BCNET

Shared IT Services for Higher Education & Research

Conference 2018

BCNET Network Services

A Technical Dive into BCNET's Network Services

Agenda

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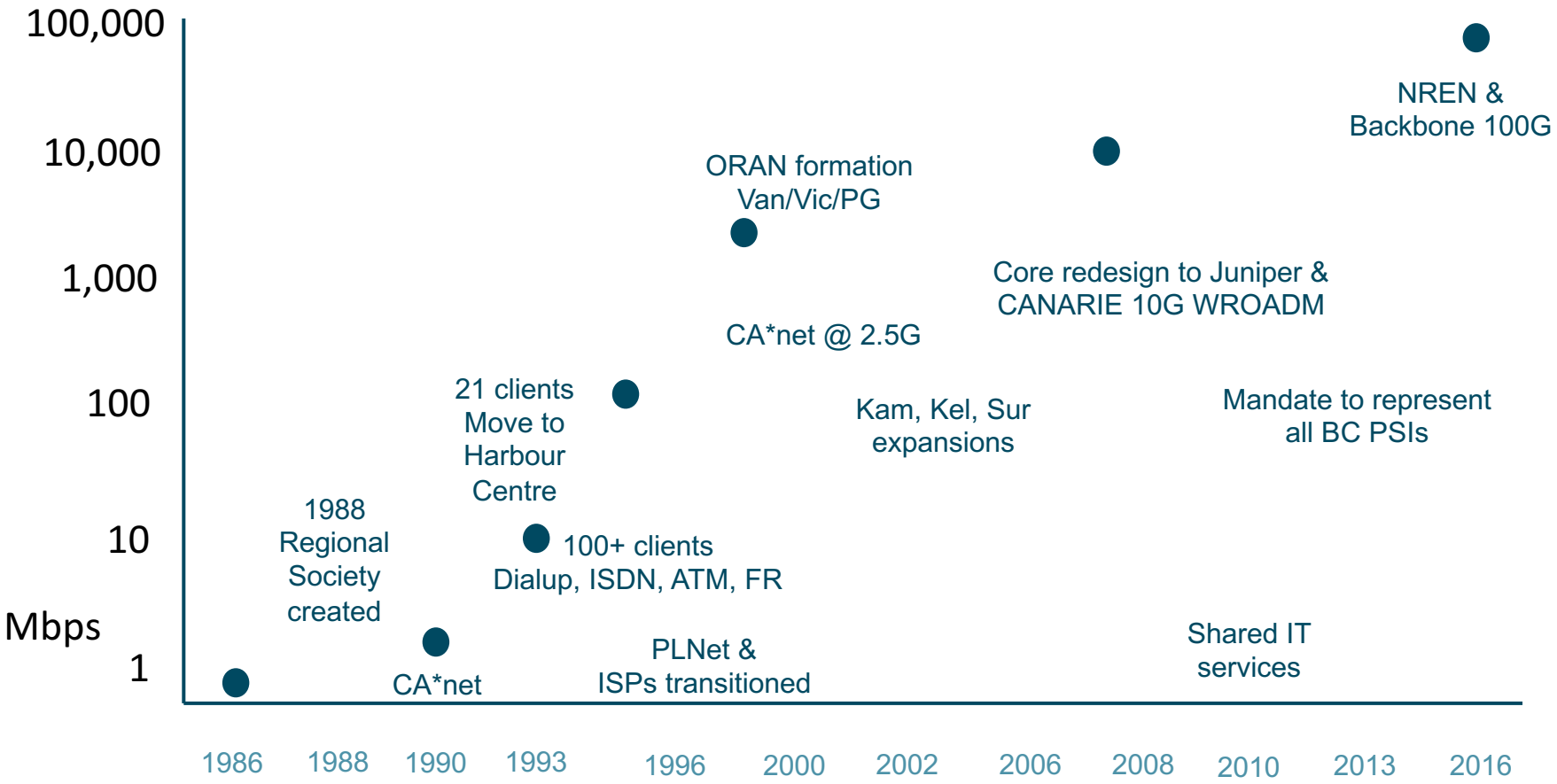
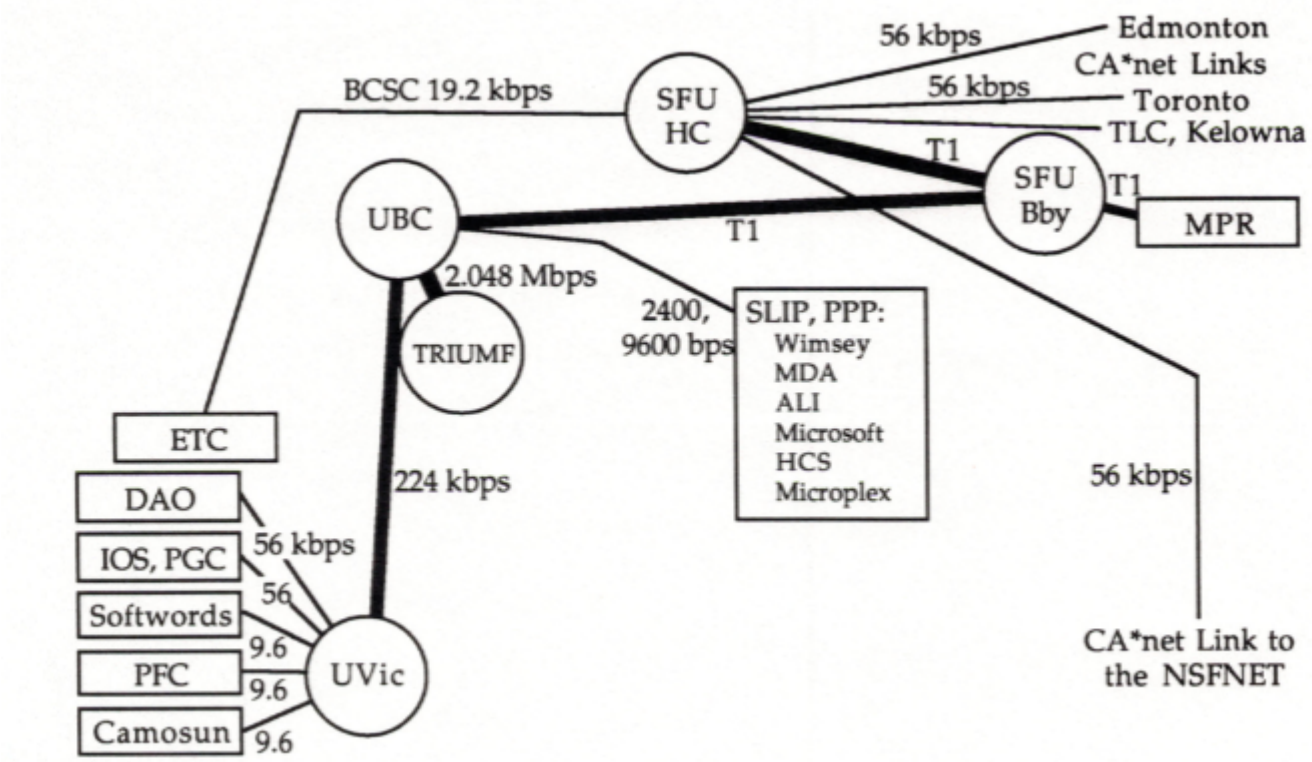
1. BCNET Then
2. Network Now
3. Service Layers
4. Support

