Whitepaper

De-risking New Service Provider Technology Deployments

Introduction

Operators are facing a slew of new technologies to roll out, but this time around there is a difference. In the past, operators have been able to deploy new technologies in series, that is, one after another (see Figure 1). With the current new technologies, due to the interdependency on each other, they are linked. Therefore, instead of deploying new technologies in series, the deployment of one new technology forces the deployment of another new technology, and so on. This paper will delve into three technologies operators are facing today: 100Gb, IP Voice, and network virtualization, the interdependencies between them, and highlight why the rollout of these technologies presents a challenge. We will explore deploying a unified tool rail approach to help overcome the inevitable resource crunch of parallel technology rollouts, accelerate and de-risk the adoption of next-generation technology, maintain uptime, and gain efficiencies and insights.

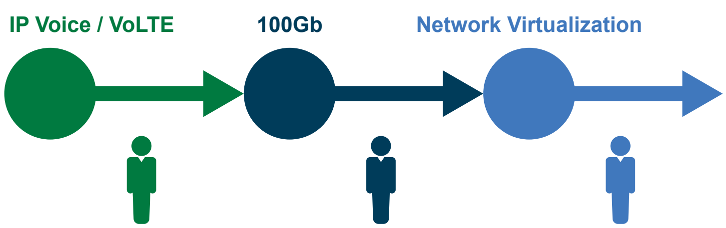

Figure 1: How operators prefer to deploy new technologies in series one after another.

What is the Triple Challenge and why will it occur?

The Triple Challenge defines the operator's predicament when deploying the next generation of technologies comprised of:

1. IP Voice
   A. VoLTE, IR.92 primarily for mobile carriers; PLMN
   B. VoWiFi, applicable to mobile, fixed, or cable providers; PSTN, PLMN and MSO
   C. VoIMS, as the underlying technology to all modern day IP Voice implementations
2. High Speed Transport Pipes
   A. 40Gb
   B. 100Gb
   C. 400Gb
3. Network Virtualization (NV)
   A. Traditional server virtualization
   B. Software-defined networking (SDN)
   C. Network functions virtualization (NFV)

The operator is faced with a number of decisions to make:

- Virtualize the core first, then deploy VoLTE as a virtualized network function, or deploy VoLTE as a legacy function in their traditional network since the network is already in place?
- Upgrade the core beforehand due to worries about DiffServ, MPLS transmission or QoS issues in general, or wait until bandwidth requirements placed upon the 4G/LTE RAN force the move of voice services from the existing circuit switched 2G RAN?
- Upgrade core routers in anticipation of rising RAN traffic, or virtualize the core routing network elements first?

It appears there is no correct answer to whether the horse or the cart goes first. With this level of uncertainty and all-encompassing network transformation, there is only one constant—the need to be able to monitor the new technologies completely and comprehensively. With comprehensive monitoring, not only will you be able to ensure that any network changes involved with the deployment of new technologies are working in the way the network equipment manufacturer (NEM) has promised during the design phase, but you will also be able to measure if expectations are met when the technologies are deployed. It is said that the person who is wrong is the person who cannot prove they are right. Monitoring of packets-in-motion greatly helps to add the legitimacy required in the conversation between the operator and the NEM when deployments of new technology do not quite go to plan.

In Figure 2, here we see a graphical representation of the resource hit and how one technology causes the in-parallel rollout of the other "Triple Challenge" technologies.

Due to the three technologies being interdependent, deploying any one will result in either of the other two technologies also being deployed, thus increasing the amount of resources needed to deploy the new Triple Challenge technologies.

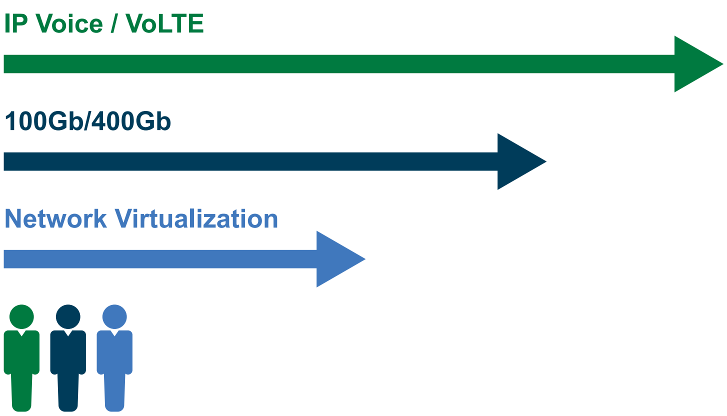

Figure 2: Inevitable resource crunch of parallel deployment rollouts.

