SD-WAN Growth Outlook

Breaking down the virtualized wide-area networking (WAN) market

Featuring: TELOIP™

Key Findings

- **Growth in SD-WAN technology tools and network-as-a-service (NaaS) revenues will exceed 30% annually for the next five years, accelerating to 75%-100% growth rates from 2017-2018.** Our data gathering from both SD-WAN software and services players and industry sources indicates that enterprise demand for cloud-based WAN services is accelerating.
- **Total SD-WAN tools and NaaS revenue will approach $1 billion by 2019 and will grow to $1.6 billion by 2021.**
- **At least four top SD-WAN NaaS and platform companies will approach or exceed $100 million in revenue in 2018.** Futuriom estimates that the leading players vying for top Tier-1 revenue production include Aryaka, Cisco/Viptela, Cradlepoint, Fat Pipe, and Silver Peak.
- **A huge shakeout in SD-WAN will happen in the 2017-2019 timeframe.** Of Tier-1 vendors, which we define as annual revenue of more than $30 million, we expect three or four to achieve leadership status.
- **At least two SD-WAN platform vendors will file for IPO in 2018.** Futuriom believes that Aryaka, Cradlepoint, and Fat Pipe Inc. are the leading venture-backed startups that are closest to filing for an IPO. These companies as well as others are also likely to be acquisition targets by either service providers or large networking equipment vendors.
- **Traditional service providers are being forced to launch SD-WAN solutions and are likely acquirers of SD-WAN technology.** Traditional global service providers such as AT&T, Deutsche Telekom, Telefonica, and Verizon are falling behind in SD-WAN to existing NaaS vendors, and they will be forced to accelerate their SD-WAN service deployment. This may include buying SD-WAN startups.
- **Ancillary revenue streams abound.** Once an enterprise SD-WAN customer is captured, service providers can provide many supplementary services, such as enhanced security and cloud optimization features, as well as network analytics and monitoring.

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Introduction

Catalysts for the Growth Stage of SD-WAN

A revolution is happening in the way that enterprises buy and consume Information Technology (IT) services. It's called cloud.

The cloud model is easy for enterprise IT managers to understand. Popularized by consumer services such as Amazon in retail, Expedia in travel, and Spotify in music, for example, the world has been conditioned to buy services on-demand, from the cloud. This trend moved to business IT services with popular enterprise IT services such as Amazon Web Services (AWS), Microsoft Office365, Slack, and Salesforce.com. It's now common to buy most IT services in the cloud, using the Internet.

So why should communications services and wide-area network (WAN) services be any different?

The fact is that today, enterprises struggle with the cost, complexity, and operational tax associated with managing networks and especially WAN services.

The consumer cloud model has been gradually seeping into the enterprise. It's now normal to buy services such as presentation and communications for the cloud, using service such as Cisco's Webex, Microsoft's Lynx or Skype, and GoToWebinar. Enterprise network connectivity. WAN shouldn't be any different.

For this reason, a new category of services, known as software-defined WAN (SD-WAN), or Cloud-delivered WAN, is expected to dominate growth in the market for enterprise communications services over the next decade. With SD-WAN, complexities in buying network services, such as configuring branch-office devices, routing schemes, and network addresses, is abstracted by software into the cloud and managed by the service provider, rather than the enterprise. In additional, service providers can bundle network management with connectivity, providing many opportunities in value-added services.

A new breed of SD-WAN software and hardware providers, as well as network operators, has emerged to build platforms for delivering WAN service in the cloud – including services ranging from branch-

office connectivity, direct cloud connectivity, WAN optimization, application acceleration, SD-WAN routing, and security services.

This report covers the economic and business drivers of this new SD-WAN services, software, and equipment market, as well as the leading players.

Futuriom has spent the last four months examining this market in detail, including dozens of interviews with SD-WAN customers, suppliers, and service-provider partners. Our major conclusions, as summarized in the key findings above, are as follows:

- The SD-WAN market is a key strategic opportunity for next-generation IT services, including cloud security, hybrid cloud, and applications performance management
- The SD-WAN market is real today – with hundreds of millions of dollars in revenue changing hands. But there are signs in the market that it's about to accelerate – making 2017-2018 key years in SD-WAN market development
- The competitive landscape will morph dramatically over the next three years, as some startups stumble and some take off. It will also be a key period for leading equipment manufacturers, such as Cisco and Nokia, to stake out their claim in SD-WAN. At the same time, service providers will have to make "build vs. buy" decisions about whether to purchase technology from equipment and software specialists to build SD-WAN services – or build their SD-WAN technology in house, possibly by buying startups.

Read on, to get Futuriom's full analysis of the SD-WAN market including:

Why? *Why is SD-WAN a popular service. Why do people want it? Why will it matter?*

What? *What is SD-WAN and what are the individual components?*

How? *How does Futuriom expect to evolve?*

How Much? *What are the total revenue numbers at stake? Futuriom spent months gathering indepdent, private, and anonymous data from many sources in the market to come up with what we believe are the most comprehensive, accurate revenue figures to date.*

