

# CANARIE

**CUSTOMER EMPOWERED NETWORKS –  
FEW YEARS LATER  
THE USERS ARE FINALLY TAKING CONTROL  
OVER C^\*net<sup>4</sup> !**

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# CUSTOMER EMPOWERED NETWORKS – FEW YEARS LATER

## Agenda

- CA\*net 4 design and lightpath concept
- User Controlled LightPath (UCLP) Directed Research Project
- UCLP deployment – technical choices and challenges
- Users are finally taking control over CA\*net<sup>4</sup>!
- 1 minute live UCLP demo
- What is next? UCLP2!



# CANARIE Inc.- Overview

- **Federal leadership:** Concept born in 1990 from Industry Canada discussions
- **Founding:** Incorporated in 1993 by industry and academia
- **Funding:** From Industry Canada: For networks and research applications from Canadian Heritage, HRDC, Health Canada
- **Mission:** To facilitate development and use of Canada's advanced communications infrastructure
- **Primary stakeholders:** Government Departments, universities, provincial research networks, broader research community, colleges, carriers, IT sector, SMEs, broader education sector, broader health sector, provinces



## **(primary) CA\*net 4 objectives**

- > to implement a production level optical transit network to enable users to directly connect to each other by setting LightPaths (LP)**
- > to develop software tools and reference models to allow users to provision and manage LPs themselves**
- > to build a national IP backbone that connects Canadian universities and research institutions and provides direct peering to world's major R&E networks**

# CA\*net<sup>4</sup>

Canada's Research and Innovation Network  
Réseau canadien pour la recherche et l'innovation





# LightPath Definition

- > Any uni-directional point to point connection with effective guaranteed bandwidth
- > Examples of LightPaths:
  - Analog wavelength on a CWDM or DWDM system
  - **STS/VC4 channel on a SONET/SDH circuit**
  - ATM CBR circuit
  - MPLS LSR with defined bandwidth or QoS
  - Diff serv “gold” service on a packet based network
  - Gigabit Ethernet VPN with dedicated bandwidth e.g. using 802.1p/q



# LightPaths application

## 1. To build IP network

traditional routed IP networks

CA\*net 4 IP network – Canadian R&E IP backbone

## 2. To support scientific projects/experiments

intensiveness and complexity of scientific data and global extent of the collaborations require dedicated end to end pipes

ATLAS project

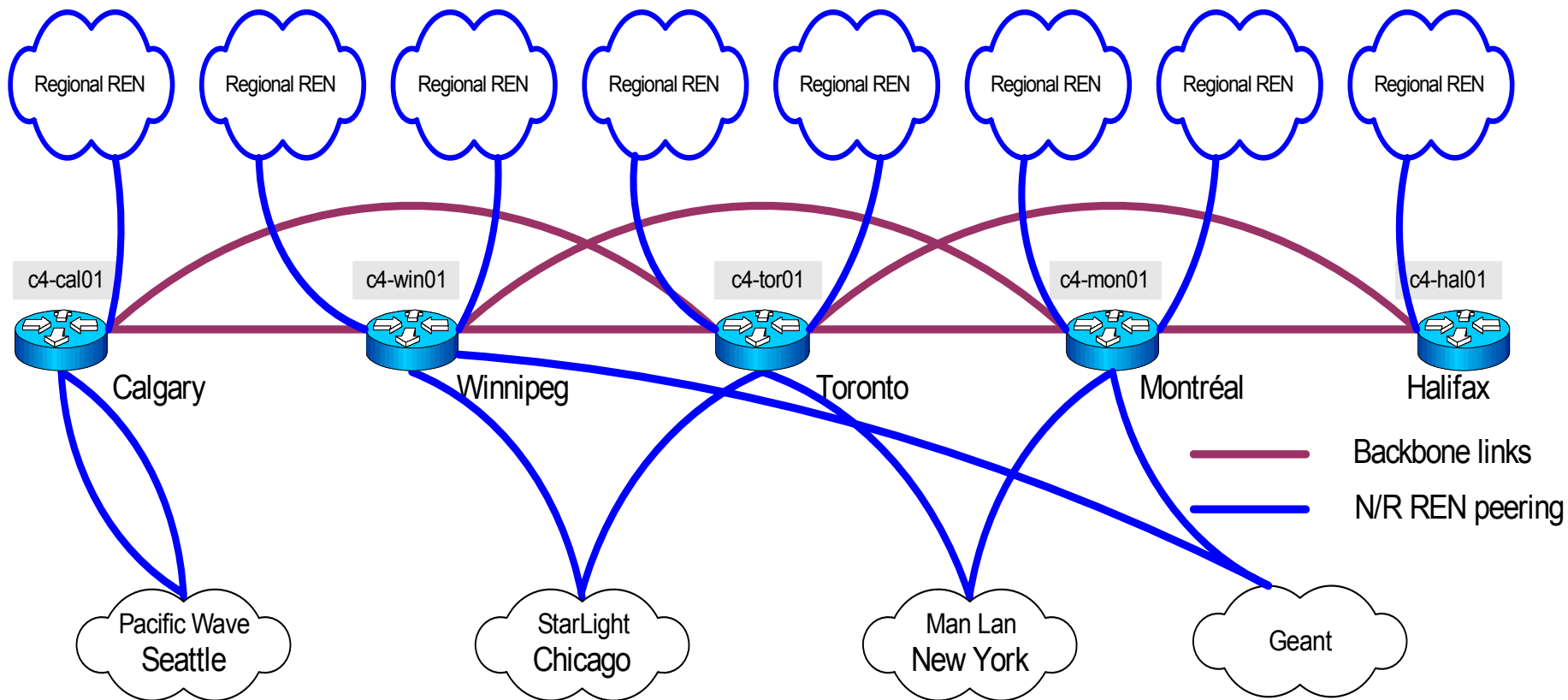
## 3. To build discipline/application specific network

