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HIGHER ED & RESEARCH TECH SUMMIT

# Maintaining Network Availability through Fire, Flood, and Pandemic: Adapting through Crisis

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March 8, 2022

# Warning: Potentially Sensitive Images

- This presentation includes images of the recent floods and fires that BC experienced during 2021.

- We apologize to any members of the audience who may find these images unsettling.

# Terms

- Reconfigurable optical add-drop multiplexer (ROADM)
  - A device that can add, pass, or redirect data-carrying light beams across a pair of fiber cables
- Fiber Cables
  - Cable infrastructure that pass data-carrying light beams across great distances
- Fire & Flood
  - Things that destroy fiber cables that are strung across bridge conduits and utility poles


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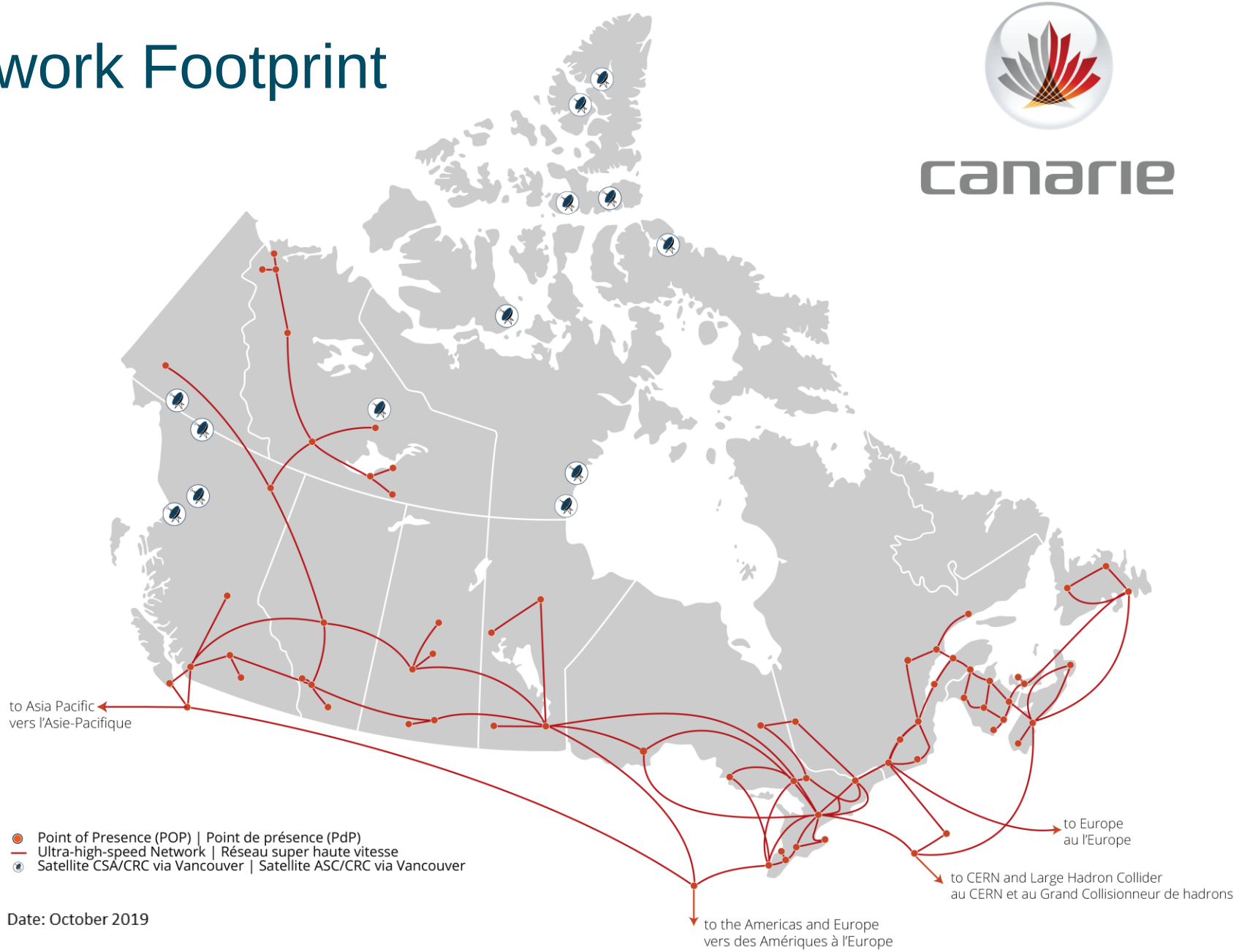
# About the CANARIE Network

# CANARIE Network Footprint



# About the BCNET Network

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# BCNET & CANARIE Networks

# Pandemic Challenges

# Pandemic Challenges

- Pandemic was not normalized yet
- Huge rebuild
  - Everything was remote
  - During that time, we didn’t want to be in the same room with another person
- Huge dependency on the network
  - Critical importance in continuity of service
- First major project for this equipment in Canada

# Pandemic Challenges

- How was escorting / door opening going to work?
- Checkpoints on the highways requiring techs to be prepared
- Vendor tech turned back at the Canadian/US border
- Dave's heroic trip to Kamloops
  - Kelowna was very tentative in its acceptability level
  - Unsure whether that trip could even happen
  - What risks are we asking of him to take?

