Canada's Advanced Research and Innovation Network
Le réseau évolué de recherche et d'innovation du Canada

ORAN Infrastructure Program
Annual Performance Report

Project Information

ORAN Name:	ACORN-NL		OIP-1
Date:	June 8, 2011		
for the Period from:	April 1, 2010	to:	March 31, 2011

CANARIE's OBJECTIVES
The objectives of CANARIE's Network for the period April 1, 2007 to March 31, 2012 are:

PERFORMANCE REPORT CHECKLIST – Please ensure the following sections are completed:

Performance Measurement Indicators	COMPLETED
1. Network Operations	Yes
2. Technology Innovation	Yes
3. Outcomes	Yes
4. Impacts	Yes

APPENDIX CHECKLIST – Please include any relevant materials:

	Attached
Communication Materials	NA

1. Network Operations

Please discuss the following performance measures, making sure to include all requested details. Network Operations are measured according to recognized outputs. It is with these outputs that CANARIE measures its performance. Please provide an answer specific to your project addressing the indicators below and making sure to elaborate where applicable.

1. *Expanded and upgraded network infrastructure*
   – Briefly describe this infrastructure project and identify/demonstrate demand for the connectivity.

   In the past year ACORN-NL's went through a Tender process which resulted in the installation of seven GigabitEthernet circuits provided by Eastlink Communications throughout the island portion of the province. Three of these were new circuits and four were replacements for circuits from a number of suppliers. As an ongoing project ACORN-NL will maintain the current network which now includes network with additional contracts added as the need arises. The basic backbone of the network is on a single-source contract and all lines will be renewed at the same time.
   .
   We have also hired a new employee to manage the current network and work with member organizations to increase utilization and extend the network into new locations.

2. *Increased access to network by real and virtual organizations*
   – Identify the number of new institutions and virtual organizations connected to the ORAN Network.
   The upgraded network now includes both the Western and Central School districts in the K-12 school system as well as the Eastern School District in St. N's, ACORN-NL provides access to all of the schools currently connected within those districts to each other and to schools and educational resources around the country and the throughout the world.

   The Centre for Distance Learning and Innovation is an agency of the Department of Education that supplies all locations in the province with learning resources that would be too expensive to supply equitably any other way. In a sense CDLI is a virtual organization as it delivers its product to the schools over TCP/IP using a number of different networks. Much of the digital telecommunications infrastructure in rural Newfoundland and Labrador was built up to meet the needs of the CDLI over the past ten years. ACORN-NL is in a position to connect CDLI and the school districts to learning resources located at Memorial University over high-performance network links. In the past, there was no standard backbone and many schools connected to CDLI resources at MUN over a patchwork of broadband cable, DSL and frame-relay networks. In the future, ACORN-NL will provide a centralized backbone and reduce the costs of using the commercial Internet to access CDLI web resources located on the MUN campus in St. John's.

3. *Improved access to network services by network users*
   – What is the contribution to the reliability, redundancy and/or availability of the CANARIE Network?
   ACORN-NL continues to address the demand for the EAO (Environment, Atmosphere and Oceans) research community to collaborate and share data with a broad range of

researchers and students. ACORN-NL also enables peering between members of the ACORN-NL family and provides an economical channel for high performance networking, which otherwise would not exist.

4. *Increased international connectivity*
    – Does your project contribute to international peering using the ORAN and CANARIE Networks? If so, which ones?

By making the rich variety of Newfoundland and Labrador EAO projects and data available through ACORN-NL, CANARIE and the world, our ongoing support of operations addresses this aspect of the mandate.

In addition, ACORN-NL staff played a key role in the IceLink project which installed a new connection between NORDUnet and CANARIE using the newly laid Greenland Connect submarine cable between the islands of Newfoundland, Greenland and Iceland.

2. Technology Innovation

1. *Were any new technologies or mechanisms developed to effect the new connections? Were any new collaborative efforts undertaken?*

   To date no new technologies have been developed as a part of the current ACORN-NL project. The existence of the connection to ACEnet has allowed numerous researchers to move collaborative projects forward that would not be possible otherwise.

2. *What network-enabled application(s) have been made possible by your infrastructure program?*

   ACORN-NL hopes to encourage the development of new software tools which, although their source will be in the area of EAO, will be of value to other similar collaborative research efforts in Newfoundland and Labrador and in Atlantic Canada.

3. *Has there been an improvement in the capability for: flexible use of distributed research equipment? flexible storage, sharing, manipulation and analysis of data?*

   ACORN-NL continues to support these shared resources in a number of areas. The links allow the west coast campus of Memorial University to leverage resources and services on the main campus, and to share information and research between the two locations. In addition it allows the interconnection of several of the campuses of CONA (College of the North Atlantic) allowing them to share data, and take advantage of centralized storage/data archiving.

