expense	\$ 5,088	\$ 3,337	\$ 3,879
Weighted-average amortization period (in years)	1.9	1.0	1.1

The Company expects to recognized stock-based compensation expense of \$8.6 million in 2019, \$3.0 million in 2020, \$0.6 million in 2021 and \$0.1 million in 2022.

Shares Reserved for Future Issuance

The Company had common shares reserved for future issuance as follows (in thousands):

	December 31,	
	2018	2017
Stock options outstanding	4,442	5,756
Restricted stock units outstanding	788	1,726
Performance restricted stock units outstanding	63	150
Shares available for future grant under 2010 Plan	2,306	281
Shares available for future issuance under ESPP	1,550	2,456
Shares available for future issuance under Nonqualified ESPP	2,764	551
	11,913	10,920

8. Employee Benefit Plan

The Company sponsors a 401(k) tax-deferred savings plan for all employees who meet certain eligibility requirements. Participants may contribute, on a pre-tax basis, a percentage of their annual compensation, but not to exceed a maximum contribution amount pursuant to Section 401(k) of the Internal Revenue Code. The Company, at the discretion of the Board of Directors, may make additional matching contributions on behalf of the participants. The Company made matching contributions totaling \$2.5 million, \$3.0 million and \$2.1 million in 2018, 2017 and 2016, respectively.

9. Accumulated Other Comprehensive Loss

The table below summarizes the changes in accumulated other comprehensive loss by component:

	Unrealized Gains and Losses on Available-for-Sale Marketable Securities	Foreign Currency Translation Adjustments	Total
Balance at December 31, 2016	\$ (6)	\$ (650)	\$ (656)
Other comprehensive income	6	481	487
Balance at December 31, 2017	—	(169)	(169)
Other comprehensive loss	—	(584)	(584)
Balance at December 31, 2018	\$ —	\$ (753)	\$ (753)

Assets and liabilities of the Company's wholly owned foreign subsidiaries are translated from their respective functional currencies at exchange rates in effect at the balance sheet date, and revenue and expenses are translated at the monthly average exchange rates. These translations result in differences called foreign currency translation adjustments. Realized foreign currency transaction gains or losses were not significant during the years ended December 31, 2018, 2017 and 2016 and are recorded in "Other income (expense), net" in our Consolidated Statements of Comprehensive Loss.

10. Income Taxes

The domestic and foreign components of loss before provision for income taxes were as follows (in thousands):

	Years Ended December 31,		
	2018	2017	2016
Domestic	\$ (20,463)	\$ (84,387)	\$ (28,931)
Foreign	1,695	2,598	1,876
	\$ (18,768)	\$ (81,789)	\$ (27,055)

Provision for income taxes consisted of the following (in thousands):

	Years Ended December 31,		
	2018	2017	2016
Current:			
State	\$ 105	\$ 115	\$ 102
Foreign	360	577	673
Current income tax	465	692	775
Deferred foreign income tax (benefit)	65	551	(428)
	<u>\$ 530</u>	<u>\$ 1,243</u>	<u>\$ 347</u>

The differences between the statutory tax rate and the effective tax rate, expressed as a percentage of loss before income taxes, were as follows:

	Years Ended December 31,		
	2018	2017	2016
Federal statutory rate	21.0 %	34.0 %	34.0 %
State statutory rate	5.7	4.5	6.1
Foreign operations	0.3	0.5	0.6
R&D tax credits	7.2	2.7	6.4
Foreign income inclusion	(1.2)	(0.1)	(0.7)
Non-deductible stock compensation	(4.3)	(3.7)	(5.1)
Other permanent items	(1.6)	(0.4)	(1.4)
Tax true-up	(2.3)	(1.7)	21.0
Valuation allowance	(25.6)	67.3	(62.2)
Tax reform	—	(104.6)	—
Topic 606 adjustment	(2.0)	—	—
Effective tax rate	<u>(2.8)%</u>	<u>(1.5)%</u>	<u>(1.3)%</u>

The significant components of the Company's deferred tax assets were as follows (in thousands):

	December 31,	
	2018	2017
Deferred tax assets:		
Net operating loss carryforwards	\$ 132,420	\$ 134,731
Tax credit carryforwards	46,884	43,095
Depreciation and amortization	1,924	1,892
Accruals and reserves	10,021	7,933
Deferred revenue	7,815	7,928
Stock-based compensation	4,447	3,100
Intangible assets	37	64
Other	5	23
Gross deferred tax assets	203,553	198,766
Valuation allowance	(203,550)	(198,746)
	<u>\$ 3</u>	<u>\$ 20</u>

All deferred tax assets, along with any related valuation allowance, are classified in the Consolidated Balance Sheet as long-term.

Management reviews the recognition of deferred tax assets to determine if realization of such assets is more likely than not. The realization of the Company's deferred tax assets is dependent upon future earnings. The Company has been in a cumulative loss position since inception, which represents a significant piece of negative evidence. Using the more likely than not criteria specified in the applicable accounting guidance, this negative evidence cannot be overcome by positive evidence currently available to the Company. As a result, the Company has established a full valuation allowance against its deferred tax assets with the exception of certain foreign deferred tax assets. The Company's valuation allowance increased by \$4.8 million in 2018 and decreased by \$40.5 million in 2017.

As of December 31, 2018, the Company had U.S. federal and state net operating losses of approximately \$597.0 million and \$189.5 million, respectively. The U.S. federal net operating loss carryforwards have begun to expire and will continue to expire

at various dates through 2037 if not utilized. The state net operating loss carryforwards have begun to expire and will continue to expire at various dates through 2037, if not utilized. Additionally, the Company has U.S. federal, California and other U.S. states research and development credits of approximately \$35.4 million, \$35.0 million and \$3.0 million, respectively, as of December 31, 2018. The U.S. federal research and development credits will begin to expire in 2020 and the California research and development credits have no expiration date. The credits related to other various U.S. states began to expire in 2018.

Uncertain Tax Positions

ASC Topic 740, "Income Taxes," prescribes a recognition threshold and measurement attribute to the financial statement recognition and measurement of a tax position taken or expected to be taken in a tax return. The guidance also provides guidance on derecognition, classification, accounting in interim periods and disclosure requirements for uncertain tax positions. The standard requires the Company to recognize the financial statement effects of an uncertain tax position when it is more likely than not that such position will be sustained upon audit. The Company recognizes accrued interest and penalties related to unrecognized tax benefits as interest expense and income tax expense, respectively, in statements of comprehensive loss.

The following table reconciles the Company's unrecognized tax benefits (in thousands):

	Years Ended December 31,	
	2018	2017
Balance at beginning of year	\$ 20,289	\$ 18,349
Additions for tax positions related to prior year	516	—
Additions for tax positions related to current year	1,193	1,940
Balance at end of year	\$ 21,998	\$ 20,289

As of December 31, 2018 and 2017, the Company had unrecognized tax benefits of \$22.0 million and \$20.3 million, respectively, none of which would affect the Company's effective tax rate if recognized. There were no accrued interest or penalties for uncertain income tax as of December 31, 2018.

The Company files tax returns in the United State and various state jurisdictions, the United Kingdom, China and Brazil. The tax years 1999 through 2017 remain open and subject to examination by the appropriate governmental agencies in the U.S. due to tax attribute carryforwards.

U.S. Tax Reform

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as the Tax Cuts and Jobs Act (the "Tax Act"). The Tax Act includes, among other items, a reduction in the federal corporate income tax rate from 34% to 21%, certain interest expense deduction limitations and changes in the timing of certain taxable income. The Company was required to recognize the effect of the tax law changes in 2017, such as remeasuring its U.S. deferred tax assets and liabilities and reassessing the net realizability of our deferred tax assets and liabilities.

On December 22, 2017, the SEC staff issued Staff Accounting Bulletin No. 118 ("SAB 118") which provided guidance on accounting for the tax effects of the Tax Act. The Company completed its analysis and accounting with respect the Tax Act and identified no additional changes from amounts previously recorded. However, future changes in law, interpretations and facts may result in adjustments to these amounts. Based on the Company's net operating loss carryovers and valuation allowance, there was no impact to its consolidated financial statements as a result of the accounting for the tax effects of the Tax Act.