Understanding the Technology Interdependencies

In the previous section we claimed interdependencies between the three new technologies: IP Voice, high-speed transport pipes, and network virtualization. These inter-relationships will make it difficult for the operator to gain confidence in rolling out each new technology, as well as challenging to pinpoint source problem areas. In this section we will detail a number of those interdependencies for further debate.

What are the interdependencies that will drive the Triple Challenge?

Figure 3 shows the stages of a technology deployment and rollout, and denotes that whichever technology is used to start the process, resource constraints are experienced by the need to roll out the other two Triple Challenge technologies. Independent of the starting technology, the interdependencies and technology interrelationships will cause the rollout of all three.

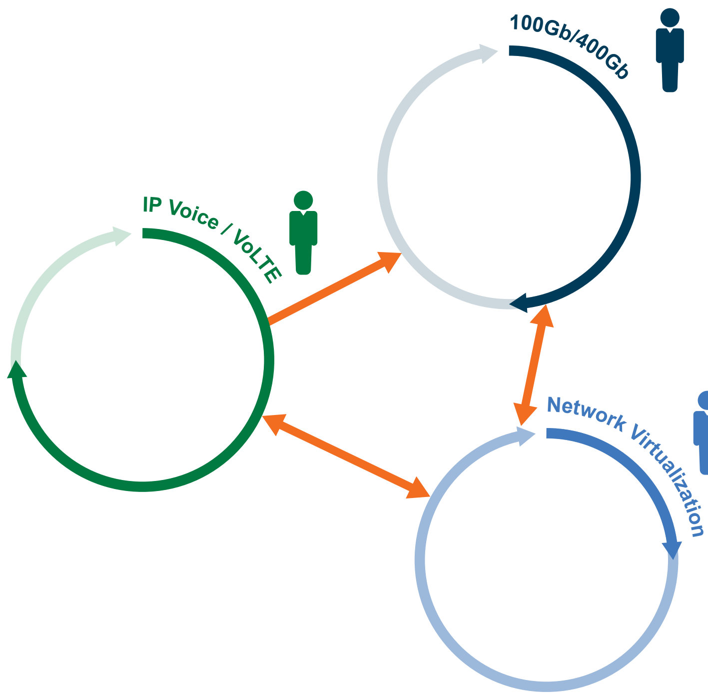

Figure 3: The cause and affect of each technology on the other technology deployments.

Starting with the deployment of IP Voice – VoLTE

Deploying VoLTE leads to greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipe deployments
• More data from packetized voice causes the need for greater bandwidth in order to guarantee dual bandwidth voice-RTP QoS • More data is driven into the core by the 2G to 4G/LTE RAN conversion which requires more bandwidth for enhanced LTE services
Deploying faster transmission pipes such as 40Gb or 100Gb/400Gb leads to network virtualization
• Removal of the final bottle neck: If the pipes are wide enough, the last bottle neck will now be the network elements (NEs) themselves • Do more while preserving existing CAPEX spend: Operators are able to go with "white box" and bare-aluminum solutions over single-use, non-upgradeable, dedicated, and often proprietary solutions
Deploying IP Voice – VoLTE leads to the deployment of network virtualization
• New services will be brought out as virtual network functions (VNFs) on NFV enabled networks. The ability to deploy a traditional upgrade on a legacy network may be short lived. • By virtualizing first, VoLTE could be deployed as part of a virtual EPC (vEPC) where a virtual IMS (vIMS) core could be deployed as a VNF

Starting with the deployment of network virtualization

Deploying network virtualization leads to the deployment of IP Voice – VoLTE
• Efficiencies can be experienced by collapsing multiple different service cores together • Network Virtualization allows cost reductions in the vEPC and new services to be deployed such as VoLTE
Deploying VoLTE leads to the greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipe deployments
• More data from packetized voice causes the need for greater bandwidth in order to guarantee dual bandwidth voice-RTP QoS • More data is driven in to the core by the 2G to 4G/LTE RAN conversion which requires more bandwidth for enhanced LTE services
Deploying network virtualization leads to greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipe deployments
• Virtualization of network elements with greater processing throughput pushes the bottle neck elsewhere • Now that compute and storage are elastic, the pipes have to be upgraded to deliver low latency, bandwidth contingent, transport and content delivery assurance, and be able to handle RTP service QoS

