White Paper

BTI Systems' Application-Controlled Networking: A Software Platform for Innovation

Software-defined networking framework enables high-margin next-generation services

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Executive Summary

Escalating traffic volumes and mounting pricing pressures are forcing service providers to rethink the ways in which they build out infrastructure and deliver services. Operators must expand network capacity to accommodate growing video, over-the-top (OTT), and cloud traffic, but run the risk of deriving nominal incremental revenue from their infrastructure investments. Many service providers are re-evaluating their product portfolios and exploring new ways to increase revenues and boost margins. By implementing simpler, more dynamic and intelligent, software-defined networks, providers can better monetize infrastructure build-outs and more efficiently target high-growth markets such as cloud services and mobile broadband.

This white paper reviews some of the business and technology trends impacting service providers and explains how BTI Systems' Application-Controlled Networking framework, a software-defined networking approach, enables operators to accelerate service delivery, optimize operations, and launch lucrative new services to extend revenues, increase profits, and improve investment returns.

Network Challenges and Opportunities

Service providers are under continuous pressure to expand network capacity. Global IP traffic grew eightfold between 2007 and 2011, and is expected to triple again by 2016.[1] A number of consumer and business trends are driving traffic growth, particularly in metro and regional networks, including:

- **Mobile broadband:** Mobile data traffic is projected to increase at a CAGR of 78% between 2011 and 2016 – three times faster than fixed IP traffic – as subscribers flock to smartphones, tablets, and higher-speed 4G/LTE services. Traffic from wireless devices is expected to exceed traffic from wired devices by 2014.

[1] All statistics cited in this section are from the Cisco Visual Networking Index: Forecast and Methodology, 2011-2016, © 2012 Cisco

- **Cloud computing and collaboration:** Global business IP traffic is anticipated to grow at a 22% CAGR between 2011 and 2016 as enterprises move to cloud-based services and deploy bandwidth-intensive telepresence and HD video conferencing solutions.
- **Internet video:** OTT Internet video such as Netflix and YouTube accounted for 51% of all consumer Internet traffic in 2011 and is expected to grow at a 34% CAGR between 2011 and 2016.

As service providers expand network capacity to meet increased traffic demands, they must identify new ways to grow revenues and margins, and avoid commoditization. By implementing simpler, more dynamic and intelligent, software-defined networks, network operators can introduce innovative new services to better monetize infrastructure investments and to participate in rapidly growing markets such as cloud services, mobile broadband, and Ethernet business services.

Software-Defined Networking Optimizes Resources and Improves Agility

Many network operators are hampered by expensive and inefficient network architectures that were originally implemented to enable conventional transport services. Legacy networks are typically composed of discrete optical and packet layers, with distinct networking equipment, management interfaces and provisioning systems. Adding capacity, implementing new services or troubleshooting problems across different systems and technologies can be a costly, time-consuming, and resource-intensive proposition. To compete in today's increasingly competitive environment, service providers must implement more agile and intelligent network architectures that enable more dynamic and differentiated services. Many service providers are looking to software-defined networking (SDN) to improve service agility and versatility, and drive down costs.

SDN enables highly extensible, programmable networks

Software-defined networking is an architectural model for building more flexible and programmable networks. Originally conceived for use in campus networks, SDN solutions are now envisioned for cloud services, next-generation data centers, and carrier transport networks.

SDN is simply an architectural concept. There is no generally accepted definition of an SDN and there are no fully ratified industry standards for implementing SDN-compliant networks or services (as of today). As independent analyst and consultancy firm Ovum explains "*there is no universally agreed definition of software-defined networking. Vendors, the ONF, large data center operators, carriers, the press, and yes even analysts have used a variety of descriptions of SDN to suit their purpose. In just a few years SDN has become part of the communications lexicon with a meaning that is as vaguely defined as cloud.*"[2]

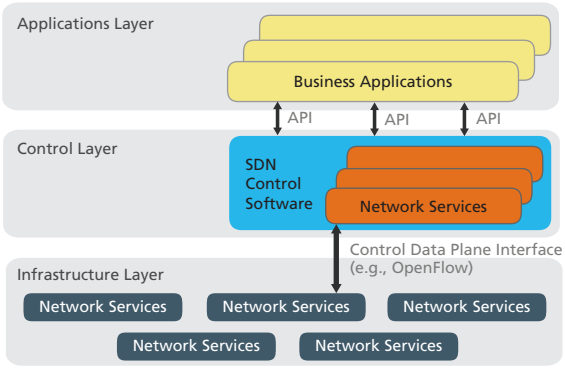

Figure 1: Open Networking Foundation's SDN Architectural Model

While the details may vary, an SDN is typically characterized as a layered network architecture with separate control and data planes, centralized management and control services, and abstract APIs, as depicted in Figure 1.

