

Undersea Cable System Outages and Global Infrastructure Resiliency

A Discussion of Issues in Managing Third-Party Expectations

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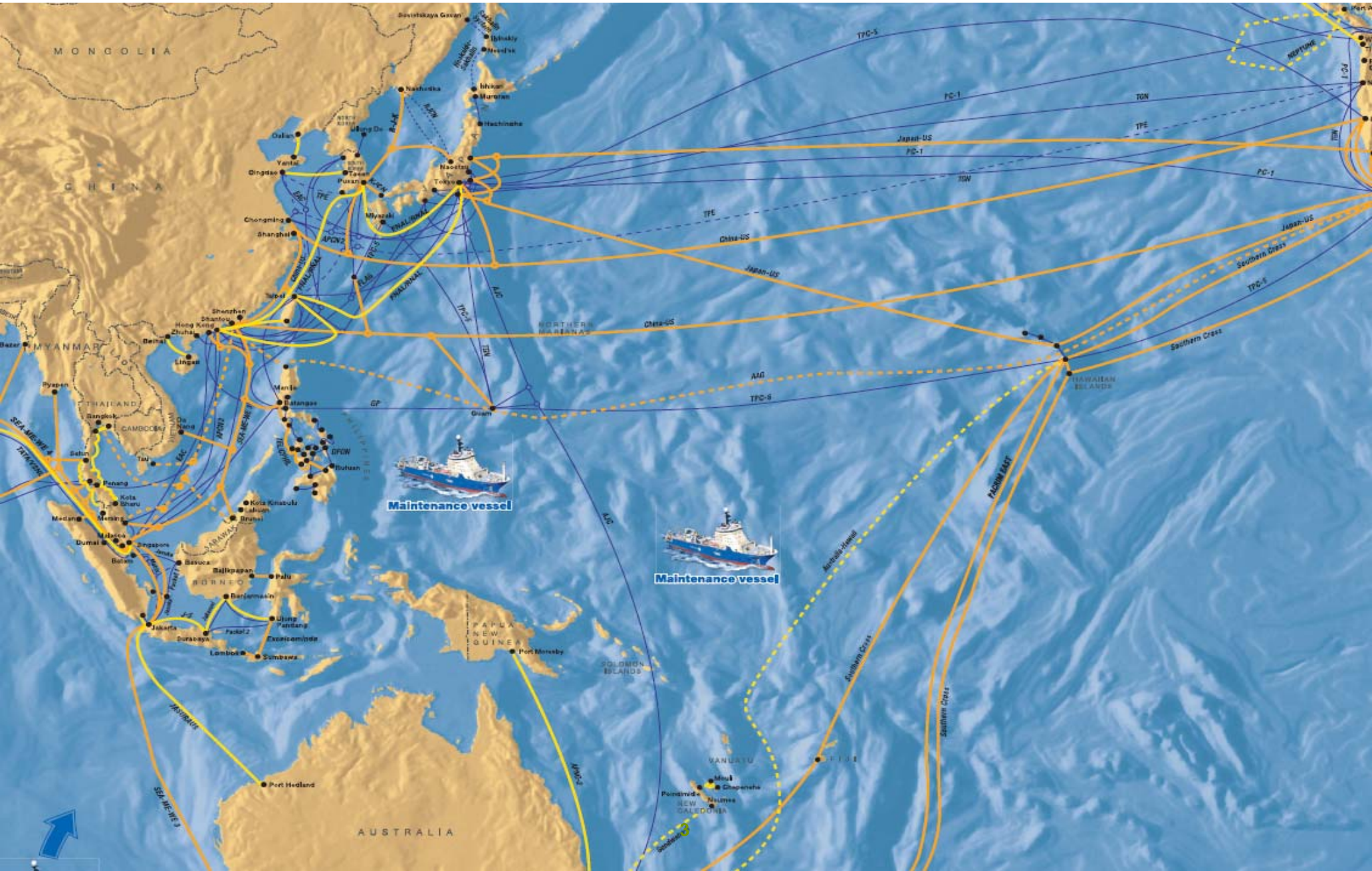
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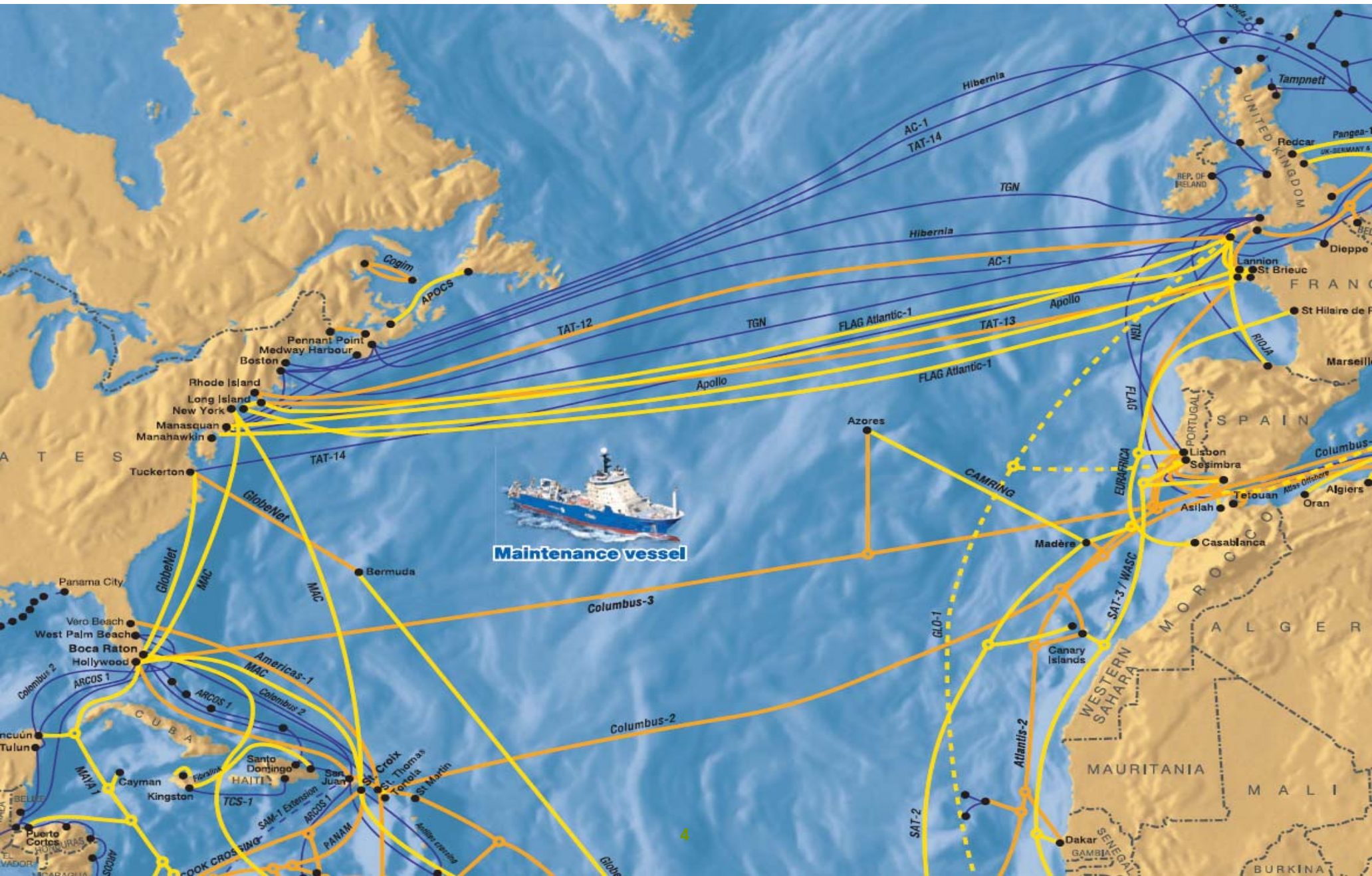
■ ■ ■ Outline