Starting with the deployment of greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipes

Deploying greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipe deployments leads to the deployment of VoLTE
• If the converged core is already running at increased speeds such as 40Gb or 100Gb/400Gb, then the RAN coverage can be increased. Therefore the 2G RAN is converted to VoLTE to enable the expansion of 4G/LTE data which produces more operator revenues • If 4G/LTE RAN is already running at increased speeds such as 40Gb or 100Gb/400Gb and has available bandwidth, then VoLTE can be deployed. This allows for the re-farming of the 2G RAN to enable expansion of 4G/LTE data which produces more operator revenues
Deploying VoLTE leads to network virtualization
• Reduced CAPEX spend by deploying a virtualized core, vIMS, instead of a traditional legacy VoLTE deployment • Virtualization will allow future ease of software upgrades, as well as ease of offering further enhanced or new software-defined services
Deploying greater density 10Gb, or new 40Gb or 100Gb/400Gb transport pipe deployments leads to network virtualization
• The cost of deploying wider transport pipes forces the move to virtualize to recover costs that would have been spent on single-use, often proprietary network switching or routing technologies. Use of SDN and NFV can save costs associated with routing and switching and allow the network to become more flexible • The ability to provide more efficient and elastic content farms and Big Data analysis is driven by high speed links • Elastic storage and compute are needed to power an operators future needs, even to offer Cloud capabilities as a service to their residential and business subscribers/customers • In order to overcome subscriber bandwidth issues at the network edge, virtualized services are needed such as video transcoding, bandwidth treatments on-the-fly, and service treatments on-the-fly such as "throttling as a VNF"

How Will the Interdependencies Cause Network and Service Related Issues?

In the previous section we have demonstrated the interdependencies between the three new Triple Challenge technologies. Here we will explain the unique capabilities of a unified tool rail and how deploying one can bring a new insight to modern monitoring: understanding the inter-related deployment dependencies via cross-technology monitoring, allowing you to find the "needle in a haystack" faster, and oftentimes to vastly reduce the size of the haystack.

In order to correctly monitor the new technologies, it is important to understand what is needed and why

- IP Voice (VoLTE/VoIMS/VoWiFi) being based on RTP is a very sensitive service, complete visibility from edge to core is needed to debug complex transport/service layer inter-related issues
- Bonded 10Gb, 40Gb, and 100Gb/400Gb Transport needs advanced processing across the fabric. Edge filtering and data optimization get the most out of the attached tools. Specifically today there are no tools capable of connecting to, nor monitoring 100Gb/400Gb transport pipes
- Network virtualization is a complex new technology with no built-in monitoring capability. To deploy NFV is to remove the visibility from a large part of your existing network

Specific issues related to IP Voice/VoLTE

- Effects of bursty traffic types and other RTP types in the same transport pipe
- Effects of server virtualization, network function virtualization on RTP-based voice traffic
- The effects of dynamic loading on RAN backhaul and RTP traffic QoS requirements

Specific issues related to 100Gb/400Gb transport pipes

- Effects of virtual servers being provisioned and de-provisioned
- VNF provisioning overhead and monitoring needs
- Multiple standards and changing technology associated with 100Gb/400Gb transport links

Specific issues related to network virtualization

- IP Voice/RTP QoS requirement overhead and associated transport pipe related issues
- Affects of huge traffic draw on services and virtualization trafficinduced burstyness
- Effects of vMotion and effects on other VNF's/SDN controller decisions resulting in knock on traffic delay/jitter/latency issues

Industry Proof Points for the Triple Challenge

Introduction of Apple iPhone 6

The introduction of the iPhone 6 represented the second widely deployed IR.92 compliant VoLTE SIP/SDP stack in a handset device after the Samsung Galaxy S series – there are now many more device-types deployed. This has introduced many new interoperability issues between the handset devices and the various manufacturers of the network core equipment. Given VoIP has been deployed approximately 15 years prior to this announcement, with well documented and well known service outages, how can we guarantee the same issues will not again arise? In addition to network element interoperability, there are also issues around how a call is carried over to a 3G network and a 2G network, or even out to a handset which is using WiFi as its connectivity. With more devices coming on line the question is "how to find and identify the problems that will arise?" Are you ready for VoLTE?

