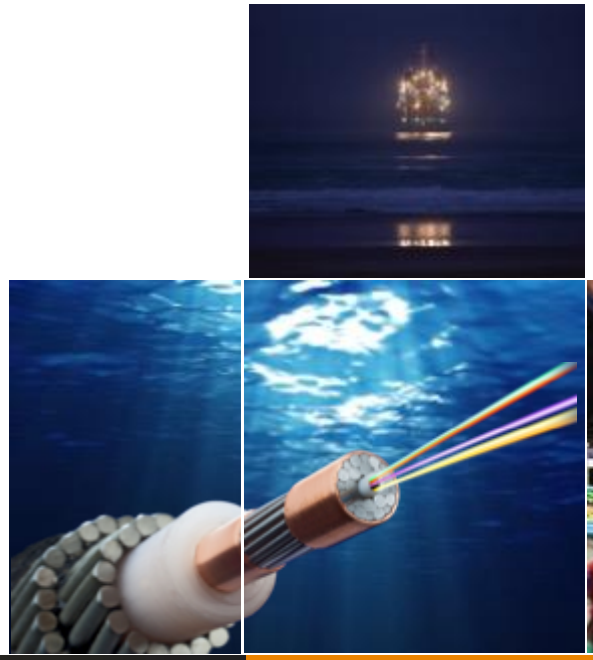

Regional Subsea Cable System in South East Asia Region

Herbert Xiong

Sept, 2017

Presentation Agenda

1. **South East Asia Subsea System Market Overview**
    a) Subsea System Market Structure
    b) Demand Growth Overview
    c) Historical & Forecast Traffic in South East Asia Region
2. **Regional Subsea System Drivers in South East Asia**
    a) Drivers overview of New Subsea Systems
    b) Regional Players Evolution
    c) Subsea Network New Considerations
    d) OBOR
    e) Regional Market Perspective and a 5-yr Outlook
3. **How Does Submarine Industry Embrace the Growth in SE Asia**
    a) How does Technology, Marine and Maintenance Meet the challenges
    b) Submarine Cable System Business Model
    c) TE SubCom
4. **Permits/Regulatory Challenges in SE Asia Market**
    a) Permit/ Regulatory Risks
    b) Geopolitical Risks
5. **Case Discussions**
6. **Summary**

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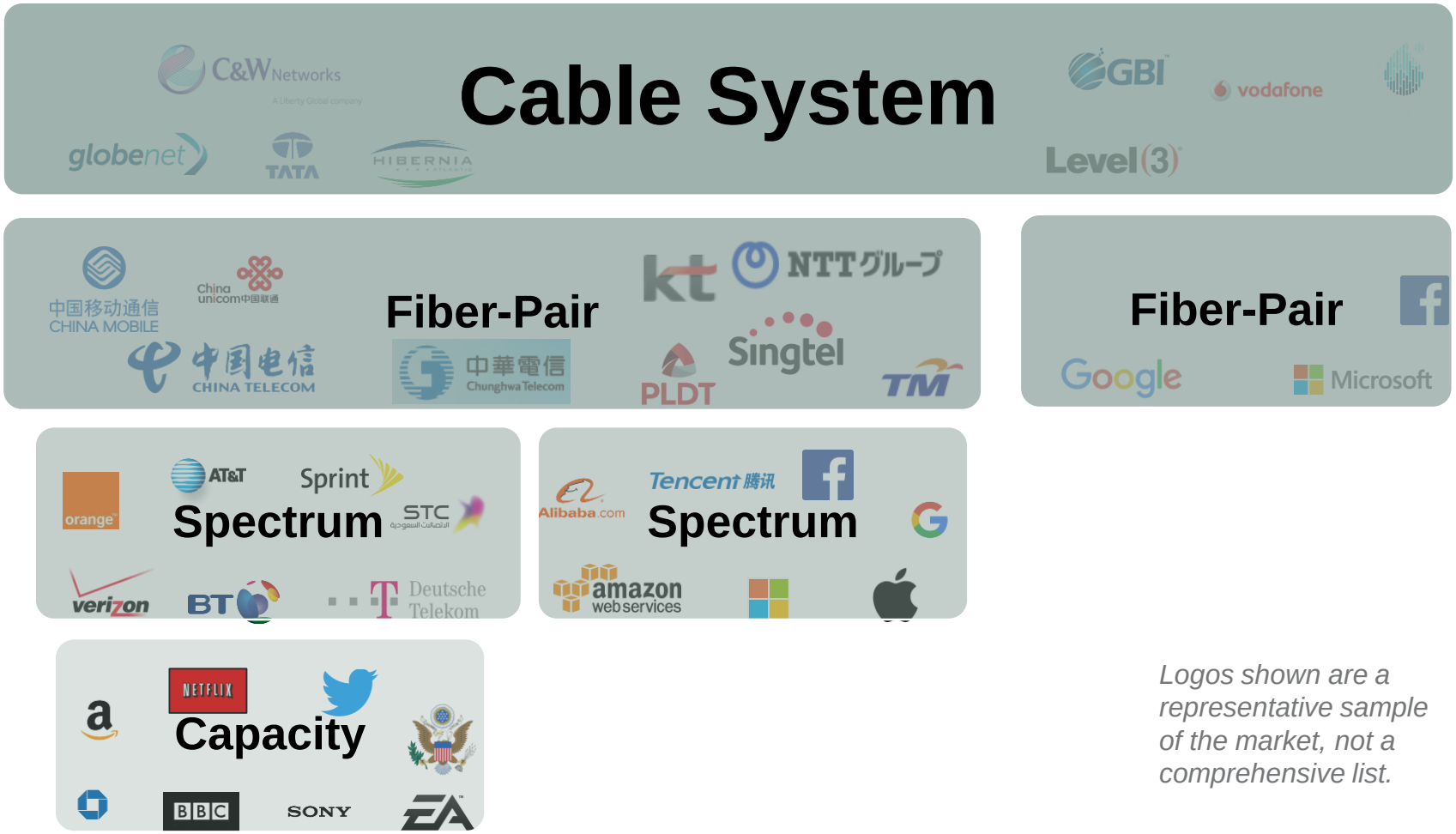
1. SE Asia Subsea System Market Overview

a) Market Structure

b) Demand Growth Overview

c) Historic and Forecast Traffic in SE Asia

Subsea System Market Today



Logos shown are a representative sample of the market, not a comprehensive list.

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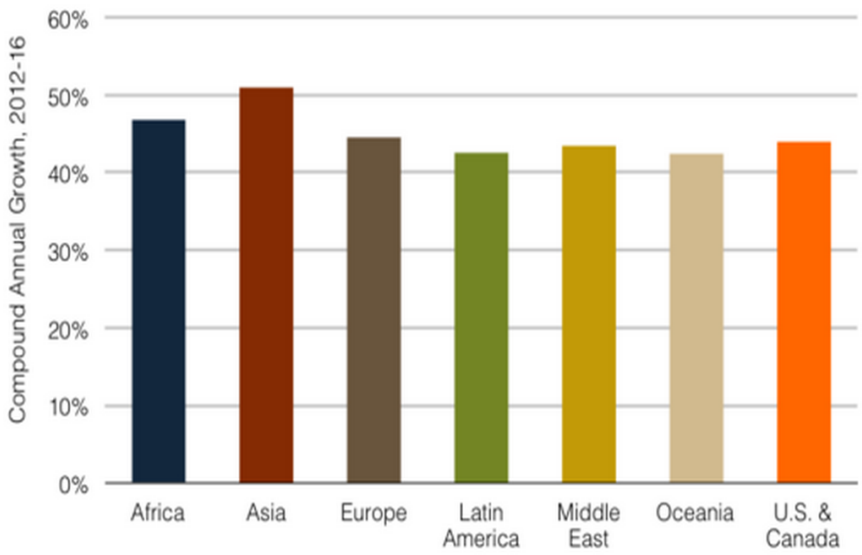
SE Asia Demand Growth Overview

- The Traffic Demands for Asia are explosive.
- Asia Demand Strong Growth will be beneficial to Every Players in industry: Content Provider, Cloud Service Provider, Infrastructure Supplier…
- Subsea is one of the beneficiaries for infrastructure.

Used International Bandwidth Growth by Region, 2012-2016



Notes: Data represent used bandwidth connected across international borders and excludes domestic bandwidth. The global total removes double counting of bandwidth between regions, such that the sum of all regions will not equal the global total.

Source: TeleGeography

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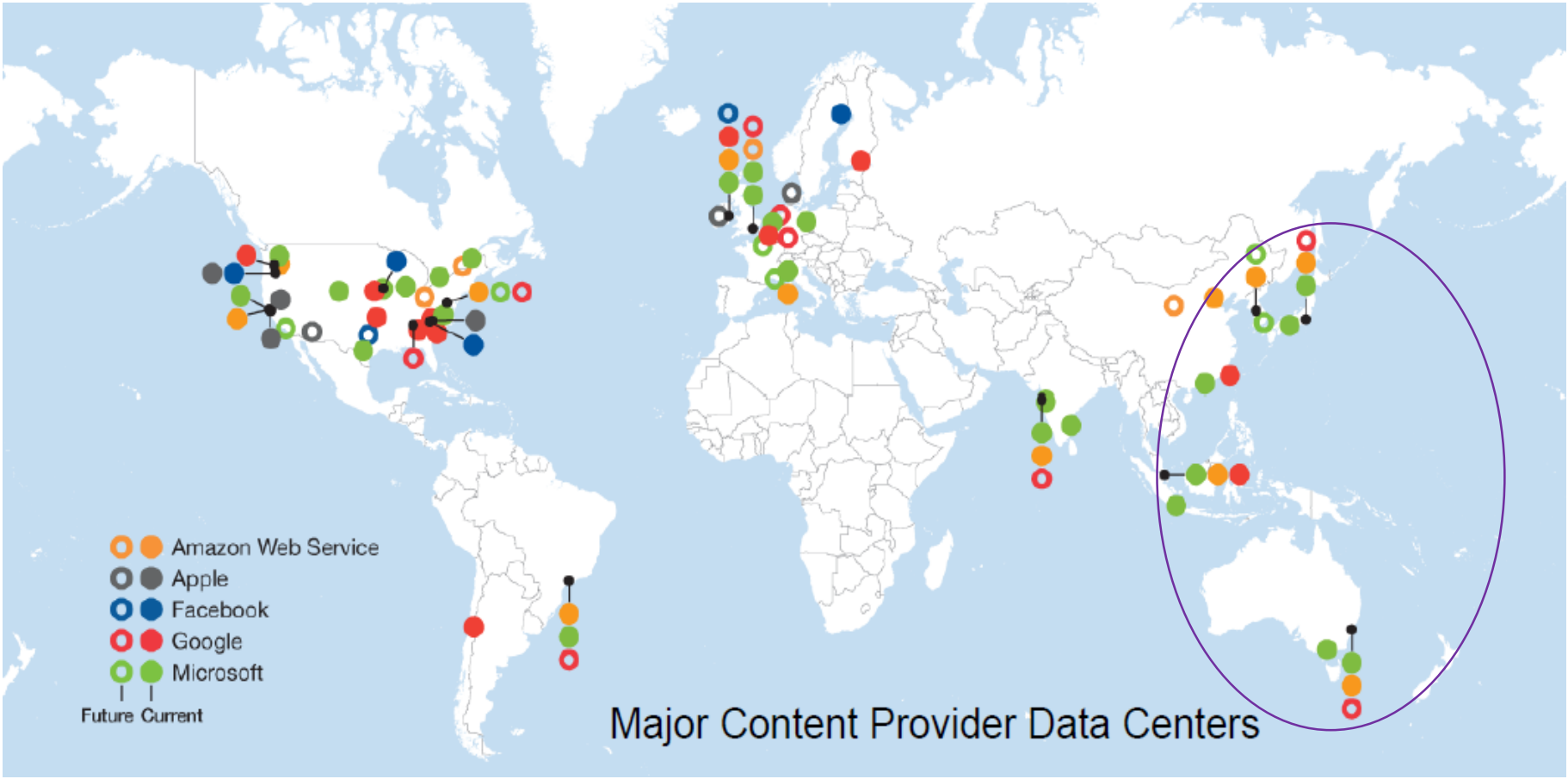
Emerging Cloud Building in SE Asia



Source: SNW 2016 Conference Paper

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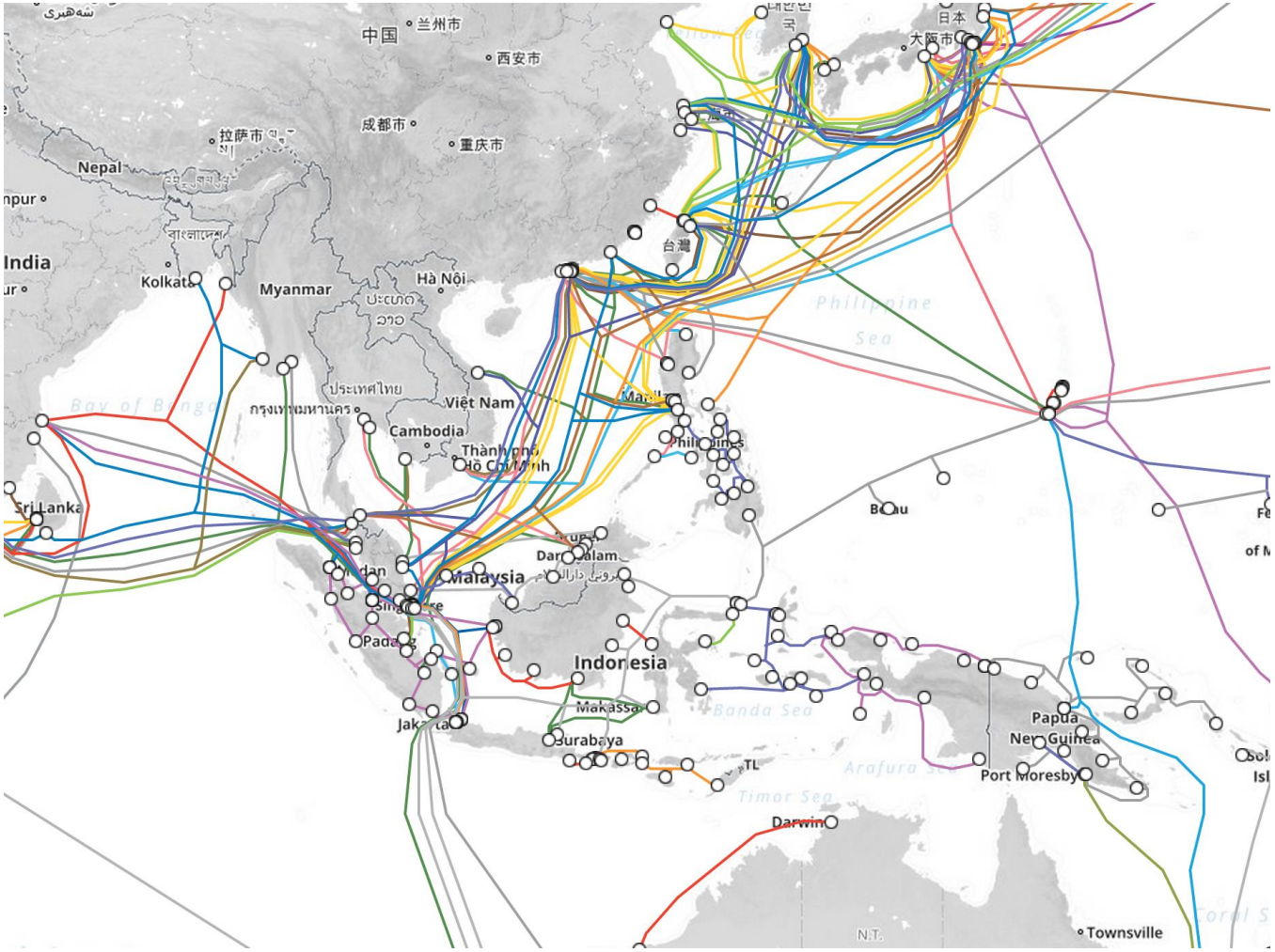
Current Submarine Cable Systems in Asia



