

Executive Summary

Controlling total cost of ownership (TCO) of access, aggregation, and edge networks used for mobile backhaul and broadband services in the face of explosive traffic growth is one of the biggest challenges facing network operators. Many technologies including SONET/SDH, TDM/PDH, Carrier Ethernet, optical, MPLS and IP have been deployed to meet rapidly evolving network requirements. Network operators' operational and organizational makeup, however, are more static. This is due to the organizational boundaries, network hierarchy and segmentation that are the result of the sheer scale and complexity of managing and operating these networks.

Ericsson has developed the Virtual Network System concept that allows operators to manage the rapid rate of introduction of new network equipment while maintaining a stable operating environment. The Virtual Network System concept supports centralized control with more easily managed network nodes. This constitutes a Software Defined Network that can act as a single point of touch to automate network functions. It contrasts with router-based networks, which provide an extensive range of functionality but with an associated level of operational complexity, sophistication, and cost.

ACG Research has conducted a TCO analysis of the Virtual Network System concept. A representative access/aggregation/edge mobile backhaul network is used to compare the TCO of the Virtual Network System concept with a router-based network. Both networks support backhaul of TDM/PDH and IP services. The analysis finds that the Virtual Network System concept has 79 percent lower TCO than today's router-based solutions.

Key Takeaways

Ericsson's Virtual Network System concept supports centralized control together with more easily managed network nodes.

The Virtual Network System concept significantly reduces TCO while maintaining the economic and flexibility advantages of IP/Ethernet.

Compared to today's router-based solutions the Virtual Network System provides the following cost savings:

- 79% lower TCO
- 80% lower CapEx
- 79% lower OpEx
- 92% lower environmental expenses
- 50% lower network care expense

Introduction

Ericsson has developed the Virtual Network System concept that allows the operator to manage the rapid rate of introduction of new technologies, network services and equipment while maintaining a stable operating environment. Driven by exploding capacity demands caused by the rapid growth of video services, the mass adoption of connected consumer electronics and new types of connected machine to machine (M2M) services operators are facing constant network change and expansion, resulting in a corresponding growth in operational (OpEx) and capital (CapEx) costs.

Figure 1 illustrates the operational challenge that exists in today's networks where TDM and IP networks are operated side by side.

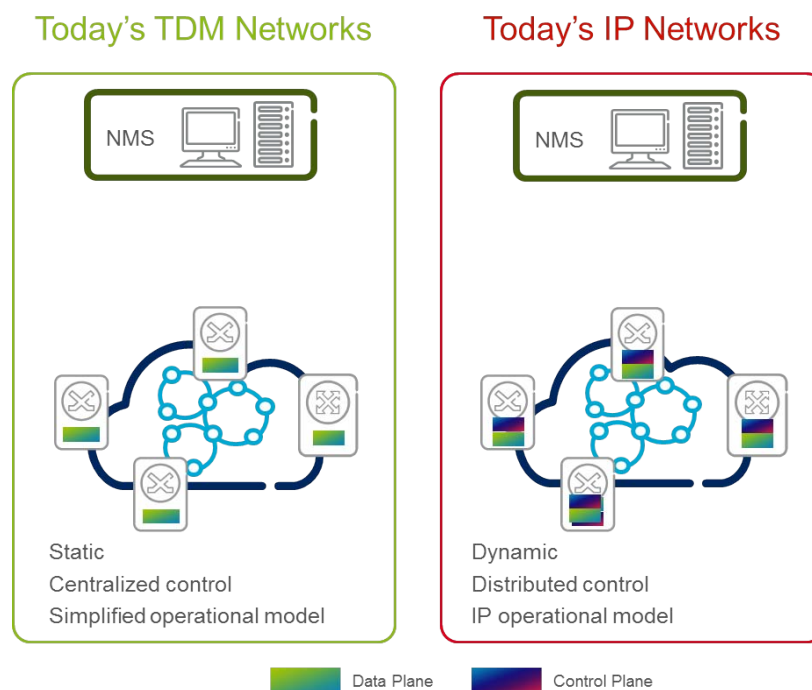


Figure 1 – Today's TDM and IP Networks

The TDM operational model is characterized by static routes and traffic flows across the network, centralized control, and a simplified operational model that limits the complexity of each network element and therefore reduces the skill requirements of the field service technicians responsible for maintaining and operating the network. In contrast, today's IP network operational model features dynamic routing of traffic across the network, distributed network control where intelligence is embedded in every network node, and an IP operational model where field service technicians must have advanced training in IP networking.

