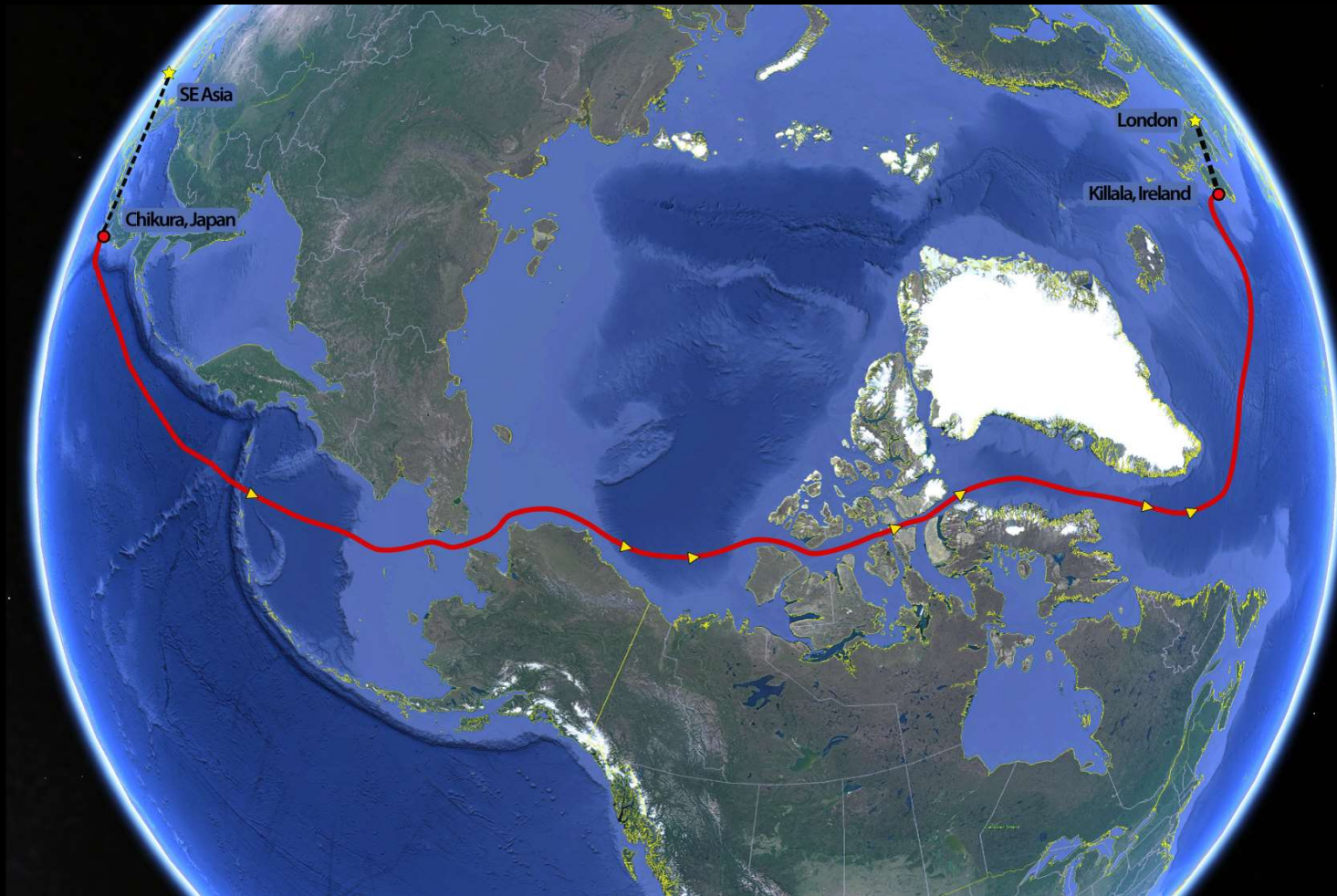


FAR NORTH FIBER

Shorter, Faster, more Secure



FAR NORTH DIGITAL, LLC

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PROJECT OVERVIEW

- Far North Digital, LLC (FND), an Alaska state limited liability company, is developing the first submarine fiber optic cable through the Arctic Ocean and the Northwest Passage connecting Asia and Northern Europe.
- This 14,000km route will greatly reduce the optical distance between Japan and Ireland relative to all other combinations of terrestrial and oceanic fiber plant currently available.
- The high fiber count cable will offer unprecedented route diversity, transmission capacity, and geopolitical stability to the global fiber network.

THE NEED

- Many existing fiber systems are reaching the end of their economic lives of about 15 years, notwithstanding 25-year design lives.
- Transmission equipment advances and improved glass fiber characteristics have expanded the carrying capacity of a fiber pair from 4-5Tbps to as much as 20-40Tbps per fiber pair today, with the potential to go higher still.
