

ORION enables first practical use of international end-to-end lightpath – 700 GBs transport cut from 67 days to 6.5 hours



In an historic data transmission test, ORION's new optical infrastructure helped reduce the transfer of 700 GBs of data from Ontario to Europe in just over six hours recently, a massive transport that would have normally taken 67 days of continuous transmission.

The test involved the Canadian ATLAS experimental group which needed to transport the data from an experimental test site at CERN in Geneva back to the Physics Departments of Carleton University and the University of Toronto.

A recent test at the CERN laboratory provided data to calibrate a set of four-ton, million-dollar particle detectors that were constructed in Canada and the U.S.

The extensive analysis of this data to be undertaken by the Canadian groups required that the data be shipped back to Canada and accessible on local computer systems. The volume of data made it impractical to do this over existing networks.

To solve this problem, a unique arrangement was orchestrated between CANARIE in Canada,

SURFnet in the Netherlands, CERN in Switzerland, StarLight in the United States, ORION in Ontario, Carleton University in Ottawa, and the shared facilities of TransLight.

A set of optical lambdas were configured to provide an end-to-end lightpath to facilitate the transfer of 700 GBs of data in what can be considered the first real practical use of an international end-to-end lightpath.

Involves 700 GBs test beam

The 700 GBs of test beam data from an experimental area at the European laboratory CERN to the Department of Physics at Carleton University was successfully transferred in about 6.5 hours overnight between July 16 and July 17.

To transfer data of this magnitude over the normal Internet network connection through firewalls and

campus networks would have taken 67 days continuously.

The end-to-end lightpath, a point-to-point optical link, between CERN and Carleton University is a realization of an emerging and core networking paradigm of CA*net 4 and other experimental infrastructure networks for enabling data and computationally intensive research.

This "optical bypass" provides a fast long wide pipe for high-speed data transport, a fundamental requirement for large-scale scientific experiments and global scale Grids.

Through the months of June and July, the Canadian and U.S detector components were exposed to a test beam at CERN using one of CERN's high-energy proton beam facilities. The detectors are part of an energy measuring system and are referred to as the Forward Calorimeters or FCALs.

The FCALs, which are an integral part of the \$500 million ATLAS detector being constructed for the Large Hadron Collider (LHC) at CERN, were designed and built at Carleton University, the

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ORION stays online during blackout



While the Great Blackout of 2003 wreaked havoc throughout Ontario and most of the northeastern United States on August 14, affecting industry and the telecommunication sector particularly hard, "Black Thursday" was also an ideal stress test for the ORION network, the world's newest advanced R&E optical network.

Partially operational only since June, the network proved its mettle and remained mostly online throughout the entire blackout.

All but two of ORION's connected PoPs stayed on line for the duration of the blackout, thanks to ORION's state-of-the-art power backup system.

"This was a good stress test ... "

Backup power also kicked in for the PoPs at York University and the Sudbury PoP, but those two sites eventually went down when batteries were depleted, some 11 hours later, when local power failed to come back online.

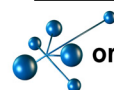
"This was a good stress test before the start of the school year and the production level provisioning of the network," said Sam Mokbel, ORION's Project Director. "All other services functioned normally and NOC and Engineering support was available and received the proper alarms and responded accordingly."

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The ORION Research and Discovery News is a monthly electronic publication providing news and information of interest to users of the Ontario Research and Innovation Optical Network and to the worldwide research and education community.



ORION launches VLAN Service for Ontario's R&E community



ORION has launched a new VLAN Transport Service for Ontario's R&E community, which provides a dedicated high-bandwidth pipe for research and education organizations. Nine Ontario organizations, including colleges and universities throughout Ontario, have already signed agreements and are being connected, said Randy Neals, ORION's Senior Manager of Strategic Partnerships.

The service, designed to provide private bandwidth from ORION Pop to PoP or multiple PoPs, is expected to be of interest to network users in linking distributed campuses or in obtaining bandwidth for specific research and education (R&E) projects.

Users can also use the VLAN to connect directly to an Internet Service Provider (ISP) of their choice in any of the ORION PoP communities.

