

---

# JUNIPER NETWORKS’ VISION FOR THE “SELF-ORGANIZED SOFTWARE-DEFINED BACKHAUL NETWORK”—ENABLING A PARADIGM SHIFT IN THE MOBILE INDUSTRY

Historically successful technology adoption cycles have one thing in common—supply of a technology concept meeting with a greater demand for that concept. There is no doubt that we are witnessing one such cycle, where the availability of LTE networks coupled with the plethora of smart devices is creating a perfect storm in the telecom industry. This perfect storm is creating an environment where the rapid evolution of mobile networks and devices continually places new requirements and challenges on the backhaul network such as:

**Massive scale:** There are industry estimates that suggest that mobile networks will be required to carry 1,000 times more data traffic within the next decade<sup>1</sup>. A significant portion of this growth is going to be served by a dramatic increase in the cell density. To give the best user experience, there is a vision of one active subscriber per cell, leading to the concept of a “personal” cell. Even short of this ideal vision, the backhaul networks may have to accommodate more than ten times growth in the number of base stations over the next ten years. Most of this growth will be in the form of small cells to enhance the capacity at hot spots or to provide coverage at “not spots.”

**Unpredictable growth:** In a hyper connected mobile data environment with social and video proliferation, it is hard to make a reliable prediction of traffic demand. Those days are long gone when mobile networks could be designed based on the busy hour voice call activity. We are living in a world where the next snow storm can lead to an equally large “tweet” storm<sup>2</sup>. It is relatively easy to plan for the planned events; however, it is extremely difficult to plan for the unplanned events. Therefore, a static service delivery and transport architecture will not suffice in this highly dynamic and data dominant user environment.

---

**New revenue streams:** The growing demand for high-quality rich media content is placing an additional strain on the backhaul and mobile core to carry high-bandwidth video streams from the data centers to the radio access network. Therefore in the developed and saturated markets, where operators want to monetize the over-the-top (OTT) delivery of rich media content through their networks<sup>3</sup>, the centralized service delivery model will not scale for the growth projections highlighted earlier. This monetization opportunity is highly dependent on the level of subscriber experience. If subscriber experience is poor, users are less likely to respond to the promotions from ecosystem partners, and in fact many might actually leave. A recent study shows that more than 40% of subscribers are ready to churn due to poor quality of experience<sup>4</sup>. The same study suggests that dissatisfaction is growing with the increasing adoption of smartphones and 4G, as the poor network quality becomes quite obvious when subscribers have seen the device and network capabilities.

To handle these challenges, Juniper Networks proposes a backhaul network that is seamless, self-optimized, and virtualized:

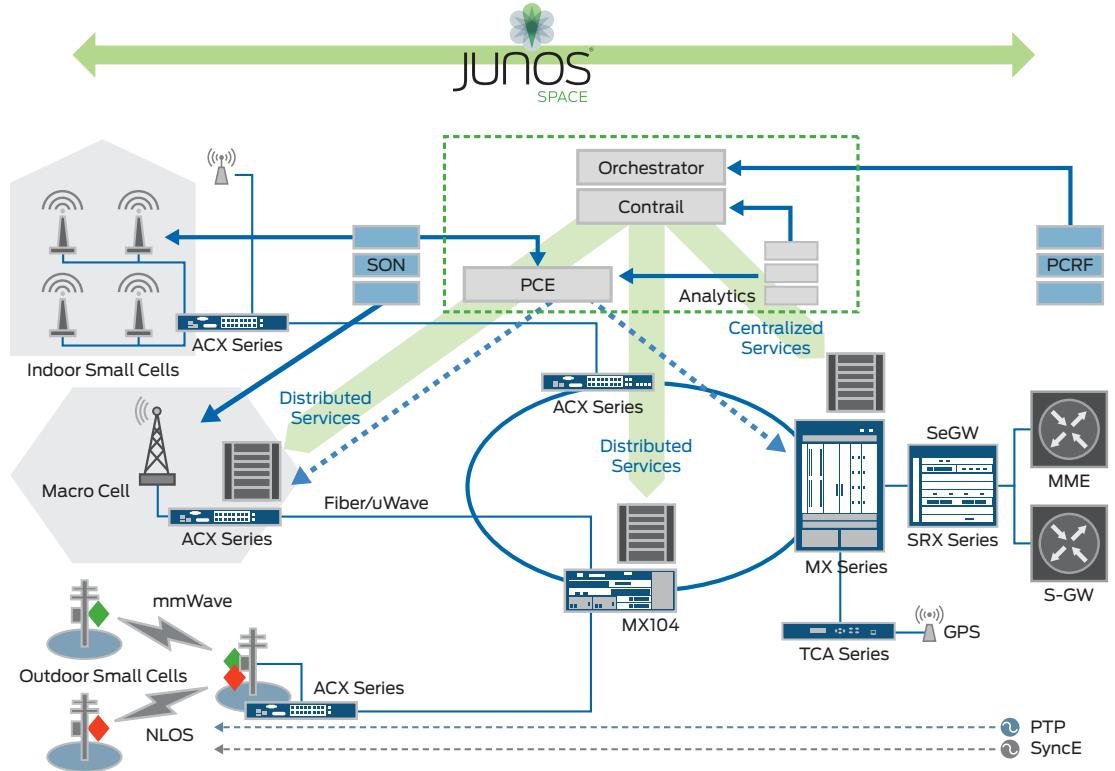
**Seamless:** With a single control plane from access to core, there is a resulting reduction in the number of service instances to be managed. Such a network scales better with the aforementioned growth leading to rapid services provisioning over complex underlying physical topologies. With the small cell growth, the number of endpoints to be managed by the backhaul network is expected to grow significantly, necessitating the seamless control plane to potentially manage hundreds of thousands of endpoints. Offering secured backhaul in a small cell environment will become an absolute necessity. The seamless network will also need to be able to provide the required network domain security through highly scalable IPsec engines in a centralized or distributed fashion.