I. SD-WAN Why:

Cloud Architectures Drive the WAN

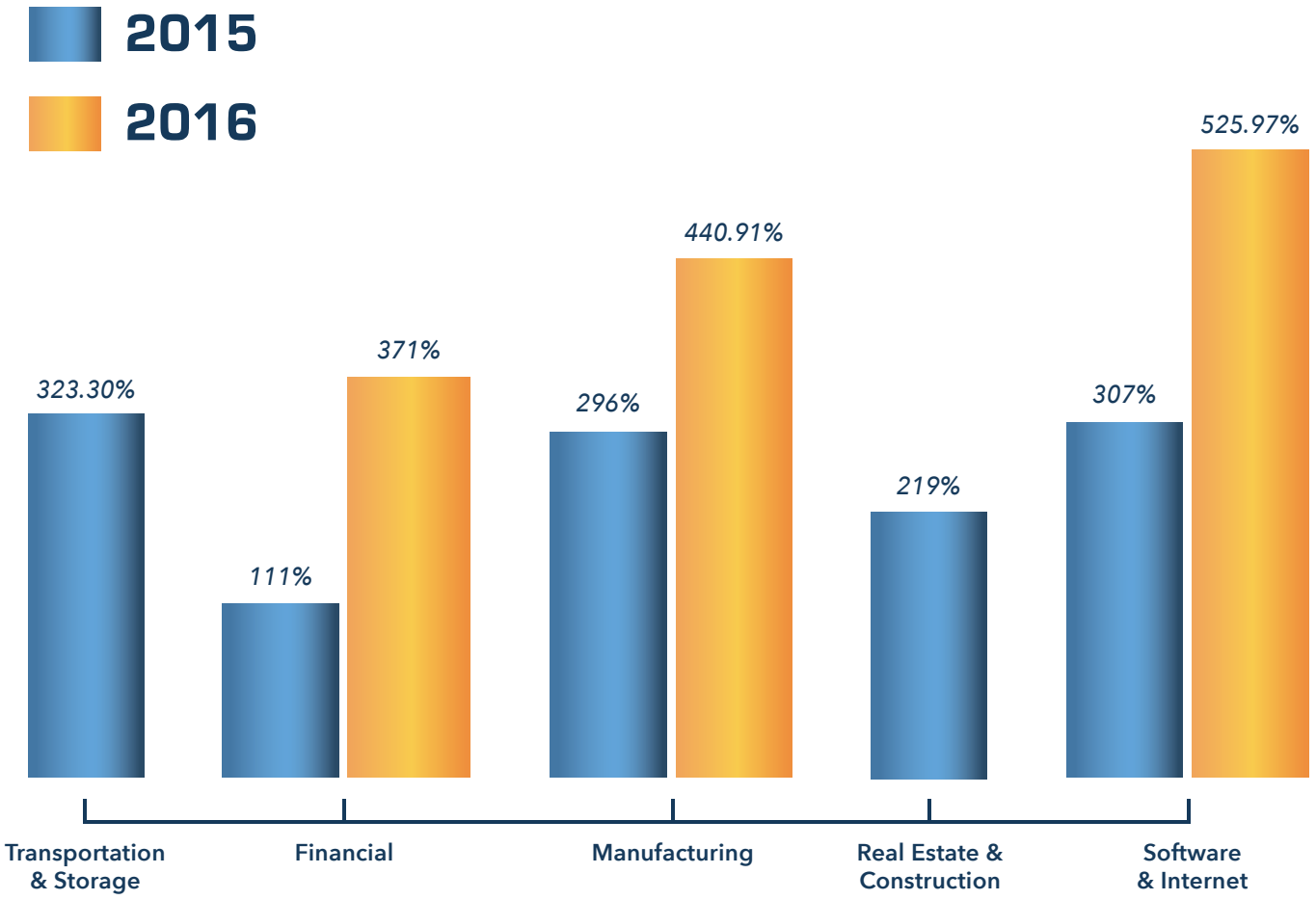
The huge demand for cloud services means huge demand for wide area network (WAN) connectivity, security, and bandwidth. But something's changed. Instead of purchasing WAN connectivity primarily internal enterprise-network connectivity, enterprises are now purchasing bandwidth and services to connect to cloud services, whether that means using the public Internet or a private direct connection to the cloud services. This is a fundamental change for the way that networks were built over the last several decades, when enterprise were focusing on building internal, private connections between data centers and branches.

Cloud platforms are driving business models and IT operations toward a global, public-Internet orientation. Forecasts for the use of IT services in the cloud are steadily growing, and are expected to dominate the growth of many IT services over the next 10 years. Amazon's recent quarterly results released showed Amazon Web Services (AWS) growing 43% year-over-year growth.

Overall, Cloud computing is projected to increase from $67B in 2015 to $162B in 2020, with compound annual growth rate (CAGR) of 19%, according to a cross-section of industry research. IT research giant Gartner says that worldwide public cloud services market will grow 18% in 2017 to $246.8B, up from $209.2B in 2016.

This cloud growth is conspiring to drive demand for WAN bandwidth. All that cloud data, software, and web surfing needs a pipe. As the chart below describes, a number of industries, driving by adoption of cloud models and digitization, is driving more WAN traffic than ever.

Where is WAN Traffic Increasing?

