ACG RESEARCH

Making the Business Case: Network Analytics for the New IP

Executive Summary

Mobile operators are experiencing large cost increases as they build out their networks to keep pace with rising traffic demand. Their revenues are failing to keep pace with the cost increases because of both declining average revenue per user and saturation in consumer additions. A comprehensive program to control costs while increasing revenue is needed. Under the present mode of operations (PMO) network analytics is an afterthought, but with the architectural and business transformations that are underway in mobile networks, network analytics is rapidly becoming a central enabler for the IP services and solutions needed to implement the necessary cost control and revenue enhancement initiatives.

Brocade provides a comprehensive and open network visibility and analytics architecture that reduces cost and increases network agility. Its architecture employs Network Function Virtualization to increase agility and to efficiently scale capacity upwards and downwards. Software-Defined Networking is used to make insights actionable in real time through dynamic policy controls. The architecture conforms to open standards, including REST, Google Protocol Buffers, and Open Daylight. The architecture operates under an orchestration blueprint that can dynamically commission and decommission probes. This eliminates stranded assets in the volatile mobile network environment and the need to ameliorate the risk of a low forecast by nailing up extra capacity. An analysis shows that the Brocade architecture reduces the time to execute network analytics business process steps by a factor of six as compared to the appliance-based present mode of operation.

An analytics offloading use case compares the total cost of ownership (TCO) of Brocade's architecture with two PMO alternative architectures. The Brocade architecture has 23 percent to 33 percent lower TCO than the PMO alternatives. Brocade's advantage is due to its use of virtual network functions hosted on virtual machines and the agility and elasticity achieved though Brocade's orchestration system. A network monitoring and customer experience management use case compares the TCO of Brocade's virtual architecture to an appliance-based architecture (PMO) and finds a 43 percent TCO savings for the Brocade architecture.

KEY FINDINGS

Brocade's network visibility/analytics architecture is comprehensive, agile, and low cost. When compared with the present mode of operations Brocade:

- Reduces the time to execute analytics business processes by about a factor of six.
- Lowers TCO 23% and 33% versus single and two appliance (PMO) alternatives for an analytics offloading use case.
- Lowers TCO 43% versus an appliance-based (PMO) architecture for network monitoring and customer experience management use case.

Introduction

Mobile network operators are facing threats to the sustainability of their businesses. For some time now operators have been experiencing large cost increases as they have built out their networks in order to keep pace with rising traffic demand. Their revenues, however, have failed to keep step with the cost increases in light of both declining average revenue per user and saturation in consumer additions.

A comprehensive program to control costs while increasing revenue is needed. Elements of the program include redesigning the network to reduce costs and developing more nuanced service offerings, other sophisticated pricing models, improved network quality, and added agile service delivery. A new, more dynamic and flexible network analytics capability can be a central enabler to the IP based services and solutions needed to implement these cost control and revenue enhancement initiatives. For example, the Brocade dynamic network analytics architecture can identify congested cell sites and signal network controllers to automatically take corrective actions in real time. This reduces the need to make costly capacity additions to remedy network congestion. A second example, the dynamic network analytics architecture can identify emerging application usage patterns and support rapid introduction of new revenue opportunities.

Brocade provides a comprehensive and open network visibility/analytics architecture that reduces cost and increases network agility. It can be leveraged to dynamically profile mobile customers, drive marketing programs, optimize the RAN and Packet Core to enhance quality of experience and identify opportunities to create innovative new service plans.

Figure 1 compares Brocade's network analytics architecture to the present mode of operations (PMO).