The Tax Act created a new requirement that global intangible low-taxed income ("GILTI") earned by our foreign subsidiaries must be included in gross U.S. taxable income. While the Tax Act provides for a modified territorial tax system, beginning in 2018, GILTI provisions will be applied providing an incremental tax on low taxed foreign income. The GILTI provisions require us to include in our U.S. income tax return foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. During 2018, we made an accounting policy election to treat taxes related to GILTI as a current period expense when incurred.

11. Net Loss Per Common Share

The following table sets forth the computation of basic and diluted net loss per common share for the periods indicated (in thousands, except per share data):

	Years Ended December 31,		
	2018	2017	2016
Numerator:			
Net loss	\$ (19,298)	\$ (83,032)	\$ (27,402)
Denominator:			
Weighted-average common shares outstanding	52,609	50,155	48,730
Basic and diluted net loss per common share	\$ (0.37)	\$ (1.66)	\$ (0.56)
Potentially dilutive shares, weighted-average	5,833	3,446	5,890

For the year ended December 31, 2018 and 2017, unvested restricted stock awards are included in the calculation of basic weighted-average shares because such shares are participating securities; however, the impact was immaterial. There were no unvested restricted stock awards for the year ended December 31, 2016.

Potentially dilutive shares have been excluded from the computation of diluted net loss per common share when their effect is antidilutive. These antidilutive shares were primarily from stock options, restricted stock units and performance restricted stock units. For each of the periods presented where the Company reported a net loss, the effect of all potentially dilutive securities would be antidilutive, and as a result diluted net loss per common share is the same as basic net loss per common share.

12. Segment Information

The Company develops, markets and sells communications access systems and software, and there are no segment managers who are held accountable for operations, operating results and plans for levels or components below the Company unit level. Accordingly, the Company is considered to be in a single reporting segment and operating unit structure. The Company's chief operating decision maker is the Company's Chief Executive Officer, who reviews financial information presented on a Company-wide basis, for purposes of allocating resources and evaluating financial performance.

Geographic Information:

The following is a summary of revenue by geographic region based upon the location of the customers (in thousands):

	Years Ended December 31,		
	2018	2017 ⁽¹⁾	2016 ⁽¹⁾
United States	\$ 386,341	\$ 452,956	\$ 415,629
Middle East	18,814	18,267	8,098
Canada	10,542	13,105	9,064
Europe	8,858	6,575	6,334
Caribbean	7,075	9,853	12,934
Other	9,690	9,611	6,728
	<u>\$ 441,320</u>	<u>\$ 510,367</u>	<u>\$ 458,787</u>

(1) Revenue amounts are accounted for under Topic 605 for 2017 and 2016.

The Company's property and equipment, net of accumulated depreciation, are located in the following geographical areas (in thousands):

	December 31,	
	2018	2017
United States	\$ 23,249	\$ 13,109
China	1,696	2,572
	<u>\$ 24,945</u>	<u>\$ 15,681</u>

13. Product Line Divestiture

In February 2018, the Company sold its outdoor cabinet product line to Clearfield, Inc. ("Clearfield") for \$10.4 million in cash as well as the assumption by Clearfield of the related product warranty liabilities and open purchase order commitments with a CM. The Company transferred \$2.1 million in net inventory and agreed to solicit orders on Clearfield's behalf on the newly transferred outdoor cabinets product lines free of charge for 15 months. The Company established a liability of \$1.6 million in

deferred revenue for providing this service and is amortizing this amount to service revenue over the corresponding 15-month period. The Company also recognized a \$6.7 million gain for the year ended December 31, 2018 within operating expenses in the accompanying Consolidated Statements of Comprehensive Loss.

14. Quarterly Financial Data—Unaudited

The Company's fiscal year begins on January 1st and ends on December 31st. Quarterly periods are based on a 4-4-5 fiscal calendar with the first, second and third fiscal quarters ending on the 13th Saturday of each fiscal period. As a result, the Company had one fewer day in the first quarter of 2018 and one more day in the fourth quarter of 2018 than in the respective 2017 periods.

The following table presents selected unaudited quarterly financial data of the Company (in thousands, except per share data). The Company's quarterly results of operations for these periods are not necessarily indicative of future results of operations.

	Fiscal Year 2018 Quarter Ended			
	March 31	June 30	September 29	December 31
Revenue	\$ 99,403	\$ 111,702	\$ 114,699	\$ 115,516
Gross profit	42,059	50,866	52,833	51,624
Operating income (loss)	(11,109)	(2,926)	676	(5,155)
Net income (loss)	(11,736)	(2,793)	809	(5,578)
Net income (loss) per common share, basic and diluted	\$ (0.23)	\$ (0.05)	\$ 0.02	\$ (0.10)

	Fiscal Year 2017 Quarter Ended			
	April 1	July 1	September 30	December 31
Revenue	\$ 117,518	\$ 126,123	\$ 128,827	\$ 137,899
Gross profit	34,377	43,323	44,633	50,557
Operating loss	(32,816)	(18,714)	(17,263)	(12,763)
Net loss	(33,325)	(18,988)	(17,853)	(12,866)
Net loss per common share, basic and diluted	\$ (0.67)	\$ (0.38)	\$ (0.35)	\$ (0.25)

15. Subsequent Event

In February 2019, the Company entered into an amendment to the Loan Agreement with SVB that amended the affirmative financial covenants to reduce the required minimum level of the AQR for the first half of 2019 and the required minimum Adjusted EBITDA for the first fiscal quarter of 2019. AQR and Adjusted EBITDA are defined in the Loan Agreement, as previously amended. These covenant modifications were provided to accommodate the increased costs and use of cash anticipated for the first half of 2019 related to activities to mitigate the impact of the U.S. tariffs imposed on goods imported from China, including advance purchases of inventory, as part of the Company's realignment of its supply chain.

ITEM 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

There were no changes in nor any disagreements with accountants on accounting principles or practices, financial statement disclosure, auditing scope or procedures, or other reportable events requiring disclosure pursuant to Item 304(b) of Regulation S-K.

ITEM 9A. Controls and Procedures

Evaluation of Disclosure Controls and Procedures

As of the end of the period covered by this report, which we refer to as the evaluation date, we carried out an evaluation under the supervision and with the participation of management, including our principle executive officer and principle financial officer, of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act).

The purpose of this evaluation was to determine whether as of the evaluation date our disclosure controls and procedures were effective to provide reasonable assurance that the information we are required to disclose in our filings with the SEC, (i) is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms and (ii) accumulated and communicated to our management, including our principal executive officer and our principal financial officer, as appropriate to allow timely decisions regarding required disclosure. Based upon this evaluation, our principal executive officer and our principal financial officer concluded that our disclosure controls and procedures were effective as of the end of the period covered by this report.

Management's Report on Internal Control Over Financial Reporting

Management is responsible for establishing and maintaining adequate internal control over financial reporting. Our internal control over financial reporting is designed 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. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, 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. Management has evaluated the effectiveness of our internal control over financial reporting as of December 31, 2018 using the criteria set forth in the Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission, or COSO, (2013 framework). Based on our evaluation, management has concluded that we maintained effective control over financial reporting as of December 31, 2018 based on the COSO criteria. The effectiveness of our internal control over financial reporting as of December 31, 2018 has been audited by KPMG LLP, an independent registered public accounting firm, as stated in their report included in this Annual Report on Form 10-K.

Limitations on the Effectiveness of Controls

Our disclosure controls and procedures provide our principal executive officer and our principal financial officer reasonable assurances that our disclosure controls and procedures will achieve their objectives. However, our management, including our principal executive officer and our principal financial officer, does not expect that our disclosure controls and procedures or our internal control over financial reporting can or will prevent all human error. A control system, no matter how well designed and implemented, can provide only reasonable, not absolute, assurance that the objectives of the control system are met. Furthermore, the design of a control system must reflect the fact that there are internal resource constraints, and the benefit of controls must be weighed relative to their corresponding costs. Because of the limitations in all control systems, no evaluation of controls can provide complete assurance that all control issues and instances of error, if any, within our company are detected. These inherent limitations include the realities that judgments in decision-making can be faulty, and that breakdowns can occur due to human error or mistake. Additionally, controls, no matter how well designed, could be circumvented by the individual acts of specific persons within the organization. The design of any system of controls is also based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated objectives under all potential future conditions.

