BROCADE

New IP Toolkit

What (Exactly) is The New IP?

New IP is...

A new way to architect networks. New IP is an industry term that refers to a relatively new class of IP networking gear (hardware and software) that allows companies to build programmable networks to innovate more rapidly at lower cost.

Defined by its characteristics. New IP is open, highly virtualized, software- centric, vendor agnostic, automated, flexible and scalable; it also makes liberal use of merchant silicon, to cite just a few of its hallmarks.

A lower-cost option. The purpose of New IP is to support rapid service innovation and user self-service at a lower cost than traditional IP networks.

Without borders. New IP has no network "edge." In the New IP environment, the edge is redefined as a set of activities where the user interfaces and executes an application, whether mobile or fixed.

Applicable to all users. New IP is not limited by user type; with New IP, the hardware and software are combined to meet the needs of the specific environment. This allows each user to move at its own pace, starting at the edge or in the data center depending on where the most value can be created.

An industry effort. New IP is not the exclusive domain of any one vendor or geographic market; it is a class of gear (hardware and software) that is being promoted and sold by vendors globally.

Fully embraced by Brocade. Brocade is among the leaders in global data center network equipment providers, and is fully committed to helping companies migrate to the New IP.

The next step in the evolution of IP networking. New IP will support rapid innovation in business models and services for the next 20 years.

Let us tell you about New IP and how it can help Your Business, Today.
#NewIP

What (Exactly) is The New IP?

New IP is Not...

Exactly new. New IP, as a market segment, has been emerging over the past few years. Thanks to advances in networking, the New IP segment is starting to gain traction globally, hence the "new" reference.

A redefinition of the actual Internet Protocol. Let's be clear—New IP is not an attempt to rewrite the original IP protocol. Rather, it is an industry term that refers to a relatively new class of networking gear (hardware and software) now emerging.

Old IP. We define Old IP as the classic version that debuted in the mid-1990s. Old IP networking is based on a proprietary (closed), vendor-specific and driven business model that relies heavily on expensive customization. It was never designed for high virtualized environments, M2M traffic, hyper scale, rapid service innovation, and self-service delivery models. New IP does all that, and more.

A product. New IP is an industry term that refers to a relatively new class of IP gear (hardware & software) that is architected in a way that makes the resulting network programmable, scalable, open and cost effective.

Limited by user segment. Just as IP networks support users across a broad spectrum of industry, New IP supports service providers of all types, education, government, as well as enterprise businesses.

The exclusive domain of any one vendor. New IP is an emerging segment of products (hardware and software) sold by Brocade and other networking vendors globally.

A marketing campaign. New IP is a class of gear (hardware and software) that incorporates advances in networking technology over the past 20 years to turn the core IP protocol into an efficient workhorse for users. It's also true that Brocade is actively marketing its New IP product line, and this card is one example of that!

Let us tell you about New IP and how it can help Your Business, Today.
#NewIP

What (Exactly) is The New IP?

Talking points:

- The New IP represents an industry movement to make the network an innovation platform for business models, for services, for revenue growth and for accelerating change. Gartner calls this the "digital business." IDC refers to it as the third platform of cloud, mobile, social and Big Data.

- At issue is the belief that current networks have become too expensive to deploy, too cumbersome to manage and too inflexible to change.

- New technologies such as the Internet-of-Things (IoT), machine learning and 5G, along with ever-growing bandwidth and service demands are forcing a review of the conventional, proprietary approach to network deployment.

- New IP takes inspiration from the way hyperscale web 2.0 companies have designed and built their compute, storage and network infrastructure: With New IP, the data center moves from the back office to the front door, supporting the user's brand and business.

- Much as the mainframe world of proprietary systems was broken-up by the separation of hardware, operating system and application, the network world is similarly fragmenting providing an ability for innovation at the chipset—with merchant silicon; at the network control layer—with controllers such as OpenDayLight; and at the network application and services layers—with Virtual Network Functions.

- Companies claiming a stake in the New IP have to provide products or components that by their very nature can be replaced with another vendor without changing the configuration of any other system (just as you can replace your TV and expect it to still work with your HiFi). This new model of openness requires not just open protocols, but open software interfaces and open management.   This forces vendors to compete on the value of their components, prevents lock-in and ensures continuous innovation in the functionality and performance of each component.

- Companies adopting the New IP typically also adopt a DevOps model of operation, where automation, self-provisioning and continuous innovation of their network are requirements.

- For users of the New IP—both enterprises and consumers—the network is now highly personalized and configurable.   Because of the virtualized network environment the New IP brings, every customer really does get their own network.

- In New IP environments, architectures rely on open interfaces to reduce single-vendor dependencies and software is based on commodity hardware and merchant silicon where possible. Companies tend to move to a New IP architecture when they desire to support new business models and new services. As an example, AT&T announced their Domain 2.0 initiative to gain operational and financial efficiencies, while delivering a platform for fast innovation of new services.