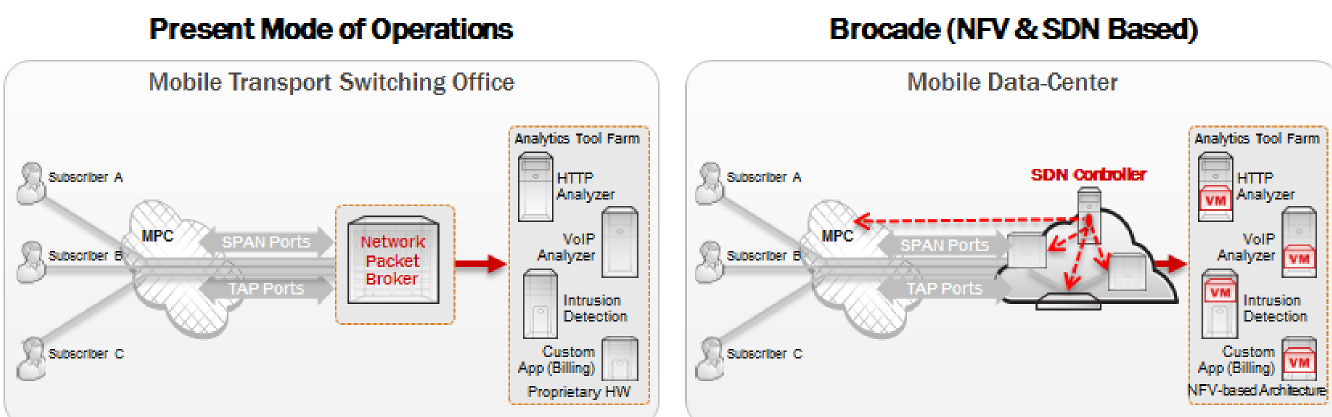

Figure 1 – PMO vs. Brocade's Analytics Architectures

Under the present mode of operations the analytics architecture is located in the mobile transport switching office and is built upon probe appliances that embody proprietary components. These closed and rigid platforms consequently have high lifecycle costs. The Brocade analytics architecture is virtualized in a mobile cloud data center and employs Network Function Virtualization (NFV) and a Software-Defined Network (SDN) control plane. It also features dynamic resource orchestration. The architecture increases the agility of the analytics solution and lowers lifecycle costs.

Elements of this comprehensive network visibility/analytics architecture include:

- Network Function Virtualization: The architecture is completely software based. This increases the agility and elasticity of the architecture and reduces network costs.
- Software Defined Networking-based dynamic control: A dynamic SDN based feedback mechanism employing open interfaces provides policy-based control. Network paths are adjusted proactively through standardized interfaces such as REST and Google Protocol Buffers (Protobuf).
- Elastic framework and orchestration: The architecture operating under an orchestration blueprint can be leveraged for scale up and scale down functions. Probes can be dynamically commissioned and decommissioned on demand. This eliminates stranded assets in the volatile mobile networking environment.
- Intelligent Network Packet Broker: An intelligent and dynamic network packet broker enables analytics tools to make situation-specific, dynamic flow requests without human intervention.
- Functional richness: The architecture goes beyond classic QoE/KPI monitoring. It includes GTP[1] correlation, security, whitelisting, blacklisting, and new service monetization.

Table 1 compares the agility of the present mode of operations architecture to the Brocade architecture.

Business Process Steps	Length of Step (Months)		Source of Increased Agility
	PMO	Brocade	
Set up analytics taps and Network Packet Broker	6	1	Orchestration, SDN control, and virtual functions running on virtual machines (VM) simplify set up and automate most processes
Set up probes	6	1	The appliances of PMOs require many manual procurement and implementation steps; orchestration system deploys virtual probes automatically on VMs
Set up servers to host analytics tools	4	1	Physical servers require a manual procurement process; Virtual Network Function-based (NVNF)tools are deployed automatically to VMs
Correlate traffic for analysis	3	0.25	PMO requires manual correlation of reports from multiple probes; the virtual architecture does this automatically
Reconfigure mobile network	0.25	0.01	PMO requires operators to analyze analytics reports and reconfigure manually; virtual architecture uses a SDN closed loop to reconfigure automatically
Analytics report creation	6	1	PMO requires creation and design of new report; virtual architecture is supported by a web-based query system

