Converged Supercore: Physical and Virtual Innovations, World-Class Silicon and SDN Programmability—Juniper's Perspective

New Level of Scale and Cost Control Right to the Core

The Internet has given even the smallest voices the power to share new ideas with a global audience—not by leveraging a massive broadcast infrastructure, but by accessing the cloud from the smartphone in their pocket. For example, a space enthusiast can share a passion for space shuttle launches armed with a camera, a tablet, and a dedicated Internet connection. What started as a hobby soon attracts 300,000 followers around the globe, sparking a new career.

In 1994, only 25 million people had access to the Internet, predominantly over dial-up lines using 9600-baud modems. In 2015, the number of people with Internet access will reach 3 billion, including 2.3 billion mobile broadband subscribers operating at an average speed of 1.3 Mbps. The accessibility of an idea increases with every new person or thing that becomes connected; as speeds increase, the methods and options for sharing those ideas increase apace. A text becomes a picture which morphs into a video, which evolves into a real-time interactive video conference, and so on. Technology has become so mainstream that today, a video gamer live-streaming "how to" achievements can become a Top 15 driver of bandwidth on networks worldwide.

Service providers have a profound impact on how users around the globe exchange ideas, whether for work, learning, or play. As new technologies emerge, network speeds increase, and as the remaining unconnected people and things join the Internet, this impact and influence will grow even greater.

Changing the World Requires Changing the Approach

There are real challenges to running a profitable business amid this exponential capacity and connectivity growth. Increased interactions between people, between machines, and between people and machines are creating massive communication flows with increasingly unpredictable traffic patterns. These two dynamics challenge traditional network products and architectures. Currently, many solve the problem by linearly increasing capacity in advance of demand by adding new equipment. Unfortunately, there is a fundamental limitation in trying to solve exponential problems with linear solutions. This limitation is compounded when static operations force carriers to overprovision capacity, deploying more than is required for each new bit demanded. This places an enormous capital and operational strain on service providers, forcing them into a never-ending cycle of anticipating growth and deploying sufficient capacity to address that growth, resulting in a razor-thin profit model. Providers wait eagerly for hardware performance improvements, only to see the bar moved yet again.

To break this vicious cycle, service providers need a new approach for dealing with this wave of Internet traffic. Complex, multidimensional growth is not sustainable using a unidimensional mindset. Only a combination of physical strength and virtual intellect will help providers break from the old ways and solve this emerging capacity problem. Combining brains and brawn will not only bring costs

down and allow networks to scale efficiently, it will also lead to more creative business models that will help providers add more revenue opportunities. By delivering a holistic IP and MPLS architecture that begins with the world's highest performing and most efficient silicon, expanding with the world's leading SDN programmability, Juniper Networks is best positioned to help service providers address the future.

Automate, Scale, and Create: Eliminate Excess Core Cost

Trusted equipment vendors must have a long-term vision to reduce cost pressures and increase profits. Juniper's vision is rooted in three simple foundational principles:

- **Scale** the infrastructure elastically
- **Automate** to remove operational complexity
- **Create** innovative, value-added services

While easy to articulate, these foundational principles are hard to deliver. They require engineering innovation and commitment at different altitudes—a challenge Juniper welcomes every day, to earn a place as a trusted partner.

Scale: Service providers require their entire network to scale up, scale out, and sometimes even scale down on demand. This requires pioneering innovation for scale that fundamentally starts with high-performance silicon, extends into high-performance systems, and ultimately leads to high-performance network-wide architectures.

- **Silicon**: Ultra-high network performance begins with advanced silicon. It's the atomic element from which the network is created. Unlike commodity or even merchant silicon, custom silicon is highly tuned and optimized to handle IP and MPLS traffic. "A designer knows perfection is achieved not when there is nothing left to add, but when there is nothing left to take away," said Antoine de Saint-Exupery. Diligent design optimizes the types of transistors, memory, and functions required to deliver the highest quality, lowest latency, fastest throughput, and lowest power draw in the tightest space possible.

  The all-new Juniper ExpressPlus™ ASIC is the latest example of Juniper's breakthrough silicon innovations. The ExpressPlus chip features 6 billion transistors in a 28 nm configuration, 3D memory technology that reduces space by 20x, and 1.6 billion advanced filtering operations per second for a whopping 500 Gbps of low latency, low power, IP/MPLS packet-processing throughput.