4. *Did this program connect any business incubator organizations? any Green IT facilities?*

5. *Will the connection be used for peering services?*

It is our hope that in the future that ACORN-NL can take advantage of these connections to leverage peering relationships via CANARIE with organizations such as Google and Desire2Learn. This work is currently being discussed with CANARIE via regular ORAN meetings.

3. Outcomes

1. More extensive use of network services?

During the past year ,, ACORN-NL contracted new connections which include the three largest school districts within the province as well as the Center for Distance Learning and Innovation (CDLI). These include new connections for Nova Central, CDLI and Western and a renewed connection for the Eastern School District offices. As these connections came online they made high-performance networking available between all of their connected schools and extended the reach of their networks to include the world of research and education networks provided through CANARE and international partners. The last of the school districts is scheduled to go live in the next few weeks after the completion of an internal network upgrade.
These connections provide the K-12 students of the province with economical access to learning resources not previously available without the facilities provided through CANARIE. This includes access to global educational networks carried on CANARIE and international partners. Year over year, traffic on the CANARIE link grew by 23% from June 2001 through May 2011 compared to the same period one year earlier.

Existing connections such as the one provided to ACEnet have seen a growth in usage in the past twelve months. These connections have proved to be invaluable for researchers, allowing them to share and move large datasets around, fostering a very collaborative research environment. Year-over year, traffic on the ACEnet link grew by 36% from June 2010 through May 2011 compared to the same period one year earlier.

2. Increased research collaboration nationally?

As previously stated, the presence of ACEnet as a member of ACORN-NL means that numerous researchers within the Atlantic region are able to access computational resources and storage located at Memorial and vice versa. Without the involvement of ACORN-NL these connection would be difficult or impossible to accomplish.

Researchers continue to benefit from high performance networking which allows the transfer of massive amounts of data unhindered by traffic engineering practices of commercial Internet service providers. Specialists in all fields are able to collaborate with distant colleagues using all of the usual networking tools and these simply work better

on networks like CANARIE and ACORN-NL. This provides a level playing field upon which remote universities such as Memorial can attract very highly qualified faculty and staff.

3. Increased research collaboration internationally?

ACORN-NL has played a role in facilitating the connection between NORDUnet and CANARIE as a part of the IceLink Project. This provides an important alternate European link for CANARIE. In computer networks, redundancy must be built in and the additional link to Europe provides important redundancy for both the CANARIE and NORDUnet networks.

All of the advantages of high-performance networking which apply to national-scale research projects also apply to international projects. The advantages are even more pronounced on the international scale as the distances are greater and the time and money saved by not travelling or shipping project materials are significant to researchers.

4. Impacts

The purpose of this section is to describe the tangible impacts CANARIE's funding, programs and partnership have had on your project and is used to demonstrate to Industry Canada and our other Government partners the benefits/opportunities/successes which result from your work with the CANARIE program.

1. ***Strengthened Science and Research Capacity***

   a. Please outline the benefits of the project itself, including the short, medium and long term benefits. Has it: increased research capabilities? Contributed to collaborative research endeavours? attracted private research or investment? strengthened the network's reputation? increased recognition of an organization or lab?
      Please elaborate on any other contributions/impacts not mentioned here.

2. ***Strengthened Innovation Capacity***

   a. Please discuss such things as: strengthened science and research capacities, industry recognition, general leadership in advanced research networking, or other.
   b. Explain the value of the ORAN Network (qualitative and quantitative) over the alternative, if such exists. Identify what alternatives would have been available, e.g., commercial internet.

3. ***Improved Prosperity and Social Well-Being***

   a. Please describe Economic Results –competitive advantage, investment, efficiency and effectiveness, overall value, business opportunities and sustainability, revenue, commercialization or other.

b. Please describe how your project provides Social Benefits –job creation, contribution to Canadian research projects/Canada's research and education community, ability to attract human resources, accessibility of network, involvement with international networking and networking-focussed collaborations, and/or other.

The current project has allowed ACORN-NL to contribute in a meaningful way to research within the province and across the country. Below are some of the research locations that have leveraged the network provided by ACORN-NL:

1. Ocean Sciences Centre St.John's:
   The Ocean Sciences Centre located above the waters of Logy Bay, on the eastern tip of Newfoundland, is a cold ocean research facility operated by Memorial University. The facility supports fifteen faculty members and an average of 58 graduate students working on research projects in fishery, aquaculture, oceanography, ecology, behavior and physiology.Essentially all of them collaborate with colleagues from other Universities and government research labs such as the Department of Fisheries and Oceans, Institute for Ocean Technology and Environment Canada. The OSC is a fundamental partner in Dr. Paul Snelgroves Canadian Healthy Oceans Network (CHONe) project. CHONe is a multi faceted project involving 65 researchers from 15 universities and multiple federal research labs across Canada. A primary aspect of the CHONe project are remote, real-time observatories which require high bandwidth, low latency networking. Without this capacity, the OSC would be unable to participate in CHONe, and many of its researchers would not be able to conduct their projects on site.