high end (grid) applications have sufficient traffic volume to require their own underlay networks

WestGRID

## 4. To extend condominium wavelength network or to (cost) share existing wavelength with others

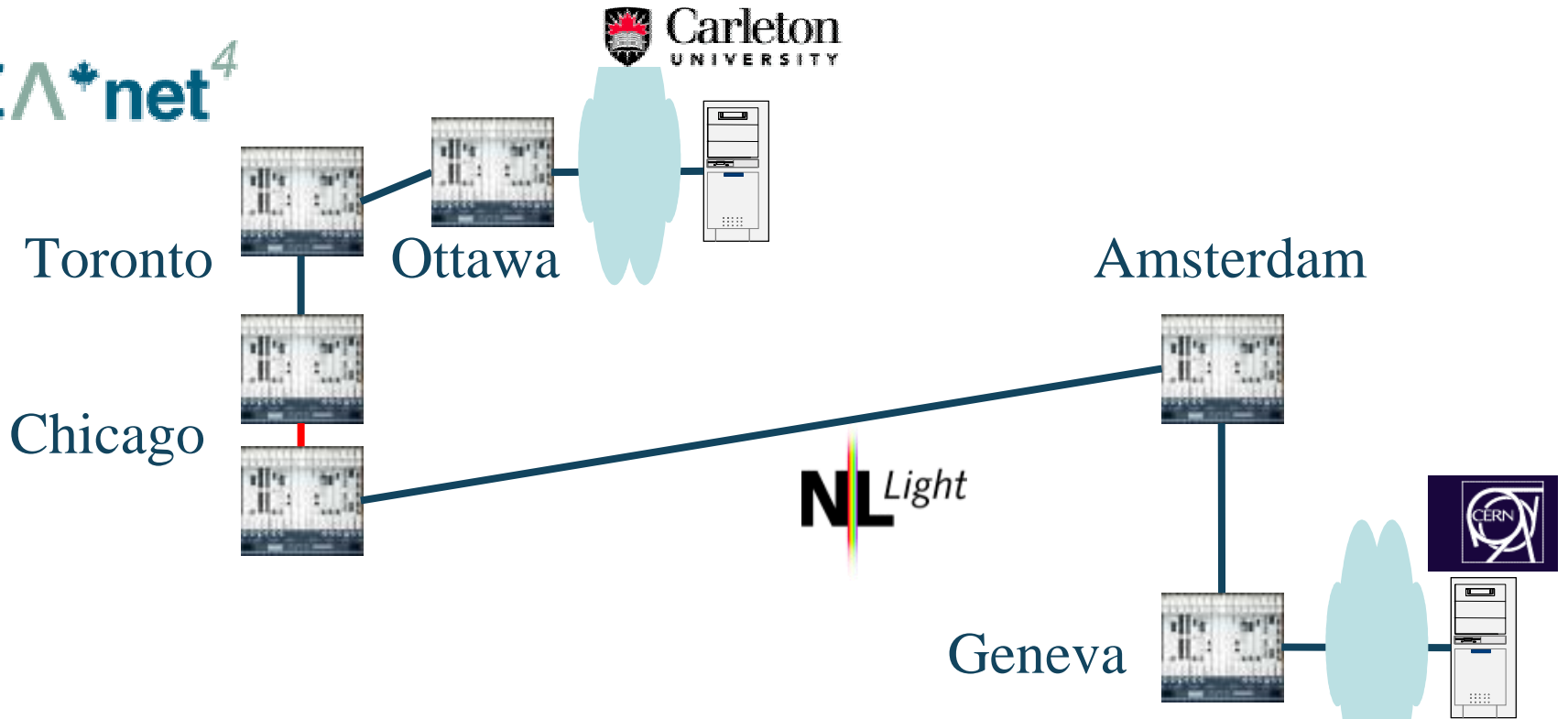