Over 10 years working with leading operators

When meeting with operators in the field, the existence of service and transport silos are often apparent. A common misconception is that "my transport network is running within agreed parameters, therefore the services running over that transport will be fine." Looking at that statement in more detail yields the following analysis:

With circuit switched technologies, it was a reasonably safe assumption if the transport layer was good, the service layer would also be good—this was due to the extremely predictable nature of the PSTN and common timing across the network. But this no longer holds true for the packet switched era. For example, let's consider route flapping which can occur with either traditional packet switched routing or with newer SDN routing schemes.

Where a route flaps and causes a different set of transport links to be used, the adaptive jitter buffers in the handsets have to re-train to adapt to the new jitter, delay and latency which is apparent on the new network links. Packets have to be discarded, dropped or replayed at a higher sampling speed than that of regular voice in order to catch up with or delay the arrival of the RTP packet stream with the new transport characteristics. So as a result, just because the transport network changes, independent of whether it stays within end-to-end specification, service outage causing effects will be experienced at the services layer. A unified tool rail, through the monitoring of both the transport and the services layer, will help to diagnose these issues which could be coming from the interdependencies and inter-relationships between the new Triple Challenge technology deployments.

Examples

Nokia Networks claimed NFV first in 2014; "major operator" to launch cloud-based VoLTE[1]: Here we saw an operator wanting to deploy VoLTE, but deciding to go down the network virtualization path first in order to deploy a virtualized version of VoLTE from the get-go. This lends industry proof to the interrelationship between these two technologies—as has been stated earlier.

Vodafone UK stepped closer to VoLTE in 2014[2]: This is an example of an operator wanting to deploy VoLTE to free up spectrum on their 2G and 3G networks and carry more data. Consequently bigger transport pipes were deployed.

Vodafone Australia's core upgrade paved way for VoLTE[3]: This operator modernized its core network to prepare for the launch of VoLTE trials, and then planned a full commercial rollout in 2015. They have stated they would virtualize their core before deploying VoLTE as a service, also likely increasing the width of their transport pipes as part of their upgrade in the process.

Smartphone Data Consumption is 44 Percent Greater on Larger Screen Phones: Another interesting industry interdependency calls out the direct relationship between handset display size and the amount of data flowing to and from that handset type. "Wi-Fi and cellular data consumption on smartphones with screens 4.5 inches and larger is 44% greater than it is on smartphones with screens less than 4.5 inches."[4] Just with the deployment of the prior generation and in anticipation of the next generation of iPhone, we see greater amounts of traffic on the network, independent of the services offered to the phone or how those services are transported.

[1] Wieland, Ken, "Nokia Networks claims NFV first; "major operator" to launch cloud-based VoLTE this year," http://www.mobileworldlive.com/nokia-networks-claims-nfv-first-major-operator-launch-cloud-based-volte-year & http://www.lightreading.com/nfv/nfv-elements/nokias-nfv-strategy-starts-with-volte--/d/d-id/710622 (September 4, 2014)
[2] Wieland, Ken, "Vodafone UK steps closer to VoLTE," http://www.mobileworldlive.com/vodafone-uk-steps-closer-volte (August 6, 2014)
[3] Waring, Joseph, "Vodafone Australia's core upgrade to pave way for VoLTE," http://www.mobileworldlive.com/vodafone-australias-core-upgrade-pave-way-volte (August 21, 2014)
[4] "Smartphone Data Consumption is 44 Percent Greater on Larger Screen Phones, According to NPD," NPD Group, http://www.connected-intelligence.com/about-us/press-releases/smartphone-data-consumption-44-percent-greater-larger-screen-phones (November 18, 2013)