By decoupling network control and forwarding functions, and centralizing network intelligence and management capabilities, the SDN model allows network operators to construct more scalable, flexible, and cost-effective networks that are better suited for highly virtualized or elastic services.

[2] Software-Defined Networking: Vendors and Product Landscape, Ovum, Reference Code TE008-001251, October 16, 2012

OpenFlow: An Emerging SDN Standard?

OpenFlow is an open standard that was originally conceived to allow researchers to run experimental switching and routing protocols in university networks. It is based on an SDN architectural model with distinct control and data planes. *OpenFlow Switches* perform packet lookup and forwarding functions under the direction of an external *OpenFlow Controller*, using the OpenFlow protocol. By decoupling control and forwarding functions, and providing an abstraction layer, OpenFlow allowed researchers to implement custom routing and switching protocols without requiring equipment vendors to expose the internal workings of their devices. OpenFlow can be implemented in commercial switches and routers, or as open source software running on commodity "white box" switches for ultimate economics and flexibility.

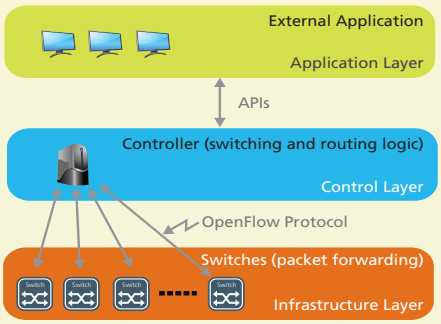

Figure 2: OpenFlow Model

OpenFlow is still in its infancy, and its future use in carrier transport networks is uncertain. While several equipment vendors have introduced OpenFlow switches, the specifications are still evolving, and early devices have been used mostly in interoperability events, research networks, and trials. It will take time for the specifications to mature, for vendors to work out interoperability issues, and for production-ready solutions to reach the market. Furthermore, OpenFlow's initial thrust has been in enterprise networks and data center network virtualization applications. OpenFlow will need to be extended if is to be employed in carrier transport networks.

"OpenFlow's role in carrier optical networks is questionable at this point, because it would require a major overhaul."
Heavy Reading, August 2012[3]

Conceptually, the SDN architecture is similar to the SS7 model, which has proven tremendously successful in carrier voice networks. By separating network signaling and transport functions, SS7 significantly reduced carrier OPEX and CAPEX while laying the foundation for new high-margin services such as call waiting and caller ID. SDN has the potential to revolutionize next-generation carrier networks in the same way SS7 transformed legacy carrier voice networks.

BTI's Application-Controlled Networking

Service providers must implement more extensible and agile networks to enable the innovative services needed to succeed in today's increasingly competitive business climate. Forward-looking providers are exploring SDNs to improve service agility and make more efficient use of resources. BTI's Application-Controlled Networking (ACN) framework allows service providers to construct simpler, more dynamic and intelligent, software-defined networks that enable high value, high-margin services.

Based on a layered SDN architecture, BTI's ACN framework includes end-to-end networking elements, controlled by a centralized management platform that performs mediation functions and provides open APIs for external operations and business support systems (see Figure 3). BTI's ACN framework allows service providers to enjoy all the advantages of SDN today – simplicity, centralized control, scalability, agility, programmability – while providing a straightforward evolution to OpenFlow or other industry standards when they mature.

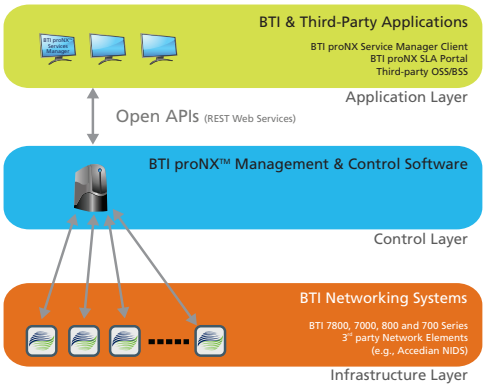

Figure 3: BTI's Application-Controlled Networking Framework

[3] SDN & the Future of the Telecom Ecosystem, Heavy Reading, Volume 10, No. 8, August 2012

BTI and Third-Party Applications

Highly flexible and extensible, BTI's ACN framework enables a wide variety of internally-developed, third-party, and BTI-supplied applications. End-customers, independent software vendors (ISVs) and systems integrators can leverage open APIs to efficiently integrate BTI managed network elements into external Operations Support Systems (OSSs) and Business Support Systems (BSSs) to enable unified fault, configuration, accounting, performance, and security (FCAPS) management functions or to automate provisioning or service activation tasks.