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the period covered by this report that has materially affected, or is 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

Information required by this Item 10 relating to our directors is incorporated by reference to the information set forth under the captions “Proposal No. 1—Election of Directors” and “Director Compensation” and in other applicable sections of the Proxy Statement for the 2019 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission pursuant to Regulation 14A of the Exchange Act, or the Proxy Statement, to be filed within 120 days of the end of the fiscal year covered by this Report. Information required by this Item 10 relating to our officers is incorporated by reference to the information set forth under the captions “Executive Officers” and “Executive Compensation” and in other applicable sections of the Proxy Statement. Information regarding our Section 16 reporting compliance is incorporated by reference to the information set forth under the captions “Security Ownership of Certain Beneficial Owners and Management” and “Section 16(a) Beneficial Ownership Reporting Compliance” of the Proxy Statement.

We have adopted a code of ethics, which applies to all employees, officers and directors of Calix. The Code of Business Conduct and Ethics meets the requirements of a “code of ethics” as defined by Item 406 of Regulation S-K, and applies to our Chief Executive Officer, Chief Financial Officer and all other employees, as indicated above. The Code of Business Conduct and Ethics also meets the requirements of a code of conduct under NYSE listing standards. The Code of Business Conduct and Ethics is posted on our website at www.calix.com under the links “About - Investor Relations - Governance - Code of Conduct.” We intend to disclose any amendments to the Code of Business Conduct and Ethics, as well as any waivers for executive officers or directors, on our website at www.calix.com.

ITEM 11. Executive Compensation

Information required by this Item 11 relating to executive compensation and other matters is incorporated by reference to the information set forth under the caption “Compensation Discussion and Analysis” and in other applicable sections of the Proxy Statement.

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

Information required by this Item 12 relating to security ownership of certain beneficial owners and management and related stockholder matters is incorporated by reference to the information set forth under the caption “Security Ownership of Certain Beneficial Owners and Management” and in other applicable sections of the Proxy Statement. Information regarding securities authorized for issuance under our equity compensation plans is incorporated by reference to the information set forth under the caption “Equity Compensation Plan Information” of the Proxy Statement.

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

Information required by this Item 13 relating to certain relationships and related transactions and director independence is incorporated by reference to the information set forth under the caption “Certain Relationships and Related Transactions” and in other applicable sections of the Proxy Statement.

ITEM 14. Principal Accountant Fees and Services

Information required by this Item 14 relating to principal account fees and services is incorporated by reference to the information set forth under the caption “Principal Accountant Fees and Services” of the Proxy Statement.

PART IV**ITEM 15. Exhibits, Financial Statement Schedules**

(a) The following documents are filed as part of this Report:

1. Consolidated Financial Statements

The consolidated financial statements of Calix and the report of independent registered public accounting firm thereon are set forth under Part II, Item 8 of this report.

Report of Independent Registered Public Accounting Firm	54
Consolidated Balance Sheets, As of December 31, 2018 and 2017	55
Consolidated Statements of Comprehensive Loss, Years Ended December 31, 2018, 2017 and 2016	56
Consolidated Statements of Stockholders' Equity, Years Ended December 31, 2018, 2017 and 2016	57
Consolidated Statements of Cash Flows, Years Ended December 31, 2018, 2017 and 2016	58
Notes to Consolidated Financial Statements	59

2. Consolidated Financial Statement Schedules

All schedules have been omitted because they are not applicable, not required, not presently in amounts sufficient to require submission of the schedule, or the information required to be set forth therein is included in the consolidated financial statements or notes thereto.

3. Exhibits

The following exhibits are filed with or incorporated by reference in this report. Where such filing is made by incorporation by reference to a previously filed registration statement or report, such registration statement or report is identified in parentheses. We will furnish any exhibit upon request to: Calix Investor Relations, Thomas J. Dinges at Tom.Dinges@calix.com.

Exhibit Number	Description
2.1	Agreement and Plan of Merger and Reorganization, dated as of September 16, 2010, by and among Calix, Inc., Ocean Sub I, Inc., Ocean Sub II, LLC, Occam Networks, Inc. (filed as Exhibit 2.1 to Calix's Registration Statement on Form S-4 originally filed with the Securities and Exchange Commission on November 2, 2010 (File No. 333-170282), as amended by Amendment No. 1 filed December 14, 2010, as amended by Post-Effective Amendment No. 1, filed December 14, 2010 and as amended by Post-Effective Amendment No. 2, filed February 7, 2011 and incorporated by reference).
3.1	Amended and Restated Certificate of Incorporation of Calix, Inc. (filed as Exhibit 3.3 to Amendment No. 7 to Calix's Registration Statement on Form S-1 filed with the Securities and Exchange Commission on March 23, 2010 (File No. 333-163252) and incorporated by reference).
3.2	Amended and Restated Bylaws of Calix, Inc. (filed as Exhibit 3.5 to Amendment No. 7 to Calix's Registration Statement on Form S-1 filed with the Securities and Exchange Commission on March 23, 2010 (File No. 333-163252) and incorporated by reference).
4.1	Form of Calix, Inc.'s Common Stock Certificate (filed as Exhibit 4.1 to Amendment No. 7 to Calix's Registration Statement on Form S-1 filed with the Securities and Exchange Commission on March 23, 2010 (File No. 333-163252) and incorporated by reference).
10.1*	Calix Networks, Inc. Amended and Restated 2002 Stock Plan and related documents (filed as Exhibit 10.2 to Amendment No. 6 to Calix's Registration Statement on Form S-1 filed with the SEC on March 8, 2010 (File No. 333-163252) and incorporated by reference).
10.2*	Calix, Inc. 2010 Equity Incentive Award Plan and related documents (filed as Exhibit 10.4 to Amendment No. 6 to Calix's Registration Statement on Form S-1 filed with the SEC on March 8, 2010 (File No. 333-163252) and incorporated by reference).
10.3	Form of Indemnification Agreement made by and between Calix, Inc. and each of its directors, executive officers and some employees (filed as Exhibit 10.5 to Amendment No. 6 to Calix's Registration Statement on Form S-1 filed with the SEC on March 8, 2010 (File No. 333-163252) and incorporated by reference).
10.4	Lease between RNM Lakeville, LLC and Calix, Inc. dated February 13, 2009 (filed as Exhibit 10.6 to Calix's Registration Statement on Form S-1 filed with the SEC on November 20, 2009 (File No. 333-163252) and incorporated by reference).