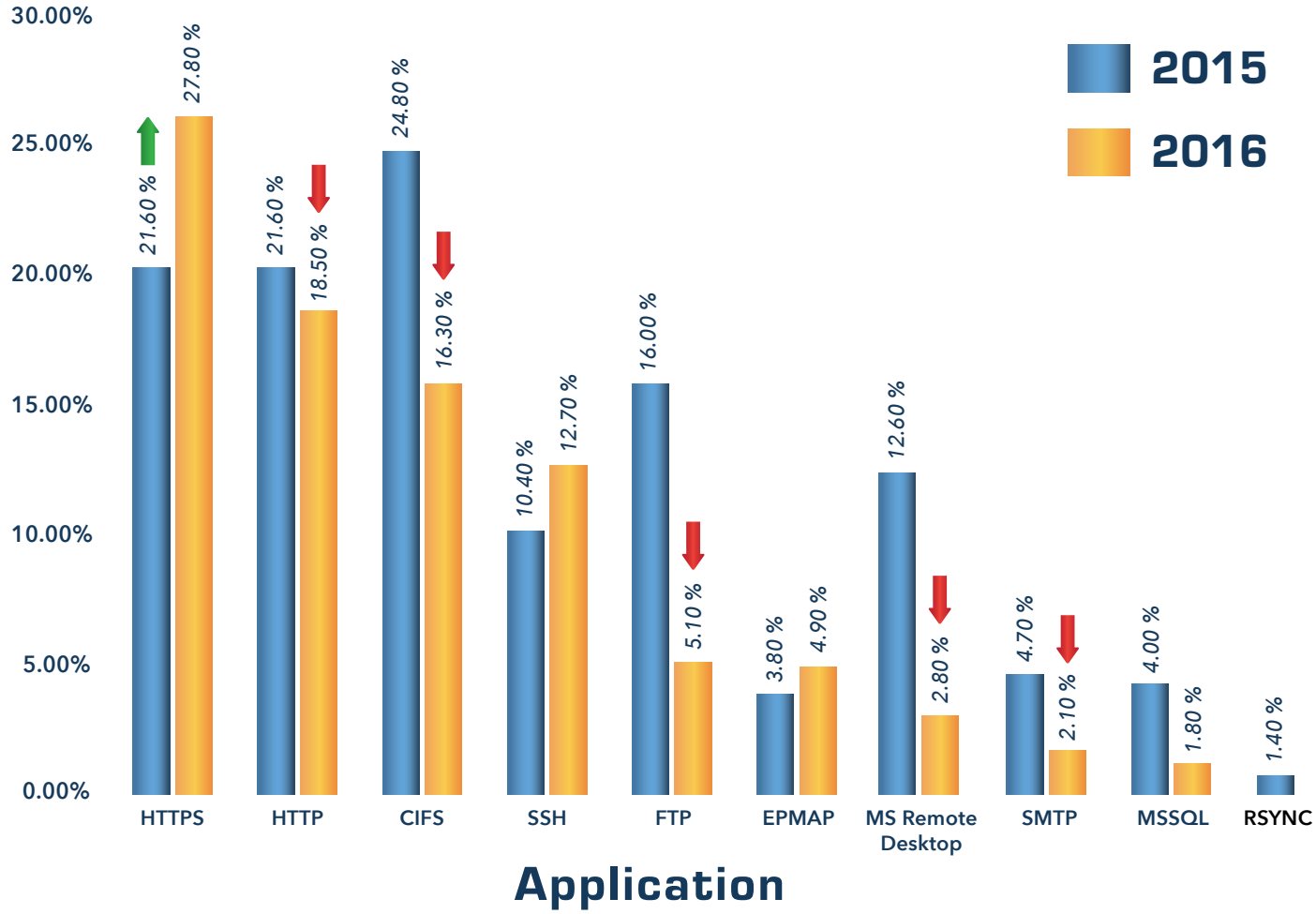


VERTICALS

Source: *'State of the WAN Report'*, Aryaka Networks

So what's the big deal? The drive to cloud and this related expansion of WAN traffic has changed the essential architecture of enterprise networks. At one time, demand for network bandwidth was driven by internally hosted applications, whether it be mail based on a server in the closet for a customer relationship management (CRM) system hosted in a private data center. With more of these applications heading to the cloud, it's more common for them to be used using the public Internet. This is driving immense thirst for WAN bandwidth – but in a different orientation. Customers want the bandwidth to connect directly to the cloud rather than a private data center.

As the chart below shows, WAN traffic is being disproportionately directed toward cloud- and web-based protocols such as HTTPS. This comes at the expense of previously enterprise-focused protocols such as FTP, CIFS, SMTP.



Source: *'State of the WAN Report'*, Aryaka Networks

In short, applications traffic has moved to the cloud and away from private enterprise networks. The implications are that IT managers and CxOs need to retrofit their WAN strategy – to align it with the needs of their employees, customers, and partners, who want more efficient access to the cloud, rather than using private enterprise networks.

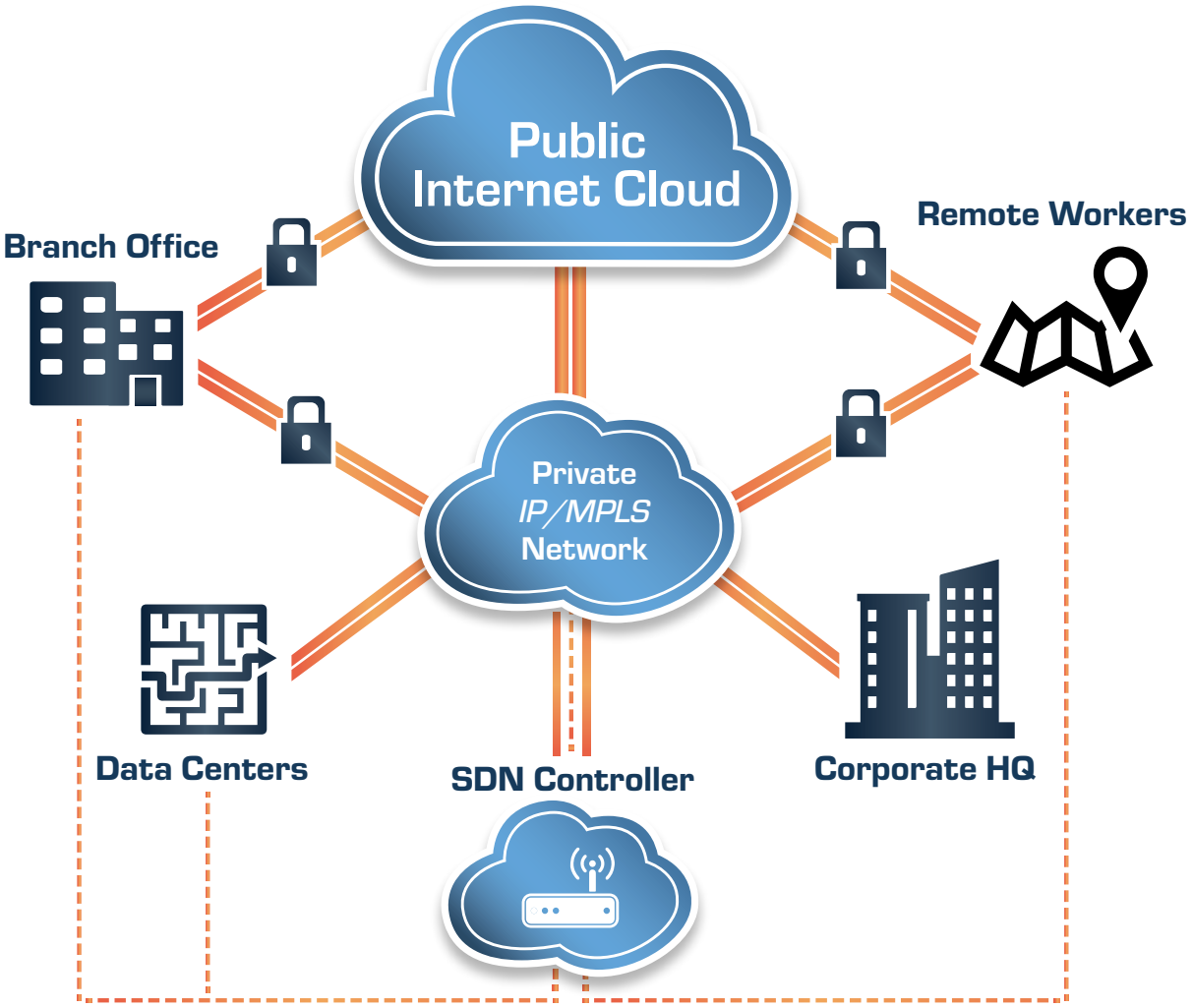
Goals for Cloud Connectivity

Because cloud platforms are changing the way end users access applications, it makes sense that a new type of WAN be developed to accommodate these changing traffic patterns.

Futuriom's interviews with dozens of equipment providers and WAN users reveals the following goals in connecting the WAN in these new cloud environments:

- Optimize and accelerate WAN traffic to the cloud
- Reduce and consolidate costs related to WAN bandwidth
- Leverage multiple access technologies such as fiber, DSL, and wireless
- Increased flexibility in customer premises equipment (CPE), so that management can be outsourced or it can be updated with software-only upgrades
- The capability to purchase, provision, and manage services via the cloud, using software

The diagram below is a depiction of what's happening in this new cloud world. The new WAN must be able to handle business-class service across the public Internet and cloud, as well as private routing of corporate traffic.



This re-orienting of enterprise network resources to the cloud, rather than to internal resources such as application servers and data centers, is what's driving SD-WAN, which seeks to be able to mitigate these challenges and optimize all WAN resources in real-time, using software, rather than specialized hardware.