The ORION VLAN (virtual LAN Ethernet data transport) Service provides connectivity through a point-to-point virtual circuit through Layer-3 data devices that bypass the routing layer. The service is available between any two ORION PoPs throughout the network. The service uses Ethernet transport at speeds of 10 or 100 Mbps (megabit per second) full duplex, as required.

"We developed the VLAN service to respond to the requirements of Ontario's research and education community, for a committed point-to-point bandwidth connections over the ORION network," said Phil Baker, President and CEO of ORANO, which owns and operates the ORION network.

"Some institutions anticipate the VLAN service will provide significant savings over the cost of acquiring access to the Internet in particular", said Neals. "In many cases, the service allows the user to access the Internet provider of their choice, with a faster, larger connection, for a much lower cost." "This also levels the field for all ORION R&E users across the province because it provides access to competitive ISP services. Some users report they are saving enough by accessing a competitive ISP to pay for the entire cost of the annual ORION user fee," he said.

"We expect huge savings in terms of bandwidth cost and enhanced performance."

While a large number of ISPs are available, all of the users that have signed up thus far have opted to use their VLAN service to establish a dedicated 100 Mbps connection to Cogent at ORION's PoP at 151 Front Street, in Toronto.

Most users also retain connectivity with the local ISPs, for diversity, he said, a practice that ORION is encouraging. "While we want to level the playing field, we're happy when users are able to maintain a relationship with the local providers."

One of the institutions looking forward to reduced Internet costs thanks to ORION's VLAN service is Sudbury's Laurentian University. "We expect huge savings in terms of bandwidth cost and enhanced performance," said Bill Sandblom, Director of Computer Services.

Cogent and Telus were selected as the transit providers for the ORION Shared Internet Service, following an RFP for Internet Transit early in the year. The vendors were selected by a review panel, which included six representatives of ORION user organizations.

ORANO has a 100 Mbps Ethernet to Cogent with additional fibres if there is a need to upgrade to Gbps service. ORANO also has a 1 Gigabit Ethernet to Telus, on a burstable service. ORANO has a 1 Gigabit Ethernet to the Toronto Internet Exchange (TORIX), which has a number of well known network participants, many of whom have indicated an interest in peering with ORION to improve connectivity to Ontario's Research and Education organizations. ORANO also hopes to peer with Rogers, Shaw, Cogeco, Persona and other broadband Internet providers.

"ORION is helping to level the playing field," said Neals, who noted that the VLAN service allows the more remote R&E institutions to access the same Internet pricing as customers in downtown Toronto, where most of the country's ISPs are located, offering lower service fees because of access and competition. ORANO's fee for Internet Transit is \$250 a month per 1 Mbps.

The costs of a VLAN connection is \$1,000 a month per 100 Mbps, a significant cost reduction for many institutions that now have the opportunity to boost their Internet connection, because of growing usage and demand, but face shrinking budgets and resources. "ORANO is not in the primary business of providing access to the Internet, but rather in deploying and operating an advanced optical research and education network," said Baker. "However, our users still need to connect to the Internet for research and education, and they expect us to provide it," he said. We are able to help them do that if the organization is a college, university, public education institution or public research facility."

While ORANO is mindful of not competing directly with the private sector, he said, ORANO's VLAN business model actually opens up the market to more providers, that would otherwise not be able to service customers in the more remote areas of the province.

ORION enables first practical use of end-to-end lightpath ...

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University of Toronto and the University of Arizona.

The data will be transferred from Carleton University to the University of Toronto and the University of Arizona as soon as similar lightpaths can be established to these universities.

All three groups will be analyzing the data to determine the performance of the detectors and establishing optimum software analysis tools to be used when the ATLAS detector begins acquiring data in 2007.

Further FCAL test data will be transmitted over this facility in the coming months.

The lightpath was established with a capacity of one Gbps end to end between the FCAL Linux data acquisition PC at CERN in Geneva and a three Terabyte Linux disk server at Carleton University Physics Department in Ottawa.

Due to the small time window to actually transport the data during the running experiment, there was no opportunity to tune the network and I/O performance of the servers.

Tsunami, an experimental high-speed network file transfer protocol developed by the Advanced Network Management Laboratory at Indiana University was used as the transfer protocol. An average rate of about 250 Mbps was obtained.

This link was made possible with the contributions and support from Ralph Michaelis and his staff at Carleton University. ORION, Ontario's Optical Regional Advanced Network provided use of the fibre between Carleton University and CA*net4 for this experiment.