# CA\*net 4 IP network





# LP (1/10 GbE) for ATLAS project

CA\*net<sup>4</sup>



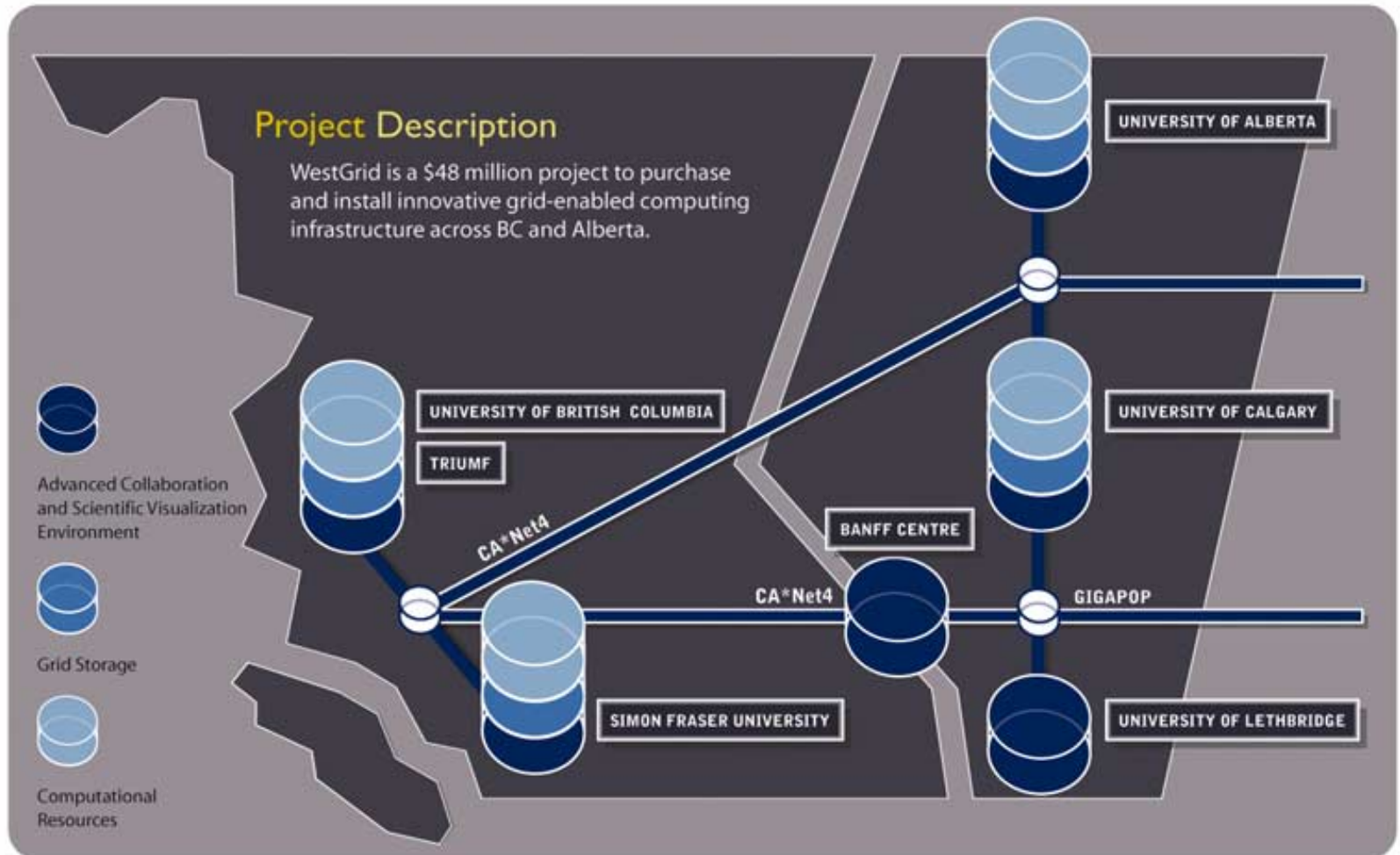
the **ATLAS Experiment**



CANARIE

NETWORKS > COLLABORATION > RESULTS > RÉSEAUX > COLLABORATION > RÉSULTATS

# WestGrid - 1 GbE lightpaths for distributed backplane

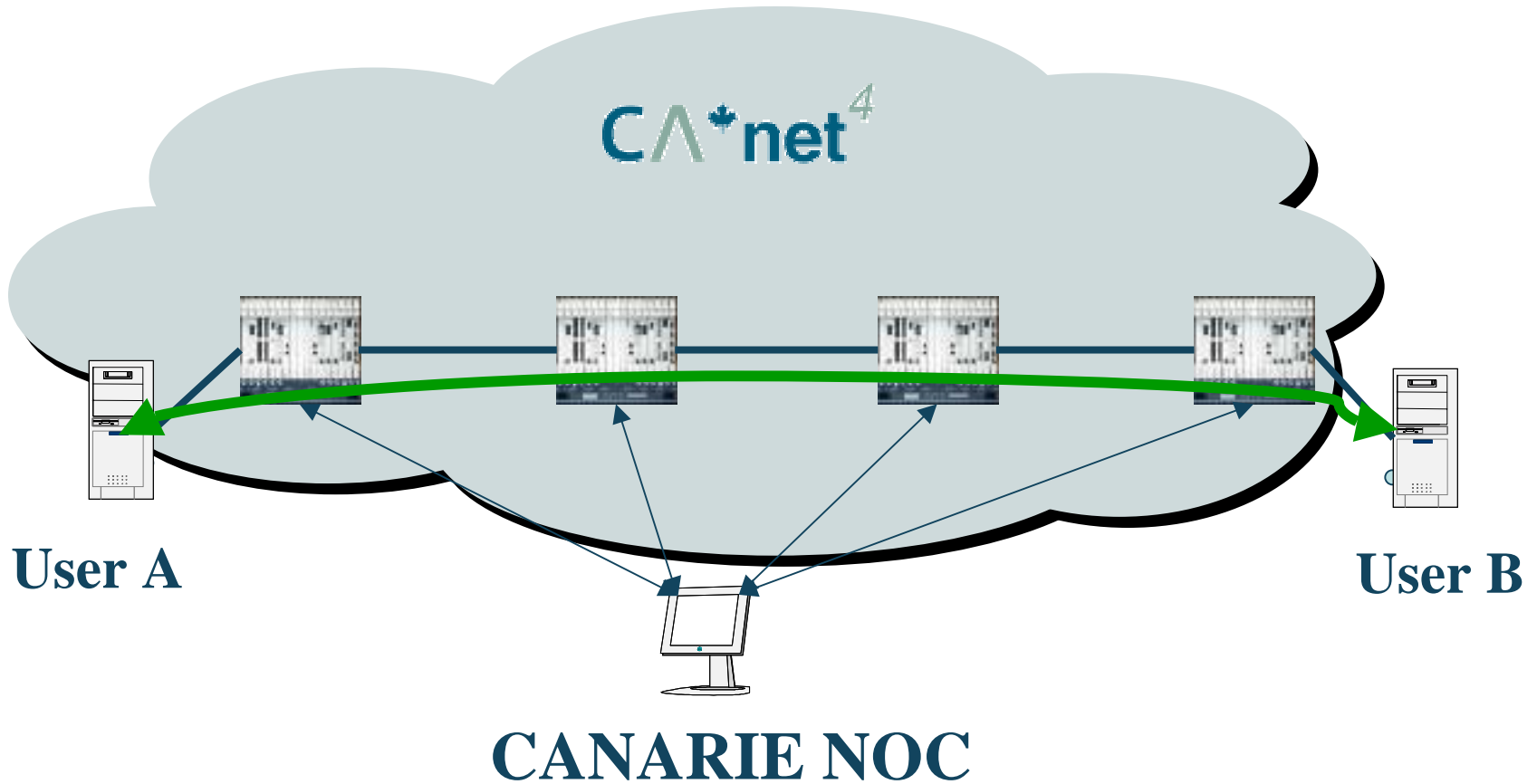




# CA\*net 4 Design

- CA\*net 4 is not a network! It's many parallel networks!**
- > It is an aggregation of point to point 10 Gbps wavelengths from a number of carriers**
  - > The wavelengths and switches are partitioned into lightpaths and (user controlled) switch partitions**