Figure 2 illustrates a future network embodying the Virtual Network System concept where the static operational model of today's TDM networks is combined with the flexibility and economic advantages of IP/Ethernet technologies.

Future Network

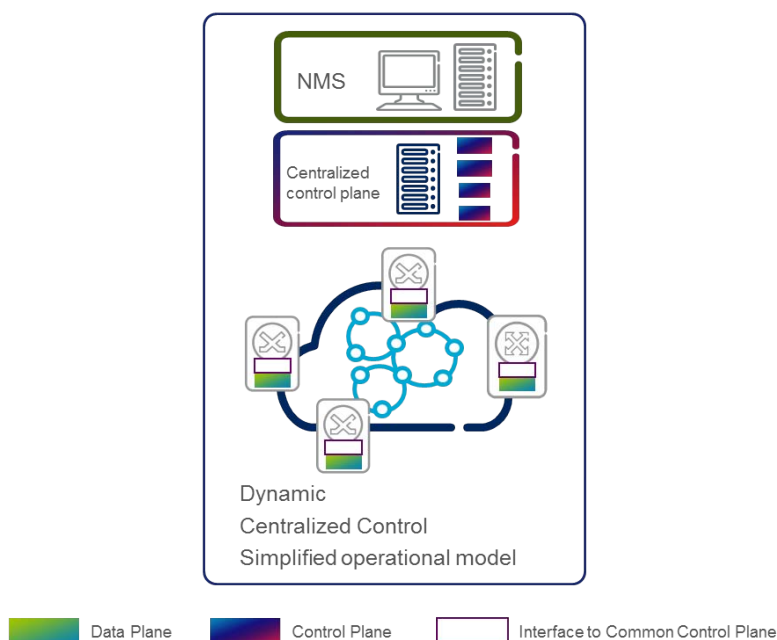


Figure 2 – Virtual Network System Concept

The Virtual Network System concept employs centralized control to more easily manage a large number of network nodes. This permits the use of the TDM operational model, which is optimized for simplicity of field operations while supporting IP/Ethernet functionality.

The Virtual Network System concept is a Software Defined Network (SDN) that acts as a single point of touch to automate network functions, including:

- Services and connections provisioning
- Virtualization (VRF, VPN, etc.)
- Inter-region route exchange
- IP address management and planning
- Dynamic restoration
- Software upgrades
- Coordination of optical and packet/IP control planes
- Network API for future application development

Software Defined Networking refers to a network architecture in which the network control plane is decoupled from the physical topology. The rationale for this approach is twofold. First, the decoupling allows for the control plane to be implemented using a different distribution model than the data plane. Second, it allows the control plane development and run-time environment to be consolidated on high-powered centralized platforms located near the edge of the network rather than distributed on the relatively lower-powered management CPUs found on hardware that is distributed in the aggregation and access sections of the network.

The simplicity of the Virtual Network System concept contrasts with router-based networks, which provide an extensive range of functionality but with an associated level of operational complexity, sophistication, and cost.

TCO Comparison of Virtual Network System Concept with Router-Based Networks

A representative access/aggregation/edge network used for mobile backhaul is used to compare the TCO of a network based on the Virtual Network System concept with a router-based network. Both networks support backhaul of TDM/PDH and IP services. Figure 3 shows the Virtual Network System applied to the model network.

