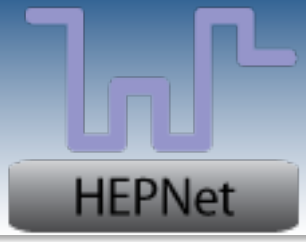


Introduction

HEPnet/Canada is responsible for national and international network connectivity for the subatomic physics community

Established in 1990

Funded with an NSERC MRS award until 2017

HEPnet Director

Ogg 1990-1994

Karlen 1994-2004

Sobie 2004-present

Technical Manager

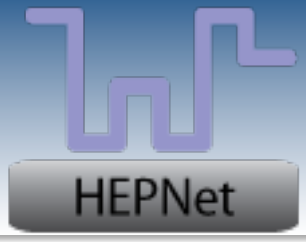
Gable 2006-2015

IPP Advisory Committee

Tafirout, Warburton, Virtue

Web site

hepnetcanada.ca



Outline

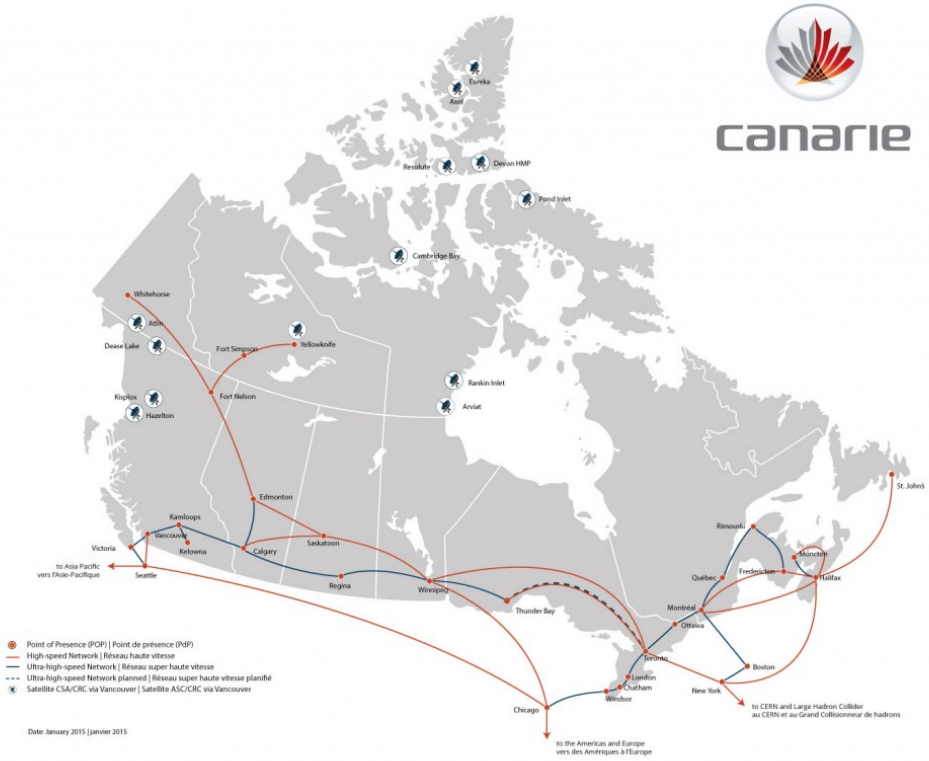
Canadian research network and international links

