International High Capacity Connectivity through Submarine Cables

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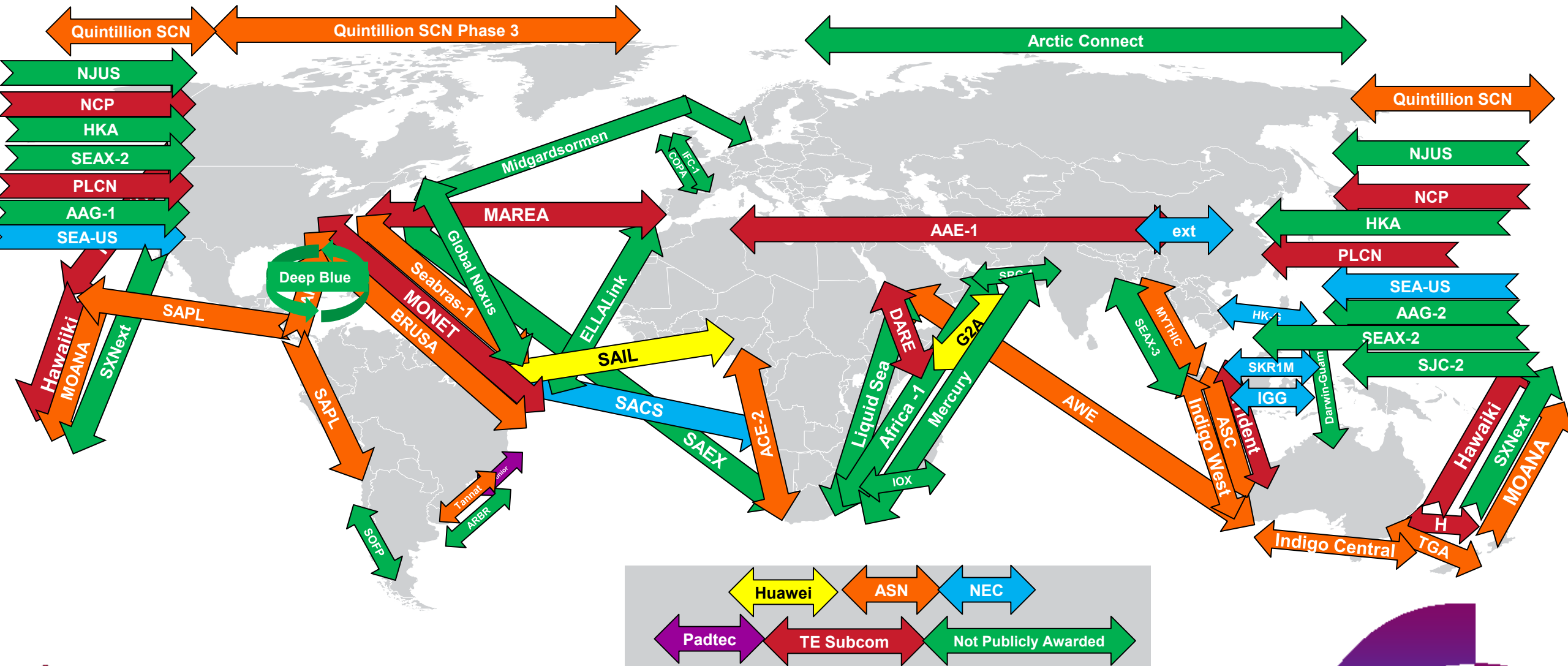Aug 2017

