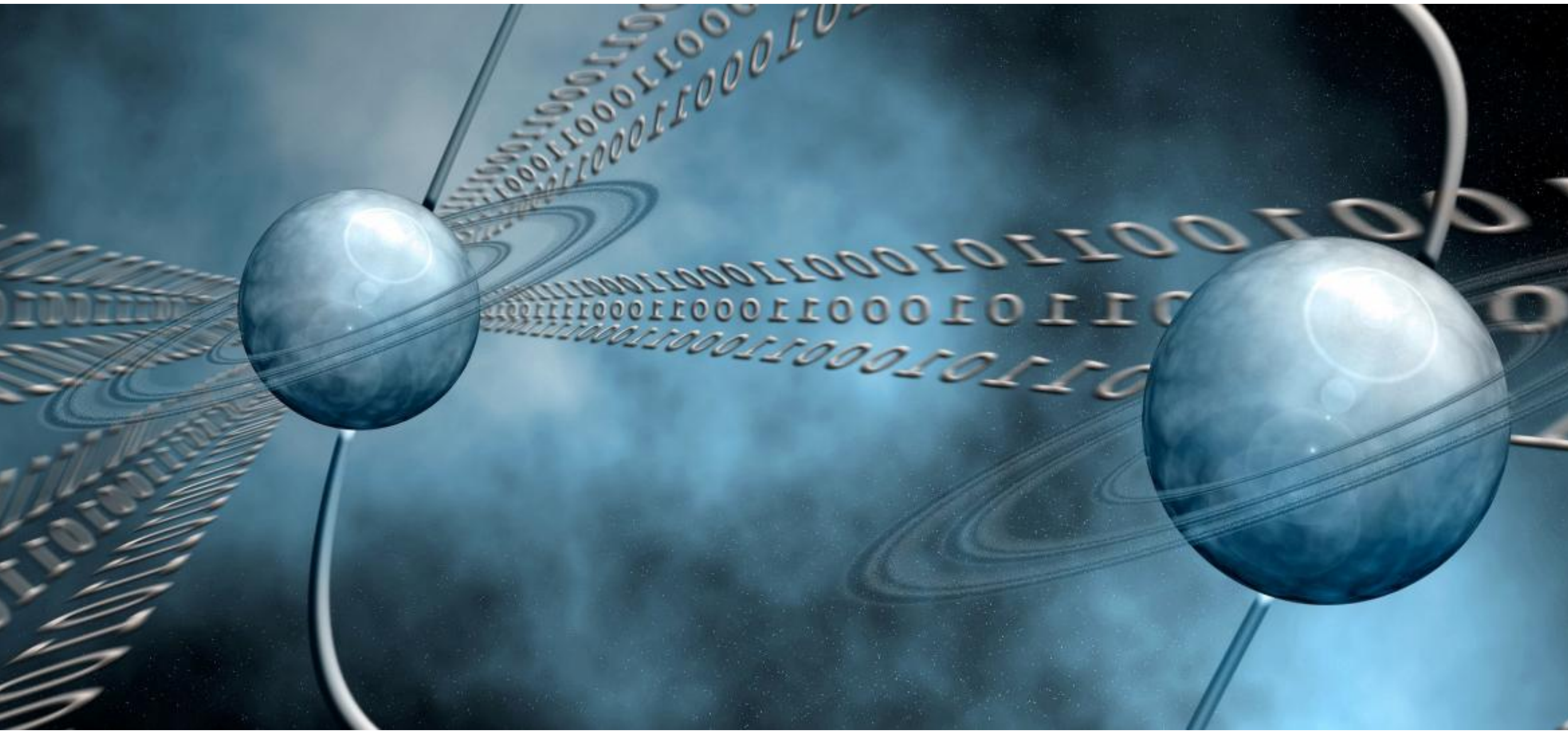
Business Case for the Cisco ASR 5500 Mobile Multimedia Core Solution



Executive Summary

The scale, use and technologies of mobile broadband networks are changing rapidly. Mobile broadband growth continues to be strong — even though usage patterns are volatile and unpredictable — but the bigger network design challenge comes from the proliferation of newer device types, such as smart phones, tablets, and M2M devices, and rapid applications growth, including applications with personalization, location, and always-on behaviors. Managing the evolution from 2G and 3G technologies to 4G also adds to the network design challenge. Mobile operators, consequently, are seeking multimedia packet core solutions that minimize cost by not only scaling to meet their network requirements but by also adjusting dynamically to the variations within them.

