Quintillion Subsea Cable System

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Meet Quintillion

- Headquartered in Anchorage, Alaska
- Building a multi-phase subsea fiber optic cable network in and around Alaska with plans to connect to Asia, Arctic Canada and Europe
- Previously affiliated with Arctic Fibre – have acquired Arctic Fibre assets and now lead the project
  - Arctic Fibre planned to build the western Europe to Asia system in one phase, which was logistically challenging considering the open water season in the Arctic
  - Quintillion was originally the US partner with exclusive rights to bring the AF project to American soil
- Private operator selling wholesale capacity to telecom service providers
  - Capacity on Quintillion's network is available to all telecom service providers
- Privately funded
- Delivering 50 to 90% price reductions for wholesale dedicated capacity

Planned Network.. a Phased Approach

Alaska Scheduled In-service Q1 2017

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Logical & Feasible Design

- Prior efforts by other companies failed to overcome the unique complexities of building in the Arctic
- Quintillion's plan will deliver the system in logical phases anchored in Alaska
- **PHASE 1 – ALASKA**
  - Nome to Prudhoe Bay (Oliktok Point) with branches to Kotzebue, Point Hope, Wainwright and Barrow
  - New terrestrial fiber from Deadhorse to Fairbanks and interconnecting to existing cables to the Lower 48
  - Construction underway now
  - ***Phase 1 scheduled in-service Q1 2017***
- **PHASE 2 – ASIA**
  - Designed to extend the system from Nome west to Asia
  - Options for additional branches into Alaska
  - Provides much needed diverse communication route between North America and Asia
- **PHASE 3 – CANADA-WESTERN EUROPE**
  - Designed to extend the system east from Prudhoe Bay through the Northwest Passage to Europe
  - Planned spurs into Arctic communities in Canada
  - Will provide the shortest route between Europe and Asia

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How *Does* One Build Arctic Subsea Cables?

Trailblazers bringing fiber to the Arctic

- Four+ years to develop Phase 1
- 3 years Permitting and approvals – over 275 Permits, approvals, easements, etc.
- 3 years analyzing and planning for risk mitigation – external aggression; logistics, etc.
- 2 seasons of Marine survey - geotechnical and geophysical studies
- 2 years to complete horizontal drilling for the shore landings
- 2 years to complete cable landing sites at each landing
- 2 years to complete the terrestrial cable to Fairbanks
- 1 year to build cable, repeaters, branching units and terminal equipment
- 1 Arctic summer to install Phase 1 subsea cable system
  - *Burying the cable deep to avoid external risks*
  - *Working around marine mammal migrations*
  - *Working around traditional activities including subsistence hunting*

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Building an Arctic-Resilient System

- Alcatel Submarine Networks: Turn-key contractor for design, build and construction
- Cable constructed of the highest quality glass, wrapped in the best protective coating and armoring, weighting, and water resistant membrane
- Resilient network design: double armored and buried below ice gouge risk
- 25+ year system design-life – many older systems are realizing longer system life
- 30 terabit per second system
- Can increase capacity with change of equipment in cable landing station
- HDD boring at each cable landing protects cable and minimizes shoreline disruption
- Four marine spreads operating in parallel to complete install during open water season
- Custom maintenance program to enable repair if necessary

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System Resilience – design & build considerations

- Human activities present the greatest risk to subsea cables, which are relatively low in the Arctic
- In the Arctic, ice gouging presents the greatest risk - Quintillion's cable burial designed to install the cable below the ice gouge risk assessed by ice study experts
- Installed shore landings using deep bores and steel conduits to protect from shallow water risks
- Dual redundant network equipment insures network operation from equipment failure

Causes of service-impacting cable breaks	Percentage
Fish trawling	40%
Ship anchorages	28%
Subsea earthquakes or subsidence	8%
Shunt (electrical faults) failures	8%
Amplifier or branching unit failure	4%
Abrasion (wave, seabed, ice)	3%
Other factors, sabotage, etc.	9%
Total	100%