LHC network

Network R&D

Other activities

Research Network



HEP accounts for a large fraction of all the research network traffic in Canada

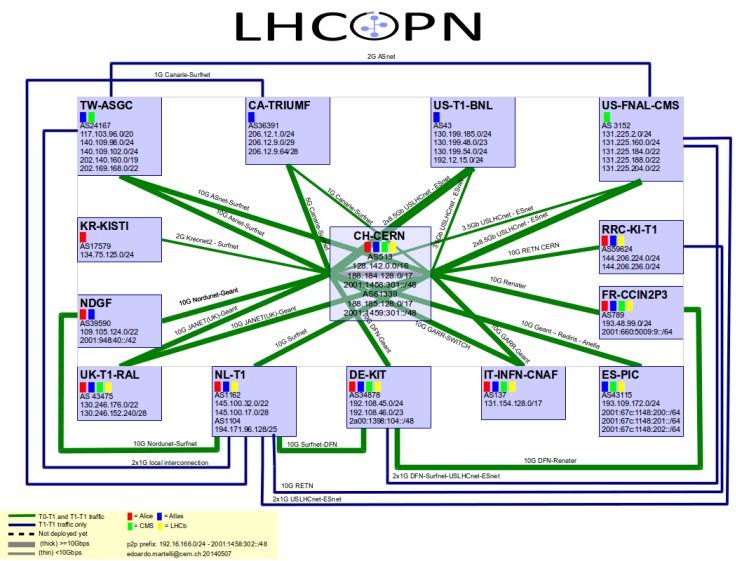
CANARIE
National research network

Provincial network
ORANs
Optical Regional Advanced Network

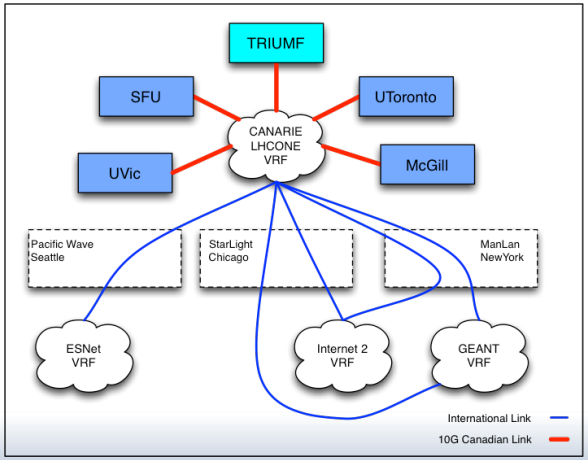
CANARIE has deployed a 100G backbone
ANA-200 shared transatlantic link
UVIC T2 at 100G

US and Europe have 100G networks

LHC networks

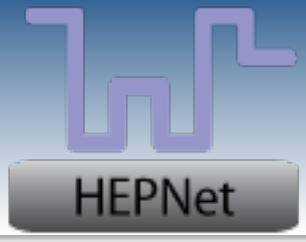


LHCOPN
Private IP network that connects the Tier-0 to the Tier-1 sites.



LHCONE
10-100G virtual private network linking the T0, T1s and T2s around the world

Belle-II joined the LHCONE network in 2014
(KEK and PNNL were not on LHCONE)

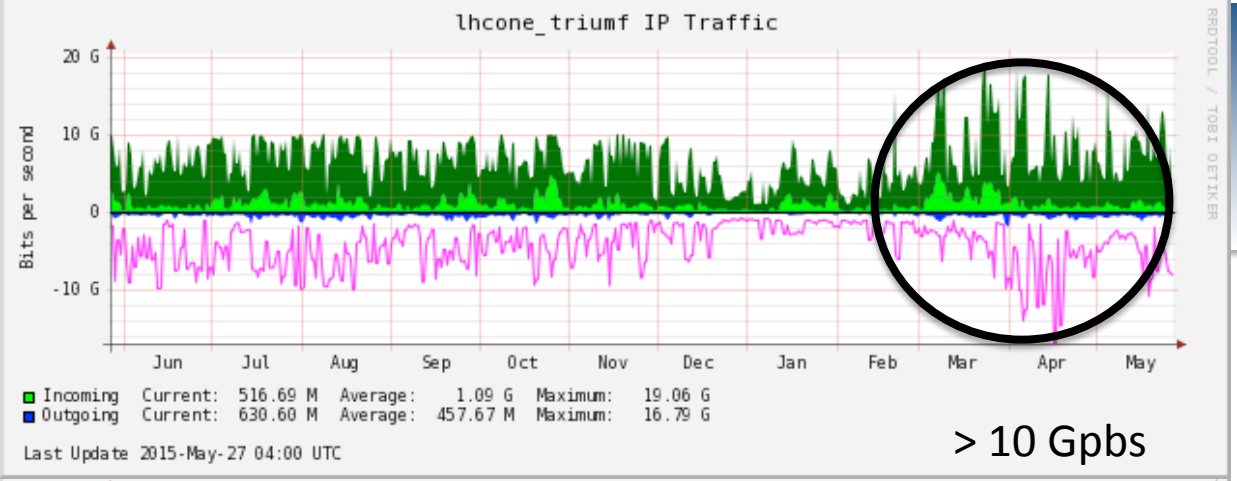


Recent activities

- Additional international peerings (capacity) with GEANT ESnet and Internet2 at StartLight and PacWave
- Canadian LHCONE migrated to CANARIE 100G network (April 2015)
- 2 x 10G for TRIUMF LHCONE (2015)
- UVic Tier-2 100G (April 2015)
- Transatlantic ANA-200 (2 x 100G) for LHCONE (2015)
- TRIUMF to CERN T0 to T1 moved to ANA-200

