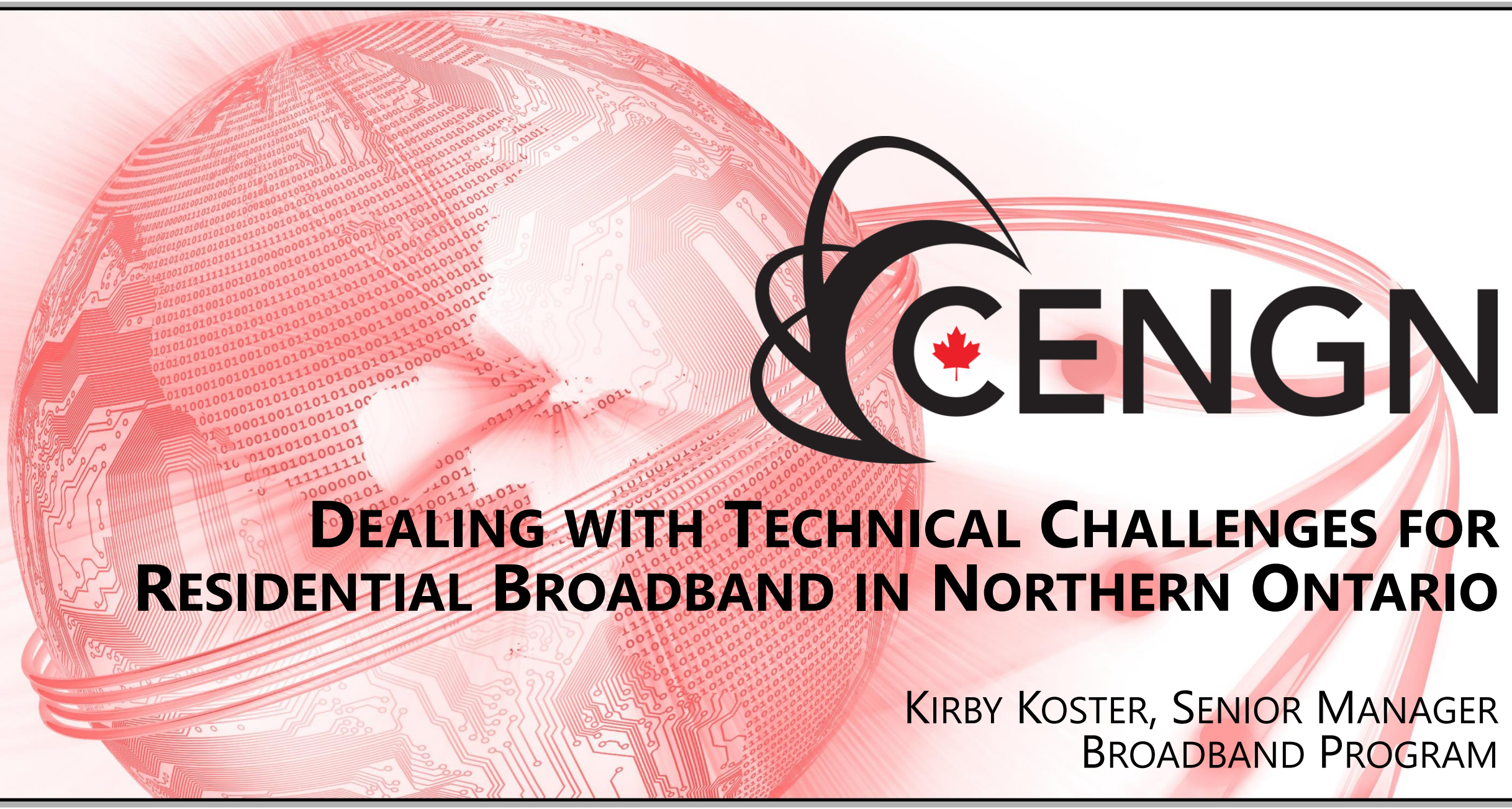


Dealing with Technical Challenges for Residential Broadband in Northern Ontario

Kirby Koster, Senior Manager
Broadband Program

Rural & Indigenous communities represent **30%** of Canada's economy

Access to high-speed internet service

Rural

Urban

1.5 million → The estimated number of Canadian households that are underserved, with no or poor internet service