*International Submarine Cable Protection Committee, 2013

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The Benefits for the Arctic

ARCTIC TELECOMMUNICATIONS

Backhaul technology drives cost of service

- **Backhaul Technology** – the connection from a community to the Internet
  - **Satellite – high cost; limited capacity**
    - Substantial operation and maintenance costs on ground stations
    - Expensive to launch a satellite
    - Susceptible to environmental outages: weather, solar flares, etc.
    - On a per Mbps cost basis, cost is very high and capacity limited **< 2,000 Mbps**
  - **Microwave – high cost; limited capacity**
    - Substantial operation and maintenance costs on towers, power plants and radios
    - Higher latency due to multiple microwave hops and daisy chains
    - Expensive to construct in remote environments
    - Susceptible to environmental outages: weather, solar flares, etc.
    - Capacity is limited and ability to upgrade is limited - 2,000 to 10,000 Mbps - on most systems
  - **Fiber Optic Cable – low cost; virtually unlimited capacity**
    - Cost of construction is coming down as tools advance
    - Low cost of operation and maintenance – no routine subsea maintenance, no remote facilities – all community based
    - Virtually unlimited capacity – **10,000,000** Mbps per fiber pair with ability to triple capacity by changing equipment in community-based landing site

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Over-Subscription Limits Rural Communities

- Broadband is essential infrastructure which much of the Arctic lacks
- Satellite, and microwave systems with too many hops, provide insufficient bandwidth to deliver dedicated broadband service
- Over-subscription (multiple users on the same service) is highest in Rural Alaska and other Arctic communities
  - Lower 48 and International typically less than 5 users to 1 service for home Internet service
  - Urban Alaska typically less than 8 to 1 for home Internet service
  - **Rural Alaska typically over 20 to 1 and as high as 30 to 1** for home Internet service
- Limited bandwidth, oversubscription and slower connectivity (latency) means users do not realize minimum standards for broadband
  - Most modern applications time-out due to the excessive latency
- Rural Alaska suffers some of the highest Internet costs in the world
- Arctic Canada and other Arctic communities suffers similar costs – satellite and microwave just can't keep up and cost too much

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Why the Arctic Needs Fiber

Location	Monthly Cost	Speed (Mbps)	Monthly Capacity Limit
Barrow, AK[2]	$215.00	6	60 GB
Kansas City, MO[1]	$70.00	1,000	No Cap
Chattanooga, TN[1]	$69.69	1,000	No Cap
San Francisco, CA[1]	$30.00	200	No Cap
Anchorage, AK[3]	$174.99	1,000	750 GB

Technology	Rural Alaska Wholesale Price (carrier to carrier)	Speed (Mbps)	Urban Alaska Wholesale Price (carrier to carrier)
Fiber Optic Cable	$500 to $1,500*	1	$50 - $150
Microwave	$3,500 to $10,000	1	n/a
Satellite	$1,500 to $10,000	1	$1,000 to $10,000

(1) As published by Open Technology Institute, New America Foundation; "The Cost of Connectivity 2014"

(2) Quoted on GCI website, October 2014 - pricing has now been removed from website

(3) Quoted on GCI website, January 2016.

*Terra SW Fiber Pricing not included

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Why aren't service subsidies solving the problem?

- In 2015 Alaska received **over $386 million in telecom/broadband subsidies** from the Universal Service Fund – all to subsidize the high cost of service
  - High Cost support to telecoms: **$182 million**
  - Service cost subsidies to hospitals, health clinics, schools and libraries: **$186.2 million**
  - Lifeline support to consumers: $18 million
- In the last 10 years over $2.5 billion of these subsidies have been delivered to Alaska
- In spite of billions of dollars, Rural Alaskans still don't have true broadband
- Extensive grant investment in last mile– fiber in town, cellular upgrades – without backhaul there is limited improvement to service and cost
- Over $500 million in grant funds to build middle mile and backhaul infrastructure in the last 10 years: only communities that received fiber saw meaningful cost reductions
- Similar dynamics in other Arctic nations
- Investing in more satellite and complex microwave systems isn't delivering affordable true broadband

Fiber optic cable is the only backhaul technology that will dynamically reduce the cost of service and reliably deliver true broadband

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Benefits of Broadband to Arctic Communities

- **EDUCATION:** Supports Digital Learning agenda; improving education and job training while lowering cost of delivery
- **HEALTH CARE:** Supports Tele-medicine solutions; electronic health records; remote diagnostic and specialist consultations
- **GOVERNMENT:** Improves efficient delivery of government services
- **ECONOMIC DEVELOPMENT:** Enables business opportunities dependent on high-speed communications and true online/remote work
- **EMERGENCY RESPONSE:** Allows real-time monitoring and management of resource development industries (oil & gas and mining) and improves Search and Rescue capabilities
- **PUBLIC SAFETY:** Improves capabilities for effective community public safety and security services
- **NATIONAL STRATEGY:** Reliable communications is essential to all three areas identified in the President's National Strategy for the Arctic Region, published 2013
  - Advance Safety and Security Interests
  - Pursue Responsible Arctic Region Stewardship
  - Strengthen International Cooperation

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THANK YOU!

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