Source: TeleGeography

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Historical Internet Traffic in Asia

International Internet Traffic by Region, 2012-2016 (Gbps)

	2012	2013	2014	2015	2016	Change 2012-13	Change 2013-14	Change 2014-15	Change 2015-16	CAGR 2012-16
Asia										
Internet Bandwidth	10,780	14,987	20,788	28,179	40,638	39%	39%	36%	44%	39%
Average Traffic	4,329	5,596	7,705	10,505	14,676	29%	38%	36%	40%	36%
Peak Traffic	6,057	8,749	11,775	16,106	22,352	44%	35%	37%	39%	39%
Average Utilization	40%	37%	37%	37%	36%	-7%	-1%	1%	-3%	-3%
Peak Utilization	56%	58%	57%	57%	55%	4%	-3%	1%	-4%	-1%

Notes: Data reflect traffic over Internet bandwidth connected across international borders including links within the region. Data as of mid-year.
Source: TeleGeography

The International Internet Traffic grew steadily in past 5 years.

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International Bandwidth Usage by Countries & Regions

International Bandwidth Usage for Asian Countries, 2012-2016 (Gbps)

	2012	2013	2014	2015	2016	2012-16 CAGR
Bangladesh	25	43	85	157	266	81%
Brunei	5	7	12	20	33	64%
Cambodia	8	13	60	127	204	126%
China	5,507	8,455	13,028	18,306	26,497	48%
Hong Kong	2,886	4,647	7,945	11,937	18,217	59%
India	1,091	1,448	2,082	3,155	5,510	50%
Indonesia	336	545	824	1,240	1,802	52%
Japan	4,783	7,256	10,932	15,375	22,736	48%
Korea, Rep.	960	1,325	1,902	2,715	3,915	42%
Laos	5	7	11	15	22	47%
Malaysia	728	1,082	1,550	2,301	3,877	52%
Pakistan	156	221	339	540	715	46%
Philippines	378	482	571	831	980	27%
Singapore	3,272	6,104	9,588	14,876	24,211	65%
Sri Lanka	37	60	89	126	172	46%
Taiwan	1,683	3,006	4,744	7,074	10,612	58%
Thailand	323	751	1,030	1,574	3,134	77%
Vietnam	354	471	852	1,293	2,042	55%

Source:TeleGeography

- **Impressive Overall Growth in past 5 years**
- **Wide variations in the pace of demand growth**

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A Mix of Mature and Developing markets in Asia

The Asia region has a unique mix of both mature and developing markets, with wide variations in the pace of demand growth.

Several countries in East Asia have had ample bandwidth for quite some time, with South Korea, Japan, and Taiwan all having multiple submarine cable connections since the 1990s, while some South Asian countries still have very limited international connectivity.

Upcoming years will bring more connectivity to these historically under-connected locations. For example, Cambodia began 2016 with no cable connections, but will be connected to two by the end of 2017.

Huge Potential Connectivity Demands will bring Opportunities for not only the Infrastructure Supplier but also to the Service Providers

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International Internet & IP Traffic Forecasts

International Internet Bandwidth (Gbps)

	Forecasts							CAGR
	2017	2018	2019	2020	2021	2022	2023	2016-23
Africa	5,688	8,414	12,178	17,358	24,378	34,240	47,986	44%
Asia	55,903	75,151	100,274	131,728	171,569	221,646	285,918	32%
Europe	225,425	295,003	382,689	493,087	631,605	807,364	1,030,841	29%
Latin America	36,700	48,698	63,515	82,988	108,330	141,215	184,031	31%
Middle East	18,464	25,740	35,539	48,441	63,007	81,553	105,470	35%
Oceania	3,025	3,791	4,832	6,150	7,824	9,945	12,453	27%
U.S. & Canada	79,072	101,344	128,413	162,879	206,578	261,241	330,420	28%
Global Total	*318,306*	*418,333*	*544,562*	*703,737*	*904,409*	*1,159,656*	*1,485,184*	*30%*

Source: TeleGeography

Total IP Transit Traffic (Gbps)

	Forecast						CAGR
Country	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**'16-'22**
Africa	3,427	4,286	5,300	6,499	7,912	9,640	24.8%
Asia	41,297	52,252	65,524	81,225	100,394	123,805	25.4%
Europe	86,119	109,589	138,464	173,980	217,117	271,127	26.9%
Latin America	22,403	28,329	35,505	44,201	54,699	67,727	26.1%
Middle East	9,871	11,812	14,041	16,619	19,595	23,121	19.6%
Oceania	1,258	1,611	2,044	2,579	3,243	4,073	21.1%
U.S. & Canada	82,893	109,556	143,334	186,375	240,737	310,735	30.8%
Global Total	*247,269*	*317,435*	*404,213*	*511,478*	*643,696*	*810,227*	*27.6%*

Source: TeleGeography

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Bandwidth of Subsea Cable Forecasts

Used Bandwidth by Submarine Cable Route (Gbps)

	Forecasts							CAGR
	2017	2018	2019	2020	2021	2022	2023	2016-23
Trans-Atlantic	101,977	155,139	237,351	361,192	545,442	815,775	1,206,610	55%
Trans-Pacific	46,944	69,992	105,617	158,845	237,336	350,388	511,601	39%
Intra-Asia	49,828	72,204	105,990	158,283	238,515	355,161	521,936	44%
US-Latin America	33,817	46,960	64,514	89,431	124,156	172,181	238,282	44%
Europe-Middle East & Egypt	9,108	12,987	18,338	25,666	33,932	44,764	59,001	50%
Europe-Asia	8,979	13,035	18,774	26,703	37,522	51,820	71,436	81%
Europe-Sub-Saharan Africa	2,533	3,825	5,689	8,324	12,044	17,385	24,914	46%

Source: TeleGeography

- New cables largely reflect traditional consortium arrangements of regional carriers, satisfying internal needs for capacity and participating in the wholesale market.
- Backbone bandwidth requirement will drive regional subsea cable system opportunities.

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Source TeleGeograhpy: Planned Cables in Asia & Trans-Pacific

Planned Cables

Region/Cable Name	Owner(s)	Length	Capacity (Initial/Potential)	Landing Countries
South Atlantic Express (SAEx)	SAEx International Ltd.	13,050	n.a./48 Tbps	South Africa, United States
Asia				
Myanmar-Thailand Interconnect Cable (MYTHIC)	Campana Group	1,400	n.a./20 Tbps	Myanmar, Thailand
Sistem Kabel Rakyat 1Malaysia (SKR1M)	Telekom Malaysia	3,800	4 Tbps/12.8 Tbps	Malaysia
Sea Cable Exchange-1 (SeaX-1)	Super Sea Cable Networks	250	n.a./364.8 Tbps	Indonesia, Malaysia, Singapore
Indonesia Global Gateway (IGG) System	Telkom Indonesia	5,300	n.a./32 Tbps	Indonesia, Singapore
PNG National Submarine Fibre Cable Network	PNG DataCo.	5,457	n.a./8 Tbps	Indonesia, Papua New Guinea
Palapa Ring System	Indonesian Government	35,000	n.a.	Indonesia, Singapore
Port Blair-Chennai	BSNL	n.a.	n.a.	India
Hong Kong-Guam (HK-G)	RTI Connectivity	3,900	n.a./48 Tbps	China (Hong Kong), Guam
Trans-Pacific				
SEA-US	Consortium	15,000	n.a./20 Tbps	Guam, Indonesia, Micronesia, Palau, Philippines, United States
New Cross Pacific (NCP) Cable System	Consortium	13,618	n.a./81.9 Tbps	China, Korea, Rep., Japan, Taiwan, United States
Pacific Light Cable Network	Facebook, Google, Pacific Light Data Communication	13,000	n.a./144 Tbps	China (Hong Kong), Philippines, Taiwan, United States
Sea Cable Exchange-2 (SeaX-2)	Super Sea Cable Networks	16,000	n.a.	Indonesia, Malaysia, Singapore, United States

Notes: Cables included may or may not have supply contracts signed or in force. Not all cables listed may be constructed.
Source: TeleGeography

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2. Regional Subsea System Drivers in South East Asia

a) Drivers overview of New Subsea Systems

b) Regional Players Evolution

c) Subsea Networking New Considerations

- Diversity Connectivity Resiliency

d) Geopolitical Example OBOR

e) Regional Market Perspective and a 5-yr Outlook

Drivers of New Subsea Systems

System Age & Reliability

- Turn-of-the-millennia systems surviving due to upgrades, however ageing

International Capacity Profile Changing

- Driven by content providers (such as OTT) into their own private networks nearer the edge

Emergence of New Global Network and Data Center Builders

- Consumer traffic consolidating onto mega-content networks
- Data flows driving architecture for key subsea routes

Need for Ownership Economics

- For those new but high volume operators without owned infrastructure

Current investment in core trunks will drive regional builds

Geopolitical Policy in SE Asia Region

- Example: China OBOR

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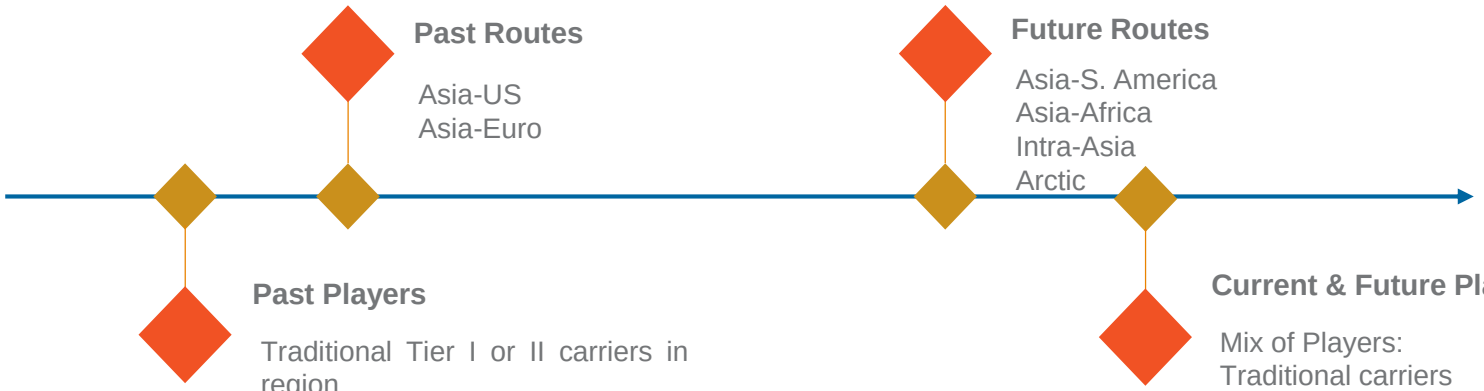
Regional Players & Routes Evolution



Past Routes

Asia-US
Asia-Euro

Future Routes

Asia-S. America
Asia-Africa
Intra-Asia
Arctic

Past Players

Traditional Tier I or II carriers in region

Current & Future Players

Mix of Players:
Traditional carriers
OTTs are joining: FB, Google, Microsoft
Private Investment Entities

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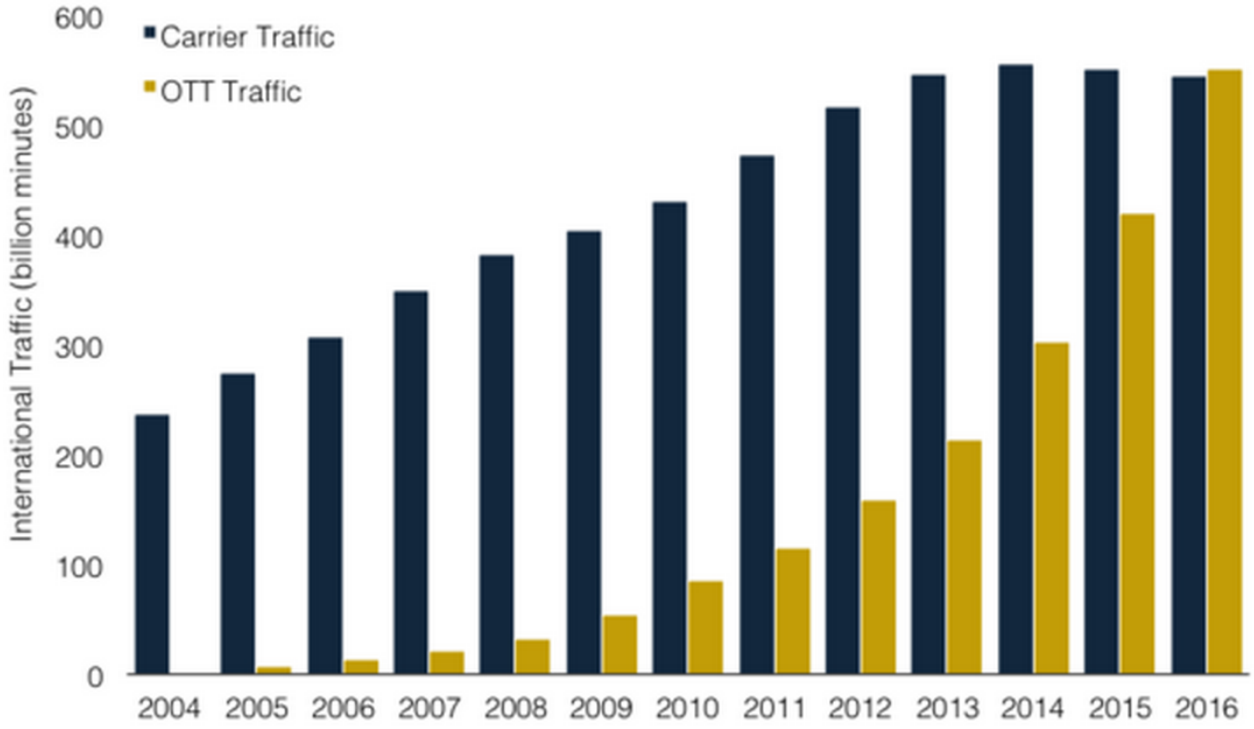
International Carrier & OTT Traffic

FIGURE 3

International Carrier and OTT Traffic, 2004-2016



Notes: OTT traffic reflects in-app cross-border traffic only, and excludes calls originated on apps but terminated to the PSTN.

