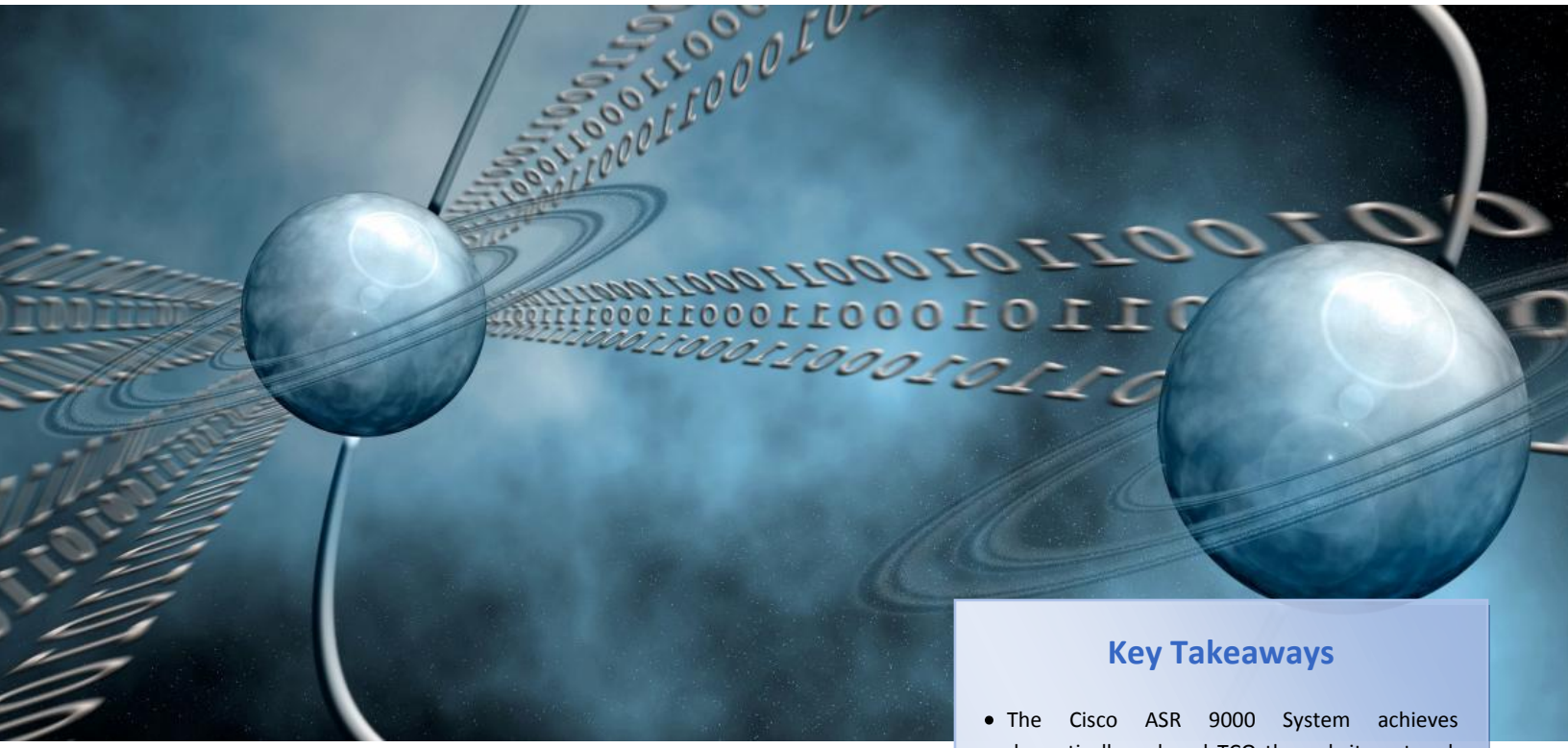
A Business Case for Scaling the Next-Generation Network with the Cisco ASR 9000 System



