

# The Next Generation ATM Switches

by

Chaelynn M. Wolak  
wolakcha@scsi.nova.edu

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School of Computer and Information Sciences  
Nova Southeastern University

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## Abstract

Today there is hardly a business without one. There is not a company who can operate without it. It is the heart of every major company in this world – the network. At the very center of this network is asynchronous transfer mode (ATM). This research paper takes a look at the next generation smart ATM switches by three rival companies. A detailed look at these companies and their new ATM smart switches is described.

## The Next Generation ATM Switches

The computer has become a very essential piece of equipment. Today, there is hardly a business that does not have one. Not only is the computer become a pertinent part of the business world but so has the cables that plug into the wall behind it. These cables connect computers to the very heart of every business – the network.

Networks used to be the support of communication in the back office. “Now they are critical, carrying that most strategic of resources – information” (The Case for the..., 1998). The flow of information throughout any business is a key factor to success. This flow of information directly affects how businesses compete and how responsive they are to customer needs.

The role of the network cannot be underestimated. “The pressure on networks to be flexible, reliable and to provide nearly limitless capacity is relentless” (The Case for the..., 1998). It is easy to distinguish a ‘good one’ from a ‘bad one’. “While some 76% of network managers are being forced to add more network capacity, nearly as many are also forced into a costly network re-design. Even more alarming is that nearly half are forced to re-design applications due to inadequate networks or face the alternative of controlling user applications by postponing deployment. The networks installed yesterday simply were not designed with tomorrow’s applications in mind” (The Case for the..., 1998).

Today’s networks need more bandwidth. Applications in the business world such as Lotus Notes, Oracle, and the World Wide Web (WWW) all have had a dramatic impact on network traffic. However, speed is not enough. The network must provide smarter bandwidth allocation, which is simpler and cheaper to maintain and administer.

Intelligent Infrastructure is a technology to build smarter networks. “The technology exists to build intelligent networks that deliver: high capacity, integration with current technology, reliability, security, scalability, future-proof technology, and low cost-of-ownership. The Intelligent Infrastructure allows us to deploy additional bandwidth without extensive, manual configuration. In this way, we can expand the network in line with business growth, providing continuous support for the commercial operation” (The Case for the..., 1998).

Asynchronous Transfer Mode (ATM) is one smart network solution that incorporates all the characteristics of an Intelligent Infrastructure. ATM is “a network technology for both LANs and WANs that supports real-time voice and video as well as data. The topology uses switches that establish a logical circuit from end to end, which guarantees a quality of service (QoS) for that transmission. However, unlike telephone switches that dedicate circuits end to end, unused bandwidth in ATM's logical circuits can be appropriated whenever available. For example, idle bandwidth in a videoconference circuit can be used to transfer data” (ATM, 1981-1998). This research paper takes a look at the next

generation smart ATM switches by three rival companies. A detailed look at these companies and their new ATM smart switches is described.

## The ATM Smart Switch Competitors

### **FORE Systems**

FORE Systems is just one of the three rival competitors in the ATM market. FORE Systems <<http://www.fore.com>> is a global supplier of smart networking solutions. They are widely recognized as the company that has commercialized ATM technology. "FORE offers a complete line of ATM switches, adapters and LAN and WAN access products for connecting existing networks to an ATM core. FORE solutions help customers build networks that last – Networks of Steel" (Inside FORE Systems).

FORE Systems' world headquarters is located near Pittsburgh, Pennsylvania. There is also a Pacific Coast operation center that is located in San Jose, California. In addition, there are engineering development facilities located in the Boston and Washington DC areas.

FORE is just one of the contenders this fall to offer the next generation smart ATM switch. They are introducing their new product called the ForeRunner ASX-4000. "The ForeRunner ASX-4000 is the core backbone component in a complete network solution that includes edge backbone switches, workgroup switches, LAN switches, multi-layer LAN switches, and WAN access devices. In addition, the Intelligent Infrastructure provides a complete solution for migrating existing enterprise LANs and WANs to a new scalable and resilient multi-service network" (ForeRunner ASX-4000, 1998).