- Annual global IP traffic will reach 4.8 ZB per year by 2022, or 396 exabytes (EB) per month. In 2017, the annual run rate for global IP traffic was 1.5 ZB per year, or 122 EB per month.¹
- Fueled by 5G, massive Internet of Things (IoT) adoption will connect billions of devices and interact with them to gather vast amounts of data, transforming broadcast and media industry, education, engineering, science, healthcare and many other sectors.
- Latest breakthroughs in Artificial Intelligence (AI) will drive exponentially increasing demand for data transmission throughput and speed. Asian markets are projected to outpace Silicon Valley in the next 5-10 years in demand for AI data.

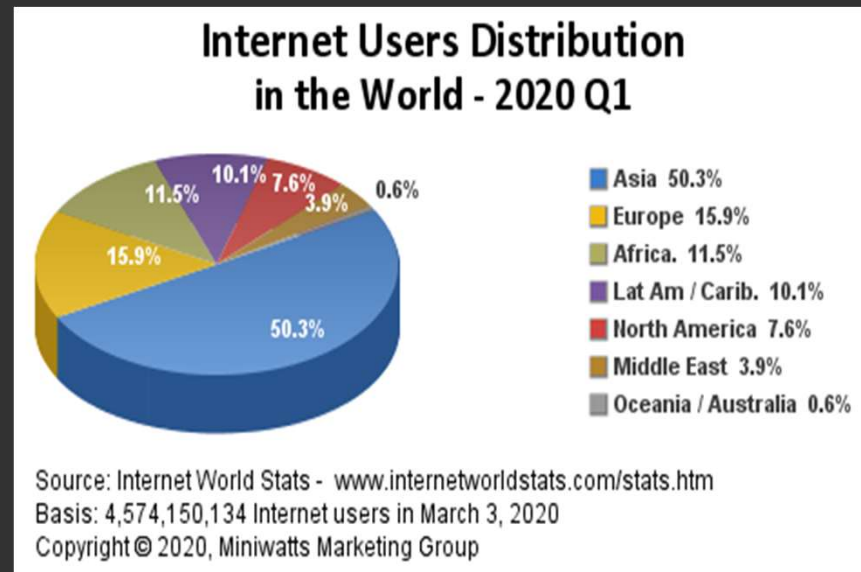
1. *Cisco Visual Networking Index: Forecast and Trends, 2017–2022. November 26, 2018*

ASIA – EUROPE EXPRESS ROUTE

Data transport capacity demand shows strongest growth along the Europe - Asia axis:¹

- Asia and Europe together, with 66% of the world's population, account for over 67% of the world's internet usage.
- Asia's internet penetration rate as a percent of population is only 59%, Europe's is 87%.
- By contrast, North America, at less than 5% of world population, represents 7% of total internet usage with over 90% penetration rate.