Exhibit Number	Description
10.5	First Amendment to Lease by and between 1031, 1035, 1039 North McDowell, LLC and Calix, Inc. effective January 28, 2013 (filed as Exhibit 10.25 to Calix's Form 10-K filed with the SEC on February 22, 2013 (File No. 001-34674) and incorporated by reference).
10.6	Lease Termination Agreement between SSCOP DE LLC and Calix, Inc. dated November 21, 2018.
10.7*	Offer Letter between Calix, Inc. and Carl Russo dated November 1, 2006 (filed as Exhibit 10.8 to Amendment No. 1 to Calix's Registration Statement on Form S-1 filed with the SEC on December 31, 2009 (File No. 333-163252) and incorporated by reference).
10.8†	Asset Purchase Agreement between Ericsson Inc. and Calix, Inc. dated August 20, 2012 (filed as Exhibit 10.1 to Calix's Form 10-Q/A filed with the SEC on December 18, 2012 (File No. 001-34674) and incorporated by reference).
10.9*	Calix, Inc. Non-Employee Director Restricted Stock Unit Deferred Compensation Plan, effective January 1, 2013 (filed as Exhibit 10.22 to Calix's Form 10-K filed with the SEC on February 22, 2013 (File No. 001-34674) and incorporated by reference).
10.10*	Calix, Inc. Management Bonus Program Under the 2010 Equity Incentive Award Plan (filed as Exhibit 10.1 to Calix's Form 8-K filed with the SEC on February 28, 2012 (File No. 001-34674) and incorporated by reference).
10.11*	Calix, Inc. Long Term Incentive Program Under the 2010 Equity Incentive Award Plan (filed as Exhibit 10.2 to Calix's Form 8-K filed with the SEC on February 28, 2012 (File No. 001-34674) and incorporated by reference).
10.12*	Calix, Inc. Non-Employee Director Equity Compensation Policy, as amended October 18, 2011, July 25, 2012, April 22, 2014 and April 26, 2016 (filed as Exhibit 10.18 to Calix's Form 10-K filed with the SEC on February 28, 2017 (File No. 001-34674) and incorporated by reference).
10.13*	Offer Letter by and between Calix, Inc. and Michael Weening dated May 20, 2016 (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on August 3, 2016 (File No. 001-34674) and incorporated by reference).
10.14*	Offer Letter by and between Calix, Inc. and Greg Billings dated December 8, 2016 (filed as Exhibit 10.24 to Calix's Form 10-K filed with the SEC on February 28, 2016 (File No. 001-34674) and incorporated by reference).
10.15*	Amendment to Offer Letter by and between Calix, Inc. and Greg Billings dated August 1, 2017 (filed as Exhibit 10.17 to Calix's Form 10-K filed with the SEC on March 14, 2018 (File No. 001-34674) and incorporated by reference).
10.16*	Consulting Agreement by and between Calix, Inc. and Cory Sindelar dated May 31, 2017 (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on August 10, 2017 (File No. 001-34674) and incorporated by reference).
10.17*	Calix, Inc. Non-Employee Director Cash Compensation Policy, as amended June 7, 2018.
10.18*	Calix, Inc. Amended and Restated Employee Stock Purchase Plan (incorporated by reference to Appendix A to the Registrant's definitive proxy statement on Schedule 14A, filed with the SEC on April 4, 2017 (File No. 001-34674)).
10.19*	Calix, Inc. Amended and Restated 2017 Nonqualified Employee Stock Purchase Plan (incorporated by reference to Appendix A to the Registrant's definitive proxy statement on Schedule 14A, filed with the SEC on April 3, 2018 (File No. 001-34674)).
10.20*	Amendment to Calix, Inc. Amended and Restated 2017 Nonqualified Employee Stock Purchase Plan dated June 24, 2018 (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on August 8, 2018 (File No. 001-34674) and incorporated by reference).
10.21†	Loan and Security Agreement dated August 7, 2017 between Silicon Valley Bank and Calix, Inc. (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on August 11, 2017 (File No. 001-34674) and incorporated by reference).
10.22	First Amendment to Loan and Security Agreement dated February 13, 2018 between Silicon Valley Bank and Calix, Inc. (filed as Exhibit 10.24 to Calix's Annual Report on Form 10-K/A filed with the SEC on May 10, 2018 (File No. 001-34674) and incorporated by reference).
10.23†	Second Amendment to Loan and Security Agreement dated August 24, 2018 by and between Silicon Valley Bank and Calix, Inc. (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on November 5, 2018 (File No. 001-34674) and incorporated by reference).
10.24*	Offer Letter between Calix, Inc. and Cory Sindelar dated September 28, 2017 (filed as Exhibit 10.2 to Calix's Form 10-Q filed with the SEC on August 11, 2017 (File No. 001-34674) and incorporated by reference).
10.25*	Nonstatutory Inducement Stock Option Grant Notice between Calix, Inc. and Cory Sindelar dated October 1, 2017 (filed as Exhibit 10.3 to Calix's Form 10-Q filed with the SEC on August 11, 2017 (File No. 001-34674) and incorporated by reference).
10.26*	Amended and Restated Executive Change in Control and Severance Plan effective September 6, 2017 (filed as Exhibit 10.1 to Calix's Form 8-K filed with the SEC on September 11, 2017 (File No. 001-34674) and incorporated by reference).
10.27*	Amendment to Amended and Restated Executive Change in Control and Severance Plan effective October 1, 2017 (filed as Exhibit 10.5 to Calix's Form 10-Q filed with the SEC on November 8, 2017 (File No. 001-34674) and incorporated by reference).
10.28*	Second Amendment to Amended and Restated Executive Change in Control and Severance Plan effective August 1, 2018 (filed as Exhibit 10.2 to Calix's Form 10-Q filed with the SEC on August 8, 2018 (File No. 001-34674) and incorporated by reference).

Exhibit Number	Description
10.29	Net Lease Agreement by and between Calix, Inc. and Orchard Parkway San Jose, LLC dated March 9, 2018 (filed as Exhibit 10.1 to Calix's Form 10-Q filed with the SEC on May 5, 2018 (File No. 001-34674) and incorporated by reference).
10.30	First Amendment to Net Lease Agreement by and between Calix, Inc. and Orchard Parkway San Jose, LLC dated November 14, 2018.
21.1	Subsidiaries of the Registrant.
23.1	Consent of KPMG LLP, independent registered public accounting firm.
24.1	Power of Attorney (included on signature page to this Annual Report on Form 10-K).
31.1	Certification of Principal Executive Officer of Calix, Inc. Pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934.
31.2	Certification of Principal Financial Officer of Calix, Inc. Pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934.
32.1	Certification of Principal Executive Officer and Principle Financial Officer of Calix, Inc. 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.
*	Indicates management contract or compensatory plan or arrangement.
†	Confidential treatment has been granted as to certain portions of this agreement.
††	Confidential treatment has been requested as to certain portions of this agreement.

ITEM 16. Form 10-K Summary

None.

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Dated: March 1, 2019

CALIX, INC.
(Registrant)

By: /s/ Carl Russo
Carl Russo
Chief Executive Officer
(Principal Executive Officer)

Dated: March 1, 2019

By: /s/ Cory Sindelar
Cory Sindelar
Chief Financial Officer
(Principal Financial Officer)

POWER OF ATTORNEY

Each person whose individual signature appears below hereby authorizes and appoints Carl Russo and Cory Sindelar, and each of them, with full power of substitution and re-substitution and full power to act without the other, as his true and lawful attorney-in-fact and agent to act in his name, place and stead and to execute in the name and on behalf of each person, individually and in each capacity stated below, and to file any and all amendments to this Annual Report on Form 10-K, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing, ratifying and confirming all that said attorneys-in-fact and agents or any of them or their or his substitute or substitutes may lawfully do or cause to be done by virtue thereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated on March 1, 2019.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<hr/> <i>/s/ Carl Russo</i> Carl Russo	Chief Executive Officer and Director (Principal Executive Officer)	March 1, 2019
<hr/> <i>/s/ Cory Sindelar</i> Cory Sindelar	Chief Financial Officer (Principal Financial Officer)	March 1, 2019
<hr/> <i>/s/ Don Listwin</i> Don Listwin	Chairman of the Board of Directors	March 1, 2019
<hr/> <i>/s/ Christopher Bowick</i> Christopher Bowick	Director	March 1, 2019
<hr/> <i>/s/ Kathy Crusco</i> Kathy Crusco	Director	March 1, 2019
<hr/> <i>/s/ Kevin DeNuccio</i> Kevin DeNuccio	Director	March 1, 2019
<hr/> <i>/s/ Michael Everett</i> Michael Everett	Director	March 1, 2019
<hr/> <i>/s/ Kira Makagon</i> Kira Makagon	Director	March 1, 2019
<hr/> <i>/s/ Michael Matthews</i> Michael Matthews	Director	March 1, 2019
<hr/> <i>/s/ Kevin Peters</i> Kevin Peters	Director	March 1, 2019
<hr/> <i>/s/ J. Daniel Plants</i> J. Daniel Plants	Director	March 1, 2019

LEASE TERMINATION AGREEMENT

THIS LEASE TERMINATION AGREEMENT (this "Agreement") is entered into as of November 21, 2018, by and between SSCOP DE LLC, a Delaware limited liability company ("Landlord"), and Calix, Inc., a Delaware corporation, (formerly Calix Networks, Inc.) ("Tenant"), on the basis of the following facts, intentions and understandings:

A. Landlord (as successor in interest to 1031, 1035, 1039 North McDowell, LLC, a Delaware corporation, as successor in interest to RNM Lakeville, LLC, a Delaware limited liability company) and Tenant previously entered into that certain lease (the "Original Lease") dated February 13, 2009, as amended by that certain first amendment (the "First Amendment") dated January 28, 2013 (collectively, the "Lease"), pursuant to which Landlord leases to Tenant approximately 82,082 rentable square feet of space (the "Premises") in the building located at 1035 N. McDowell Blvd., Petaluma, California (the "Building"). Capitalized terms used herein and not defined herein shall have the same meanings as set forth in the Lease.

B. Tenant acknowledges that Landlord is requesting for the early termination of the Lease with respect to the Return Space (defined in Section 1 below) to facilitate Landlord entering into a written lease with a third party (the "Third Party Lease") that will require Landlord to deliver the Return Space to such third party on December 10, 2018, and to deliver the balance of the Premises to such third party on March 1, 2019.

