The tremendous acceleration in data traffic is rapidly overwhelming today’s mobile networks. Every year brings new applications and more powerful smartphones. Stress points in the network include the Radio Access Network (RAN), RAN backhaul, and the mobile packet core.

Legacy GGSN’s (Gateway GPRS Support Nodes) have presented a number of scaling challenges, most having to do with the difficulty in providing services at the throughput rates that are required to support all of the traffic generated by smartphones. These gateways can offer very impressive performance numbers for basic packet forwarding, but they really struggle when high touch services are enabled. It is not uncommon to see performance of these GGSNs drop by as much as 80%. And this problem will only get worse as more smartphones are activated, pushing ever greater amounts of data and video onto the network. The move to LTE (Long Term Evolution) will only compound the problem, as it greatly increases the capacity of the RAN. Operators are faced with the challenge of adding capacity to their packet cores, but want to do it in a way that protects their investment. Legacy GGSNs often promise a software upgrade to EPC (Evolved Packet Core) functionality, but that doesn’t help if the underlying gateway doesn’t have the performance with services enabled to keep up with the load. New solutions are needed.

The Juniper Networks® MobileNext open mobile core has been designed to meet the needs of mobile operators as they transition to a world dominated by smartphones (mobile computers). The MobileNext Broadband Gateway provides a converged user plane function (Serving Gateway + PDN Gateway + GGSN + IP Services) in an open mobile core.

The MobileNext Broadband Gateway has been designed to meet the needs of a mobile world being overwhelmed with Smartphones.
- Open Junos SDK can increase service velocity.
- Strong security capabilities can protect the core from attack.
- Scalability to truly meet the needs of a smartphone centric world.

Figure 1: MobileNext open mobile core
The GGSN provides the user plane function for second-generation (2G) and third-generation (3G) mobile packet cores. The Serving Gateway and PDN Gateway provide the user plane function in an Evolved Packet Core (EPC). The PDN Gateway provides many of the same IP anchoring functions as a GGSN in the 3G world, whereas the Serving Gateway provides many of the functions found on the user plane of a legacy Serving GPRS Support Node (SGSN).

With the arrival of Mobility Management Entity (MME) technology, we will finally see a complete separation of the data plane and the control plane (this started with direct tunnel in 3G deployments). The user plane handles packet forwarding, subscriber management, and IP services and is best done with a high-end edge router with ASIC-based hardware acceleration of mobile traffic.

It is necessary for the MobileNext Broadband Gateway to operate in both the GGSN and PDN Gateway modes simultaneously, as next-generation mobile devices will be equipped with 2G, 3G, and LTE radios for seamless handover and roaming. This requirement for devices and networks to operate in 2G, 3G, and LTE will be with us for many years to come.

**Juniper Networks MobileNext Broadband Gateway**

The key elements of the MobileNext Broadband Gateway include:

- Built on the industry-leading Juniper Networks MX Series 3D Universal Edge Routers with the Juniper Networks Junos® Trio chipset
- Third-Generation Partnership Project (3GPP) Release 8 compliant
- Support for direct tunnel
- Multi-access for 2G, 3G, and LTE
- Advanced hardware accelerated support for real-time charging
- Stateful firewalls to provide protection against attacks
- Intrusion prevention systems (IPS) to inspect, enforce, and report on network attacks
- Carrier Grade Network Address Translation (CGN)
- IPv4/IPv6 for any service
- Provider edge (PE) router support
- Integrated video optimization for RAN capacity optimization
- Policy management
- Lawful Intercept with optional Lawful Intercept mediation system
- Quality of service (QoS)
- And additional third-party mobile services developed with the Juniper Networks Junos SDK

It is the ability of third parties to develop services for the MobileNext Broadband Gateway that will finally open up the mobile core to innovation. Juniper’s open SDK consists of a set of APIs that third parties can use to develop interesting and compelling new services. The primary goal is to identify those new services that will allow operators to more effectively monetize data traffic. The latter can’t be emphasized enough, as the mobile packet core will be the method by which mobile networks are monetized in a world that is rapidly going all-IP end-to-end.

**The Juniper Advantage**

**3D Scaling**

Scaling is an area that has been getting a great deal of attention in mobile packet core deployments. Much of this is driven by the rapid uptake in smartphones. The dimensions of scaling on the MobileNext Broadband Gateway include the number of subscribers, throughputs with high touch services enabled, and the number of call events per second. Scaling with high touch services enabled has been a great challenge for legacy GGSNs, which often experience significant performance degradation when functions like deep packet inspection (DPI) or real-time charging support are enabled. Juniper is changing all that with the release of the MobileNext Broadband Gateway. The Juniper Networks MobileNext Broadband Gateway can support rich mobile services at rates approaching 120 Gbps per module or 480 Gbps per chassis. This is made possible via a unique architecture that allows the control plane to dynamically offload high touch transactions to the Trio chipset. A case in point is a service that requires that the URL be extracted from the packet. The Multiservices Dense Port Concentrator (MS-DPC) is involved only long enough to extract the necessary information from the packet flow, and then offload it to the Trio ASICs. This enables more efficient use of the MS-DPC resource, while leveraging the Trio chipset to accelerate flows in process.