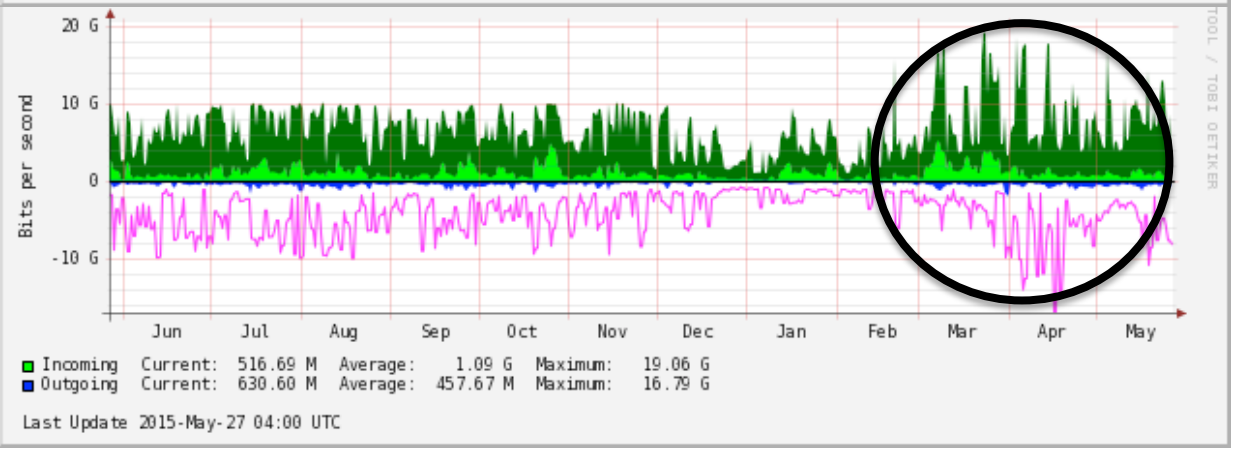
Despite many transitions, the network for HEP was very stable