Source: TeleGeography

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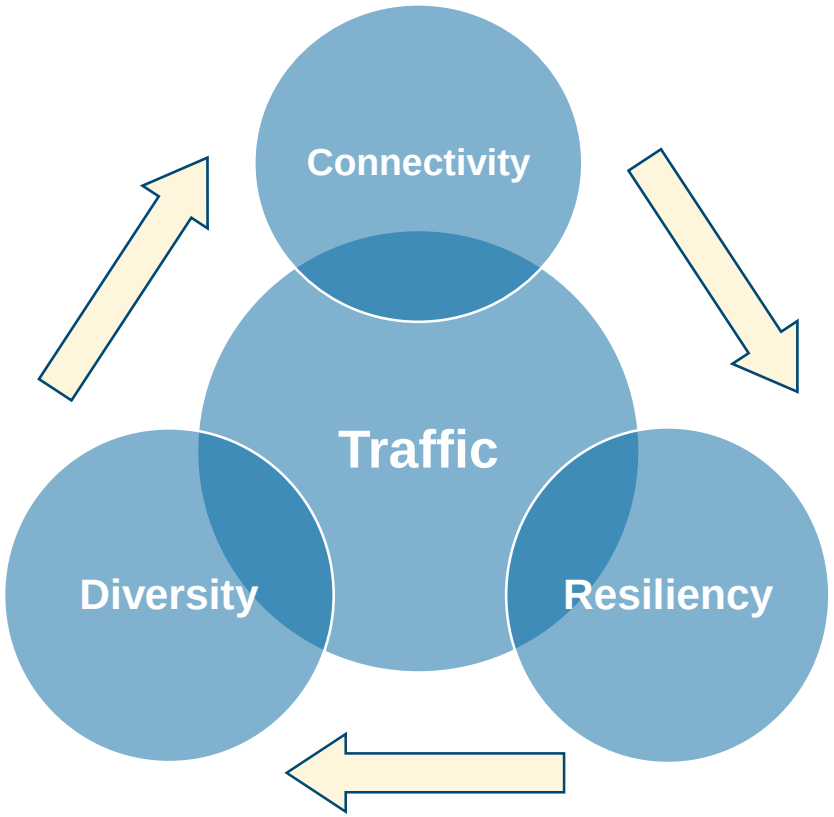
Subsea Network New Considerations



- Traffic is the fundamental driver for Submarine Cable system.
- With the demand of new business, such as Video, Social Networking, Cloud Storage and etc., the business model of Subsea is evolving.
- Resiliency is built upon the dynamic of Diversity & Connectivity.

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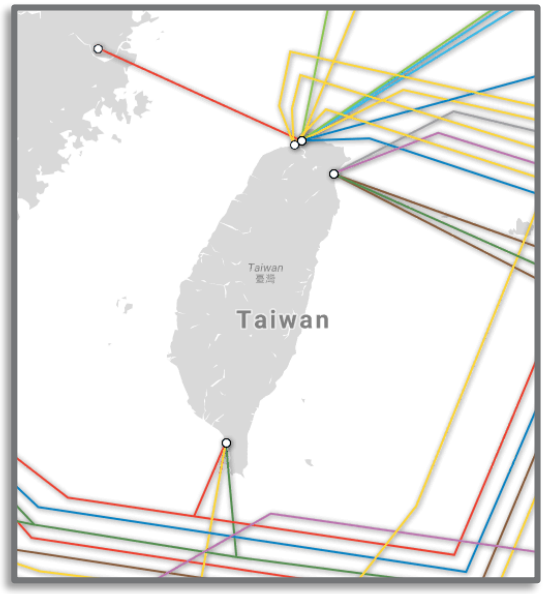
Diversity



Example:
Taiwan – Earthquakes in 2006 and 2007 severed multiple cables south of the island

Having alternative cable routes is critical to protect against:

Naturally occurring hazards

- Earthquakes
- Landslides

Accidental acts of aggression

- Fishing and trawling
- Anchor dragging

Deliberate acts of aggression

- Sabotage or attack

Political unrest

- Regime changes

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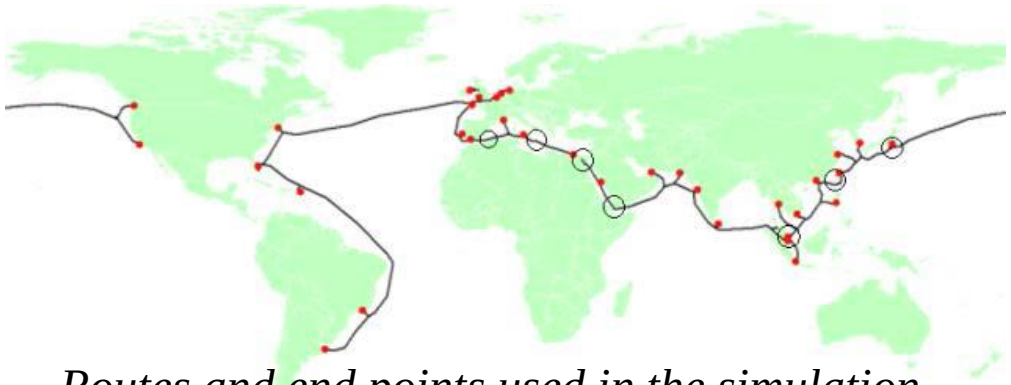
Needs for Route Diversity

	Repairs per Year	Outage (days/year)
Philippines-Taiwan	2.7	42.8
Singapore-Hong Kong	2.6	45.5
Hong Kong-Tokyo	2.1	37.8
Mumbai-Singapore	1.0	26.6
Tokyo-Los Angeles	0.5	8.4

Source: Palmer-Felgate, A., and Booi, P., How Resilient is the Global Submarine Cable Network? SubOptic 2016 #OralWE2A-5



Routes and end points used in the simulation.

- It indicates that cables in regions with expansive shallow seas tend to be less reliable than cables elsewhere, irrespective of their length.
- This is predominantly due to heightened risk from human activities such as fishing and anchoring.

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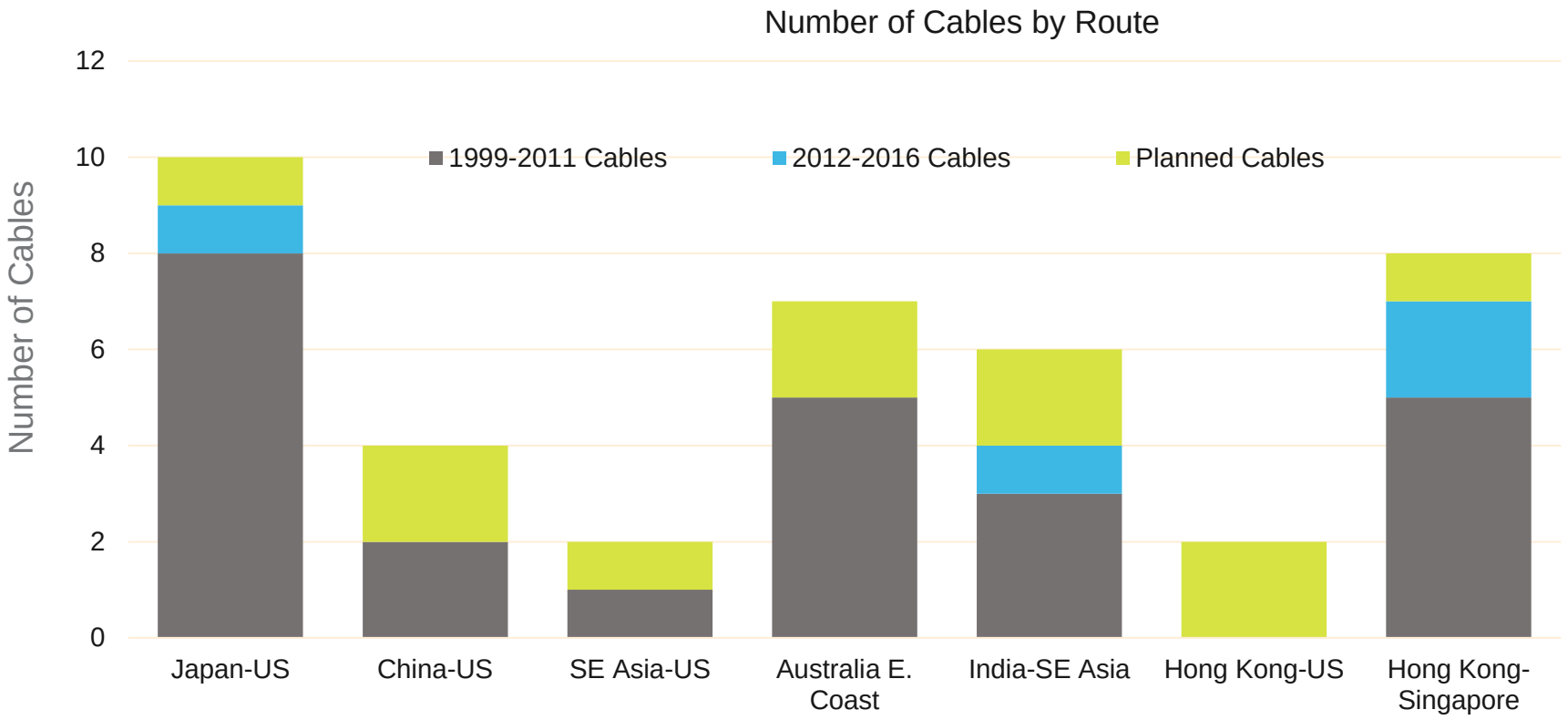
Not All Routes are Created Equal



- Some routes like Japan-US, Hong Kong-Singapore have more connectivity.
- SE Asia-US, China-US, Hong Kong-US has fewer connections.
- Fewer connectivity routes drive More Planned cables.

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From Connectivity to Resiliency

No More Chokepoints

- Competitive connectivity builds pathways to meet demand
- Mesh network to provide robust network security

Abundance and Stability

- Complexity of OTT's business models
- Sometimes, stability is even more important than latency

Resilient Network

- Through complex connectivity, to provide available alternatives for network backup solutions
- Resiliency can be achieved either Physically Or Logically

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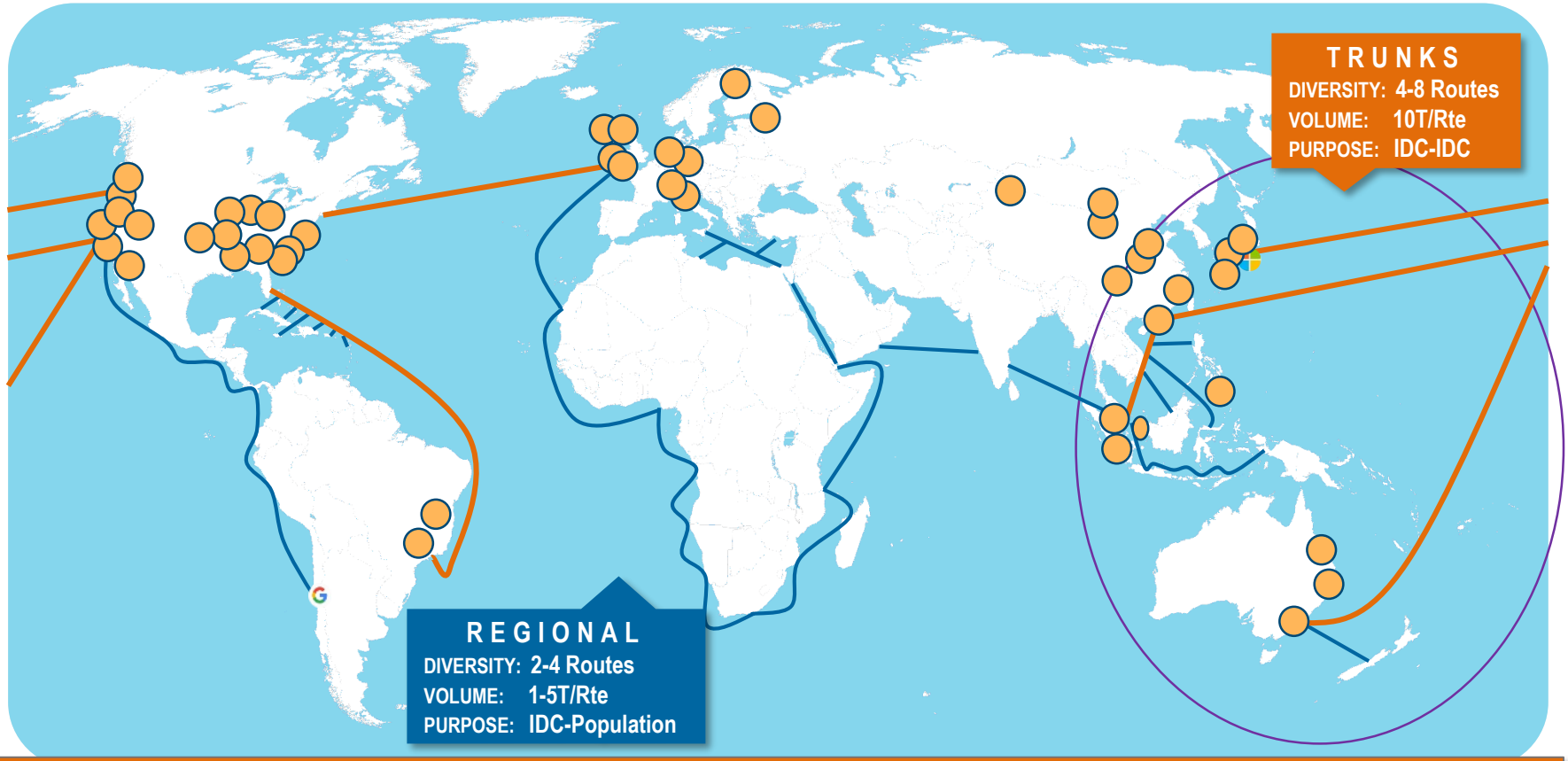
Trunk Investment will drive regional builds



