



The Amsterdam Internet Peering Exchange (AMS-IX) is one of the largest Internet Exchanges in the world. With more than 340 connected members, including the largest Internet Service Providers (ISPs), telecommunications carriers and content suppliers in Europe and North America, AMS-IX currently processes up to 890 Gb/s. Even at this volume, it is continuing to experience exponential growth in data volume driven by increasingly bandwidth-heavy applications like video streaming.

Create

In 2003, AMS-IX was seeing peak loads of 16 Gb/s and rapidly growing toward 25 Gb/s. This growth was taxing the capacity of its data centers, so the AMS-IX network engineers began looking for a solution that would allow their Exchange to offer more access to its members (introducing 10 Gb/s ports), create system redundancy for better protection against network outages and equipment failures while enabling the instantaneous and transparent switch-over of a new, more efficient topology to all members.

Monitor

Reconfigure

Glimmerglass provided a physical layer optical fiber switching solution for AMS-IX that enabled the Exchange to smoothly transition from its four-location, metro ring network topology to a “double-star” topology supporting vastly greater traffic volumes. The Glimmerglass optical switching solution also enabled AMS-IX to instantaneously switch between the two redundant-star networks, supporting the system redundancy required by the Exchange. The double-star topology has worked flawlessly since it was implemented in February 2004, while supporting ever-increasing volumes of traffic.

The Challenge

An Internet Exchange interconnects independent (ISPs), telecom carriers and content suppliers, enabling them to exchange Internet traffic with each other, nationally and internationally.

This exchange of traffic is known as “peering.” Because an Internet Exchange must accommodate the peering requirements and router variations of each of its members, its edge switching infrastructure is quite complex. AMS-IX must connect extremely small, “garage-based” ISPs with some of the largest telecom companies in the world. In addition, it must provide continuous equivalent service while supporting the many different cultures and change management processes of its members.

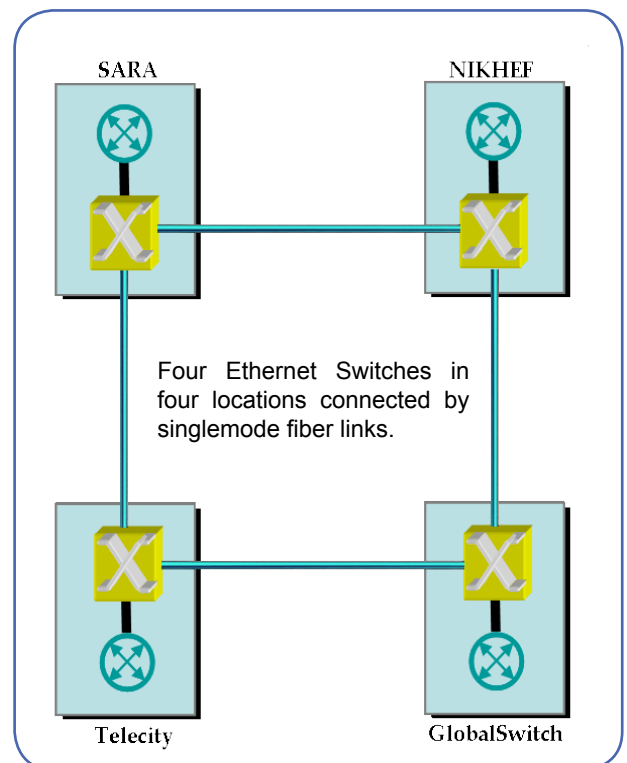


Figure 1. Original Metro Ring

Already facing capacity issues and wanting to address scalability and new service opportunities, the Exchange team considered the benefits of implementing a network based on a different architecture.

In other environments, organizations might have simply opted to build a second network to accommodate larger capacities. This wasn't an option for AMS-IX, as some of its members would not have been able to afford the connection to a second network. In addition, the switchover from the original to the second network would take time, given the many different environments involved and unknown communications protocols arranged between different ISPs. As any downtime results in service interrupts and lost revenues to Exchange members – any changeover needed to be immediate and perfect.

So, the technical staff at the Exchange began to investigate the possibility of building a more robust, future-proof topology with built-in redundancy – eventually deciding on a double-star network configuration.

The Strategy

The Exchange team planned to build two core switches in the middle of its hubs, with the intention of switching back and forth between the switches as necessary. This approach also had the advantage of enabling the Exchange to test one switch with each build-out (new version of system software and interfaces) and ensure that it was working properly before involving the second switch. In this way the Exchange could always fall back to a “known good” situation if they experienced a problem. The reliability of the exchanges data communications was a critical consideration for the Exchange team at every juncture. Reliability is one of AMS-IX'S competitive strengths and a feature expected by its members.

