

Executive Summary

Mobile traffic growth is exploding in response to the worldwide uptake in smartphone sales. At the same time new types of smartphone applications, cloud computing, and machine to machine (M2M) communications are making mobile traffic more volatile and changing traffic-flow patterns. Control plane capacity that scales up and down rapidly (elastic capacity) is needed to efficiently handle this massive and mercurial traffic growth.

Juniper Networks virtual Mobile Control Gateway (vMCG) is the SGSN/MME function hosted on a virtualized platform. It delivers elastic capacity by employing an MX 3D router that provides a single point of management, virtualization through the JunosV App Engine, and low technology costs using Virtual Services Engines (VSE), Juniper's industry standard x86-based blade servers.

ACG Research compared the total cost of ownership (TCO), deployment/install time and cost for a standalone appliance-based solution with the vMCG solution for an actual mobile operator's network that supports 10 million active subscribers. The comparison showed that the virtual solution has 54 percent lower TCO over five years and that the time to deploy the initial implementation is 46 percent faster than for the standalone appliance-based solution. The study also showed that the vMCG solution compared to the standalone appliance-based solution provides incremental capacity additions in 87 percent less time and at 92 percent less cost.

Key Takeaways

Compared to standalone appliance-based hosting of SGSN/MME mobile gateway control functions, virtualized MCG offers:

Financial benefits

- 54% lower TCO
- 65% lower OpEx
- 53% lower CapEx

Operational benefits

- 73% less environmental cost
- 72% less operator training cost
- 63% less OA&M cost

Deployment time & cost

- 46% faster initial deployment
- 61% less initial deployment cost
- 87% faster capacity additions
- 92% less capacity addition cost

Introduction

Over the next three years the number of smartphones is expected to double (40 percent CAGR)¹. Data plane traffic growth will be even faster (60 percent CAGR²) because each smartphone produces more traffic than the legacy phone it replaces. The combination of more smartphones, more data plane traffic, and multiple IP sessions per smartphone will drive control plane traffic fastest of all (more than 100 percent CAGR³).

The emergence of new types of smartphone applications, cloud computing, and M2M communications also is making mobile traffic more volatile and changing traffic flow patterns. Large event-specific traffic surges, also, are occurring more frequently. The release of the iPhone 5, for example, prompted a surge in traffic volumes the day after its release as its new owners downloaded applications.

Juniper's Mobile Control Gateway provides the Serving GPRS Support Nodes (SGSN) on 2G/3G networks provide mobile control gateway functions, and LTE networks use Mobility Management Entity (MME) in LTE networks. Most mobile operators expect to operate these functions in parallel for the next several years as they gradually move all services to LTE.

Capacity that scales up and down rapidly in response to changes in control plane traffic (elastic capacity) is needed to efficiently handle this massive and volatile control plane traffic growth. Elastic capacity provides multiple economic benefits:

- Over provisioning costs are avoided by shortening the lead time required to provision additional capacity. Shorter lead times make requirements projections more accurate.
- Lost revenue is avoided through rapid capacity additions.
- Service value is enhanced through reliable delivery of high-quality services. Stated conversely, poor quality or service outages severely damages subscribers' loyalty and willingness to pay. Rapid capacity additions help maintain optimal control plane capacity.

Business Case Studies of Virtual Mobile Control Gateway

The business case for Juniper Networks virtualized Mobile Control Gateway is analyzed by comparing its TCO and deployment/installation time and cost to that of a standalone appliance-based approach.

Figure 1 is a network schematic showing the role of the SGSN and MME functions in a network supporting 2G, 3G and LTE cell sites.