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# Fire Season

# Wildfires and the Western ROADM Upgrade Project

Installers were taking breaks in trucks with A/C to get out of the heat

Challenges for service providers:

- Area is safe to enter, no active fire risk
- Have service poles in place to attach fiber cable

BC Hydro poles were the first priority.

- Then telecom services were given permission to attach fiber to BC Hydro poles
- Typically, this is not allowed; separate pole structures are installed for telcom infrastructure.

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# Wildfire Timeline: June 3, 2021

## Lumber Mill Fire

- Affected Kamloops to Kelowna
  - Repaired June 5, 2021
  - Outage of 1.75 days

# Wildfire Timeline: June 30, 2021

## Lytton

# Wildfire Timeline: August – October 2021

## White Rock Lake

- August 5, 2021
- Took out 2-3 km of Highway 97

- Repaired October 15, 2021
- Outage of 71 days

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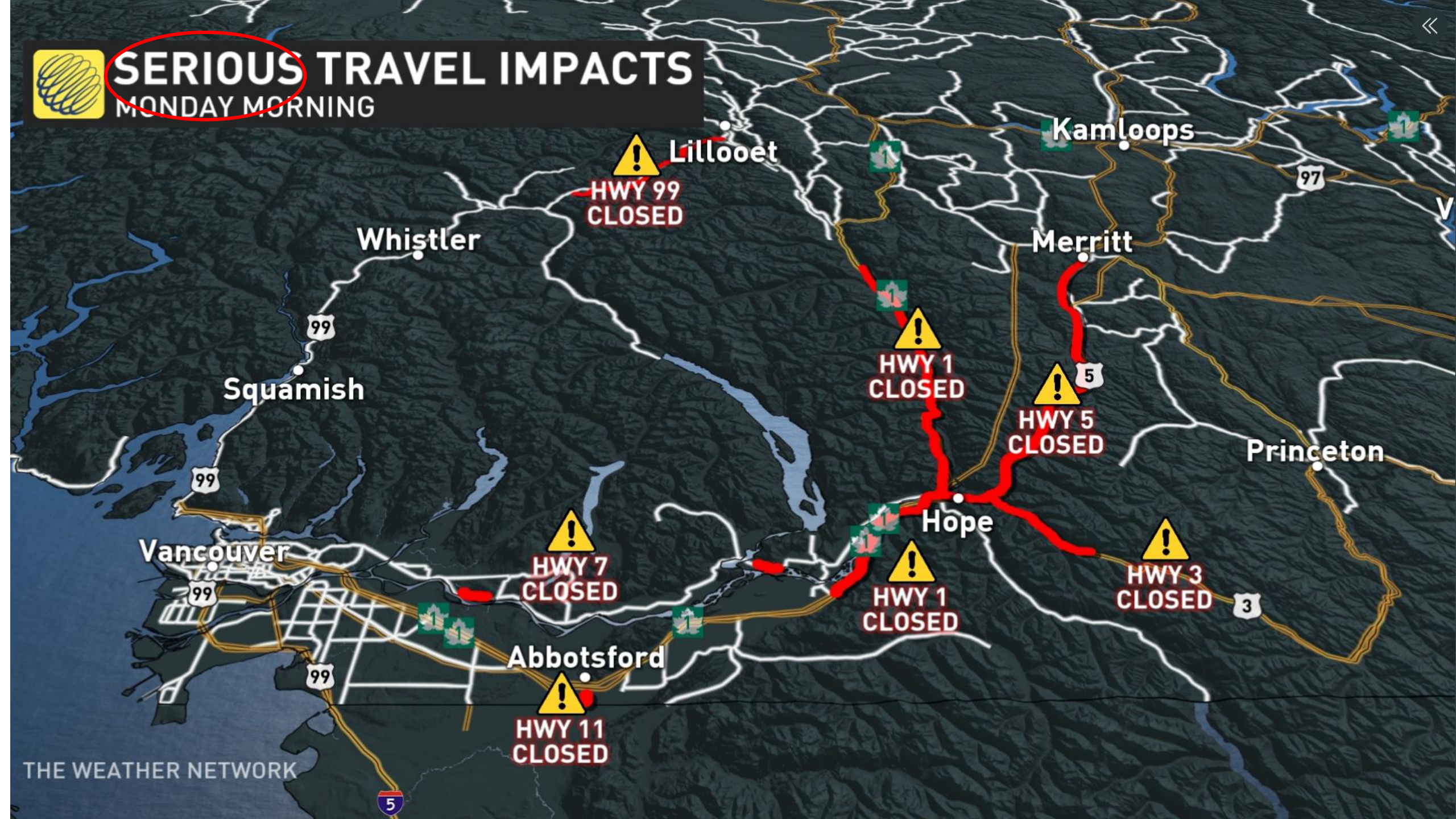
SERIOUS TRAVEL IMPACTS
MONDAY MORNING
Lillooet
HWY 99
CLOSED
Whistler
Kamloops
Merritt
97
HWY 1
CLOSED
HWY 5
CLOSED
Squamish
99
Princeton
Hope
Vancouver
HWY 7
CLOSED
HWY 1
CLOSED
HWY 3
CLOSED
Abbotsford
HWY 11
CLOSED
THE WEATHER NETWORK