Current investment in core trunks will drive regional builds

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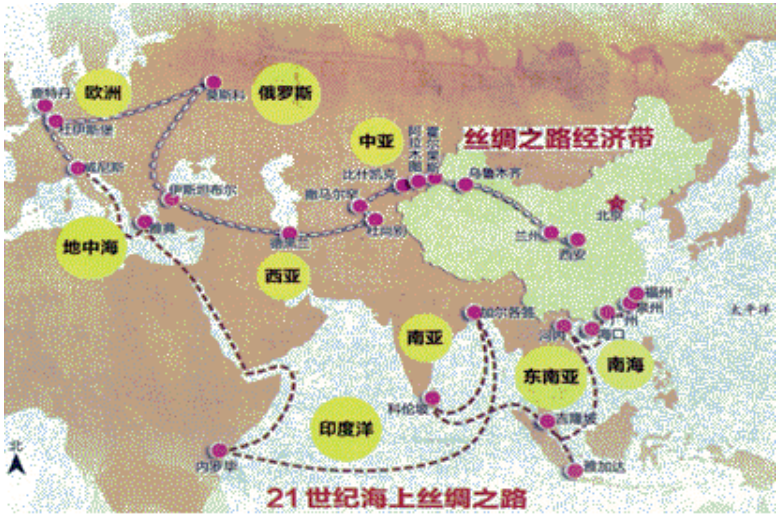
Geopolitical Strategy Example: OBOR

-- One of the Regional Drivers



The Silk Road Economic Belt and the 21st-century Maritime Silk Road, also known as One Belt, One Road (or “OBOR”) is a development strategy and framework, proposed by the Chinese paramount leader Xi Jinping.

OBOR focuses on connectivity and cooperation among countries primarily between the China and the rest of Eurasia, which consists of two main components, the land-based "Silk Road Economic Belt" (SREB) and oceangoing "Maritime Silk Road" (MSR).

OBOR strategic concept was established in 2013.

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How Do Regional Subsea Systems Benefit from OBOR?

Funding Support

- Some potential regional projects are most likely lacking funding (sponsored by Tier 2 or Tier 3 carriers);
- Chinese OBOR fund, such as “Silk Road Fund”, or funding from the Export-Import Bank of China is willing to support these projects.

Government Cooperation Geopolitically

- Governmental Cooperation to support Fund/Permits/Regulatory
- State Owned Telecoms in China, CM, CT and CU have motivations to join

SE Asia Pacific is significant Portion of OBOR Route

- Population Density
- Huge Traffic Demands

Potentially ~$2BN of new cable system builds over 5 years connected to the OBOR strategy

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Market Perspective

Market is Growing Steadily

- The suppliers order books are filling up:
  - *Many Projects In Asia region are under constructions*
- Project schedules will push out due to market supply limitations
- OTTs are very actively involved with Subsea investment
- High activity trending for next 3-4 years; cyclical nature of the industry

Access to Fiber Ownership Economics

- Direct investment provides access to cost based economics on a FP basis
- Ability to leverage next generation transmission technology with D+ fibers
- However projects need sponsorship to succeed:
  - Others are leading, promoting, sponsoring, developing
  - Entrepreneur developers suffering due to project finance constraints
  - Reducing IRU / Lease type options

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AP 5-yr Outlook (Beyond FY18)

- New JPN-US: Likely replacement system to supplement NJUS/Faster
- New China-US: replacement of China-US and supplementary to TPE/NCP
- New Asia-Europe: new planning after SMW-5/AAE-1 PNA
- SE Asia-China: new route to connect two population centers
- Potential “One Belt, One Route” (OBOR) related projects

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3. How Does Submarine Industry Embrace the Growth in SE Asia

a) How does Technology, Marine and Maintenance Meet the challenges

- Submarine System Introduction: Major System Components, Typical Scope of Marine Service
- Open Cable Concept
- New Technologies: WSS ROADM & C+L
- Marine Solutions
- C&MA and Maintenance Solutions

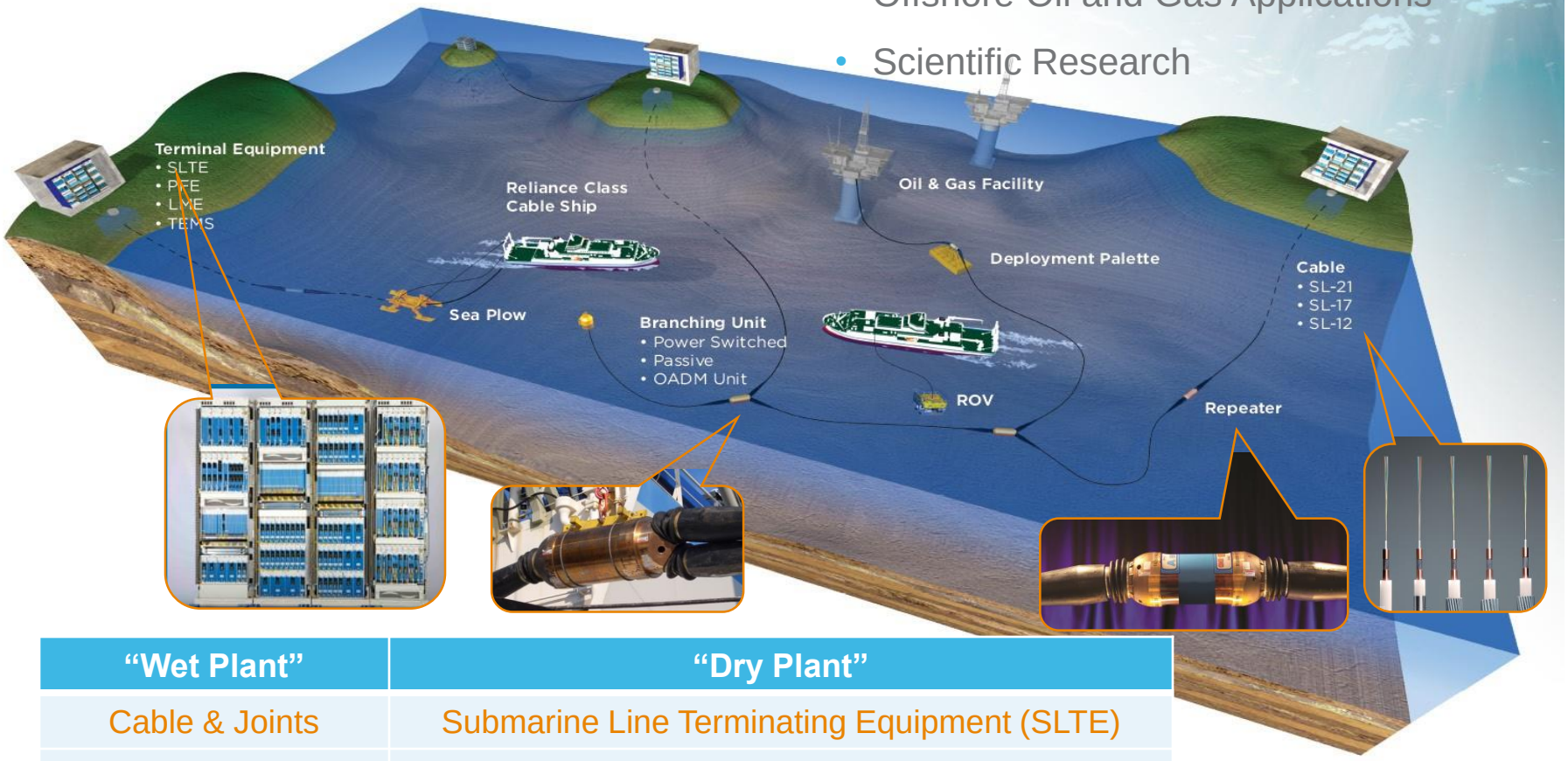
b) Submarine Cable System Business Model

- Consortium
- Private

c) TE SubCom

Major System Components

- Repeatered, Repeaterless and Upgrade Telecommunications Solutions
- Offshore Oil and Gas Applications
- Scientific Research



"Wet Plant"	"Dry Plant"
Cable & Joints	Submarine Line Terminating Equipment (SLTE)
Repeaters	Power Feed Equipment (PFE)
Branching Units	Management Systems

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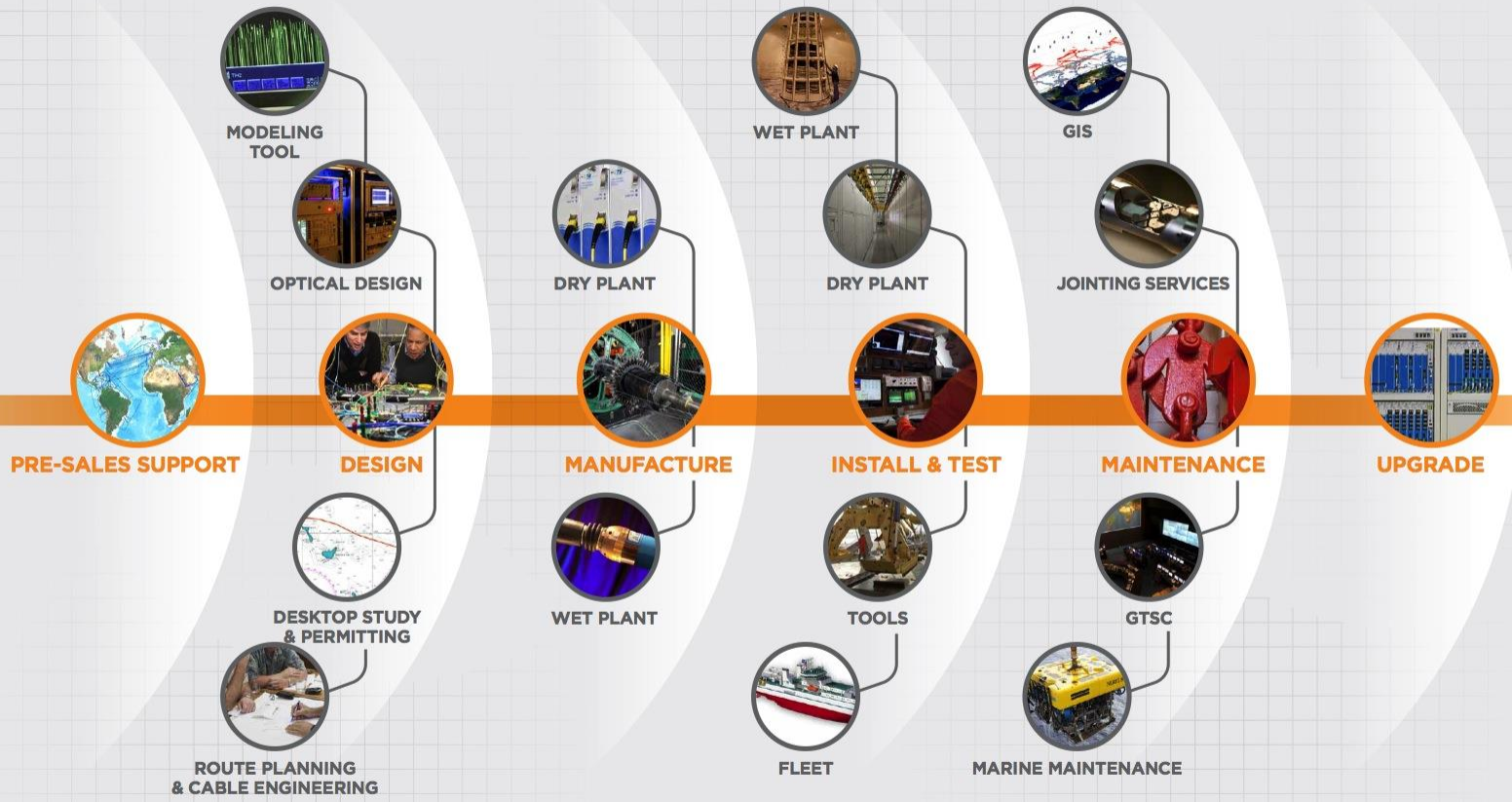
Undersea Cable Process – Standard Scope



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Typical Scope of Marine Services

Marine Project Coordination

Permitting
Marine Documentation

Desktop Study
Cable Route Survey

Marine Liaison
Fisheries

Environmental
Health and Safety

CLS — BMH — BMH — CLS

Terrestrial
- ✓ land cable
- ✓ ocean ground
- ✓ station splice
- ✓ OSP construction

Pre-Laid Shore End
- ✓ shallow water vessel
- ✓ route clearance
- ✓ cable lay
- ✓ cable burial
- ✓ split pipe

Main Lay
- ✓ cable loading
- ✓ route clearance
- ✓ cable burial
- ✓ surface lay
- ✓ ROV Inspection / Burial

Direct Landing
- ✓ cable landing
- ✓ beach splice
- ✓ cable positioning
- ✓ diver burial
- ✓ split pipe

Terminal
- ✓ terminal installation

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TE connectivity SUBCOM

The What, Why and How of Open Cables

What?

- Separating the purchase of Line Cards from the initial purchase of the cable system

Why?

- Open Cables allow the decision on line cards to be made in the later part of the project cycle.
  - Line Card technology cycles are two years and line card improvements across the industry appear every 18 months
- Allows a more flexible solution where desired by the purchaser
- Allows our customers a multi-vendor supplier base for transponders
- Choice of submarine equipment supplier consistent with customer's terrestrial networks
  - Operations, Training, Sourcing, Software Control

How?