**Figure 2: The dimensions of 3D scaling on the MobileNext Broadband Gateway**
### Deployment Flexibility

The PDN Gateway and GGSN functions can run simultaneously on the same MobileNext Broadband Gateway. This enables a mobile device to seamlessly switch radio access technologies as the subscriber moves about in the coverage area. The Serving Gateway function can also run with the PDN Gateway/GGSN or it can run standalone. In addition to being able to flexibly deploy the mobile gateway functions, transport layer functions such as Carrier Grade NAT (CGN), firewall, IPS, video optimization, PE router, video optimization, etc. can be flexibly deployed on the MobileNext Broadband Gateway.

One of the great advantages of this approach is in its ability to support a multi-edge mobile core. The PDN Gateway/GGSN function can be deployed at a centralized data center as well as remotely out in a Mobile Telephone Switching Office (MTSO). Internet traffic can be quickly offloaded at the MTSOs, while traffic that requires more services, such as feature phone traffic, can be brought back to the central data center. In addition to distributing the PDN Gateway/GGSN, all the supporting mobile services such as CGN can also be distributed in the same gateway.

### Real-time Charging

Real-time charging support is a critical feature of a mobile packet core. Legacy GGSNs perform this function in software on a service module which has a significant performance impact, typically resulting in fewer subscribers being supported, lower throughput, or both. The MobileNext Broadband Gateway can provide real-time charging support at line rate using the Trio chipset on the packet forwarding line card. This is a huge step up over what can be done with legacy CPU-centric architectures, and it provides a significant reduction in revenue leakage for real-time billing environments.

### Inline Services

The MobileNext Broadband Gateway is capable of running a wide variety of services inline. This applies to Juniper developed services or services developed by third parties using the Junos SDK. This greatly improves on the industry norm of running one service per blade or per chassis. With inline services, a number of different services can be performed on a single pass through the switching fabric, greatly improving performance and scalability within the MobileNext Broadband Gateway.

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![Inline services in the MobileNext Broadband Gateway](image)

Figure 3: Inline services in the MobileNext Broadband Gateway

### Innovation Through an Open SDK

One of the great challenges in the mobile space has been the lack of innovation in mobile infrastructure. The Juniper SDK allows third parties to develop services for the mobile packet core. These services will be key to enabling operators to better monetize all data traffic flowing through their cores. The great advantage of the Junos SDK is that it brings more vendors into the ecosystem, and the more vendors the more innovation.

### Mobile Core Security

With the world rapidly going all-IP end-to-end, and more and more operator revenue running through the packet core, security is rapidly rising in importance. Juniper is the clear leader in mobile packet core security. Security can be integrated into the MobileNext Broadband Gateway or it can be provided on a dedicated security platform such as the Juniper Networks SRX Series Services Gateways.

### Value Based Routing

Smartphones generate a great deal of traffic that is almost always headed for the Internet. With value-based routing, this traffic can be off-loaded before reaching legacy GGSNs which are ill equipped to handle the load. There are a variety of criteria that can be used to make the off-load decision, and this approach is much more flexible than having the GSN steer based on the access point name (APN).

### MX Series 3D Universal Edge Routers

The MobileNext Broadband Gateway is built on the Mx Series router. This is an industry-leading edge router designed specifically to address the challenge of providing packet forwarding with services enabled.

The key elements of the MX Series product family are as follows:

- **Innovative silicon.** The Trio chipset processor, the first in a new family of processors, is just the latest in a long line of innovative Juniper silicon design. Because we develop our own silicon technology rather than simply using off-the-shelf components, we can ensure that our platforms are optimized to deliver high performance with mobile services enabled.

- **Innovative software.** Juniper Networks Junos operating system, our foundational OS, is the common language running across our router, switch, and security devices in our portfolio. The inherent security and stability of Junos OS, combined with its modular architecture and single code source, provide a proven foundation for delivering best-in-class performance, reliability, security, scale, and total cost of ownership (TCO) for mobile operators.

- **Innovative systems.** The MX Series 3D Universal Edge Routers have been designed to address the needs of the mobile core today, and well into the future. These routers leverage the Trio chipset to support a wide variety of services at line rate. This capability will be essential in helping operators evolve their networks and their business models. The MX Series also leverages the Junos SDK to enable an environment for service innovation.
Figure 4: MX Series family of universal edge routers

The MX Series 3D Universal Edge Routers are offered in four different models (MX80, MX240, MX480, and MX960) to address different deployment scenarios. The primary modules on the MX Series router are the I/O modules which are powered by the Trio Packet Forwarding Engines (PFEs), and the MS-DPC server modules. Trio enabled I/O modules can perform selected mobile services at line rate, which can approach 120 Gbps. Other services can be performed on the MS-DPC, which consists of two Network Processing Units (NPUs), each of which can perform more in-depth packet processing.

Summary

The Juniper Networks MobileNext Broadband Gateway has been designed to meet the needs of a mobile world that is rapidly being overwhelmed by smartphones. The key elements of the MobileNext Broadband Gateway value proposition are that it is scalable, secure, and open. The Junos SDK will play an essential role in increasing the level of innovation in the mobile packet core, and this will increase the monetization opportunities for operators. The MobileNext Broadband Gateway can provide high touch services without the performance degradation of legacy solutions. These services include real-time charging and deep packet inspection. Juniper is also building on its reputation as the clear industry leader in securing the mobile core. This technology has now been integrated into the MobileNext Broadband Gateway and will play a crucial role in protecting the mobile packet core from Internet-based attacks. The “new network” is here, and Juniper will be at the core.

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.