Simplified Submarine Cable Design
Where subsea meets terrestrial…

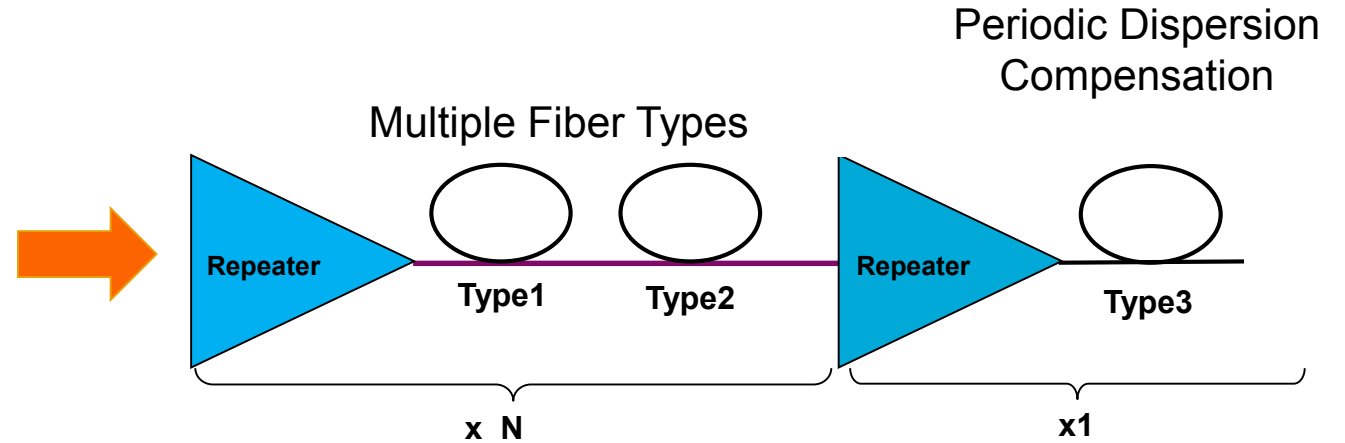# New Build Landscape
Predominantly D+ Cable Design

Simpler Networks
## Intelligent SLTE with D+ Cable Designs

Previous typical design

- Multiple fibre types
- Precise fiber design
- Complex Repairs

Multiple Fiber Types

Periodic Dispersion Compensation

Repeater Type1 Type2 Repeater Type3

x N x1

Coherent Optimised Designs

- Simplified fiber type
- Simple Repairs (single fiber type)
- 100G services and beyond

