Quintillion Subsea Cable System

PRESENTED BY:
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CEO

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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
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
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*
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
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

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

*International Submarine Cable Protection Committee, 2013*
The Benefits for the Arctic
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
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
## Why the Arctic Needs Fiber

<table>
<thead>
<tr>
<th>Location</th>
<th>Monthly Cost</th>
<th>Speed (Mbps)</th>
<th>Monthly Capacity Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrow, AK²</td>
<td>$215.00</td>
<td>6</td>
<td>60 GB</td>
</tr>
<tr>
<td>Kansas City, MO¹</td>
<td>$70.00</td>
<td>1,000</td>
<td>No Cap</td>
</tr>
<tr>
<td>Chattanooga, TN¹</td>
<td>$69.69</td>
<td>1,000</td>
<td>No Cap</td>
</tr>
<tr>
<td>San Francisco, CA¹</td>
<td>$30.00</td>
<td>200</td>
<td>No Cap</td>
</tr>
<tr>
<td>Anchorage, AK³</td>
<td>$174.99</td>
<td>1,000</td>
<td>750 GB</td>
</tr>
</tbody>
</table>

(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.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Rural Alaska Wholesale Price (carrier to carrier)</th>
<th>Speed (Mbps)</th>
<th>Urban Alaska Wholesale Price (carrier to carrier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber Optic Cable</td>
<td>$500 to $1,500*</td>
<td>1</td>
<td>$50 - $150</td>
</tr>
<tr>
<td>Microwave</td>
<td>$3,500 to $10,000</td>
<td>1</td>
<td>n/a</td>
</tr>
<tr>
<td>Satellite</td>
<td>$1,500 to $10,000</td>
<td>1</td>
<td>$1,000 to $10,000</td>
</tr>
</tbody>
</table>

*Terra SW Fiber Pricing not included
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*
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
THANK YOU!

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