# Very Serious

# “Must Go Faster!”
– Dr. Ian Malcolm

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# Slack Loops Waiting for Poles

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# Slack Loops By Burnt Pole

# Lean on Me

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# New Wood by Burnt Wood

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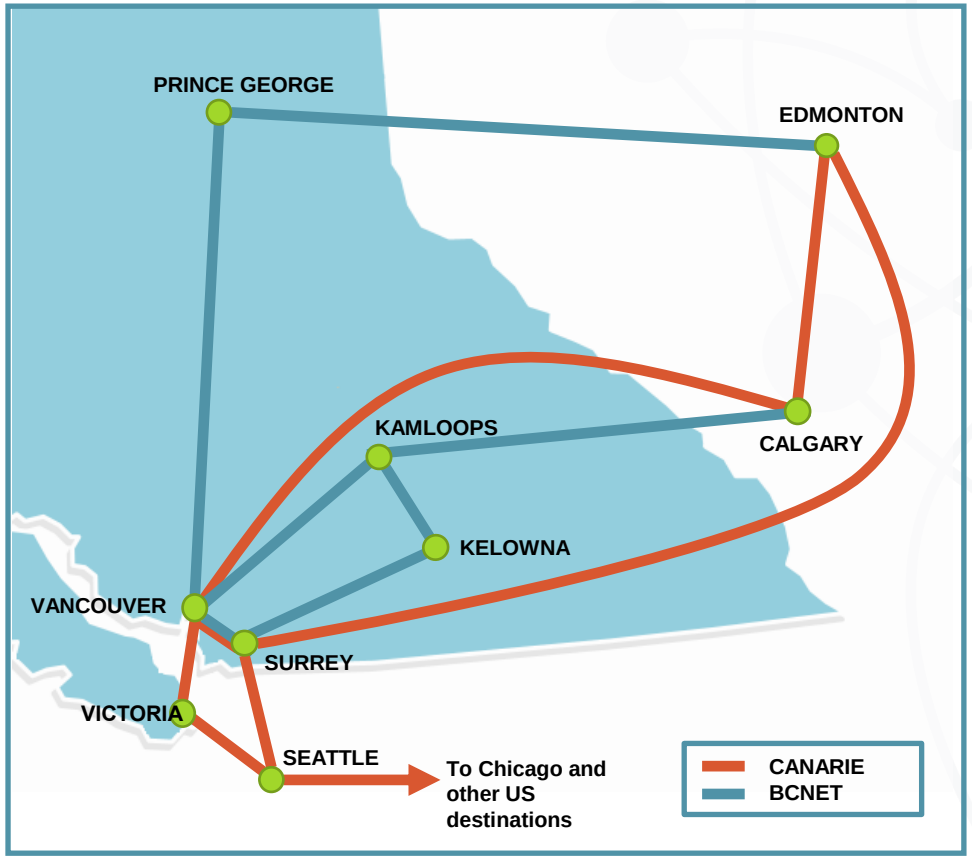
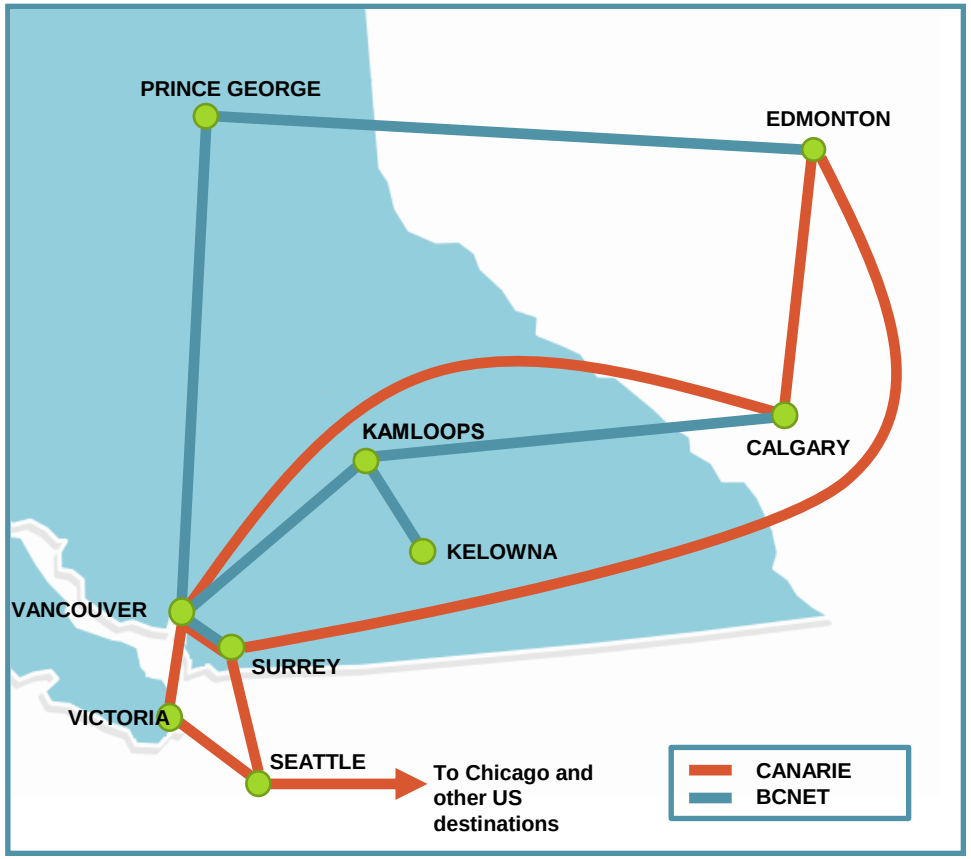
# Floods