# (non UCLP) LP provisioning





# UCLP Directed Research Project

**To design, develop and deliver a technology for user control of LPs**

**> The UCLP objectives are:**

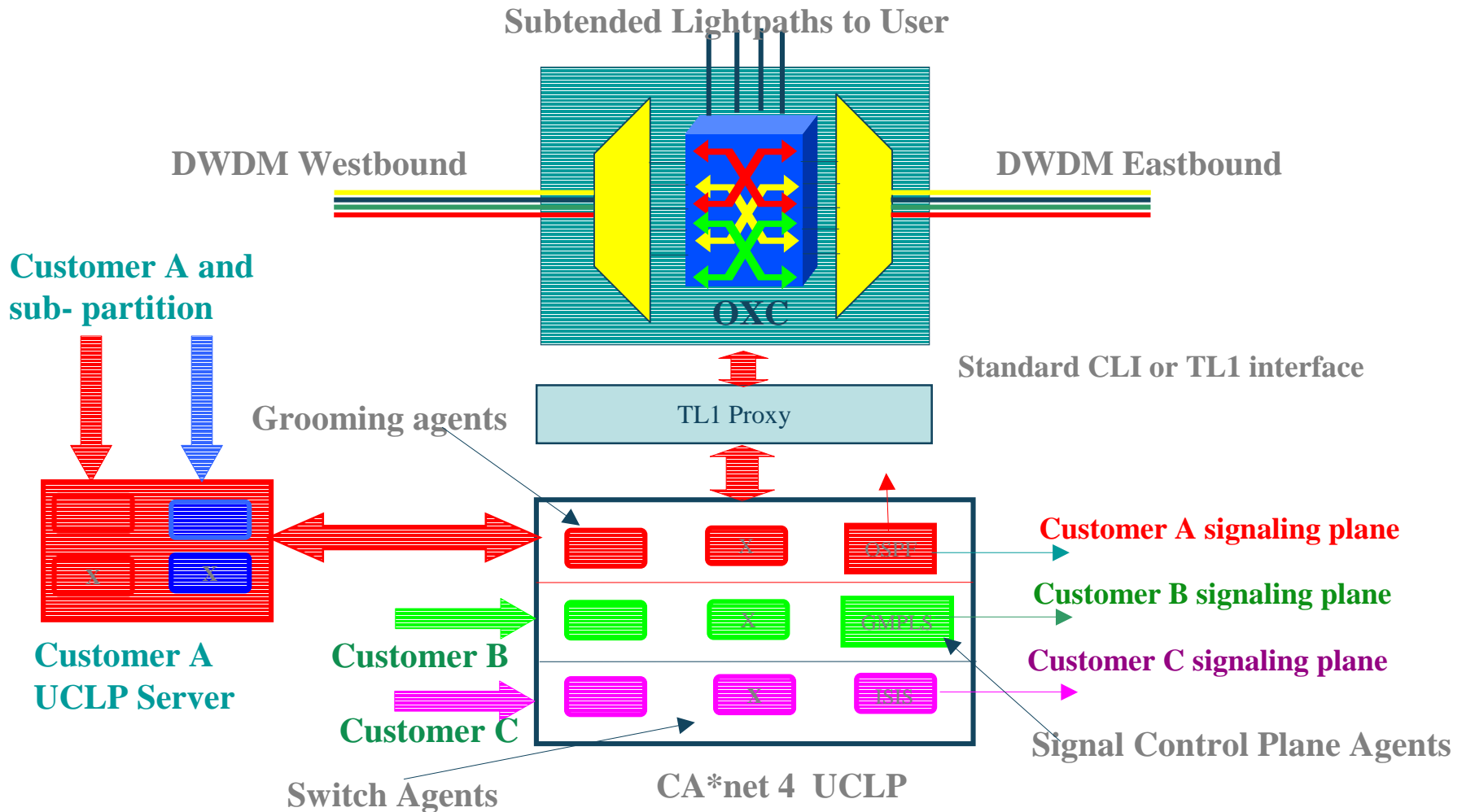
- Customer owned and managed networks
  - To allow customer to create networks with resource heterogeneity - LPs obtained from different service providers can be integrated as a seamless overlay network
  - To allow users to advertise portions or all of their LPs to other users when not in use
  - To allow provisioning and establishment of LPs across multiple independently managed domains
  - To allow each user in the common DWDM segment to manage their individual wavelength as part of their cloud
- Create discipline specific re-configurable IP networks
- User controlled traffic engineering



# User Controlled LightPath

- > **User Controlled LightPaths is a configuration and provisioning tool built around web services**
  - A proxy that sits in front of optical switches and SONET cross connects that allows control of a subset of the cross connects to be delegated to a third party
  - Third party can concatenate cross connects together from various networks to produce a wide area network that is under their control
  - Uses Service Oriented Architecture (SOA) and so network can be integrated with other web service applications

# UCLP general operation





# UCLP deployment

## > **Operation – three UCLP implementations!**

- Do not talk to or collaborate with each other: assure peaceful coexistence!
- Resources – partitioning, allocating, re-allocating

## > **Network management**

- User owned ports and lightpaths
- Reserve NOC a full visibility and right to override user's action

## > **Security**

- Prevent any form of DoS
  - A valid user has access to all available resources
  - Services do not authenticate each other
- Allow access to registered hosts only