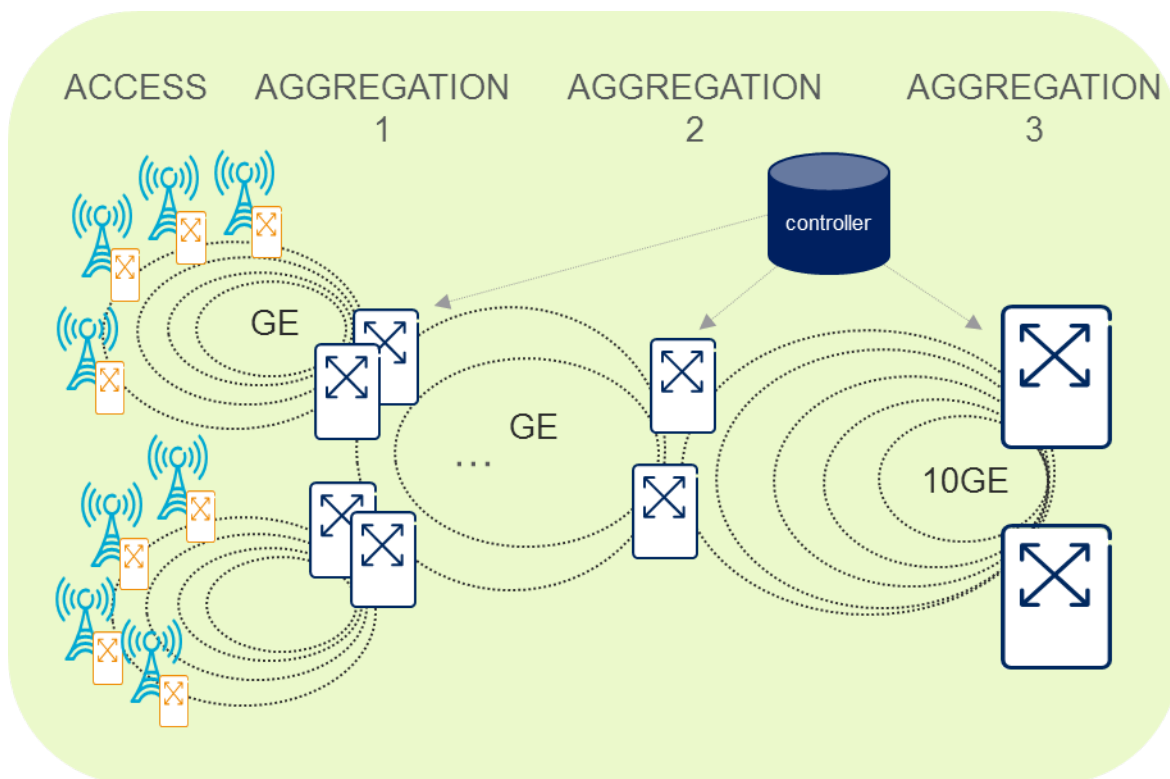


Figure 3 – Model Network with Virtual Network System

The model network backhauled traffic from cell sites. It has three layers of aggregation and uses GE and 10 GE rings on the access and aggregation layers. The cost analysis assumes that all CapEx is incurred in the first year, and OpEx is calculated for five years.

Virtual Network System Concept

The Virtual Network System concept in this example is implemented using the Ericsson SPO 1410 packet optical transport system at the Agg1 and Agg2 nodes, and a pair of SPO 1460 packet optical transport systems are used at the Agg3 nodes. The SPO 1400 product family is optimized for use in access and metro networks. It provides carrier-class Ethernet and TDM services and interworks with edge, metro, and core networks based on SDH, Ethernet or WDM.

Note that in Figure 3 the Ericsson SP 210 and/or SP 310 carrier Ethernet platforms also could be included into the model to address smaller aggregation sites and/or mobile cell sites. In this case the TCO results

would not differ greatly from the results shown in this paper as the underlying OpEx and CapEx cost dynamics would remain in place.

A centralized controller provides the Software Defined Network functionality. It offers an abstraction layer for the IP forwarding elements, hence representing a group of forwarding elements as if they are a single IP node. Managing a remote system, for example, becomes equivalent to managing a card in a chassis.

Note that in Figure 3 the centralized controller is shown as a standalone entity. In the future, this function could likely be hosted as a feature on an IP edge router subtending the 10GE aggregation ring (for example, the Ericsson SSR platform). In this case the TCO results would not differ greatly from the results shown in this paper as the underlying OpEx and CapEx cost dynamics would remain in place.

Router-Based Solution

The router-based solution employs an MPLS enabled Carrier Ethernet switch/router at the Agg1 and Agg2 nodes. A multiservice edge router is deployed at each Agg3 node. Network control is distributed across all network nodes. Service providers must configure each node separately and must individually provision new services across each node.

TCO Results

Figure 4 compares the five-year TCO of the Virtual Network System concept with the router-based solution.