Sites Traffic West

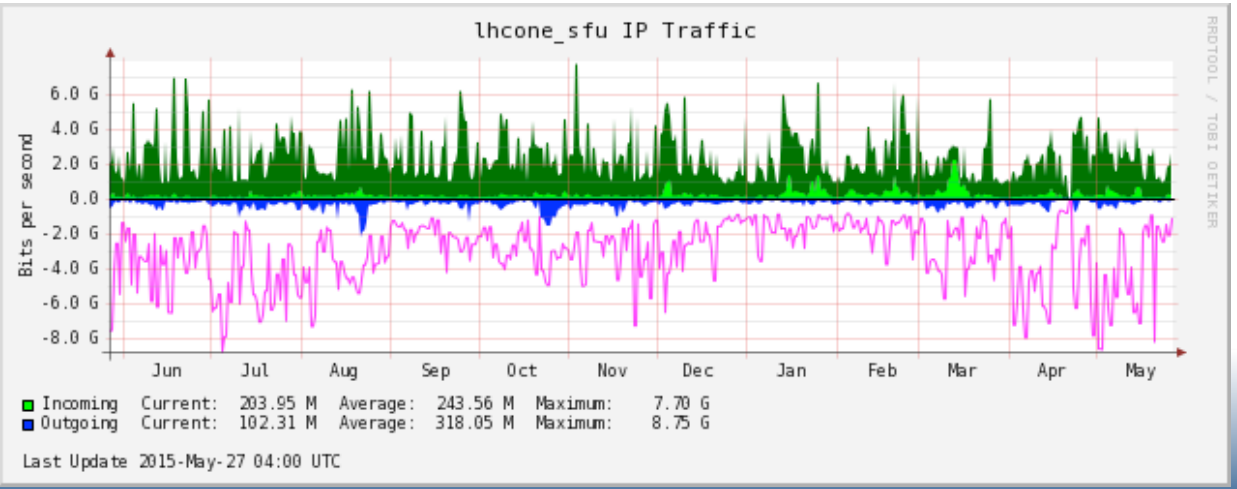


UVic

> 10 Gpbs

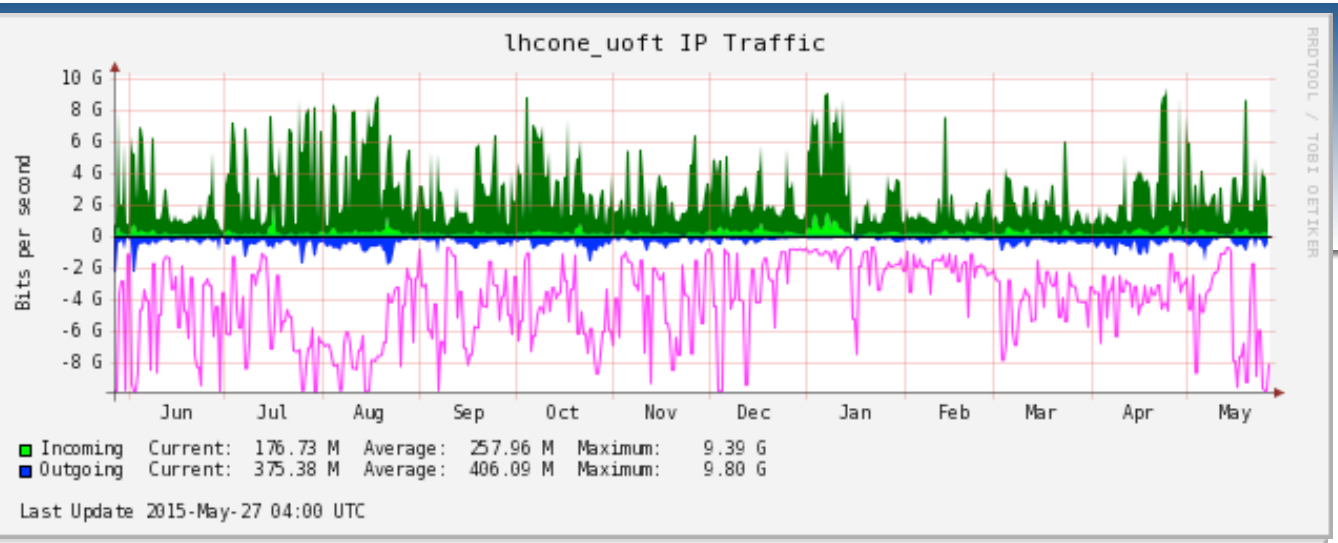


TRIUMF

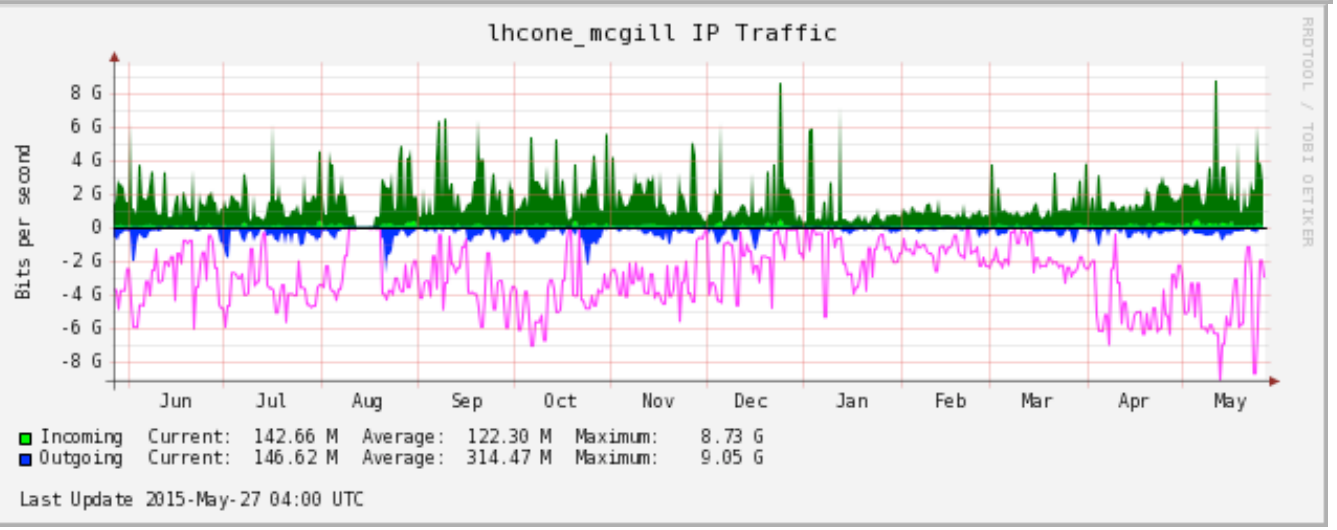


SFU

Sites Traffic East

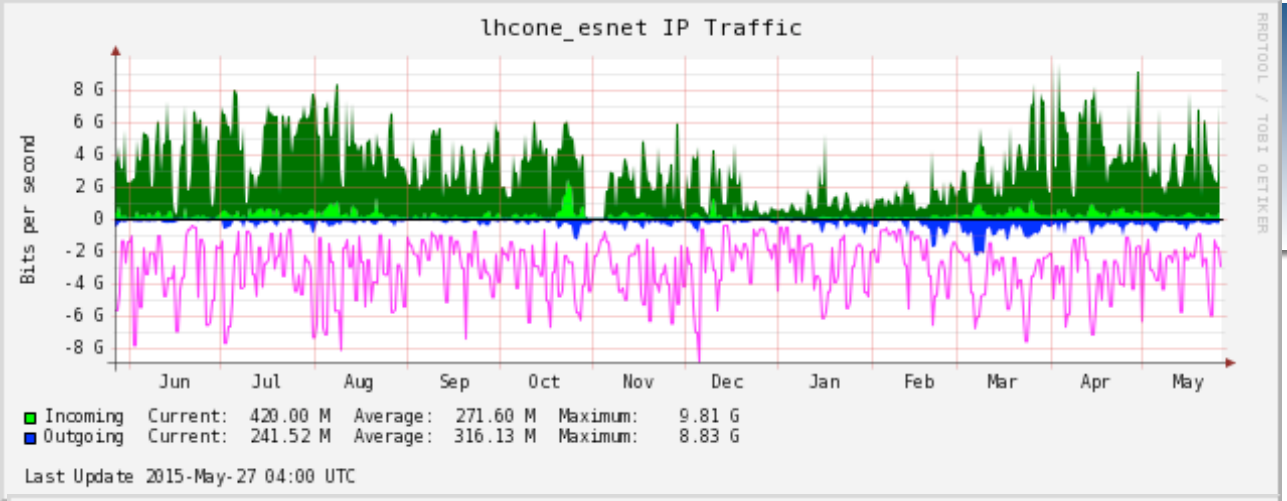


U Toronto

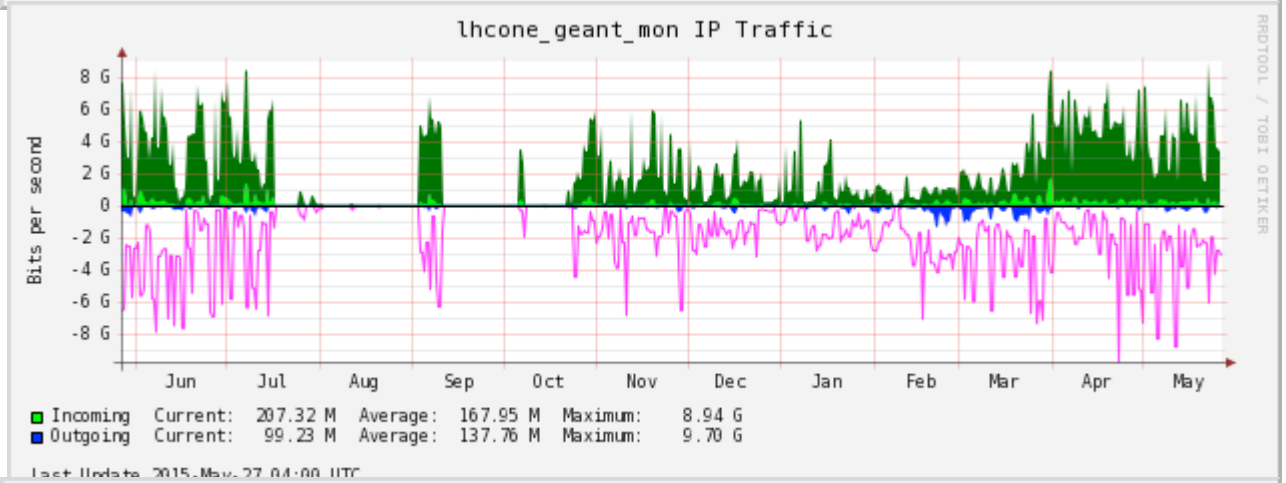