C. Landlord and Tenant now desire to terminate the Lease with respect to the Return Space only, on the terms and conditions set forth below. Landlord and Tenant acknowledge that the Lease expiration date of February 28, 2019 shall be extended by up to 31 days at the Base Rent applicable to February, 2019, applied at a daily rate, and, in all other respects, remain in effect with respect to the balance of the Premises.

NOW, THEREFORE, IN CONSIDERATION of the mutual covenants and promises of the parties, the parties hereto agree as follows:

1. Partial Termination. Effective 11:59 p.m. December 9, 2018 (the "Partial Termination Date"), the Lease shall terminate solely with respect to the portion of the Premises containing approximately 23,650 rentable square feet of space shown without cross-hatching on Exhibit A-1 (the "Return Space"), and Tenant shall vacate and surrender the Return Space to Landlord on the Partial Termination Date in accordance with Section 23 of the Lease. If Tenant fails to timely vacate and surrender possession of the Return Space by the Partial Termination Date, then notwithstanding any contrary provision of the Lease, Tenant shall be deemed to be holding over in the Return Space, and if Landlord is unable to deliver possession of the Return Space to a new tenant or to perform improvements for a new tenant as a result of Tenant's holdover, then Tenant shall indemnify, defend and hold Landlord harmless from all claims, liabilities and damages that Landlord suffers from Tenant's holdover. With respect to Tenant's obligation to surrender and vacate the balance of the Premises on February 28, 2019, Tenant shall be entitled to a grace period up to 31 days during which the increased rent and indemnity obligations set forth in Section 23.2 of the Original Lease shall not apply. Instead, Tenant shall pay the Base Rent applicable to February, 2019, which shall accrue at the pro-rata daily rate.

2. **Demising Wall**. Tenant acknowledges that Landlord or a new tenant may construct a secure demising wall separating the Return Space from the remainder of the Premises immediately following the Partial Termination Date. So as to provide minimal disruption to Tenant's right of quiet enjoyment of the Premises, Construction of the Demising Wall shall commence no earlier than 5:30 p.m. and end no later than 8:00 a.m. Monday through Friday, and without restriction on Saturdays and Sundays until complete.

3. **Rent/Tenant's Share**. Tenant shall continue to pay Rent for the Return Space through and including the Partial Termination Date. Thereafter, (a) the Base Rent due under the Lease shall be reduced for each period set forth in Section 2 of the First Amendment to reflect the removal of the Return Space from the Premises (i.e., the Base Rent shall be equal to $58,432/82,082$ r.s.f. X the Base Rent amount set forth in Section 2 of the First Amendment for the applicable period), and (b) Tenant's Share (as defined in Section 1.4 of the Original Lease) shall be 77.18% of the Building and 37.79% of the Project.

4. **Condition Precedent**. It is a condition precedent to the effectiveness of this Agreement that Landlord enter into the Third Party Lease within five (5) business days following the mutual execution and delivery of this Agreement. Landlord shall inform Tenant within 24 hours of the condition set forth in this Section 4 has been satisfied.

5. **Other Pertinent Provisions**. Landlord and Tenant agree that, effective as of the date of this Amendment, address of the Tenant for purposes of giving Notice, as required by Section 25.9 of the Lease shall be as follows:

Calix, Inc.
Attn: General Counsel
2777 Orchard Parkway
San Jose, California 95134

With Copies to Chief Financial Officer and Senior Director, Facilities.

All other provisions of the Lease, as Amended, remain in full force and effect.

6. **Successors and Assigns**. The terms, covenants and conditions contained in this Agreement shall be binding upon and inure to the benefit of the successors and assigns of the parties hereto.

7. **Entire Agreement**. This Agreement contains all of the covenants, conditions and agreements between the parties and shall supersede all prior correspondence, agreements and understandings, both oral and written, with respect to the termination of the Lease.

[SIGNATURES ON FOLLOWING PAGE]

IN WITNESS WHEREOF, the parties hereto have executed one or more copies of this Agreement as of the day and year first above written.

“LANDLORD”

SSCOP DE LLC,
a Delaware limited liability company

By: G&W Ventures, LLC,
A California limited liability company
Its Manager

By: /s/ Matthew T. White
Matthew T. White
Manager

“TENANT”

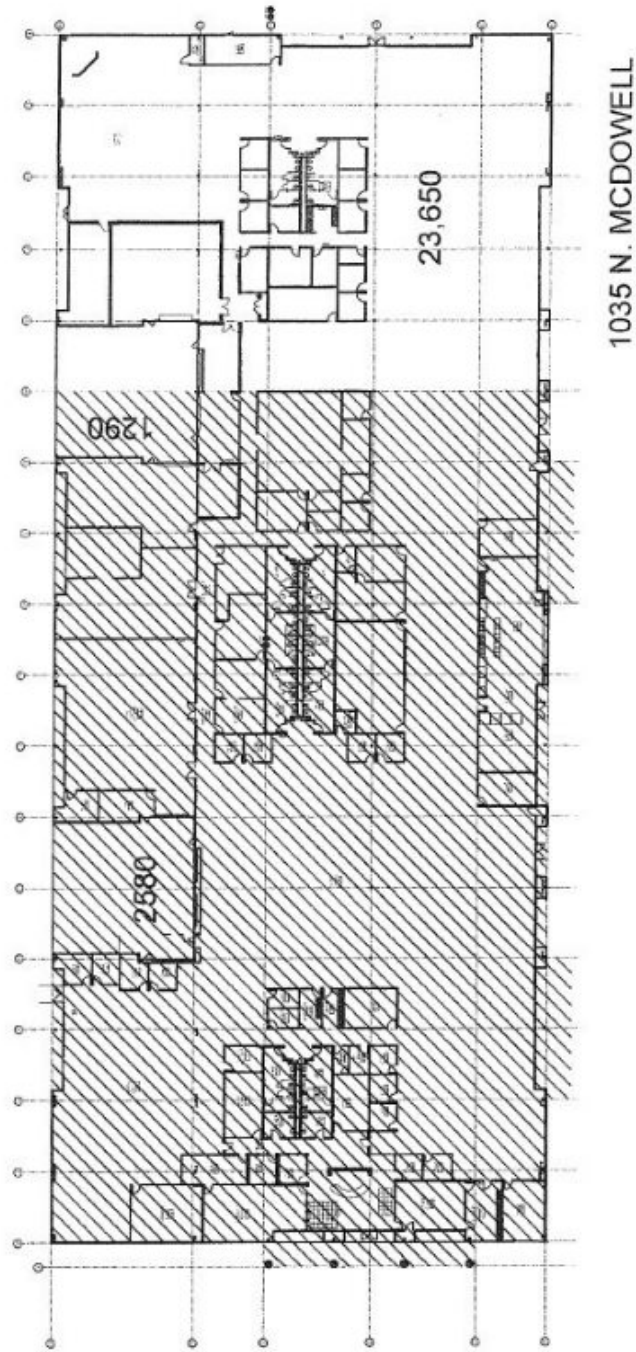
CALIX, INC.,
a Delaware corporation

By: /s/ Diane Prins Sheldahl

Name: Diane Prins Sheldahl

Its: SVP, Talent and Culture

Exhibit A-1



CALIX, INC.

Non-Employee Director Cash Compensation Policy, as amended June 7, 2018

1. General. This Non-Employee Director Cash Compensation Policy (“Policy”) was adopted by the Board of Directors (“Board”) of Calix, Inc. (“Company”) on and is effective as of June 7, 2018.
2. Annual Cash Compensation. Each member of the board who is not employed by the Company or one of its affiliates shall be entitled to an annual retainer with the amount determined as follows (the net sum for each director, his or her “Annual Retainer”):

	Chair	Members
Board of Directors Retainer	\$40,000	\$40,000
Committee Retainers		
Audit Committee	\$35,000	\$10,000
Compensation Committee	\$20,000	\$7,500
Nominating & Corporate Governance Committee	\$10,000	\$5,000
Cybersecurity Committee	\$10,000	\$5,000
Strategic Committee	\$10,000	\$5,000

3. Timing of Payment. Annual Retainers shall be paid in quarterly installments in arrears on the date of each regularly scheduled quarterly board meeting. Installments will be pro-rated for any partial period of service.
4. Policy Subject to Amendment, Modification and Termination. This Policy may be amended, modified or terminated by the Board at any time in the future at its sole discretion.