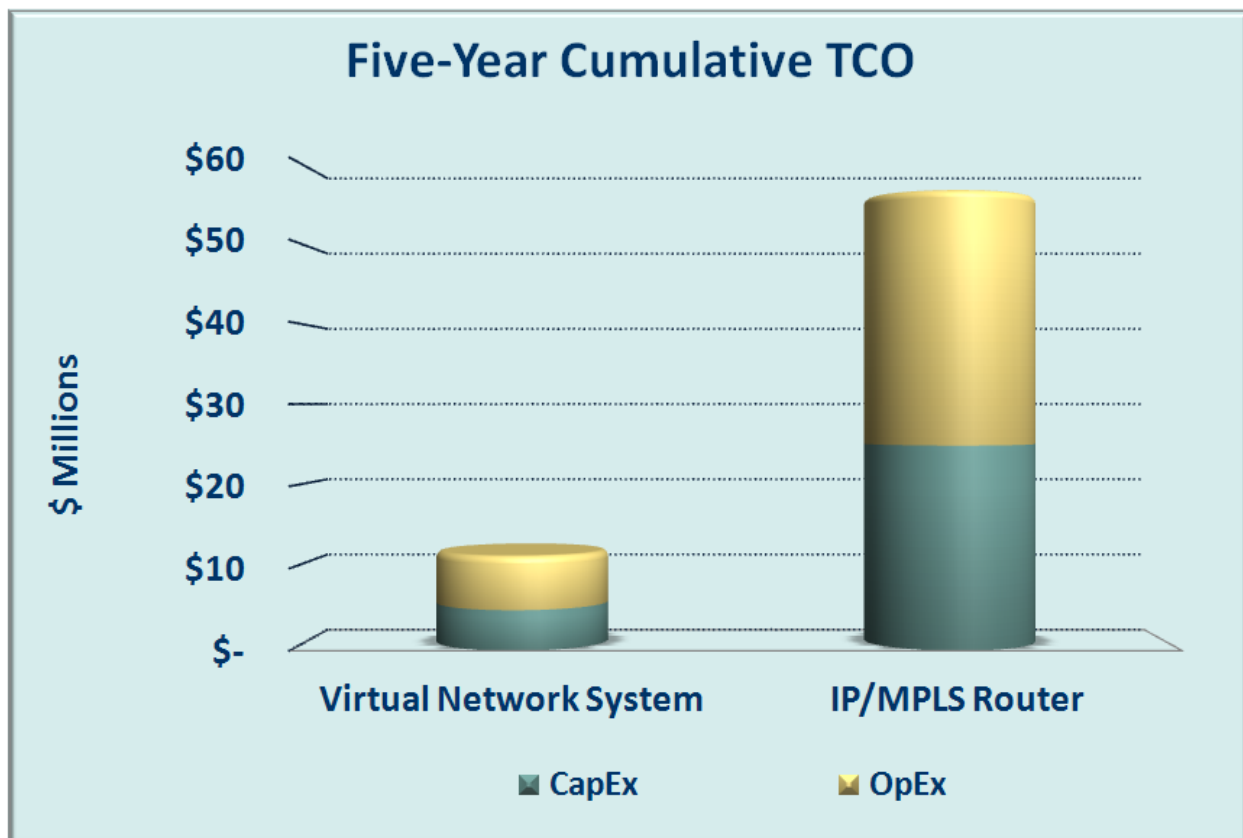


Figure 4 – Five-Year Cumulative TCO Comparison

The Virtual Network System concept has 79 percent lower TCO than the router-based solution. Both components of TCO (CapEx and OpEx) are lower for the Virtual Network System concept. CapEx is lower because of the cost advantages of the SPO 1410 packet optical transport systems used at the Agg1 and Agg2 levels. In addition, the centralized controller used by the Virtual Network System enjoys substantially better economies of scale than the distributed controllers deployed in the router-based solution. OpEx is lower because the Virtual Network System provides a single point of touch for management of the entire network as compared to the individual node-by-node management required by the router-based solution.

Figure 5 compares the five-year OpEx of the Virtual Network System with the router-based solution.