- Overview of undersea cable systems
- A global enterprise customer's perspective
- State of undersea cable outages
 - Authority (Point of Contact)
 - Methodology
 - Categorization
 - Thresholds
- Observations regarding reporting of undersea cable outages
- Suggestions for future action

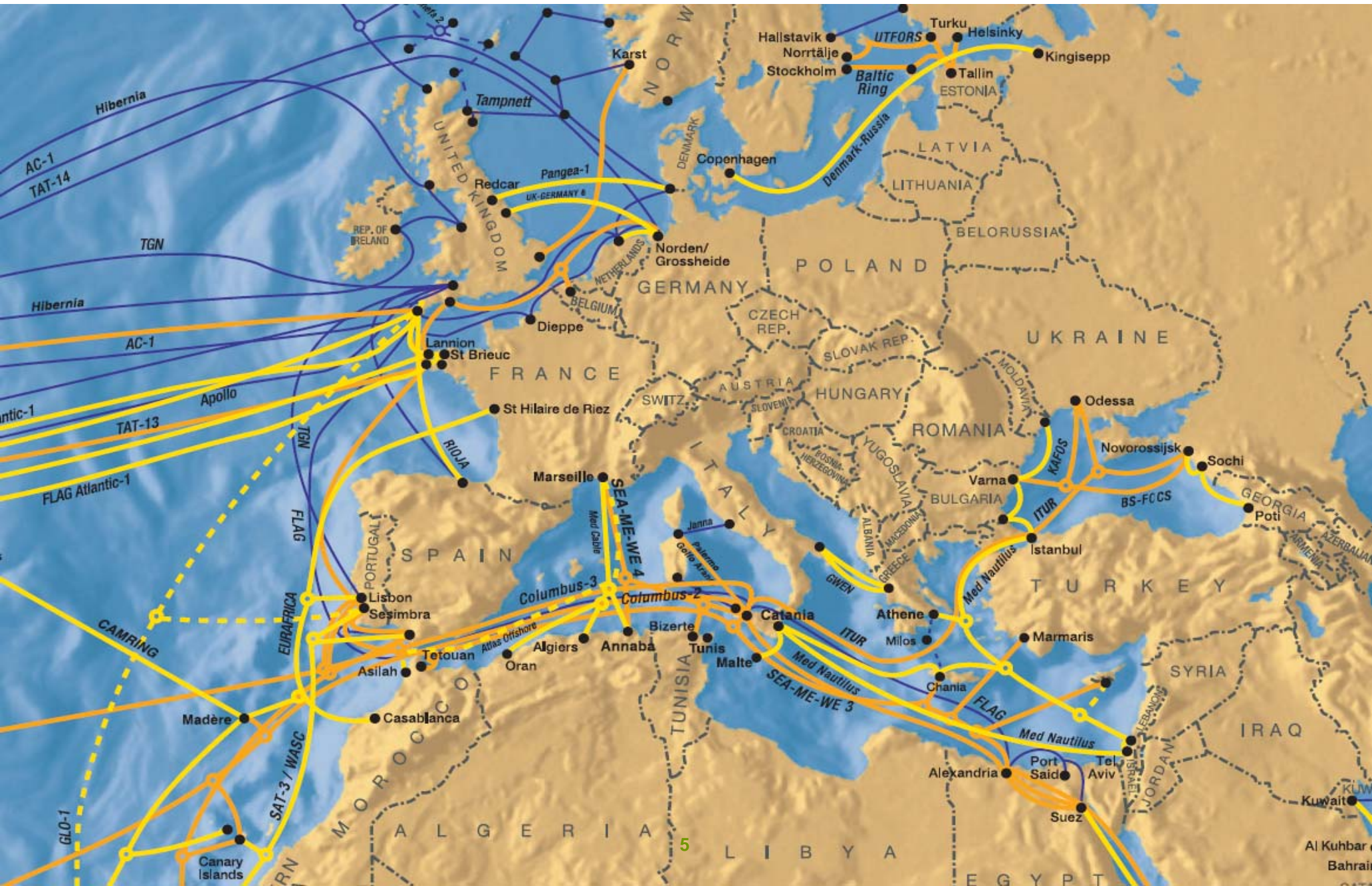
Undersea Cables in the Pacific Ocean



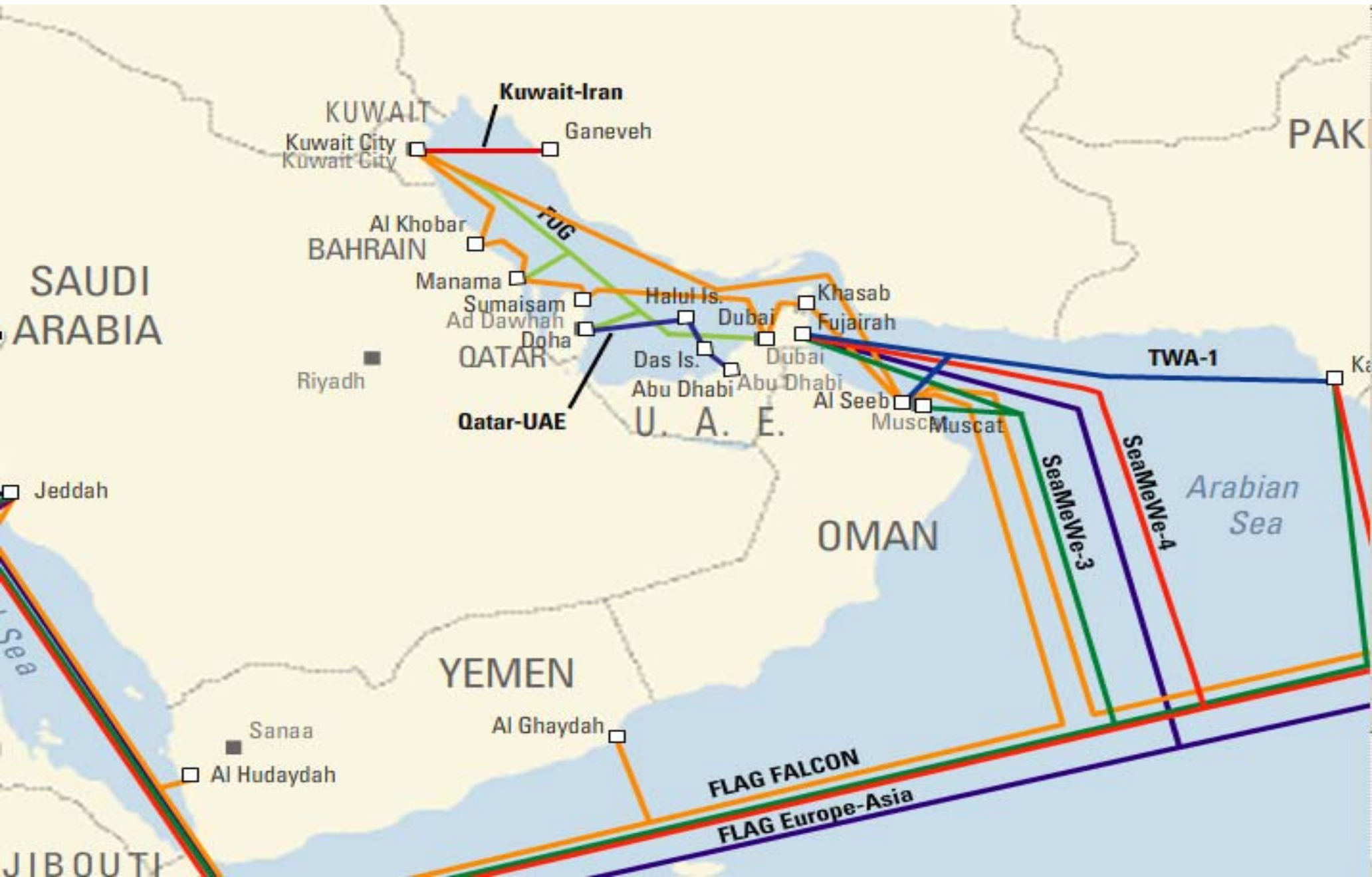
Undersea Cables in the Atlantic Ocean



Undersea Cables in the Mediterranean Sea

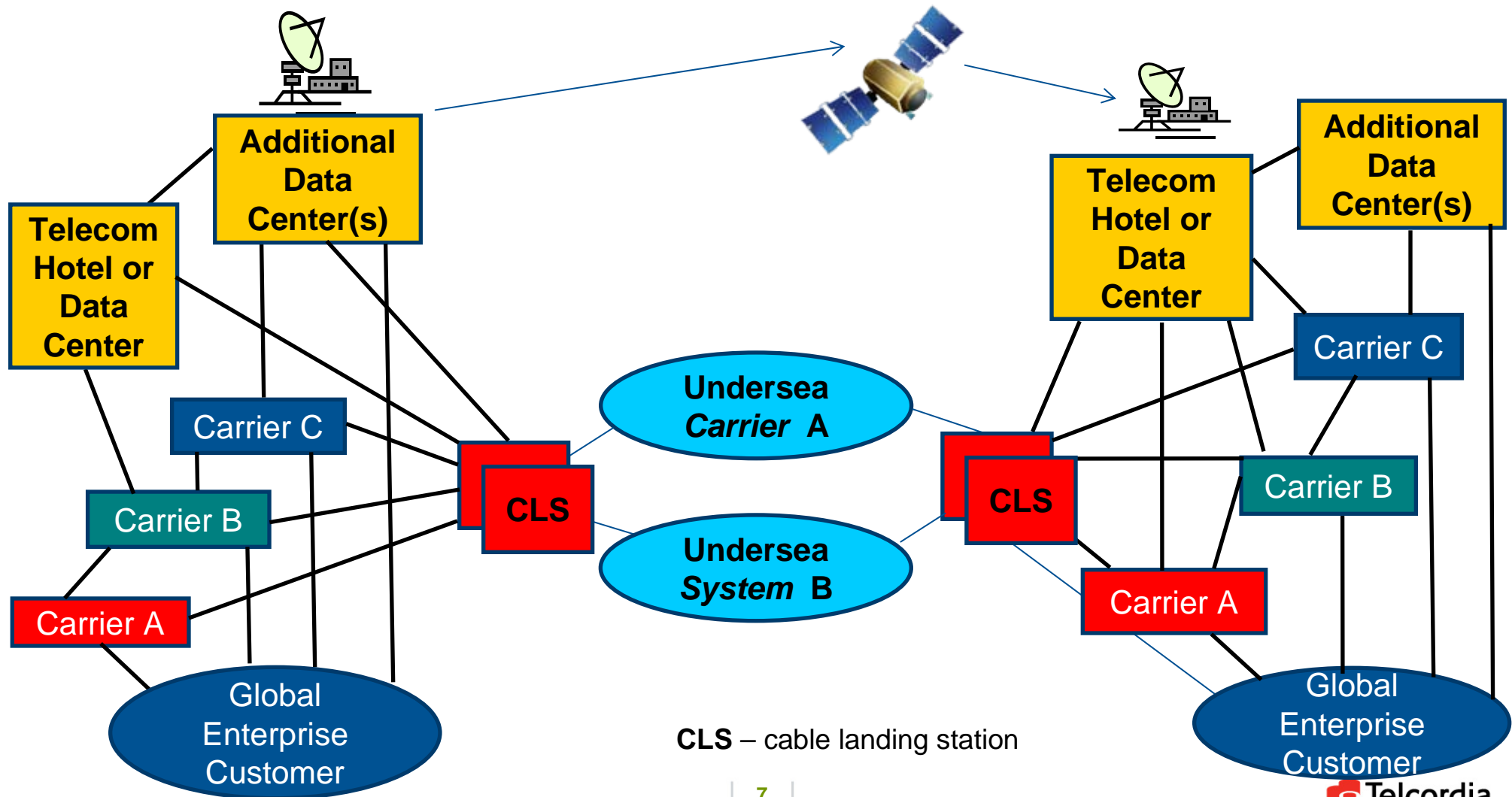


Undersea Cable Maps in the Persian Gulf



Global Enterprise Customer, Global Infrastructure

- In the *past*, enterprise customers focused on terrestrial segments
- Consider the permutations & combinations of this diagram
- Note undersea systems, segments, and carriers are key (They are in the middle!)



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Global Enterprise Customers' Perspective

 - Global enterprise customers are dependent upon a variety of third-party carrier global network infrastructures