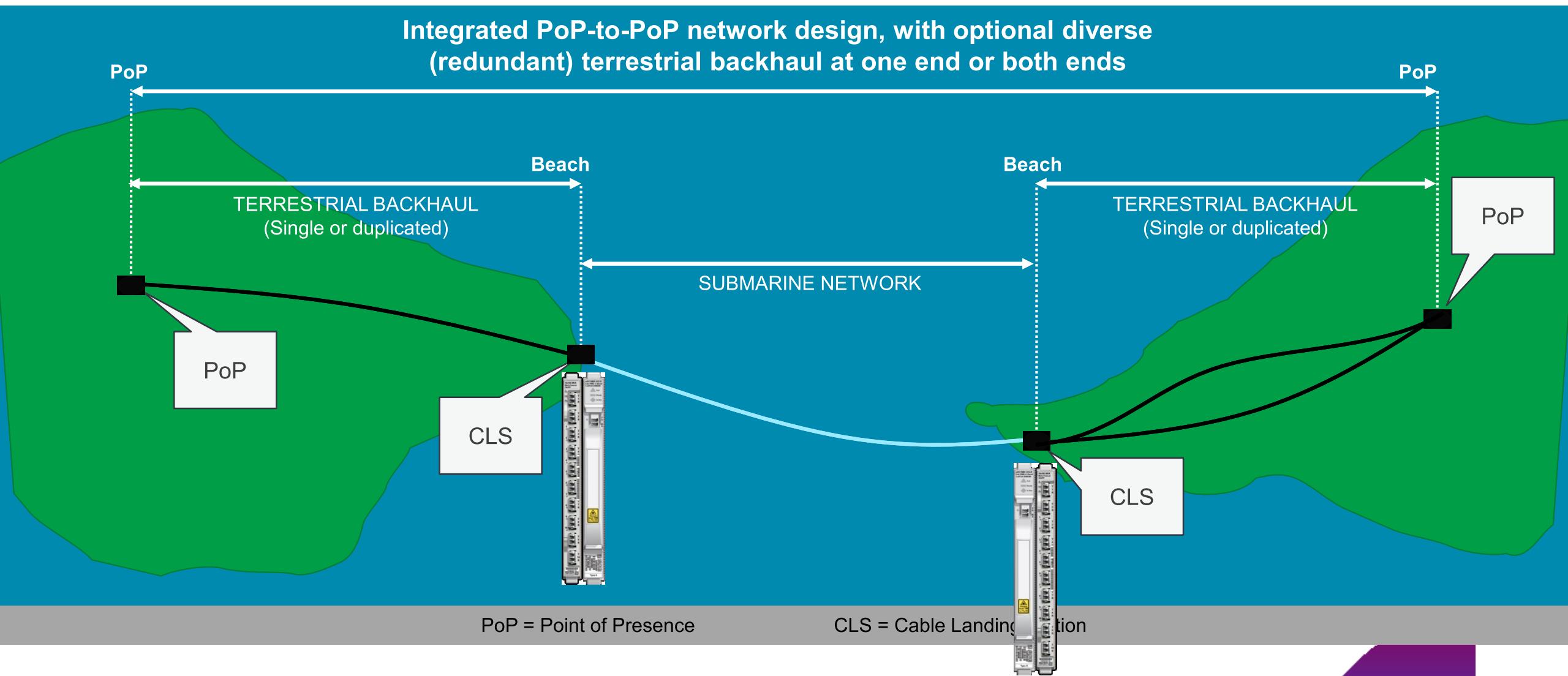1-Fiber Type

No Optical Compensation
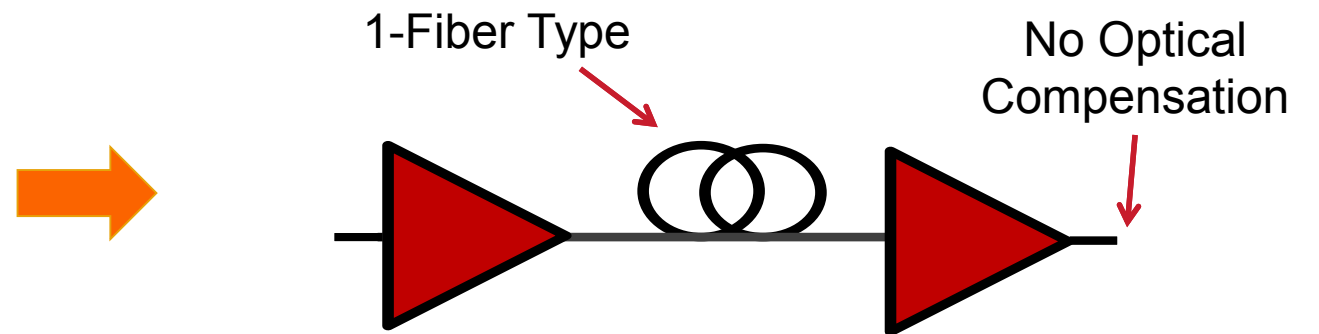
Geo Mesh for simplified Submarine Solutions

Submarine-Terrestrial Networks Demarcation Point

Simplifying the Cable Landing Station via GeoMesh
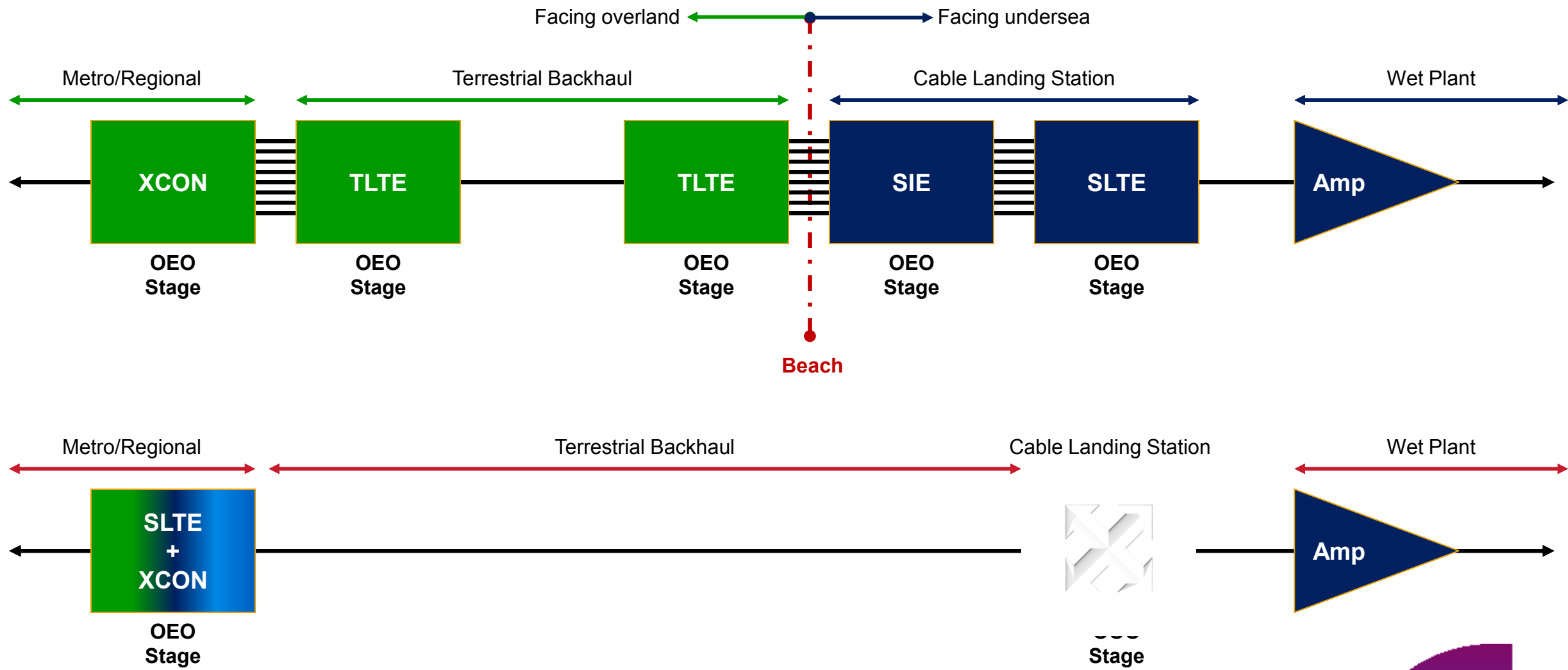
GeoMesh: POP-to-POP Connectivity