2. Ridge Road Campuses of the College of the North Atlantic and the Marine Institute
   This link connects two member sites to ACORN-NL which occupy adjacent buildings..
   Next door to the CNA campus, the Fisheries and Marine Institute of Memorial University connects to the network through the same routing hardware via a short, campus owned fibre.

   This CNA campus hosts the Manufacturing Technology Centre, where the manufacturers and entrepreneurs can access applied research and advanced technologies. CNA maintains its own data network between many of its eastern campuses, which allows them to leverage the connection to ACORN-NL into a connection to the CANARIE network at many of their remote locations across the province.

   The Marine Institute, located within sight of the Atlantic Ocean is recognized as one of the most respected centres for marine learning and applied research in the world. Boasting several specialized training and applied research centres, the Institute relies on the capabilities provided by a high speed network and the resources available through CANARIE for many of its research projects, including large-scale multidisciplinary, multi-tiered projects like SmartBay.

3. Sir Wilfred Grenfell College (SWGC), Corner Brook:

SWGC has been rapidly expanding its research activities and capacity in recent years, requiring increased access to remote resources, collaborative tools, and high speed networking. The completed link renewal upgrade from 100Mbs to 1Gbs, will accommodate increased research activity at SWGC into the near future. Several stakeholders have expressed the need for a higher speed connection to the ACORN-NL network and CANARIE backbone, including Dr. Ivan Emke, Associate Vice Principal (Research) at the College. When speaking of increased collaboration between SWGC and CNA's Geospatial Research Facility, he commented that *"one of the issues we've had in the past is a low connectivity between the CNA campus and ourselves"*. SWGC also hosts an office of the Atlantic Forestry Centre (AFC) which is a partner in the SAFORAH project, a National system of grid computing technology and remote sensing facilities which facilitate research in support of our national forest monitoring activities. Access to a high speed network is mandatory for participation in such collaborative programs. Barry Wheeler, Research and Operations Analyst at the AFC had this to say about the current connection to CANARIE; "The data sets we share out are large, hundreds of megabytes a piece at times. Our connection to our local office here…is prohibitive to some of the work / collaboration that we do at times.*"*

Current research activity at the college includes the Humber River Basin (HRB) Project; A large scale project consisting of multiple research elements which offers excellent potential to collaborate with the international community, such as the ability to link Canadian and European workers dealing with risk analysis and Decision-Support Systems (DSS), Salmon research, bio-remediation, tourism research, biodiversity research, and estuarial science. In addition to such large scale research projects, many faculty at SWGC such as Dr. Pierre Rouleau, rely on the ACORN-NL network to take part in collaborative research projects both National and International in Scope. Dr. Rouleau collaborates with researchers at UCLA, Mexico, and Korea on Modal summation and geobase data-inversion for high-resolution 3-D mapping of Earth properties on distributed computer systems. The college and its affiliates also have large scale research projects on the horizon such as the GeoConnections GeoSpatial Data Infrastructure project, which will likely require access to HPC resources (ACEnet), and greater videoconferencing/collaboration capabilities.

Without the involvement of ACORN-NL and the provided connections many of the organizations and locations would either have no links, or would have to make due with much slower commercial links. These links would be costly, slower and in some instances insufficient to support the research being carried out.

4. **Center for Distance Learning and Innovation and the K-12 School Districts**

CDLI is an agency of the **Department** of Education with a mandate to provide distance learning to the students in the K-12 system throughout the province.

The service delivery model in use for the past several years, has employed Information and Communications Technology, in particular the Internet Protocols which are compatible with both ACORN-NL and CANARIE. The communications network has evolved over many years and has not benefited from a single central design process. Many schools connect to CDLI over leased lines and others connect over the Internet using cable modems, asynchronous digital subscriber loop and even dedicated frame relay circuits provided by the incumbent telephone carrier. This infrastructure is expensive due to piecemeal construction, uncoordinated contracts. They are also outdated and under-provisioned in the case of frame relay.

Many schools have connectivity through facilities leased by CDLI while others connect using fibre optic cables from different service providers. None of these arrangements are sufficiently reliable, scalable, cost-effective or easily managed.

The completed portion of the ORAN Infrastructure Program provides high performance networking to approximately half of the province's K-12 institutions.