In a traditional, enterprise-based WAN, branch offices are connected to HQ and data centers via private lines or VPNs. However, as the amount of traffic to the cloud increases, this adds a "tax" to enterprise private lines that require carrying traffic to a corporate data center first, before going out to the cloud. In the cloud model, it makes a lot more sense for the end-users to connect directly to the cloud, using the public Internet or an optimized SD-WAN connection.

II . SD-WAN What:

SD-WAN Positioning and Demand

With the outline of drivers and catalysts in place, the next question is how the SD-WAN technology is delivered. It turns out that this is complicated and has resulted in a huge bubble of SD-WAN startups, service providers, and all-inclusive NAAS providers.

There are many approaches to building SD-WAN networks that can leverage a variety of access technologies and cloud resources. According to Futuriom's research, there are at least 20 providers of SD-WAN tools, platforms, and services. For the purposes of this report, we have focused on the technology vendors, platforms, and services that we consider leaders in the market.

For the purposes of this report, Futuriom is looking at pure-play next-generation SD-WAN platforms, tools, and NAAS services. For NAAS, we looked at vendors focused on bundling SD-WAN software with cloud services, rather than service providers offering SD-WAN bundled with connectivity. What we've found looking at the market is that the large global service providers are gradually getting into SD-WAN, they are not perceived as leaders in providing technology and services and they are heavily reliant on technology partners. This report focuses on the pure-play SD-WAN technology as well as specialized NAAS vendors such as Aryaka.

[Note: In collecting data for this report, Futuriom reached out to more than 15 providers of SD-WAN technology and services, though not all replied. In the cases in which vendors did not reply we did our best to describe technology or services using publicly available information].

Platforms, Tools and NAAS

The SD-WAN market can be broken down into a number of approaches, all focused on similar technology approaches. Futuriom sees two main categories:

- **SD-WAN software and hardware platforms.** Includes SD-WAN hardware and software – targeted at helping both enterprise and service providers to build their own SD-WAN services, for more flexible access to cloud services.
- **Full SD-WAN network-as-a-service (NaaS).** Targeted at enterprise that want to outsource the entire network – getting SD-WAN services and software directly from the cloud, with minimal intergration required.

Examples of Vendors

For references purposes, we would put the following vendors and service providers in the different categories we have outlined above. The SD-WAN market is evolveing rapidly and can contain overlap, which means that some of the vendors are targeting several approaches at once.

Please note these are examples only. In Appendix A, we provide a more comprehensive analysis of SD-WAN vendors.

SD-WAN platforms and tools: Cisco (including Viptela), FatPipe, Silver Peak, VeloCloud, Versa

Full SD-WAN NaaS: Aryaka, Cradlepoint, TELoIP, VeloCloud

One trend that's been noticeable: Many of the platform and tools vendors appear to be hedging their bets as to whether they sell directly to enterprises or partner with service providers. One challenge for these companies is that if they choose to sell to service providers and depend on the service providers to launch services, there could be delays in realizing revenue. The recent trend appears to be for many of the startups to attempt to sell to both enterprises, as direct SD-WAN providers, and to service

Primary Features of SD-WAN

Technology professionals like to talk about "use cases" for emerging technology. These are useful references points for why a technology will be purchased or implemented, though they are not the end-all or be-all.

In fact, a unique characteristic of the SD-WAN market is that it can package several use cases at once. Here are some of the more popular use cases for SD-WAN implementations

Open Customer Premises Equipment (CPE): The old model of WAN was this – you bought an expensive leased-line from a service provider, and they required you to integrate highly specialized and proprietary equipment into the endpoints of the network – known as the CPE. One of the higher costs of WAN frequently cited by enterprise customers is the operating expense (opex) of managing proprietary hardware and CPE. For example, if you have a load of Cisco gear, it might require having a Cisco Certified Internetwork Engineer (CCIE). Not only is this complicated, but it may also introduce errors and complexities in building and managing the network as the proprietary gear is configured.

Many SD-WAN technologies run on open, standard commercial off-the-shelf (COTS) computing platforms that act as a CPE. This means that the software for the SD-WAN service can be "pushed" out to cheaper, standardized hardware platforms. Features, upgrades, and patches can be installed as software on the server, running in a virtual framework (using technologies such as virtual machines (VMs) or containers).

Cloud VPN for Branch Office: One of the allures of SD-WAN technology is that it can be used to deploy a virtual private network (VPN) as a software overlay using end-to-end encryption. This helps meet security requirements for businesses that may want to connect branch offices or retail outlets but also have high security requirements. It also means that value-added security services such as stronger encryption and intrusion detection serices (IDS) can be offered by the SD-WAN providers.

WAN Optimization: Many networking functions that are provided as discrete sofware and hardware solutions will be subsumed by SD-WAN services and solutions. For example, WAN optimization emerged with network appliance vendors added special software and hardware that could increase the efficiency of WAN links using techniques such as compression and de-duplication of data. Many

SD-WAN technologies include WAN optimization functionality and we expect his to be checklist item in SD-WAN deployments.

Application Performance Enhancement: Cloud WAN solutions can be built that optimize access to cloud applications tracking traffic patterns and routing higher-priority business applications ahead of leisure services such as Netflix and YouTube. Additionally, many WAN services can peer directly with cloud services to offer a "fast lane" to the business applications. These techniques can be used to "offloads" enterprise WAN backhaul, routing cloud traffic directly to the source using a combination of broadband technologies. This will also have the effect of challenging the traditional Applications Delivery Controller (ADC) model of providing this services as part of a discrete hardware devices.

Broadband Link Balancing: One of the key features of many SD-WAN services is the ability to aggregate and balance broadband links, such as combining mobile broadband, fiber, DSL, and/or cable. As broadband technologies proliferate and point-to-point 5G becomes a reality, this will become important resources for maximizing access resources and building a more mission-critical WAN.

In addition, SD-WAN solutions can be used to optimize cloud connectivity using mobile connections. Examples might include the Internet of Things, whereby a retail kiosk or a commercial truck is connected to the corporate WAN using mobile connectivity, whether that be cellular or other flavors of WAN (such as WiFi or LoRa). In these cases, having SD-WAN features such as WAN optimization and central SD-WAN software routing can optimize connectivity to save money on cellular or WAN connection costs. Specialized SD-WAN vendors such as Cradlepoint are focusing on this aspect.

Network as a Service (NaaS): Many enterprises don't even want to build or manage the WAN, but they also want something better than plain-vanilla Internet. In this case, they can go to NaaS providers who can provide software that aggregates existing broadband services into an SD-WAN that is managed by the service provider. Customers can provision and operate the WAN using a provisioning and management system provided with a Web interface, and they avoid the costly process of managing and configuring hardware, because the hardware is provided by the service provider and managed using SD-WAN software.

Evolution of SD-WAN Platform

Enterprises want to outsource their networks which is why they are looking at cloud WAN and SD-WAN services. The main reason is the architectural shift detailed above – they need an "express lane" to cloud service, without always connecting to corporate data centers.