BCNET Network Growth



1986: 3 Research Universities
56Kbps + 1.5Mbps

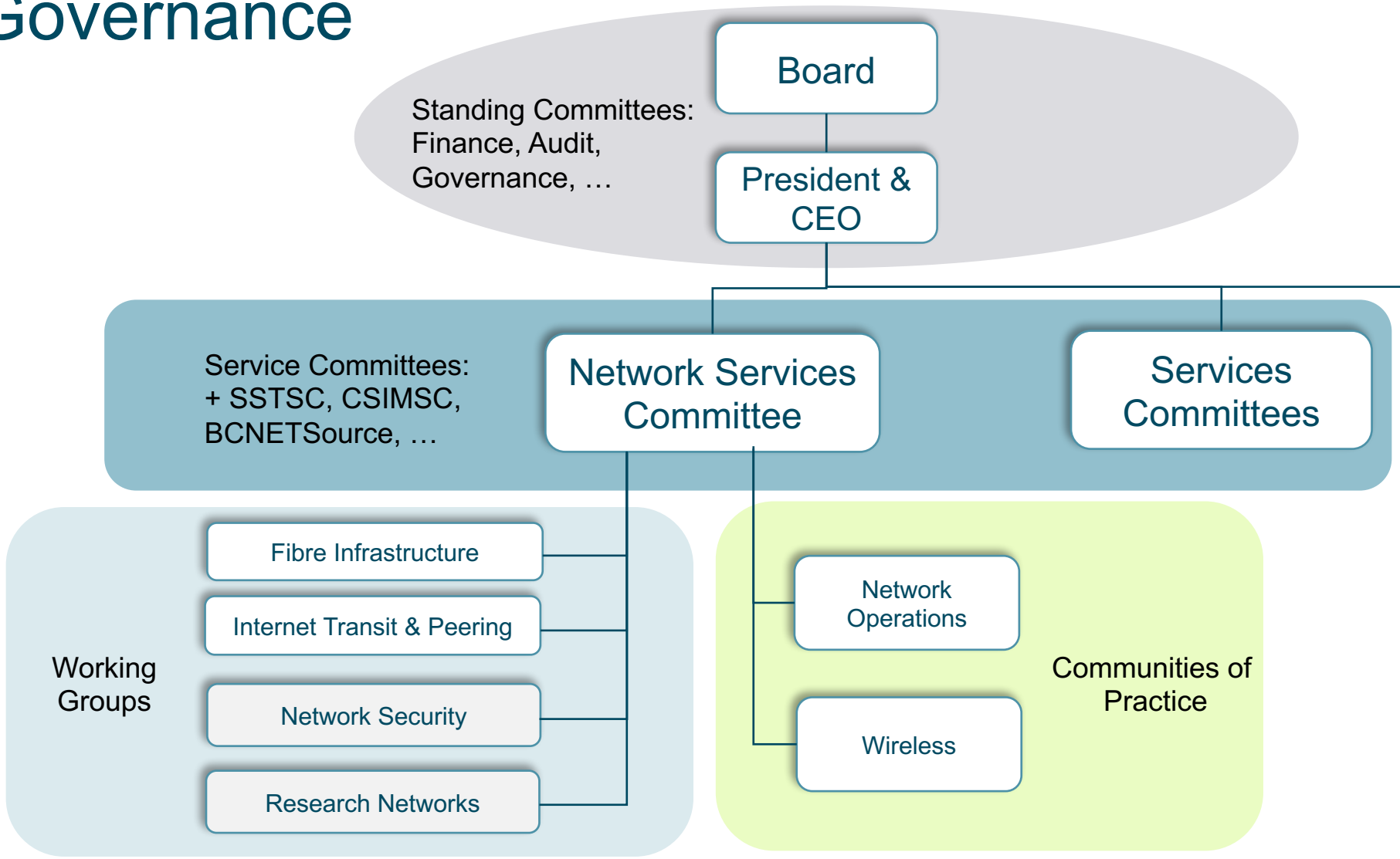
BCNET Network 1991



Vision

We will deliver, operate and advance network infrastructure to support education, research and innovation in British Columbia.

Governance


Board
Standing Committees:
Finance, Audit,
Governance, …
President &
CEO
Service Committees:
+ SSTSC, CSIMSC,
BCNETSource, …
Network Services
Committee
Services
Committees
Working
Groups
Fibre Infrastructure
Internet Transit & Peering
Network Security
Research Networks
Network
Operations
Wireless
Communities of
Practice

Exchange Infrastructure

- University, College, and Institute
- City and Municipality
- Provincial government

Metro Networks

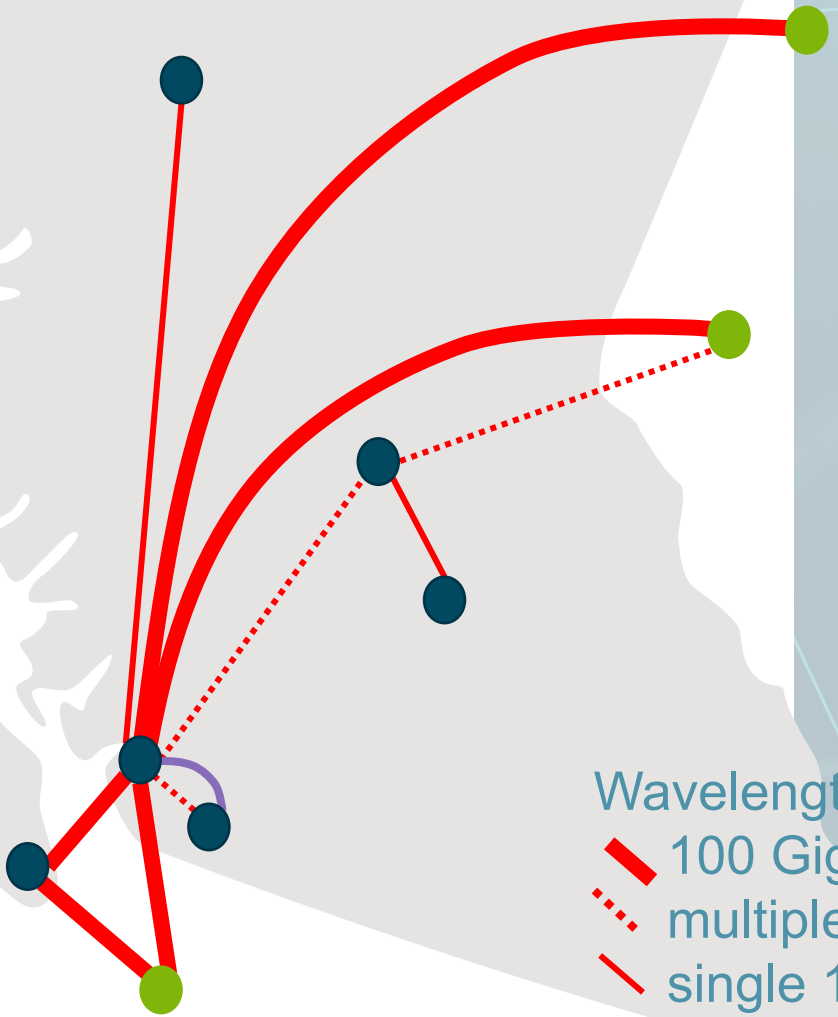
Fibre strand network in each Exchange metro area

Total fibre asset = 9,980 Fibre Kilometers

includes WAN and member connections

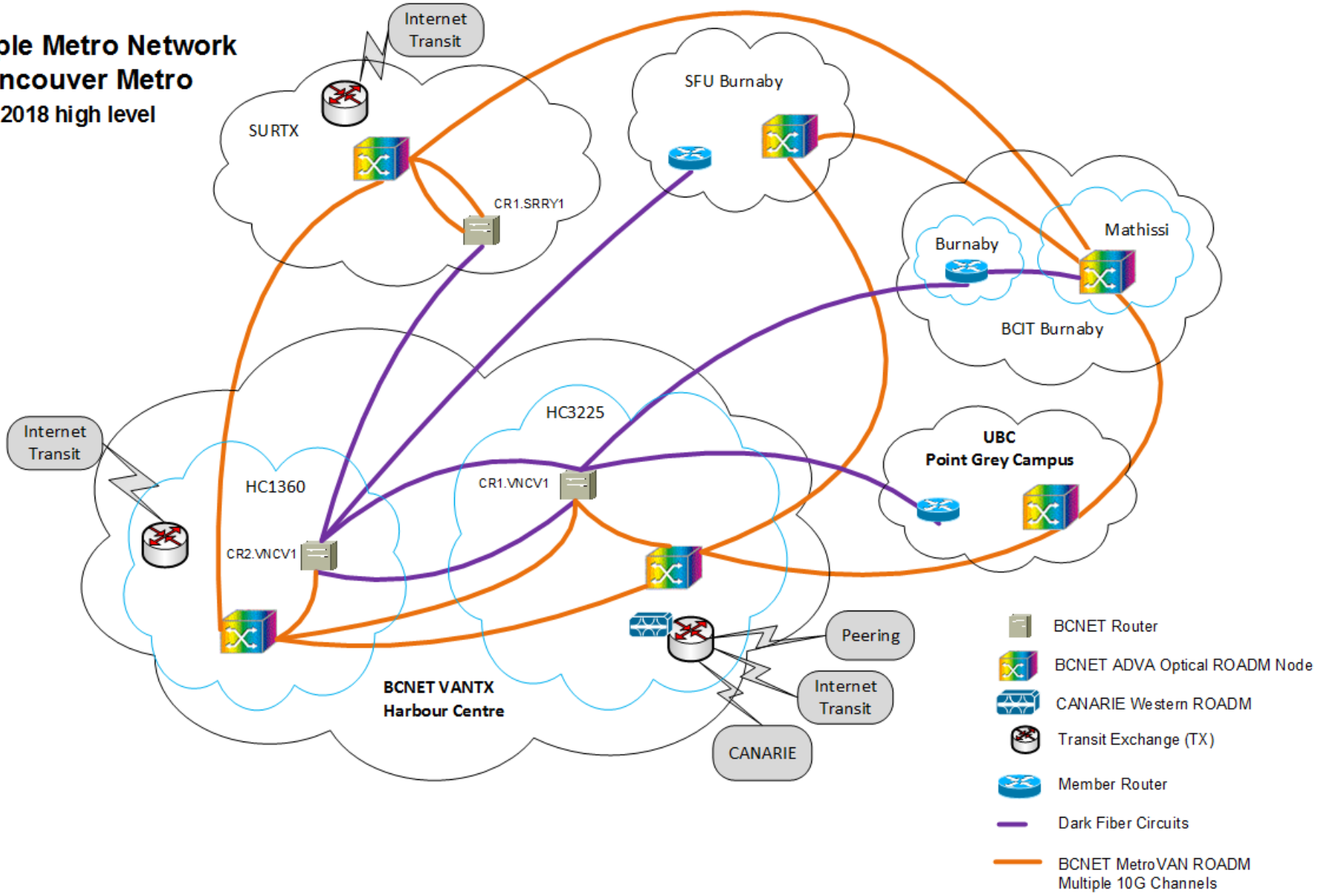
- KAMTX — 307 FKm
  - KCN: Kamloops Community Network
- KELTX — 280 FKm
  - City of Kelowna
  - 3rd party supplier
- PGTX — 30 FKm
  - City of Prince George
- Vancouver — 3,400 FKm
  - SURTX and VANTX
  - 3rd party suppliers
- VICTX — 2,700 FKm
  - 3rd party suppliers