The Cisco ASR 5500 mobile multimedia core solution meets those changing and volatile requirements through high-capacity integrated system architecture. All processes and functions (for example, GGSN, MME) are distributed across the entire system, and the architecture automatically adapts the allocation of its resources to meet current performance needs.

ACG Research analyzed the total cost of ownership (TCO) of meeting operators' evolving requirements in the mobile multimedia packet core for the Cisco ASR 5500 solution and a leading competitor's solution. The analysis found that the ASR 5500 solution has 47% lower five-year cumulative TCO than the competitor's solution; CapEx is 51% and OpEx is 32% lower. The primary source of cost advantage of the ASR 5500 solution is that it delivers the required throughput and functionality using 65% fewer chassis. This is achieved through the single integrated system design and higher capacity configuration of the ASR 5500 solution.

Key Takeaways

The Cisco ASR 5500 mobile multimedia packet core solution delivers the flexible capacity and performance to meet the evolving scale, use and technologies required by operators at minimum cost.

Compared to a leading competitive solution the ASR 5500 solution provides up to:

- 47% lower cumulative five-year TCO
- 51% lower CapEx and 32% lower OpEx
- 65% fewer chassis

Introduction

Every aspect of mobile networks is changing: technology, applications, devices, users and network traffic patterns. Explosive traffic growth driven by rapid mobile broadband take-up rates and the increase in per subscriber data usage are challenging network architects to scale network capacity. Change in the makeup and use of mobile networks also imposes new demands for flexibility and adaptability in the mobile multimedia packet core.

The cost of meeting requirements for capacity, performance and responsiveness to volatility in the mobile multimedia core is compared for two solutions:

1. Cisco ASR 5500 solution
2. Leading competitor's mobile multimedia core solution

The cost comparison is made by defining the traffic and functional requirements for the typical multimedia packet core solution in a mobile network over five years and then simulating the equipment build-out for each vendor's equipment.

Growth and Change in the Mobile Multimedia Core

Design requirements for the mobile multimedia core are fluid and volatile because of the rapid acceptance of mobile broadband and the dynamic and unpredictable demand patterns from new uses, applications and devices that must be managed. The sources of this growth and change include:

- End-users' connections: Increasing subscriber bases, expanding broadband data consumption, and machine to machine (M2M) transponders
- Devices: New device types include smart phones, tablets, mobile hot spots, and M2M devices
- Applications: Proliferation of novel applications with personalization, location, and always-on behaviors coupled with increased video usage
- Access technology and network architecture: Managing the evolution from 2G and 3G technologies to 4G for seamless experiences

End-users' Connections

Despite the rapid penetration of mobile broadband, most of its growth and impact is still in the future. For example, in the U.S., one of the leading countries in mobile broadband adoption, about 40% of the 328 million wireless connections in service are equipped for broadband. This leaves a potential of 1.5 additional new mobile broadband connections for every existing one.

Machine to machine connections are just emerging as a significant market factor. Some example device types include:

- Smart grid transponders
- Utility meters
- Security sensors
- Location-based systems
- Inventory control transponders

- Medical sensors
- Smart cards
- Traffic control systems
- Home appliance transponders
- Environmental sensors

The massive investments that utilities and governments are making in Smart Grid technology are driving this growth.

M2M usage patterns often break established rules for design of the mobile multimedia core. For many uses the data payloads are much smaller than their signaling and overhead traffic, and the devices are always on but infrequently communicate actively. Upload traffic can substantially exceed download traffic. In addition, catastrophic events may cause thousands, if not millions, of devices to flood the network with active sessions. Thus, end-device connections require high-scale and dynamically responsive flexibility from the mobile multimedia packet core.