Source: IDC Canada, 2019

By 2022, IDC Corp. predicts that at least 60%+ of global GDP will be based on digitalization

Wider adoption of digital technologies by Canadian industries could add

$330B to annual **GDP**

Growth in every sector will be driven by digitally enhanced offerings, operations, & relationships

Smart Health	Mining	Ag Tech	Forestry	Environment
Tele-surgery	Asset tracking	Automation of machinery	Automated harvesting	Flood monitoring
Remote monitoring	Autonomous drilling	UAVs	Supply chain management	Air quality monitoring
Asset tracking	Off-site monitoring	Sensors for growth, pests, moisture	Fire detection	Earthquake detection

Source: IDC Canada, 2019

Solidifying Canada's Leadership in Networking

CENGN enables innovative tech solutions through its **Rural & Northern Ontario Residential Broadband Program**

Residential Broadband Innovation Projects

- **8 Residential Broadband Projects across Northern and Rural Ontario over the next 2 years**

- 3-6 Month technology project to prove residential broadband technology solution
- **50% of expenses funded, up to $500,000 from CENGN, per project**

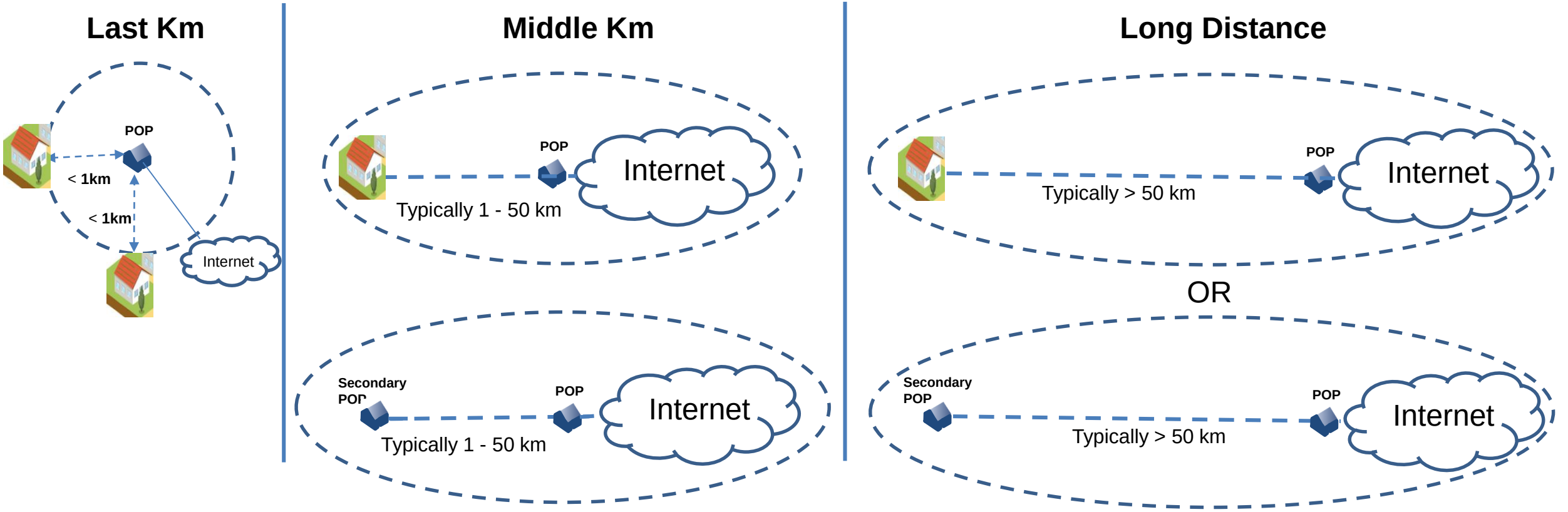
- No cost to host community participating in residential broadband project
- Technology applicant must be willing to fund up to at least 50% of the cost of the project

Primary Objectives of Program:

1) Drive and support innovative solutions that solve real problems for small communities.

2) Select Technology Applicants that have the drive, ability, experience, and technology that can be deployed in a commercial service that will meet the performance needs of the community.

Residential Broadband Access



Technology - copper/cable, wireless, optical, or satellite.