- In the New IP environment, edge services can be delivered virtually, from the cloud, or physically from virtualized network services on a general server.
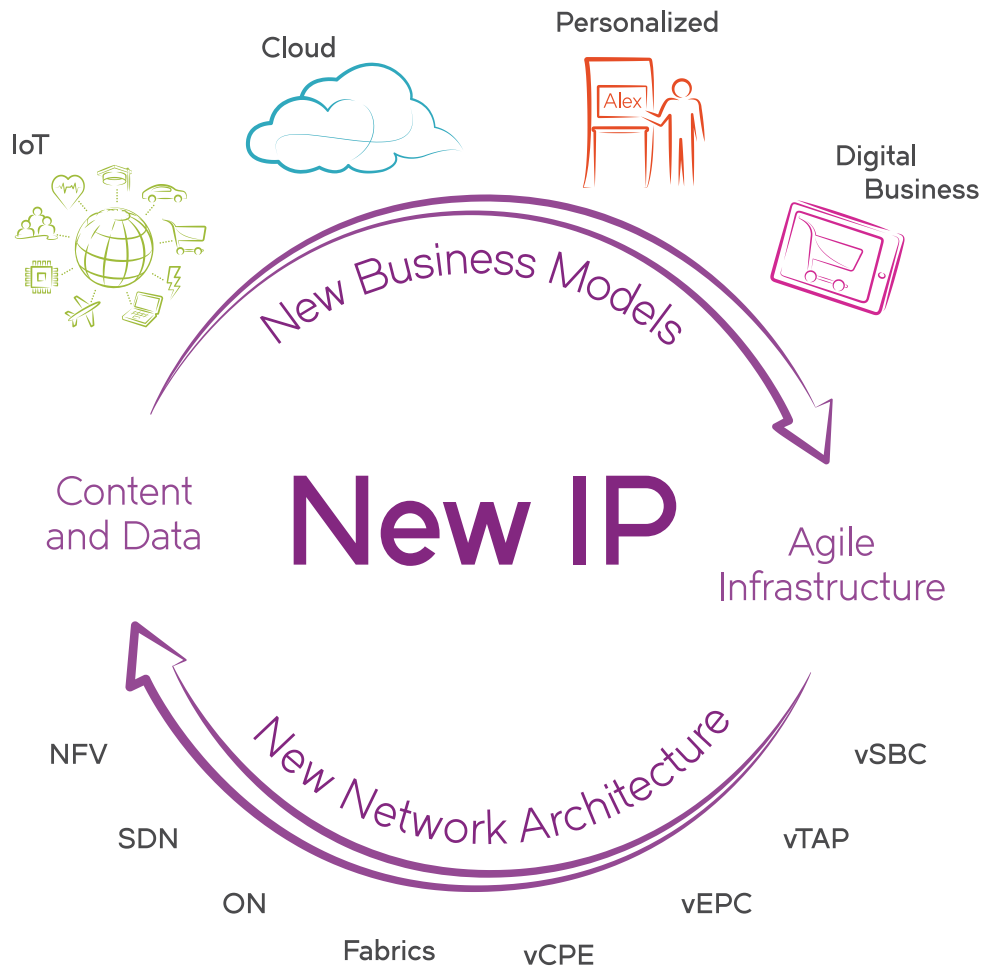
- New IP is agnostic in terms of the customer type—it supports everybody. This includes, but is not limited to: service providers (all sizes and types), large enterprise, education and government agencies.

- New IP makes use of YANG models, open source projects like ODL and OpenStack, NetConf, NFV, SDN, and more.

- New IP builds on the foundation laid over the last 20 years, and takes it to the next level of open, programmable and scalable networks designed for our modern era.

- New IP allows companies to build programmable networks, allowing them to innovate more rapidly at a far lower cost. This allows each user to move at its own pace, starting at the edge or in the data center depending on where the most value can be created.

- Old IP—referring to the original version that debuted in the mid-1990s—was never designed for high virtualized environments, M2M traffic, hyper scale, rapid service innovation, and self-service delivery models.

- **New IP is designed for all this, so it doesn't have these limitations.**

- **New IP is the future of IP networking.**

- **New IP is the future of networking...Did we mention that?**

Compute Transitions Drive the Need for the New IP Network

January 2015

Prepared by:

Zeus Kerravala

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Introduction: A New Model for Networking Is Needed

The enterprise network has undergone two major transitions since the introduction of computing as a pervasive business resource. First, the client/server era introduced networking and created the need for basic local-area network (LAN) connectivity. During this era, LANs lived in isolation, and there were several competing connectivity methods including SNA, AppleTalk and LANtastic.

Second, the next wave of computing introduced branch office connectivity and gave rise to the corporate wide-area network (WAN). Branch office computing created the requirement to connect the LAN "islands" to one another. The era of branch computing brought about routed IP networks to interconnect locations. Also, the network evolved to have limited application intelligence for prioritization purposes.

Now, cloud computing is driving yet another shift in the network as the cloud creates new demands that legacy networks simply cannot meet. The cloud computing era is here, and the network must be able to deliver cloud principles everywhere. The network needs to become open and agile, and it must shift to a new economic model to be in better alignment with the cloud (Exhibit 1).

Legacy networks were designed for an era when the connected endpoints were static. Rigid endpoints meant the network could also be rigid in architecture. Also, most traditional, premises-based applications were "best effort" in nature, so the network that delivered the applications could be designed with best effort in mind. In reality, despite the billions of dollars spent on network infrastructure, current networks are no better than "good enough."