Devices

The large number of different device types also determines mobile multimedia core design requirements in that messages must be sent and acknowledged before data flows that meet the specific requirements of each device type can be established. More than 630 different handsets and devices are manufactured by 32+ companies for the U.S. market, and in the last year vendors brought an additional 120 new smart phone models to the market according to the CTIA[1].

Device types include:

- Smart phones
- Tablets
- PCs
- Laptops and notebooks
- Mobile hot spots
- Gaming devices
- PDAs
- M2M
- Wireless modems

This proliferation of device types and the different signaling and control requirements add to the volatility and unpredictability of mobile multimedia core designs, increasing the need for flexible capacity and performance in the mobile packet core.

Applications

The rapid growth and acceptance of applications on mobile devices is driving a new level of bearer and control (signaling) plane traffic demands within the mobile multimedia core. Over the next three years

[1] Other estimates on the number of different devices are much higher. For example, AT&T says it has certified more than 1,000 devices for use on its network.

46% growth in global application downloads is projected[2]. Mobile core signaling traffic, however, will grow in excess of 100% annually[3] because new applications involve more signaling transactions per session than older ones and because mobile users are increasing their activity as the utility of their mobile devices increases.

Signaling events are triggered by new usage patterns created by applications. For example, watching a YouTube video has a different usage pattern than simply viewing a web page. Watching a YouTube video begins by viewing web pages to locate the desired video, generating signaling similar to viewing other web pages. However, additional state change signals are required when the video link is selected and when it is subsequently exited.

New application behaviors also increase control plane requirements. For example, the FindMe application allows friends to find each other on a digitally displayed map. The app has substantial control plane requirements, cell I.D.s, GPS information and network information that must be exchanged. Most importantly, updates are traded each minute so that the friends can observe each other's movements.

Access Technology and Network Architecture

Mobile operators' technology evolution and network design/architecture strategies also affect the rate of change and volatility of design requirements for the mobile multimedia core. Two strategies are of primary importance:

1. Gradual evolution to 4G: 2G and 3G technologies are being replaced with LTE/4G technologies. This requires simultaneous operation of multiple technology generations within the mobile core.
2. Deployment flexibility: Operators need maximum flexibility to locate packet core functions within their network designs, consolidating functions where economically attractive to manage costs effectively amid the volatility in mobile network environments.

Mobile packet core evolution and design requirements go beyond reducing complexity and cost by enabling multiple functions on the same hardware platform. Control and bearer plane behaviors differ for 2G, 3G and 4G. Operators need solutions that manage these differences and can respond to the shifting volumes among these technologies as networks evolve.

Simulation of always-on behavior, for example, can increase mobile operators' internal control traffic. Many applications require an always-on behavior mode. Yet device manufacturers are working to minimize device uptime to conserve battery power. Consequently, devices periodically go into an idle or standby state and then to an active state so that battery power is conserved while the application has the appearance of being always on. This can create large quantities of control plane traffic relative to data traffic.

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[2] Juniper Research projection

[3] ACG Research projection

TCO Comparison: Cisco ASR 5500 Solution versus Competitor's Mobile Multimedia Core Solution

A typical mobile multimedia core network is modeled to compare the TCO of the Cisco ASR 5500 solution versus that of a leading competitor. Figure 1 provides an overview of the modeling process.