However, there are other demands on enterprise IT that would be naturally outsourced to service providers. Managing networks has become increasingly complex, due to virtualization, worker mobility, and ever-increasing endpoints – including those connected to customers, partners, and employees. This means that systems are no longer contained within corporate boundaries and it makes sense for a more centralized view of applications and performance monitored on a service provider network

III . SD-WAN Growth and Forecasts

Futuriom has spent several months interviewing SD-WAN service providers, technology vendors, and customers to gain view of how revenue will scale in the market.

To simplify things, we have the different segments of the market that we have defined – DYI vendors, technology tools, and services, into one. The reason for this is that the move to the NFV model of providing software as a service (SAAS) for SD-WAN blurs the lines between technology vendors and service providers. In addition, many of the vendors in the SD-WAN market, market the technology as software that can optimize an SD-WAN service. Therefore, we believe they are targeting the same market – whether it be service providers buying technology to set up their own SD-WAN offerings, or independent SD-WAN companies providing SD-WAN in a SAAS or NaaS model. They are all selling the same thing: Software that can maximize the value of their network connections.

Substitution of Existing Markets

Futuriom believes that some of the value of SD-WAN will come from substitution of the SAAS or NAAS model substituting revenue for previous hardware models for functions such as ADC, VPN, and WAN optimization. All of these functions are rapidly being included as features as part of a larger SD-WAN offering.

This means that SD-WAN is likely to take market share from existing hardware based ADC, VPN, and WAN opt markets. According to an aggregated view of revenue figures from multiple research services in these markets, the revenue opportunity in 2018 for each to these is listed below:

WAN Optimization:

- $800 million in 2017
- 0% growth
- 10% annual “substitution rate” into SD-WAN platforms

ADC Market:

- $2.2 billion in 2017
- 10-20% annual substitution rate into SD-WAN

VPN Market:

- $4B in 2017
- 15% CAGR
- 10%-20% annual substitution rate

Sources: Gartner, IDC, Grand View Research, Markets and Markets, Goldman Sachs

Organic SD-WAN Growth

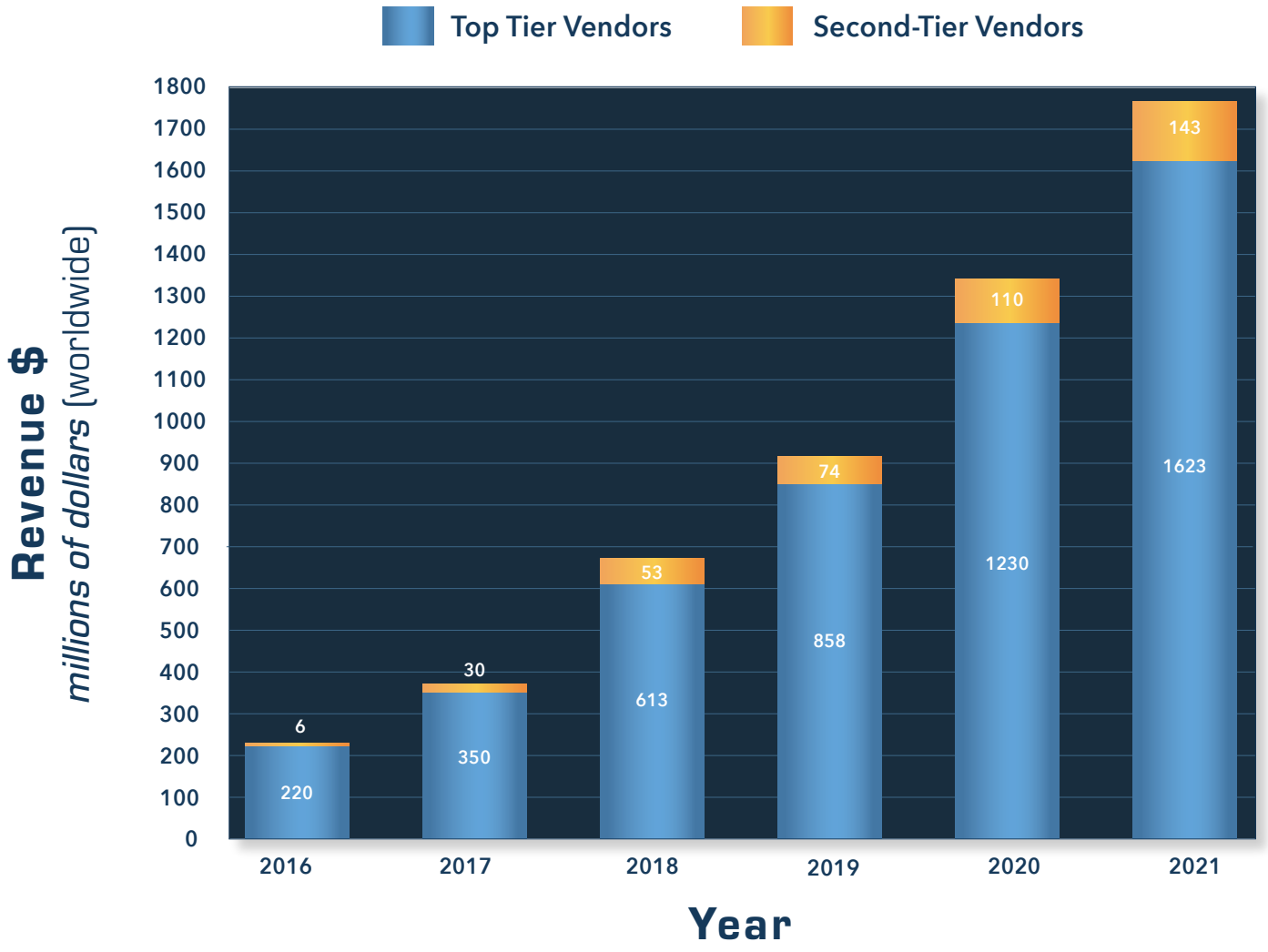
Not all SD-WAN revenue will be attained by cannibalizing or substituting existing legacy enterprise WAN services. Some of the value we have seen extracted from new SD-WAN services comes in the form of savings and optimization of existing WAN networking systems.

For example, if a company is spending $20 million a year on WAN but they believe that half of that is opex related to managing legacy WAN infrastructure, the ROI rationale is to spend money on SD-WAN software is that it will lower overall opex. In interviews with vendors and end-users, we have found this to be the driver of SD-WAN technology. We have also seen individual business cases that show an average reduction in opex by 40%. In this example, in the example above if 50% of the WAN is opex ($10M), and a 40% cost reduction in opex can be delivered with SD-WAN technology ($4M), it may justify a $1-$2M annual SD-WAN software investment (e.g. you are investing $2M a year to save $4M, for total savings of $2M). It's likely that end-users will demand even better ROI. Please note these are not exact numbers, but give you an idea of the potential for value creation for SD-WAN.