FIRST AMENDMENT TO LEASE

This First Amendment to Lease (“ **First Amendment** ”) is entered into as of November 14, 2018 (“ **Effective Date** ”), by and between **Orchard Parkway San Jose, LLC** , a California limited liability company (“ **Landlord** ”), and **Calix, Inc.** , a Delaware corporation (“ **Tenant** ”).

RECITALS

A. Landlord and Tenant executed that certain Net Lease Agreement dated March 9, 2018 (the “ **Original Lease** ”) for the premises commonly known as 2777 Orchard Parkway, San Jose, California (“ **Building** ”), consisting of approximately 64,991 rentable square feet of space (“ **Premises** ”) and more particularly described on Exhibit A attached to the Original Lease;

B. Landlord and Tenant desire to memorialize their understanding regarding the Commencement Date of the Original Lease, the application of the One-for-One Rent Credit due Tenant, the application of the Converted Amount for Change Orders (as defined in Section 2(c) below), the applicable commencement dates for monthly Rent and Operating Expenses and the substantial completion of the Tenant Improvement Work (subject to the performance of the Outstanding Tenant Improvement Work Items described in Section 7(b) below); and

C. Landlord and Tenant also desire to provide a limited waiver of claims and mutual release related to their settlement of issues concerning the delivery date and acceptance of the Premises.

AGREEMENT

NOW, THEREFORE, in consideration of the mutual promises, covenants and conditions contained in this First Amendment, the receipt and sufficiency of which is acknowledged by the parties, the Landlord and Tenant agree as follows:

1. **Capitalized Terms** . All capitalized terms when used herein shall have the same meanings given such terms in the Original Lease unless expressly superseded by the terms of this First Amendment. The term “ **Lease** ” where used in the Original Lease and this First Amendment shall refer to the Original Lease as revised, amended and modified by this First Amendment.

2. **Summary of Lease Provisions** .

(a) **Commencement Date** . The following words in Paragraph 1.6 of the Original Lease “August 1, 2018, subject to the provisions of Paragraph 3 below. (Paragraph 3)” shall be deleted in their entirety and the following words “September 17, 2018” shall be substituted in their place.

(b) **Ending Date** . The following words in Paragraph 1.7 of the Original Lease “The last day of the eighty-seventh (87th) full calendar month following the Commencement Date, unless sooner terminated pursuant to the terms of this Lease. (Paragraph 3)” shall be deleted in their entirety and the following words “December 31, 2025, unless sooner terminated pursuant to the terms of this Lease” shall be substituted in their place.

(c) **Converted Amount**. In accordance with the terms of Paragraph 1.8 of the Original Lease, Tenant delivered a Conversion Notice dated August 2, 2018 to Landlord. Tenant elects and Landlord agrees to convert the Amount of One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70) to be the Converted Amount. Landlord and Tenant acknowledge and agree that (a) the Change Order Request Log attached hereto as **Exhibit A** shows any and all change orders (hereafter “**Change Orders**”), and any and all Extra Work (as defined in Exhibit C to the Original Lease), relating to the Tenant Improvement Work and (b) Landlord shall defray the Change Order Costs (as defined in Exhibit C to the Original Lease) relating to such Change Orders, and any costs associated with any such Extra Work, with the Converted Amount. Since such Converted Amount is equal to one installment of base Rent, as a result of such conversion, the last occurring installment of the abated base Rent described in Paragraph 1.8 of the Original Lease shall be reduced (in its entirety) by such Converted Amount. Landlord and Tenant acknowledge and agree that Tenant is liable to pay the Landlord for all Change Order Costs relating to such Change Orders, and the cost of performing any such Extra Work, in the total amount of One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70). Landlord and Tenant further acknowledge and agree that (i) Landlord has no other claims against Tenant for any other Change Order Costs relating to such Change Orders, and/or the cost of performing any such Extra Work, and waives any right to any future claim for any other Change Order Costs relating to such Change Orders and/or the cost of performing any Extra Work described on **Exhibit A**, in accordance with Paragraph 8 below and (ii) Tenant will not request any further change orders and/or any further Extra Work.

3. **Confirmation of Lease Terms** . Contemporaneously with signature and delivery of this First Amendment, Landlord and Tenant will execute a factually-correct Commencement Date Letter in the form attached to this First Amendment as **Exhibit B** confirming the Lease Term and the other information pertaining to the terms contained herein.

4. **Monthly Rent** . Beginning on the Commencement Date, the monthly Rent for the Premises shall be payable by Tenant in accordance with the terms of Paragraph 1.8 of the Original Lease as amended by this First Amendment. The Converted Amount (as that term is defined in Paragraph 1.8 of the Original lease) is agreed to be in the amount of One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70). The Converted Amount shall be applied by Landlord in order to defray the cost of the Change Orders, and the costs associated with any Extra Work, shown on **Exhibit A**, in accordance with Section 2(c) above, with the result that Tenant’s right to abatement of monthly base Rent during the first three (3) full months of the Lease Term (not including any partial month) shall be reduced to encompass only the first two (2) full months.

5. One-for-One Rent Credit . In accordance with Paragraph 3.2 of the Original Lease, the "One-for-One Rent Credit Trigger Date" is August 17, 2018. There are no Tenant Delay days or Force Majeure Delay days that extend the One-For-One Rent Credit Trigger Date. Landlord and Tenant acknowledge and agree that (i) a total of thirty-one (31) days elapsed between the One-For-One Rent Credit Trigger Date (i.e., August 17, 2018) and the Commencement Date (i.e., September 17, 2018) and (ii) as a result thereof, the One-for-One Rent Credit amount is deemed to be One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70). Landlord shall apply the One-for-One Rent Credit amount towards the installment of monthly Rent due with respect to the Premises in the form of a one-month extension of the conditional abatement of monthly base Rent referred to in Paragraph 1.8 of the Original Lease, with the result that the conditional abatement of monthly base Rent shall again encompass the first three (3) full months of the Lease Term.

6. Operating Expenses . Landlord acknowledges and agrees that Tenant's obligation to pay Tenant's percentage share of Operating Expenses (as that term is defined in Paragraph 12 of the Original Lease) for the Premises shall commence on October 1, 2018. With respect to any such Operating Expenses allocable to any period prior to October 1, 2018, Landlord acknowledges and agrees that Landlord shall be solely responsible for all such Operating Expenses for the Building, at Landlord's sole cost and expense, and Tenant shall not be charged any such Operating Expenses relating to such period.

7. Condition of Premises .

(a) **Acceptance** . Tenant has inspected the Premises, has been in occupancy and possession of the same since the Commencement Date (i.e., September 17, 2018), and, except as expressly stated in this First Amendment and subject to the Landlord's express obligations herein, agrees that Landlord has delivered (and Tenant has accepted) the same in accordance with the terms and conditions of the Lease.

(b) **Tenant Improvement Work** . The parties hereby acknowledge and agree that, other than the Outstanding Tenant Improvement Work Items described in the following sentence, as of the Effective Date, Landlord has completed the Tenant Improvement Work (as that term is defined in the Improvement Agreement dated March 9, 2018 attached as Exhibit C to the Original Lease) as required by the Original Lease. In connection with this First Amendment, Landlord or Landlord's contractor shall perform the outstanding balance of the Tenant Improvement Work as soon as reasonably practicable after the Effective Date of this First Amendment, which outstanding balance solely consists of the following two items (collectively, the "**Outstanding Tenant Improvement Work Items**"): (i) the installation of the movable wall between Rooms 154 and 158; and (ii) the renewal of the elevator permit applicable to the Premises (which permit expired on October 5, 2018). Landlord and Tenant hereby agree and acknowledge the following with respect to the movable wall described in the immediately-preceding sentence: (x) the manufacture of such wall is scheduled to commence on November 30, 2018; (y) the installation of such wall is scheduled to occur on December 10, 2018; and (z) Landlord shall use good-faith efforts to monitor (and keep Tenant apprised of) the progress of both the manufacturer, Hufcor, and the installer, B.T. Mancini, in a good-faith effort to meet the scheduled production date, and the scheduled installation date, set forth in this sentence above.