¹ Strategy Analytics (<http://www.strategyanalytics.com>) 10/16/2012

² ACG Research estimate

³ ACG Research estimate

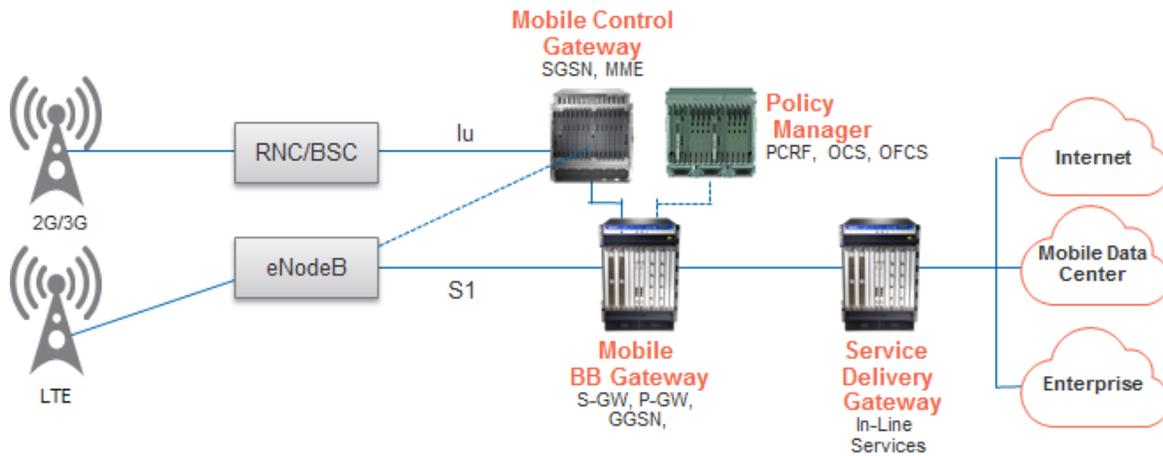


Figure 1 – 2G, 3G and LTE Network

2G/3G cell sites are connected via backhaul to Radio Network Controllers (RNC) and Base Station Controllers (BSC); LTE cell sites are connected to eNodeBs. Control traffic flows from the RNC/BSC to the SGSN, and LTE control traffic flows from the eNodeB to the MME.

Mobile Control Gateway

The Juniper Networks Mobile Control Gateway hosts SGSN and MME software on a standalone appliance consisting of a fully redundant hardware platform with application blades. The application blades employ Juniper’s proprietary packet processor chips. The system simultaneously operates in both the SGSN and MME modes.

Virtual Mobile Control Gateway

The Virtual Mobile Control Gateway (vMCG) uses the Juniper Networks JunosV App Engine solution to simplify management of high-scale SGSN/MME capabilities and to exploit the economics of x86 based computing technology. Figure 2 illustrates the Virtual Mobile Control Gateway solution.

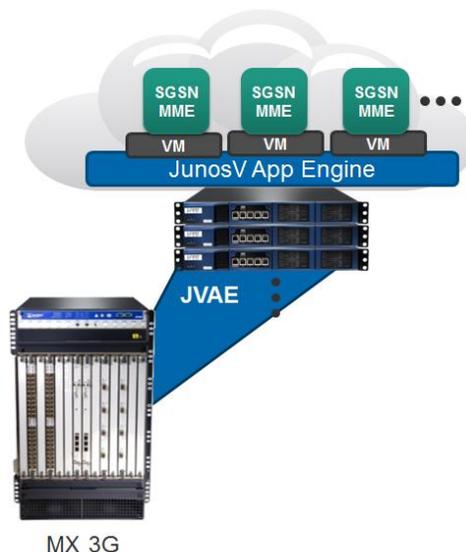


Figure 2 – Virtual Mobile Control Gateway

The Virtual Mobile Gateway solution consists of three network elements:

1. MX 3D router: provides routing services and acts as a single point of management for the associated virtual machines and SGSN and MME applications.
2. JunosV App Engine: a virtualization platform that extends the SGSN and MME services to a virtual plane and enables services to be hosted in virtual machines on x86 based blade servers located outside the router.
3. Virtual Services Engines (VSE): industry standard x86 based blade servers.

This virtualized solution has several benefits as compared to the Mobile Control Gateway (standalone appliance) solution:

- The single point of management of the router simplifies and greatly reduces operational costs as compared to the standalone appliance-based solution that has one management point for each standalone appliance.
- The benefits of elastic capacity discussed previously are produced by expanding or contracting assigned virtual machines within minutes.
- X86 industry standard blade servers cost less and follow a much steeper technology progress curve than proprietary network processors.
- Router capacity is nearly limitless because router slots are not used by application blades.