The ForeRunner ASX-4000 offers many smart network options such as functionality, scalability, reliability, fault tolerance, and maximum performance while maintaining the industry's ATM standard compliance. "The ForeRunner ASX-4000 features a non-blocking switching fabric that scales from 1 to 40 Gbps on an in-service basis in 10 Gbps increments. First-to-market OC-48c ATM ports and high density OC-12c ports enable backbone trunking for networks whose edge and server connections are scaling from 10 Mbps, switched 10/100, 155 Mbps, and 622 Mbps" (ForeRunner ASX-4000, 1998). It is designed to support more 1,000,000 VCs since it provides advanced traffic and signaling capabilities. Some of these capabilities include per-VC queuing, 4,500,000 cell buffers, PNNI, distributed LAN emulation, and MPOA. All of these features can provide the backbone support to thousands of users even under the highest levels of congestion while maintaining a high level of QoS.

The ForeRunner ASX-4000 also incorporates features that provide node-level redundancy and network-level resiliency. It is intelligently partitioned to have no single point of failure. "All components – power supplies, port cards, fan trays, switch control processors (SCPs) and switch fabrics – can be removed and inserted, or 'hot-swapped',

while the unit is in operation. This minimizes downtime during switch maintenance and network expansions, and allows users to upgrade individual components as opposed to the whole system. Redundant, load-sharing power supplies and redundant fans are standard. Power is available in AC or DC configurations for connection to continual backup UPC power systems. An optional, redundant switch control processor provides automatic non-service affecting fail-over for PVCs and PVPs allowing in-service software upgrades or processor maintenance. Additionally, the switch is architected for future support of optional 1+1 redundancy for switch fabrics, port cards and ports based on SONET/SDH automatic protection switching (APS)” (ForeRunner ASX-4000, 1998).

FORE has definitely taken the lead in developing and utilizing the latest in ATM technology. One major application that incorporates FORE’s “Network of Steel” is the Eurotunnel. The Eurotunnel is a company that operates a high-speed shuttle train linking France and the United Kingdom via the Channel Tunnel. At the heart of this Channel Tunnel was an Ethernet network. According to Garry Metcalf, telecommunications network manager at Eurotunnel, “the old network was ‘creaking’ by the end of 1996. Following a temporary fix that included removing the network’s routing element and running it in bridge mode, Metcalf’s department began searching for a solution that would allow them to avoid the complexities of Layer 3 and routing” (FORE at the..., 1998).

FORE’s ATM Intelligent Infrastructure was the solution. “Eurotunnel created a new ATM-based network consisting of the ForeRunner ASX-1000 expandable backbone switches at the core (WAN) for greater connectivity capacity, and ES-3810 Ethernet workgroup switches in the department LAN. The WAN includes multiple nodes connected via fiber optic lines. Each node consists of multiple hubs connecting desktop clients and workstations to the backbone through ES-3810 LAN switches. The ASX-1000 is scalable from 2.5 to 10 Gbps and can connect multiple devices, WAN access trunks or legacy network connections such as those existing in the Eurotunnel network” (Metcalf, 1998).

Today, the Eurotunnel is operating with its new heart – the ATM network. “Eurotunnel’s ATM network supports a broad range of administrative and voice applications, including the company’s call center, control tower and traffic-control systems. The company also conducts broad-cast quality videoconferencing over the network, reducing the need for staff to travel between company offices in Folkestone and Calais and preserving train space for paying customers during peak operating hours” (FORE at the..., 1998). Ultimately, ATM has given Eurotunnel a new life.

## **Cisco Systems**

Cisco Systems <<http://www.cisco.com>> is the second of the three major competitors in the ATM market. However Cisco has a different philosophy in regards to networks. “Cisco does not take a rigid approach that favors one technology over the alternatives and

imposes it on customers as the only answer. Cisco's philosophy is to listen to customer requests, monitor all technological alternatives, and provide customers with a range of options from which to choose. Cisco Systems is the worldwide leader in networking for the Internet" (Cisco Fact Sheet, 1998).

Cisco's headquarters is located in San Jose, California. There are other major operation centers located in Research Triangle Park, North Carolina and Chelmsford, Massachusetts. Cisco also encompasses more than 210 sales and support offices in 54 countries.

Cisco's latest ATM switch due out this fall is LightStream 1010, a 20 Gbps version. "The LightStream 1010 uses a five-slot, modular chassis featuring the option of dual, fault-tolerant, load-sharing power supplies. The central slot in the LightStream 1010 is dedicated to a single, field replaceable ATM switch processor module that supports the 5 Gbps shared memory, fully non-blocking switch fabric with two field upgradable feature cards, and the high-performance RISC processor that provides the routing intelligence for this architecture. It is the first in a series of switches that will span from 5 to 40 Gbps, providing services optimized for both cell- and packet-based applications" (LightStream 1010, 1998).