Inter-Exchange Infrastructure

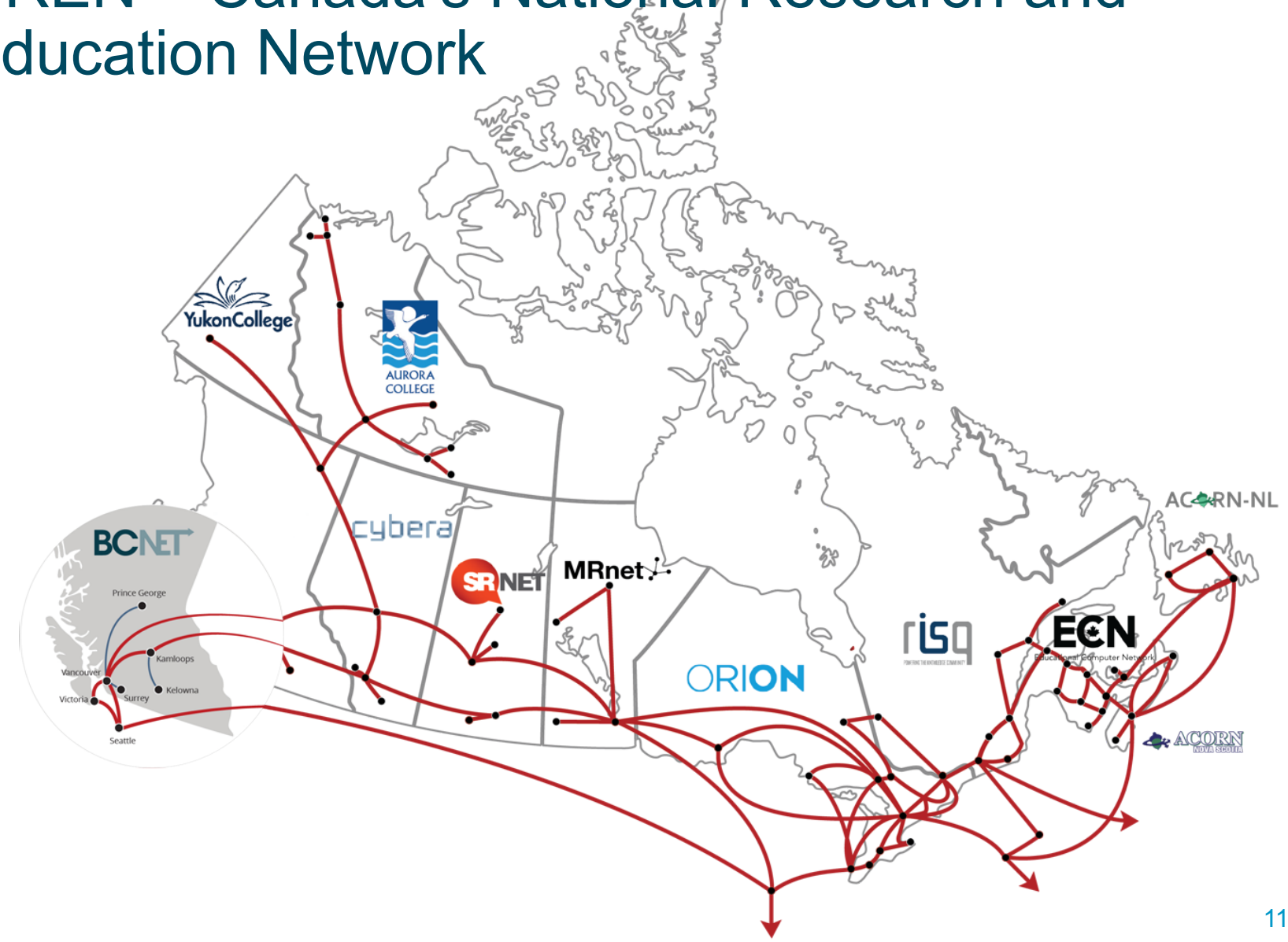


- CANARIE partner
  - co-manage and operate
- 3rd party suppliers
- Long term contracts
  - Wavelengths
  - Dark Fibre Strands
- Ciena optical transport