Key Takeaways

- The Cisco ASR 9000 System achieves dramatically reduced TCO through its network virtualization (nV) technology that delivers GE aggregation and access ports with rich levels of functionality provided by an ASR 9000 System.
- CapEx is reduced because the ASR 9000 System has high port densities and more card slots per chassis, and due to its distributed router functionality.
- The ASR 9000 System's network virtualization design simplifies network operations and reduces operations expense (OpEx).
- The ASR 9000 System reduces network OpEx by up to 71%. The savings are attributed to simpler network operations across the lifecycle and up to a 65% reduction in power consumption, which reduces power, cooling, and floor space expenses.
- TCO is reduced by up to 73% over competitive solutions that lack nV technology.
- The payback on the investment in a complete ASR 9000 System is less than one year, assuming that only 2% of service revenues are allocated to paying back this investment.

Executive Summary

The demand for triple-play and quad-play services is putting pressure on vendors to deliver highly scalable network solutions. Video services are driving explosive growth in bandwidth, particularly in access and aggregation networks. Consequently, broadband operators' business models are threatened because pricing policies do not reflect the increasing bandwidth growth. To address this challenge, broadband operators require routing solutions that cost efficiently scale with the growth in traffic. Cisco addresses this challenge with the Cisco ASR 9000 System and its network virtualization (nV) technology.

ACG Research has developed a business case analysis for the Cisco ASR 9000 System when deployed across a triple and quad-play access and aggregation network. The business case analysis compares the cash flow and six-year cumulative total cost of ownership (TCO) of the Cisco ASR 9000 System with the routing solutions of two leading vendors (Vendor A and Vendor B) where the necessary routing and advanced features needed for triple-play and quad-play service delivery are embedded in the hardware of each routing chassis. The analysis shows that the Cisco ASR 9000 System drives down the cost of bandwidth as compared to the competing solutions.

Bandwidth cost is driven down by the Cisco ASR 9000 System's nV technology and its increased port density. ACG Research developed a cash flow analysis for each routing solution. It allocates 2 percent of the service revenue to the access and aggregation routing operation. The Cisco ASR 9000 System has an 11 month payback[1]; Vendor A's solution fails to reach payback within 6 years; and Vendor B's solution has 4.5 year payback. The ASR 9000 System also has 73 percent lower TCO[2] over 6 years than Vendor A and 60 percent lower TCO than Vendor B.

Network Architecture

Cisco ASR 9000 System is a distributed, scalable, virtual routing system consisting of ASR 9000v GE aggregation and access nodes and clustered ASR 9000 nodes. All the nodes are managed as a single system, providing GE, 10 GE and 100 GE ports.

The Cisco ASR 9000 System (Figure 1) distributed virtual routing system consists of the following:

- ASR 9000 Cluster Nodes: ASR 9922/9010/9006
- GE Aggregation and Access Nodes: ASR 9000v
- High-Density 10 GE and 100GE Cards on ASR Cluster Nodes (24X10GE and 2X100GE Cards)

These components together create a distributed virtual routing system that provides IP access and aggregation services to subscribers. The Cisco ASR 9000 System reduces network TCO in multiple dimensions:

- Elimination of hardware-based routing functionality in the access nodes
- Reduced CapEx due to higher port densities and lower port costs
- Reduced OpEx due to operational simplicity
- Reduced OpEx due to lower power, cooling, and floor space expenses

