Customer PROFILE

# University of Amsterdam Reaps the Benefits of True Line-Rate Performance for Advanced Grid and Networking Research

**Customer**
Advanced Internet Research Group, University of Amsterdam

**Industry**
Scientific research

**Applications**
Cluster/grid computing; data transport; Lambda Grid; optical networking

**Highlights**
Leading Dutch research group selects Force10 Networks E-Series switch/router to incorporate line rate 10 Gigabit Ethernet connectivity in its computer cluster research environment and connect to the national research and education network, NetherLight.

***To run their most processor- and data-intensive computing applications, enterprises and research institutions today are turning to clusters and grids made up of small commodity servers interconnected with scalable, high-performance Ethernet networks. These clusters and grids deliver the equivalent of supercomputer capacity to users and applications at an affordable cost.***

However, grid and cluster computing systems also place heavy demands on network infrastructures. To meet these demands, the University of Amsterdam's Advanced Internet Research Group selected E-Series switch/routers from Force10 Networks. Force10 provides the true, line rate 10 Gigabit Ethernet connectivity needed for advanced Internet research — as well as to connect the research facility to national and international research networks.

## Advanced Research Requires High-speed Connectivity

The University of Amsterdam's Advanced Internet Research (AIR) group researches new architectures and protocols for the Internet. In addition to actively participating in worldwide standardization organizations such as the Internet Engineering Task Force (IETF) and the Global Grid Forum, AIR conducts experiments with extremely high-speed network infrastructures, and carries out ground-breaking research in the fields of security, authorization, authentication and accounting for grid environments. The research centers around three themes:

- In collaboration with SURFnet and the StarLight community in Chicago, AIR is exploring networking architectures and models of optical networking that can support the world's most demanding applications — some of which can use data streams of 5 to 10 Gbps — without hampering the operation of the Internet.
- The group is researching solutions for transporting large volumes of data at high speeds, particularly alternatives that are emerging to replace current, aging Internet protocols. AIR is using compute clusters and Force10 switches to test these new protocols at high speeds and see their effect on the stability of the Internet.
- Finally, the AIR group is investigating how to authorize and allocate the usage of new high-speed networks. The group participates in several standardization working groups, including the Internet Research Task Force (IRTF) Authorization Authentication and Accounting Architecture Research Group (AAAARCH), the Global Grid Forum (GGF) Authorization Working Group, and the Grid Resource Allocation Agreement Protocol Working Group (GRAAP WG).

As part of this research, the University of Amsterdam is a partner in DataTAG, a project funded by the European Union. The goal of DataTAG and its sister project, DataGrid, is to create a next-generation computing infrastructure that will provide massive computation and analysis resources and access to shared large-scale databases across widely distributed scientific communities. These capabilities are necessary to handle the enormous amounts of scientific data that will be produced by new experiments underway at CERN in Geneva. For example, grid research teams in Amsterdam are working on solutions that will enable international scientific collaborations to share and access massive databases in fields such as particle physics, astronomy and biology.

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# University of Amsterdam: Reaps the Benefits

Customer PROFILE

"We selected the Force10 Networks solution because it is the only next-generation switch/router that has high-density Gigabit Ethernet; true, line rate 10 Gigabit Ethernet; and the capability to upgrade to 40 Gigabits. The Force10 E-Series offers the scalability we need for future research."

**Dr. Cees de Laat**
Associate Professor,
Advanced Internet Research Group,
University of Amsterdam

The AIR group connects to TransLight, DataTAG, StarLight and other optical networking test beds through NetherLight, an advanced optical switching facility optimized for high-performance access, over a 10 Gigibit Ethernet infrastructure. From there, the research group has access to SURFnet, the Dutch research and education network as well as the CERN research network and StarLight. The SURFnet backbone links 200 higher education and research organizations to each other, as well as to other research networks in Europe and the rest of the world.

"Being a research institute, we wanted to make sure we were doing our work using the latest and most feature-rich technology we could afford," says Dr. Cees de Laat, Associate Professor with the AIR group and a member of the Global Grid Forum Steering Group. "We selected the Force10 Networks solution because it is the only next-generation switch/router that has high-density Gigabit Ethernet; true, line rate 10 Gigabit Ethernet; and the capability to upgrade to 40 Gigabits. he Force10 E-Series offers the scalability we need for future research."

"After talking to our peers, it was quite apparent that competing products weren't there yet in terms of performance with their current generation of equipment," de Laat continues. "Most of them were limited to 8 Gigabits per slot at that time. But in today's grid research community, you only count if you can do 10 Gbps and are looking into 40 Gbps."