# Prior to Outages



# November 14, 2021
# 7:30 p.m.

- Surrey – Kelowna circuit goes down

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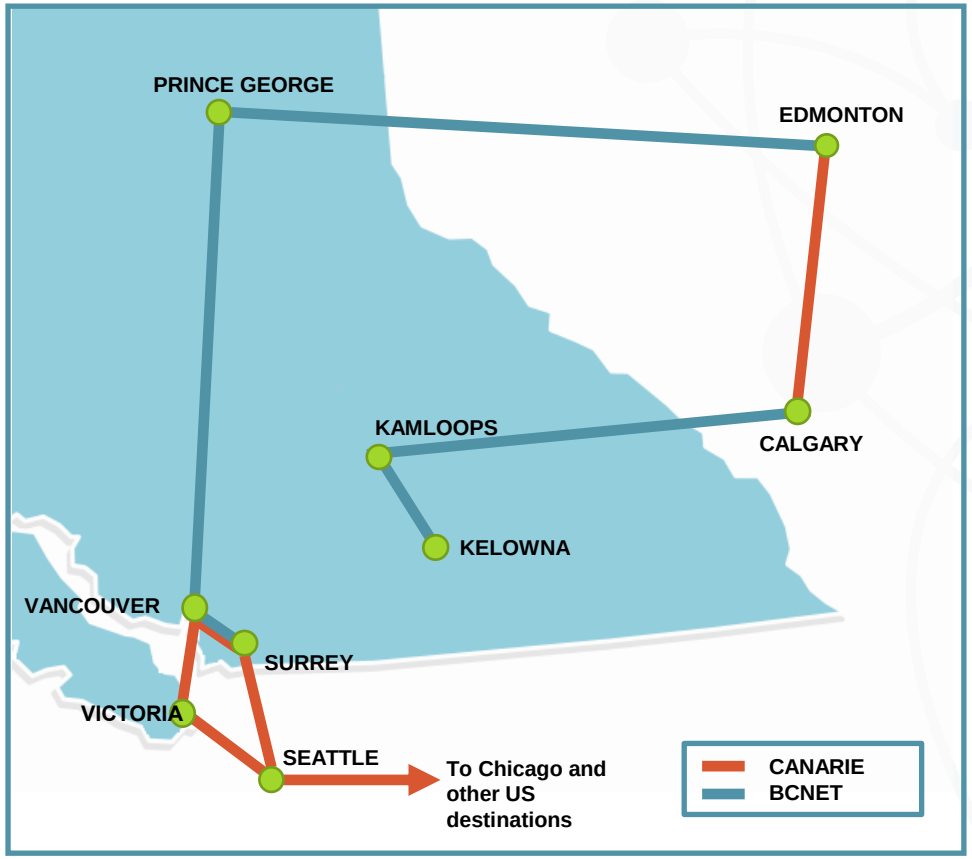
# November 15, 2021
# 11 a.m.

