Executive Summary

Service providers want to optimize their networks to minimize total cost of ownership (TCO), contain operational risk and environmental impact, and concurrently monetize their network base with services that increase average revenue per user (ARPU) and profitability. Traditionally, service providers use a variety of appliances to deliver and monitor services and ensure security services; however, this approach becomes more inefficient, complex, expensive and risky as network scale and service offerings increase.

Juniper Network’s Network Optimization Services portfolio trumps these shortcomings by integrating services on one platform, the MX Series 3D Universal Edge Router, and one operating system, Junos®. Consolidating service on the MX Series 3D supports the business goals of service providers by significantly lowering the cost to implement and operate the network and by improving return on network and service investments (ROI).

ACG Research compared network upgrades for three hypothetical mobile operators. Operator 1 implemented a traditional appliance-based network; Operator 2 implemented a hybrid approach using both router-based services and appliance-based services; Operator 3 implemented a fully converged infrastructure based on Network Optimization Services. Among other findings, our research established that the Juniper Network Optimization Services demonstrated up to 42% lower TCO, 75% lower environmental emissions, and produced 1.5 times higher ROI than the other service delivery methods.

Key Takeaways

Compared with appliance-based service solutions, Network Optimization Services offers:

Financial benefits
- 42% lower TCO
- 54% lower OpEx
- 29% lower CapEx

Operations benefits
- 95% less OS patch/upgrade costs
- 84% lower OAM costs
- 17X lower operational risk
- 76% floor space reduction
- 75% less power costs
- 74% cooling reduction

Time to market benefits
- 69% faster rate of deployment
- 76% faster rate to add new apps
- 14X less implementation risk

Environmental benefits
- 75% less carbon emissions
Introduction

A service delivery scenario is developed for three theoretical network operators that are deploying a next-generation mobile broadband data service network that meets the following business and technical requirements:

- Invest in and protect scale through 40Gbps capacity and 2 million subscribers per service zone.
- Increase ARPU via monetization services such as targeted ad insertion and managed video.
- Better optimize network resource utilization with intelligent traffic balancing.
- Reduce network bandwidth demands by transparently caching popular web content.
- Extend without disrupting the current IPv4 address pool.
- Improve network visibility and fault isolation capabilities.
- Protect network resources and assets and improve security posture.
- Ensure nonstop network availability.

The scenario includes optimization and monetization services that are typically implemented in service providers’ networks. Specifically:

- **Optimization services**
  - L4 load balancing and L4-L7 Application Delivery Control to optimize traffic distribution;
  - Web caching to reduce network bandwidth demands;
  - Flow monitoring for network troubleshooting and analysis activities;
  - Carrier-grade network address translation (CGN) to ensure an efficient, low-risk transition to IPv6;
  - Firewall services for network security.

- **Monetization services**
  - Targeted ad service that provides anonymous subscriber-related data to ad networks and inserts optimal ads into the subscribers web transactions; and
  - Managed video service that delivers premium video for subscribers.

The study analyzes cost, time to revenue, ROI, risks and other criteria for three different approaches to service delivery:

- Operator 1 uses an appliance-based service approach: each service is implemented using a discrete appliance that is connected to the network via a router or switch.

- Operator 2 uses a hybrid approach: some services are router-integrated, some appliance based.

- Operator 3 uses a converged Network Optimization Services-based approach: all services are implemented on the Juniper MX960.

In the analysis, all capital expenses (CapEx) are incurred on project initiation; operations expenses (OpEx) are incurred and calculated over five years.
Operator 1, Appliance-Based Service Delivery

This redundant design employs 42 individual network elements and 7 network operating systems to provide routing, switching flow monitoring, CGN, application delivery control, firewall, managed video, transparent caching and targeted ad insertion. It consumes 152 square feet of floor space.

Operator 2, Hybrid Service Delivery

Operator 2 employs routing, switching and some services on the router itself. Flow monitoring runs as a licensed application on the routing cards. CGN runs on one type of service card and managed video on a different type of service card. Load balancing, firewall, transparent caching and targeted ad insertion are all provided on separate appliances. This redundant design uses 31 network elements and 5 network operating systems, and consumes 103 square feet of floor space per data-center.
Mobile Operator 3, Full Service Convergence Using Juniper Network Optimization Services

Operator 3 uses Network Optimization Services to fully consolidate routing, switching and all services on the Juniper Networks MX960 Universal Edge Router. Flow monitoring and transparent load balancing are licensed applications for Junos Trio chipset-based routing cards. CGN, Application Delivery Controller and targeted ad insertion run on a processing optimized service card. A storage optimized service card hosts managed video and web caching. This redundant design uses just two MX960 chassis and one network operating system, Junos®, and occupies a single, standard telecom rack.