- A commercial framework to allow the separation of Line Card purchasing from the system performance / acceptance process
- Specifications for acceptance, and sharing of key wet plant parameters as needed for planning the dry plant
- New acceptance test procedures and industry wide standards being considered

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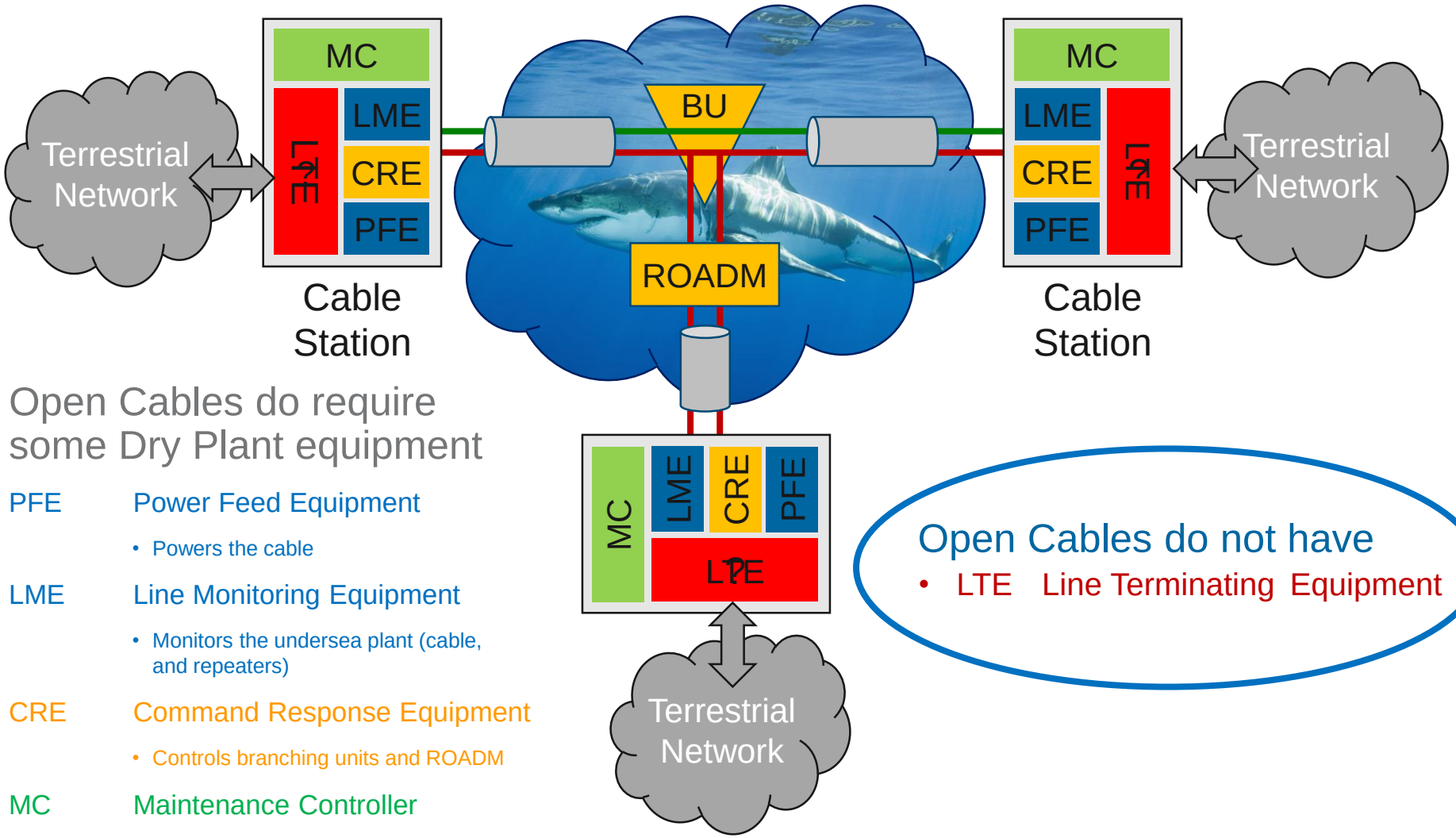
Basic Open Cable Network Architecture



Open Cables do require some Dry Plant equipment

PFE Power Feed Equipment
- Powers the cable

LME Line Monitoring Equipment
- Monitors the undersea plant (cable, and repeaters)

CRE Command Response Equipment
- Controls branching units and ROADM

MC Maintenance Controller
- Element management system

Open Cables do not have
- LTE Line Terminating Equipment

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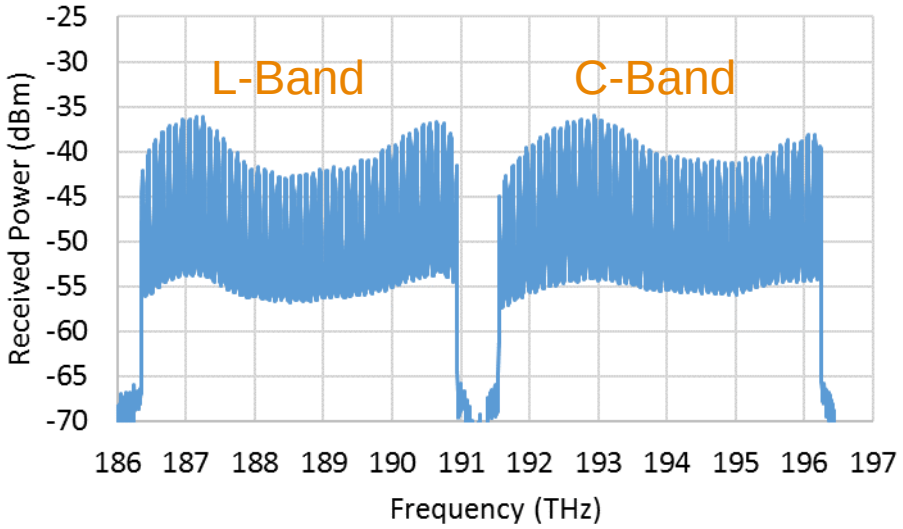
Key Technology Leadership

C+L Technology

First to market **doubling** transmission capacity per fiber

Enabling huge cable capacity while **decreasing $/bit**

Gives ICPs **optionality**

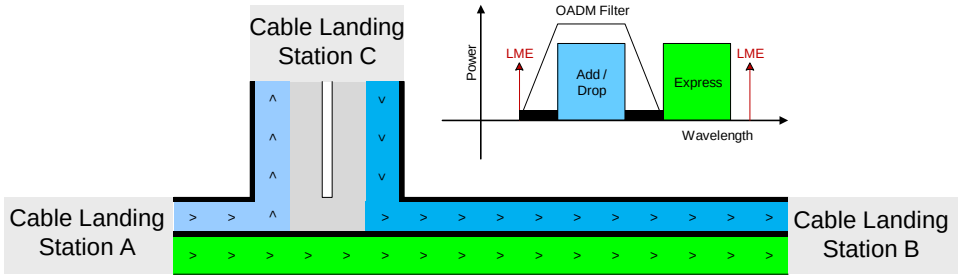


WSS ROADM

First to offer fully programmable **optionality** of network design

Flexibility solves future demand uncertainties; **“futureproofs”**

Optimizes asset utilization for maximum ROI



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Marine Solution 1 – Main Lay Vessel

Route Clearance

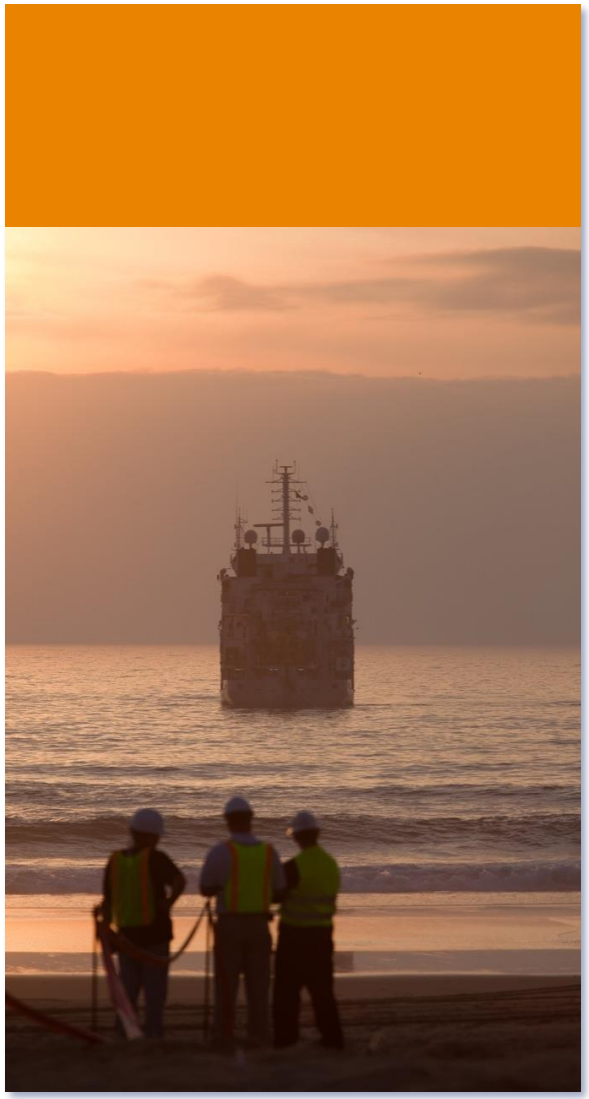
– Clears out-of-service cables
– Reduces risk to burial equipment
– Accommodates future maintenance activity

Main Lay & Burial

– Cable loading
– Cable installation
– Slack to cover seabed contours
– Burial to address fishing & anchors
– Splicing and Testing

Post Lay Inspection & Burial

– Supplements the sea plow burial
– Verifies the installation



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Marine Solution 2 – Landing and Terrestrial

Shore End & Terrestrial

- Shallow water installation
- Cable landing operations
- Land cable installation
- Ocean ground bed installation
- Station cable terminations

Terminal Installation

- Station layout
- PFE installation
- SLTE installation
- ODF installation
- Fiber Guide installation
- Power and data cabling

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Marine Solution 3 – Civil Works

Outside Plant (OSP) Construction

- BMH installation
- Duct bank installation
- MH/HH

Horizontal Directional Drilling (HDD)

- Engineering
- Drilling

Modular Cable Station

- Manufacture (3rd Party)
- Shipping
- Installation

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Typical C&MA Or JBA Model

Network Configuration

- Terrestrial Section, Segment T
- Submarine Section, Segment S

Establish Management Committee

- How MC setup and work
- Establish Sub-committee
  - Investment, Financial and Agreement Subcommittee (IF&ASC)
  - Operations and Maintenance Subcommittee (O&MSC)
  - Assignments, Routing, and Restoration Subcommittee (AR&RSC)
  - Procurement Group (PG)

Provision, Construction & Ownership of Segments

- Provision of Segment S;
- Provision of Segment T;

Capital, O&M cost

- Definitions of Segment Cost, MoU, NOC, O&M Cost and etc.
- Setup CBP

Acquisition, Entitlement Allocation, Upgrade of Capacity

- Portability of capacity
- Transfer of capacity
- Increase or decrease design capacity

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Undersea Cable Maintenance

Faults expected in cable lifetime	Factors affecting fault rates	80% faults happened in shallow water	Protections	Post Installation	Maintenance Scheme
•A new cable system should expect, on average, to have approximately 3 faults over a 25 system life[1]. •Actual experience varies from zero faults to multiple faults per year. •[1] Source: Bell labs	•Component failure (for example, laser diodes), •Amount of cable installed in shallow water (more prone to faulting due to fishing and anchors) •Armoring of the cable (the more armor, the better in shallow water due to the fishing threat) •Plowing of the cable in shallow waters (generally deeper than the fishing threat) •Region (North America has few faults, Asia has a plethora)	•> 80% of the faults experienced are attributed to anchors and fishing in water depths < 2,000 meters. •Probability of and source of threat should be analyzed to potentially modify installation requirements (for example, deeper burial).	•Burial, armoring, cable protection visits and AIS monitoring can reduce, but not eliminate, that threat (nothing can protect from a large anchor).	•Post installation maintenance and repair schemes should be analyzed to determine the proper maintenance and repair solution for the cable.	•Prior to the system entering service, the type of post RFPA maintenance solution should be finalized so that it is operational on day one.