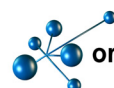
ORION's Sam Mokbel and Randy Neals were instrumental in enabling this. Damir Bobic and Thomas Tam from CANARIE coordinated the provisioning of the lightpath between CERN and Carleton University, as well as helping to isolate local high dispersion fibres, which were problematic.

Dale Theoret and Verna Murray from Telecom Ottawa, and Michael MacKenzie from Group Telecom assisted in identifying and interconnecting fibres at the Ottawa ORION PoP and at the Ottawa CA*net4 PoP, respectively.


This experimental use of an end-to-end lightpath was conducted as part of the Carleton University led CA*net4 International Grid Testbed, supported under CANARIE's Directed Research Program.

ORANO's President and CEO Phil Baker is looking forward to more practical research uses of the ORION network. "That's part of our mandate," he said.

"As one of the world's largest and most advanced optical research networks, ORION certainly wants to collaborate with the international research community, and remain at the cutting edge of technology and innovation in the field," he said.



High-speed connection expands access to Scholars Portal

 Spending time in libraries has become a lot less attractive. Faculty and students have turned increasingly to online digital sources for their research to save time, increase productivity and find new ways of incorporating access to digital libraries into research and education.

The Scholars Portal is Ontario's digital library located at the University of Toronto's Robarts Library. All 19 Ontario universities, as well as specific electronic publishers, are licensed to access the electronic contents of the digital library. The libraries of colleges are expected to gain access in the future.

The Portal is already in the process of increasing its digital library from 2.9 million articles to six million articles to meet these needs, and is projected to have as many as 20 million electronic journal articles in the not-too-distant future, making this resource one of the largest in the world.

At 900k for a typical article, existing download connections can't handle the high volume demanded by faculty and students across Ontario.

"Once we have the ORION platform to give libraries easy, efficient access to digital files, I expect the number of downloads to increase at an extraordinary rate," said Peter Clinton, Director, Information Technology Services at the University of Toronto. "I also expect the volume of new digital resources at the library to increase to meet the demand."

With connection speeds of ORION's broadband pipeline, the Portal will meet increased demand with ease, enabling much greater volumes of data to be downloaded at much faster speeds.

Ontario's universities downloaded over two million digital documents from the Digital Library at the University of Toronto in the past year.

"The sheer volume is increasing rapidly and will increase even faster as the capacity of the download pipeline increases with ORION," added Clinton.

Leslie Weir, Chief Librarian at the University of Ottawa couldn't agree more.

"High-speed perpetual access is required, and ORION's broadband capabilities are the solution."

"From text to images to video, our resources are moving toward a much greater emphasis on the digital library," said Weir. "In fact, digital access has even become a part of the classroom experience for some courses. For all

of these resources to work effectively, we need to be able to mesh our digital resources with the needs and demands of the users. High-speed perpetual access is required, and ORION's broadband capabilities are the solution."

In a related development, the University of Toronto is testing a new system for a searchable, downloadable database of wide-ranging scholarly material in every known digital format. Known as T-Space, the project stems from D-Space, originally a joint development between MIT and Hewlett-Packard, which has since become the D-space Federation of seven universities - Cambridge, Columbia, Ohio State, Rochester, Washington, Cornell and Toronto.


Conceivably, the amount of data stored in T-Space could reach sizes that are almost impossible to fathom. High-resolution images for one medical research project alone can require more than two terabytes in size.

That's more information than can be stored in forty thousand four-drawer filing cabinets. It's possible that T-Space may store data in the petabyte range or, according to SearchStorage.com, more than twenty million four-drawer filing cabinets of information.

When T-Space comes online later this year, ORION will be in position to act as the best possible pipeline for effortlessly accessing and distributing this much information on demand.



Engineering team in final sprint to complete network

 All but three of ORION's 22 PoP sites are now up and running, allowing users to connect directly to the ORION network, says ORION Project Director Sam Mokbel.

The network's Engineering Team is traveling the province to connect institutions to the network and conduct testing. The latest PoP to come on line is the network connection point in Sarnia, being connected this week.

Mokbel reports that ORION has also started routing traffic from CANARIE's CANet* 4 and the commercial Internet.