McGill

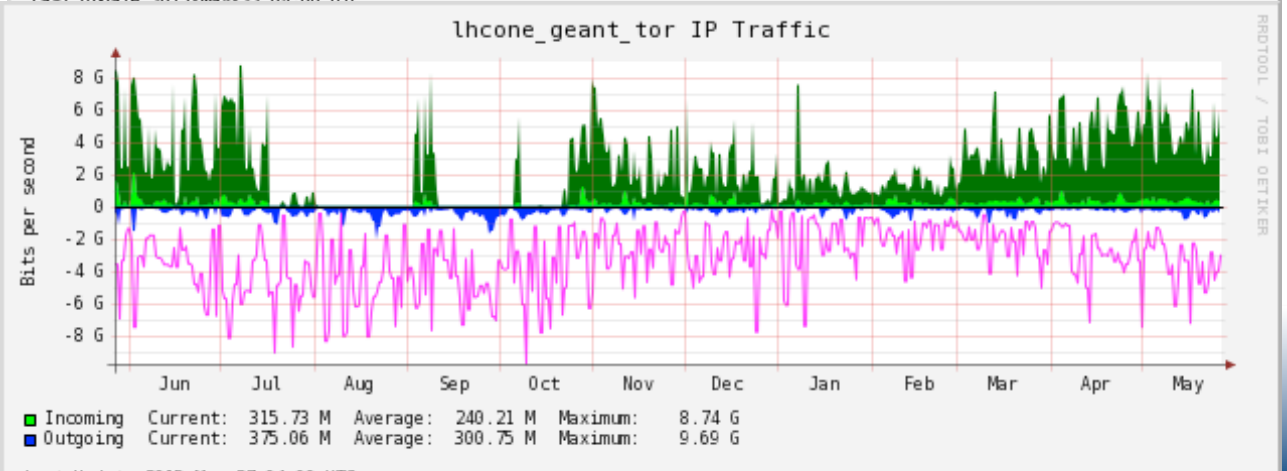
Peering



Esnet ManLan



Geant Montreal



Geant Toronto

Upcoming changes

LHCOPN – LHC Optical Private Network
5G CERN-TRIUMF link

ATLAS Tier-1 site at SFU
SFU-LHCOPN link under discussion
Move LHCOPN traffic to LHCONE