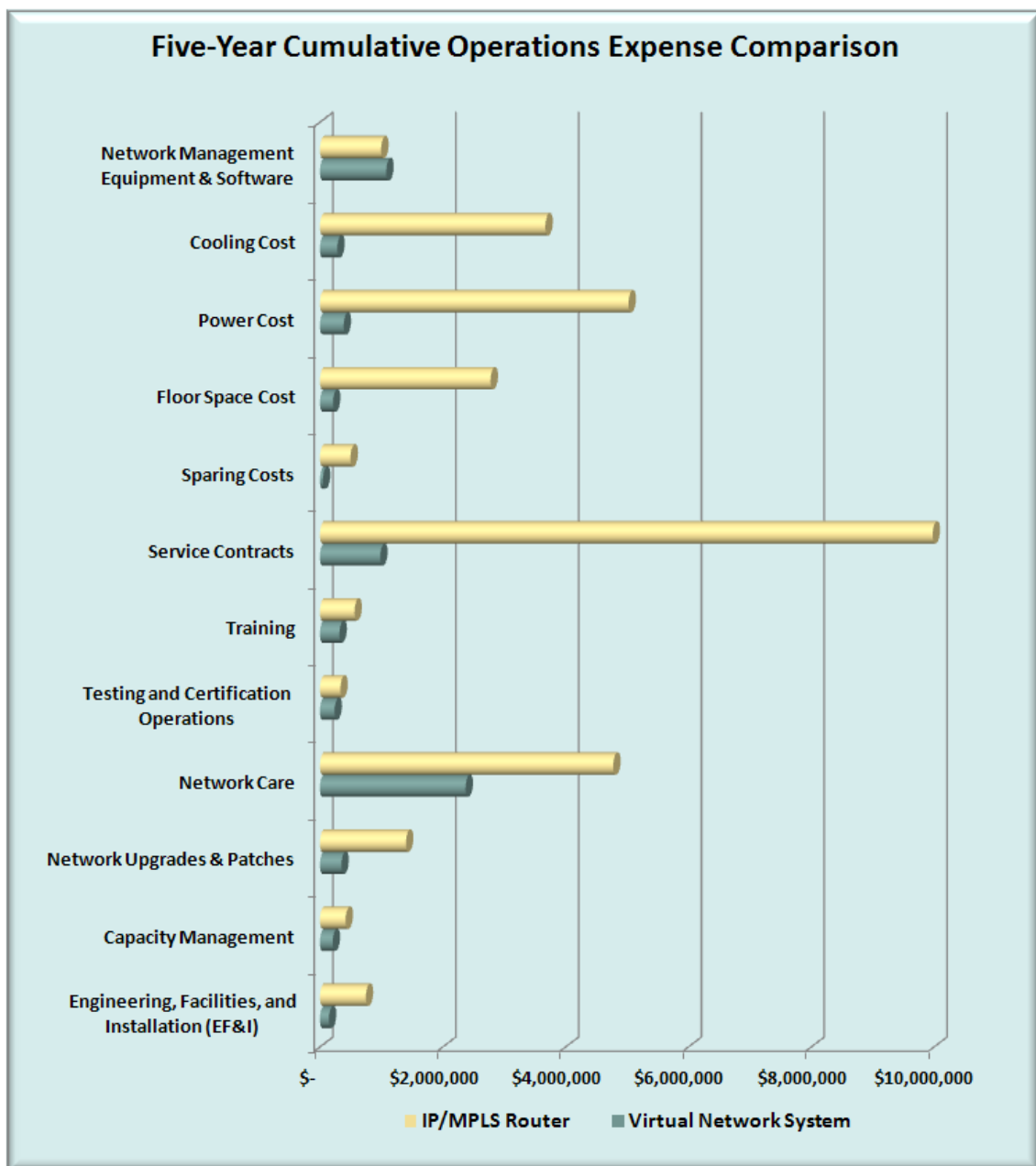


Figure 5 – Five-Year Cumulative OpEx Comparison

Service contract expense is tied directly to the purchase price of the network equipment. Because the Virtual Network System concept has much lower CapEx than the router-based solution, service contract expense is correspondingly lower. Environmental expenses (cooling, power, and floor space) are determined by the resources required by each network element. The packet optical transport equipment is much simpler to operate than router-based Carrier Ethernet switches. Consequently, environmental expenses are much lower for the Virtual Network System concept. The single point of touch approach to network care of the Virtual Network System reduces the amount of work required to operate and maintain the network and therefore reduces network care expense as compared to the router-based solution.

Conclusion

Ericsson has developed the Virtual Network System concept that allows the operator to manage the rapid rate of new technologies while maintaining a stable operating environment. As compared to a router-based solution the Virtual Network System concept has:

- 79% lower TCO
- 80% lower CapEx
- 79% lower OpEx
- 92% lower environmental expenses
- 50% lower network care expense

The Virtual Network System concept uses centralized control with more easily managed network nodes. This significantly reduces TCO when compared to today's router-based solutions and supports the economic and flexibility advantages of IP/Ethernet networking.

ACG Research

ACG focuses on providing market analysis and consulting to help service providers, enterprises, and vendors monetize their existing infrastructures and increase operational efficiency and profitability. Through ROI and TCO analysis, product and service message testing, and business model review, reports and forecasts, ACG gives you strategic and tactical advice, services and products, and timely answers so that you can better understand market dynamics and grow your telecom operations more efficiently and profitably. Copyright © 2012 ACG Research.