LightStream 1010 can be ordered with one of two different traffic management feature cards. "For typical campus ATM networks, one feature card provides per-class queuing, which supports all the defined traffic classes in the ATM Forum Traffic Management 4.0 specification and offers flexibility needed for bursty, client/server traffic patterns. For service provider or customer premises deployments, the other feature card supports per-flow queuing, which can support greater traffic shaping granularity and can service individual QoS contracts for several thousand flows at once, making it perfect for wide-area environments that demand more unique and granular QoS features" (LightStream 1010, 1998).

Lastly, LightStream 1010 incorporates redundancy and resiliency features. "The remaining slots support up to four hot-swappable carrier modules (CAMs), each of which, in turn, can support up to two hot-swappable port adapter modules (PAMs), for a maximum of eight PAMs per switch. This configuration supports a wide variety of desktop, backbone, and wide-area ATM and circuit emulation interfaces" (LightStream 1010, 1998).

Florida Hospital, the nation's second-largest non-government hospital, has standardized its network on Cisco devices. "Equipment such as WAN switches, LightStream 1010 ATM switches, Cisco 7000 family routers, AS5300 universal access servers and Catalyst 5500 (R) switches enable the Florida Health Network. This rapidly expanding health network employs 1,600 physicians and associates at 120 locations, across 6 campuses, including its new model for delivering 21st century health care – Celebration Health. Celebration Health is successfully integrating cutting-edge applications and preventative medicine programs through visionary planning and innovative implementation of

networking solutions” (Florida Hospital..., 1998). Cisco and its smart ATM switch are becoming renowned in the health industry.

## **Bay Networks**

The last of the rival companies in the ATM arena is Bay Networks <<http://www.baynetworks.com>>. Bay Networks specializes in the internetworking market. “The company offers frame, and ATM switches, routers, shared media, remote and Internet access solutions, IP services and networking management applications” (Bay Networks, 1998). Their main purpose is to revolutionize the way people work, learn and play by eliminating constraints of distance and time. Bay Networks is headquartered in Santa Clara, California.

Bay Network’s Centillion line is another prominent class of ATM switches that are sweeping the marketplace. Their latest introduction is Centillion 1600. Centillion 1600 is capable of 10 Gbps of ATM switching capacity. It is designed for deployment in the network center of large ATM networks. “This 16 slot multi-service switch is unique in its ability to provide total switch fabric, processor, and power supply redundancy, and is ideal for installations where total availability of integrated voice, video, and data services is a necessity” (Centillion 1000, 1998).

One company that has employed the Centillion line is Evanston Northwestern Healthcare (ENH). ENH is a health organization located in Chicago. “The organization provides the full continuum of healthcare services – from high-risk deliveries and heart transplants to home-care and hospice. ENH has implemented an asynchronous transfer mode (ATM) network backbone to support both clinical and business applications. The network is based on Bay Networks Centillion(TM) 100 ATM switches, the System 5000(TM) modular enterprise chassis and Bay Networks routers” (Evanston Northwestern Healthcare..., 1998).

Thomas W. Smith, vice president of information systems and chief information officer at ENH states “we are investigating methods of maximizing the multimedia capabilities of ATM and deploying voice and video applications. ENH is deploying critical applications over the high-performance network, including: a clinical data repository, master patient index, patient records, telemedicine, teleradiology, bedside charting, scheduling, time reporting, and financials” (Evanston Northwestern Healthcare..., 1998). Bay Networks is another major competitor providing state-of-the-art ATM services to health care organizations.

## **Conclusion**

In the early 1990s, everyone thought ATM would begin a new era in networking. However, equipment was expensive and standards were confusing. Then came the

announcement of Gigabit Ethernet and everyone thought ATM was dead. “But a funny thing happen on the way to the graveyard. By the late 1990s, the ghosts were breathing, and ATM equipment revenues began to increase. Over the years, ATM has been deployed as a backbone technology by major enterprises and all major ISPs” (ATM, 1981-1998).

It is clear that more bandwidth and speed is not enough, but a network that is intelligent and smart. ATM is the core technology to do just that. There are three main companies, FORE Systems, Cisco Systems, and Bay Networks, who are making strides in smart networks. ATM smart switches are becoming the hearts of every business network.

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