To calculate the total market opportunity, Futuriom took a look at the potential for substituted revenue of WAN Optimization, ADC, and VPN with the organic growth rate of value-added SD-WAN. Then we derived the true organic growth rate from an aggregated base of revenue numbers given to us by at least five SD-WAN startup vendors. In addition, we polled dozens of industry sources, including current and former members of sales staffs, to gauge their sense of the revenues of the startups in the market. Our market forecast is a realistic blend of these numbers, based on real deals and revenue run rates. that we have seen and heard about.

The sweet-spot of growth rate will be 2017-2019, with the greatest growth rates of up to 100% into 2018 as startups grow a relatively low revenue base. While growth rates will scale back a bit to the 20-40% in the 2019-2021 timefame, larger revenues will produce larger nominal revenue growth, with several companies approaching or exceeding $100 million in revenue in the 2018-2019 timeframe.

The numbers of our forecasts are presented below:



The Coming Shakeout: Tier-1 vs. Tier-2 Players

Futuriom discussions with SD-WAN vendors, partners, and customers reveals a lot of confusion and divergence in the market. For example, many SD-WAN products have different architectures and methods of implementation. Furthermore, there is a heavy integration component involved in building an SD-WAN solution, which means that many SD-WAN providers must also act as integrators.

For this reason, the successful companies will have to have high levels of execution: Blending scalable technology, effective sales and marketing strategies, as well as integration capabilities. While some of the "hot" startups have buzz, multiple sources have told us that many named customers are proofs of concept, or at best, trials.

In deriving revenue forecasts we would say that most of the SD-WAN players are in two groups, a Tier-1 group that already has a strong roster of paying customers and is ramping quite fast, and the Tier-2 group that is working largely with proofs of concept (POCs and trying to create a viable revenue stream in excess of $30 million. We would describe it as such:

- **Tier-1** (6-8 companies): 2017 annual revenue run rate of $30M-100M
- **Tier-2** (6-8 companies) 2017 annual revenue run rate of $0-$29M

Tier-2 companies haven't necessarily lost the game, but they are either late to market or slow to ramp revenue. Futuriom believes that this market will segment itself very quickly and that it's going to be very difficult for Tier-2 companies to catch up. In addition, if 1-2 SD-WAN companies are able to go public, they will raise additional capital and use the IPO visibility to establish themselves as leaders.

SD-WAN Startup Companies Positioning for IPO

For this report, Futuriom has scored a ranking of companies based on information from industry sources. Futuriom believes that the successful SD-WAN companies will be in high demand as acquisition targets, but some may also opt to pursue an IPO to reward their private investors.

Our ranking methodology includes three categories of data: 1) Revenue estimates from internal and external sources 2) Word-of-mouth from industry sources 3) Existing public customer announcements and proof points.

Based on the available information, we believe there are at least several credible Tier-1 SD-WAN companies positioning themselves for a potential IPO in 2017. If these companies do not make it to IPO, they will also be top acquisition candidates:

Aryaka Networks. Aryaka is uniquely positioned as the only full global SD-WAN NAAS company, operating 26 global POPs as of 1H 2017. It has focused on a strategy of improving the performance of the "middle mile," for example connecting branch offices around the globe, which is pragmatic approach that appears to mid- to larger enterprise looking to leverage the public Internet with SD-WAN to provide quality of service to offices around the world. Aryaka is scaling to more than 300 employees and may be the first independent SD-WAN startup player to reach $100 million in revenue. Company leadership has expressed the desire to file for an IPO, which we expect could occur in 2018.

Cradlepoint. Boise, ID-based Cradlepoint has focused its SD-WAN solutions on fixed branch and mobile networks that have a dependency on one or more 4G LTE connections for primary or secondary WAN links. This includes highly distributed enterprise networks — such as retailers and quick-serve restaurants, kiosks and pop-up stores, smart cities, and in-vehicle networks – such as municipal buses, school buses and first responders. It gained additional credibility in the SD-WAN space when it acquired the Pertino Networks in 2015, giving Cradlepoint an SDN controller that improve the its orchestration and overlay networking capabilities. Cradlepoint has an impressive customer base and the company's leaderships says it has market penetration in more than half of the top Fortune 100-ranked companies.

FatPipe. This Salt Lake City-based SD-WAN company deserves more recognition than it gets in the trade press. It has been around longer than some of the hot Silicon Valley startups, and it has a solid roster of companies and is profitable.. In a more interesting twist, FatPipe is involved in a patent dispute with Viptela, the startup that was acquired by Cisco (which we expect to be settled). As one of the SD-WAN pioneers, FatPipe has hundreds of customers that use its technology to connect branch offices, create secure VPN overlays, and provide WAN optimization and application performance.

SD-WAN Players to Watch

Cisco/Viptela. Cisco recently completed the purchase of Silicon Valley-based Viptela for $610 million, a price that reset expectations for SD-WAN companies (the multiple was very high, possibly more than 10X revenue). This was necessary because Cisco's SD-WAN story was fragmented and linked heavily to Cisco hardware devices, whereas Viptela has been shipping an open CPE with superior routing software. Industry sources say Viptela has some of the best SD-WAN routing software in the business, but execution will come down to how Cisco can position it in its vast portfolio of routing and security hardware and software. Even though the future lacks details at this point, the potent combination of Cisco and Viptela needs to be watched closely

TELoIP. Another underhyped player, TELoIP took a quiet and unique approach to the market. It was funded by individual investors, all of whom sit on the company's board, rather than classic VCs. It gained traction and built its product by developing an anchor client in the Mac's conveniences store chain in Canada. It claims some deals that have 1,000+ sites, and Futuriom has reason to believe that these are real paying customers, not POCs or trials. The company also has a strong intellectual property portfolio as well as a top management team with connections into some of the top North American service providers. TELoIP is more likely to be acquired than go for IPO, but sources indicate that it's scaling well.

Emerging SD-WAN Players to Watch

In addition to startups, there are a lot of large technology companies that have WAN products being reoriented toward SD-WAN. Some of the following companies are also developing products to become leading SD-WAN players, even though they are not traditionally known as SD-WAN pure plays:

- **Citrix** is repositioning its Netscaler ADC product as a cloud-based SD-WAN product. This is a smart move because, as we have observed, ADC hardware will eventually go away and the software functionality is being absorbed into the network cloud.
- **Huawei** is starting to ramp its SD-WAN offerings and will have key account positions with leading Asian providers where it already sells networking gear and servers.
- **Nuage Networks** has an SD-WAN product in VNS, which is built with the same underlying technology it uses for its datacenter virtualization technology.
- **Riverbed Networks** is a WAN optimization specialist that is reorienting its products toward the cloud to position itself as an SD-WAN vendor. The challenge will be moving from an appliance model to a cloud services model.
- **Versa Networks** has a NFV platform that it sells to carriers to build virtualized SD-WAN services including VPNs and WAN optimization.