In addition to the single unified control plane, the seamless network will have a high-capacity data plane from access to core to handle future LTE-Advanced growth requirements. The seamless network elements have advanced features such as integrated precise timing and service-level agreement (SLA) management capabilities, and they are managed through an open network management platform. The seamless network builds the foundation to handle self-optimization and service agility through a software-defined network (SDN)-based control plane at a later phase of network evolution.

**Self-Optimized:** A path computation element (PCE) implemented over an SDN control plane can effectively handle the unpredictable growth of traffic. It provides the required automation and service agility by translating the high-level user inputs into low-level commands directed towards each node in the network. Within this framework, the network operator's input can be as abstract as "I need to support 200,000 subscribers with a latency of less than 10 ms in this part of the network consisting of 100 eNbs and five gateways." The network configuration and the required updates in the face of any change in the traffic demand (eNb and subscribers) or service delivery (gateway) locations will be managed by the PCE. The PCE will be coupled with the analytics engine that proactively measures network and service Key Performance Indicators (KPIs) to make sure that the SLAs are met for all of the subscribers and services in the network.

The PCE will have the capability to interface with the Self-Organizing Network (SON) layer within the radio access network, in order to accommodate all of the required updates within the backhaul network as a result of dynamic updates or reconfigurations in the radio layer. Tight integration between the radio and backhaul transport layers will be necessary to deliver the best user experience, as providing the highest level of radio coverage alone will not suffice if the backhaul link is of poor quality.

---



**Virtualized:** There will be capability to offer value-added services at any point in the network. With an all-IP LTE architecture, the backhaul network is no longer restricted to just providing the connectivity between access and core. It can also be used to cache and serve high-quality content at locations near the subscribers. Service enrichment within the backhaul network can result in significant quality enhancement for delay-sensitive services, leading to increased customer satisfaction and monetization opportunities through service guarantees passed on to ecosystem partners.

Likewise, through NFV and service chaining over the SDN control plane, other value-added services such as security, firewalling, and Network Address Translation (NAT) can be provided as virtual functions to residential and enterprise customers. Virtualization capabilities embedded in the seamless network architecture allow for hosting of these services over

generic x86 servers at colocated or centralized locations. The ability to centralize or distribute services within the mobile network decouples services from the transport to meet the evolving mobile architecture requirements.

Juniper Networks' mobile backhaul solution implements this vision through a seamless network that is built on IP/MPLS with SDN control plane support for self-optimization and NFV for service enrichment. For further information, please visit Juniper Networks mobile backhaul solution website: <http://www.juniper.net/us/en/dm/mobile-lte/>

## References:

- <sup>1</sup><http://www.qualcomm.com/solutions/wireless-networks/technologies/1000x-data>
- <sup>2</sup><http://www.zdnet.com/snowy-monday-saw-spike-in-vpn-mobile-usage-3039610059/>
- <sup>3</sup>[http://about.att.com/newsroom/introducing\\_sponsored\\_data\\_for\\_mobile\\_data\\_subscribers\\_and\\_businesses\\_jan.html](http://about.att.com/newsroom/introducing_sponsored_data_for_mobile_data_subscribers_and_businesses_jan.html)
- <sup>4</sup><http://www.nokiasiemensnetworks.com/news-events/press-room/press-releases/dissatisfaction-with-mobile-broadband-key-driver-for-changing-operator-mwc12>

---

## 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](http://www.juniper.net)



---

### Corporate and Sales Headquarters

Juniper Networks, Inc.  
1194 North Mathilda Avenue  
Sunnyvale, CA 94089 USA  
Phone: 888.JUNIPER (888.586.4737)  
or 408.745.2000  
Fax: 408.745.2100  
[www.juniper.net](http://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

Copyright 2014 Juniper Networks, Inc. All rights reserved. Juniper Networks, the Juniper Networks logo, Junos and QFabric are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners. Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.