Integrated PoP-to-PoP network design, with optional diverse (redundant) terrestrial backhaul at one end or both ends

PoP

PoP

PoP

Beach

Beach

TERRESTRIAL BACKHAUL
(Single or duplicated)

TERRESTRIAL BACKHAUL
(Single or duplicated)

PoP

SUBMARINE NETWORK

PoP

CLS

CLS

PoP = Point of Presence

CLS = Cable Landing Station

GeoMesh Extreme
LAND SEA CLOUD NETWORKS UNITE

Photonic Cable Landing Station
Simplified "all optical" network design

Submarine SLTE ROADM

Power management channels added locally

Submarine SLTE ROADM

$\lambda_1 \cdots \lambda_n$

$\lambda_1 \cdots \lambda_n$

Terrestrial
Backhaul Route

Redundant Terrestrial
Backhaul Routes

Cost / Opex Reduction
Reliability Improvement

PoP

PoP

$\lambda_1 \cdots \lambda_n$

Submarine transponders are relocated
directly into the PoP

Removes four terrestrial backhaul
transponders for each inland wavelength

Submarine Tx/Rx

Submarine Tx/Rx

$\lambda_1 \cdots \lambda_n$

ciena. | GeoMesh Extreme
LAND SEA CLOUD NETWORKS UNITE.

Photonic Cable Landing Station
Express wavelength pass-through network design

Express Wavelengths

Submarine SLTE ROADM

Submarine SLTE ROADM

Submarine SLTE ROADM

λ_1 ▪▪▪ λ_n

0 to N wavelengths may be added/dropped at the intermediate station

Flexible wavelength routing between express and drop ports
No regeneration for express wavelengths
Fixed channel filters for connecting client ports
Power management added/dropped in both directions

Cost Reduction,
Latency Reduction,
& Improved Reliability

Geo Mesh
Customer examples

ciena. | **GeoMesh Extreme**
LAND SEA CLOUD NETWORKS UNITE.