TCO Comparison: Virtual Mobile Control Gateway versus Standalone Appliance-Based Solution

A TCO comparison is made for an actual mobile network deployment serving 10 million active subscribers. The network is divided into three regional sub-networks to provide geographic and administrative decentralization. Figure 3 shows the physical equipment configuration for each solution in a single region.



Figure 3 – Physical Equipment Configurations for One Region

The standalone appliance-based solution uses 11 MCG in a cluster configuration for each of the three regions. The virtual Mobile Control Gateway solution employs an MX 3D router, JunosV App Engine, and nine VSE pairs in each region. Each VSE pair hosts one SGSN and one MME. VSEs are deployed in pairs to provide one active and one hot standby system.

Figure 4 shows the TCO comparison for the network deployment in three regions.

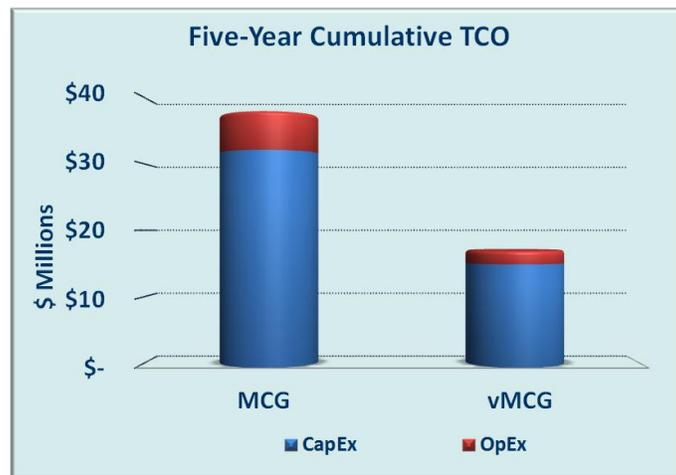


Figure 4 – Five-Year Cumulative TCO Comparison of MCG versus vMCG

The vMCG solution has 54 percent lower TCO than the MCG solution. The vMCG has 53 percent lower capital expenses (CapEx) and 65 percent lower operations expenses (OpEx) than the MCG solution. The use of x86 processor technology in the VSEs by the vMCG and virtualization of the Mobile Control Gateway, which eliminates the complexity of the MCG clusters, are the primary sources of reduced CapEx.

Figure 5 compares the OpEx elements for the MCG versus the vMCG solutions.

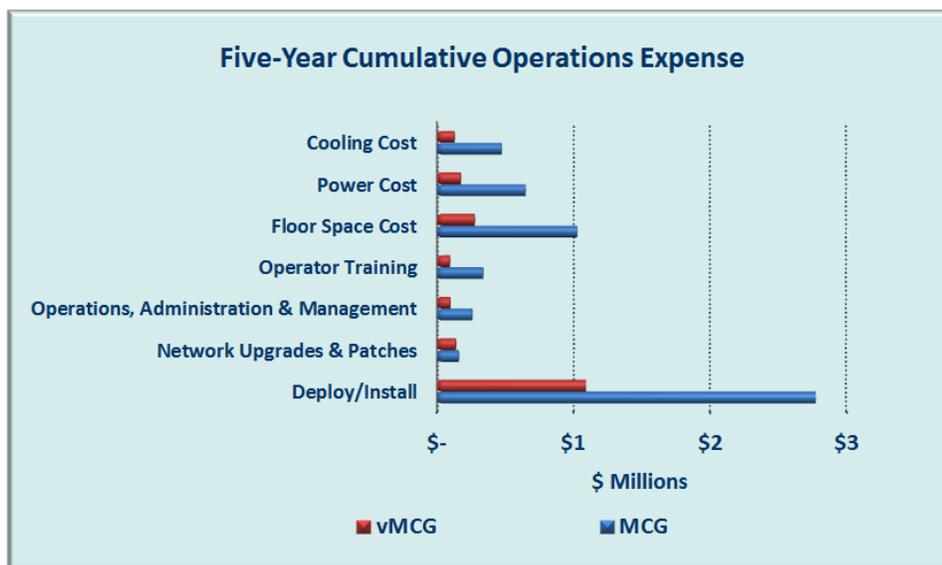


Figure 5 – Five-Year Cumulative OpEx Comparison

There is a 61 percent reduction in the cost to deploy the vMCG solution as compared to the traditional physical deployment of MCG. The sources of this cost reduction are discussed in the following section. Cooling, power, and floor space (environmental) items produce the second largest OpEx savings. The savings are generated by virtualization, which greatly simplifies the hardware configurations and the energy required to operate the hardware.