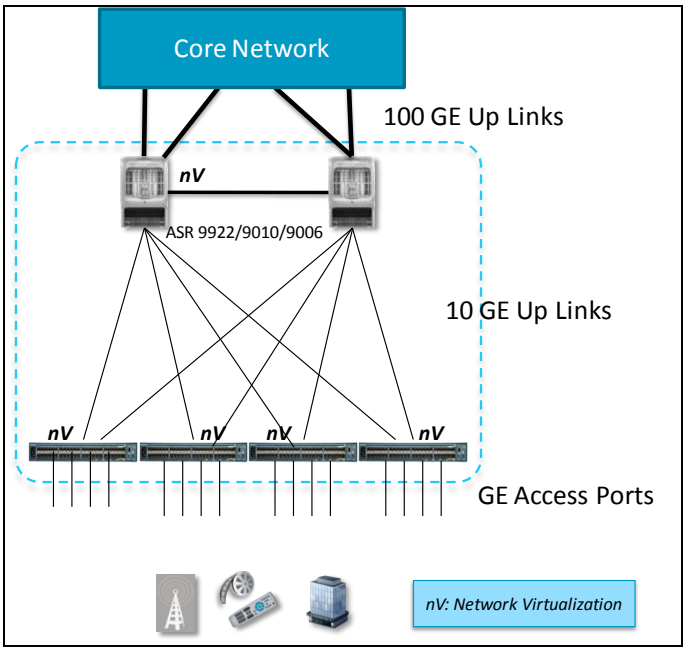


Figure 1. ASR 9000 System Network Configuration

[1] Payback is the time required for project cumulative discounted net cash flow to reach the breakeven point.
[2] Total Cost of Ownership (TCO) is the sum of capital expense (CapEx) and operations expense (OpEx).

A detailed TCO/cash flow model compares the Cisco ASR 9000 System with alternative solutions provided by two leading IP routing vendors. These vendors' solutions deliver equivalent access and aggregation router functions as do those used in the Cisco ASR 9000 System; however, these products use independent hardware-based routing functions embedded in each chassis.

Business Case Modeling Approach and Assumptions

The business model analyzes TCO and cash flow for each solution over a six-year period. Network services drive traffic and revenue; network traffic drives equipment configurations, which drive CapEx. A detailed OpEx model employs a bottom-up analysis. The components of CapEx and OpEx considered are:

CapEx Categories

- Average Selling Price (list price with discount)
- Engineer, Furnish, and Install (EF&I)

OpEx Categories

- Acquisition Engineering Installation
- Install Commission
- Software Maintenance
- Troubleshooting
- Power
- Cooling
- Floor Space

Key Assumptions

The key services and assumptions used to drive the TCO and cash flow model are:

- Residential services drive traffic and revenue
  - Services are Internet, broadcast TV, video on demand, and voice over IP
  - Cisco VNI data is used to calculate peak demands
- ASR 9000nV or competing Ethernet switch/router aggregation/access nodes are located in access central offices
- Each access central office serves up to 5,000 households
- ASR 9922 cluster nodes or multiple competing large Ethernet switch/routers are located in edge central offices
- Networks use subscriber level QoS that require a large number of queues on each card
- 400% traffic oversubscription is assumed at the edge layer

The OpEx model considers service expenses, environmental expenses, and network care expenses. The key assumptions in the OpEx model are:

- Managing an ASR 9000v node is equivalent to managing a card in a chassis; it is part of the ASR 9000 System

- The overall management hours required for a ASR 9000 System are lower than the management hours required for separate interconnected routers
- EF&I expenses are lower for the ASR 9000v than for standalone routers; it is part of the virtual router
- Power, cooling, and floor space are calculated directly from the power consumed by cards and chassis

Business Case Model Results

The business model analyzes the revenues and expenses for providing residential services in a metro region. It is assumed that the number of residential subscribers will grow from 250,000 to 500,000 during a six-year period. The model calculates network traffic and designs the access, aggregation and edge networks to meet demand. The key dimensions of the network are presented in Table 1.

Key Network Dimensions						
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Residential Subscribers	250,000	300,000	350,000	400,000	450,000	500,000
DSLAMs	350	400	450	500	550	600
GE Ports per DSLAM	8	9	10	10	10	11
GE Access Ports	2,800	3,600	4,500	5,000	5,500	6,600
Central Offices	114	132	153	164	175	200

Table 1. Network Dimensions

The business case for investing in the Cisco ASR 9000 System is summarized in Figure 2. This cash flow analysis assumes that only two percent of service revenues are used to pay back the investment in the Cisco ASR 9000 System. Annual net cash flow is computed as allocated revenue (two percent of service revenue) less annual CapEx and OpEx. Cumulative discounted net cash flow is used to estimate project payback.

Using this very conservative revenue allocation, the Cisco ASR 9000 System investment is paid back in only 11 months. The cumulative discounted net cash flow is positive in the first year and has sequential growth year over year. In comparison, investing in Vendor A's solution results in a negative cumulative discounted net cash flow over the six-year period; the payback is greater than six years. Vendor B's solution has four and one-half year payback.