The PoPs at North Bay, Timmins and Sault Ste. Marie are all that remain to connect to the 3,700-kilometre network. Mokbel expects they will come on line within the next eight weeks.

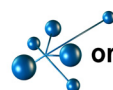
In the past two weeks, 15 institutions, including colleges, universities and others, have already signed up for ORION connectivity, through the network PoP (Point of Presence) in their community. Those institutions are being connected this week and will start to access the network to link to CANet* 4 and the Internet.

ORION expects to have more than 100 institutions signed up by the end of 2005.

The Ontario Ministry of Enterprise, Opportunity and Innovation and Ontario's SuperBuild Corporation are ORION's primary funding partner, with an investment of \$32.3 million.

The federal government has invested \$3.4 million through CANARIE, Canada's Advanced Internet Development Organization, which operates CA*net 4.

Additional private and public sector investments over the next three years will bring the value of the ORION project to over \$78 million.



York University's Stan Shapson joins ORANO Board of Directors



Stan Shapson, Vice President of Research and Innovation at York University, has joined the ORANO Board of Directors.

Shapson attended his first board meeting on August 14 and participated in the board's strategic planning discussions.

"He is a great addition to our Board", said President and CEO Phil Baker.

His involvement and expertise in research in the use of technology in the field of learning is of particular importance to us," he said.

"Stan is certainly one of Canada's foremost authorities in this field. He will bring invaluable insights to our board and to our network."

Shapson has published widely and served as lead researcher for several large-scale national and provincial research projects. He currently leads the Advanced Broadband En-

abled Learning (ABEL) program, a CANARIE-funded broadband initiative, which facilitates professional development in the use of broadband networks as teaching tools.

"He will bring invaluable insights to our board and to our network."

Through videoconferencing, on-line discussions with experts in the use of broadband technologies in the classroom, the ABEL project will use CANARIE's CA*net 4 research

network to develop a model for an innovative, collaborative means of on-line professional development for teachers.

He has chaired provincial working groups on IT and co-chaired federal committees on technology and professional development.

He is a member of the Governing Council of Social Sciences and Humanities Research Council (SSHRC) and chair of the council's Research Support Committee. He is a member of the executive of the Ontario Council on University Research (OCUR).

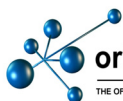
Shapson is looking to ORION to contribute significantly to the design of interactive post-secondary learning environments and new learning models.

He also expects that ORION will lead to better-networked centres of research excellence, in such areas as infectious diseases and alternative sources of energy, for instance.



About ORION

ORION is an advanced high-speed fibre optic network that connects



orion research and discovery news

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research and education institutions to each other and to colleagues around the world. Spanning 3,700-kilometre to 21 cities throughout the Province of Ontario, ORION was created to bring leading-edge network capability to Ontario's publicly funded R&E community and to become a catalyst for creative and innovative next generation Internet applications.

For more information

ORION is owned and operated by the Optical Regional Advanced Network of Ontario (ORANO). For more information, visit our web site at <http://www.orion.on.ca>. Communicate directly with the Editor of the ORION Newsletter at info@orano.on.ca.

To subscribe to the electronic version of this newsletter, visit this web site. <http://www.orano.on.ca/newsletter/subscribe.html>

ORION stays online during blackout

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The York PoP remained operational until 3:03 a.m. Friday morning when the ORION backup battery power was exhausted, almost 11 hours after the power failure started. The PoP automatically came back up when power was restored at 5:37 a.m.

The Sudbury PoP remained operational until 3:00 a.m. Friday morning when the batteries were drained and came back up at 5:39 a.m. It lost power again at 6:02 a.m. because of a faulty main circuit breaker. The fault was identified and the breaker changed with the cooperation of our Sudbury PoP colleagues. The PoP resumed operations on Saturday at 10:36 a.m.

"What we've learned is that the network managed to continue to operate at near full capacity, and that our only limitation was the local power and local connections.

"This is a testament to the robustness of the ORION network design," said Phil Baker, President and CEO. It certainly gives confidence to our users, who rely on the network to transport critical research and other data.

Ironically, the blackout occurred just as the ORANO Board of Directors was wrapping up an important planning meeting in Mississauga. Like most travelers that day, members experience major delays in getting back home.