The MX Series 3D Universal Edge Router and the Junos operating system support routing, switching, security and services, including partner developed applications that are fully integrated with Junos® via the Junos SDK. This converged approach greatly reduces network and service design and testing complexity, time and costs when contrasted with solutions composed of elements and multiple operating systems. This innovative design allows the easy addition of new applications via non-disruptive license activation, and service cards provide linear scale without linear costs.

Network Optimization Services include features that improve service delivery:
- The MX Series 3D integrates routing, switching, security and service functions.
- The Junos® operating system provides consistent operations across all functions and applications.
- Modular applications allow incremental service deployment to support evolving requirements.
- Services consolidation and convergence for environmental impact reduction.
- Network and service consolidation reduces training, sparing and service contract related costs.

Total Cost of Ownership Comparisons

The initial costs to implement each service complex and ongoing operations expenses over five years are compared in this section. Figure 4 shows the TCO comparison for the cumulative five-year TCO.
Using Network Optimization Services, Operator 3 has 42% lower TCO, 54% less OpEx and 29% less CapEx than Operator 1. Operator 3 also has 42% lower TCO, 48% less OpEx and 37% less CapEx than Operator 2. The lower CapEx and OpEx afforded by Network Optimization Services are directly attributable to its converged architecture. The following table summarizes the number of chassis and operating systems used by the solutions.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Service Approach</th>
<th>Chassis</th>
<th>Operating Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator 1</td>
<td>Appliances</td>
<td>42</td>
<td>7</td>
</tr>
<tr>
<td>Operator 2</td>
<td>Hybrid</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Operator 3</td>
<td>Network Optimization Services</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

*Table 1 – Number of Chassis and Network Operating Systems*

The primary source of CapEx advantage over the other approaches is the use of a single chassis type (the MX960) for all services. Operator 1’s appliance-based service model uses 21 times more chassis than Operator 3’s Network Optimization Services implementation. Operator 2’s hybrid approach uses 13 times more chassis than Operator 3’s Network Optimization Services approach. Because each chassis has common equipment such as power supplies, fans and controllers, the multiple chassis used by Operators 1 and 2 replicate these costs many times. In the Network Optimization Services implementation, the common components of the MX Series 3D chassis power routing, switching and services.

**Operations Expense Comparisons**

Figure 5 shows the OpEx expenses for all expense categories except vendors’ service fees.
The Network Optimization Services has substantially lower OpEx in each expense category because implementing fewer chassis reduces labor expenses, environmental costs, and vendors’ service fees.

**Environmental Impact Comparison**

Figure 6 shows the environmental impact of powering and cooling the service delivery equipment.

The electricity needed to power and cool the network produces greenhouse gases. Operator 3’s implementation reduces these emissions by 76% compared to Operator 1 and 63% compared to Operator 2.

Table 2 restates these emissions as equivalent to the number of miles driven in an auto.
Time to Market and Time to Add a New Service Comparison

Network Optimization Services improve time to market by utilizing a single network element (the MX Series 3D) and operating system (Junos®), enabling a consistent set of operations, administration and management processes (OAM); software update schedule and procedures; and technical support.

Time to market increases when multivendor multi-element solutions are used, as it takes longer to qualify vendors and certify elements. Implementation times were analyzed using a work breakdown structure per solution and show that the rate of deployment time for the MX Series 3D and Network Optimization Services is 69% and 38% faster to implement than the appliance and hybrid solutions, respectively (which is equivalent to 41% and 28% reduction in number of days to deploy system and services). This faster deployment time adds 13% and 7% more to top-line revenue to Operator 3 as compared to Operator 1 and Operator 2.

A service provider’s ability to quickly respond to market trends and customers’ requests with new services is a major competitive advantage. The time to add a new service to an existing network is 76% faster (which is equivalent to 46% reduction in number of days) for the Network Optimization Services as compared to the other solutions, as no additional vendor or element qualification is needed. This makes it feasible to rapidly exploit market niches that could not be profitably addressed with traditional solutions.

Comparison of Implementation and Operational Risks

All implementation projects are subject to risks:

- Vendor/product fails qualification.
- Qualified technical staff is not available.
- Installation fails due to bad design or execution.
- Project management risks where coordination breaks down and unforeseen events occur.