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Subsea Cable Maintenance Options

Post RFPA maintenance options include:

- **Call out basis**
  - No prior agreement with ship provider(s) for vessel(s)
  - Once fault occurs, attempt to contract with Vessel of Opportunity (VOO) to perform the repair
    - Pros– No annual expense
    - Cons– Vessel may not be available for long period of time so the network is down for a prolonged period, expensive day rates for vessel could result in large expense, crew may not have cable working experience, jointers and tooling for the cable may be impossible to find, all tools, for example, ROV may not be available.
- **Dedicated maintenance vessel(s)**
- **Regional maintenance agreements**
  - Can be either private contracts or consortium based agreements
  - Shares cost of vessel and crew among multiple cable owners / operators resulting in less annual expense than a dedicated vessel
  - Multi vessel agreements so that coverage is better than with a dedicated vessel
  - Multi year contracts / agreements allow for continued maintenance and repairs

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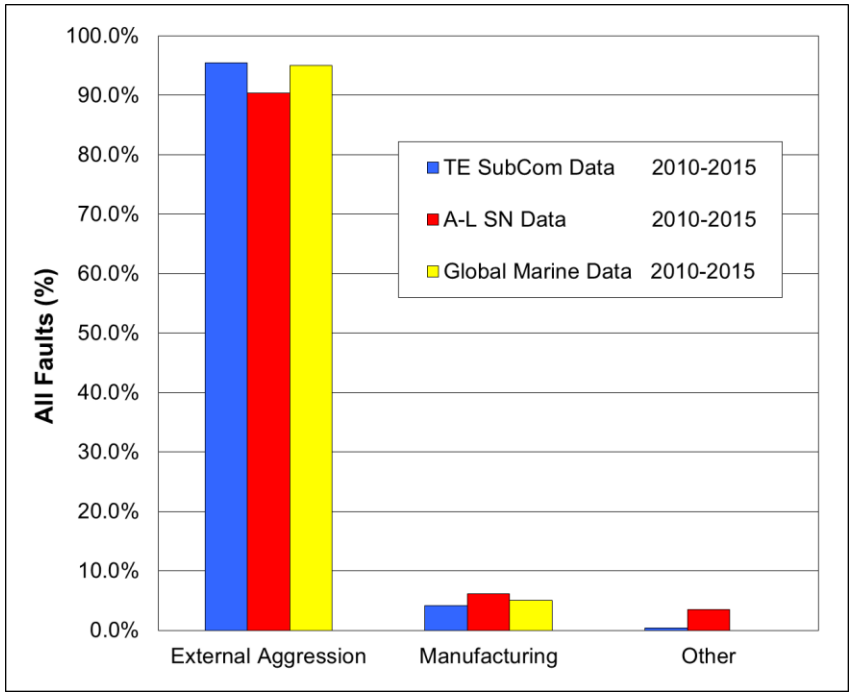
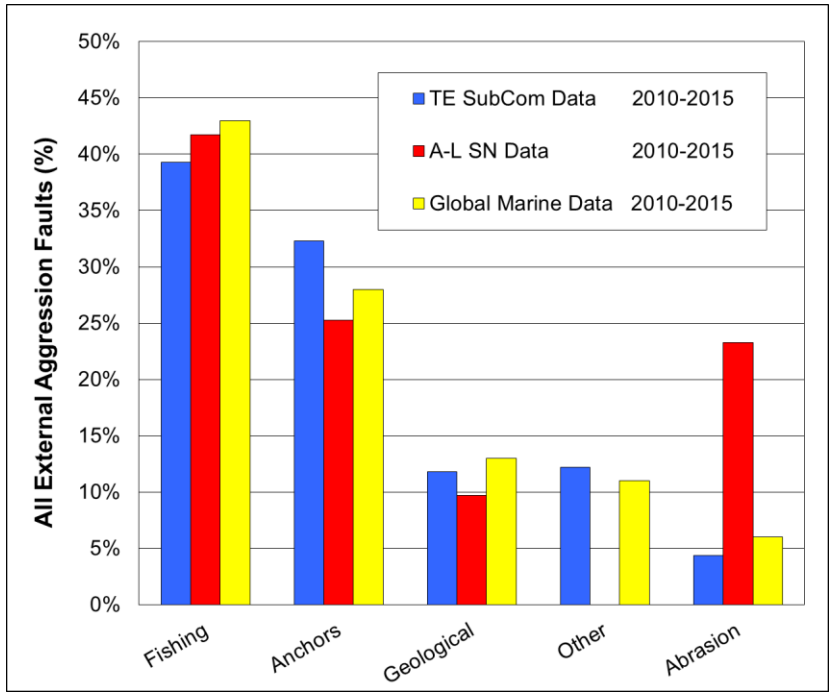
Causes of Cable Faults



Overall Causes of Fiber-Optic Cable Failure



External Aggression Faults for all Water Depths

Global Trends in Submarine Cable System Faults, SubOptic 2016
Maurice E. Kordahi, Robert K. Stix, Ron J. Rapp, Sydney Sheridan (TE SubCom); Gordon Lucas (Alcatel-Lucent Submarine Networks); Stuart Wilson, Brian Perratt (Global Marine Systems Ltd)

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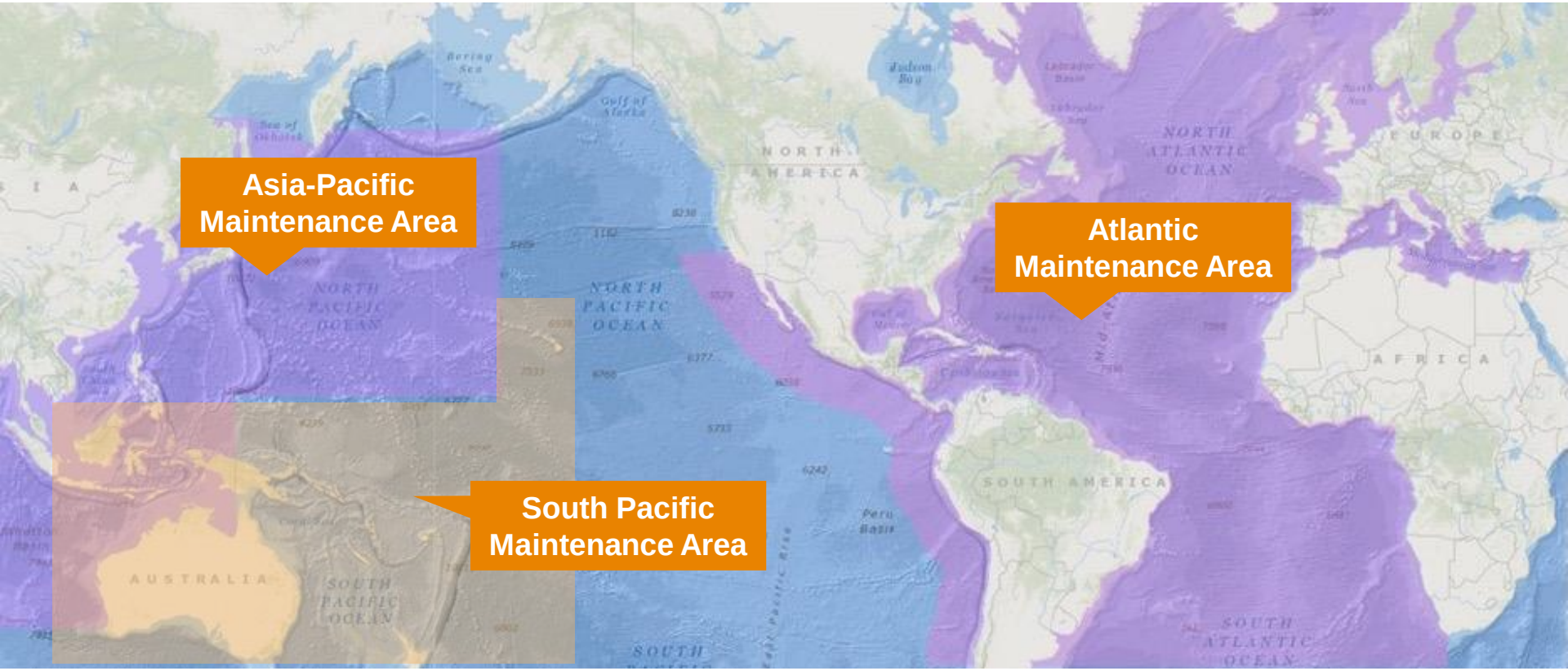
TE SubCom Maintenance Coverage



MAINTENANCE SERVICES:

- Vessel coverage for cable repair
- Spare cable and optical body storage
- Jointing services
- Cable Awareness Protection
- Marine Liaison Programs
- Personnel (e.g. owner representation)

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Submarine System Business Operation Models

- 2 main Business Operation Models of Submarine Cable System
- A: Consortium Model, invested by Carriers and Enterprises unitedly; B: Private Model, invested by Private Company.

Consortium

- Participants: Lead by Tier 1 or Tier 2 Telecom Carriers
- Funding: Customer CAPEX; capex is spread over a number of customers, depending on their ownership share of the system

Pros
- Joint Investment, lower risk

Cons
- Low Efficiency

Private (Entrepreneur)

- Participants: Private Company
- Funding: Funded with Equity and Debt model, Debt is usually secured with capacity presale agreements between system developer and system customers

Pros
- Higher Efficiency

Cons
- Lack of Funding, Higher Risk
- Sales risks on market

Consortium

Private

- Participants: Mixed Companies
- Participation Way: Typically dominated by One Shareholder, other parties joined for construction, operation and maintenance.
- Funding: Mix of Consortium CAPEX & Private Equity and Debt.

Pros
- Joint Investment, lower risk
- Clear share equity

Cons
- Lower Efficiency

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Consortium Cable Systems

More traditional approach to financing undersea cable systems

- Allows customers to spread cost & risk over a number of partners
- Cable system typically has landings in countries where consortium members have a presence
- Turnkey contract includes delivery of end to end system, including manufacturing and marine lay of undersea cable and repeaters, construction to beach manhole and cable station, and installation of optical gear in cable station.
- Consortium members typically sign Construction and Maintenance Agreement (C&MA) that includes rights & obligations of each party

Opportunity is to join with consortium of Telcos to drive ownership model and reduce network infrastructure costs

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Entrepreneur Cable Systems

Entrepreneur cable systems require equity/debt financing supported by project business model

- Typically requires investment bank as a lead arranger for equity & debt
- Equity sources typically private equity and pension funds looking to invest in infrastructure, along with project sponsors
- Debt sources typically include commercial banks, export credit agencies (US EXIM bank) and World Bank
  - Debt secured by capacity presale agreements w/credit quality counter parties
- Entrepreneur signs turnkey contract, similar to Telcos

Opportunity is to support capacity presales as anchor customer, achieving entry level pricing and reducing network infrastructure costs

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Consortium Cable Business Model

Core System

- PoP-to-PoP arrangement on Core System
- Core System segments are mutually discussed and agreed among consortium parties
- Cost of Core System to be shared by all Consortium Parties

Branches

- Investment on Branch to be shared by that Branch Party and any other interested Party(s)

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Consortium Cable Business Model (Cont'd)

Capacity Allocation

- Full allocation of dark end-to-end wavelength entitlements on day 1
- No more need to depend on system upgrades to light up wavelength entitlements

Capacity Activation

- Party can light up any amount of entitlements at System RFS on Party's own costs
- Party can light up its entitlement periodically at own costs
- Activation at wavelength levels
- No restrictions to activate capacity on a jointly-assigned or wholly-assigned basis

Assignment & Capacity Transfer

- Parties can transfer capacity on an ownership basis or any other form (as the Parties may decide) to any of the Parties' legal subsidiaries or affiliates
- Parties can lease or sell its capacity (on IRU basis) other than on an ownership basis to any other third party.

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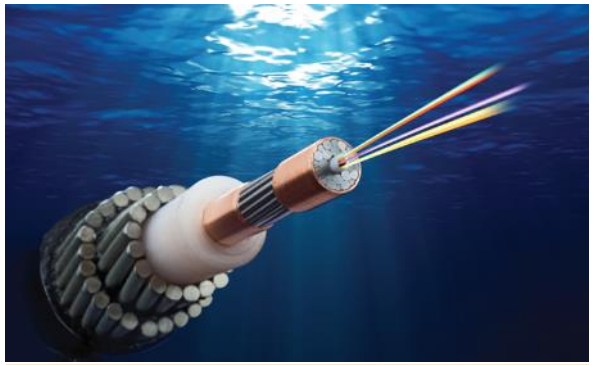
SubCom Overview

1,380+
EMPLOYEES
average tenure of 9 years

195
PATENTS
granted or pending

200+
ENGINEERS
globally

100+
FIBER OPTIC NETWORKS
Constructed globally



- **Manufacturing**: New Hampshire & Australia
- **Headquarters, R&D**: New Jersey
- **Global Sales & Marine** footprint

Leading Supplier of Undersea Communications Technology

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TE connectivity
SUBCOM

What SubCom Provides

Turnkey Solution

- Integrated system solution
- Network upgrades and marine services, with unsurpassed reliability that support the needs of telecommunications, internet providers, offshore and science customers worldwide

100 Undersea System in 60+ yrs

- Designed, manufactured, and installed more than 100 undersea fiber optic systems around the world – for more than five decades

Leading R&D

- Global presence
- Backed by industry leading R&D laboratories, manufacturing facilities, installation and maintenance ships, depots, and management team

Global Support

- Networks which enable: the proliferation of the internet, call centers in India, geographically diverse R&D centers operating in concert, telephone communications and manufacturing outsourcing

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Industries We Serve

Undersea Systems

- Research and development, design, manufacturing and deployment of undersea networks and their upgrades

Key Business Drivers

- Increased global capacity demands
- Deregulation and increased competition among service providers
- Increased global investment in developing nations
- Increased need for faster, more secure, cost-effective communications

Offshore Oil & Gas and Scientific

- Network applications specifically tailored to unique requirements of offshore oil and gas installations
- Innovative research applications

- Demand for cost-effective, efficient communications
- Emphasis on safety
- Emergence of remote operations

Marine Services

- Maintenance and repair services for existing undersea cables

- Requirement for uninterrupted network services
- Protection of assets
- Country specific regulations governing usage of ships

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Cable Ship Fleet

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TE SubCom Ready For Anything

We Understand that every undersea communications system is unique, which is why SubCom is prepared for just about anything, anywhere.

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4. Permit/Regulatory Challenges in SE Asia Market

a) Permit/Regulatory Risks
   - Types of Permit
   - Permit Duration Examples
   - Examples of Specific Permits Requirements in Some Asia Countries

b) Geopolitical/Jurisdictions Risks

Permits/Regulatory Risks Overview

Permit acquisition is now universally recognized as the “critical path activity” on almost all projects.

- Long Duration
- Frequent procedures changes
- Comprehensive Negotiations with Various Functionalities across the Different Levels of Government
- In some countries, military approval is involved

Permit acquisition is Regulatory Orientated

- Regulatory Policy various in different countries, some loose, some strict.
- Regulatory presents in all aspects of full life cycle of Subsea systems, including but not limited: survey, installation, operation, maintenance and etc.