Example Metro Network
Vancouver Metro
2018 high level

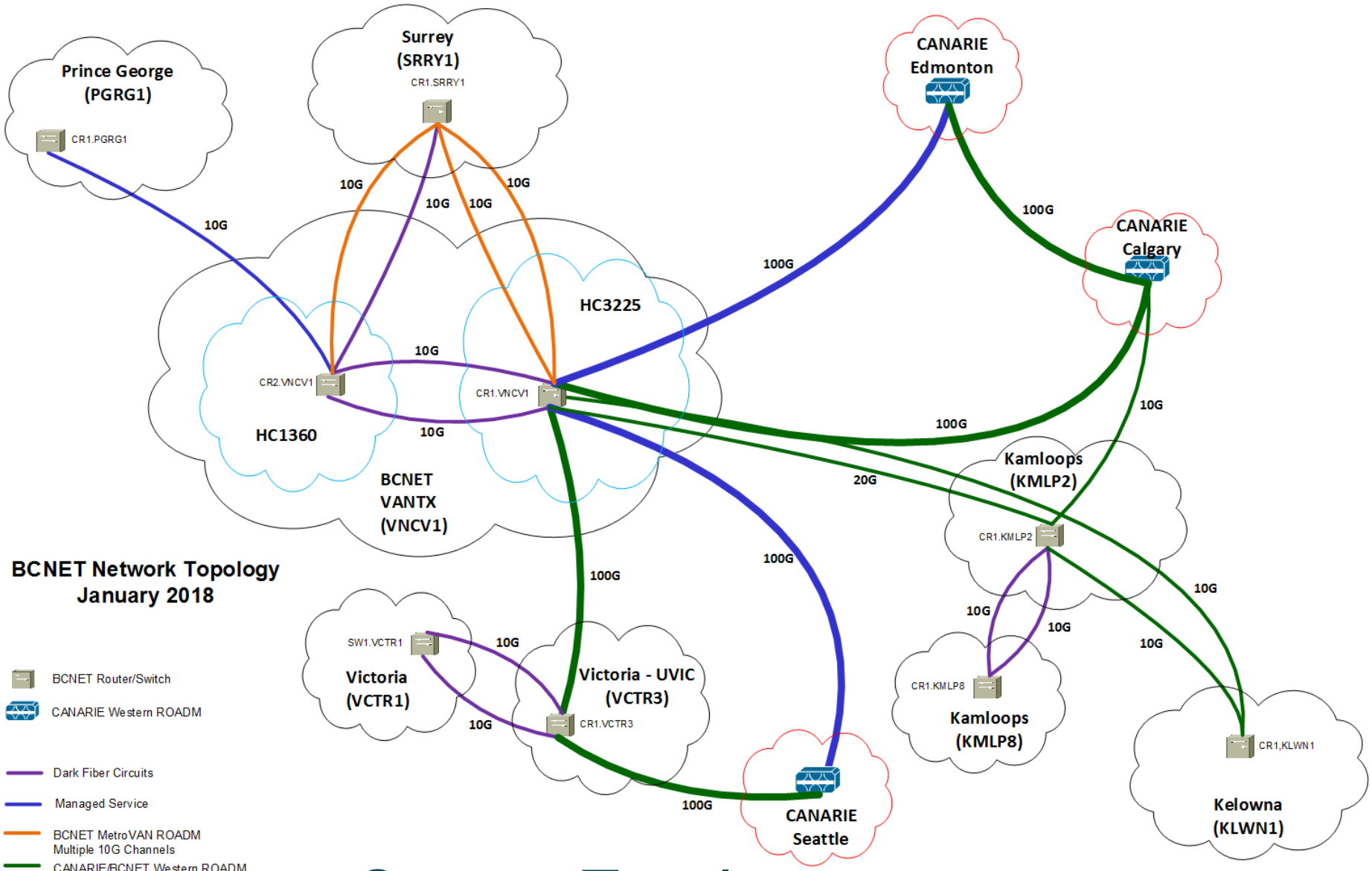


NREN – Canada's National Research and Education Network

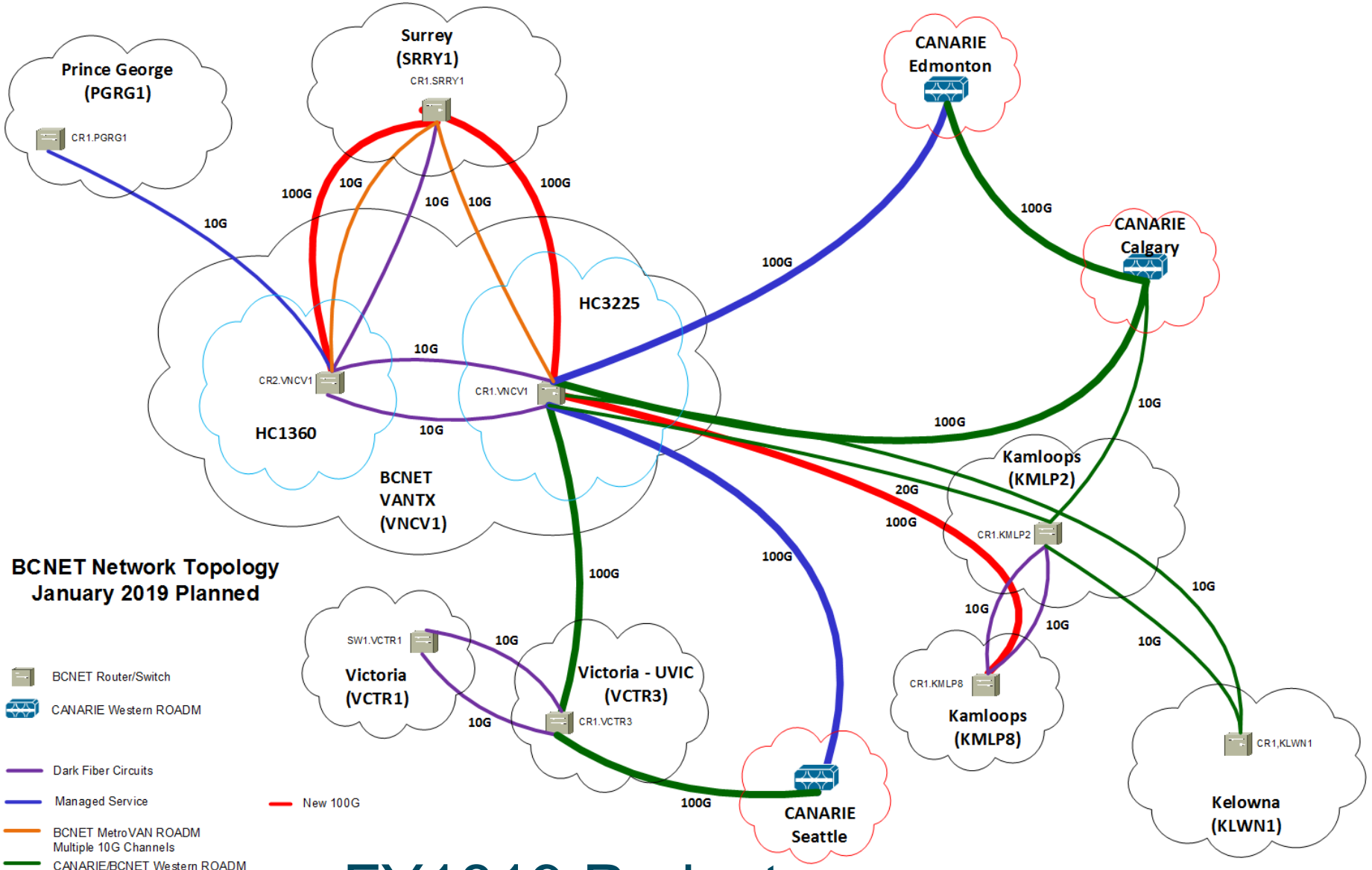


Core Network Architecture - Routing

- 3 categories of upstream connectivity
  Provisioned through Routing Instances
  1. **Internet Transit** – TX
  2. **Peering** – IX
     Local, Caches, BGP communities for tagging
  3. **Advanced Research Network** – ORAN backbone
     Jumbo frames
- Exchange routers in full IBGP mesh peering
- ISIS and MPLS with LDP across the core
- Full IPv4 and IPv6
- All services at all Exchanges

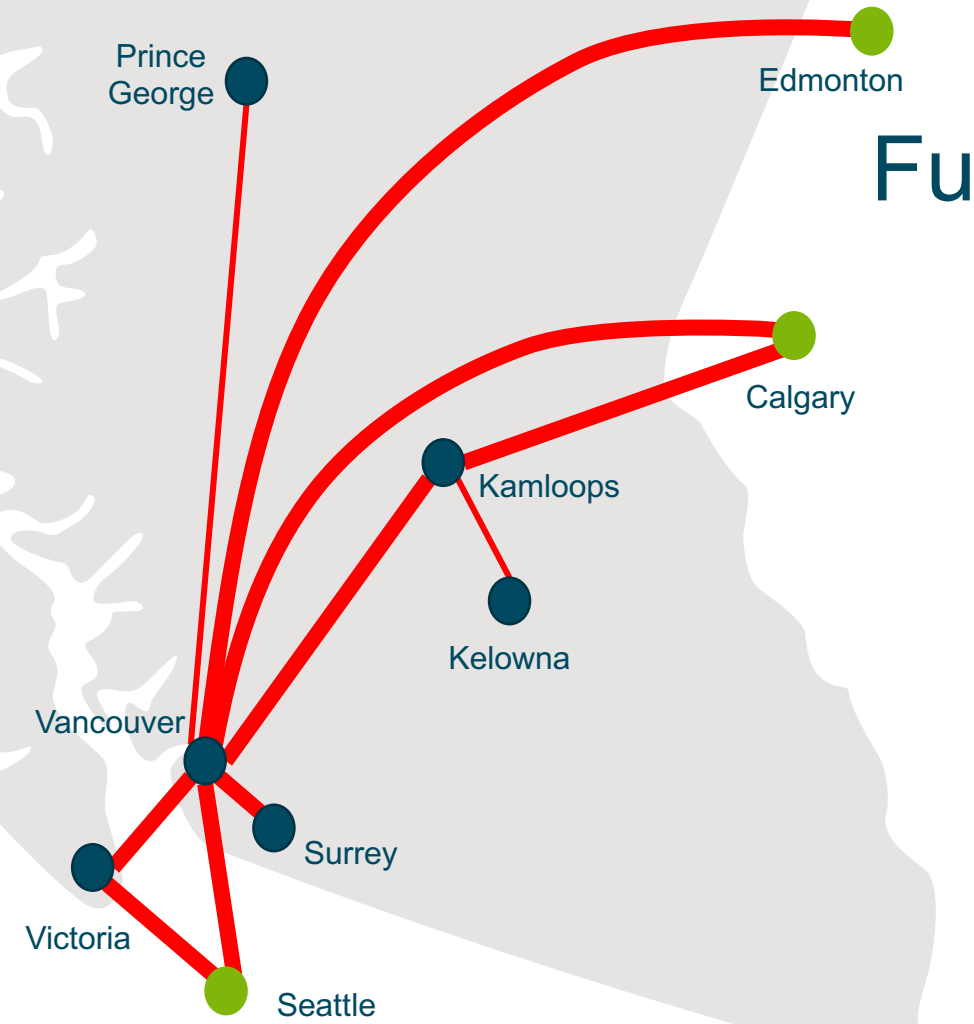


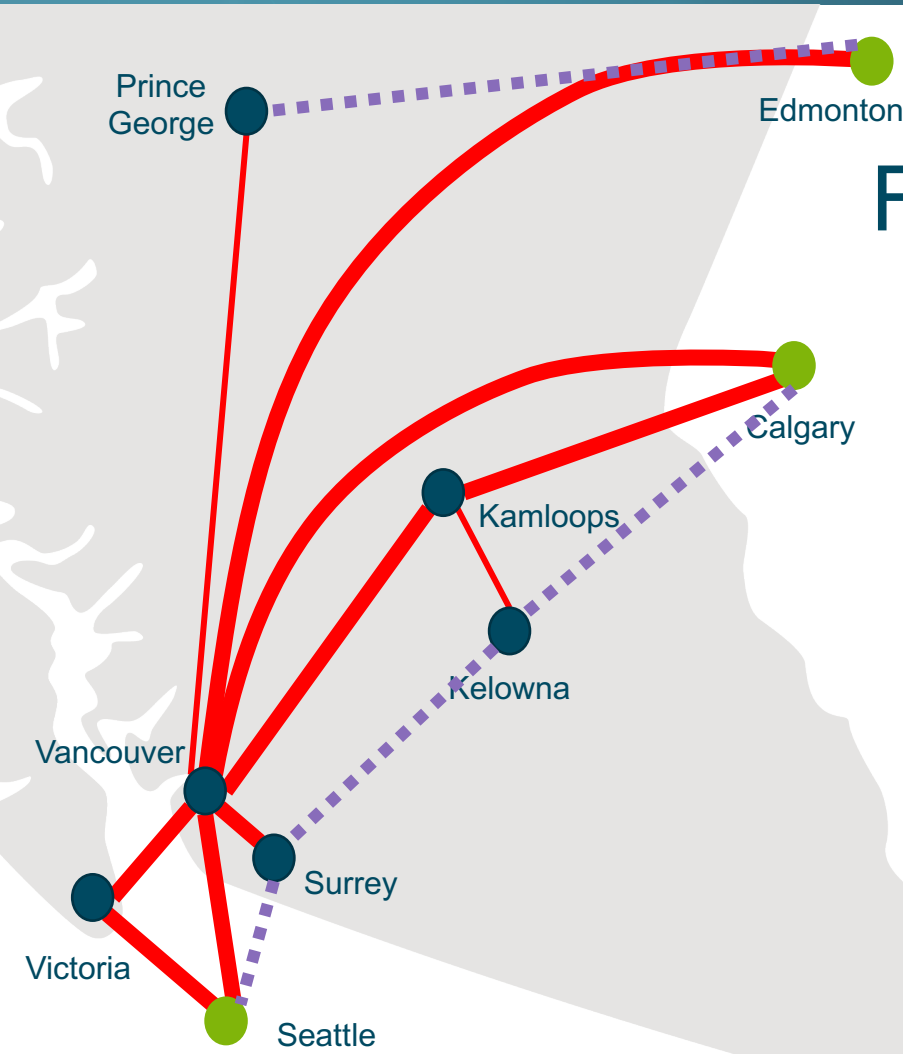
Current Topology



FY1819 Projects

Future Architectural Plans





Future Architectural Plans

- Full MPLS core
  Requires alternate paths
- Review routing platform
- Options for member multiple diverse connections