The probability of encountering these risks increases with complexity. Simply, the risk of a failed vendor qualification increases if three vendors are qualified rather than one; the risk of an install failure grows as the number of chassis and operating systems increases. Given a 1% chance of an implementation failure event occurring per chassis, Operator 3 faces a 2% chance of implementation failure per facility; Operator 1 has a 42% chance (17 times more\(^1\)); and Operator 2 has a 25% risk.

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\(^1\) The probability that no risk event will occur during implementation is \(1 - Pr^N\) where \(Pr\) is the probability of an event not occurring for one chassis and \(N\) is the number of chassis.
ROI on Monetization Services

The return on investment realized in deploying two monetization services is analyzed:

- **Targeted Advertising**: subscribers can opt in to receive preference-based web advertisements.
- **Mobile Video**: operators can offer high-quality mobile video services to subscribers.

The ROI obtained by investing in the service delivery equipment needed to deliver these services is compared for the three operators. Although the additional revenue is the same for each operator the investment cost, monthly recurring operations expense, and time to market differs for each operator because of their choices of service delivery architecture.

**ROI Results**

The net cash flow consisting of 7% ($294,000 per month) of the revenue from the ad insertion and video services less the initial investment in service delivery equipment and monthly operations expenses is used to compute the ROI over 36 months for each mobile operator. Only 7% of the revenue is attributed to the investment in service delivery equipment because there are many other expense components, for example, sales, promotions, billing, and general and administrative expenses that are not part of this analysis. Figure 7 shows the cumulative net cash flow for each operator.

![Cumulative Net Cash Flow from Monetization Services](image)

**Figure 7 – Cumulative Net Cash Flow from Monetization Services**

A substantial net cash flow advantage is seen for the Network Optimization Services solution versus the appliance and hybrid service solutions. ROI over 36 months is 171%, 170% and 266% for the appliance, hybrid and Network Optimization Services solutions, respectively. The Network Optimization Services solution reaches the break-even point in 12 months; the other solutions require 19 months to reach the break-even point.
Conclusion

Three service delivery solutions, discrete appliances, hybrid convergence, and the Network Optimization Services full convergence approach, were compared by modeling implementation and operation of the solutions for three mobile broadband operators. Selected network optimization and monetization services were featured in the analysis. Table 3 summarizes the amount of savings produced by the Juniper Network’s Network Optimization Services solution.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Discrete Appliances</th>
<th>Hybrid Model</th>
<th>Network Optimization Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Optimization Services Percentage OS Patch and Upgrade Cost Savings</td>
<td>95% less</td>
<td>92% less</td>
<td>-</td>
</tr>
<tr>
<td>Network Optimization Services Percentage OAM Cost Saved</td>
<td>84% less</td>
<td>76% less</td>
<td></td>
</tr>
<tr>
<td>Network Optimization Services Percentage Less Emissions</td>
<td>75% less</td>
<td>63% less</td>
<td>-</td>
</tr>
<tr>
<td>Time to Market (months) for First Office Application</td>
<td>115</td>
<td>94</td>
<td>68</td>
</tr>
<tr>
<td>Network Optimization Services Percentage Time Saved to Add a Service to the Network</td>
<td>46% less</td>
<td>46% less</td>
<td></td>
</tr>
<tr>
<td>Monetization ROI</td>
<td>171%</td>
<td>170%</td>
<td>266%</td>
</tr>
<tr>
<td>Risk of Failure Event if Each Chassis Has a 1% Chance of Failure</td>
<td>34%</td>
<td>22%</td>
<td>2%</td>
</tr>
<tr>
<td>Network Optimization Services Percentage Space Saved</td>
<td>76% less</td>
<td>22%</td>
<td>2%</td>
</tr>
<tr>
<td>Power Consumed compared to Network Optimization Services</td>
<td>4x more</td>
<td>2.5x</td>
<td>-</td>
</tr>
<tr>
<td>Network Optimization Services Five-Year TCO Percentage Saved</td>
<td>42% less</td>
<td>42% less</td>
<td>-</td>
</tr>
<tr>
<td>CapEx Juniper Percentage Saved</td>
<td>29% less</td>
<td>37% less</td>
<td></td>
</tr>
<tr>
<td>OpEx Juniper Percentage Saved</td>
<td>54% less</td>
<td>48% less</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 – Summary of Results, Percentage Savings Produced by Network Optimization Services

Our research indicates that Juniper Network’s Network Optimization Services solution reduces cost, environmental impact and improves network ROI by providing full convergence of routing, switching, security and services. It delivers consistent operations and management across applications, produces environmental efficiency and lowers the cost of deployment and operations.

ACG Research

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