- Vancouver – Calgary circuit goes down
- Edmonton – Surrey circuit goes down
- Vancouver – Calgary circuit goes down

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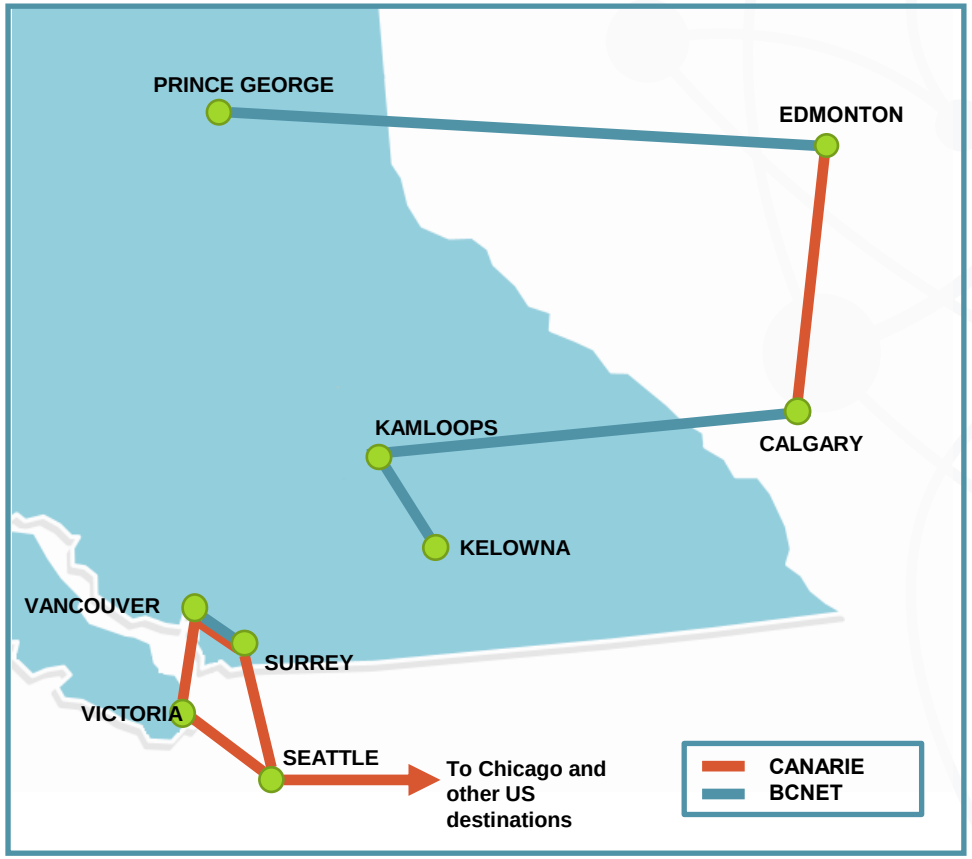
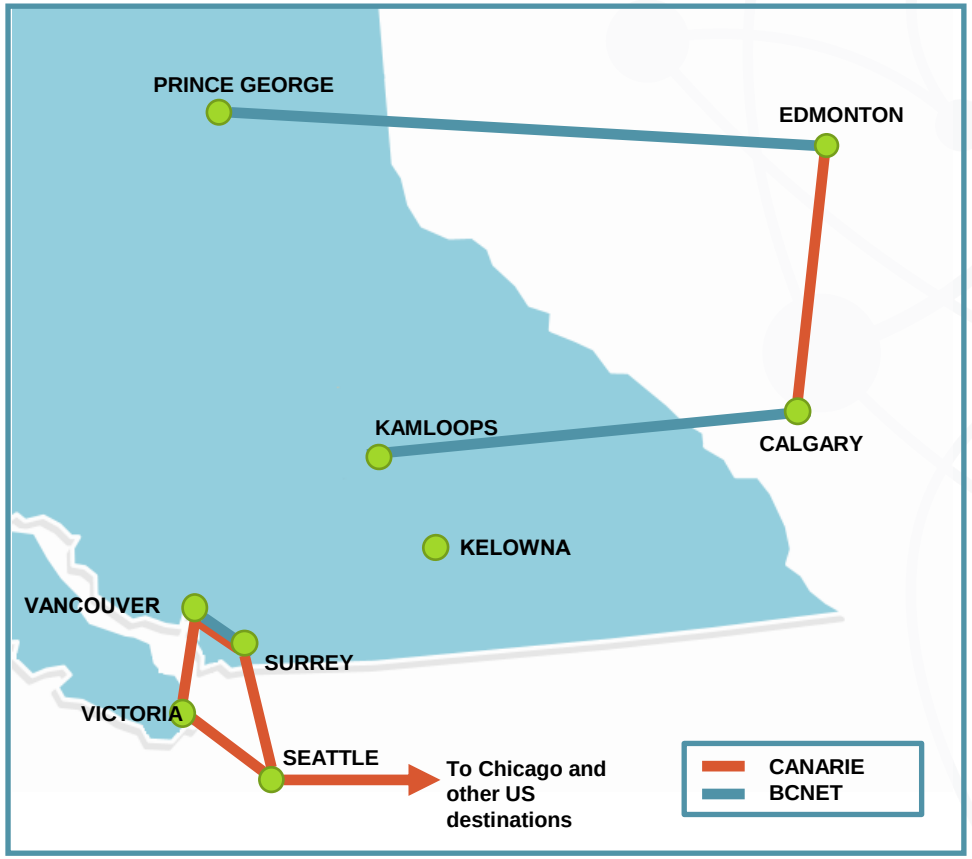
# November 15, 2021
# 12:30 p.m.