Although a good-enough IP network may have been sufficient until now, it will not meet the future demands of the cloud computing era. The cloud is a key enabler for other key technology trends such as mobility and the Internet of Things. Cloud services are elastic in nature and require a network with an equal amount of agility. The next era of computing will enable the connectivity of an order of magnitude more devices, requiring the network to scale up and out almost instantaneously. Additionally, network operators will need the ability to create services anywhere, at any time, and those services must be migrated whenever required. Cloud providers have already adopted new network models, and it is critical for network operators to follow these models to remain competitive.

Today, the rigidity of legacy networks inhibits network operators and enterprises from taking full advantage of the cloud. Additionally, the inefficient, manual processes that plague network operations today have driven costs up to the point
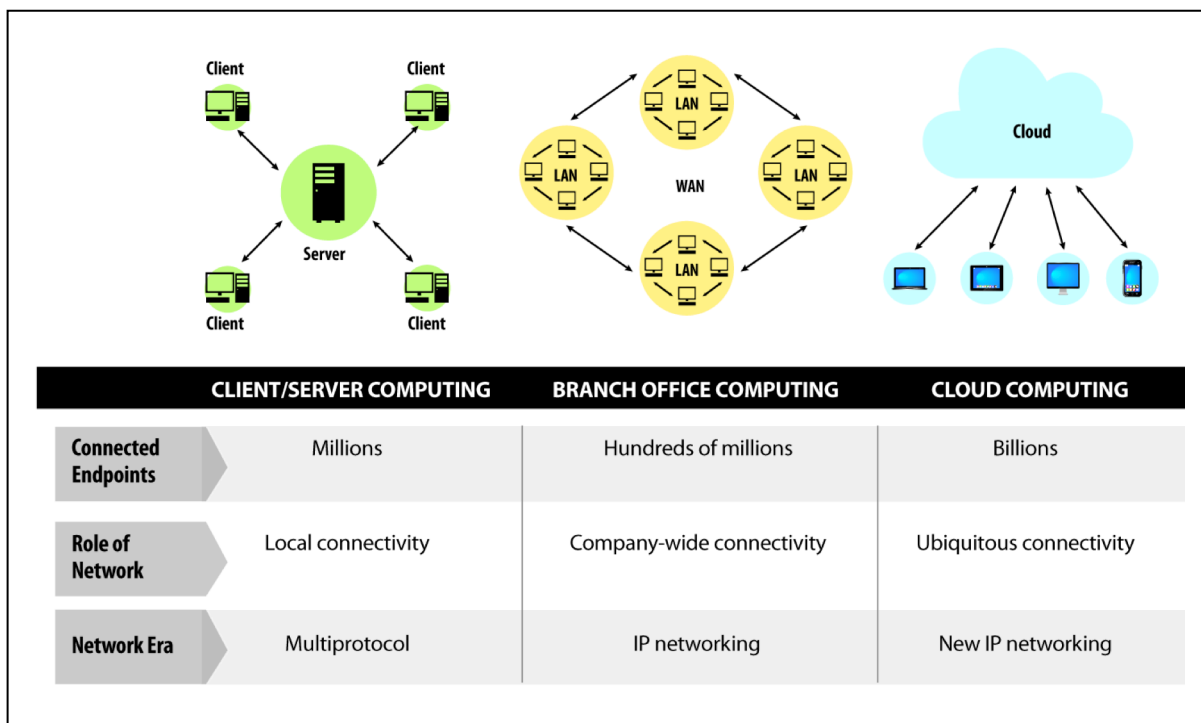
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Influence and insight through social media

Exhibit 1: The Network Needs to Evolve to Support the Cloud Computing Era

	CLIENT/SERVER COMPUTING	BRANCH OFFICE COMPUTING	CLOUD COMPUTING
Connected Endpoints	Millions	Hundreds of millions	Billions
Role of Network	Local connectivity	Company-wide connectivity	Ubiquitous connectivity
Network Era	Multiprotocol	IP networking	New IP networking

Source: ZK Research, 2015

where there is little time or budget for innovation. The ZK Research 2014 Network Purchase Intention Study revealed that 83% of the budget allocated to managing networks is used just to maintain the status quo. What's required is a new type of network that is better aligned with cloud and mobile computing.

To address the needs for this next generation of computing, evolving the network is now a business imperative. The New IP network is open, standards based and flexible, and it can meet all the new demands that cloud computing brings. Organizations that embrace the New IP era will thrive and leapfrog their competition, while those that do not will fall behind their peers and rapidly become irrelevant.

Section II: The Challenge with Legacy Networks

The architecture and infrastructure used to build legacy networks have not changed in almost three decades. There have been great leaps in the speed of network connections and the density of ports, and link latency continues to fall. However, the network

is fundamentally the same as it was 30 years ago. Many limitations need to be overcome if organizations are to make the shift to a New IP network. These limitations include:

- **Rigid architecture and topology:** The architecture used to build traditional networks was designed for an era when IT resources such as compute and application infrastructure were fairly static. Therefore, the network, too, could be rigid in nature. When an event occurred that required the network to change, such as adding or deleting a new application, long lead times were often required to make even simple changes. In today's era of increased agility requirements, this is not acceptable because the IT infrastructure can only be as agile as its least agile component—which is often the network. Too often, the rigidity of legacy network infrastructure is a huge impediment to organizations becoming agile businesses.