## High Performance and Headroom to Grow

The University of Amsterdam's DAS-II (Distributed ASCI Supercomputer II) supercomputer cluster consists of 32 IBM 340 server nodes connected by Gigabit Ethernet. To connect these systems to NetherLight, the university is installing a Force10 E600 switch router configured with two 24-port 100/1000BaseT cards and one two-port 10 Gigabit Ethernet LAN PHY card. The Force10 system aggregates Gigabit Ethernet connections from the nodes into a 10 Gigabit Ethernet upstream connection to NetherLight. It also connects to a workstation equipped with an Intel 10-Gbit/s Ethernet NIC card used for single-stream, high-speed protocol tests.

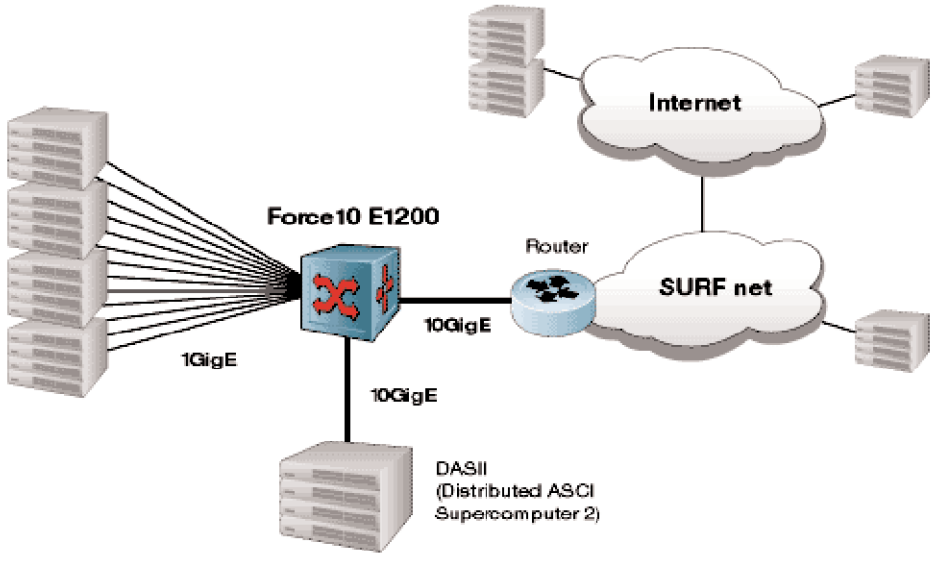


Figure 1: AIR's Highly Reliable Gigabit and 10 Gigabit Cluster Configuration

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In addition to true line rate performance, even with ACLs enabled, the Force10 system gives the university headroom to grow as its computing requirements increase in the future without requiring a forklift upgrade. The E-Series platform backplane offers up to 672 Gigabit Ethernet and 56 10 Gigabit ports in a half-rack chassis, and can scale up to 5 terabits/second.

Another differentiating factor that led the University of Amsterdam to choose Force10 systems was the level of technical innovation in switch fabric, backplane, ASIC design and system control plane. For example, the E-Series' switch fabric provides 40 Gigabits per second of non-blocking bandwidth to each line card slot — which will be important to the university as it conducts advanced research in Internet protocols.

"We run large amounts of line-speed traffic through the Force10 Networks' switches and have more than enough throughput for both current and future experiments, as well as upgrades," says de Laat.

Designed to accommodate the demands of demanding environments such as grid computing, Force10's hardware-accelerated E-Series gives the university predictable line-rate forwarding for every packet regardless of the number, type, or complexity of features enabled across the chassis. Jumbo frame support allows lower interrupt levels and reduces the CPU load required to transmit data at faster than 1 Tbps. Force10's FTOS™ software, E-Series architecture and Force10 ASICs provide the robust L2 switching and L3 routing functionality the university needs to explore new grid provisioning architectures.

"With Force10, we have the networking performance we need to deliver innovative grid applications that will change the way the world thinks about computing," de Laat comments.

## A Partner for the Future

A final factor that played into the University of Amsterdam's decision to select Force10 Networks was the expected high level of customer support. Force10 Networks is working closely with the university to tune the E600 to its particular computing environment, in order to ensure that researchers are truly able to push the boundaries of current research. At the same time, Force10 will solicit the university's input on product direction.

"We see developing an ongoing relationship with Force10 Networks, almost in a customer advisory role," says de Laat. "Our experiments will help shape the direction of their product. It's clear they're not just moving a box. I expect that we will work with them as a partner."

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