AMX-1
Atlanta to Rio – without regeneration
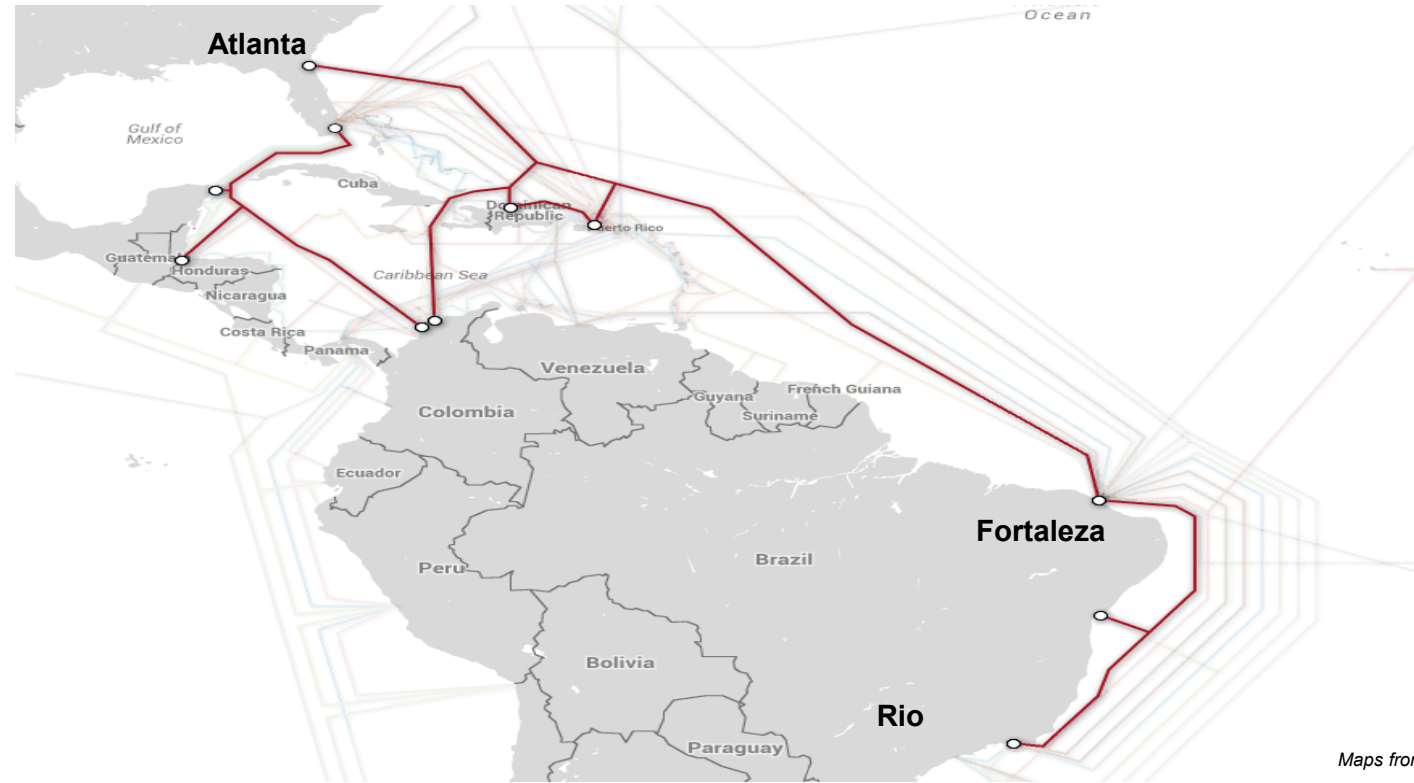
Maps from Telegeography

SLTE Upgrade Highlights

- Utilizing GeoMesh for terrestrial backhaul and optical bypass at two cable stations, AMX have achieved unregenerated distances >11,000km with Wavelogic 3 extreme QPSK modulation
- Over 250,000ps/nm of dispersion compensation within the DSP

Aquacomms and AEConnect
*Trans-Atlantic Pop – POP Solutions*

Upgrade Highlights

- NYC to Dublin and London un-regenerated with GeoMesh capabilities
- Terrestrials builds in NYC / Ireland and UK
- Solution includes Unified Management System / PinPoint Advanced Fibre Analytics / Layer 0 Control Plane.

Intelligent GeoMesh SLTE
Operational Savings

ciena. | GeoMesh Extreme

GeoMesh Networking

Rethink segmented network designs

PoP

Think Optimized End-End Network Design

PoP
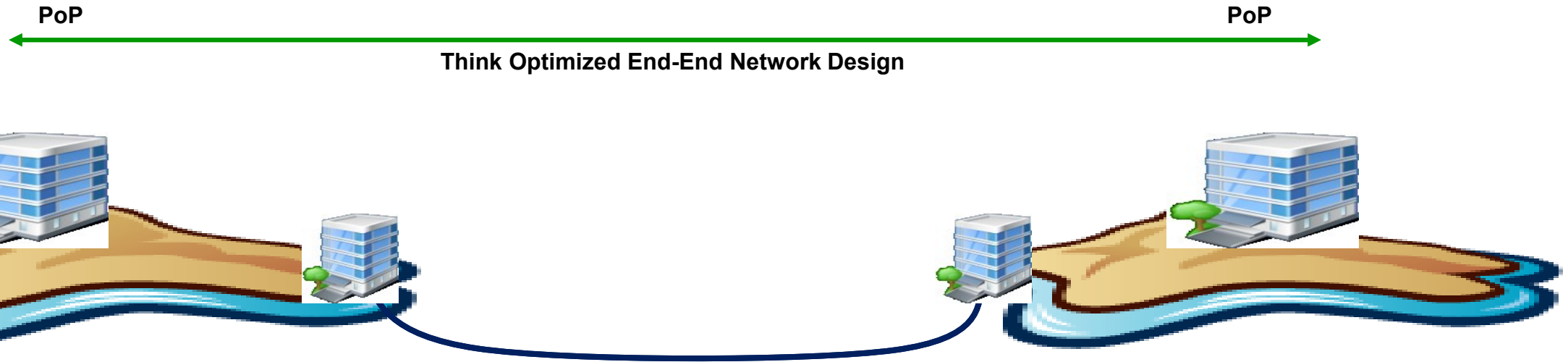
GeoMesh with Intelligent SLTE provides the following benefits:
- Optimised network infrastructure with reductions in power, space,
- simplified operations,
- Lower costs
- End-to-end service provisioning
- Improved traffic handoff between submarine networks and terrestrial networks
- Reduced latency by avoiding unnecessary optical-electrical conversion stages
- Improved network resiliency

