



The Backbone of Research,  
Education and Innovation

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## BCNET

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- Develop advanced networks for research and higher education
- Connect higher education and research institutions provincially, nationally and 42 nations around the world
- Not-for-profit organization
- Funded by universities, provincial and federal government

# The Transit Exchange

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- Neutral "meet-me" place where organizations can interconnect, share data and purchase services from commercial service providers.

# What is a Transit Exchange?

A new model for open, competitive network services >>>

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- Innovative model
- Pioneered for universities, need innovative networks
- Network neutrality
- Peering exchange
- Neutral meeting place where users and ISPs can come together at one location
- Centrally located close to government and business
- Diverse users within a community can interconnect to exchange data freely with each other

## Benefits

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- Reduced costs for transit services (community peering)
- Reduced commercial internet costs, due to competitive buying place
- Increased control over your network
- Improved performance
- Increased capacity for large amounts of data
- Higher bandwidth connections



## Challenges with traditional models>>>

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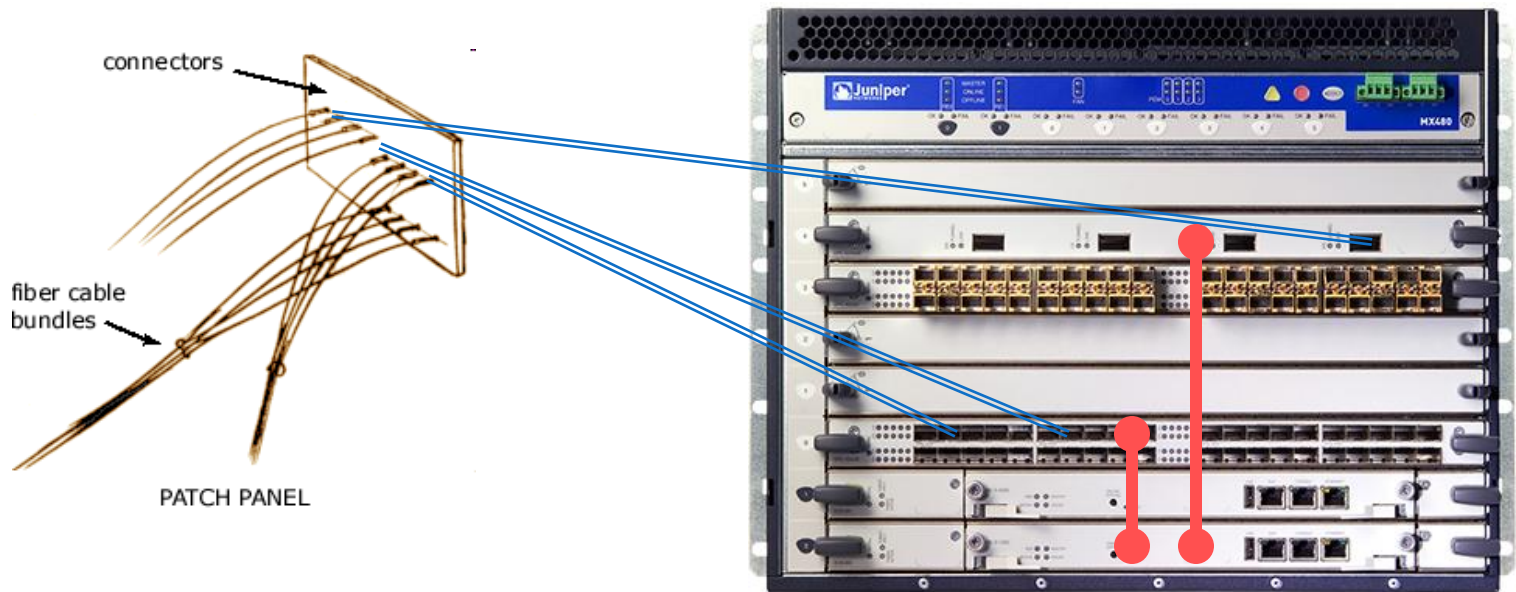
- Traditional Model: End users connect through a single loop to the Internet
  - Structure not scalable
  - Peering points become bottlenecks
  - Locked-in to a single ISP, stifles innovation and keeps costs high
  - Difficulty to switch providers