Table 1 – Agility of PMO Compared to Brocade

Table 1 shows that use of NFV, SDN, and orchestration by Brocade's architecture dramatically reduces the time required to not only build, reconfigure, and add capacity to the analytics infrastructure, but also makes the entire mobile network more dynamic. This elasticity allows network operators to run their networks hotter (higher capacity utilization) than is prudent with an appliance-based (PMO)

[1] GPRS Tunneling Protocol (GTP) is a group of IP based communications protocols used to carry general packet radio service (GPRS) within GSM, UMTS, and LTE networks. GTPc (control) protocol is used within the GPRS core network for signaling between GGSN and SGSN nodes. GTPu (user) protocol is used for carrying users' data within the GPRS core network and between the RAN and the core network.

architecture. The Brocade architecture, furthermore, can just as easily be scaled down as scaled up. In contrast, once appliances are deployed in the PMO architecture that investment cannot be easily recovered if projected capacity requirements fail to materialize. The total cost of ownership (TCO) of the Brocade architecture is lower because it requires less network capacity than the PMO architecture, and it reduces operational risks associated with long planning/deployment cycles and their unavoidable forecasting errors.

The benefit of the agility of the Brocade architecture is quantified in the TCO analysis to follow.

TCO Analysis

The TCO advantages of Brocade's architecture, which features NFV, SDN and orchestration, are demonstrated by comparing it to two PMO architectures using two use cases.

1. Analytics offloading: Processing overhead for security analytics is reduced by up to 50 percent using intelligent, programmable traffic forwarding.
2. Network monitoring and customer experience management: A combination of probes passively replicate and decode traffic on the GTP, Diameter, and Gi interfaces. Also, analytics tools are used to extract data for computing KPIs and provide visualization and reporting of analyzed data.

Use Case 1: Analytics Offloading

The analytics offloading use case employs a network packet broker controlled by a subscriber and session aware controller to offload the GTP correlation function from analytics probes. The TCO for two PMO architectures are compared to the Brocade architecture.

1. PMO A, two appliances: Separate packet broker and GTP correlation appliances.
2. PMO B, network packet broker with service module: Physical packet broker with GTP correlation service module.
3. Brocade architecture: Brocade physical packet broker with virtualized SDN controller running on commodity x86 based server that performs GTP correlation.

Traffic requirements that are typical of those in a large mobile network are used to compare the TCO of the three offloading architectures. Figure 2 illustrates the network elements and the required traffic flows.

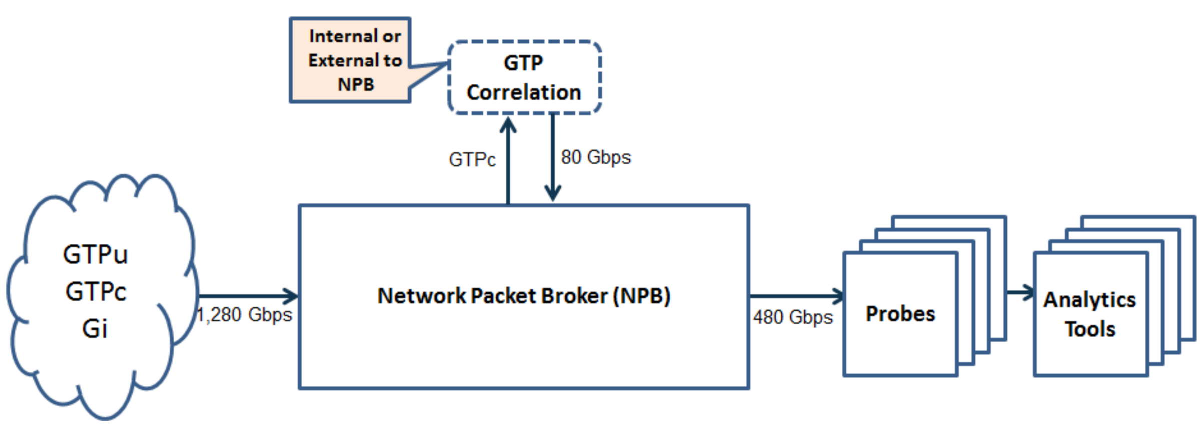

Figure 2 – Analytics Offloading Use Case

The capital expenses (capex) and operation expenses (opex) (TCO) associated with the network packet broker and GTP correlation functions are analyzed. The cost of the probes and analytics tools are not affected by this analysis and as such are not part of the cost analysis.