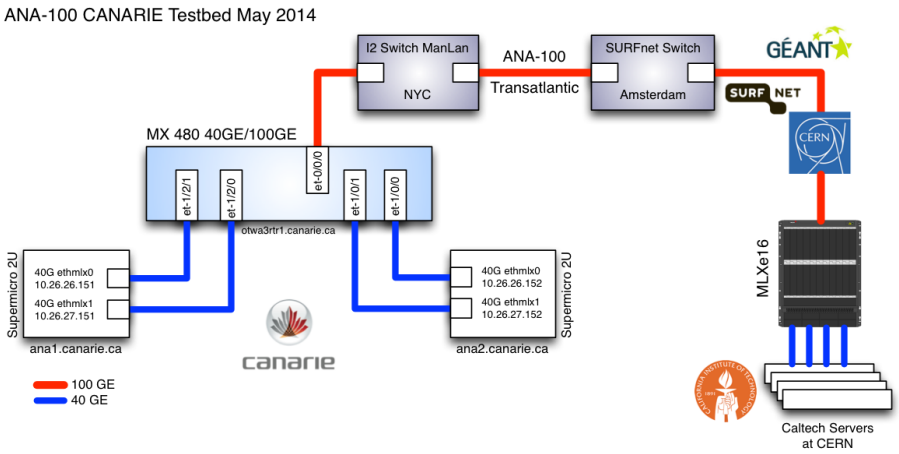
LHCONE – LHC Open Network Environment
10-100G links to T1 and T2s
100G national network
100G international links

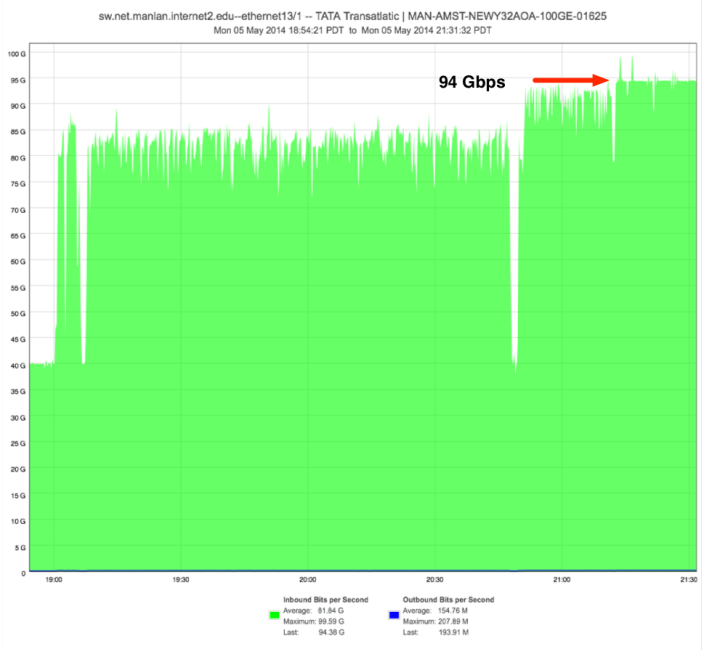
SFU and Waterloo Tier-2 sites
Belle-II Tier-2 cloud (Victoria and Sherbrooke)