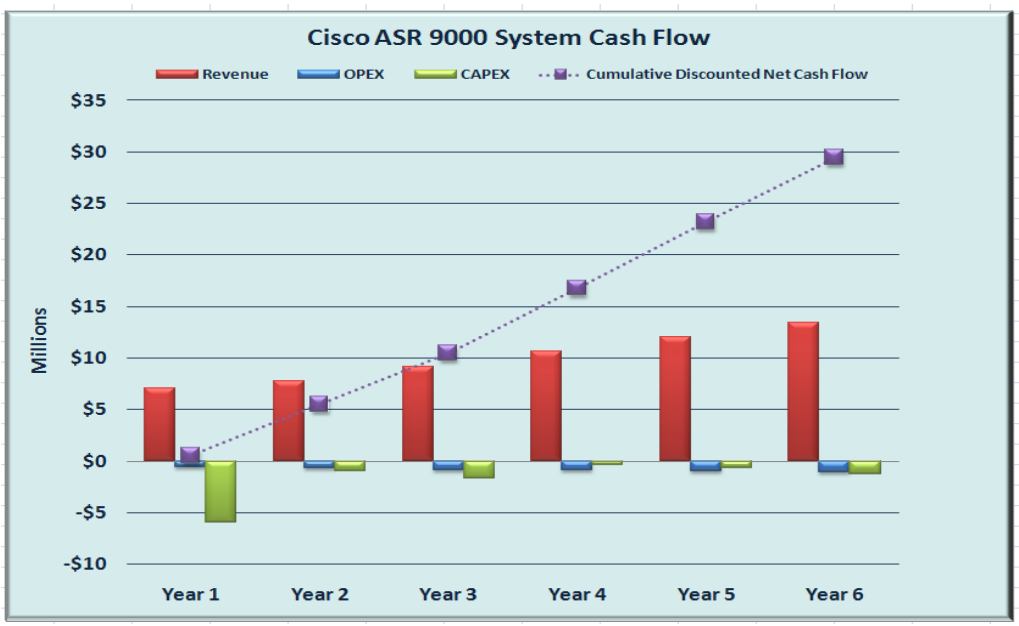


Figure 2. ASR 9000 System Cash Flow

The model also compares the TCO of the Cisco ASR 9000 System with network solutions lacking nV technology from Vendor A and Vendor B. The results of this analysis are summarized in Figure 3, which compares the cumulative TCO of each solution over a six-year period. Cisco's solution is 73 percent less expensive than Vendor A's solution and 60 percent less expensive than Vendor B's. The savings are primarily due to:

- Reduced CapEx for access nodes due to the nV technology
- Reduced CapEx due to higher port densities and lower port costs
- Reduced OpEx due to operational simplicity
- Reduced OpEx due to lower power, cooling, and floor space expenses