GTP and Gi[2] traffic is gathered using taps, which replicate and forward network traffic to the packet broker. The session aware controller examines GTPc traffic to ensure that all GTPu traffic associated with any given session is forwarded to the same analytics tool instance (regardless of which gateway services the subscriber). Further, the session aware controller dynamically reprograms traffic flows from the network packet broker based on the needs of individual analytics tools. The GTP correlation function can be hosted on VMs in a data center, on a service processor module within the packet broker or on an appliance. Traffic flow requirements are 1,280 Gbps of traffic flow from the mobile core into the packet broker but only 480 Gbps of traffic flows through to the probes. This represents a substantial reduction of probe capacity requirements. Up to 80 Gbps of traffic is delivered to the GTP correlation function by the network packet broker.

PMO A, Two Appliance Architecture

Figure 3 shows the network configuration for the two appliance architecture.

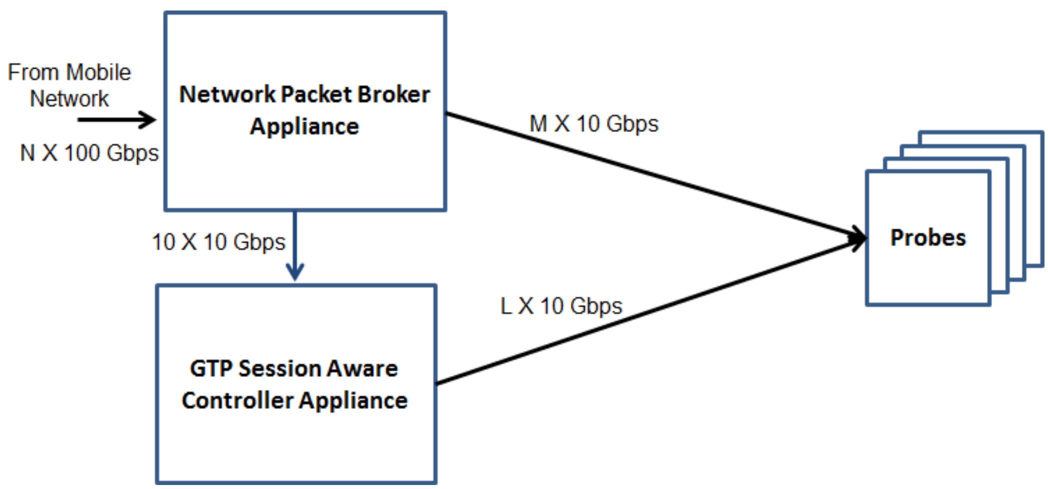

Figure 3 – PMO A, Two Appliance Architecture

The architecture is implemented using two separate appliances. A network packet broker appliance provides the packet broker function; the GTP correlation function is provided by a separate purpose-built, session-aware controller appliance. The appliance includes a proprietary services module to host the GTP correlation software. Two sets of 10 GE ports are used to connect the two appliances to the probes.

This appliance-based architecture lacks the agility and elasticity of the NFV/SDN based architecture. The engineered capacity of the GTP session-aware controller appliance is specified to be 15 percent greater than the traffic flow requirement (92 Gbps versus an 80 Gbps requirement) of the use case.

[2] Gi is the IP based interface between the P-GW/GGSN and a public data network.

PMO B, NPB Appliance with Services Module

Figure 4 shows the network configuration for the network packet broker with services module architecture.