- **Siloing of the network inside IT:** The network has always been treated as its own silo within the IT department. Network changes can certainly

impact the performance of applications and compute infrastructure, but historically the network was managed independent of the technology that sits "up the stack" from it.

- **Legacy networks built on closed, proprietary protocols:** Market-leading vendors have used closed, proprietary technologies as a way to deliver features faster instead of waiting for industry standards to be developed. Often, this leads to "vendor lock-in" and inhibits customers from implementing a best-of-breed technology. Despite these limitations, closed, proprietary networks were sufficient when the network existed in its own silo. The cloud has driven the need for greater integration among applications as well as compute and network infrastructure. Closed and proprietary technologies can hinder cloud ecosystems and limit innovation.

- **Inefficient use of network resources:** Traditional, multi-tier networks use Spanning Tree Protocol (STP) to protect against routing loops and broadcast storms. When multiple paths exist between two points, STP will enable the fastest path, disable the alternative route, and only make it active when the primary connection fails. STP was a great leap forward for networking a few decades ago. However, as networks have grown, the use of STP has caused organizations to overbuild networks. Today, as a result of STP, up to half of network ports are inactive because they are passive links. Consequently, service providers and enterprises have had to overbuild networks significantly, resulting in a less-than-optimal average network utilization of approximately 30%, according to ZK Research.

- **Hardware centric:** With legacy networks, any kind of scaling for additional capacity or new services must be done through the addition of new hardware. This typically requires "forklift upgrades" of the existing technology over a long period of time, resulting in lower application and data availability. In addition, the hardware-centric nature of legacy networks makes running a network very expensive, particularly for service providers and global enterprises that often need to add capacity or services quickly.

- **Manual configuration processes:** Traditional network devices, such as switches and routers, are designed with integrated control and data planes. Therefore, the majority of configuration and management must be done on a box-by-box basis. This leads to lengthy change management periods and a high amount of human error. The ZK Research 2014 Network Purchase Intention Study reveals that human error is the number-one cause of network downtime today (Exhibit 2). To enable rapid, accurate changes, automation has become a top priority, with IT leaders and business executives looking to automate changes to their compute and application infrastructure based on business policies. The device-centric nature of managing network devices makes it difficult, if not impossible, to bring automation to the network.

- **Lack of programmability:** Because converged infrastructure has become more commonplace, it's important that the network is able to interface with a wide range of applications and infrastructures to optimize performance. For example, when a video call is being initiated, the application needs to direct the network to reserve a certain amount of bandwidth for the voice and images. This is challenging today because legacy infrastructure lacks programmable interfaces, which prohibits application developers from programming the network to automatically accommodate these types of random traffic spikes.

- **Designed for "yesterday's" applications:** Traditional networks were optimized for old-school applications such as email, voice, CRM and other static applications. Today's applications are enabled by the cloud and include mobile applications, big data analytics and social business. These new-age applications have significantly different network requirements from their old-school counterparts, though there is still a need to simultaneously support both.

The shift to cloud computing is ushering in a new era in networking. A New IP network that is optimized for the cloud era is now required.

Historically, organizations made network infrastructure decisions based on brand, incumbency and market share versus technical superiority because "good enough" was adequate to support legacy compute models. But as the cloud era gains momentum and hybrid clouds become the dominant compute model, the network will continue to increase in value. Infrastructure that was good enough for Internet computing will not be sustainable for cloud computing. A New IP network is now a business mandate.

Exhibit 2: Human Error Is the Main Cause of Network Downtime
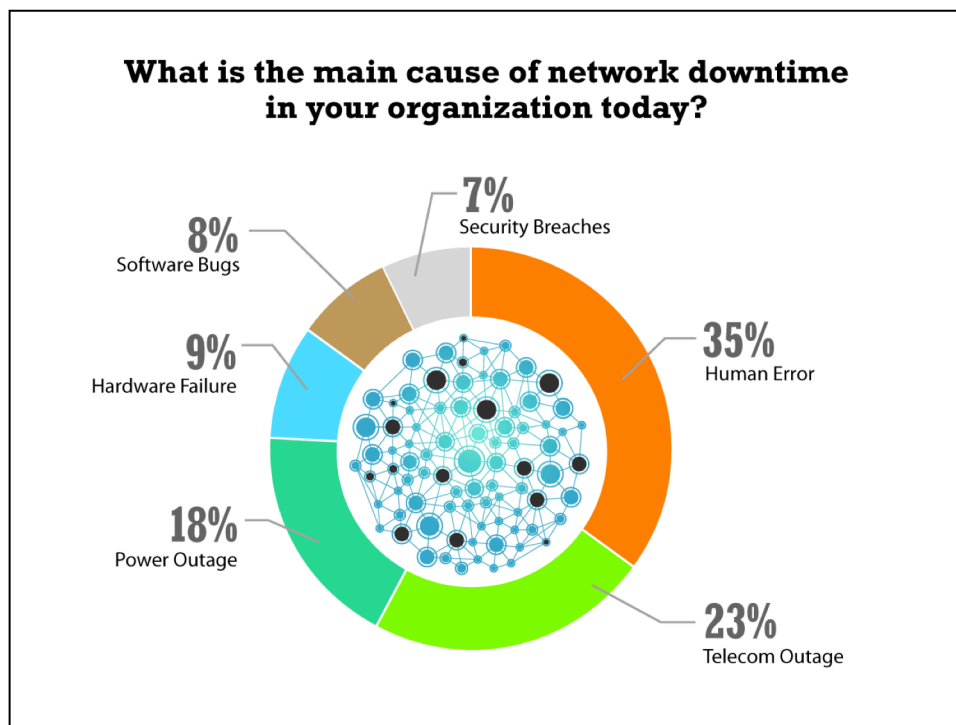
Section III: Defining the New IP Network