Disconnect TRIUMF and Tier-2s from LHCONE when decommissioned

Network R&D

HEPNET/CANARIE/Caltech had exclusive use of the 100G link for one week
Ottawa-CERN tests
The link is supported in part by CANARIE





CANARIE News

Canadian physicists achieve 100 gigabit/second transatlantic transmission, enabled by CANARIE and its global partners

Posted on May 16, 2014 in Press Releases

Industrial collaboration


BROCADE

SUCCESS STORY

University of Victoria

The Fast Path to International Research Collaboration

The University of Victoria (UVic), located in British Columbia, Canada, is a globally recognized, research-intensive university offering innovative programs for more than 20,000 students. Approximately 1,000 research faculty teach and conduct work in a wide range of areas, including oceans and climate, genomics and proteomics, physics, astronomy, chemistry, engineering, and computational modeling. UVic research teams connect to colleagues, cutting-edge projects, and powerful resources around the world through a number of networks.

UVic connects to BCNET, a regional education network that provides connectivity to Canada's Research and Education Network (CANARIE) backbone, which connects 12


SanDisk Products Consumer Data Center OEM Support About

News Release

Home | About SanDisk | Media Center | News Releases | SanDisk Helps Accelerate High Energy Physics Research on the Origin of the U

SanDisk Helps Accelerate High Energy Physics Research on the Origin of the Universe - Supercomputing 2014

SanDisk's Fusion ioMemory™ Solutions Help University of Victoria and University of Michigan Researchers Push the Boundaries of Network Technology, Enabling New Discoveries

Milpitas, Calif., and New Orleans, LA—Supercomputing 2014—November 20, 2014 – SanDisk Corporation (NASDAQ: SNDK), a global leader in flash storage solutions, today announced that the University of Michigan and University of Victoria (CA) are utilizing SanDisk's Fusion ioMemory solutions to fuel their multi-site supercomputing project, which helps them dramatically reduce the server footprint needed to transmit enormous datasets. Working in conjunction with the CERN Laboratory in Geneva, Switzerland, teams of high-energy physicists at each university are using flash memory to push the limits of network technology, enabling access to approximately 170 petabyte datasets from the Large Hadron Collider to research centers around the world. By utilizing Fusion ioMemory solutions, the universities can accelerate access to data, allowing physicists to expedite the potential discovery of new particles and forces that will help explain the nature of the universe.

HEPNET supported by
Brocade, SanDisk/FusionIO, DELL, IBM, Xyratec, Ciena, Juniper, Amazon, Google

Other activities

HEPNET provides support for site connections

Port charges, optical transducers and other items
SNOLAB connection to regional network
Network monitoring systems at T1/T2 sites

Other areas of activity

High speed data R&D
Cloud computing
Data Preservation for HEP

Non-traditional funding support

CANARIE, BCNET, UVIC, Cybera, Amazon, Google, NRC

In-direct (equipment loan)

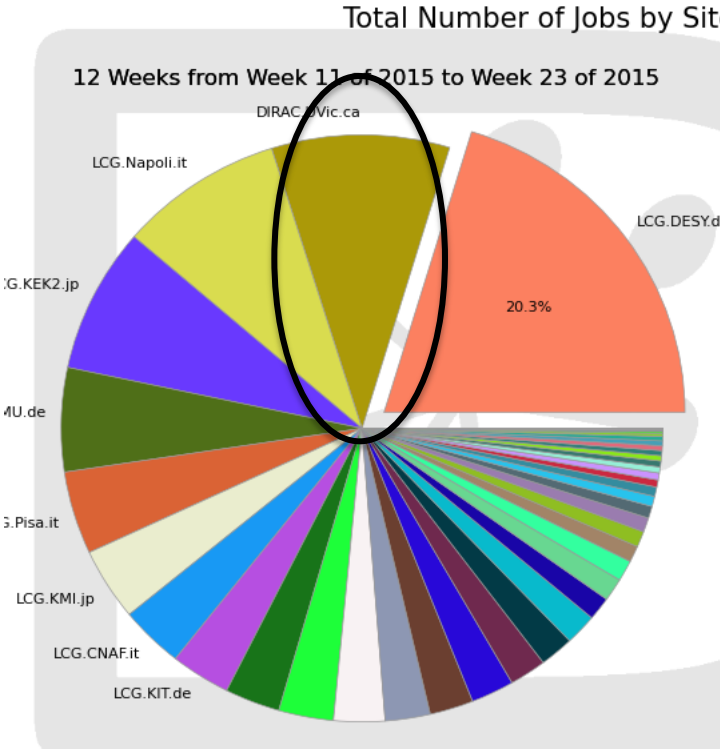
Ciena, Juniper, Brocade, Xyratex, IBM, Dell, Scalar, SanDisk/Fusion IO