Research Networks Working Group

Network Services Catalogue

Physical Access

- Fibre Connection
- Fibre Cross Connect
- Point to Point Ethernet

Layered Services

- Advanced Network
- Internet Transit
- Transit Exchange
- Virtual Router

Core Services

Member Fibre Connections

Vancouver area : 2000

Victoria : 2000

Prince George : 2001

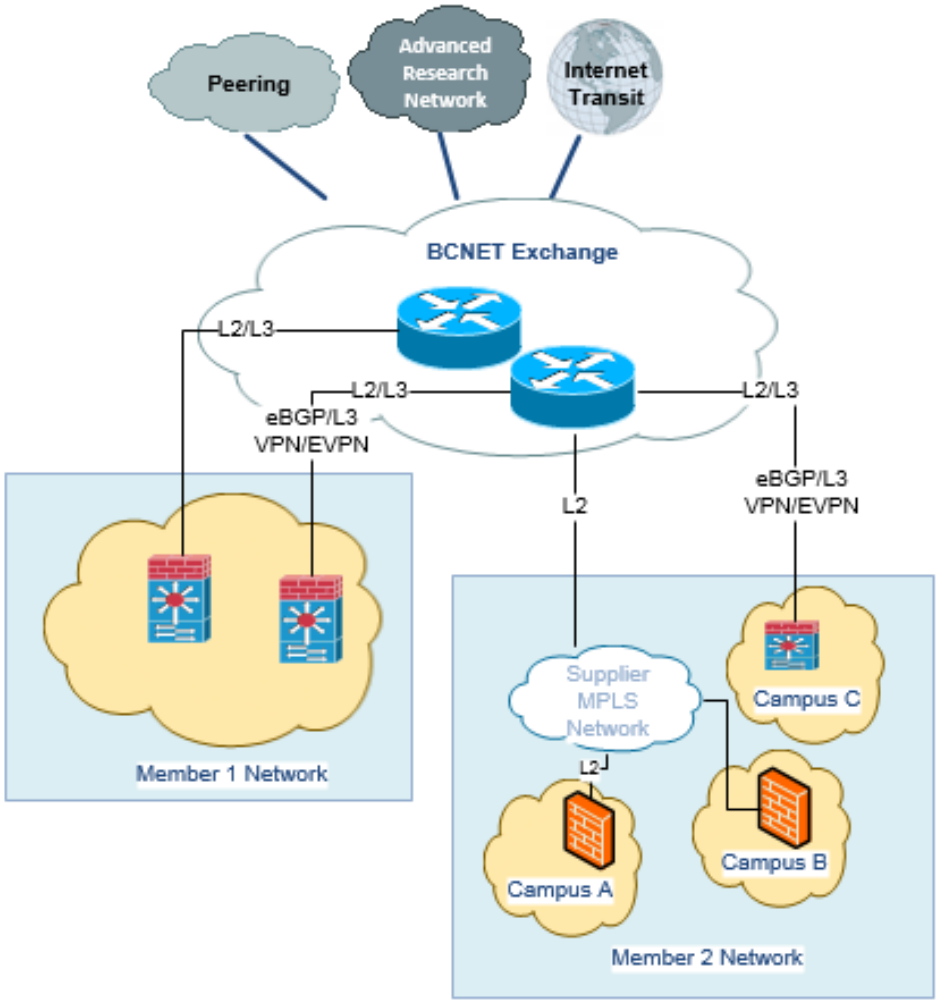
Kamloops and Kelowna : 2005

14 Institutions

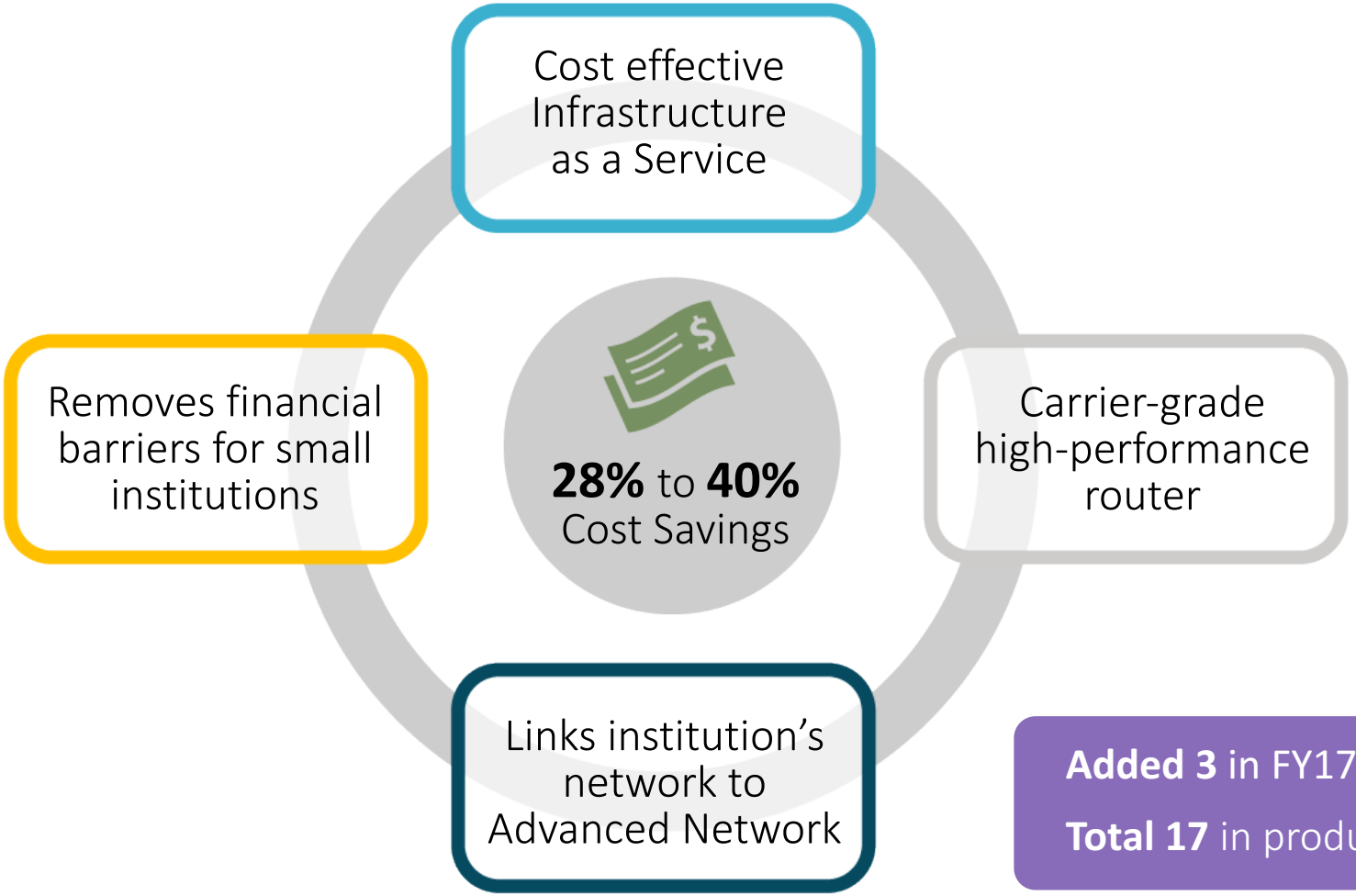
Total fibre asset = 9,980 Fibre Kilometers

Member Ethernet Connections

- 3rd party supplier connections
- 10 M – 1 G – 10 G – 100 G
- L2
  - Point-to-point
  - Point-to-multipoint
  - VLAN delivery
  - MTU frame sizes
- L3 as well
- 3 virtual instances transit, peering, research