The New IP network is built for the era of cloud computing. It is highly flexible and agile, and it aligns with the other trends in IT.

The key characteristics of a New IP network are:

- **Built on a fabric architecture:** Network fabrics are built to handle the requirements of virtualization and the cloud. A network fabric can be thought of as a network in which every point is virtually connected to any other point. A fabric is a network system that connects storage, compute and network functions through high-bandwidth interconnects to function as a single, logical infrastructure unit.

  Fabrics will perform better and have higher availability and scalability than traditional networks, with better utilization. A network fabric has the following attributes:

  - *Optimized for east–west and north–south traffic flows:* Legacy networks are optimized for client/server traffic, which moves in a north–south direction. The rise of virtualization, cloud and big data has increased the amount of east–west traffic, which is generally handled poorly by traditional networks.

  - *Flat network architecture:* Traditional networks have three or more tiers. Each of these tiers requires extra hops for network traffic, which adds latency to the transmission of data and hampers application performance. A fabric is a flatter, two-tier network that simplifies the design, lowers latency and improves the flow of data (Exhibit 3).

  - *Evolves away from STP:* As powerful as STP has been, the protocol is long outdated. Network fabrics that utilize protocols such as TRILL are better aligned with today's trends in cloud computing. TRILL provides the same level of redundancy as STP but is designed with "active-active" links to improve overall network utilization.

Exhibit 3: Traditional Network vs. Network Fabric
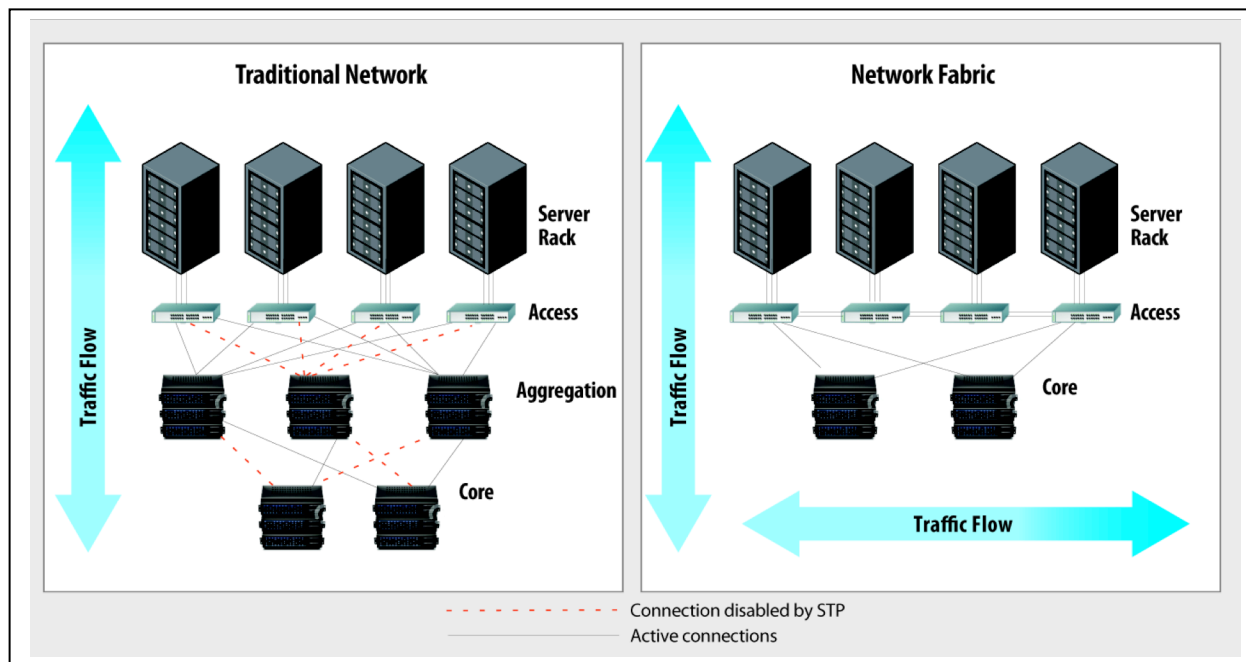
- **Centralized control through an open software-defined network (SDN) architecture:** With an SDN, the control plane and the data planes are physically separated (Exhibit 4). The centralized control layer enables a single point of control for the entire network. The centralized control functionality can be delivered via an SDN controller that can interface with business applications above it and the network elements below it.