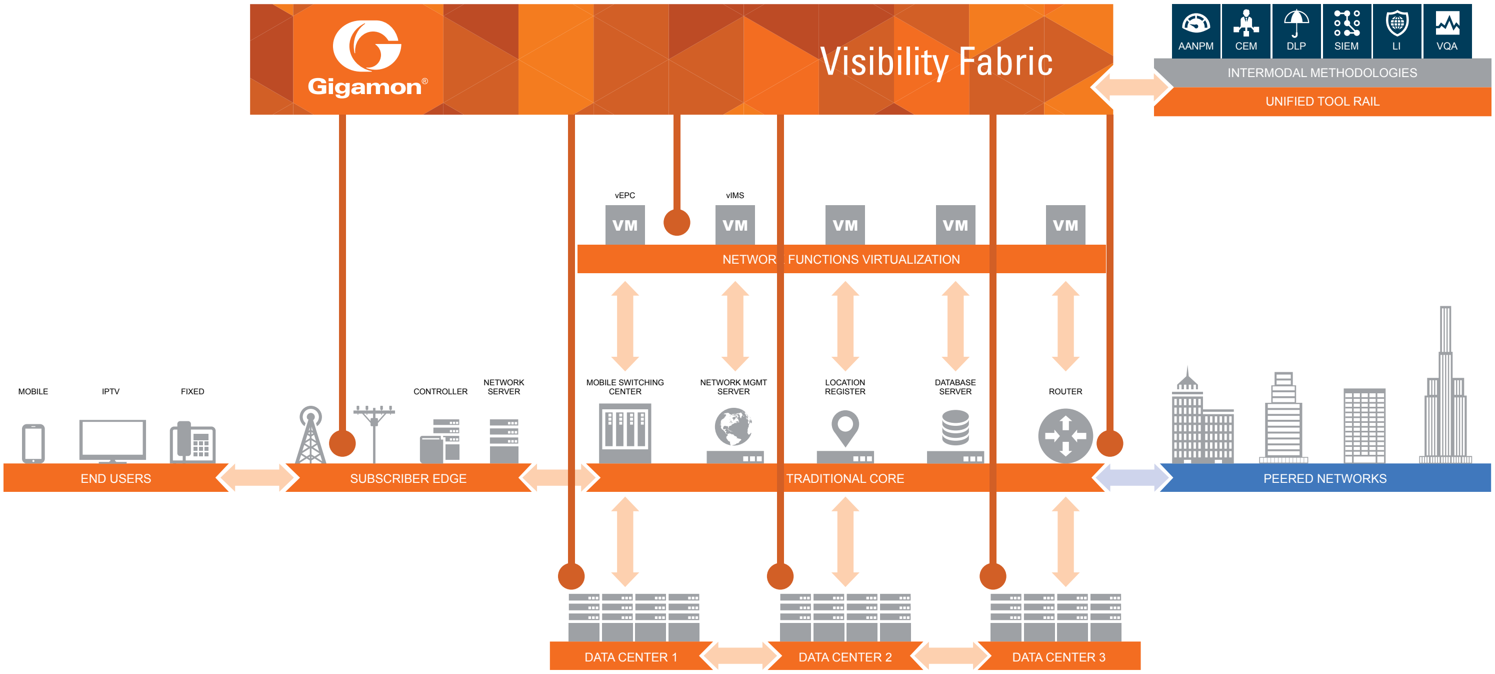

Figure 4: A Unified Tool Rail approach leveraging the Gigamon Visibility Fabric to provide pervasive visibility across environments and technologies.

How a Unified Tool Rail Helps to De-risk the Deployment of the New Triple Challenge Technologies

In this diagram, we can see how a unified tool rail that has visibility to each new technology and to all the places in the network where issues could become apparent will allow operators to be able to de-risk the deployment of the new Triple Challenge technologies in a predictable and systematic way.

The unified tool rail shown in the diagram above is superimposed on top of the Gigamon Unified Visibility Fabric™ architecture which sits on top of the network itself. All parts of the network are being monitored in unison, allowing the following to be understood and analyzed:

- How each of the Triple Challenge technology deployments affects the other technologies
- How each transported traffic type is affected by each deployed technology
- How RTP traffic is affected by other transported traffic types

The diagram also includes the new NFV layer and the more traditional virtualized data center layer. This allows the operator to understand if there are interactions between the user-generated East/West traffic and possible interactions with the North/South virtual transport traffic. Spot solutions, or "thin layer monitoring solutions" from existing router and switch manufacturers simply do not have either the pervasive visibility—for example no ability to monitor virtual networks, nor the rich feature set to be able to make sense of the monitored data. Therefore they do not possess the ability to provide insight on the complexities associated with the deployment of Triple Challenge technologies. The advantage of a unified tool rail and the Gigamon Unified Visibility Fabric architecture is the ability to gain visibility across the new technologies eliminating any barriers or silos.

In Figure 4 above, it can be seen that each of the three new technologies is being comprehensively monitored, such that the impact of one upon another is minimized, facilitating the prompt understanding of the unknown or misunderstood interdependencies. When looking for the "needle in the haystack," end-to-end visibility changes the dynamic of monitoring. This allows an operator to not only reduce the size of the haystack, but facilitates looking at the correct haystack and more importantly for the correct needle, instead of a fake needle. Overall the ability of the monitoring system, the Unified Visibility Fabric architecture, and the unified tool rail can enable the operator to de-risk the deployment of new technologies, maintain network uptime, deploy technologies faster with the same amount of resources, reduce network and service down time, reduce customer support service call costs and ultimately reduce churn.

