

ATM Core Switch Recommendations

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ATM Core Switch Recommendations

Overview

Under legislative guidelines a cooperation between SchoolNet, DAS, OET, and the OECN has resulted in the creation of ONEnet, a state-wide initiative to bring voice, video, and data capabilities to every school building in Ohio. \$28 million dollars has been appropriated to assist schools in purchasing equipment, and the OECN DA-Sites have been allocated \$3.5 million towards the purchase of ATM core switch equipment that will be needed to facilitate school building connectivity.

The OECN, in cooperation with SchoolNet and DAS, formed a committee to study proposals from three vendors (Nortel, FORE, and Cisco) and determine the best course of action regarding core switch equipment. This committee met to determine the needs of the DA-Sites and to build a list of requirements for a core switch. Each of the vendors were given the opportunity to present the technical merits of their proposal and detail how each proposal was a solution for our requirements. In addition to the items on our requirements list (see page 3), the committee asked for information regarding the following items:

- T1/IMA port density
- Ability to support channelized DS-1 on DS-3 or OC-3
- Switch latency
- Standards support and known interoperability issues
- Available diagnostic tools and management platform(s)
- Technical support and training
- Reconvergence capabilities and constraints
- Speed of call setup and teardown
- Queuing, fairness, and shaping
- User interfaces (command line, graphical, web)
- Processor and software upgrades
- Design and installation support

Upon review, it was determined that each vendor could meet the basic requirements for a core switch, and that the choice of vendor should be made at the local DA-Site level based on the needs and plans of that DA-Site. This document is being provided to communicate the finding of the committee to the DA-Sites to assist them in their decision.

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ATM Core Switch Requirements

Required Items

- DS-3 connectivity (for connectivity to the state cloud)
- OC-3 connectivity (for existing IP router and other ATM switches)
- Ability to serve T1 circuits (directly or aggregated)
- IMA
- PNNI
- SNMP
- SVC's and PVC's
- Support all ATM classes of service (CBR, VBRrt, VBRnrt, ABR, UBR)
- Ethernet port for out-of-band management
- Console port for local or dial-in management
- Redundant power supplies

Local Considerations

- 25 Mb ATM ports for local video
- H-PNNI
- Circuit emulation (for voice)
- Redundant switch fabrics or switch processors or route processors
- T1 to DS-3 aggregation

Size Recommendations

While it is impractical to make a “one size fits all” recommendation, the committee feels that, for most DA-Sites, the FORE ASX-200, the Cisco 8510 and 5500/LightStream 1010 module, and the Nortel V-Switch are limited by one or more factors that make them ineligible for use as the “primary” core switch. Any of these could, however, be used in addition to the core switch to add ports or additional functionality.

A Note about Routers

This committee did not undertake a study of routers or router functionality included with or attached to the ATM core switch. There are multiple ways to configure a border router and firewall attached to the switch, including, in some cases, an optional router module within the switch chassis. For purposes of comparison the committee asked each vendor to include an OC-3 port for connectivity to the border router. This would, of course, require a corresponding OC-3 port on the router. We would advise you to contact DAS to confirm your router connectivity before ordering the switch.