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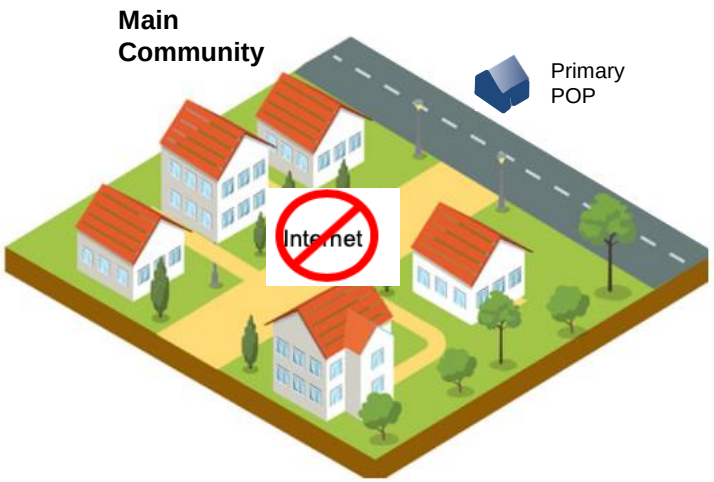
Last Kilometer Residential Broadband Technical Solutions

No Last Km Access

POP in community but no residential broadband access.



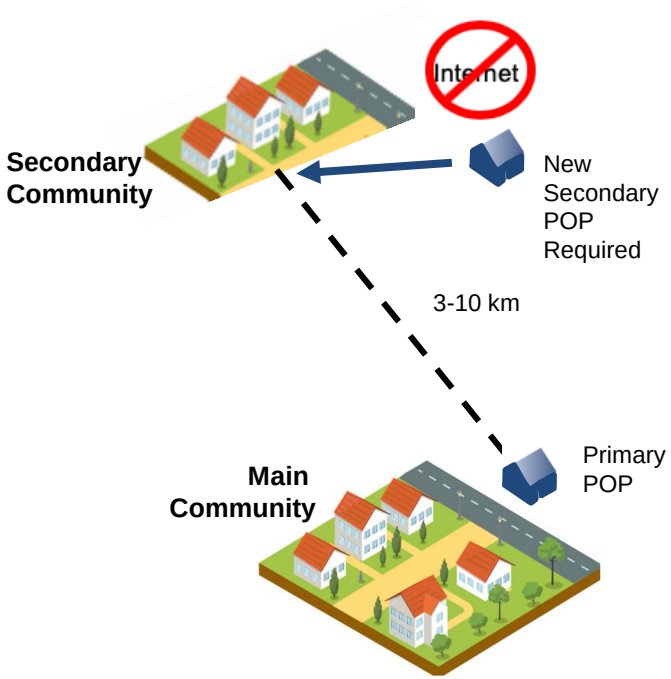
Technology Solutions for Small Communities

Technology	Technology Innovation	Business Innovation
Optical	Improved and Varied Installation Methods	Plowing road shoulder to reduce access delays, pole engineering, replacement & rental costs. Horizontal Drilling to minimize repaving costs.
Wireless 5G LTE	Multi-band – Higher Power, Higher BW, Gigabit Peak Speeds NOKIA	Higher Power, Beam Forming High-Gain Antennas, Better service reliability
Wireless OTFS Modulation	5G Massive MIMO - New multi-dimensional modulation dramatically increases bandwidth and coverage. cohere technologies	NLOS support means alignment is easier and faster, offers prospect for more reliable 5G access services In urban and sub-urban environments
Wireless TV White Space	5 – 10 km Range Performs well in heavily treed areas Penetrates buildings 6HARMONICS CONNECTING PEOPLE & THINGS redline communications	Do not require high towers Easy installation, and alignment

Middle Kilometer – Broadband POP Extension Technical Solutions

Middle-KM POP Extension Needed

POP in main community but no residential broadband access in remote community or residences.