ciena. | GeoMesh Extreme
LAND SEA CLOUD NETWORKS UNITE

Thank You

Intelligent SLTE
WaveLogic Ai

Integrated Test-set Capability (ITS)

A high level summary of the benefits of the Integrated Test Set are as follows:

➢ **Enables generating & monitoring of 10Gb/s & 100Gb/s traffic patterns**

➢ **Performed remotely from the Network Operations Center (NOC)**

➢ **Alleviates buying expensive test-sets**

➢ **Can be enabled on one or more client ports simultaneously**

➢ **ITS operations do not affect traffic on other client ports that are in service**

➢ **Each client port is treated as an individual test set and can be operated independently of other client ports**
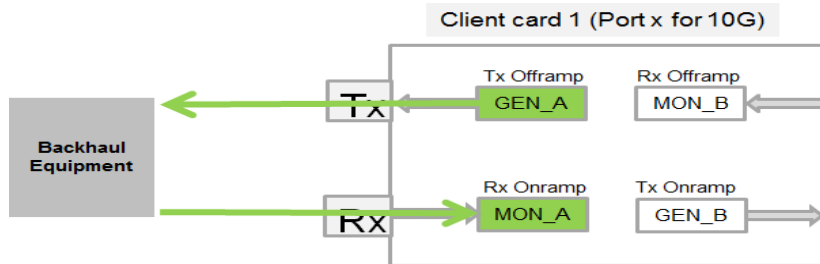
Test-Set Configuration
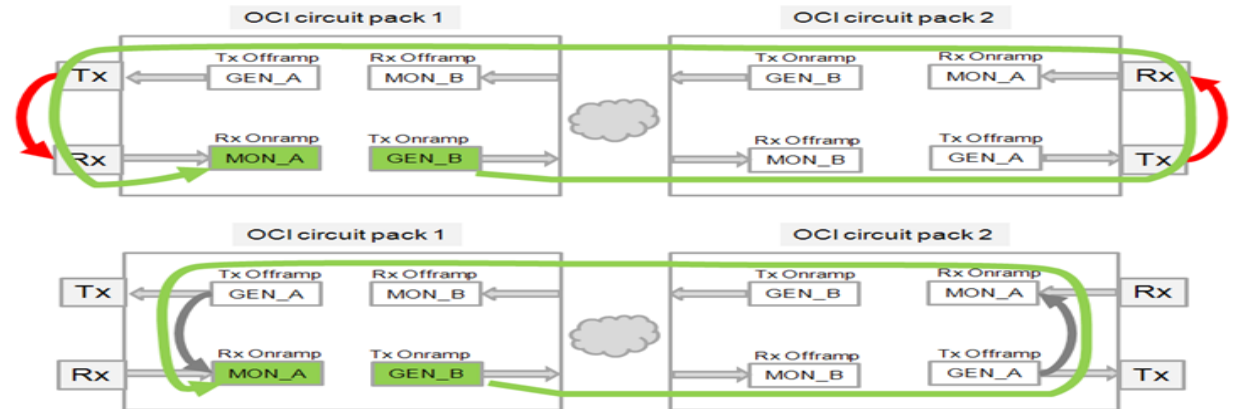
RaceTrack Configuration

Marine Pin-Point Break Identification

Loss of traffic detected on DLS by SLTE

C-OTDR run to identify failure point and cable distance

SLD database analysed to determine GPS coordinated of failure

GPS information sent to marine maintenance company

34.37035
137.0098

North
Pacific
Ocean