- **Leverage the power of network functions virtualization (NFV) to create a virtualized network services layer:** Deploying network services typically requires new hardware to be installed at every point where the service will reside. This can be very expensive for organizations that run global networks, such as large enterprises and service providers. The physical linkage between services and infrastructure may cause organizations to miss out on significant business opportunities. NFV can enable a layer of virtualized services such as routing, VPN and load balancing that resides above the physical infrastructure. These services can be deployed, migrated or turned off through a centralized management console with no additional infrastructure being deployed. The virtualized service layer allows for any service to

be deployed in any location at any time. The virtualized service layer gives the New IP network a level of agility that legacy networks cannot achieve.

- **Network automation capabilities:** The cloud requires rapid deployment of applications and infrastructure services. Consequently, the New IP network must be agile to instantly adapt to changes within the business. The network's ability to adapt to the speed of the cloud hinges on the automation of network updates and configuration changes based on business policy. Automation also enables rapid provisioning of new services, which is vital for network operators to remain competitive with cloud providers. Legacy networks have few automation capabilities, whereas automation is a key characteristic of the New IP network.

- **Integration with orchestration systems:** Virtualized services, centralized control and automation are tremendous leaps forward for the New IP network. However, network management must be done in conjunction with the needs of the business and its users. The New IP network must integrate with orchestration platforms through standard protocols such as CloudStack and OpenStack to ensure interoperability within a broad ecosystem.

Exhibit 4: A Software-Defined Network Architecture
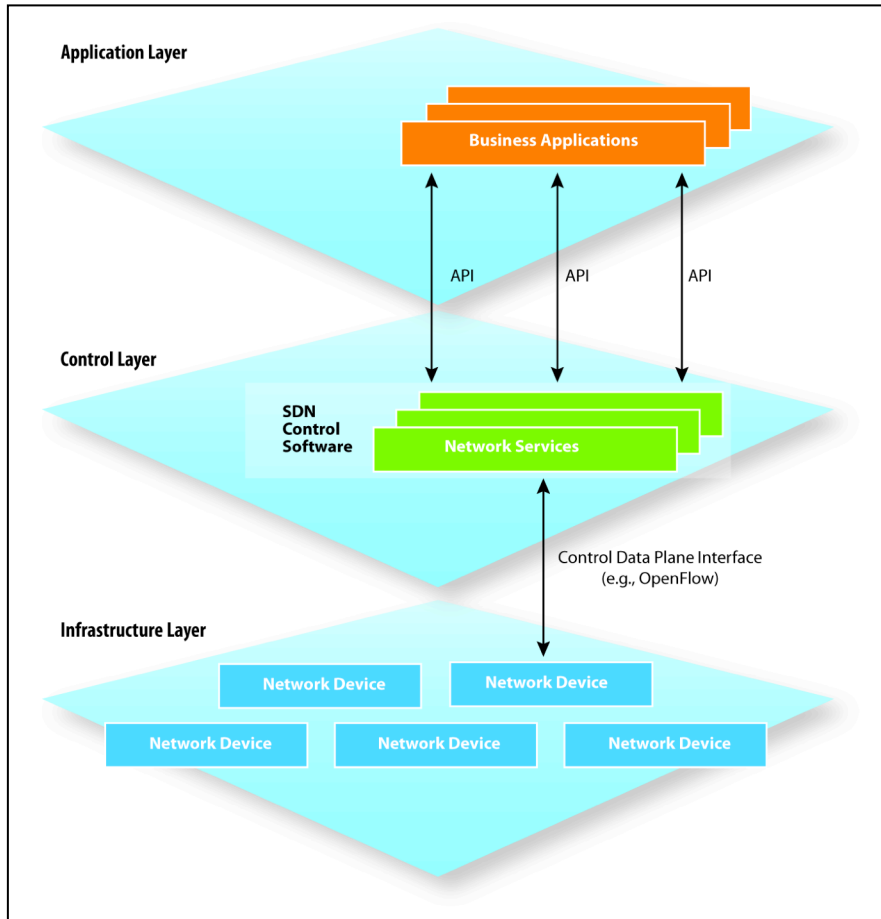
Source: ZK Research, 2015

- **Programmable network:** Historically, the network has had almost no level of programmability. Some highly skilled network managers can create scripts to program the network, but these skills certainly aren't widespread. In a New IP network, programmable application programming interfaces (APIs) must exist between the application and the control layer, and between the control layer and the infrastructure layer (Exhibit 4). Also, the APIs must be in a format that application developers can understand without having a high degree of network acumen. For example, many application, compute and network vendors are adopting the industry standard OpenFlow to standardize the programmability of a network.

- **The network as a security enabler:** The rise of the cloud and mobility has made security a top business initiative. In the ZK Research 2014

Network Purchase Intention Study, security was the top business driver of network investments. Many advanced security tools today use predictive analytics to secure the network. The New IP network should provide rich data and flow information to a wide range of security solutions to protect the business.