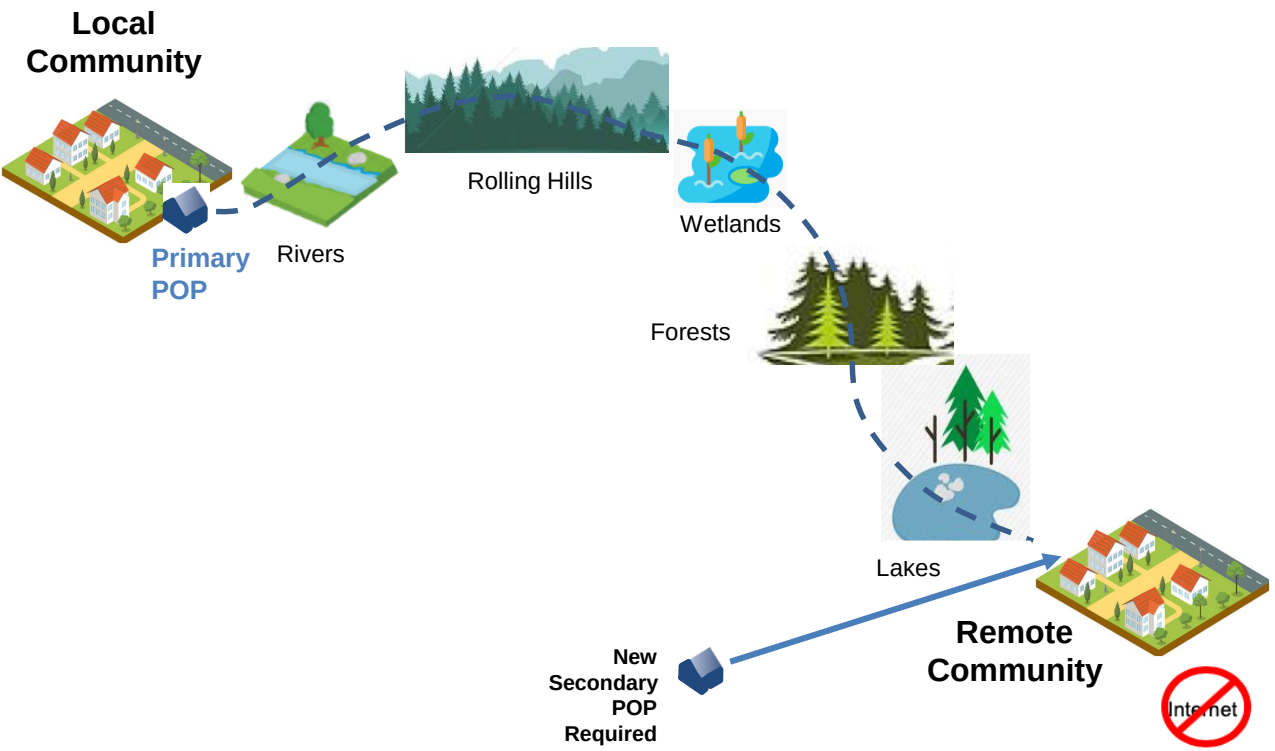
Technology Solutions for Small Communities

Technology	Technology Innovation	Business Innovation
Optical	Improved and Varied Installation Methods	Plowing road shoulder to reduce access delays, pole engineering, replacement & rental costs. Horizontal Drilling to minimize repaving costs.
LEO Satellite	Lower latency than traditional Satellite Higher BW than other Satellite Lower cost base stations than GEO satellite TELESAT OneWeb SES	Extends to longer middle km or long-distance POP extensions at lower cost than fibre At least 2 years out at this point
Wireless OTFS Modulation	5G Massive MIMO - New multi-dimensional modulation dramatically increases bandwidth and coverage. cohere technologies	NLOS support means alignment is easier and faster, offers prospect for more reliable 5G access services In urban and sub-urban environments
Wireless TV White Space	5 – 10 km Range Performs well in heavily treed areas Penetrates buildings 6HARMONICS CONNECTING PEOPLE & THINGS redline communications	Do not require high towers Easy installation, and alignment
Microwave	Higher BW, Data Compression, Licensed Spectrum, and Lightly Licensed eg. Eband CERAGON Aviat NETWORKS	Distances up to 20 km offer enough BW for small communities and very low cost middle km access compared to fibre.