The BTI proNX Management and Control Software provides element, network, and service management for BTI platforms that closely aligns with the business processes of service providers. The BTI proNX Management and Control Software includes the BTI proNX Service Manager Client and the BTI proNX SLA Portal applications.

BTI proNX Service Manager Client

Designed to simplify the provisioning and administration of packet-optical services, the BTI proNX Service Manager client provides easy-to-use, point-and-click, end-to-end management for next-generation networks. The solution includes provisioning templates, configuration wizards and one-click activation features that eliminate manually intensive and error-prone tasks, accelerate deployment, and simplify operations.

BTI proNX SLA Portal

The BTI proNX SLA Portal lets network administrators easily monitor application performance and service levels. The solution provides real-time and historical reports on key service level metrics such as jitter, latency, throughput, and utilization, which enable administrators to ensure the network is adequately meeting the needs of delay-sensitive or mission-critical traffic.

BTI proNX Management and Control Software

The BTI proNX Management and Control Software serves as the intelligent control layer in the BTI ACN framework. It monitors and controls BTI networking platforms, and provides centralized, northbound interfaces – REST Web Services APIs, Java APIs, SNMP interfaces – for external applications. The proNX Management and Control Software simplifies OSS and BSS integration by centralizing control functions and by providing an abstraction layer that shields software developers from the underlying complexity of the networking infrastructure. Over time, BTI will evolve the BTI proNX Management and Control Software to support OpenFlow or other SDN standards as they mature – providing a uniform, standards-based, centralized control layer for multi-vendor management.

BTI Networking Systems

BTI networking platforms deliver carrier-grade, dynamic scale at a radically lower cost-per-bit for packet-optical services delivery. They enable a variety of high-value services including cloud networking, 4G/LTE mobile backhaul, data center interconnect, and Ethernet business services.

BTI 7800 Series

The BTI 7800 Series is a software-rich, high performance, high density networking system designed for cloud and data center connectivity. The open platform integrates high-capacity optical switching with optional MPLS label switch routing (LSR) to meet the massive scalability and flexibility requirements of the cloud at a fraction of the cost of alternative networking solutions.

BTI 7000 Series

The BTI 7000 Series is the industry's most compact, flexible, and easy-to-use packet-optical networking system. By unifying packet and optical service delivery, and integrating Carrier Ethernet switching, a WDM optical layer, ROADM, and photonic-layer elements, the BTI 7000 Series lets service providers consolidate equipment, simplify administration and operations, and contain CAPEX and OPEX. The platform offers massively scalable, carrier-grade networking and ease of deployment, while conserving valuable rack space.

Based on a highly extensible architecture that scales from 1Gbps to 800Gbps capacity, the BTI 7000 Series allows any mix of modules and supports incremental shelf expansion, providing a true pay-as-you-grow model. Because any module can fit in any slot, photonic, wavelength and packet layer modules can be deployed in the configuration that uniquely meets a particular service provider's specific needs.

BTI 800 Series

The BTI 800 Series is a compact, multiservice, carrier-grade platform designed to deliver both Ethernet and TDM-based connectivity in support of enterprise business and mobile backhaul service applications. The small form factor, low power, and temperature-resilient platform can be installed in wireless towers or customer premises to solve space and power challenges, and reduce operational costs.

BTI 700 Series

The BTI 700 Series provides intelligent demarcation, extension, and aggregation of Ethernet and IP-based voice, video, and data services. With multiple small form-factor configurations for cost-effective and rapid service delivery, the BTI 700 Series delivers Ethernet connectivity through the access network directly to customer premises, allowing providers to extend Ethernet services to business customers, cell towers, outside plant deployments and multi-tenant campuses.

Accelerate, Optimize, and Innovate with BTI's ACN Portfolio

BTI's ACN portfolio combines comprehensive management and control software with end-to-end networking systems, providing a highly scalable and efficient foundation for high-value services. Featuring carrier-class networking elements, a centralized management platform with open APIs, and rich off-the-shelf management applications, the ACN portfolio helps operators *accelerate* service delivery, *optimize* OPEX and CAPEX, and launch *innovative* new services to extend revenues, increase profits, and monetize assets.