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Cisco 8540	FORE ASX-1000/ASX-1200	Nortel 6480/15000
The Cisco 8540 is a 13 slot chassis. Five slots are reserved for three switch fabrics and two route processors, leaving 8 slots for SuperCAMs. Each holds two PAMs, for a total of 16 PAM modules.	The FORE ASX-1000/ASX-1200 each hold four separate switch fabrics. Each fabric can contain two processor modules and four Netmods (network interface modules).	The Nortel 6480 is a 16 slot chassis. The 15000 is a fully redundant carrier-class switch. It does not directly support T1 ports, but it can support up to 1400 T1's multiplexed on DS-3's.
In the first chassis you need DS-3 and OC-3 PAMs, leaving seven SuperCAMs holding 14 8-port IMA T1 PAMs, or 112 T1 ports. Cisco's IMA configuration allows 4 streams per IMA PAM, for a maximum of 56 sites.	The switch fabrics can be added incrementally. With one fabric you have slots for DS-3, OC-3, and two T1 IMA Netmods. This would allow up to 16 T1 ports or 16 remote sites.	For configurations of 112 T1's or fewer, a 6480 chassis can support up to 112 T1's (112 remote sites) in addition to DS-3 and OC-3 cards
For more than 56 sites you need a second chassis. Because you would not need a DS-3 PAM in the second chassis, the total number of IMA T1 ports is 120 ports or 60 sites.	Each additional switch fabric would allow up to 32 additional IMA T1 ports. A completely populated chassis can hold 112 IMA T1 ports.	For more than 112 T1's you need a second 6480 chassis or advance to the 15000. A second 6480 chassis can serve 120 T1's while including the OC-3 card.
	For more than 112 T1's you would need a second chassis. The second chassis could hold a maximum of 120 IMA T1 ports (without need for the DS-3 netmod)	Nortel's pricing structure makes the 15000 a more practical choice when you need 112 or greater T1's (See the note on M13 muxing below)
Notes	Notes	Notes
The Cisco 8540 does not have 25 Mb ATM ports to support local video. If you need to support local video you would have to front-end with some other switch with 25MB ports.	The ASX-1000 i960 processor must be upgraded to a Pentium processor to get ONEnet approval. The ASX-1200 comes with a Pentium processor and is strongly recommended	If your carrier does not provide T1's multiplexed on DS-3's you will need a M13 mux for every 112 T1's. (approximately \$25,000 per M13 box) if you opt for the 15000 series chassis
The Cisco IMA T1 PAMs have eight T1 ports. Each PAM can support up to four unique IMA streams. The PAM can support from one to four remote sites and from one to eight T1's	Netmods are interchangeable between the ASX-200, ASX-1000, and ASX-1200 switches	Line cards are not interchangeable between the 6480 and 15000 series
The committee recommends leaving at least one slot available for circuit emulation card(s), which would reduce the T1 count by eight IMA T1's or four remote sites per card	The committee recommends leaving at least one slot available for circuit emulation card(s), which would reduce the T1 count by eight IMA T1's per add'l card	The committee recommends leaving at least one slot available for circuit emulation card(s), which would reduce the number of available T1 ports by eight per add'l card if all slots are filled

Switch Port/Size Comparison Chart

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Findings and Conclusions

Cisco Systems – Cisco 8540

The Cisco solution can have a positive effect in environments that already have Cisco core routing equipment. In this environment, a Cisco solution would eliminate “finger pointing” between vendors if a problem exists between the ATM switch and existing IP equipment. Cisco is offering an aggressive discount, and references provided by Cisco have made favorable comments regarding implementation, performance, and reliability.

On the negative side, Cisco has the lowest port density for T1 IMA cards. Cisco’s IMA configuration allows for eight T1 connections, but only four IMA streams (four remote locations) per card. IMA by nature requires multiple bonded T1’s per remote location. In fairness to Cisco, it could be considered an advantage that they took this into account in developing a lower cost card that offers a growth path for future IMA bonding at no additional cost. However, this lower port density can result in multiple 8540 chassis if there is a need to connect more than 56 remote locations.

Another possible disadvantage for the 8540 is a lack of a 25Mb ATM port module for this chassis. These ports would be needed if a site requires local ATM video services. This situation would require another switch that has 25Mb ATM port functionality be installed in addition to the 8540.

Marconi/FORE – ASX-1000 and ASX-1200

Customer references have indicated high satisfaction regarding implementation, performance, and reliability with FORE ASX equipment. FORE has a longstanding dedication to ATM. There are two devices in the FORE proposal that meet the requirements established by the committee. These are the ASX-1000 and its newer sibling, the ASX-1200. Interface modules are interchangeable between the two products, and the 1000 is field upgradeable to the 1200. Although they have the same port density, the ASX-1200 has larger buffers, a faster processor, and it has a greater likelihood for future enhancements. It is highly recommended that the ASX-1200 be selected over the ASX-1000.

An issue may arise regarding redundancy in the FORE box. There are multiple switch fabrics per box (from one to four), and each fabric can contain a hot-swappable processor module, but there isn’t automatic fail-over between switch fabrics. Although a failure in the switch fabric may be uncommon, it would require manual intervention to move connections to open ports.

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Nortel – Passport 6480 and 15000

Nortel took a slightly higher approach with their proposal for the 6480 and 15000. While Cisco and FORE presented “campus” switches, Nortel proposed “enterprise” level equipment with telco-grade reliability and redundancy. Their experience in the telco environment also showed in the voice-processing capabilities of the hardware and management platform. Voice networking may actually be the “killer app” for ONEnet, which makes the Nortel solution very intriguing.

The 6400 and 15000 do not share line cards, processors, or other components. This may restrict the ability to start small and grow larger as needed. The 15000 chassis cannot directly interface T1 circuits. T1’s must be multiplexed on DS-3’s. If a site cannot get this from their carrier, additional M13 multiplexer units must be purchased to handle the connectivity. The 15000 can, however, handle more than 1400 T1 circuits multiplexed in this fashion.