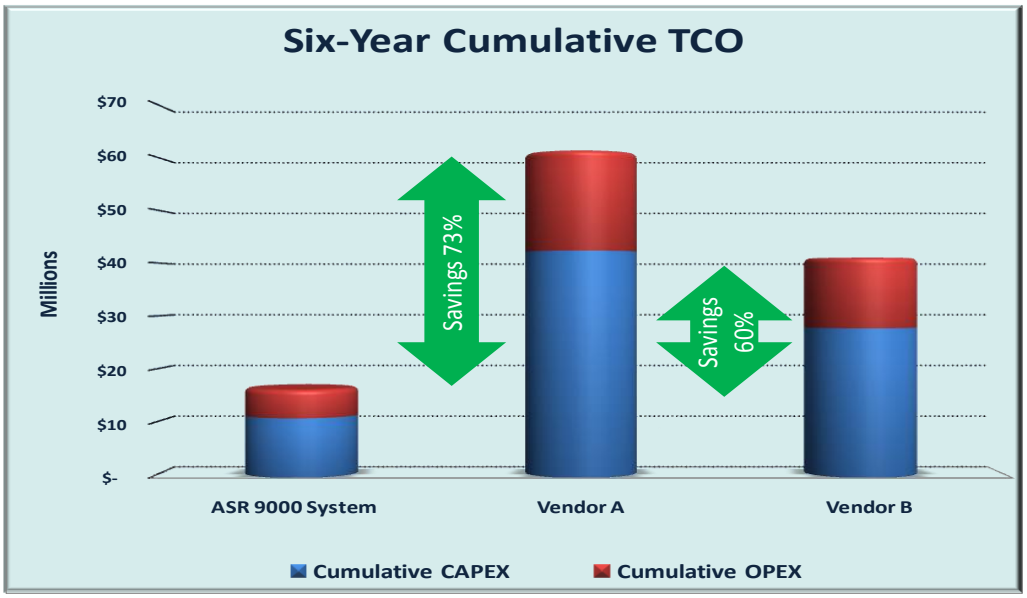


Figure 3. Six-Year Cumulative TCO Comparison

The breakdown of cumulative OpEx is presented in Figure 4. The savings in network care (configuration, fault, and performance management) are due to the simplicity of the Cisco ASR 9000 System. A virtual system is easier to manage than a network consisting of independent routers; therefore, the cost of operating the virtual system is lower. Technical support and service savings are a result of lower, overall cumulative CapEx, which drives support expenses. Reduced environmental expenses (power, cooling, and floor space) are the outcome of reduced power consumption. The Cisco ASR 9000 system is 65 percent more power efficient than Vendor A's solution and 48 percent more efficient than Vendor B's.

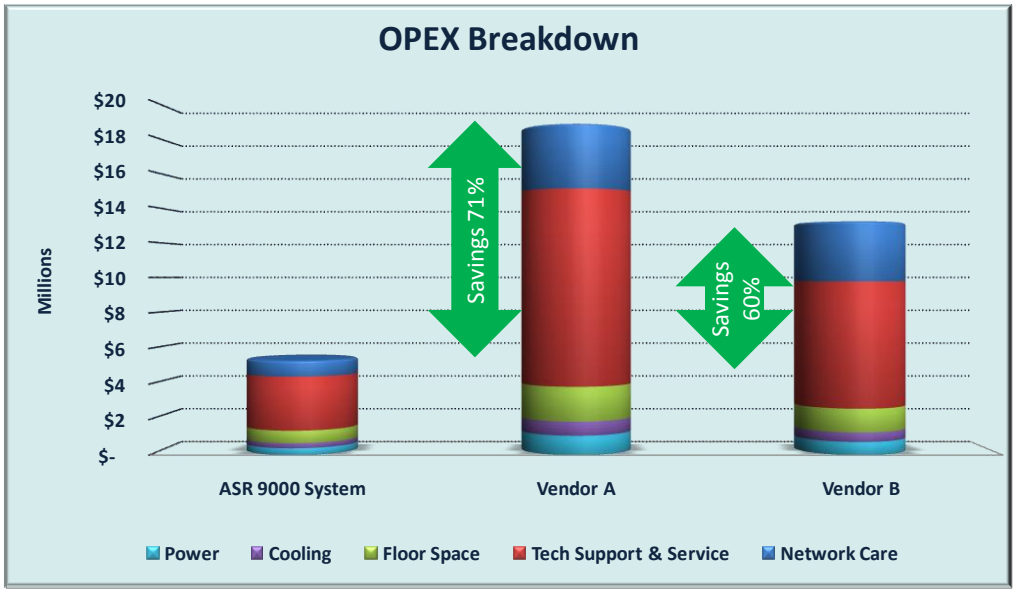


Figure 4. OpEx Breakdown Comparison

Conclusion

The Cisco ASR 9000 System enables service providers to profitably scale networks to support bandwidth-intensive applications by increasing the scaling efficiency of the access, aggregation and edge router networks. The cost of router networks is reduced by these key factors:

- Reduced CapEx by taking hardware-based routing functionality out of the access nodes
- Reduced CapEx due to higher port densities and lower port costs
- Reduced OpEx due to operational simplicity
- Reduced OpEx due to lower power, cooling, and floor space expenses

With the ASR 9000 System, Cisco is providing service providers with the tools for future profitability.

ACG Research

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