You can read more details about these and other players in the Appendix.

IV . Conclusion:

The Future of SD-WAN Is Bright

Futuriom believes that the flexible, software-based approach of SD-WAN is right for the changing dynamics of the WAN market, which includes to a shift to the cloud and SaaS services. Furthermore, broader trends to reduced on-premises equipment and software means that enterprises are looking to purchase more services that offer network-on-demand capabilities.

For this reason, you can look to SD-WAN as a broad array of WAN services and software that can replace the expensive and complicated enterprise legacy hardware and software of the past. CIOs and IT professionals will be incentivized to look at new SD-WAN solutions that can lower both capex and opex, increase organizational and management flexibility, and take away some of the management headaches of installing and services WAN equipment.

Although it's by no means a simple task, many of the emerging SD-WAN players have made progress from the slideware and the lab and into real customer deployments. The next few years will result in a shakeout as more than a dozen SD-WAN startups are reduced to a core of five to six successful players that could have the wherewithal to stand on their own. The remainder will be sold to service providers looking to build their own SD-WAN solutions or larger players that would like to consolidate the market. It's going to be interesting to watch the market as SD-WAN evolves into a more than $1 billion market in the next few years.

Appendix A: Profiles of Leading SD-WAN Players

Featured Company

TELOIP™

Product Type: Service

TELoIP Description: The TELoIP SD-WAN services is designed for multisite organizations with typically 10 – 100 sites (scalable to 1000+) which need a new backbone network that better supports public & private cloud services. TELoIP believes these organizations want to have lower latency, higher throughput networks at overall lower cost in order to improve their agility and have a more elastic WAN. Unlike MPLS backbones, TELoIP claims that its VINO SD-WAN-as-a-Service provides at least 10x performance typically at 50 – 70% less cost.

Key differentiator: VINO SD-WAN can be installed in minutes versus months using any low cost DSL, Cable, LTE or even MPLS technology. It delivers zero downtime for real-time applications like voice, video and virtual desktops. Our Devops team works with partners and end users to ensure flawless network performance.

Virtual CPE: Yes

Hardware CPE Available: Yes

Network POPs: Yes (9)

Target Market: Service providers and enterprises

Top Named Customers: Kohls, LCBO, Brookdale Senior Living, Sprint Retail Stores, LEGO Stores

Company URL: www.teloip.com

Aryaka Networks - http://www.aryaka.com

Product Type: NAAS

Description: Aryaka's global SD-WAN is an MPLS replacement and alternative for global enterprises. Aryaka provides a global enterprise connectivity solution for data centers, branch offices and remote/mobile employees delivering significantly better performance for on-premises and cloud/SaaS applications – voice, video and data. It is delivered as a fully managed service eliminating the need for complicated, expensive and time-consuming WAN construction, management and maintenance. Unlike MPLS, Aryaka global SD-WAN can be deployed anywhere in the world within days without requiring additional hardware or resources.

Virtual CPE: Included in current roadmap **Hardware CPE Available:** Yes **Network POPs:** Yes (28)

Target Market: Service providers, enterprises

Top Named Customers: Augmedix, JAS Forwarding Worldwide, Platform Specialty Products, Skullcandy, Xactly Corp.

Partner Strategy: Aryaka's Partner Network is segmented into 3 unique partner types: 1) Referral Partners include master and sub-agents who have a vertical/geographic focus with strong relationships that transcend the traditional telco industry. Examples of Aryaka's referral partners are AVANT, Intelisys, and Bridgepointe Technologies. 2) Reseller Partners include VARs and partners that have both sales and technical sellers, can provide both tier 1 and tier 2 Support, and have additional managed services. Examples include Coevolve, GAB Enterprise IT Solutions GmbH, Videns IT, and SDN Africa. Fusion Partners include telcos and MSPs. In this model, we provide the software and managed service while the partner provides the hardware and (network) bandwidth. Examples include Telehouse Europe (subsidiary of KDDI Corporation), Internet Binat, 21Vianet, Sejong Telecom and SK Broadband.

Cisco / Viptela - http://www.cisco.com

Product Type: Hardware and software platform

Description: Cisco has long supplied its iWAN portfolio of SD-WAN features bundled with its routing hardware, It recently closed the deal to acquire SD-WAN startup Viptela, but information about how these platforms has not yet been disclosed.

*[**Editor's Note:** Futuriom reached out for details on the product offerings but Cisco did not respond on the specific details. However, given Cisco's reach in the market and Viptela's well regarded software, we expect the forthcoming Cisco solutions to maintain a high profile in the marketplace.]*

Citrix Systems - http://www.citrix.com

Product Type: Hardware and software platform, service

Description: Citrix NetScaler SD-WAN provides centralized policy and control for application aware packet-level real-time path selection, WAN optimization, firewalling, routing, and analytics, on a hardware or virtual appliance on-premises or in the cloud, to increase application availability, and security, simplify the branch network and reduce bandwidth costs by virtualizing the WAN.

Virtual CPE: Yes **Hardware CPE Available:** Yes **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: AIDS Healthcare Foundation, Cornerstone Home Lending, HMS Host, Royal Caribbean Cruises, The Tile Shop.

Partner Strategy: Equinix to enable customers to connect SD-WAN via 145 data centers to the Cloud Exchange for connectivity between multiple cloud providers and enterprise networks. Zscaler to enable secure internet breakout from the branch to cloud security services which provide Secure Web Gateway, cloud firewall, sandboxing, and other branch security needs.

CloudGenix - https://www.cloudgenix.com

Product Type: Hardware and software platform

Description: The CloudGenix software-defined WAN with AppFabric technology allows you to define a global WAN with top-down policies based on business intent rather than fragmented bottoms-up networking configuration. With CloudGenix, you can integrate heterogeneous WAN connections at any site, confidently deploy cloud and SaaS applications globally, improve app performance visibility and SLAs, and simplify network operations.

Virtual CPE: Yes **Hardware CPE Available:** No **Network POPs:** Yes (# not disclosed)

Target Market: Service providers, enterprises

Top Named Customers: Autodesk, Jax Federal Credit Union, Teleflex

Partner Strategy: We partner with security firms including Palo Alto Networks and zScaler to integrate the CloudGenix Application Firewall with their advanced security offerings. We also partner with Intel to deliver networking, security, and analytics functionality as software. We also partner with cloud companies such as Amazon to help customers integrate and migrate to the cloud.