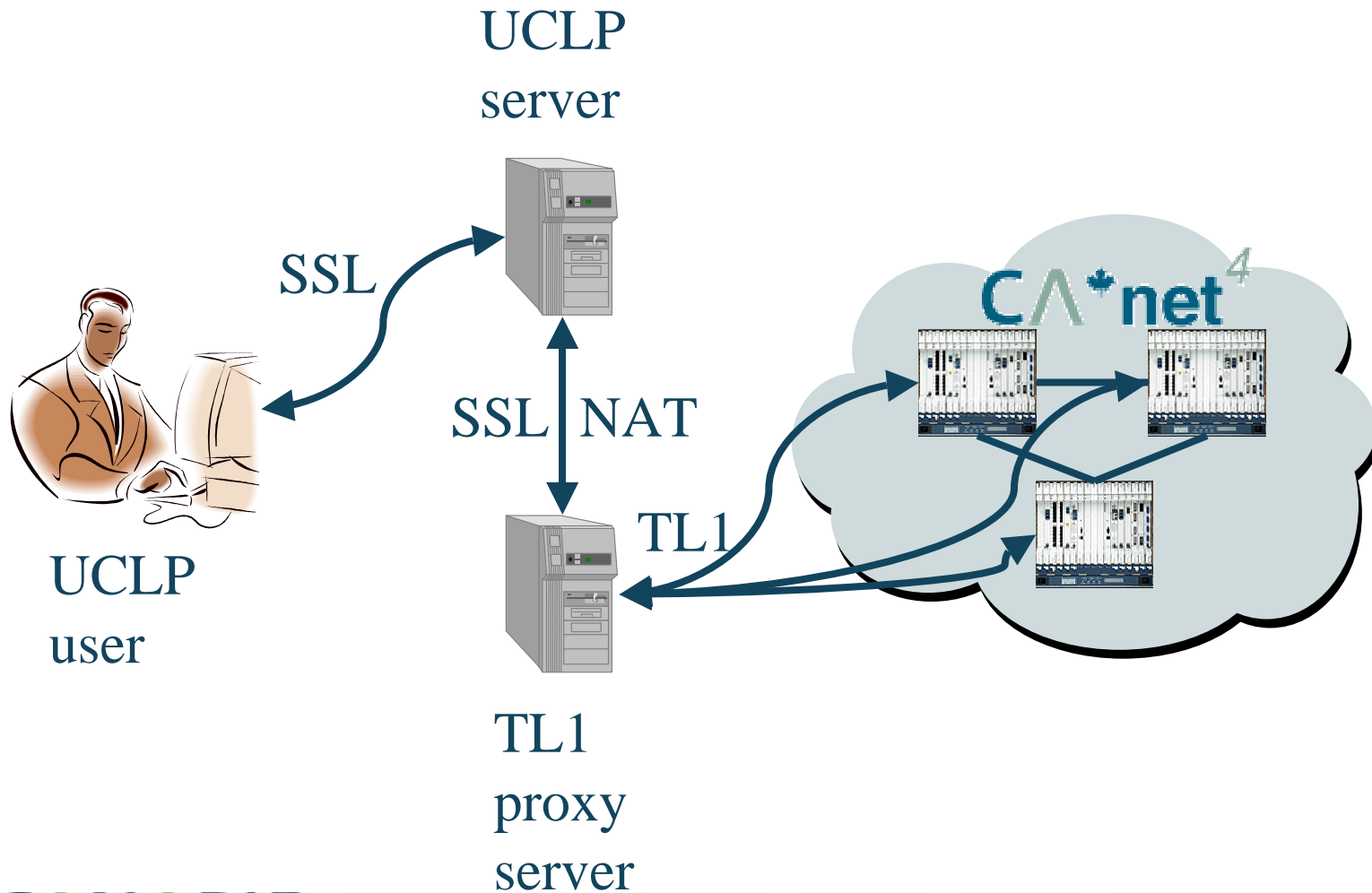
# TL1 proxy server

**Sonet boxes talk TL1 (Transaction Language One)!**

**All-in-one (router, bastion host, AAA ...) rather than just a TL1 proxy server**

- > Initially, conceived to preserve CA\*net 4 operation by allowing access to UCLP allocated resources only**
- > Crucial role in partitioning and security**
  - UCLP resources allocation, separation and validation**
  - Network Address Translation**
  - Password translation**
  - SSL protocol support**
- > XML configuration file, sensitive data encrypted**

# TL1 proxy server





## UCLP characteristics (as NMS)

- > **decentralized, fully distributed and service-oriented**
- > **object oriented recursive architecture**
- > **It is not a comprehensive NMS for optical network management**
- > **It is not competing optical network protocol to GMPLS or ASON**