Initially, AMS-IX approached two Ethernet vendors who proposed the simultaneous use of both as core switches and for connecting 10 Gb/s customers, with a big pipe in-between. Neither of the Ethernet solutions worked. The system looped and created other unsolvable problems. The Ethernet-based solution was simply not engineered to solve the particular problem faced by AMS-IX. Meanwhile, some of the Exchange's technical staff had heard of photonic switches and decided to investigate – considering the technology futuristic and as a possible Ethernet switch option in the next few years.

AMS-IX visited Glimmerglass and quickly determined that use of a photonic switch was the best and possibly - the only solution. First, the AMS-IX team determined that a photonic switch would be the ultimate fiber patch panel. Managing fiber is always a challenge and is particularly complex at AMS-IX. The photonic switch's ability to “remember” previous configurations and revert back automatically or at the click-of-a-mouse was both a time saver and confidence-builder. The Glimmerglass solution's

ability to automatically and instantaneously switch to a new network topology meant that the AMS-IX network could easily reconfigure itself back to a “known-good” configuration – anytime, day or night. Additionally, with two Glimmerglass systems in place, the AMS-IX staff could use either core Ethernet switch to service 10 Gb/s customers and to connect new customers to higher bandwidths.

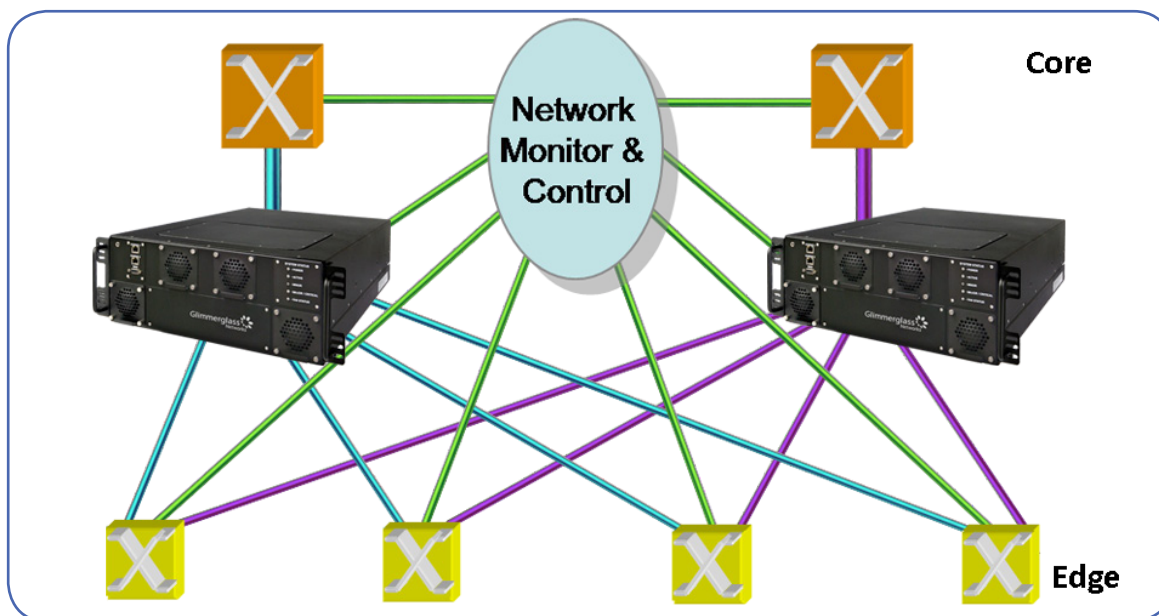


Figure 2. Redundant Double-Star Network

Glimmerglass photonic systems connected legacy Ethernet switches to new 10 Gb/s capable Ethernet switches. Glimmerglass systems can instantly reconfigure the network back to its original metro ring and can switch-over the network connections from the four Ethernet switches to the standby core switch (top) in case of a network failure or for maintenance purposes.

Once the benefits of using a Glimmerglass Intelligent Optical System became clear, AMS-IX began to investigate reliability issues. They discovered that MEMS – the core technology behind photonic switches – had actually been in widespread use for years - in ticketing systems, in automobiles, in airliners; all types of applications which impact people’s lives every day. Long-term production of use of this seemingly “new” technology helped alleviate much of the hesitation about moving forward.

The Implementation

AMS-IX purchased two Glimmerglass Intelligent Optical Systems, and embarked upon an extremely methodical, step-by-step testing process. The Exchange management team initially experienced some pushback from its members, who were wary of technology they believed to be

new and experimental. The Glimmerglass systems use purely optical, photonic switching technology that some Exchange members believed was too advanced and unproven - being used primarily in academic environments and not in revenue-dependent, commercial situations.

Adding to the pressure was the fact that the Exchange was reliant upon the Glimmerglass systems not only for the operation of the double-star topology, but for the migration process itself. So the technical team proceeded extremely carefully, testing each build-out in the lab before making it live and keeping passive fiber couplers available outside the switch in the event of failure.