Cradlepoint - https://cradlepoint.com/

Product Type: Hardware, software, and NAAS

Description: Cradlepoint provides both fixed (branch) and mobile (in-vehicle) SD-WAN solutions using LTE-enabled routers with multiple wired and wireless broadband WAN connections. They are powered by Cradlepoint NetCloud, which combines cloud management and orchestration with SD-Radio, SD-WAN, and virtual network function (e.g. Zscaler, Trend Micro, Webroot) software on the edge router.

Virtual CPE: Yes **Hardware CPE Available:** Yes **Network POPs:** Yes (# not disclosed)

Target Market: Service providers, enterprises

Top Named Customers: City of Page, AZ, David's Bridal, Doddle, Evereve, Fuzzy's Tacos

Partner Strategy: Cradlepoint has a diverse channel for bringing its SD-WAN solutions to the market. They include the following: Enterprise partners delivering SD-WAN solutions (e.g. StepCG); major cellular carriers integrating LTE into SD-WAN solutions (e.g. VZ, AT&T); managed Service Providers delivering as-a-service solutions (e.g SoftBank); and vertical integrators (e.g. Panasonic partnership for first responders).

FatPipe - https://www.fatpipeinc.com/

Product Type: Hardware, software, and NAAS

Description: FatPipe's SD-WAN is designed with flexibility and adaptability in mind. Allowing customers to deploy SD-WAN on FatPipe's CPE or a virtual machine on any of the leading platforms including VMware, OpenStack, AWS, or Azure. FatPipe allows flexibility in scaling in term of bandwidth (2Mbps to 40 Gbps) and features per site. FatPipe also allows flexibility in purchasing either as a capex purchase or as a service.

Virtual CPE: Yes **Hardware CPE Available:** Yes **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: FatPipe does not name customers. See case studies on the website.

Partner Strategy: AT&T has been a 10-year partner selling FatPipe to manage diverse access arrangements. Avaya is offering SD-WAN to improve UC experience. TCS / Accenture is offering global additional global management as a system integrator.

Huawei - http://www.huawei.com/

Product Type: Hardware and software platform

Description: Huawei anticipates further announcements about the launch of its SD-WAN services which will incorporate the use of its WAN CPE devices including its AR160 series, AR2200 series, and AR3200 series routers. These devices will be integrated to provide NFV capabilities using the Agile Controller Campus and vCPE VNFs including the vCPE AR1000V and vFW.

Virtual CPE: Included in current roadmap, **Hardware CPE Available:** Yes **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: Huawei has not yet disclosed its customer but it is working with several larger enterprises and global service providers.

Partner Strategy: Huawei cooperates with top global operators including Vodafone, Telefonica, Wind, e.t.c. Also cooperates with global top distributors including Arrow and Merlion.

Nuage Networks - http://www.nuagenetworks.net/

Product Type: Hardware and So tware Plat orm and NAAS

Description: Silver Peak offers an SD-WAN solution (Unity EdgeConnect) that provides secure and reliable virtual overlays to connect users to applications with the flexibility to use any combination of underlying transport, including consumer broadband services, without compromising network or application performance. This results in greater business agility and lower costs.

Virtual CPE: Yes **Hardware CPE Available:** Yes **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: Asco, BT (Agile Connect), China Telecom, Telefonica, Telus, Telia.

Partner Strategy: The Nuage Networks VSP Integration partner (VIP) program includes 32 partners that cover a broad range of functions/use-cases that include orchestration, security, application delivery, networking, analytics among others. For example, the company supports leading security vendors (Palo Alto Networks, Checkpoint & Fortinet). It also works with ADC vendors and service orchestration vendors (Amdocs, Netcracker, Ciena Blue Planet etc.).

Silver Peak - https://www.silver-peak.com/

Product Type: Hardware and Software Platform and NAAS

Description: Silver Peak offers an SD-WAN solution (Unity EdgeConnect) that provides secure and reliable virtual overlays to connect users to applications with the flexibility to use any combination of underlying transport, including consumer broadband services, without compromising network or application performance. This results in greater business agility and lower costs.

Virtual CPE: Yes **Hardware CPE Available:** Yes **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: Fruit of the Loom, Goldberg & Osbourne, Monroe Bank & Trust, Munters, Paladin Security, Republic National Distributing Company, and Urban Health Plan.

Partner Strategy: Silver Peak has an ecosystem of technology alliances with industry leading network, storage, and security providers designed to extend the value of the Unity EdgeConnect SD-WAN solution for customers. Silver Peak has also formed partnerships with service providers with Unity EdgeConnect underpinning the managed SD-WAN services offerings for Masergy, Cygate, Hyundai HCN, Interoute, NTT, and China Telecom to name a few.

VeloCloud - https://www.velocloud.com/

Product Type: Platform, Tools, NAAS

Description: VeloCloud Cloud-Delivered SD-WAN enables Enterprises to securely support application growth, network agility, and simplified branch implementations while delivering optimized access to cloud services and enterprise applications. Service Providers are able to increase revenue, deliver advanced services and increase flexibility by delivering elastic transport, performance for cloud applications, and integrated advanced security.

Virtual CPE: Yes, **Hardware CPE Available:** Yes **Network POPs:** Yes

Target Market: Service providers, enterprises

Top Named Customers: TGI Fridays, Texas Roadhouse, MetTel, Deutsche Telekom, AT&T, Sprint, Telstra, Devcon , Redmond, Vonage, Dunne Edwards, The Bay Club, Meineke, Windstream, Triton Management

Partner Strategy: VeloCloud is best-of-breed genuine SD-WAN and we work with best-of-breed technology vendors for additional on-premises, VNF and cloud-based technology. Security vendors in the VeloCloud SD-WAN Technology Partner program include Fortinet, Checkpoint, Zscaler, Palo Alto Networks, Symantec, Forceport, and IBM. Other partners include Amazon, Cisco, Google, and VMware.

Versa Networks - https://www.versa-networks.com/

Product Type: Software-only platform

Description: Versa CloudIP Platform consists of Versa FlexVNF, Director and Analytics providing a highly flexible carrier-grade multi-service and multi-tenant platform solution that enables businesses to simplify, automate and deliver rich network and security services. Versa CloudIP provides a single software solution for SD-WAN, SD-Security and SD-Branch (integrated vCPE with SD-WAN and security)

Virtual CPE: Yes, **Hardware CPE Available:** No **Network POPs:** No

Target Market: Service providers, enterprises

Top Named Customers: Comcast Business, CenturyLink, Nitel, Tata Communications, VergX

Partner Strategy: Versa has partnered with Dell EMC to provide differentiated and competitive vCPE and SD-WAN offerings. Versa is working with multiple SI (system integrators) to integrate SD-WAN into a managed offering as well as continuing to increase its VAR partner ecosystem to continue scaling out the business