# User owns the network!

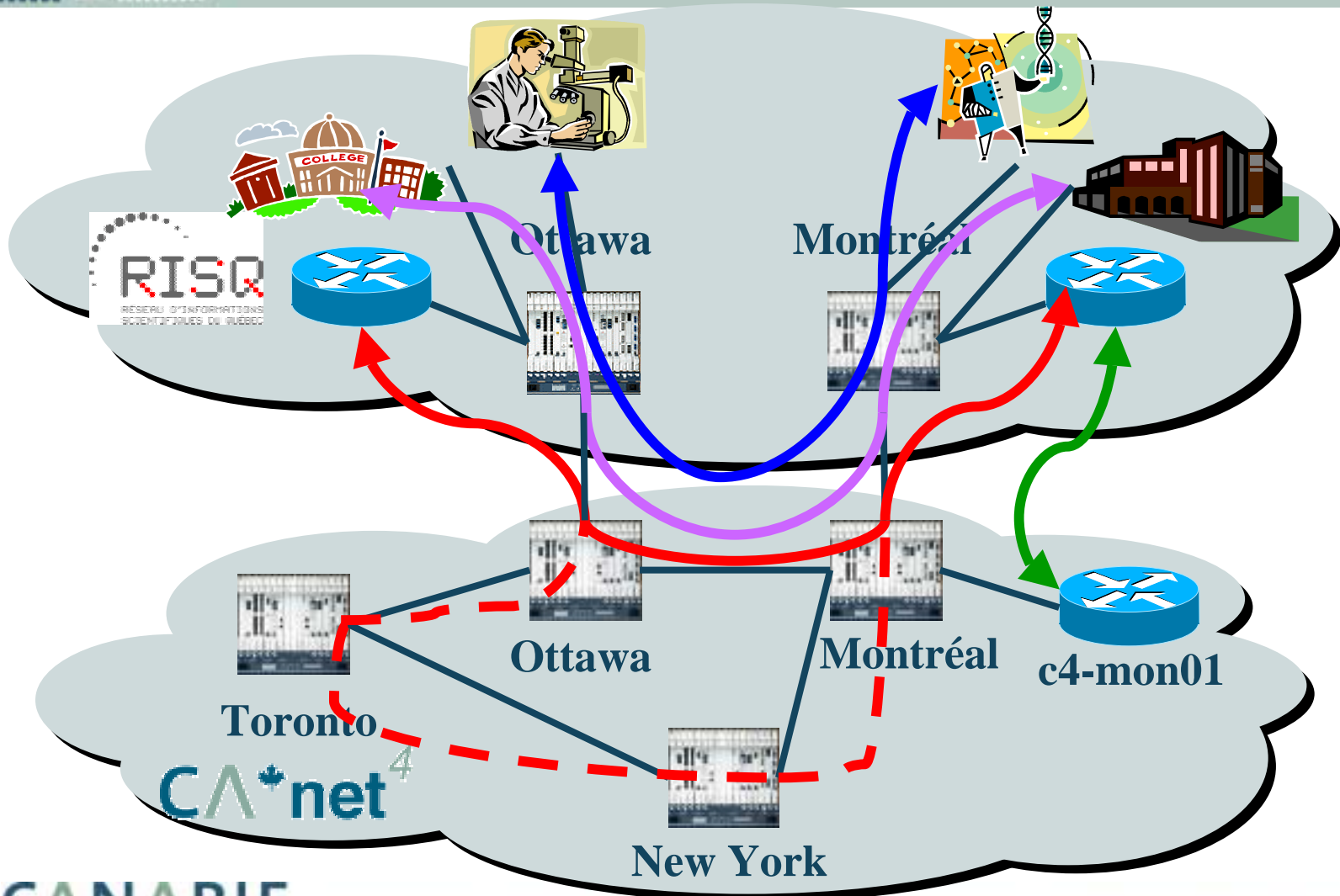
- > **User have control over physical network resources**
  - Create x-connects in order to provision e2e circuits
  - Swap and/or sub lease (part of) them to other users
  - Create their own independent networks
  - Implement their own routing, restoral and protection schemes
  - Integrate resources with those from other networks
- > **User is responsible for**
  - e2e connectivity
  - diverse paths for lightpaths/VPN
  - link failure detection and re-routing