In its original 4-switch configuration, the team had always maintained one Glimmerglass system as a back up -- transmitting only control traffic to make sure that the link was alive. The switches were first added to this link. Once that link was working, live traffic was added. Once the live traffic was tested a portal was added and so on, proceeding until the new switches were in place with the original ring topology. The core switch was added and the migration to the redundant star system was accomplished.

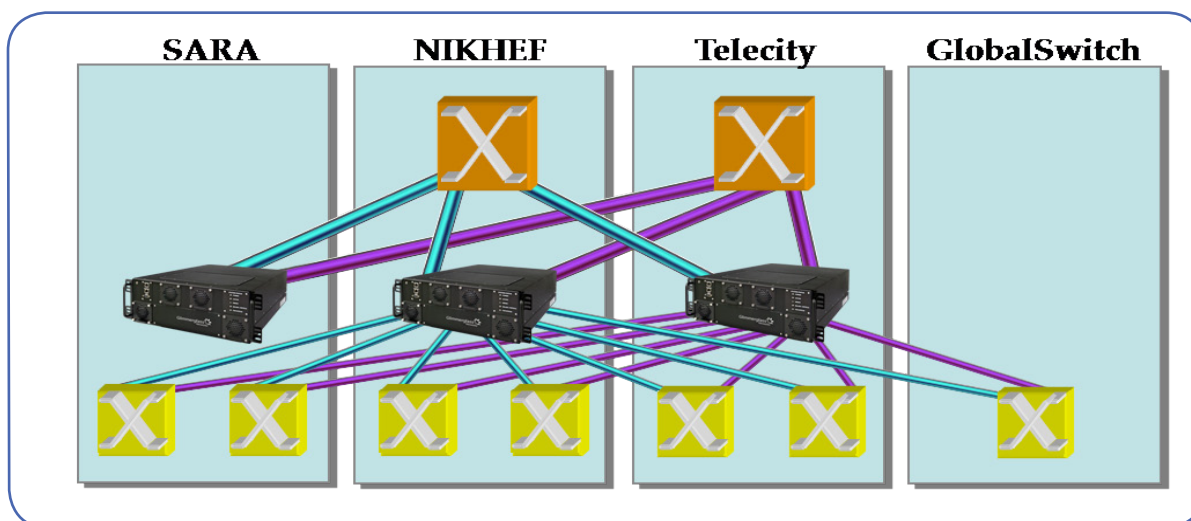


Figure 3. AMS-IX Topology at the end of 2004

Two core Ethernet switches and 7 edge Ethernet switches at 4 sites. All configured in a dual redundant star by 3 Glimmerglass Intelligent Optical Systems. New 10GE service connected directly through the Glimmerglass Intelligent Optical System.

The Glimmerglass Intelligent Optical Systems performed flawlessly both in the lab and in production, enabling the team to proceed on schedule and complete migration to the first switch in December 2003 and the second switch in February 2004. Remarkably, AMS-IX members didn't even notice the switch from the ring to the double-star topology and from 4 to 9 Ethernet switches. The Glimmerglass systems have continued to perform flawlessly through the present time.

Five Year Update

In the five years since AMS-IX introduced Glimmerglass Intelligent Optical Systems into its network, the Exchange has expanded dramatically. The introduction of Glimmerglass in 2004 permitted AMS-IX to offer its first 10GE services. Today the number of 10GE customer ports in the AMS-IX network exceeds 250 and those 10GE services now account for almost all of the growth in Exchange ports. Exchange members utilize equipment from many different vendors to connect to these 10GE ports, including Cisco, Juniper, Foundry/Brocade, Force 10 and Alcatel. All of vendors' equipment integrates seamlessly with the Glimmerglass Intelligent Optical Solution.

At the beginning of 2004, when the Glimmerglass solution was introduced, AMS-IX had peak traffic loads of 25Gb/s. In 2009, AMS-IX has seen that grow to 890Gb/s. AMS-IX has also become the largest IPv6 peering exchange in the world. This growth has resulted in many changes. The network has gone from 4 to 7 sites around Amsterdam. The number and size of the Ethernet switches has increased. The role of the Glimmerglass systems has expanded from protecting the core Ethernet switches to fully protecting 10GE services through both core and edge switches. The number of Glimmerglass systems has also increased, but since they are fully transparent to data rate and format, they have never needed to be replaced, unlike the Ethernet switches.

The Amsterdam Internet Exchange is now looking forward to being one of the first to implement 100GE when it becomes available. The Glimmerglass Intelligent Optical Solution will be ready and waiting.

About AMS-IX

Headquartered in Amsterdam
The Amsterdam Internet Exchange (AMS-IX) is one of the fastest growing Internet Exchanges.

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