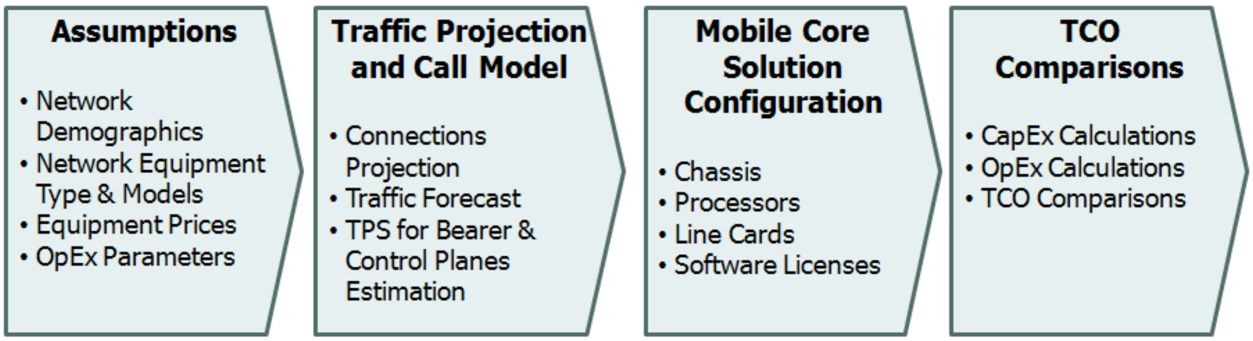

Figure 1 – TCO Modeling Process

The modeling process simulates the design and configuration of network elements deployed to meet the demands on the mobile multimedia core. The process begins by making assumptions on the number of mobile subscribers, the network equipment that will be deployed, equipment costs, and operations expense (OpEx parameters used to estimate items such as network care and environmental expenses). The network demographic assumptions are then used to project mobile connections, forecast traffic, and estimate control and bearer plane transactions rates. Each network element is then configured using guidelines in published vendors' data sheets. Capital expense (CapEx), using estimated market prices, is calculated for the resulting configuration, and an ACG Research OpEx model is used to estimate OpEx.

Network Evolution

Gradual transition from 3G (GPRS) to 4G (LTE) is modeled with the following components:

- GPRS
  - SGSN: Serving GPRS Support Node
  - GGSN: Gateway GPRS Support Node
- LTE
  - MME: Mobility Management Entity
  - SGW: Serving Gateway
  - PGW: PDN Gateway

Over the five-year study period data and connection processing traffic is gradually shifted from the GPRS network to the LTE network.

Traffic Projection and Call Model

The mobile network modeled serves 12.1 million active busy hour connections in Year 1, growing to 17.1 million by Year 5, a 9% CAGR.

Figure 2 shows the call events per connection per hour projection.

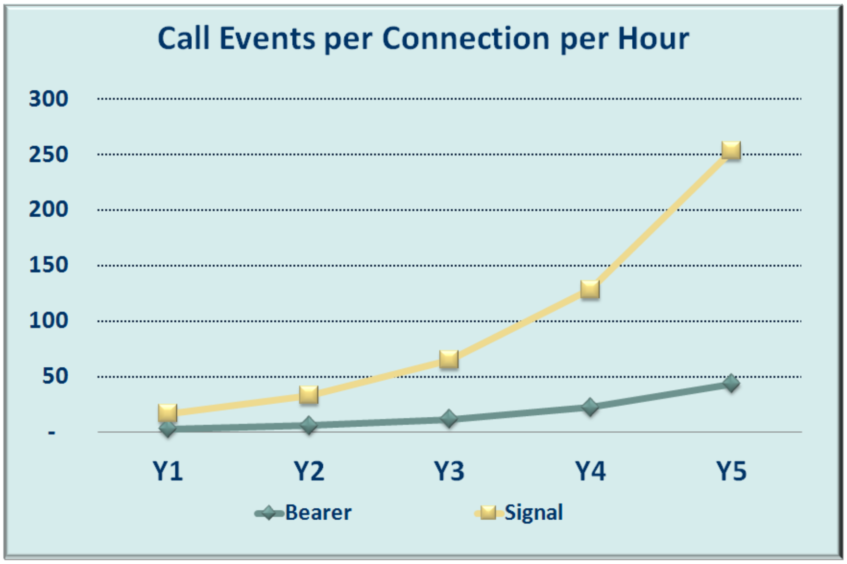

Figure 2 – Call Events per Connection per Hour

Signaling call events grow at a 116% annual rate over five years. This growth is driven by the move to LTE, adoption of smart phones and other advanced devices, and the growing sophistication of applications. Bearer call events grow at a 113% annual rate over five years but from a smaller initial base level. This growth is driven by the increasing sophistication of applications, the trend toward multiple bearers per session, and the rapid adoption of smart phones and their associated applications.