- **System**: Silicon innovations that push the boundaries of performance and efficiency can't solve the problems of service providers alone. The networking platforms that utilize Juniper ExpressPlus silicon—the Juniper Networks® PTX5000 and PTX3000 Packet Transport Routers—also require intricate system design in order to deliver meaningful performance, economics, and ease of deployment.

  With 24 Tbps of capacity, the PTX5000 outdelivers every competitor in the industry by at least 3 times. Furthermore, service providers can scale with the lowest cost per bit in the industry at 0.57 watts per Gbps. That means these new levels of scale can be accomplished in existing space and power footprints without requiring any facility redesigns. In addition, by taking advantage of Junos Continuity technology, the new 3 Tbps line cards can be added to an existing chassis with a simple driver update. This avoids lengthy requalification and high testing costs, allowing the

new capacity to be used in a matter of weeks, not months.

Unlike the competition, however, Juniper does not have a "one-size-fits-all" approach to core routing. Service provider operations centers vary greatly worldwide; not all central office environments can reasonably support full-sized routing platforms like the PTX5000. For those environments, the PTX3000 Packet Transport Router—offering 8 Tbps of capacity—is the only platform compliant with ETSI 300 mm standards. This means that the PTX3000 delivers all of the capacity the competition offers today in less than one-tenth the space and at one-eighth the weight. Capacity can be added without spending time and capital upgrading facilities to support power, cooling, and structural integrity before the equipment can even be used.

Juniper doesn't stop there, however—we do even better. These physical innovations are unparalleled, but still only part of the entire solution to control costs. Virtual innovations in SDN and automation expand cost control beyond the individual platforms and prepare the entire network for optimization.

Automate: Networks must be efficient and simple to operate. Operational complexity plagues operators and slows any material reduction in cost across the network. Virtual innovations bring SDN intelligence to complement physical strength and deliver network-wide optimization. The manner in which the service provider interacts with the network is transformed, reducing long planning cycles into real-time control. When what was once manually provisioned is now automated, operators can eliminate unforeseen errors and emergencies, drastically increase network utilization, and optimize the network across layers to bring down costs. For example, with SDN control, service providers increase traffic utilization by as much as 35 percent, making the most out of current investments. They can also reduce unnecessary capital spending caused by redundant overprovisioning by as much as 40 percent.

With Juniper Networks NorthStar Controller, network changes can be made for the first time with the push of a button. NorthStar uses open, standards-based protocols such as BGP-LS, NETCONF/YANG, Path Computation Element Protocol (PCEP), and REST APIs for third-party integration. Network operators can simulate, model, and implement changes with precision. Service providers can automate seamless network upgrades without fear of human error, SLA impact, and negatively influencing the end-customer experience. Rather than overengineer the router's hardware and software to implement hitless upgrades, SDN can be used to remove any router from the network resource pool and automatically redistribute traffic across the remaining routers, eliminating node maintenance windows. Furthermore, shifting transport topologies—even in multivendor environments—can be managed with certainty, making network upgrades and traffic optimization easy. The ability to predict the future means costs can be optimized, but amazing new ideas are also now possible. The network becomes flexible so that new services can be introduced much more rapidly and with lower investments.

Create: Juniper's Converged Supercore® architecture enables service providers to create virtualized services anywhere in the network by leveraging physical innovations to match traffic demands and virtual innovations to precisely control traffic network-wide, without sacrificing the services experience.

Conclusion: Giving Service Providers Scale While Driving Cost Down

Physical and virtual innovation requires dedicated engineering to holistically increase network scale while driving costs down. The Converged Supercore from Juniper—"Networks That Know How to Scale Up and Drive Costs Down"—liberates service providers from the status quo of tedious planning and upgrade cycles by scaling capacity with a fraction of the size and power, eliminating extensive test and qualification cycles, automating traffic optimization network-wide across all layers, and creating new opportunities for service creation with newfound elasticity.

It's time your network scaled as fast as your business. It's time you deployed the most efficient and easy to use core router available. It's time you unchained yourself from the burden of continuous manual network provisioning. It's time for a Converged Supercore from Juniper Networks.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net

Corporate and Sales Headquarters
Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, CA 94089 USA
Phone: 888.JUNIPER (888.586.4737)
or +1.408.745.2000
Fax: +1.408.745.2100
www.juniper.net

APAC and EMEA Headquarters
Juniper Networks International B.V.
Boeing Avenue 240
1119 PZ Schiphol-Rijk
Amsterdam, The Netherlands
Phone: +31.0.207.125.700
Fax: +31.0.207.125.701

3200048-001-EN Feb 2015