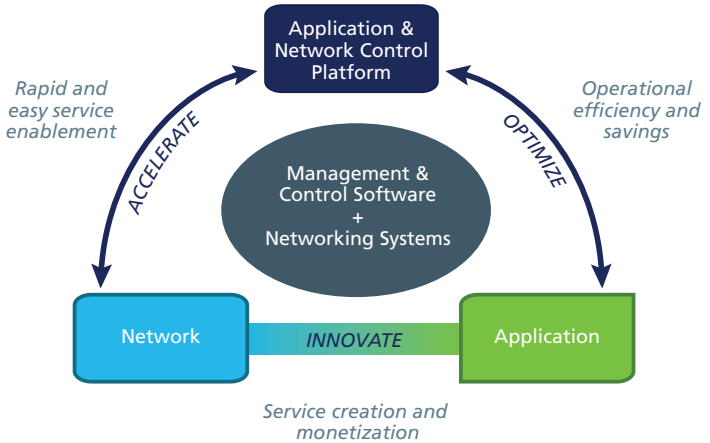

Figure 4: Accelerate, Optimize & Innovate

Avoid Commoditization with High Margin, High-Value Services

BTI offers a variety of ACN-enabled solutions that help operators better monetize infrastructure investments by targeting high growth, high-value markets.

Cloud Networking

BTI's Intelligent Cloud Connect is the first SDN-enabled inter-data center cloud networking solution specifically engineered from the ground up to meet the stringent price-performance, scalability and service innovation demands of the cloud. Combining the intelligence and flexibility of routing, with the capacity and scale of optical bolstered by the efficiencies and extensibility of applications integration, BTI Intelligent Cloud Connect enables content providers and service providers to increase cloud connectivity performance – quadrupling capacity and scale, reducing latency by half, and increasing network applications performance by as much as 10 times – while significantly improving operational efficiency, network control and service innovation compared to legacy solutions.

Mobile Backhaul

BTI's Mobile Backhaul Solution helps metro network service providers capitalize on the rapidly expanding mobile broadband market. The end-to-end solution lays a stable and secure foundation for next-generation mobile broadband deployments and allows service providers to incrementally construct a highly available all-packet infrastructure with consistent, QoS-enabled services and an access-independent architecture. The solution combines voice, data and management traffic onto the same packet infrastructure providing a "one pipe to the tower" implementation. It supports the necessary security features and prioritization capabilities to allow various traffic types - as well as traffic from multiple wireless operators - to transit the same packet connection. The Mobile Backhaul Solution delivers an economical and straightforward path from 2G TDM networks to 4G/LTE while also supporting native 4G build outs.

Data Center Interconnect

BTI's Data Center Interconnect Solution provides industry-leading 10G to 100G density in a compact footprint with low power consumption. BTI's highly flexible metro networking service infrastructure responds instantly and efficiently to changing conditions, ensuring mission-critical information is always available and always secure. BTI's data center-optimized solutions significantly reduce network latency and accelerate the flow of data, providing a critical advantage to online businesses.

Ethernet Business Services

BTI's Ethernet Business Services Solution enables metro network service providers to offer comprehensive Ethernet-based services that deliver the high performance, fine service granularity, and wide scalability required by today's enterprises. The BTI solution combines the performance and cost benefits of Ethernet with the reach and reliability of optics in a variety of compact, yet fully featured platforms. Leveraging MEF certified Carrier Ethernet technology, BTI's Ethernet Business Services Solution lets operators offer a complete, standards-based Ethernet service set, including Ethernet private line services, Ethernet virtual private line services and Ethernet LAN services.

Summary

Skyrocketing traffic volumes and declining product margins are causing service providers to re-examine how they build out infrastructure. Many providers are exploring SDN solutions for next-generation networks. By decoupling network infrastructure and control functions, and by centralized network intelligence and management functions, SDNs help operators create more agile and efficient networks that are better suited for today's virtualized services.

BTI's Application-Controlled Network framework enables service providers to construct simpler, more dynamic and intelligent, software-controlled networks that enable high margin, high-value services. Leveraging carrier-class networking systems, a robust centralized management platform with open APIs, and comprehensive off-the-shelf management applications, BTI's ACN solutions enable operators to *accelerate* service delivery, *optimize* costs, and launch *innovative* new services to move up the value chain, increase profits, and ride the next wave of industry growth.

About BTI Systems

BTI delivers solutions that transform the economics, performance and innovation of global networks through intelligent networking software and systems. Leading content, cloud and service providers choose BTI to drive improved operational efficiencies and profitably deliver high-value services to businesses and consumers around the globe. With more than 350 customers, BTI is headquartered in North America, and operates regional sales, marketing, and R&D centers of excellence throughout the world. For more information, visit btisystems.com.

2012-BTI-WP0170.2

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