1. <https://www.internetworldstats.com/stats.htm>



THE PROJECT

First ever long-haul submarine fiber route through the Arctic Ocean from Asia to the UK. Features:

- The Far North Fiber project is a high speed, low latency network which will connect Japan to Ireland by way of the Northwest Passage.
- Approximately great circle route greatly reduces the optical distance between Asia and the UK, minimizing signal latency. Nominal round trip latency ~142 msec.
- Route avoids potential geopolitical risks of, e.g., Russia territorial waters or other similar.
- Significantly cuts the number of network elements encountered on existing Japan - UK routes spanning either the eastern or western hemisphere, each of which require multiple marine and terrestrial segments.
- Cable terminations in Japan and Ireland selected as regional focal points for capacity demand corridors.
- Branching units located to support Arctic communities, infrastructure needs, and system redundancy and diverse backhaul.

TECHNICAL SPECS

- ~14,000 km Repeated long-haul submarine cable system
- 12 fiber pairs
- Network Capacity:¹
 - Spectrum: $60\lambda \times 250\text{Gbps/FP} = 15\text{ Tbps/FP}$
 - Low Latency Express Capacity: $12\text{FP} \times \text{up to } 15\text{ Tbps/FP} = 180\text{ Tbps}$
- Non-service interrupting upgrades to meet future capacity expansion needs as required.



1. Figures reflect current transponder technology. Minimum 20Tbps/FP anticipated by time of RFS.



BENEFITS

- Shortest, fastest, most secure system connecting Asia, North America and Europe
- The lowest latency (RTD) : 142ms between Japan and United Kingdom
- Route diversity
- Latest generation, high bandwidth capacity
- Physical and political security of the system, and Carrier-neutral access
- Reduced threats of external aggression to the submarine cable
- Featured products
 - Dark fiber pairs
 - Virtual Fiber Pair, 1/2 Dark Fiber Pair, 1/4 Dark Fiber Pair
 - 400G Wavelengths
- SDN-enabled activation on-demand
- Agreement terms: IRU, Lease



SECURITY

- System architecture permits interconnection with geographically diverse, redundant route restoration options.
- Cable burial to 1,000m water depth.
- Lower volume of ship traffic versus conventional routes within or crossing vessel lanes.
- Arctic route avoids critical global choke points and political risks, especially in the Middle East/Mediterranean region.
- Fishing ban in the Arctic Ocean helps to reduce the principal physical threat to seafloor cables – bottom contact fisheries.¹
- Route engineering and installation technology are product of 15+ years' study and proven successful experience in similar Arctic deployments.

¹ <http://www.sciencemag.org/news/2017/12/nations-agree-ban-fishing-arctic-ocean-least-16-years>