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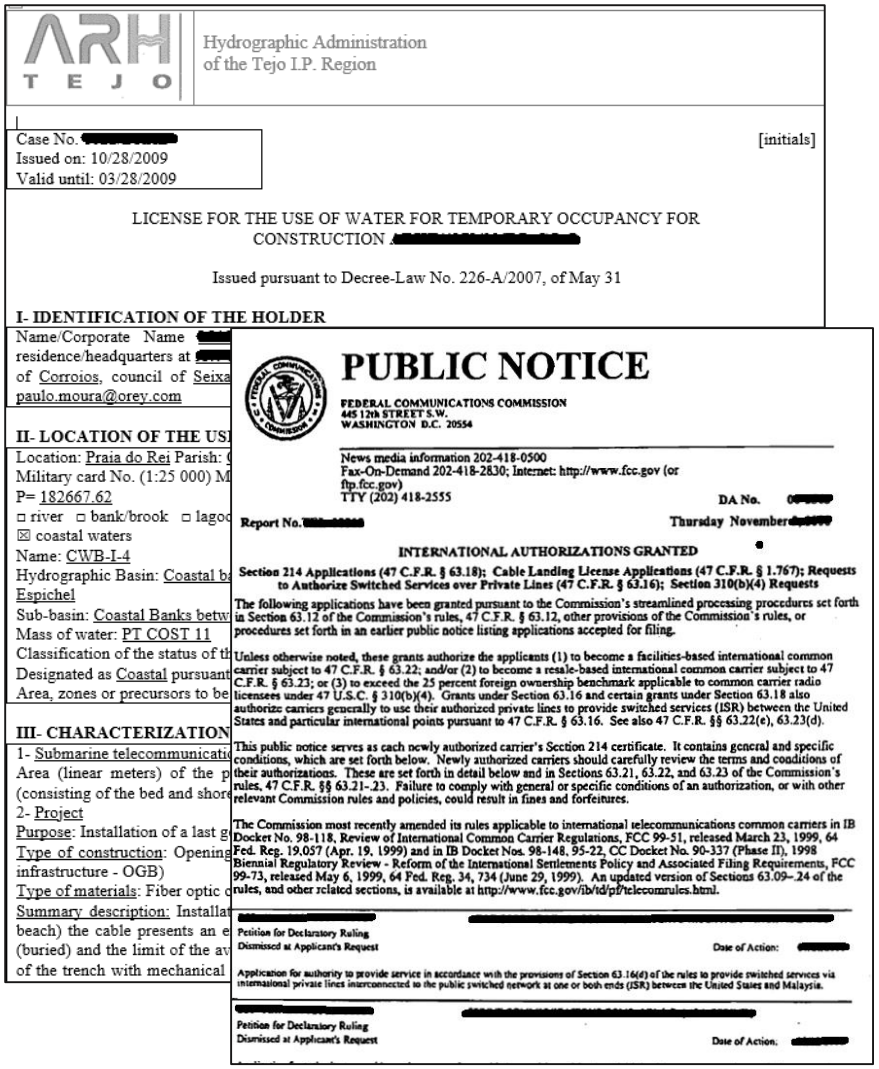
Landing License / Approval

- Generally the cable owner's responsibility however; Supplier, like TE SubCom often provides enhanced support for their acquisition within the USA.
- "Landing Party" – either the recipient of the cable landing license or "Party / Signatory" in some way to a submarine contract
- Within the various regulatory jurisdictions of the USA, the availability of the FCC license is required at varying points in the project's lifetime.
- In some cases, absent an FCC license, a Special Temporary Authority (STA) license is secured so as to allow for the construction of the system.



ARH TEJO
Hydrographic Administration
of the Tejo I.P. Region

Case No. [redacted]
Issued on: 10/28/2009
Valid until: 03/28/2009

[initials]

LICENSE FOR THE USE OF WATER FOR TEMPORARY OCCUPANCY FOR CONSTRUCTION [redacted]

Issued pursuant to Decree-Law No. 226-A/2007, of May 31

I- IDENTIFICATION OF THE HOLDER

Name/Corporate Name [redacted]
residence/headquarters at [redacted]
of Corroios, council of Seixa
paulo.moura@orey.com

II- LOCATION OF THE US

Location: Praia do Rei Parish:
Military card No. (1:25 000) M
P= 182667.62
□ river □ bank/brook □ lagoo
☒ coastal waters
Name: CWB-I-4
Hydrographic Basin: Coastal ba
Espichel
Sub-basin: Coastal Banks betw
Mass of water: PT COST 11
Classification of the status of th
Designated as Coastal pursuant
Area, zones or precursors to be

III- CHARACTERIZATION

1- Submarine telecommunicati
Area (linear meters) of the p
(consisting of the bed and shore
2- Project
Purpose: Installation of a last g
Type of construction: Opening
infrastructure - OGB)
Type of materials: Fiber optic c
Summary description: Installat
beach) the cable presents an e
(buried) and the limit of the av
of the trench with mechanical

PUBLIC NOTICE

FEDERAL COMMUNICATIONS COMMISSION
445 12th STREET S.W.
WASHINGTON D.C. 20554

News media information 202-418-0500
Fax-On-Demand 202-418-2830; Internet: http://www.fcc.gov (or ftp.fcc.gov)
TTY (202) 418-2555

DA No. [redacted]
Report No. [redacted] Thursday November [redacted]

INTERNATIONAL AUTHORIZATIONS GRANTED

Section 214 Applications (47 C.F.R. § 63.18); Cable Landing License Applications (47 C.F.R. § 1.767); Requests to Authorize Switched Services over Private Lines (47 C.F.R. § 63.16); Section 310(b)(4) Requests

The following applications have been granted pursuant to the Commission's streamlined processing procedures set forth in Section 63.12 of the Commission's rules, 47 C.F.R. § 63.12, other provisions of the Commission's rules, or procedures set forth in an earlier public notice listing applications accepted for filing.

Unless otherwise noted, these grants authorize the applicants (1) to become a facilities-based international common carrier subject to 47 C.F.R. § 63.22; and/or (2) to become a resale-based international common carrier subject to 47 C.F.R. § 63.23; or (3) to exceed the 25 percent foreign ownership benchmark applicable to common carrier radio licensees under 47 U.S.C. § 310(b)(4). Grants under Section 63.16 and certain grants under Section 63.18 also authorize carriers generally to use their authorized private lines to provide switched services (ISR) between the United States and particular international points pursuant to 47 C.F.R. § 63.16. See also 47 C.F.R. §§ 63.22(e), 63.23(d).

This public notice serves as each newly authorized carrier's Section 214 certificate. It contains general and specific conditions, which are set forth below. Newly authorized carriers should carefully review the terms and conditions of their authorizations. These are set forth in detail below and in Sections 63.21, 63.22, and 63.23 of the Commission's rules, 47 C.F.R. §§ 63.21-.23. Failure to comply with general or specific conditions of an authorization, or with other relevant Commission rules and policies, could result in fines and forfeitures.

The Commission most recently amended its rules applicable to international telecommunications common carriers in IB Docket No. 98-118, Review of International Common Carrier Regulations, FCC 99-51, released March 23, 1999, 64 Fed. Reg. 19,057 (Apr. 19, 1999) and in IB Docket Nos. 98-148, 95-22, CC Docket No. 90-337 (Phase II), 1998 Biennial Regulatory Review - Reform of the International Settlements Policy and Associated Filing Requirements, FCC 99-73, released May 6, 1999, 64 Fed. Reg. 34, 734 (June 29, 1999). An updated version of Sections 63.09–.24 of the rules, and other related sections, is available at http://www.fcc.gov/ib/id/pf/telecomrules.html.

[redacted]
Petition for Declaratory Ruling
Dismissed at Applicant's Request
Date of Action: [redacted]

Application for authority to provide service in accordance with the provisions of Section 63.16(d) of the rules to provide switched services via international private lines interconnected to the public switched network at one or both ends (ISR) between the United States and Malaysia.

[redacted]
Petition for Declaratory Ruling
Dismissed at Applicant's Request
Date of Action: [redacted]

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Proprietary and Regulatory Permits

- (Proprietary) Those permits and approvals associated with a subsea cable's fundamental right to occupy its footprint within the terrestrial and marine environment

- (Regulatory) The relevant governmental approvals which are imposed during the life cycle of the project to ensure that the methodologies employed are conducted in a professionally and environmentally / engineering sound manner in accordance with local laws and customs

    - Rights of way, easements, wayleaves, Non-Landing traverse approval (where no subsea cable landing occurs however; a country's TS/CZ/EEZ is traversed)
    - USACE Nationwide / Individual Permits (in the USA)
    - Marine Sanctuary Approvals
    - Environmental Permits as secured via the conducting of Environmental Impact Assessments / Environmental Assessments / Essential Fish Habitat Studies / Marine Traffic Impact Assessments

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Operational Permits

- Relevant approvals from Maritime Authorities, Ministries of Defense, Naval / Coast Guard & Port Authorities for both marine and terrestrial survey and installation activities (Post-Prop/Reg)

- Submission of relevant notifications (LNTM) and adherence to any pre-established notification protocols

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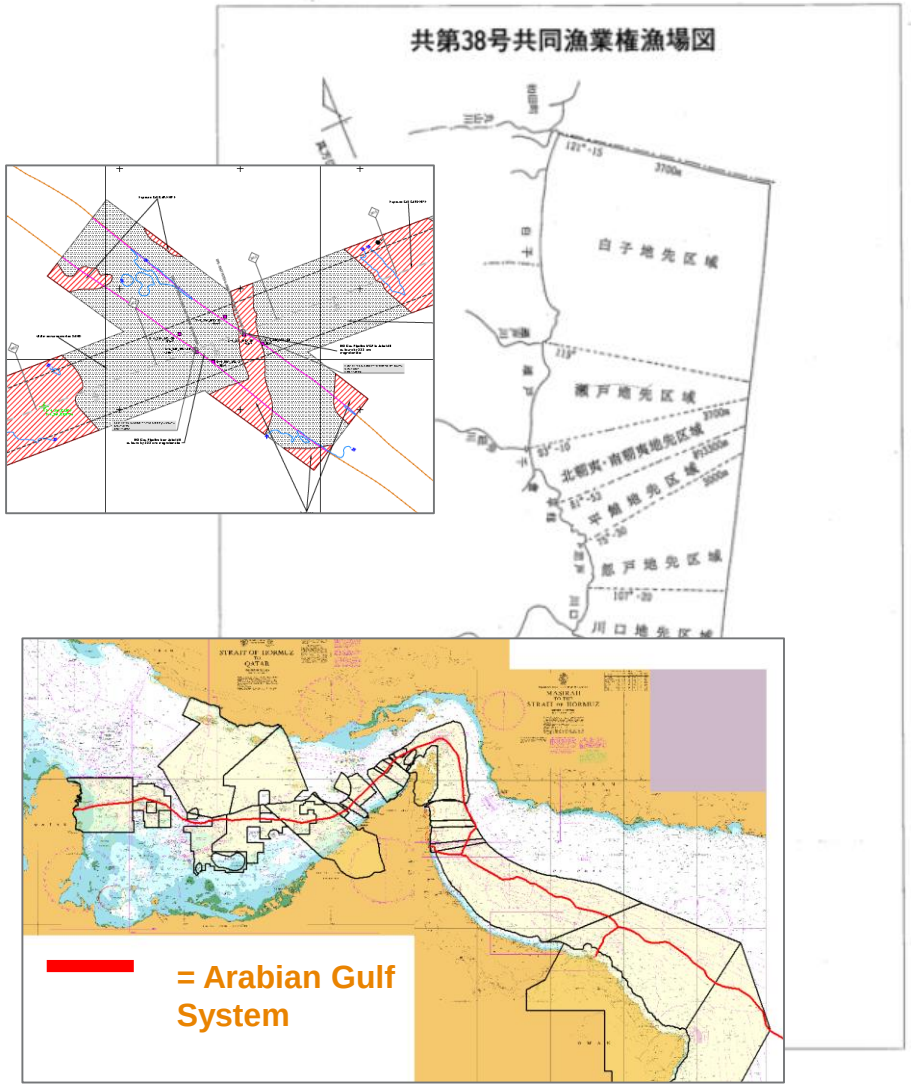
Marine Liaison / 3rd Party Stake Holder Approvals / Formal Agreements

- Fisheries Agreements (both formal and informal), Native / Indigenous People's Agreements
- Cable, Pipeline & any other subsea architecture crossing approvals / potential agreements
- Hydrocarbon and Mineral Lease Blocks / Concession traverse approval agreements



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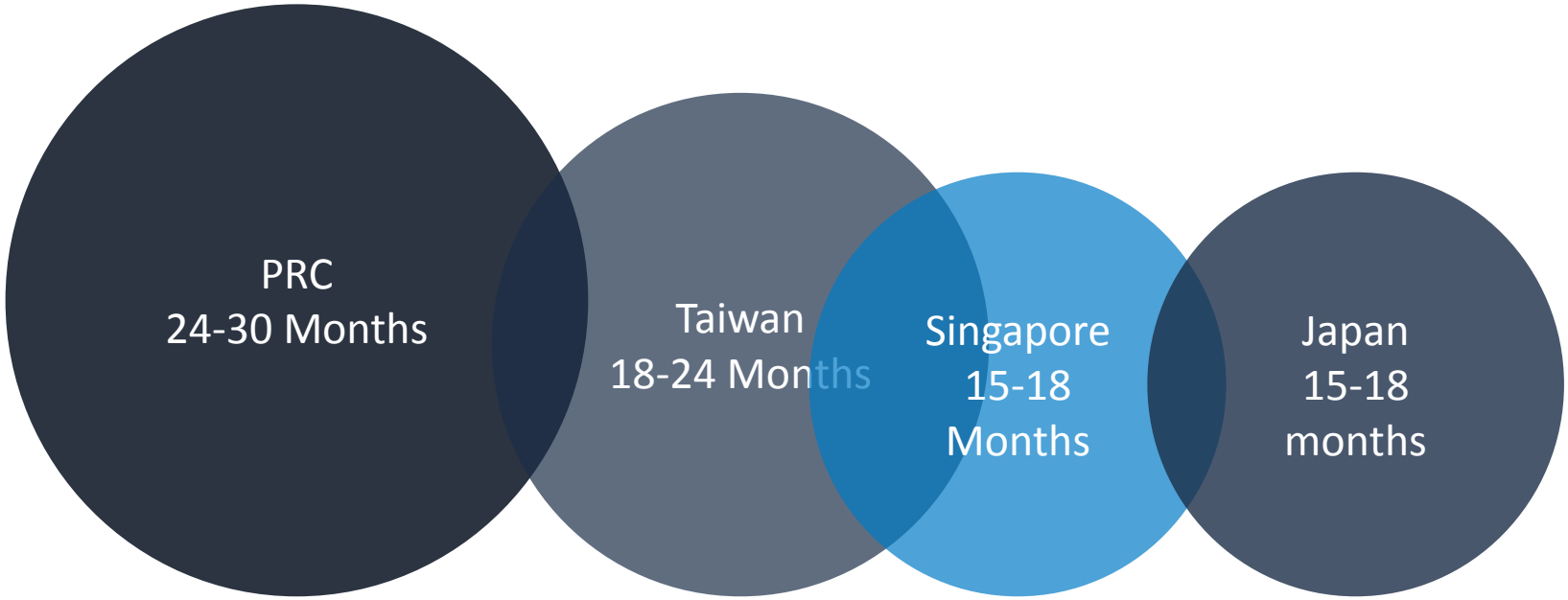
Permit Duration Examples



Permits become the critical path with almost every single Submarine system worldwide

Above Permit duration is a rough high level assumption
based on recent project experience

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Taiwan Permitting Requirements

Telecommunications System & Operating Permits – Customer Responsibility

- System Approvals from Ministry of Transport & Communications
- System Licenses from National Communications Committee

Specific Permitting Requirements

- Ministry of Interior Permit (MOI) – MOI coordinates with nearly all other administrations within Taiwan for cable construction permits
- Cable Route Survey permit - MOI
- Fisheries – fisheries agreements if required
- Right of Way Permit for Installation- MOI
- Foreign-flagged vessels clearance from MOI and local government
- Marine Ecology & Fishery Impact Assessment Report
- Seabed Area Usage Location Permit
- Permitting effort will require Customer support

Key Considerations

- Impact Assessment on Marine Ecology and Fisheries (*requires 2 seasons)
- Fisheries agreements – must be acquired prior to Right of Way for Cable Route approval from MOI. Thus agreements with fisheries critical to Permit approval process
- Purchaser/landing party to assist with the Fishing Union negotiations

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Taiwan Permitting Requirements (cont.)