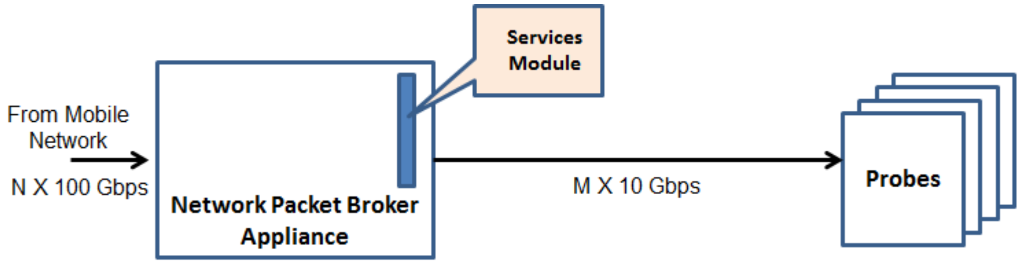

Figure 4 – Appliance with Services Module

The architecture consists of a network packet broker appliance that hosts the GTP correlation software on a services module. The service module employs a proprietary processor design. This design minimizes interface port requirements by using its backplane to interconnect the services module, control functions, and I/O interfaces.

The proprietary services module lacks the agility and elasticity of the NFV/SDN based architecture. The engineered capacity of the services module is specified to be 15 percent greater than the traffic flow requirement (92 Gbps versus an 80 Gbps requirement) of the use case.

Brocade's Architecture

Figure 5 shows the network configuration for the Brocade architecture.

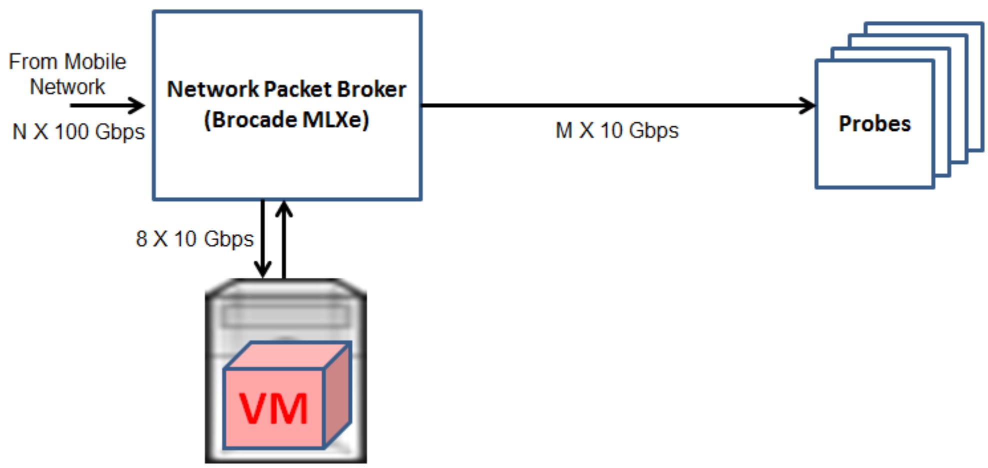

Figure 5 – Brocade Analytics Offloading Architecture

The Brocade MLXe platform functions as the network packet broker in this architecture. It aggregates, replicates, and filters the traffic that is forwarded to the analytics tools. Granular traffic selection is based on Layer 2 and Layer 4 header criteria. 100 GE ports connect the MLXe to the mobile network; 10 GE ports are used for all other interfaces. The GTP correlation function is performed by a virtualized, software controller running on an x86 based commodity server, which controls the Brocade MLXe Network Packet Broker through an SDN interface. An orchestration system combined with the NFV/SDN design provides agility and high elasticity, eliminating the necessity to dedicate added hardware capacity to ameliorate forecasting errors.

TCO Comparisons

Figure 6 provides a five-year cumulative TCO comparison for the three analytics offloading architectures.