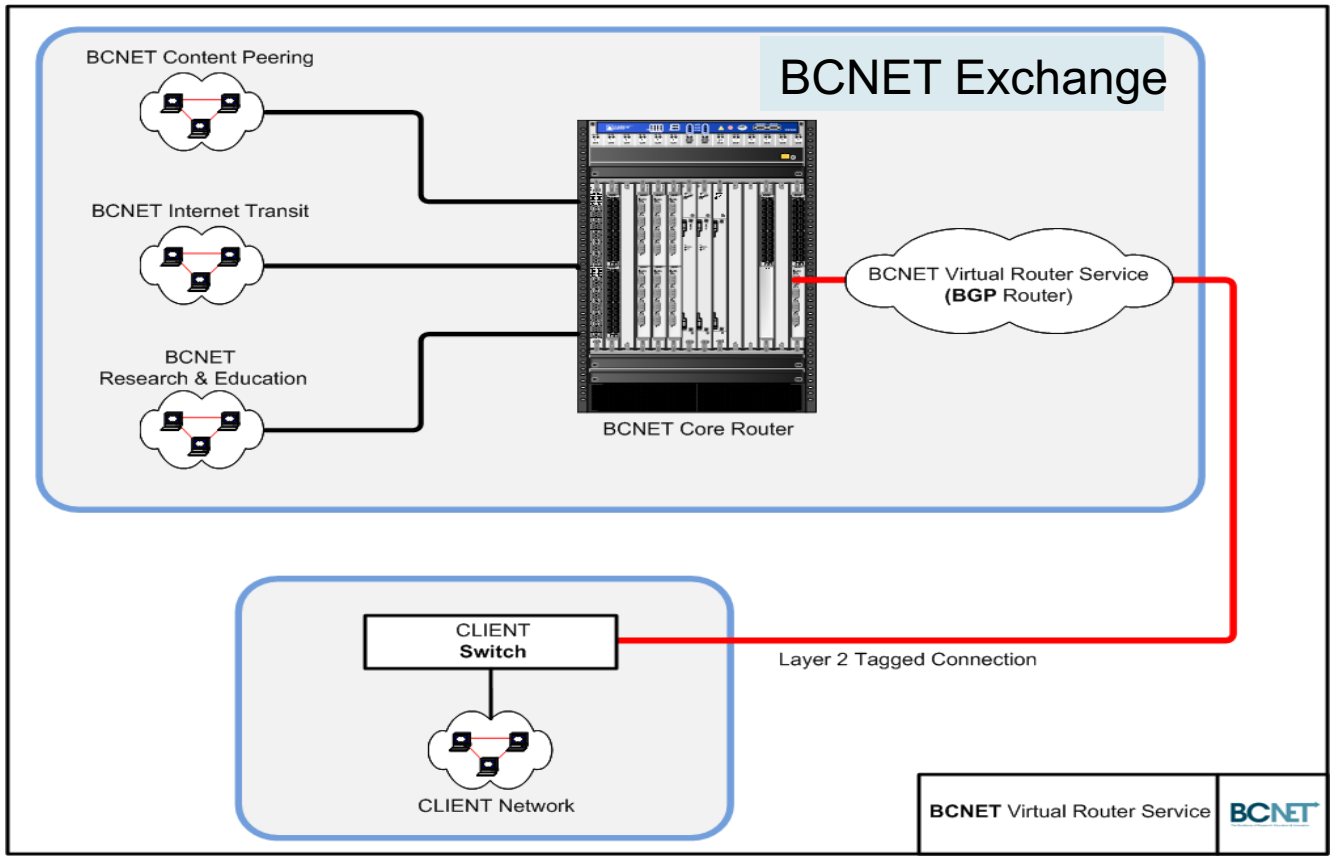


Virtual Router Service



Added 3 in FY1718

Total 17 in production



Virtual Router Setup

- Based on Juniper MX platform
- Supports OSPF, BGP, ASNs
- Local accounts
- Rancid maintained backups

Network Security

- Best Current Practices
  - Filtering
- DDoS Mitigations
  - CIRA D-Zone Anycast
  - Nessus Vulnerability Scanning
  - RTBH – to be developed

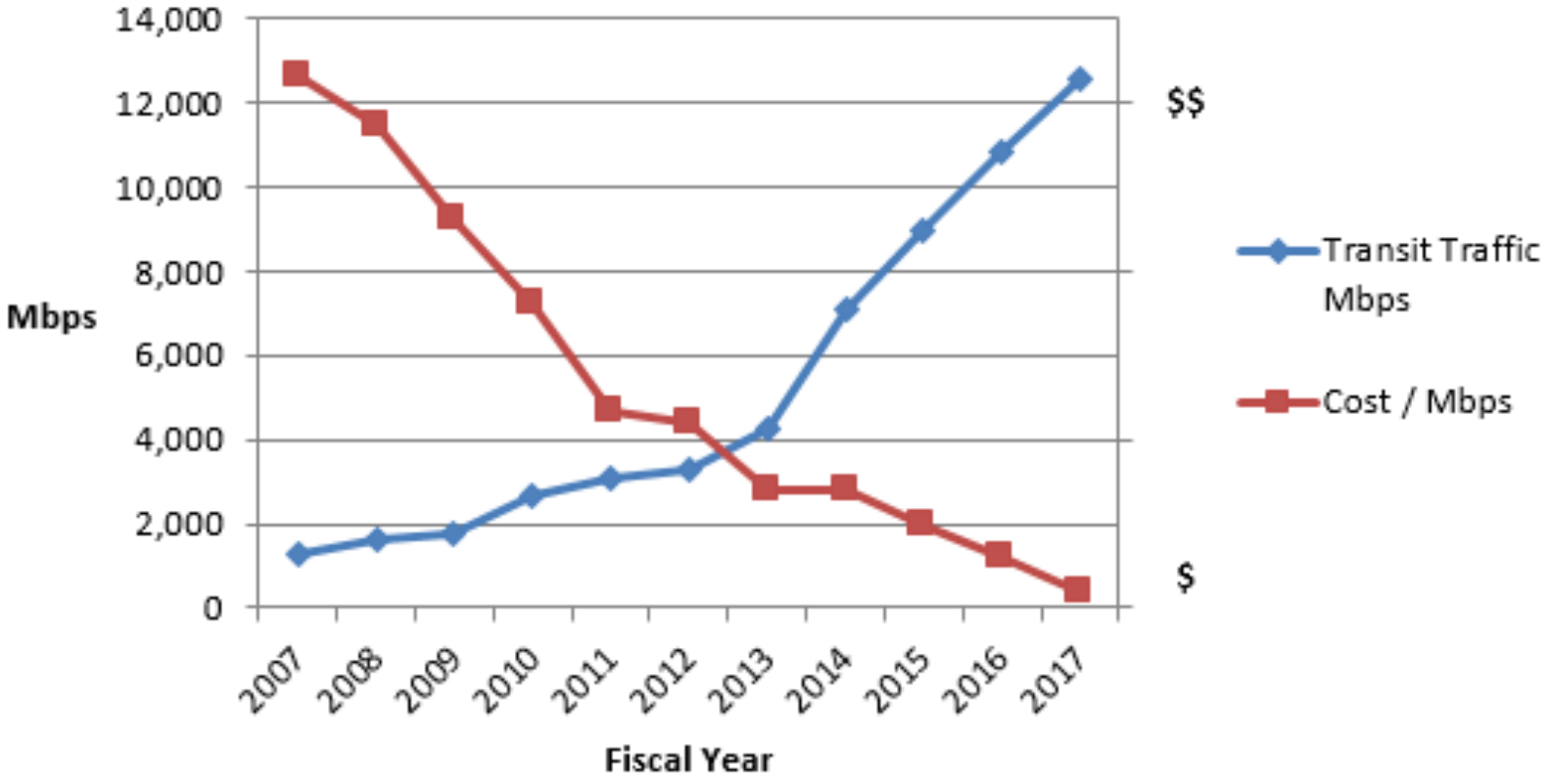
Network Security Working Group

Internet Transit Service

- Aggregate purchase for all members
- Lower total cost
- Traffic optimization
- Available at each Exchange
- IPv4 and IPv6
- Exchange to Exchange failover
  - GRE tunnels
  - increased resiliency

100% Availability

Internet Transit Traffic



- RFPs for suppliers
- Cost continues to drop

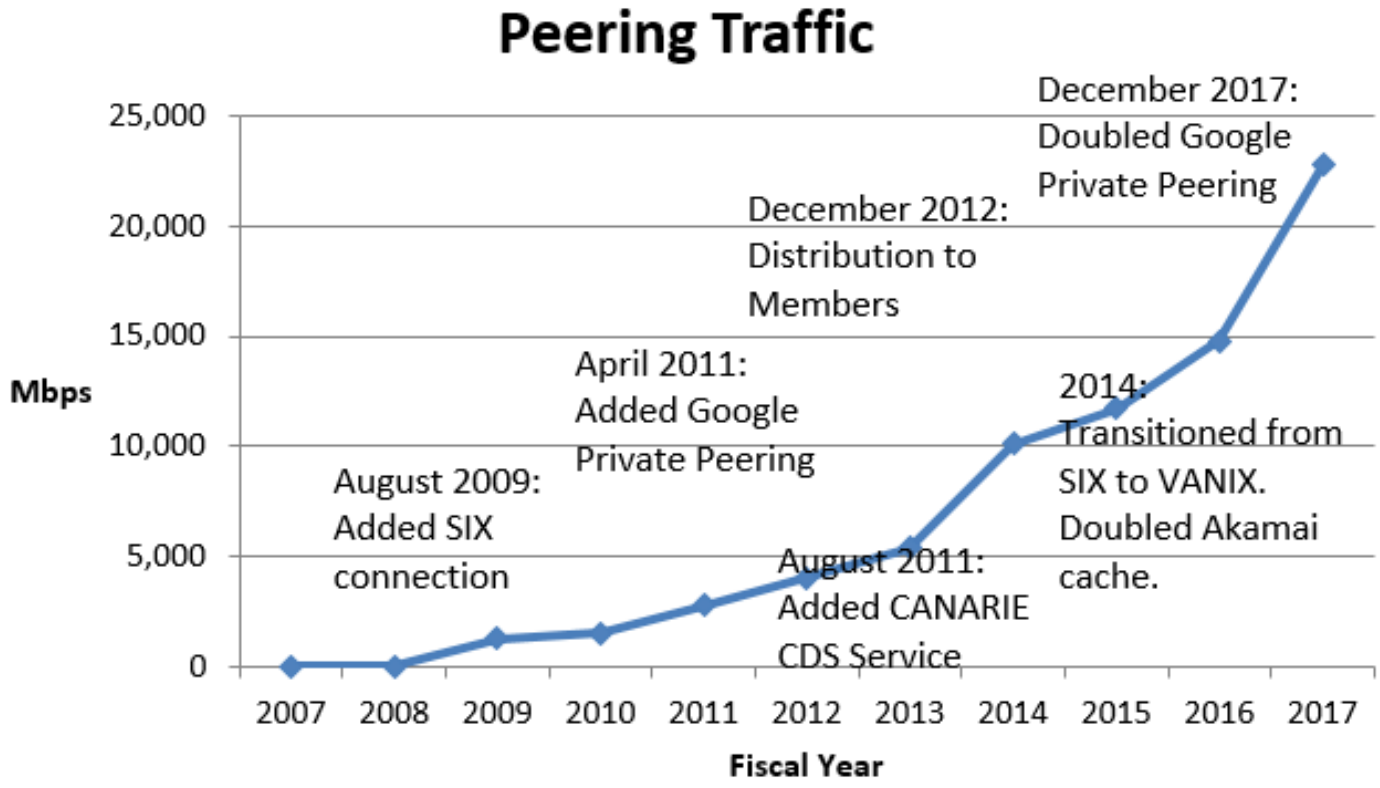
- Traffic doubles every 2 years
- Internet Transit & Peering Working Group