Figure 3 shows busy hour data throughput projections for the entire network and on a per subscriber basis.

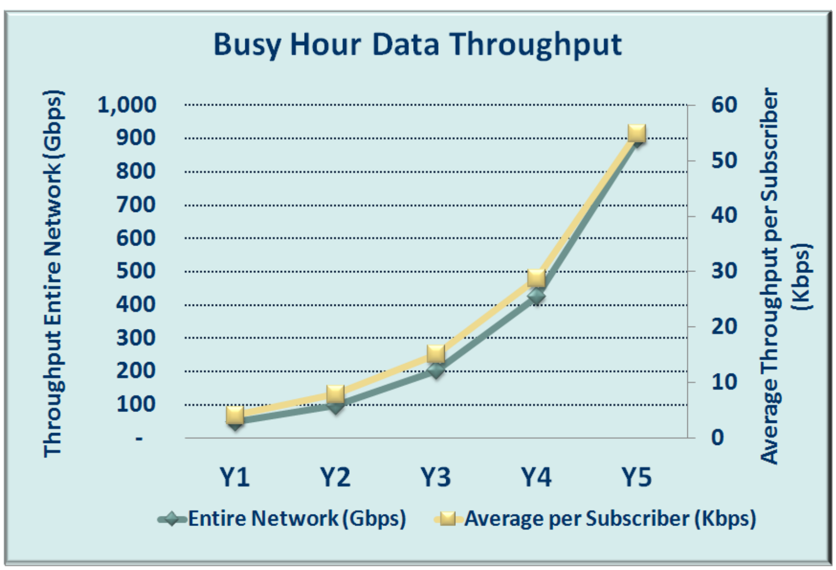

Figure 3 – Busy Hour Data Throughput

Average throughput per subscriber during the busy hour grows at an annual rate of 91% over five years; throughput for the entire network grows somewhat faster at a 108% annual rate. This rapid growth in throughput is largely attributable to expected rapid adoption of video on smart phones, tablets and other consumer devices.[4]

Cisco ASR 5500 Solution

The Cisco ASR 5500 solution has a flexible architecture to meet the changing and volatile functional requirements of the mobile multimedia core, as it transitions from 3G to 4G technology and as users continue to shift to smart phones, tablets, and other advanced devices. The ASR 5500 solution also addresses high-scale requirements such as those projected in the previous section.

The ASR 5500 solution uses an integrated systems approach on a single platform to maximize its flexibility and simply accommodate increased mobile network demands. All processes for GPRS and LTE functions are distributed across the entire system, and the architecture allocates resources automatically to adapt to current performance needs. The ASR 5500 solution can support the SGSN, MME, GGSN, SGW and PGW functions individually or in any combination.

Competitor

A leading competitor's mobile multimedia core solution is compared to the ASR 5500 solution. The solution supports the GGSN, SGW, and PGW functions in one device and the SGSN and MME functions in another.

The system supporting the GGSN, SGW, and PGW offers slot independence to improve asset utilization. Its processors or services cards support multiple functions that allow load sharing and increased flexibility. The second system supports the SGSN and MME functions. These functions are enabled in software so that no hardware changes are required or assets compromised when the MME function is added to an existing SGSN enabled system.

TCO Results

Figure 4 summarizes the TCO comparison between the Cisco ASR 5500 solution and the competitor's product.

Figure 4 – Five-Year Cumulative TCO Comparison

[4] The video projection is derived from Cisco's VNI project.

The ASR 5500 solution has 47% lower five-year cumulative TCO than the competitor's solution; CapEx is 51% and OpEx is 32% lower. The primary source of the cost advantage of the ASR 5500 solution is that it delivers the required throughput and functionality using fewer chassis. Figure 5 compares the number of chassis required to meet the requirements of the model network in each year.