- Vancouver – Prince George circuit goes down



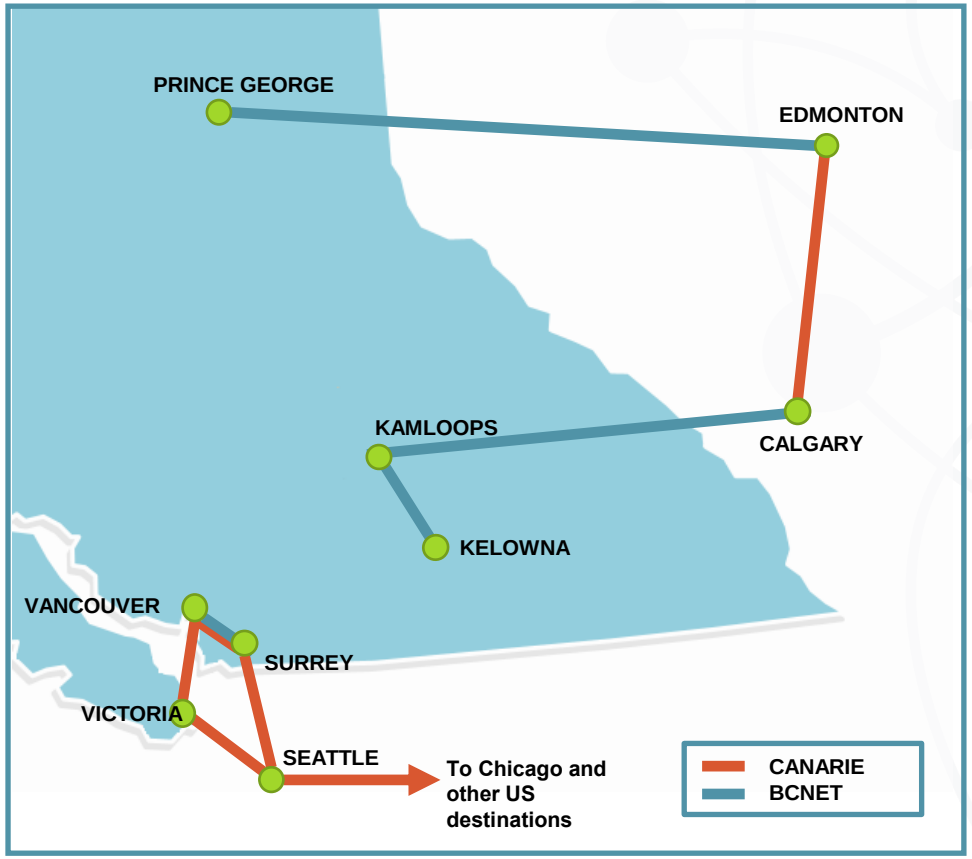
# November 17, 2021
# 10 p.m.

- Optical amplifier failure in Kamloops
- Kamloops – Kelowna circuit goes down



# November 17, 2021
# 10:30 p.m.

- Optical amplifier restored in Kamloops
- Crews unable to access landslide areas were readily available
- Kamloops – Kelowna circuit come back

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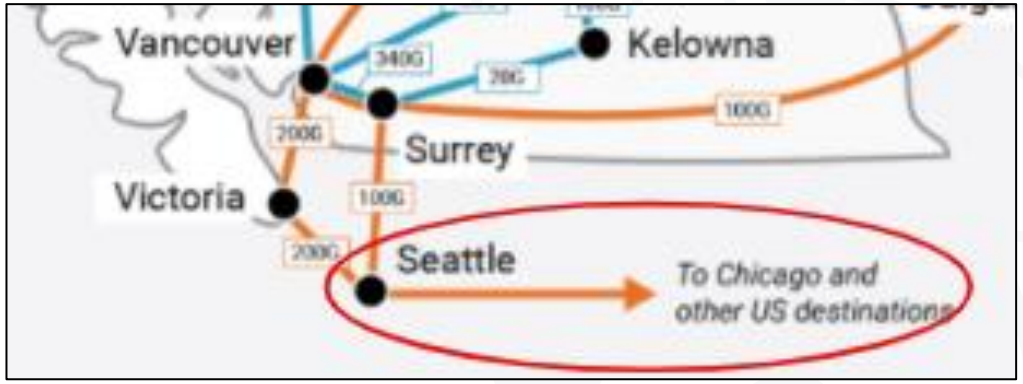
# BCNET/CANARIE Network Resiliency