8. Landlord Release. Except for the obligations and rights created under this First Amendment, Landlord hereby waives, releases, acquits, and forever discharges Tenant, and Tenant's respective agents, directors, officers, employees, shareholders, partners and members to the maximum extent permitted by law, of and from any and all claims, actions, causes of action, demands, rights, liabilities, damages, losses, costs, expenses, or compensation whatsoever, direct or indirect, known or unknown, foreseen or unforeseen, that Landlord now has or which may arise in the future on account of or in any way growing out of or connected with: (i) the Change Order Costs relating to the Change Orders, and/or the cost of performing any Extra Work, shown on **Exhibit A** attached hereto, including those provisions of the Lease which specifically pertain thereto, that Tenant may otherwise be liable to compensate, reimburse or pay for; and (ii) any claim or demand for damages or remedies due to any Default by Tenant (as defined in the Original Lease) that Landlord may claim or bring against Tenant for any failure on the part of Tenant to accept the Premises delivery condition (or failure to accept delivery of the Premises) prior to the Commencement Date (i.e., September 17, 2018). The foregoing waiver, limited release, acquittal and discharge by the Landlord shall also run to the benefit of the successors and assigns of Tenant and to their agents, directors, officers, employees, and Landlord's waiver, limited release, acquittal and discharge above shall extend to and bind all of Landlord's respective agents, directors, officers, employees, shareholders, partners and members, and its successors and assigns. Furthermore, Landlord has consulted with legal counsel of its choice as to the meaning and consequences of waiving the benefits conferred by California Civil Code Section 1542, which states that:

"A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which if known by him must have materially affected his settlement with the debtor."

It is understood by Landlord that if the facts or law with respect to which the foregoing limited release and waiver is given hereafter turn out to be other than the facts or law in that connection now known to be (or believed by Landlord to be) true, then Landlord expressly assumes the risk of the facts and law turning out to be so different, and agrees that the foregoing limited release shall be in all respects effective and not subject to termination or rescission based upon such differences in facts or law.

Landlord hereby waives all rights under California Civil Code Section 1542 and agrees that its waiver, limited release, acquittal and discharge above extends to claims Landlord did not know or expect to exist in its favor at the time of executing this First Amendment.

Landlord Initials: _____

9. Tenant Release. Except for the obligations and rights created under this First Amendment, Tenant hereby waives, releases, acquits, and forever discharges Landlord, and Landlord's respective agents, directors, officers, employees, shareholders, partners and members to the maximum extent permitted by law, of and from any and all claims, actions,

causes of action, demands, rights, liabilities, damages, losses, costs, expenses, or compensation whatsoever, direct or indirect, known or unknown, foreseen or unforeseen, that Tenant now has or which may arise in the future on account of or in any way growing out of or connected with: (i) the substantial completion of the Tenant Improvement Work, including those provisions of the Lease which specifically pertain thereto (provided, however, that (a) Landlord shall in no event be released from its express repair, maintenance, replacement and/or restoration obligations under the Lease (including, without limitation, pursuant to Paragraphs 2.3 and 10.1 of the Original Lease) and (b) nothing set forth in this Section 9 shall be deemed to diminish or otherwise affect Tenant's rights pursuant to Paragraph 8 of Exhibit C (Work Letter) of the Original Lease); and (ii) the One-for-One Rent Credit rights provisions of the Lease, and any other provisions, which pertain to delayed delivery of the Premises. The foregoing waiver, limited release, acquittal and discharge by Tenant shall also run to the benefit of the successors and assigns of Landlord and to their agents, directors, officers, employees, and Tenant's waiver, limited release, acquittal and discharge above shall extend to and bind all of Tenant's respective agents, directors, officers, employees, shareholders, partners and members, and its successors and assigns. Furthermore, Tenant has consulted with legal counsel of its choice as to the meaning and consequences of waiving the benefits conferred by California Civil Code Section 1542, which states that:

"A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which if known by him must have materially affected his settlement with the debtor."

It is understood by Tenant that if the facts or law with respect to which the foregoing limited release and waiver is given hereafter turn out to be other than the facts or law in that connection now known to be (or believed by Tenant to be) true, then Tenant expressly assumes the risk of the facts and law turning out to be so different, and agrees that the foregoing limited release shall be in all respects effective and not subject to termination or rescission based upon such differences in facts or law.

Tenant hereby waives all rights under California Civil Code Section 1542 and agrees that its waiver, limited release, acquittal and discharge above extends to claims Tenant did not know or expect to exist in its favor at the time of executing this First Amendment.

Tenant's Initials: _____

10. General Provisions

(a) **Entire Agreement**. Any agreements, warranties and/or representations with respect to the subject matter of this First Amendment not expressly contained herein shall in no way bind either Landlord or Tenant, and Landlord and Tenant expressly waive all claims

for damages by reason of any such agreements, warranties and/or representations, if any, not contained in this First Amendment. This First Amendment supersedes and cancels any and all previous negotiations or arrangements, between the parties relating to the subject matter of this First Amendment. The Lease (i.e., the Original Lease and this First Amendment) constitutes the entire agreement between the parties hereto and no addition to, or modification of, any term or provision of the Lease shall be effective until and unless set forth in a written instrument signed by Landlord and Tenant.

(b) **Ratification of Original Lease**. Except as modified hereby, all other terms and conditions of the Original Lease remain unchanged and in full force and effect and are hereby ratified and confirmed by the parties hereto. In the event of any conflict between the terms and provisions of this First Amendment and those of the Original Lease, the terms and provisions of this First Amendment shall prevail.

(c) **Time of Essence**. Time is of the essence as to each and every provision in this First Amendment requiring performance within a specified time.

(d) **Brokers**. Tenant hereby represents to Landlord that Tenant has dealt with no broker in connection with this First Amendment. Tenant agrees to defend, indemnify and hold Landlord harmless from all claims of any brokers claiming to have represented Tenant in connection with this First Amendment. Landlord hereby represents to Tenant that Landlord has dealt with no broker in connection with this First Amendment. Landlord agrees to defend, indemnify and hold Tenant harmless from all claims of any brokers claiming to have represented Landlord in connection with this First Amendment.

(e) **Severability**. In case any one or more of the provisions contained herein shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this First Amendment, but this First Amendment shall be construed as if such invalid, illegal or unenforceable provision had not been contained herein.

(f) **Captions**. Captions and paragraph headings used in this First Amendment are for convenience of reference only. They shall not be construed to limit or extend the meaning of any part of this First Amendment, and shall not be deemed relevant in resolving any question of interpretation or construction of any paragraph of this First Amendment.

(g) **Exhibits**. All exhibits attached to this First Amendment shall be deemed to be incorporated herein by the individual reference to each such exhibit, and all such exhibits shall be deemed to be a part of this First Amendment as though set forth in full in the body of the First Amendment.

(h) **Authority**. Each party represents and warrants that each person executing this First Amendment on its behalf is duly authorized and empowered to execute it, and do so as the act of and on behalf of such party as indicated below.

(i) **Counterparts**. This First Amendment may be executed in multiple counterparts, each of which is to be deemed original for all purposes, but all of which together shall constitute one and the same instrument. Either party may deliver its signature to this First

Amendment by facsimile or electronic mail and any party that receives an executed signature page from another party by facsimile or electronic mail may rely upon said signature as if it was a signed original.

(j) **Attorneys' Fees** . In the event either party hereto shall bring any action or legal proceeding for damages for an alleged breach of any provision of this First Amendment, to recover Rentals, to enforce an indemnity, defense or hold harmless obligation, to terminate the tenancy of the Premises, or to enforce, protect, interpret, or establish any term, condition, or covenant of this First Amendment or right or remedy of either party, the prevailing party shall be entitled to recover, as a part of such action or proceeding, reasonable attorneys' fees and court costs, including reasonable attorneys' fees and court costs of appeal, as may be fixed by the court or jury. Notwithstanding anything to the contrary contained in this First Amendment, "prevailing party" as used in this paragraph shall include the party who dismisses an action for recovery hereunder in exchange for sums allegedly due, performance of covenants allegedly breached or considerations substantially equal to the relief sought in the action.

(k) **Successors** . The provisions of the Lease expressly apply to all successors, sublessees, assignees and transferees of either party hereto.

(l) **Governing Law** . This First Amendment shall be construed and enforced in accordance with the laws of the State of California.