- **Pay-per-use economics:** Traditional networks typically required a high upfront commitment to purchase infrastructure because organizations were often forced to buy capacity they might not use for years. The New IP network incorporates a subscription pricing model so the network can be a true IT utility. A subscription model enables organizations to deploy the needed level of capacity today, but then add more when the business requires it.

- **Better interoperability between enterprises and cloud/service providers:** Legacy networks

were deployed as islands. A cloud provider or service provider network had very little interoperability with an enterprise network. The New IP network should enable enterprises to interoperate with cloud providers and network service providers through standardized protocols.

- **Designed for today's applications:** The network has always played a critical role in the performance of applications. The New IP network is optimized for today's applications such as virtualization, real-time video traffic, big data analytics, cloud computing and mobility.

The New IP network is an enabler of business transformation rather than the biggest impediment to change. Legacy networks had, at best, tactical value to a business, whereas the New IP network is a strategic asset that can both provide short-term value and be a platform for long-term competitive advantage. Exhibit 5 summarizes the main differences between a legacy network and the New IP network.

Organizations that shift to a New IP network will realize many benefits. These benefits will vary between enterprises and service providers but will center on providing an optimized customer experience.

The enterprise benefits of a New IP network are:

- Rapidly scale the network, both up and down and out and in.
- Shift to an IT-as-a-service model.
- Have greater network agility.
- Provision new applications and services at the speed the business requires.
- Evolve to a cloud-centric business model.

The service provider benefits of a New IP network are:

- Scale service offerings from a few mega data centers to thousands of virtual points of presence.
- Shift to a cloud business model and offer more pay-per-use services.
- Rapidly provision network services across the network.
- Lower operational costs.
- Have greater interoperability with customers.

Section IV: What to Look for in a Solution Provider

The demands of the cloud era are driving network evolution faster than ever before. The New IP network will play a key role in determining the ultimate success or failure of this next era of computing, and it will raise the strategic value of the network. Consequently, network decision-makers must shed old-school buying strategies based primarily on brand or vendor incumbency, and instead evaluate network infrastructure based on its ability to support the needs of the New IP network and the business.

However, what to look for in a network solution provider may not be obvious, especially with the evolution to cloud currently under way. Enterprises and service providers evaluating other solution providers must consider the following:

- Solutions built on open standards
- Breadth of ecosystem
- Robust APIs designed for software developers
- A leader in fabric networking
- Simplicity
- Economic flexibility

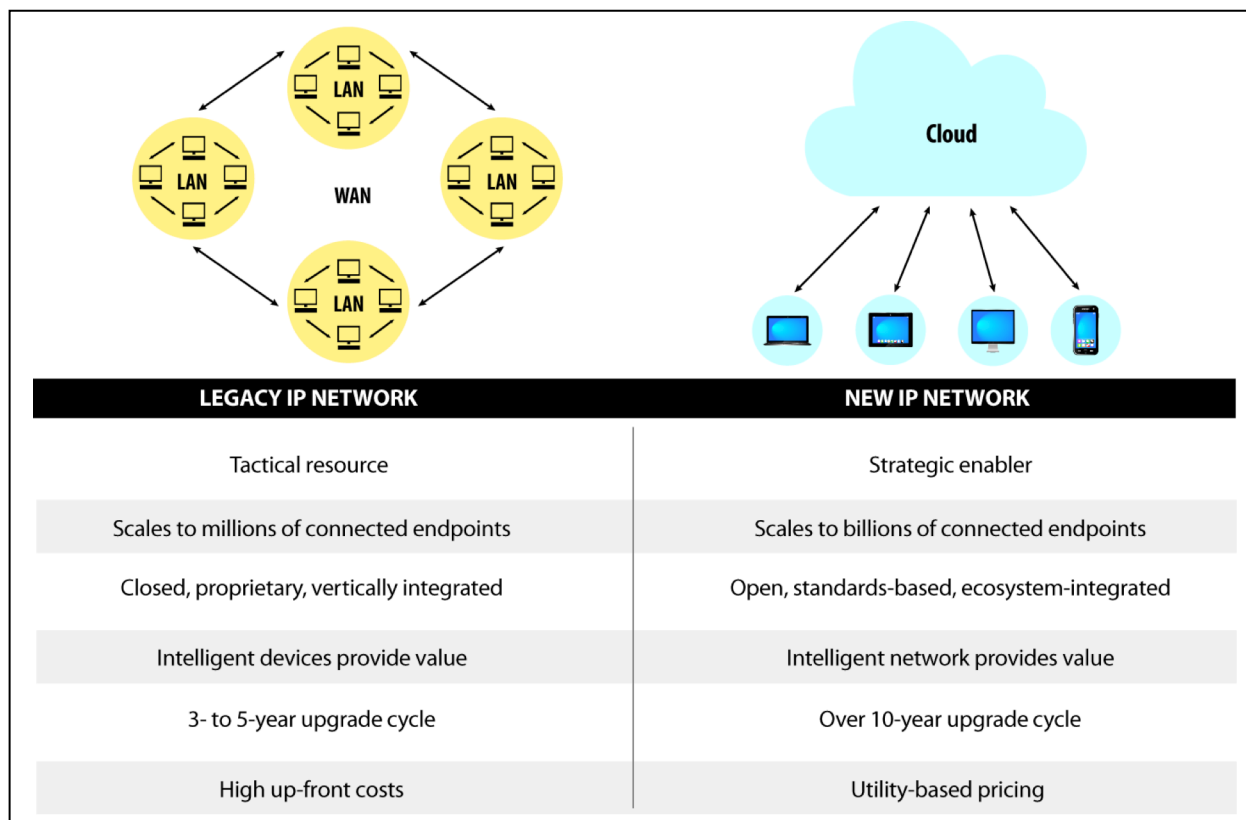Below is a detailed look at each evaluation criterion.