Deployment Time and Cost Comparisons

Table 1 provides a comparison of the time and cost to deploy the two SSGN/MME solutions.

Initial Deployment in Parallel in Three Regions

Activity	MCG		vMCG	
	Duration (Weeks)	Professional Services (\$)	Duration (Weeks)	Professional Services (\$)
Project Setup & Kickoff	3.0	\$153,000	3.0	\$153,000
Design	21.6	\$888,000	16.0	\$442,500
MCG Installation & Configuration (Hardware)	5.6	\$240,000	3.0	\$102,000
Software Configuration & Initial Testing	12.0	\$591,000	5.0	\$150,000
RAN Integration	5.6	\$249,000	2.0	\$93,000
Customer Acceptance Testing	17.0	\$651,000	6.0	\$150,000
Total	64.8	\$2,772,000	35.0	\$1,090,500
Percentage Savings vMCG Compared to MCG			-46%	-61%

Table 1 – Comparison of Initial Deployment Time and Cost

The initial deployment of the SSGN/MME solutions consists of six high-level activities. The length of the deployment and its associated labor costs are reduced by 46 percent and 61 percent respectively for the vMCG solution as compared to the MCG solution. The biggest reductions are made for the design, software configuration and testing activities. Virtualization and its associated network abstraction function are the sources of the savings. Virtualization reduces the 33 management points in the MCG down to three (one for each region) in the vMCG. The reduced number of management points produces a corresponding 11:1 elimination of repetitive configuration and testing activities.

Deployment of additional capacity (support for additional active subscribers) also is simplified by the vMCG solution (see Table 2).

Addition of One MCG or VSE Pair

Activity	MCG		VSE Pair	
	Duration (Weeks)	Professional Services (\$)	Duration (Weeks)	Professional Services (\$)
Project Setup & Kickoff	0.6	\$3,500	0.6	\$3,500
Design	4.0	\$25,500	0.6	\$1,500
MCG Installation & Configuration (Hardware)	1.0	\$7,000	0.2	\$500
Software Configuration & Initial Testing	3.0	\$19,000	-	-
RAN Integration	1.4	\$12,000	-	-
Customer Acceptance Testing	3.4	\$23,000	0.4	\$1,500
Total	13.4	\$90,000	1.8	\$7,000
Percentage Savings vMCG Compared to MCG			-87%	-92%

Table 2 – Comparison of Additional Capacity Deployment Time and Cost

The addition of capacity is highly simplified by the virtualization and abstraction capabilities of vMCG because computing capacity whether in the form of virtual machines or VSE hardware is separated from

the logical configuration of the SGSN/MME software. Thus, most design, configuration and testing work is eliminated entirely by the vMCG solution.

Conclusion

Mobile control plane traffic is expected to grow at more than 100 percent annually and become more volatile. Elastic capacity is needed to efficiently handle this massive and volatile control plane traffic growth. SGSN/MME mobile control gateway software provides the mobile control plane function. It provides multiple economic benefits including:

- Reduces over provisioning costs
- Eliminates lost revenue caused by capacity shortages
- Enhances service value by ensuring that network performance objectives are met by maintaining optimal control plane capacity

A case study for a SGSN/MME control plane supporting 10 million active subscribers compared the TCO, deployment/install time and cost for a standalone appliance-based mobile control gateway versus Juniper Networks Virtual Mobile Control Gateway. They study found that the vMCG solution offers:

Financial benefits

- 54% lower TCO
- 65% lower OpEx
- 53% lower CapEx

Operational benefits

- 73% less environmental cost
- 72% less operator training cost
- 63% less operation, administration and maintenance cost

Deployment time & cost

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