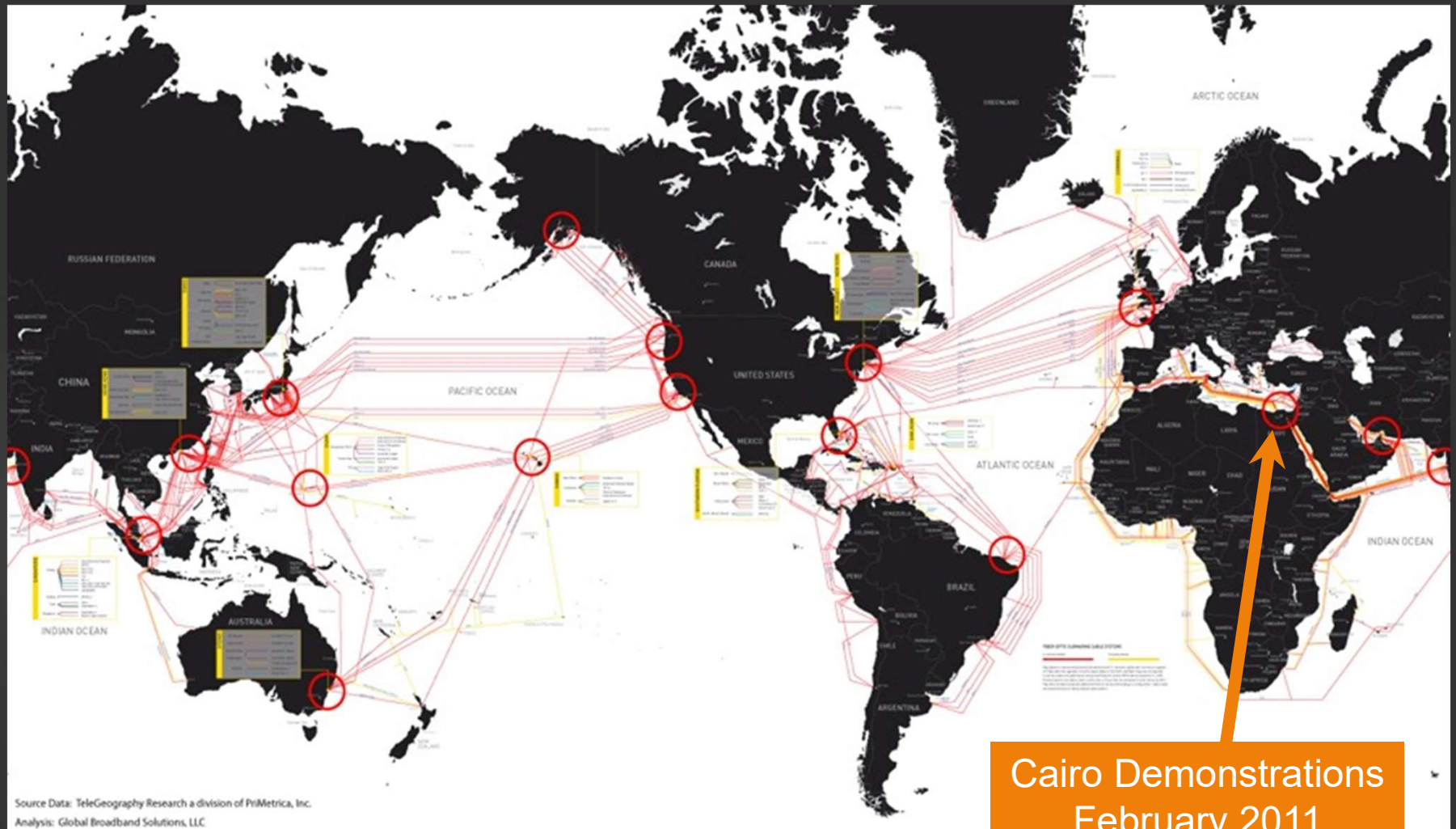
ALTERNATE ROUTE LATENCIES (RTD)

Europe to Asia (London –Tokyo)

Route	Distance (km)	Delay (ms)	Pro's	Con's
Far North Fiber	Approx. 14,000	142	<ul style="list-style-type: none">• Low latency• N. America drops• Politically stable	<ul style="list-style-type: none">• Not yet in service
Pacific to Europe*	21,000	280	<ul style="list-style-type: none">• Various cables along the route	<ul style="list-style-type: none">• Higher latency• Passes Yemen; through Cairo
Russian Terrestrial Route*	12,530	176	<ul style="list-style-type: none">• Low latency	<ul style="list-style-type: none">• Network access• Reliability• Cost• Political risk

* Slightly higher latency per km due to additional network elements along route

GLOBAL FIBER CHOKEPOINTS



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TIMELINE

Estimated Project Interval remaining: Approx. 45 months.¹

Route design, EPC contractor MOU pending, Landing Parties under negotiation, Permitting initiated	To date
Desktop Study (DTS)	2021
Supply Contract-in-Force (CIF)	2021
Marine Route Survey	2021-2022
Cable Installation	2022-2024
Ready-for-service (RFS)	2025

1. Timeline assumes ship and other resource availabilities that are subject to revision at time of CIF.