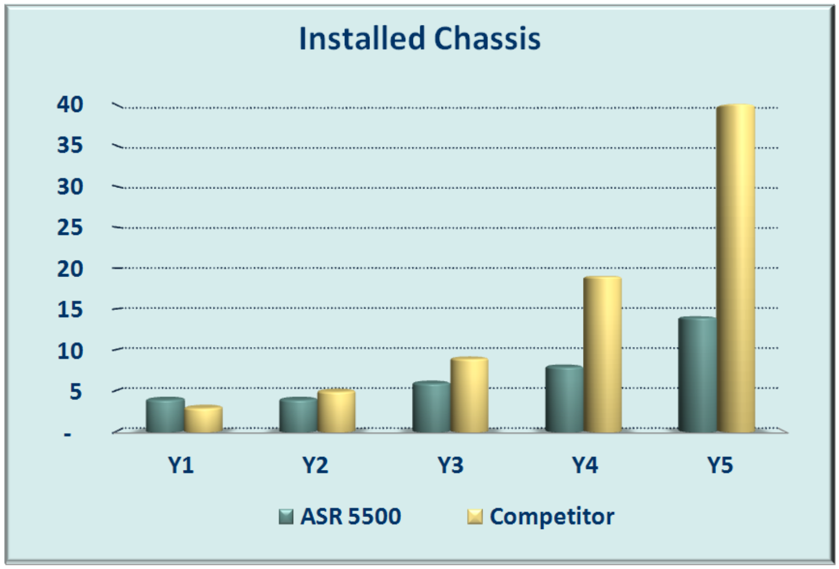

Figure 5 – Chassis Required for Each Solution

Sixty-five percent fewer chassis are required by the ASR 5500 solution in Year 5 as compared to the competitor's solution. There are two primary sources for this advantage:

1. The flexibility of the ASR 5500 solution to support all functions provides more efficient asset utilization than when functions are separated between two systems.
2. The ASR 5500 solution has greater TPS capacity than each system in the competitor's solution, especially in comparison to the control plane system. Figure 2 shows that signaling transactions require especially high scale.

OpEx

Figure 6 breaks down the OpEx components. (Sparing and contract support expenses are excluded from this analysis as they are directly related to CapEx.)