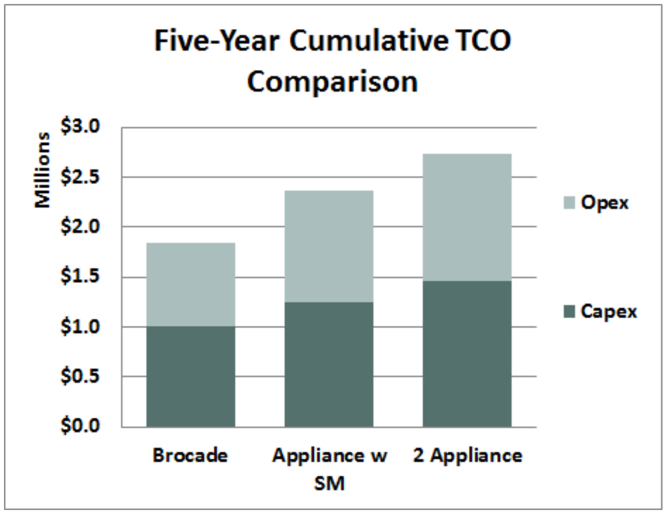

Figure 6 – Five-Year Cumulative TCO Comparison for Analytics Offloading Use Case

The Brocade architecture has 23 percent lower TCO than the Appliance with Services Module (PMO A) architecture and 33 percent lower TCO than the Two Appliance (PMO B) architecture. Brocade's capex is 19 percent lower than the Appliance with Service Module and 31 percent lower than the Two Appliance architectures. Five-year opex is 26 percent and 35 percent lower than the Appliance with Service Module and Two Appliance architectures, respectively.

Brocade's primary cost advantage compared to the Appliance with Service Module architecture results from its software-driven controller, which is deployed on VMs orchestrated via standard, open methodologies as compared to the use of proprietary compute modules by the alternative. Also, use of an orchestration system and cloud data center VMs for function hosting by Brocade increases the agility and elasticity of the architecture. This allows higher asset utilization than the PMO alternatives without increasing the risk of a capacity shortfall.

Brocade's primary cost advantage compared to the Two Appliance architecture is the large number of additional ports required by the Two Appliance architecture. Each of the two appliances must connect to every probe in the analytics installation. As is the case for the Appliance with Service Module architecture the Two Appliance architecture also has higher cost than Brocade because it is a purpose-built appliance and employs proprietary processor design, and it requires greater processor capacity to ameliorate capacity forecasting risks.

Use Case 2: Network Monitoring and Customer Experience Management

This use case compares the TCO of Brocade's virtualized probe and analytics tool architecture with an appliance-based architecture (PMO). A typical large network analytics deployment sized to serve one million concurrent subscribers supporting 3G and 4G services is used to compare the cost of the two architectures. Probes processing Diameter, GTP, and Gi protocols/interfaces are at the front end of the installation; analytics tools that analyze network performance, service delivery, and subscriber behavior sit behind the probes. The installation also includes visualization and reporting tools.

Appliance-Based Architecture (PMO)

The appliance-based architecture uses purpose-built appliances with custom silicon to provide the probe function and host Diameter, GTP, and Gi applications software. Analytics tools provide the network performance, service delivery, and subscriber analysis, visualization and reporting functions. The analytics tool software is hosted on a Linux-based server.

The probes are engineered to support 15 percent additional capacity (150,000 concurrent subscribers) because deployment is a six-month process. The 15 percent additional capacity is needed to ameliorate the risk that the capacity forecast is too low. However, this rigid design of the appliance-based architecture renders it incapable of ameliorating the risk of an over forecast.

Brocade's Architecture

The Brocade analytics platform uses an open NFV based architecture. It features:

- Vistapointe Intelligent Protocol Engine (vIPE): Performs deep-packet extraction, parsing and decoding.
- Vistapointe Analysis and Correlation Engine (vACE): Performs correlation and analyses of decoded traffic metadata.
- Vistapointe Visualization and Insight Dashboard (ViVID): Provides a dashboard, graphics, and a presentation engine.
- An orchestration system that automates add/move/change processes to enhance agility and elasticity.

These VNFs are hosted on VMs and orchestrated by an OpenStack controller.