HQP

50 undergraduates (engineering, CSC and physics)
14 staff (7 currently)

Cloud computing

- Developed a distributed cloud ("grid of clouds") for HEP and astronomy
  - Manage Coordinate the ATLAS Cloud Operations group and ATLAS Cloud resources at CERN (1000 cores) and commercial UK cloud
  - Canadian ATLAS cloud resources (~ 1000 cores)
  - Belle II (2000 cores) for MC production
  - Using CC, Amazon and other opportunistic clouds
- Installing software on CC to manage batch jobs (Victoria and Sherbrooke)
- Collaborate with CERN-IT/ATLAS/Belle-II
  - CernVM, Squid discover service, distributed VM management and data federations
- External direct and in-kind support
  - CANARIE, NRC, Amazon, Google
- Proposal to CFI Cyberinfrastructure Program
- Data preservation (DPHEP collaboration)



20% of Belle II computing is cloud

HEPNET - HQP

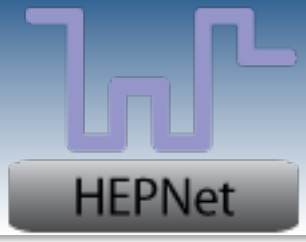
Current team

Randall Sobie	Research Scientist (**Group Leader**)
Andre Charbonneau	Computer Developer (SSC in Ottawa)
Ron Desmarais	Research Associate
Ian Gable	HEPnet Technical Manager
Colin Leavett-Brown	Cloud Developer
Micheal Paterson	Cloud Developer
Ryan Taylor	ATLAS Tier 2 support
Mathew Murry	Coop student
Martin Conklin	Coop student

Former Graduate Students and Staff

Frank Berghaus	CERN
Chris Tooley	Industry
Ashok Agarwal	Industry
Kyle Fransham	Industry
Matt Vliet	Industry
Duncan Penfold-Brown	Industry
Daniel Vanderster	CERN

Colson Driemel	Summer 2014 and Winter 2015
Alex Lam	Spring 2014
Robert Prior	Fall 2013
Michael Chester	Winter 2013
Pranav Shrestha	Winter 2012
Andrey Polyakov	Fall 2011
Tubego Phamphang	Fall 2011
Robert Rusnak	Google Sumer of Code 2011
Tony Bashl	Spring 2011
Brennan McKinney	Spring 2011
Drew Harris	Fall 2010
Michael Anderson	Fall 2010
Holly Leavett-Brown	2010-2012
Matt Vliet	Google Summer of Code 2010 and Winter 2009
Adam Bishop	Winter 2010 and Google Sumer of Code 2009
Michael Paterson	Winter 2010, Fall 2009, Summer and Fall 2008
Vikram Sandhu	Fall 2009
Chris Usher	Summer 2009 and Winter 2006
Cole Uhlman	Summer and Fall 2008
David Bartle	Spring 2008
David Grundy	Spring 2008
Sean Manning	Spring 2008
David Gong	Fall 2007
Sydney Schaffer	Summer 2007
Cameron Sobie	Summer 2007
Tristan Sullivan	Spring 2007
Duncan Penfold-Brown	Spring 2007
Sergey Popov	Fall 2006
Simon Ramage	Summer 2006
Patrick Armstrong	Summer 2006
Avery Berman	Winter 2006
Angela Norton	Fall 2005, Fall 2006
Ron Desmarais	Summer 2005
Marco Yuen	Spring 2005
Quinn Matthews	Fall 2004
Clayton Lindsay	Summer 2004
Alexandro Dimopoulos	Spring 2004
Lila Klektau	Fall 2003, Summer 2004
Manjinder Benning	Spring 2003
Jenny Allan	Spring 2003
Dan Vandrster	Fall 2002
Ian Zwiers	Summer 2002
Graeme Smetcher	Spring 2002



Summary

HEPNet/Canada has a important role for Canadian HEP

Recognized by the recent NSERC MRS award

Networks are enabling the transition to an on-demand environment

Data and computing will not longer be co-located

100G networks are becoming the new standard

Expect terabit/second networks by end-decade

HEPNet is active in an area of wide interest

We will continue to leverage funds from other sources

http://hepnetcanada.ca
http://supercomputing.uvic.ca
http://heprc.phys.uvic.ca