# Old vs. New Networks



Old	New
Few producers	Everyone is a producer
Limited distribution	International distribution
Content and network tied	Content independent from network
Asymmetric	Symmetric
Centralized	Peer-to-peer
One size fits all	Customizable/Flexible
Real-time, time slots	Whenever you want

## Components of the Transit Exchange >>>

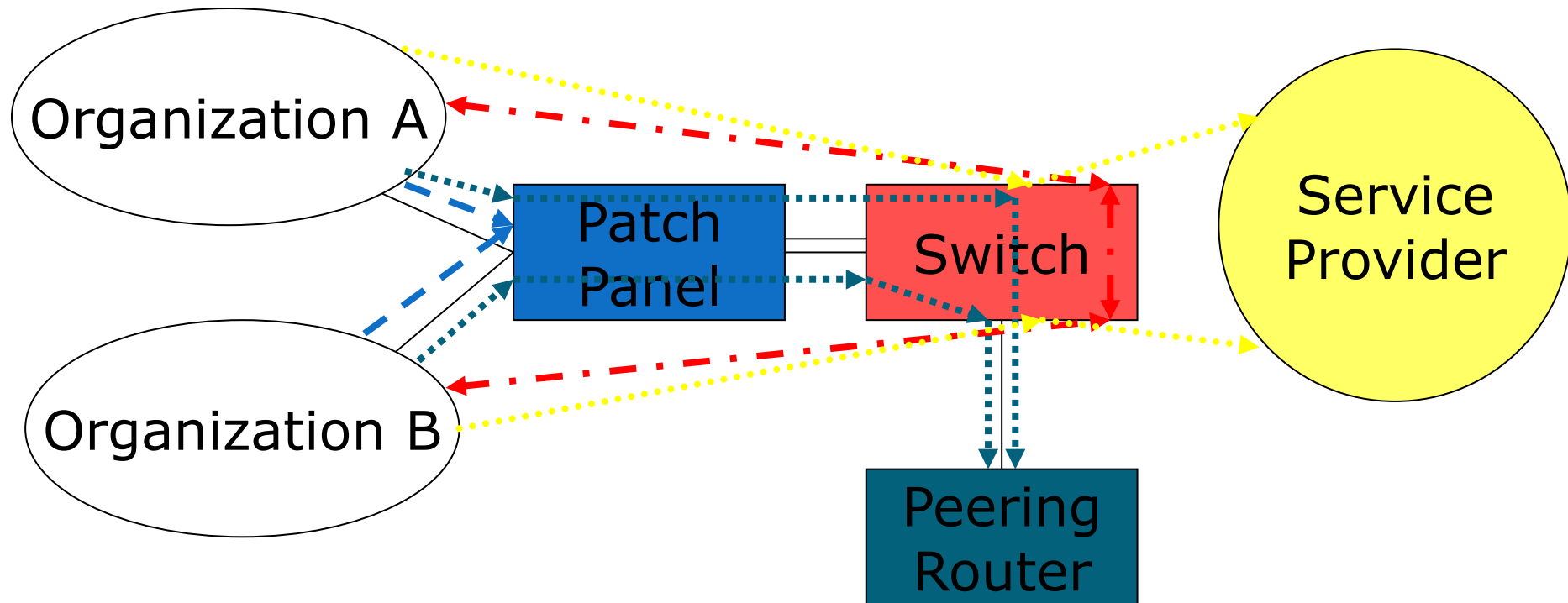


Layer 1  
Fibre Cross Connect

Layer 2  
Ethernet Switch

Layer 3  
Peering Router

## Components of the Transit Exchange >>>



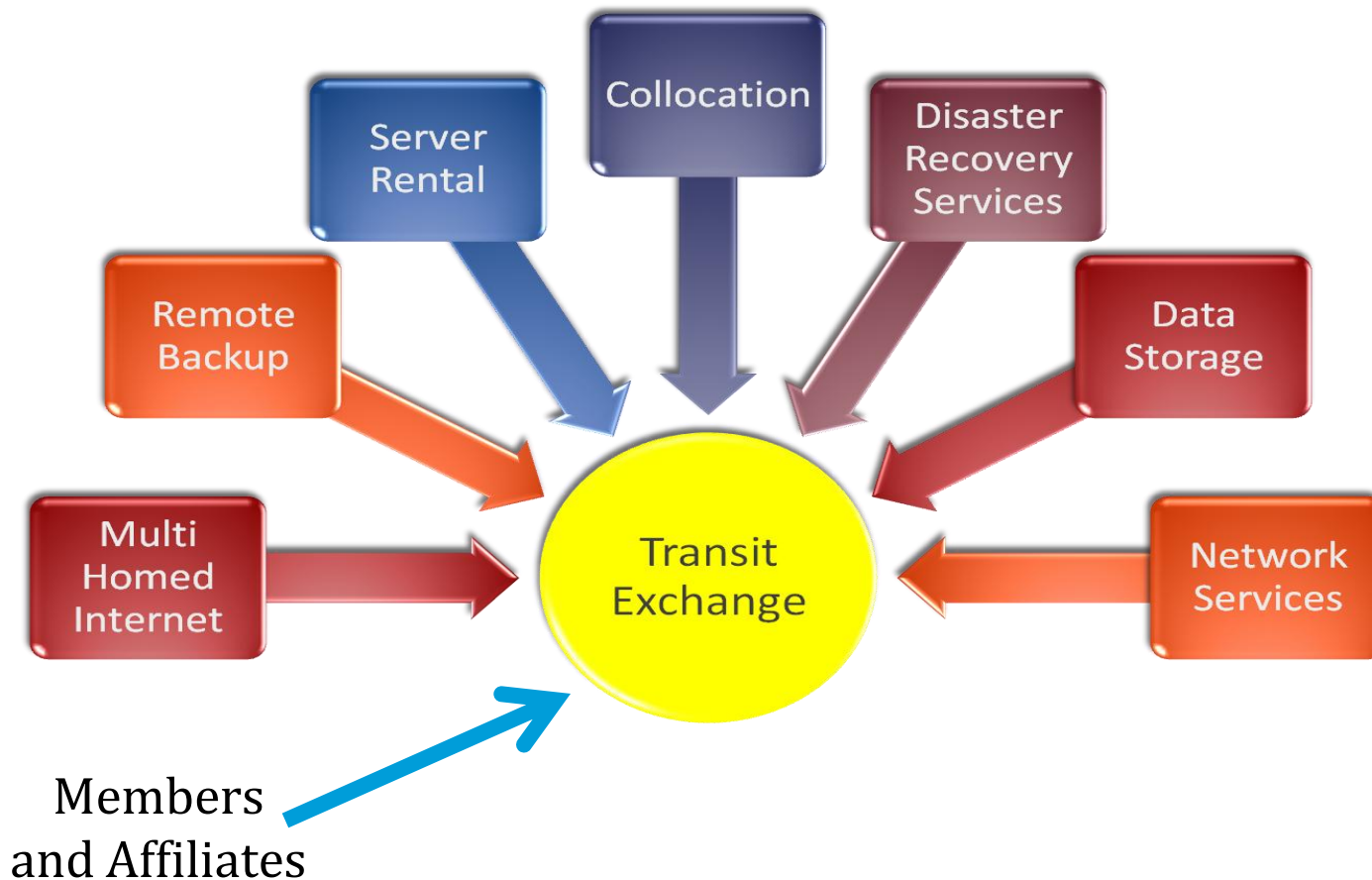
# Network Capability

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- Acquire services from multiple ISPs
- Redundancy (multi-homing)
- Peering
- Dedicated connections

## Capabilities of the Transit Exchange >>>



# Connections at the Vancouver Transit Exchange



## MEMBERS

### Simon Fraser University:

- Harbour Centre Campus
- Burnaby Mountain Campus
- Surrey Campus

### University of British Columbia:

- Point Grey Campus
- Robson Square Campus
- UBC at Vancouver General Hospital
- UBC at St. Paul's Hospital
- UBC at BC Children's Hospital
- UBC Medical Program
- Video Conference Bridge

### British Columbia Institute of Technology:

- Burnaby Campus
- Marine Campus
- Downtown Campus
- Aerospace & Technology Campus

### University of Victoria:

- Project Venus Iona Node

### Emily Carr University of Art & Design

- Great Northern Way Campus

### Fairleigh Dickinson University

### BC Cancer Agency

- BC Cancer Research Centre
- Canadian Space Agency
- CBC Radio

### Inter Tribal Health Authority

- Genome Sciences Centre

### Government of British Columbia:

- Provincial Learning Network

### Government of Canada:

- Department of Fisheries and Ocean:
- Regional Headquarters Data Unit
- National Research Council:

- Institute for Fuel Cell Innovation

### Provincial Health Services Authority:

- BC Children's Hospital

### Statistics Canada:

- SFU Node
- UBC Node

### TRIUMF

# Connections at the Vancouver Transit Exchange



AFFILIATES	ISPs
<p>Affiliates</p> <ul style="list-style-type: none"> <li>Akamai</li> <li>Chancery Software Ltd.</li> <li>Cipherkey Exchange</li> <li>Communications Research Centre Canada</li> <li>HGTN.net (Hosted Ventures Corp.)</li> <li>Novus Entertainment</li> <li>Payment Processing Inc.</li> <li>Pearson Inc.</li> <li>Prolan Network Services Inc.</li> <li>TeraGo Networks</li> <li>Thinktel Communications</li> <li>Trail Networks</li> <li>Vancouver Foundation</li> <li>VeriSign</li> </ul>	

# Connections at the Provincial Transit Exchanges



## VICTORIA

### Members:

University of Victoria:

Victoria Campus

Project VENUS

Vancouver Island Technology Park

Genome B.C. Proteomics Centre

Royal Roads University

Environment Canada:

Canadian Centre for Climate Modeling & Analysis

National Water Research Institute

Government of British Columbia:

Provincial Learning Network

Government of Canada:

National Research Council:

Herzberg Institute of Astrophysics

Department of Fisheries and Oceans:

Institute of Ocean Sciences, Sidney

Pacific Biological Station, Nanaimo

Statistics Canada:

UVIC Node

Vancouver Island Health Authority:

Royal Jubilee Hospital

### Internet Service Providers:

Bell

Shaw

RackForce Networks

Telus

### Affiliates:

City of Victoria

Cube Global Storage

Spinnaker Systems

The University Presidents' Council

Victoria Conference Centre

# Connections at the Provincial Transit Exchanges



PRINCE GEORGE	KAMLOOPS
<p><b>Core Members:</b>            British Columbia Institute of Technology:                Sonography Program            University of Northern British Columbia:                Prince George Campus</p> <p><b>Research Organization Members:</b>            Government of British Columbia:                Provincial Learning Network            Northern Health:                Prince George Regional Hospital</p> <p><b>Internet Service Providers:</b>            Bell            Shaw            RackForce Networks            Telus</p> <p><b>Affiliates:</b>            ABC Communications            Prince George Public Library</p>	<p><b>Core Members:</b>            Thompson Rivers University:                Kamloops Campus</p> <p><b>Research Organization Members:</b>            Government of British Columbia:                Provincial Learning Network            Interior Health:                Royal Inland Hospital</p> <p><b>Internet Service Providers:</b>            Bell            Shaw            RackForce Networks            Telus</p> <p><b>Affiliates:</b>            City of Kamloops            On Call Internet Services            Welcome Back Clinic</p>

# Connections at the Provincial Transit Exchanges



## KELOWNA

**Core Members:**

University of British Columbia:  
  UBC Okanagan Campus  
British Columbia Institute of Technology:  
  Kelowna Aerospace Technology Campus

**Higher Education Members:**

Okanagan College:  
  Kelowna Campus  
  Landmark Centre  
  Penno Road Campus

**Research Organization Members:**

Government of British Columbia:  
  Provincial Learning Network  
Government of Canada:  
  National Research Council:  
    Dominion Radio Astrophysical Observatory  
Interior Health:  
  Kelowna General Hospital

**Internet Service Providers:**

Bell  
Shaw  
RackForce Networks  
Telus

**Affiliates:**

Dargal Interline Worldwide

# Easy Network Management



- TX model enable virtual network operators
  - For easy customer management
  - Acts like a virtual co-location
- Can purchase and integrate per customer
  - Local loop
  - TX cross connect
  - Virtual router
  - Upstream transit
  - Local peering

## How to Connect



- Dedicated fibre to one of five TX facilities
  - Vancouver (Harbour Centre)
  - Victoria (downtown)
  - Kelowna (Landmark Centre)
  - Kamloops (City Hall)
  - Prince George (City Hall)
- VLAN ethernet services from provider
- Ethernet switch and BGP-capable router