The use of the orchestration system and VNFs enhances solution agility and elasticity and as such no additional capacity is needed to protect against capacity forecasting errors.

TCO Comparisons

Figure 7 compare the five-year TCO for the two architectures.

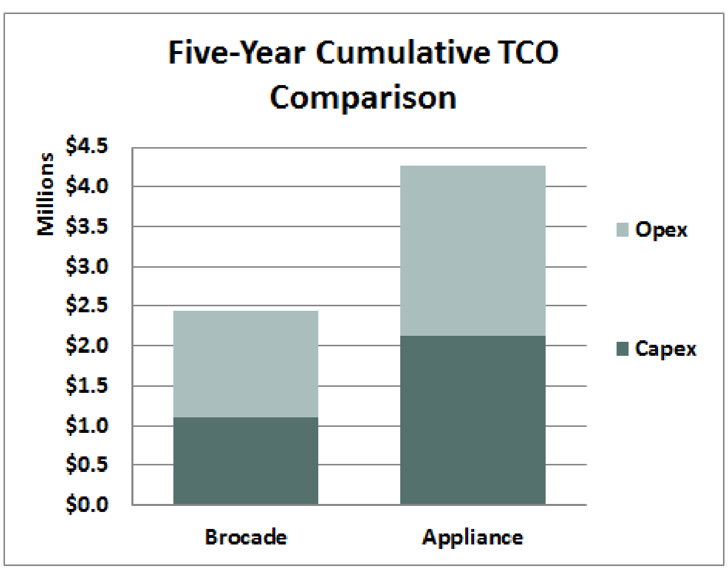

Figure 7 – Five-Year TCO for Network Monitoring and Customer Experience Management Use Case

The five-year TCO of the Brocade architecture is 43 percent lower than that of the appliance architecture. Brocade's capex is 48 percent lower; its opex is 37 percent lower than that of the appliance architecture. Brocade's architecture has two primary cost advantages: 1) Brocade's NFV approach and its use of VMs cost significantly less than the purpose-built appliance with its custom processors; 2) the cost advantage is in the elasticity and agility of the virtualized architecture. The capacity of the virtualized architecture can be quickly increased or decreased in very small increments. The appliance architecture requires about a six times longer lead time for capacity additions and capacity must be added in large chunks. This reduces asset utilization and can strand assets if demand fails to materialize. Figure 8 illustrates this effect.

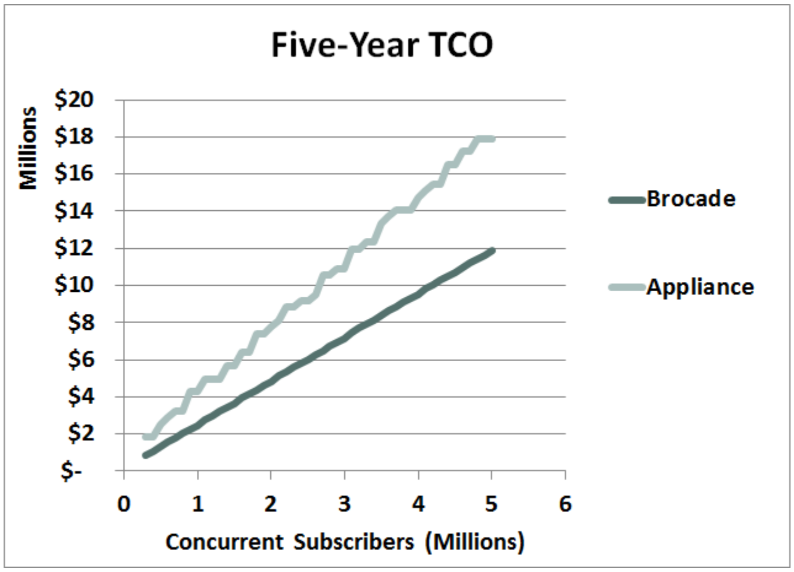

Figure 8 – Five-Year TCO Scaling Efficiency

Figure 8 shows that the Brocade architecture scales better[3] than the appliance architecture. Also, the more elastic nature of the Brocade architecture is seen in the smoothness of Brocade's cost curve compared to the lumpiness of the appliance architecture.