Long Distance - Broadband POP Extension Technical Solutions

Very High Optical Fibre Installation Costs

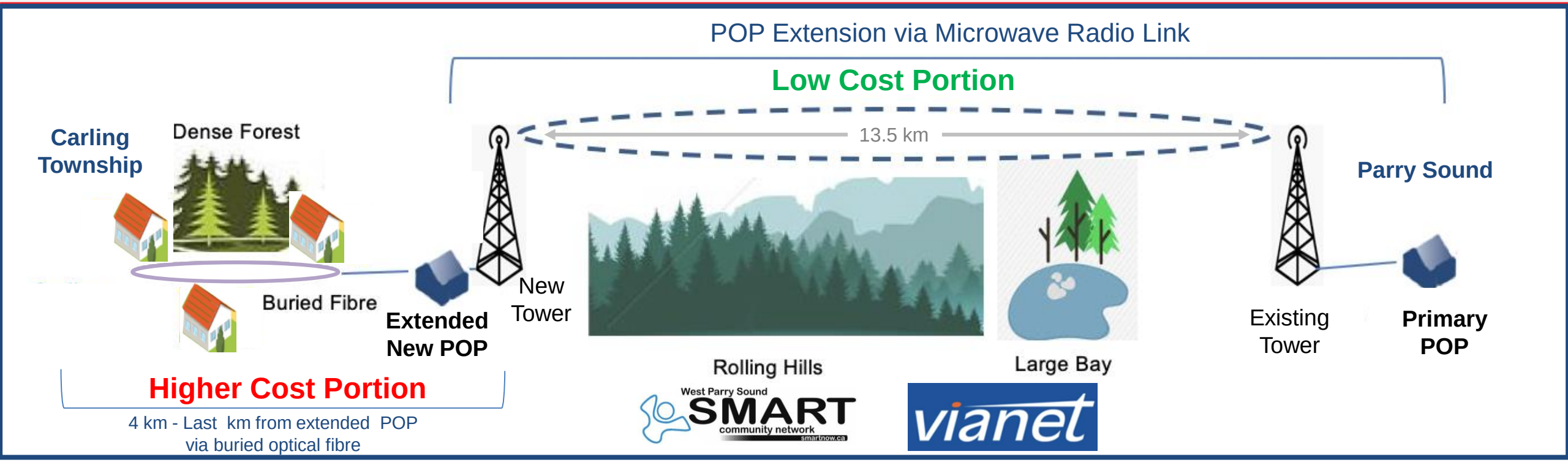
New and innovative approaches to fibre Installation techniques and armored cabling technologies can eliminate the need for trenching or hanging fibre from poles.



Technology Solutions for Small Communities

Technology	Technology Innovation	Business Innovation
Optical	Improved and Varied Installation Methods Stronger and more rugged cables for land and under water	Plowing road shoulder to reduce access delays, pole engineering, replacement & rental costs. Horizontal Drilling to minimize repaving costs.
LEO Satellite	Lower latency than traditional satellite. Higher BW than other Satellite Lower cost base stations than GEO satellite TELESAT, OneWeb, SPACEX, SES	Extends to longer middle km or long-distance POP extensions at lower cost than fibre At least 2 years out at this point
Microwave	High BW, Data Compression, Licensed Spectrum, and Lightly Licensed eg. Eband CERAGON, Aviat Networks	Distances up to 20 km per hop offer very low cost compared to fibre. Multi-hop configurations can also be cost effective.

Project#1– Innovative Middle Km Solution



FTTH - Future-Proof Last-kilometer Solution

- Cost-limited 4 km buried optical fibre ring

Low-cost POP Extension Middle-km Solution

- High-bandwidth, fixed-wireless, microwave radio link

Avoided Fixed-Wireless Challenges

- Towers ensure Line of Sight above dense tree canopy, large water bodies, & hills of rock/forests
- Buried optical fibre in gravel shoulder of roads means dense tree cover for last km not an issue

Cost Reduction Innovation

Fixed Wireless POP Extension, with FTTH loop in outlying community

Significant Last Km Cost Reduction

- **No Last Km Pole Costs** - road shoulder plowing and horizontal drilling for fibre

Very Large Middle Km Cost Reduction → **$1.2 Million Cost Saving**

- **Very Large Reduction in Middle Km POP Extension Costs** - reduced by 85%
- **No Middle Km Pole Costs** – no poles required, no pole replacements, no pole engineering
- **No Middle Km Fibre Costs** – no fibre required for middle kilometer

Subsequent Network Expansion Opportunities

Using the same technology approach as the CENGN project, additional townships could be reached with new tower sites to provide much better broadband access.

Legend

- CENGN Project#1 Service Areas
- CENGN Project#1 Tower Sites
- Subsequent Expansion Prospects

Contact Info

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