## Costs

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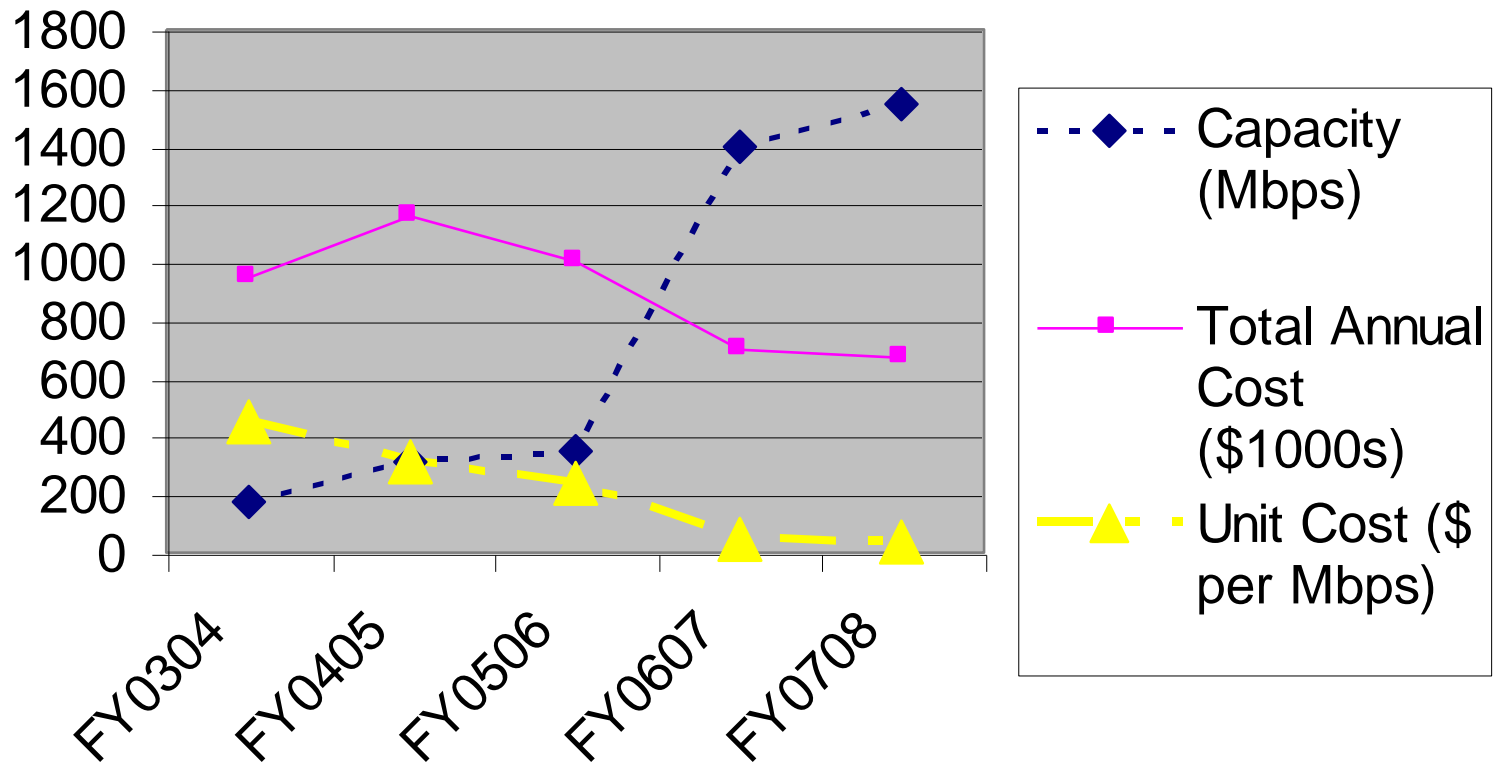


- Local circuit costs
- TX fees, 100 Mgbps or 1 Gbps service
- Internet Service Provider Fees

# TXs and Transit Costs



## Transit Cost and Capacity Trends



## Closing Thoughts

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- New networks need new ways of thinking about infrastructure
- Open access fibre and transit exchanges are key components for next generation networks
- Need to preserve competitive landscape



# BCNET

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