(m) **Representations** . Each party represents and warrants to the other party that, to its actual knowledge as of the date hereof: (i) Landlord and Tenant are in full compliance with all terms, covenants and conditions of the Lease; (ii) there are no breaches or defaults under the Lease by either party; and (iii) such party knows of no events or circumstances which would constitute a default under the Lease.

[Remainder of Page Blank; Signatures on Next Page]

NOW THEREFORE, the parties hereto have executed this First Amendment as of the dates set forth by each party's signature.

LANDLORD:

Orchard Parkway San Jose, LLC,
a California limited liability company

By: /s/ Scott R. Trobbe
Name: Scott R. Trobbe
Title: Authorized Signatory
Date: Nov. 14, 2018

TENANT:

Calix, Inc.,
a Delaware corporation

By: /s/ Suzanne Tom
Name: Suzanne Tom
Title: VP, General Counsel
Date: 11/14/18

EXHIBIT A
CHANGE ORDER REQUEST LOG

*[*** Attach Here Mutually-Approved Change Order Request Log ***]*

EXHIBIT B

COMMENCEMENT DATE LETTER

Re: Net Lease Agreement, dated March 9, 2018 (“ **Original Lease** ”), between Orchard Parkway San Jose, LLC, a California limited liability company, as “ **Landlord** ”, and Calix, Inc., a Delaware corporation, as “ **Tenant** ”, as amended by that certain First Amendment to Lease dated November __, 2018 (“ **First Amendment** ”) between Landlord and Tenant (collectively with the Original Lease, the “ **Lease** ”), concerning that premises, consisting of approximately 64,991 rentable square feet, more or less, consisting of the entire rentable areas of the building having a street address of 2777 Orchard Parkway, San Jose, California (the “ **Premises** ”).

Ladies and Gentlemen:

In accordance with the subject Lease, we wish to advise and/or confirm as follows:

1. Landlord delivered possession of the Premises to Tenant on September 17, 2018 with all improvements and work, if any, completed in a good and workmanlike manner and otherwise in the condition required under the Lease and Tenant accepted possession of the Premises, subject to completion by Landlord of the Outstanding Tenant Improvement Work Items listed and described more fully in Section 7(b) of the First Amendment.
2. The Commencement Date of the Lease Term for the Premises is September 17, 2018 (the “ **Commencement Date** ”) and the initial Lease Term for the Premises expires on December 31, 2025 (the “ **Ending Date** ”), unless sooner terminated according to the terms of the Lease.
3. That in accordance with the Lease, monthly Rent shall commence to accrue on September 17, 2018 (except that monthly Rent shall be conditionally abated for the first three (3) full months of the Lease Term in accordance with (and subject to) the provisions of Paragraph 1.8 of the Original Lease), and Tenant’s obligation to pay Tenant’s share of Operating Expenses (as described below) shall commence to accrue on October 1, 2018. The Converted Amount (as set forth Paragraph 2(c) of the First Amendment) is the amount of One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70).
4. Tenant’s percentage share of Operating Expenses is one hundred percent (100%) as to the Building and sixty-four and eleven one hundredths percent (64.11%) as to the Project.

5. In accordance with the Lease, the Converted Amount shall be applied by Landlord against the abated installment of monthly Rent due for the last full month of the abatement of Rent, with the result that Tenant shall have two (2) full months of abatement of Rent (and not three (3) full months of abatement of Rent). Application of the Converted Amount (i) defrays the cost of the Change Orders, and the costs associated with any Extra Work, as described in Section 2(c) of the First Amendment, and (ii) reduces by one (1) full month the Tenant right to abated monthly Rent set forth in paragraph 3 above.
6. In accordance with the Lease the "One-for-One Rent Credit Trigger Date" is August 17, 2018. The One-for-One Rent Credit amount is One Hundred Seventy-five Thousand Four Hundred Seventy-five and 70/100ths Dollars (\$175,475.70) and shall be applied by Landlord as an extension to the conditionally abated monthly Rent. Application of the One-For-One Rent Credit amount off sets in part the application of the Converted Amount set forth in paragraph 5 above, with the result that Tenant shall again have three (3) full months of abatement of Rent.
7. Notwithstanding anything to the contrary contained in the Lease and/or this Commencement Date Letter, Tenant's first payment of monthly Rent is due December 16, 2018 in the amount of Ninety Thousand Five Hundred Sixty-eight and 10/100ths Dollars (\$90,568.10) for the balance of the calendar month of December 2018 (i.e. \$175,475.70/31 days x 16 days).
8. Authorized Signatories. Each party represents and warrants to the other that it is duly authorized to enter into this document and that the person signing on its behalf is duly authorized to sign on behalf of such party.

[Remainder of Page Intentionally Blank]

- EXHIBIT FORM. DO NOT SIGN -

LANDLORD:

ORCHARD PARKWAY SAN JOSE, LLC,
a California limited liability company

By: _____
Name: _____
Title: _____
Date: _____

ACCEPTED AND AGREED:

TENANT:

CALIX, INC.,
a Delaware corporation

By: _____
Name: _____
Title: _____
Date: _____

SUBSIDIARIES OF THE REGISTRANT

<u>Entity Name</u>	<u>Jurisdiction</u>
Calix Networks Canada, Inc.	Canada
Calix Network Technology Development (Nanjing) Co. Ltd.	China
Calix Networks UK, Ltd	England, UK
Calix Brasil Servicos Ltda	Brazil

Consent of Independent Registered Public Accounting Firm

The Board of Directors and Stockholders
Calix, Inc.:

We consent to the incorporation by reference in the registration statements (No. 333-223637, 333-218066, 333-216323, 333-209732, 333-202496, 333-194054, 333-185025, 333-172379, 333-166245) on Form S-8 of Calix, Inc. of our report dated March 1, 2019, with respect to the consolidated balance sheets of Calix, Inc. and subsidiaries as of December 31, 2018 and 2017, and the related consolidated statements of comprehensive loss, stockholders' equity, and cash flows for each of the years in three-year period ended December 31, 2018, and the related notes, and the effectiveness of internal control over financial reporting as of December 31, 2018, which report appears in the December 31, 2018 annual report on Form 10-K of Calix, Inc.

/s/ KPMG LLP

San Francisco, California
March 1, 2019

**CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER
PURSUANT TO SECTION 302 OF
THE SARBANES-OXLEY ACT OF 2002**

I, Carl Russo , certify that:

1. I have reviewed this annual report on Form 10-K of Calix, Inc. for the year ended December 31, 2018 ;
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 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;
5. The registrant's other certifying officer 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: March 1, 2019

/s/ Carl Russo

Carl Russo

Chief Executive Officer

(Principal Executive Officer)

**CERTIFICATION OF PRINCIPLE FINANCIAL OFFICER
PURSUANT TO SECTION 302 OF
THE SARBANES-OXLEY ACT OF 2002**

I, Cory Sindelar , certify that:

1. I have reviewed this annual report on Form 10-K of Calix, Inc. for the year ended December 31, 2018 ;
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 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;
5. The registrant's other certifying officer 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: March 1, 2019

/s/ Cory Sindelar

Cory Sindelar

Chief Financial Officer

(Principal Financial Officer)

**CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER AND PRINCIPAL FINANCIAL OFFICER
PURSUANT TO 18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

I, Carl Russo , certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that the Annual Report of Calix, Inc. (the "Company") on Form 10-K for the fiscal year ended December 31, 2018 fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 and that information contained in such Annual Report on Form 10-K fairly presents in all material respects the financial condition and results of operations of the Company.

Date: March 1, 2019

/s/ Carl Russo

Carl Russo
Chief Executive Officer
(Principal Executive Officer)

I, Cory Sindelar , certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that the Annual Report of Calix, Inc. (the "Company") on Form 10-K for the fiscal year ended December 31, 2018 fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 and that information contained in such Annual Report on Form 10-K fairly presents in all material respects the financial condition and results of operations of the Company.

Date: March 1, 2019

/s/ Cory Sindelar

Cory Sindelar
Chief Financial Officer
(Principal Financial Officer)

This certification accompanies the Form 10-K to which it relates, is not deemed filed with the Securities and Exchange Commission and is not to be incorporated by reference into any filing of Calix, Inc. under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended (whether made before or after the date of the Form 10-K), irrespective of any general incorporation language contained in such filing.