- BCNET / CANARIE maintained connectivity to members institutions for Research, Peering, and Internet access
- Re-routing was milliseconds and automatic
- Latency increased from 20ms to 150 to 170ms




Kamloops - Edmonton - Winnipeg - Chicago - Seattle - Victoria - Vancouver

# CANARIE Partner Networks

- Vancouver – Victoria – Seattle still up at 200G+
- Only 100G between Seattle – Chicago – Winnipeg/Toronto
- CANARIE worked with international partners to add an additional 100G between Seattle – Chicago

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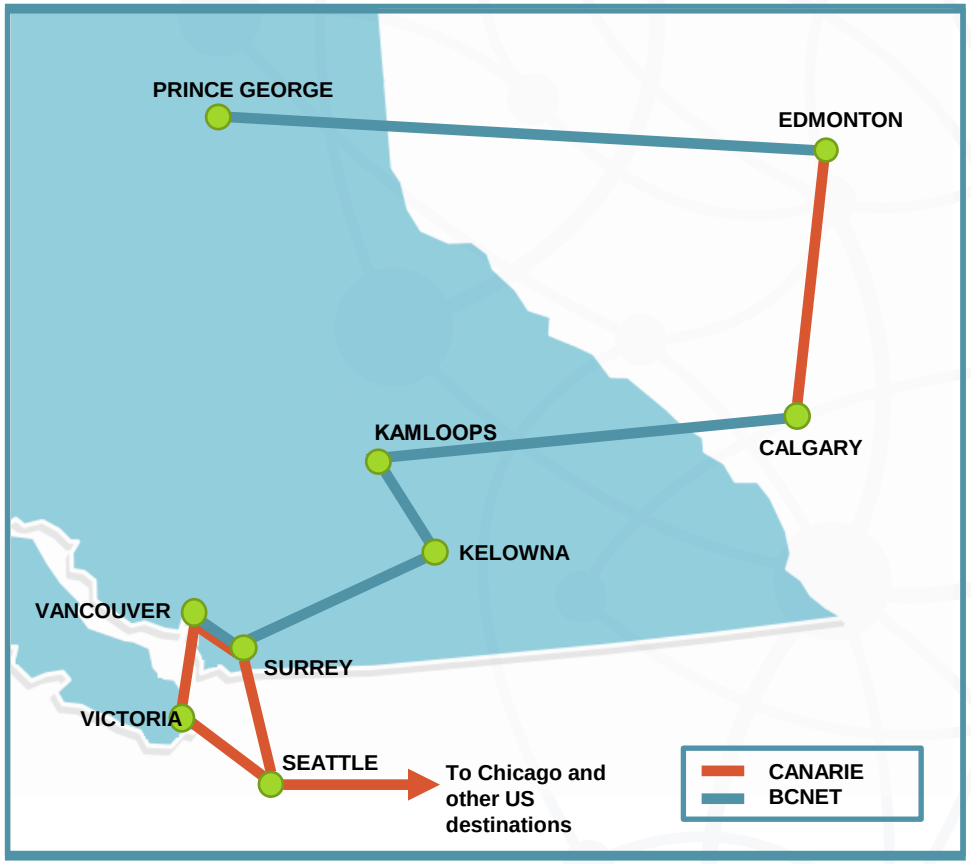
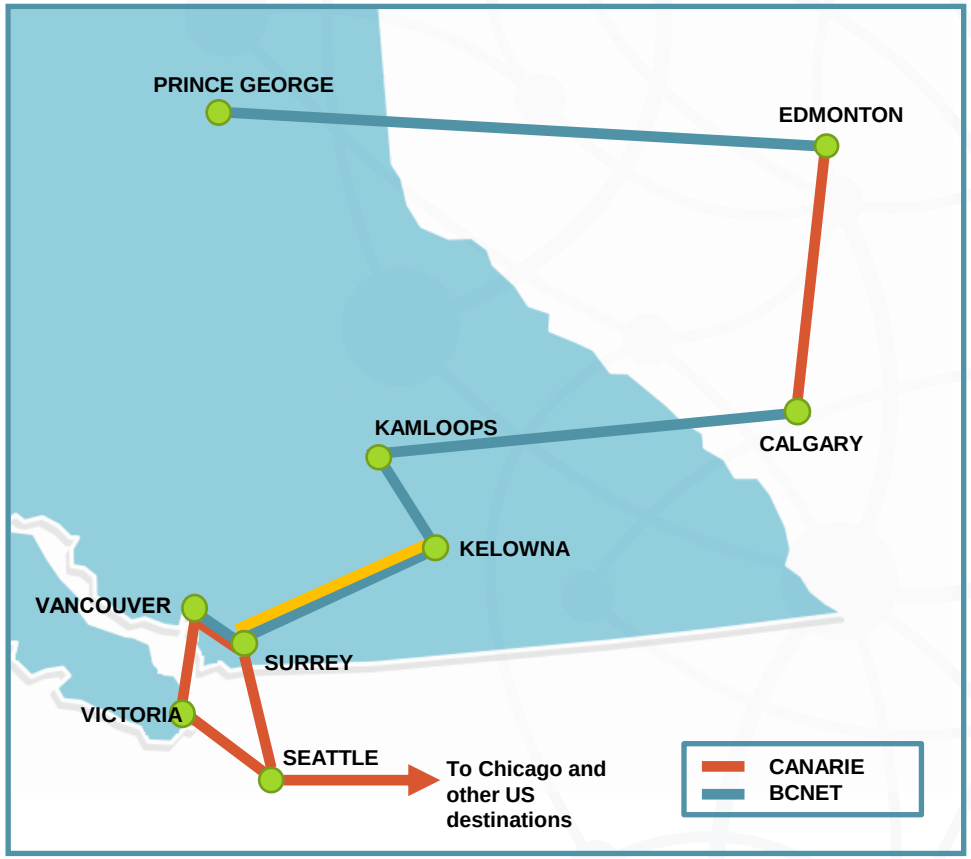
# November 18, 2021
# 10:30 a.m.