Benefits of the Brocade Analytics Approach

Benefits of the Brocade Analytics architecture to various service provider stakeholders are described:

- For the CNO: Increased agility as well as more scalable analytics infrastructure improves network asset utilization and frees up technical resources to work on projects with higher strategic value.
- For the CIO: Virtualization of network analytics infrastructure increases the value of the cloud-centric data center and allows application of best practices (orchestration, policy-based control, and virtualization) to a greater range of business processes.
- For the CMO: The availability of an agile analytics capability enhances the ability to combine intelligence on subscribers, devices, and the network to create new and dynamic service offerings.

[3] This means that the incremental cost of a capacity addition is lower for the Brocade architecture.

- For network planners: Increased network knowledge and the ability to proactively control the network create the opportunity to nimbly deploy and redeploy network resources to reduce costs while improving network performance.
- For network architects: An agile network analytics capability allows architects to be more creative in designing more efficient and timely network architectures.
- For network operations: Better network intelligence, more agile architectures, and increased automation allow network operations to improve network performance and be responsive to service requests.

Conclusion

Mobile network operators are facing threats to the sustainability of their businesses. They, consequently, are being forced to rethink their business models and their approach to network design. Under the present mode of operations network analytics was an afterthought. Now network analytics is a central enabler to the IP based services and architectures needed to implement these cost control and revenue enhancement initiatives.

Brocade provides a comprehensive and open network visibility/analytics architecture that reduces cost and increases network agility. The architecture includes NFV, SDN, and an elastic framework that incorporates orchestration.

The use of NFV, SDN, and orchestration by Brocade’s architecture dramatically reduces the time required to not only build, reconfigure, and add capacity to the analytics infrastructure, but also makes the entire mobile network more dynamic. The TCO of Brocade’s architecture is lower because it is open, requires less network capacity than the PMO architecture, and reduces operational risks associated with long planning/deployment cycles and their unavoidable forecasting errors.

ACG Research compared the TCO of Brocade’s architecture with PMO architectures using two use cases:

1. Analytics Offloading
2. Network Monitoring and Customer Experience Management

The analytics offloading use case employs a network packet broker and an associated GTP correlation function to offload processing capacity from analytics probes. The TCO of the Brocade architecture is compared to two PMO alternatives:

1. PMO A, two appliances: Separate packet broker and GTP correlation appliances.
2. PMO B, network packet broker with services module: Physical packet broker appliance with GTP correlation services module.

The Brocade architecture has 23 percent lower TCO than the Appliance with Services Module architecture and 33 percent lower TCO than the Two Appliance architecture. Brocade’s capex is 19 percent lower than the Appliance with Services Module and 31 percent lower than the Two Appliance architectures. Five-year opex is 26 percent and 35 percent lower than the Appliance with Service Module and Two Appliance architectures, respectively.

Brocade’s primary cost advantages compared to the Appliance with Services Module architecture are its use of VMs to host controller function (which performs GTP correlation), which is more cost efficient than the proprietary services module approach, and its higher agility and elasticity. The Two Appliance approach incurs a substantial cost penalty because of its need to duplicate connections to the analytics probes; it also suffers from a lack of agility and elasticity.

The network monitoring and customer experience management use case compares the TCO of Brocade's virtualized probe and analytics tool architecture with an appliance-based architecture. The five-year TCO of the Brocade architecture is 43 percent lower than that of the appliance architecture. Brocade's capex is 48 percent lower; its opex is 37 percent lower than that of the appliance architecture. Brocade's NFV approach yields much lower cost than the purpose-built appliance architecture. The use of mobile cloud data center VMs versus the custom-built processors of the appliance architecture and Brocade's superior agility and elasticity are the primary sources of its cost advantage.