Peering Services

- Distributed across Advanced Network
- BGP Peers
  - CANARIE Content Delivery Service – CDS
    Amazon, Box.net, D2L, FB, MS, Yahoo!, …
  - BCNET Local Exchanges
    Limelight, Novus, …
  - Vancouver Internet Exchange – VANIX
    Cloudflare, OpenDNS, Peer1, …
- Caching Services
  - Nearby servers
  - Akamai, Apple, Google

Bilateral routing agreements = improved user experience

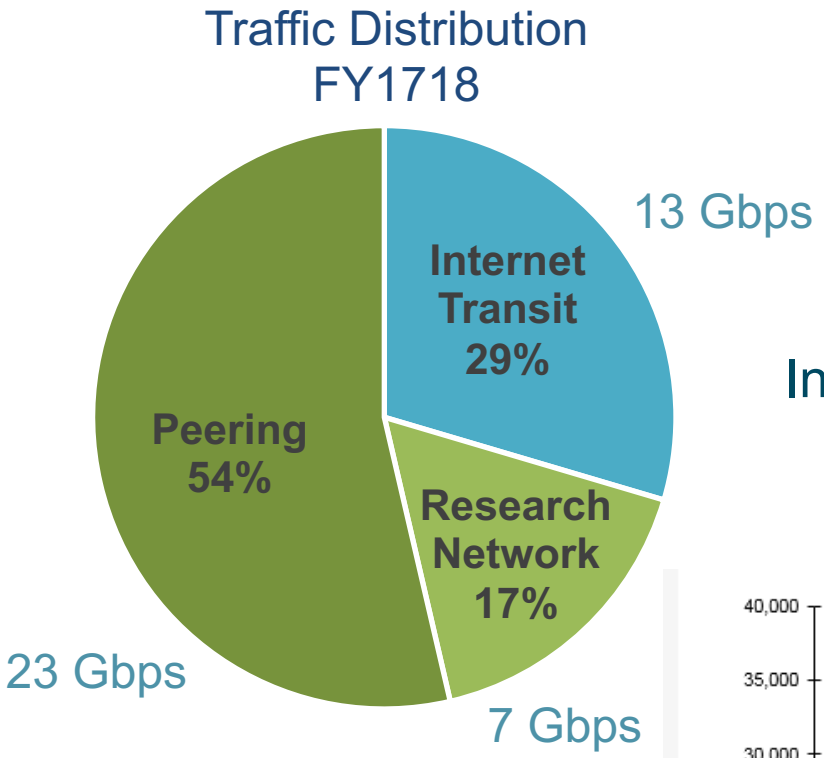
Peering Service Growth



- Akamai first installed 2001
- Apple Caching online in 2018

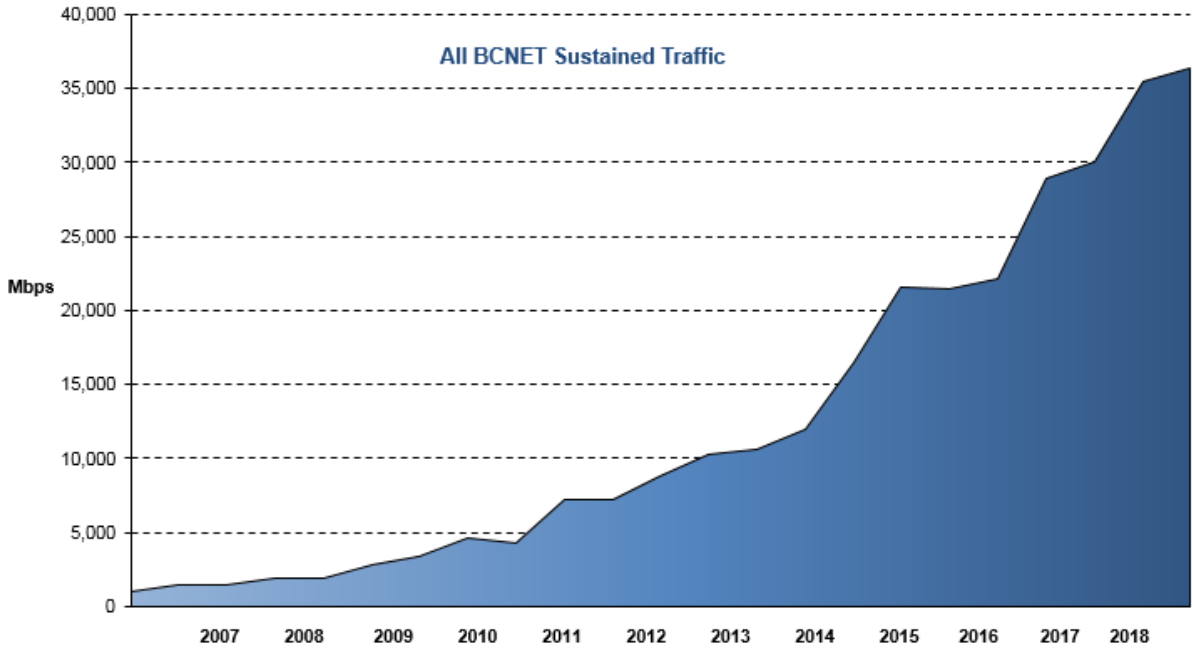
- $1.7M avoided network costs for members over FY1718
- 54% of all traffic is on Peering

Network Traffic

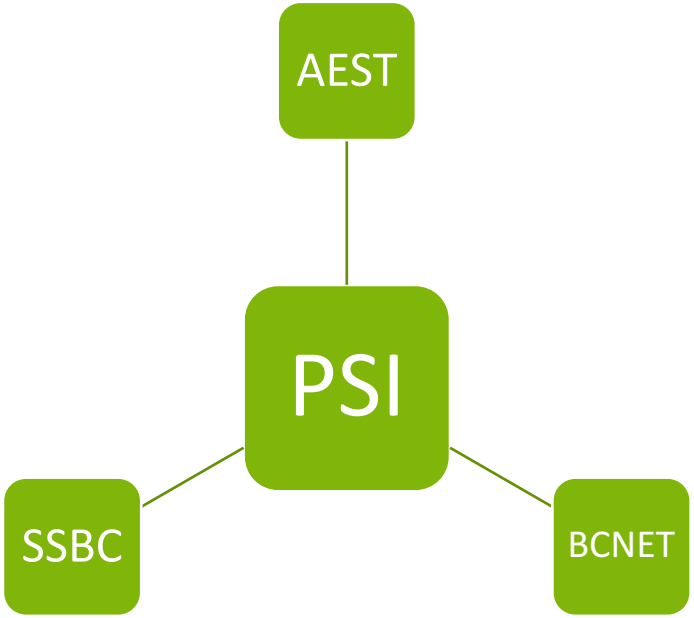


Investment in Research Network + Peering = $2.2 M annual avoided cost for members

Approximate 25% traffic increase per year



PSI Integration Project



Collaboration to allocate funding where required to support rural and remote connectivity

