Converged Network Management

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Abstract Submission

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Abstract: The Navy Marine Corps Internet faces the challenge of convergence. This paper provides the background and unique network management requirements as they relate to the topic of convergence. The NMCI must assess the interoperability, security and network operations and maintenance to fulfill its mission.

Convergence today means simply the combination of the Internet and the telephone networks. These two types of networks were destined to collide. The integration of the old circuit switched and the new digital packet based network, has forced mass activity and confusion. Key questions regarding compatibility and management surround the convergence of these networks. Fortunately we can take some lessons from the past in this attempt to extrapolate into the future.

In 1876, Alexander Graham Bell was the single customer, network administrator and troubleshooter for the first transmission of speech over outdoor wires. Interestingly, as he expanded his voice network he borrowed from the previous telegraph network between Brantford Ontario and Paris Ontario. This was arguably the first example of the convergence of data and voice. It shares many similarities with the current convergence. It is a pattern repeated as advances leverage existing infrastructure much the way DWDM took advantage of existing fiber optic cables. Another example of reusing existing infrastructure in the 1980's was the fax machine which used and was completely compatible with the PSTN (Public Switched Telephone Network). Now we are beginning to use the Ethernet network for voice.

According to Metcalf's law, the value of a network grows exponentially with the number of customers using a network. Currently this applies to both the PSTN and the Internet. The business reality is that organizations must cope with the burden of managing these growing networks. Additionally the impact of network glitches grows with the network as does the importance of avoiding outages for larger numbers of users. Continual innovation pushes the limits of technology often disrupting business models in the process. The decline in the cost of long distance is one example. The speed of microprocessors and advances is signal processing made it possible to treat voice as a special case of digital data reducing cost. This is not without its own challenges as illustrated by the concerns surrounding quality of service (QoS) and the difference between using dedicated circuits vs. packets strategies for transmission.

Convergence does not occur because a new box is connected to a heterogeneous network. It occurs when previously separate networks are combined.

The idea of using a universal network capable of transmitting all types of information pushes the envelope and provides a noble goal. It became apparent to Mr. Bell that the telegraph network was not adequate for telephone services. This in turn morphed into a new network that addressed the concern of noise immunity. Voice was much more susceptible to the noise introduced by the one wire telegraph circuits. This lead to the

introduction of copper pairs found in today's telephones. DSL then took the analog copper pairs one step further send digital information down the copper lines. Rather than run both CAT-5 and twisted pair, one physical transmission media is an option.

Until the breakup of AT&T there was no incentive to make the conversion from analog to digital. Competition drove innovation because using the latest technology was a competitive advantage (recall the original noise observed by Mr. Bell). Sprint was one of the first companies to create an all digital fiber optic network truly minimizing interference so you could hear the "pin drop".

Compatibility at the electrical and optical level is a must. TDM, SONET and Ethernet are all standards implemented by a wide variety of manufacturers. Standards compliance is required to simply connect equipment to the network. Unfortunately the management aspect of the equipments interface is often a less rigorous standard. A new router can be introduced in a network without necessarily requiring the ability to manage that router. SNMP is one of the most widely used management protocols but even this standard provides for vendor specific extensions. A subset of SNMP is the MIB2 standard which not all vendors embrace fully. Vendors usually only implement the interface, IP and system portions of the SNMP MIB2 standard, and opt for proprietary extensions for DWDM, SONET and ATM. This is an illustration of how things get complicated quickly within a single management "Standard". Most network equipment manufacturers do not provide management solutions for heterogeneous networks. Their primary concern is supporting their own equipment. In addition they are compelled to differentiate themselves by including new and advanced features. This feature creep is the reason the network equipment will never be a commodity, nor will the management.

The focus is on all about the administration and management of the network. Cost structures have been reduced due to competition from both bandwidth providers and equipment manufactures. Now the data that rides the network may be more valuable than the network itself. It is more than cost savings driving the need for better management tools.

The need arises for a solution that is vendor, technology, protocol and implementation agnostic. Swivel chair integration where a human interfaces with multiple element management systems (EMS's) is slow, error prone and does not scale. Employing teams of network and transport professionals is cost prohibitive in today's budget sensitive environment. The human being is often the limiting factor when it comes to the rapid deployment of network services. Autonomous self healing networks are the goal which further complicates management. Optical Mesh equipment from Ciena is one example. Manual processes should be automated to free up valuable resources to focus on the more important network management issues requiring human intervention.

The layering of technology over the years leads up to interesting challenges. Imagine IP packets moving up and down a protocol stack. Problems at lower levels exhibit themselves and appear higher up in the stack and correlation is a must to correctly identify the root cause. The overall system should monitor the entire range of equipment.

The idea that not everything is standard and will work out of the box is a fallacy. The network equipment must be flexible because each network is tuned depending on the services it provides. A network management application should allow modification and adaptation without man months of programming.

There is also a clear need for a consolidated repository of network assets to best understand the relationship between layers, vendors and protocols. Artificial separation of SONET and IP is an example. Voice over IP (VoIP) eliminates the need for two separate networks. VoIP management issues require understanding the relationship between components and layers. Converged networks provide connectivity between the PSTN as well as transport services and QoS. The trend is toward an IP based network.

The software industry evolving in parallel and has made advances that improve on the arcane proprietary telephony software of the past. Since these legacy applications can not be replaced, modern solutions face the additional challenge of interoperating with both state of the art eXtensible Markup Language (XML) interfaces as found on Juniper gear as well as ASCII command line interfaces (CLI) supported by transport equipment such as a Nortel. Private Branch Exchange (PBX) equipment must also be included for "one view" of the converged network to be achieved. Middleware is available that is capable of connecting these systems. The legacy equipment can be "wrapped in XML cotton" to protect it from change. Then XML web services can abstract the interaction to "play nice" with older systems. This concept is termed the Net Centric Enterprise Services (NCES) approach.

A full featured network management application should be able to analyze the performance of the NMCI. Simply responding to alarms is passé. The network management tools should allow administrators to be proactive in finding problems before they occur. This is where performance monitoring gives a view of the stress of the network enabling identification of potential problems and bottlenecks before they cause service interruption.

The convergence of the NMCI network is driving the need for advanced, state of the art network management tools that can talk to the entire network, that can proactively monitor performance and tools that can provide a single view of the converged network.

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