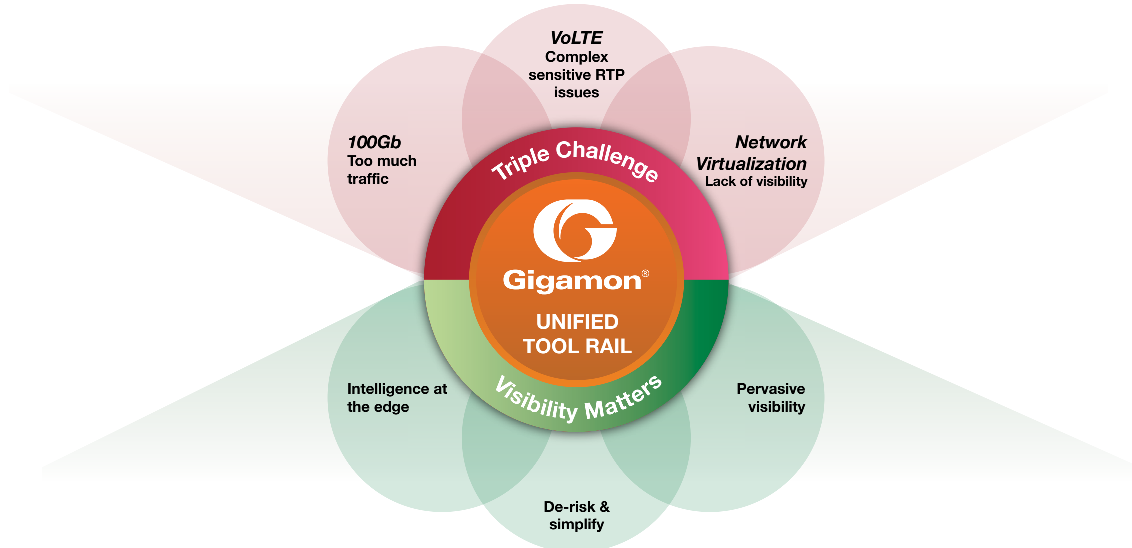

Figure 5: The challenges of the Triple Challenge technologies and the benefits of a unified tool rail coupled with visibility.

Conclusion

Service Providers are contemplating how to de-risk their rollout of several new technologies, namely IP Voice (VoLTE/VoIMS/VoWiFi), network virtualization and 100Gb/400Gb transport links. The interdependencies of these new and largely untried Triple Challenge technologies poses a great change in how service providers architect their networks and how services will be deployed across them.

Traditional methods of deploying new technologies in series, one after another, will no longer be viable. And, in order to de-risk Triple Challenge deployments and understand technology interactions, monitoring will become critical. No longer can monitoring solutions operate in silos for each technology independent of each other. Legacy, low cost/thin monitoring solutions defend against "spot" problems only and are not useful to network-wide monitoring.

By deploying a unified tool rail and leveraging the power of the Gigamon Visibility Fabric architecture, operators can achieve pervasive visibility across their physical and virtual infrastructure with the ability to monitor speeds up to 100Gb/400Gb. With distributed processing offered by the Visibility Fabric, data can be intelligently delivered to a unified tool rail supporting the diverse monitoring needs of operators as they strive to maintain uptime, realize operational efficiencies, and gain greater insight in order to accelerate and de-risk technology rollouts. With a unified tool rail, OPEX can be preserved and CAPEX can be reduced.

About Gigamon

Gigamon provides an intelligent Unified Visibility Fabric™ to enable the management of increasingly complex networks.Gigamon technology empowers infrastructure architects, managers and operators with pervasive visibility and control of traffic across both physical and virtual environments without affecting the performance or stability of the production network. Through patented technologies, centralized management and a portfolio of high availability and high density fabric nodes, network traffic is intelligently delivered to management, monitoring and security systems. Gigamon solutions have been deployed globally across enterprise, data centers and service providers, including over half of the Fortune 100 and many government and federal agencies.

For more information about the Gigamon Unified Visibility Fabric visit: **www.gigamon.com/solutions/service-providers**

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