23% under budget

30 Gbps installed – 51% increase from budget

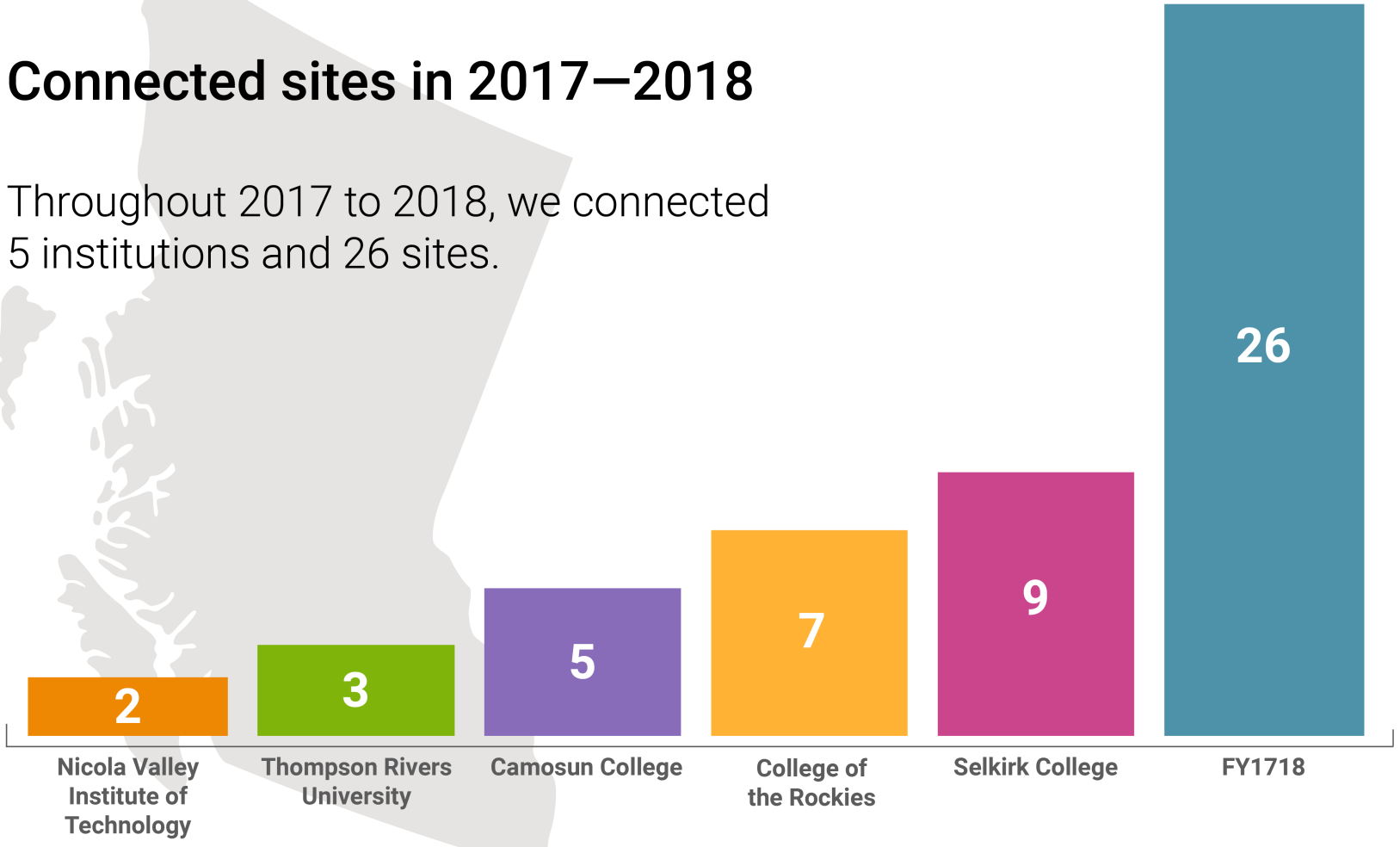
15 institutions in the entire project with ~90 campuses

60% complete to date

PSI Integration Project – FY1718

Connected sites in 2017—2018

Throughout 2017 to 2018, we connected 5 institutions and 26 sites.



PSI Integration Project – April to August

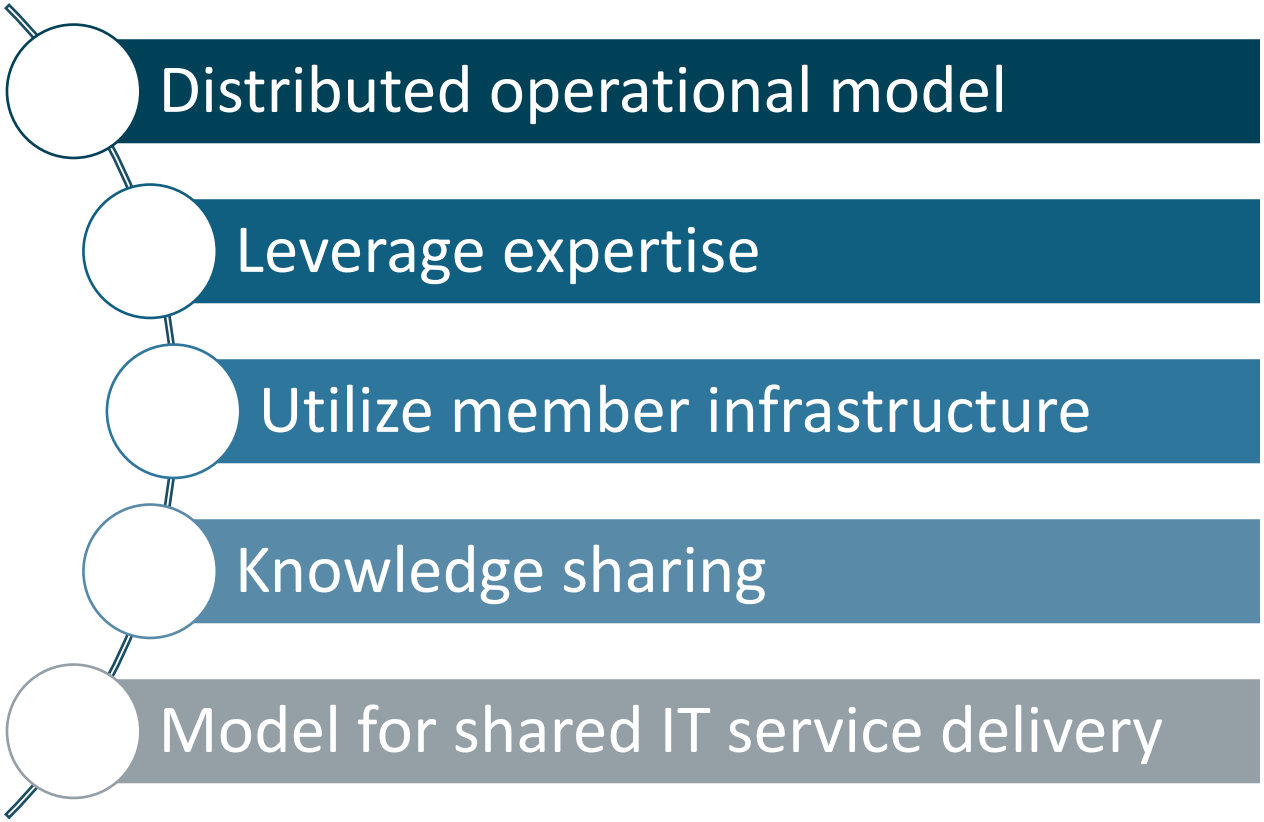
Planned connections in 2018

We plan to connect the remaining 6 institutions and 39 sites by September 2018.

The number of organizations and sites connected to BCNET network have doubled in the last five years

	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18
Network Site Connections	71	85	95	121	143	179
Organisations Connected	13	17	20	23	28	32

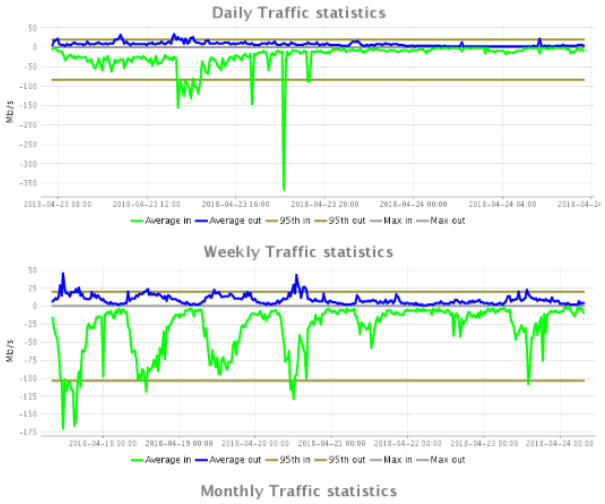
Network Support



98% On 2017 Member Satisfaction Survey

Client Portal

- BCNET
  - Service Bulletins, Network Metrics
  - Policies
- Member Services
  - Network statistics
  - Incident reports
  - EduCloud Server metrics
  - Service agreements



	Current	Maximum	Average	95th percentile
Outbound	*2018-04-24 07:40:* 4.78Mb/s	*2018-04-23 13:15:* 33.35 Mb/s	7.71 Mb/s	19.40 Mb/s
Inbound	*2018-04-24 07:40:* 8.71Mb/s	*2018-04-23 18:10:* 364.63 Mb/s	22.44 Mb/s	84.11 Mb/s

From: 2018-04-23 07:45
To: 2018-04-24 07:40
Average Out: Outbound from the client. I.e Upload to BCNET
Average In: Inbound to the client. I.e Download from BCNET

	Current	Maximum	Average	95th percentile
Outbound	*2018-04-24 07:30:* 4.22Mb/s	*2018-04-17 11:30:* 87.34 Mb/s	8.94 Mb/s	20.42 Mb/s
Inbound	*2018-04-24 07:30:* 9.66Mb/s	*2018-04-23 18:30:* 364.63 Mb/s	30.95 Mb/s	103.52 Mb/s

From: 2018-04-17 08:00
To: 2018-04-24 07:30
Average Out: Outbound from the client. I.e Upload to BCNET
Average In: Inbound to the client. I.e Download from BCNET

Vancouver & Core Staff
- Blake Bridgewater
- Morgan Dapilly
- Pallavi Kapoor
- Don McWilliam
- Oscar Rondon
- Dave Stillwell
- Toby Wong

Victoria - UVic
- Steve Lahey
- Hans Yodzis
- + staff

Operations - UBC
24 x 7
- Rose Chan
- + staff

Prince George - UNBC
- Curtis Bowden

Kamloops - TRU
- David Burkholder

Kelowna - UBC
- Keelin O'Reilly

Surrey - SFU
- Vic Hiebert

Distributed Network Management

Co-operative expert support across the province for each Exchange

Thanks to All!

BCNET Network Services

www.bc.net

www.bc.net/service-catalogue

noc@bc.net

604-822-1348