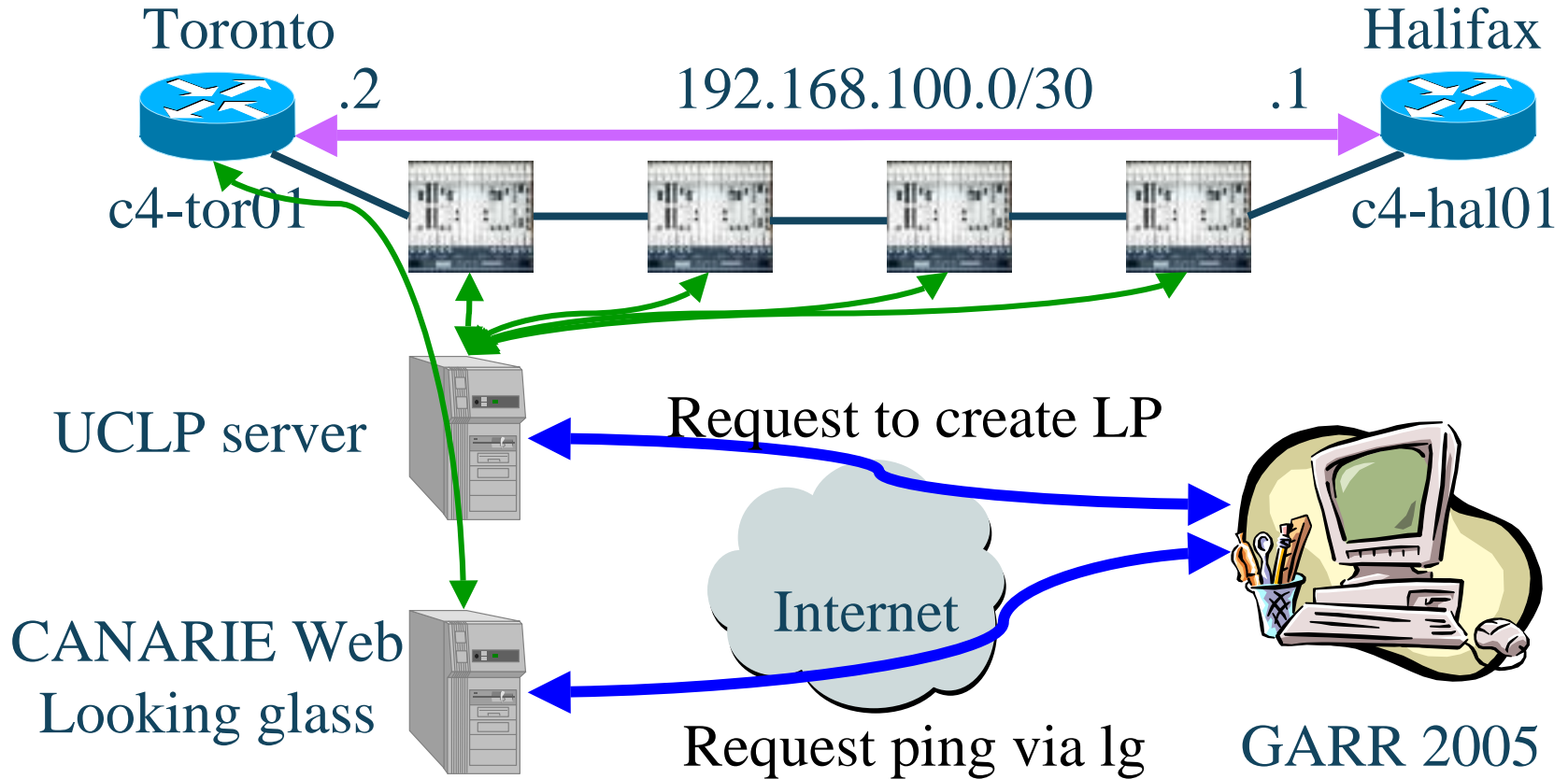
# CANARIE NOC roles

- > **CANARIE NOC responsible for overall CA\*net 4 health i.e. sonet infrastructure**
- > **Continue to use vendor supplied NMS for most of the management tasks**
- > **Use UCLP to have a visibility of user provisioned LPs**
- > **Manage UCLP and TL1 proxy servers**
- > **Provide UCLP training and technical support**

# Integrating LP into regional R&E network (RISQ)



# UCLP - 1 minute live demo!





# What is next?

- > **UCLP program version 2**  
(<http://www.canarie.ca/funding/uclp/index.html>)
  - To allow creation of Articulated Private Networks (APNs) where each cross connect device, or groups of devices, may be in separate management domains;
  - To expose lightpaths and lightpath creation tools as web services that can be incorporated into workflow tools and services (such as Kepler and BPEL);
  - To extend UCLP technology to LAN/Campus networks
  
- > **Evaluating deployment of ROADMs (Reconfigurable Optical Add/Drop Multiplexer) to further enable possibility of the customer owning and controlling the network.**
  - With ROADMs all active optical network devices can be at the customer premises
  - If university or researcher needs a wavelength they can self provision by purchasing their own line driver card
  - With UCLP they have complete control of the wavelength in terms of routing, add/drop, termination, etc





# Additional information

- > CANARIE web site <http://www.canarie.ca/canet4/>
- > Need help with UCLP? Send e-mail to UCLP Project Manager Hervé Guy [herve.guy@canarie.ca](mailto:herve.guy@canarie.ca)



# Thank you!

> Questions?