Key Considerations – Marine Ecology & Fishery Impact Assessment (MEFIA)

- A requirement for the Marine Ecology & Fishery Impact Assessment (MEFIA) will be performed by the National Taiwan Ocean University (NTOU) under contract with Global World Enterprises (GWE) Limited.

- The specific requirement of the MEFIA will takes a minimum of 180 days to prepare and requires at least two (2) season studies/surveys.

- The MEFIA is a predecessor to the cable route Right-Of-Way permit from the Ministry of Interior (MOI) of Taiwan

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Hong Kong Special Administrative Region (SAR) Permitting Requirements

Telecommunications System & Operating Permits – Customer Responsibility

- System Approvals - Office of Communications Authority (OFCA)

Specific Permitting Requirements

- Lands Department, Foreshore and Seabed Reclamation Ordinance (FSRO), Leisure and Cultural Services Department (LCSD) – Long process that includes gazettal periods, which may well be iterative
- Marine Department (MARDEP)

Key Considerations

- Permitting process in the Hong Kong Special Administrative Region (HKSAR) is highly complex.
- Vessel and crew visas – long process to permit foreign vessels in HK.

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Philippines Permitting Requirements

Telecommunications System & Operating Permits – Customer Responsibilty

- System Approvals from the Department of Transportation & Communications / Security and Exchange Commission

Specific Permitting Requirements

- Environmental Compliance Certificate (ECC)/Environmental Impact Assessment (EIA) Study from Dept. Environmental and Natural Resources (DENR)
- Maritime Industry Authority (MARINA) Special Permit to Operate Foreign Flagged Vessels for Survey and Installation
- Notification/Approval from Philippines Coast Guard/Navy for Survey and Installation
- Clearance and Letter of Notice of Arrival from Bureau of Immigration, Customs, Quarantine
- Fisheries – Fisheries Agreements as Required
- Permitting effort will require Customer support (e.g., preparation of supporting cover letters for application submissions)

Key Considerations

- Fisheries agreements – must be acquired prior to Right of Way for Cable route cable be approved. Thus agreements with fisheries critical to Permit approval process
- Permitting will also need to consider fishing seasons when operations will be restricted. This issue links in to fisheries agreements, so due consideration to fishing seasons must be taken

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PRC Permitting Requirements & Considerations

Key Considerations

- DTS, Cable Survey/Route EIA (two seasons survey), and Sea Area Utilization (SAU) approvals are subject to lengthy and complex review periods. Progress requires constant monitoring and liaison with the State Oceanic Administration (SOA).

- Care and sensitivity required with respect to permitting vessels compatible to PRC, Taiwanese and Korean jurisdictions (e.g., PRC-flagged vs foreign-flagged)

- Sensitivities with regard to overlapping (disputed) maritime claims within this area requires diplomatic approach from Contractor and Purchasers

- Close coordination with fisheries required to avoid ‘blackout’ periods where construction activities may not be allowed

- Close coordination with Military required due potential presence of defense cables and interaction with exercise areas.

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Japanese Fishing Considerations

Specific Permitting Requirements

- Liaison and negotiations with affected Fishing Unions (Customer participation and representation often required or insisted upon by Fishing Unions)
- Liaison and coordination with Japanese Coast Guard prior to and during installation operations
- Collaborative effort in negotiating with Japanese fishing unions

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Geopolitical Risks

Disputed Territory

Barrier to entry

Unstable Political Situation

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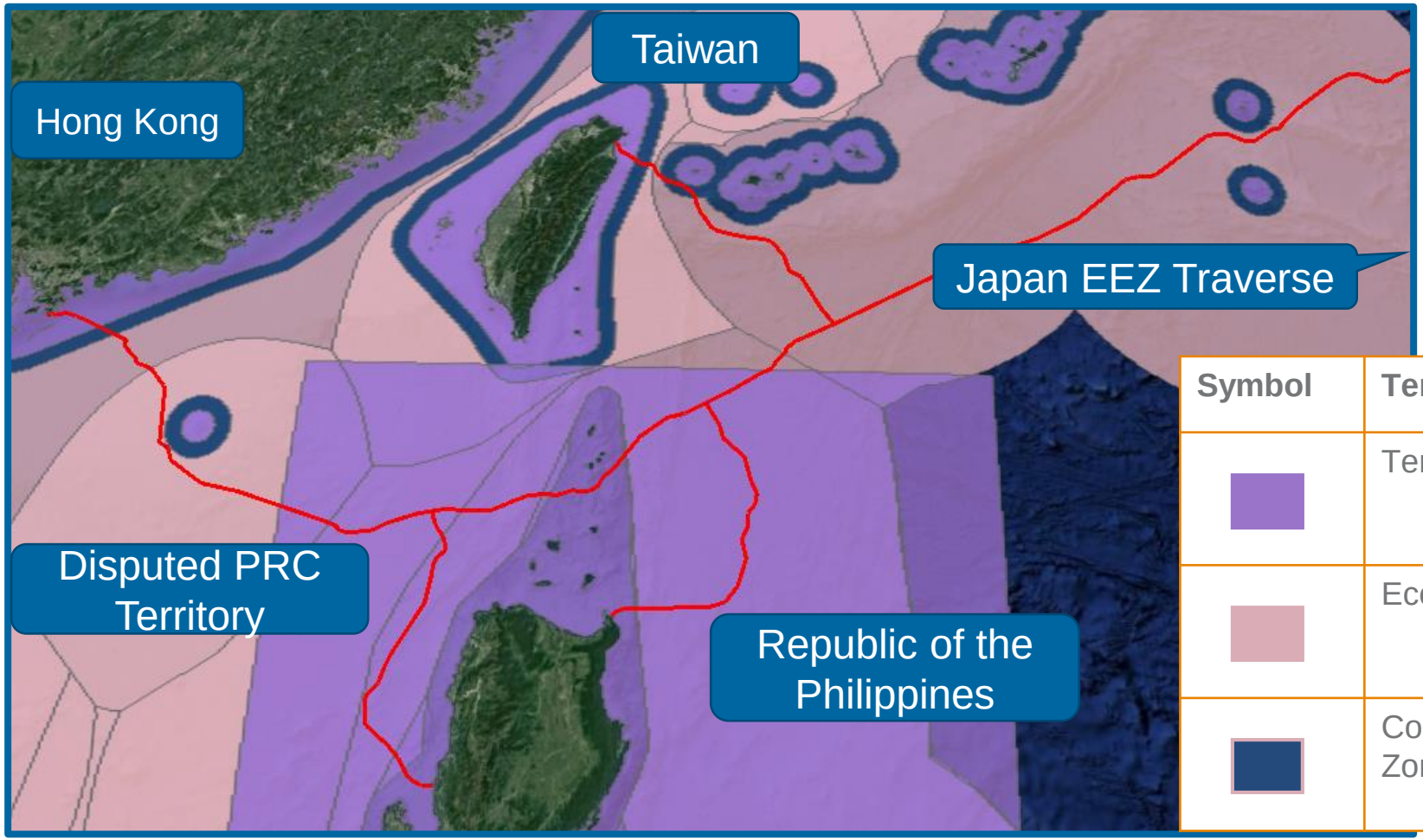
Jurisdictions (Example of HK-Taiwan-Japan-Philippines)



Symbol	Territory
	Territorial Sea
	Economic Zone
	Contiguous Zone

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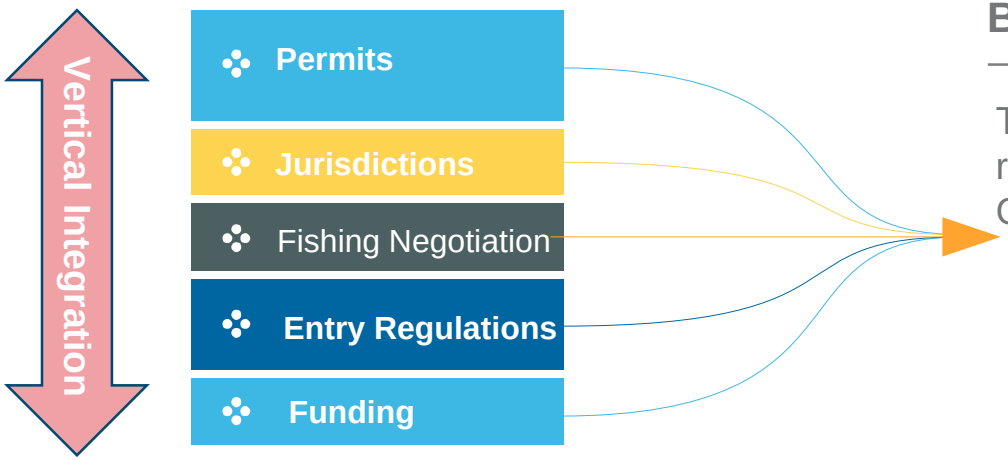
Mitigations to Permit & Regulatory Challenges in SE Asia



Better Submarine Ecosystem

Typically, with Purchasers' dominant role and connects with Local Governments:

- Purchasers & Suppliers work together to influence the Submarine Industry Chain
- Including but not limited to: local Subcontracts, Government agencies, Banking, Third party Consulting firms, Media Press and etc. for a better Submarine Ecosystem.

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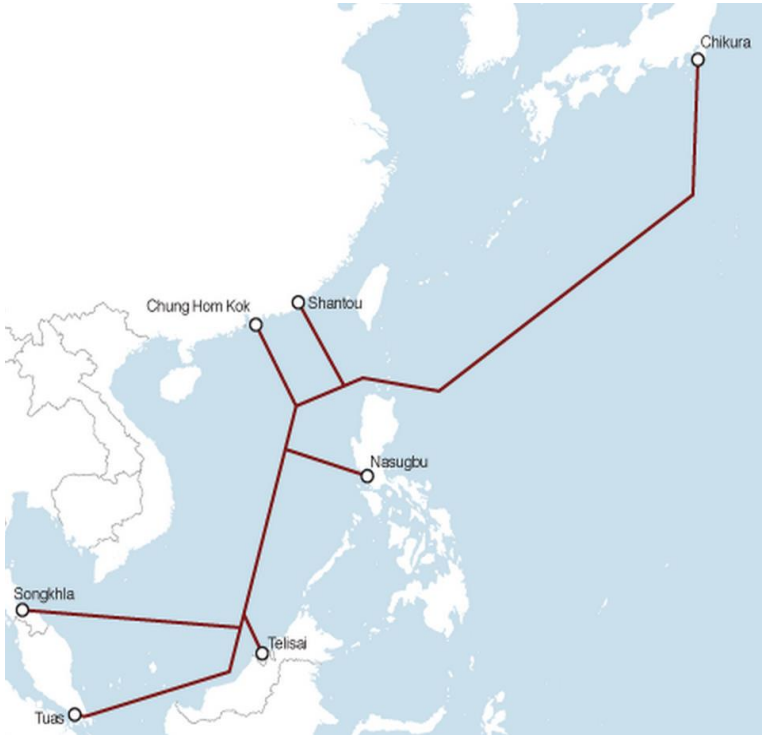
5. Case Discussions

a) Intra-Asia

b) Domestic

Case 1 Intra-Asia Project S*



- **Huge Traffic Demands among Hot Spot Regions**
- **Typical Consortium Model, Major Regional Carriers and OTTs**
- **Similar Route is being planned**

RFS: June 2013

Cable Length: 8,900KM

6 FPs Design capacity of 45.6 Tbps

It interconnects China Mainland, Hong Kong, Japan, Singapore, Philippine, Brunei

Owners (12): Globe Telecom, Google, KDDI, Telkom Indonesia, SingTel, China Telecom, TOT, China Mobile, Chunghwa Telecom, Brunei International Gateway, SingTel Optus, Airtel

Landing Points

- Chikura, Japan
- Chung Hom Kok, Hong Kong, China
- Nasugbu, Philippines
- Shantou, China
- Songkhla, Thailand
- Telisai, Brunei
- Tuas, Singapore

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Case 2 Domestic Asia Project M*

Landing Points

- Mataram (Indonesia)
- Sumbawa Besar(Indonesia)
- Ambalawi (Indonesia)
- Saraemee (Indonesia)
- Waingapu (Indonesia)
- Ende (Indonesia)
- Kupang (Indonesia)

RFS: 2011

Cable Length: 1300 km

Owner: PT Telkom

System Transmission Technology: 10 Gbps

Huawei Marine is the supplier

- **Domestic Subsea Requirement increase by years in SE Asia**
- **More focus on Flexible, Repeaterless, regional System solutions**

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6. Summary

Summary

More Regional Subsea System Opportunities in SE Asia in near future

- Traffic Demand is explosive
- More connectivity to these historically under-connected locations
- New Drivers
  - New Considerations for Networking: Diversity, Connectivity and Resilience
  - OTTs & Private Entities become actively involved in Regional Systems
  - New Opportunities in new directions

To Embrace the Growth in SE Asia Subsea Market

- Mix of Subsea Cable Systems Business Operation Models: Consortium & Entrepreneur
- New Subsea Technologies, Experienced Marine Solutions and Global Maintenance Services

Permits and Regulation Challenges are the Keys to Project Success

- Purchasers and suppliers should work together to influence the subsea industry chain including but not limited to: Government agencies, Consulting firms, Banking, Media Press and etc to create a better submarine system ecosystem.

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Thank you.