Solutions Built on Open Standards

There are many ways for solution providers to meet the requirements of the New IP network. Many vendors choose to use proprietary protocols and solutions to develop new products quickly. However, in the long term, doing so causes vendor lock-in and impairs a customer's ability to choose best-of-breed products in the future. A standards-based solution guarantees interoperability with other best-of-breed products and ensures a wide variety of choice. Solutions today must support standards such as TRILL, OpenFlow and OpenStack.

Breadth of Ecosystem

A solution provider that supports open standards and interoperability will have a large ecosystem of compute, application and storage partners. Having a broad ecosystem guarantees the ability to implement best-of-breed solutions either today or in the future and provides the greatest amount of choice. A broad ecosystem can also enable faster

Exhibit 5: The New IP Evolves the Network

LEGACY IP NETWORK	NEW IP NETWORK
Tactical resource	Strategic enabler
Scales to millions of connected endpoints	Scales to billions of connected endpoints
Closed, proprietary, vertically integrated	Open, standards-based, ecosystem-integrated
Intelligent devices provide value	Intelligent network provides value
3- to 5-year upgrade cycle	Over 10-year upgrade cycle
High up-front costs	Utility-based pricing

Source: ZK Research, 2015

feature velocity because customers do not need to wait for the vendor to develop every feature and product. Instead, these can be delivered via the ecosystem.

Robust APIs Designed for Software Developers

Almost every network solution provider offers APIs in network products today. However, most are limited in scope and require a significant amount of network knowledge. Network solution providers should offer APIs that mask network complexity and are usable by software developers and not just network engineers.

A Leader in Fabric Networking

The network fabric is the foundation for the New IP network. However, the concept of a fabric is still new to many network vendors even though it has been commonplace in storage networks for decades. Organizations looking to leverage the benefits of a New IP network should seek out a solution provider that is a leader in fabric networking and has a large

installed base of both storage and network fabric deployments.

Simplicity

Legacy networks are typically highly complex and require huge teams of costly engineers to run. Network vendors that enable a New IP network should have solutions that are simple to deploy, manage and tune by automating common tasks. It's important to note that "simple" does not mean "commodity" or "less advanced." In fact, it is much harder to build products that are simple to manage than it is to build complicated ones because the solution provider must create interfaces that mask much of the complexity. Escalating personnel-related costs could quickly outweigh any savings from using commodity infrastructure. For instance, a 2014 ZK Research data center study revealed that personnel-related costs account for 40% of the TCO in a data center. The key is for the network infrastructure to be more advanced than legacy products but also simpler and easier to manage.

Economic Flexibility

The cloud is built on the concept of economic flexibility. Customers have several different ways of procuring cloud services. The network should also have the same level of flexibility as the cloud if it is to meet the challenges of the cloud. Solution providers should offer economic flexibility in pricing models, such as subscription or per-port pricing, for optimized TCO.

Section V: Conclusion and Recommendations

The transition to the cloud computing era is evolving the network faster than at any other time in the history of IT. In this new era of computing, the network shifts from a tactical resource to one with high strategic value. The network must have the ability to scale from millions of devices to billions of devices and to do so faster than ever before.

To realize its full potential, the network needs to undergo a major transformation: The legacy IP network must now evolve to a New IP network. ZK Research recommends the following to help companies achieve this evolution:

- **Shed legacy thought processes when evaluating vendors.** The easiest thing to do when selecting a vendor is to leverage the incumbent or to make a purchasing decision based on market share. However, this can be the wrong strategy during moments of market transitions because the requirements post-transition can be markedly different from pre-transition requirements. Choose a vendor today that has a solution optimized for the New IP network: One that is built on a fabric and embraces cloud economics, open standards and broad ecosystems is a must for the New IP network.

- **Remove the complexity from the network.** Legacy networks are far too complex and rigid to support the vision of a New IP network. Shift to a simple, fabric-based deployment where many of the points of complexity have been removed. A software-defined network can centralize the control and management of the network, thereby simplifying network operations.

- **Embrace network automation.** After the network has been simplified and control has been centralized, network professionals should look to automate as many network tasks as possible. This will speed up configuration changes, reduce

downtime and allow the network operations team to focus on more strategic initiatives.

By taking these steps to transform their networks, organizations will be able to align their operations with the cloud. In turn, they will deliver much greater strategic value to the business.

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