- Surrey – Kelowna restored
- Telus restored service between Kelowna and Surrey on November 18 at 10:40 a.m.
  - 4-day outage
- Telus *chartered a helicopter* to fly a fibre crew into Manning Park to repair the broken lines after rescuing workers trapped by landslides



# November 18, 2021
# 4:30 p.m.

- Surrey-Kelowna twinned to 20G with UBC
- BCNET engineered traffic from Kamloops to Vancouver via Kelowna, to reduce the latency to 50ms
- 10G circuit between Surrey and Kelowna proved insufficient
- UBC allowed BCNET to trunk with a functional 10G circuit

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# Flood Timeline

## December 4, 2021 - 5:30 p.m.

- Vancouver - Prince George restored
  - 20-day outage on circuit

## December 7, 2021 - 5:30 p.m.

- Vancouver - Kamloops restored via Western ROADM service
  - 23-day outage on circuit

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# Flood Impacts

- Vancouver – Kamloops: 40 repairs due to multiple landslides
- Vancouver – Prince George: up to 30 repairs due to landslides
- Over 2 weeks with crews on hold until land stabilized

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# Tank Hill: Before

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# Tank Hill: After

# Highway 1

# The Scale of the Problem


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# Little Engine That Could…

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# Questions we asked…

- What stayed up that should have gone down?
- Does latency matter?
- Is 10G big enough between the lower mainland and the interior?
- Is circuit diversity worth it?

# Lessons we learned…

- Close collaboration between BCNET and CANARIE and members – relationships matter!
- What we did right:
  - Redundant network
- What we got lucky with:
  - UBC line from Surrey to Kelowna
  - Member last-mile connections were maintained
  - Institutional knowledge

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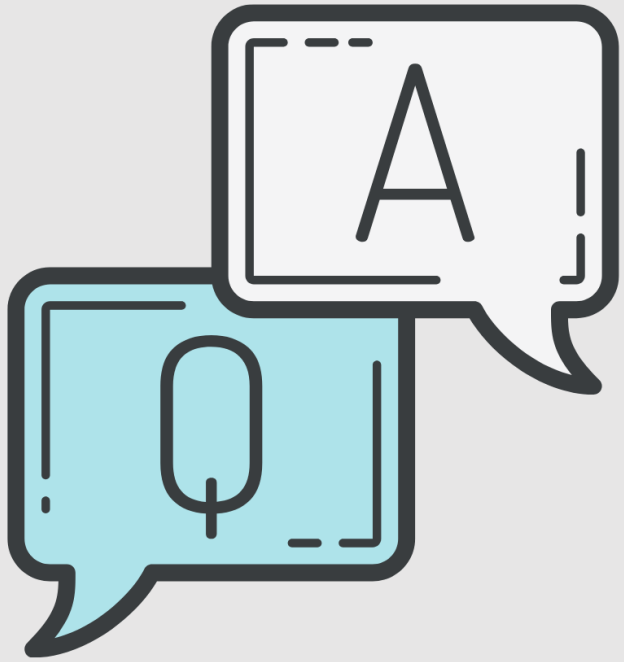


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