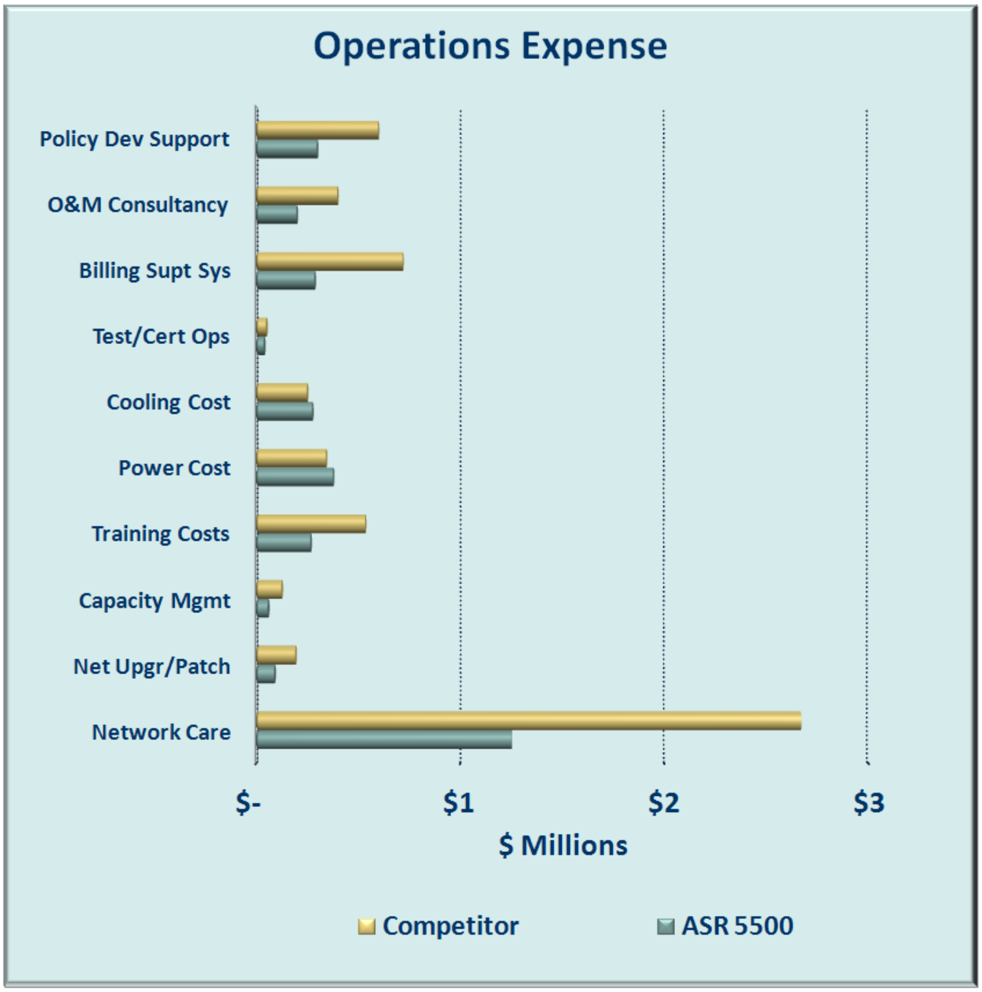

Figure 6 – Operations Expense Breakdown

Network care, the largest expense category, is significantly higher for the competitor than for the ASR 5500 solution. Network care expense increases directly with the number of installed chassis because each chassis requires several hours of monitoring, management and maintenance work each year. Since the ASR 5500 solution requires fewer installed chassis than the competitor's solution its network care expense is proportionately lower. Capacity management, and network upgrades and patches have higher costs for the competitor than the ASR 5500 solution for the same reason.

Policy development support, operation and management consultancy, billing support systems, training and test and certification expenses are higher for the competitor's solution because two systems must be managed rather than the single ASR 5500 system.

Flexibility and Dynamic Adaptability Benefits

The TCO analysis captures some of the benefits of the flexibility and the responsiveness of the ASR 5500 system architecture by demonstrating the cost savings achieved as it supports a gradual transition from 3G to 4G technology and supports annual growth in excess of 100% in control, bearer, and throughput. However, the single system design of the ASR 5500 solution also delivers other benefits that are not quantified in the analysis. Specifically, the volatility in system capacity requirements and supported functions are handled more efficiently because the integrated system design supports rapid reassignment of its hardware resources and the enabling of new functions via software license activation with no physical change in the system. For example, mobile operators are developing processes and network capabilities that will incorporate Wi-Fi as part of their service offerings rather than having traffic offloaded onto an unaffiliated fixed broadband provider. This new functionality can be added to the mobile multimedia packet core with no change to the hardware of the ASR 5500 solution.

Conclusion

The scale, use and technologies of mobile broadband networks are changing rapidly. Usage patterns are volatile and unpredictable. Mobile operators, consequently, are seeking mobile multimedia packet core solutions that minimize cost with the scale and flexibility to meet their solution requirements.

The TCO to build out and operate a typical mobile multimedia core network undergoing the transition from 3G to 4G technology and subject to high growth in control, bearer, and throughput requirements was modeled over five years. Two mobile multimedia core solutions were compared:

1. Cisco ASR 5500 solution
2. Leading competitor's solution consisting of two systems: One supporting the GGSN, SGW, and PGW functions and one supporting the SGSN and MME functions

The TCO analysis found that the ASR 5500 solution has 47% lower five-year cumulative TCO than the competitor's product; CapEx is 51% and OpEx is 32% lower. The primary source of the cost advantage of the ASR 5500 solution is that it delivers the required throughput and functionality using 65% fewer chassis. This is achieved through its integrated system architecture flexibility and its higher capacity and performance.

ACG Research

ACG Research is an analyst and consulting company that focuses in the networking and telecom space. Our best-in-class subject matter analysts have a combined 120+ years of experience and expertise in telecom segments that address both technology and business issues. We offer comprehensive, high-quality, end-to-end business consulting and syndicated research services.

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