 - Recent undersea cable outages have reinforced the need for these enterprise networks (multi-national corporations) to develop and implement **end-to-end risk mitigation strategies**, which includes land-based as well as undersea cable infrastructure

QUESTIONS:

- 1) How does a global enterprise customer create an end-to-end resilient network that includes both land-based and undersea infrastructure?
- 2) What information should a global enterprise customer focus on and what should they ask for from their upstream service providers?
 - 3) Is there enough information provided on the state of undersea cable infrastructure for enterprise customers to make informed routing decisions prior to an incident *and* keep informed during a time of crisis?

- ■ ■ **Global Enterprise Customers' Perspective – Key Needs**
 - A multi-national enterprise customer depends on a number of telecom infrastructures (landline, wireless, satellite-based or **submarine cables**) owned by different entities to ensure an end-to-end connectivity of its various locations around the globe
 - **Transparency on the state of the network(s) is key** to retaining the confidence of the global enterprise customer in the underlying undersea cable system and land-based networks
 - **End-to-end information on the state of the entire network** infrastructure is important for the global enterprise customer to maintain a resilient infrastructure
 - Information flow on the status (health) of the entire network infrastructure is a key factor in a smooth business relationship between the telecom service provider(s) and the global enterprise customer
 - Information could be passed via a variety of parties for the global enterprise customer to obtain a clear picture of the outage and the potential impact on its operations

■ ■ ■ Global Enterprise Customers' Perspective – Questions

- What do enterprise customers need to know during a time of a undersea cable system outage?
- How does a service provider balance keeping their enterprise customers informed without creating unnecessary anxiety or disclosing information to competitors? *A delicate balancing act...*
- What precedents could be leveraged in the terrestrial environment and ported to the undersea environment?
 - A standardized categorization of outages?
 - A generic reporting methodology and definitions of what an outage is?
 - Best Practices for keeping enterprise customers informed for outages in both the terrestrial and submarine cable environments?
 - Performance degradations (end-to-end or segment specific?)

KEEP IN MIND: Transient “outages” could affect applications to a much higher network delay (i.e., connectivity could be restored but performance could be drastically impacted due to increased delays)

- ■ ■ State of Reported Undersea Cable Outages - 1
- There is little publicly available information of a nature to allow a statistical analysis. For example,
 - Only six (6) FCC-reportable outages by U.S. companies for the 11-yr period (1993 to 2004) when data was publicly available ([2004 NRSC Annual Report](#))
 - Tyco and Alcatel-Lucent undersea cable outage data analysis for the 6-yr period (2001-2006) (2007 published paper on behalf of the Submarine Cable Improvement Group - SCIG www.scig.net)
- There is no common methodology for capturing and characterizing the attributes of an outage
- The term “outage” is:
 - Commonly used to describe either a “cable fault” or a “cable cut”
 - Undefined in SCIG’s “Standard Definitions” webpage are:
 - How long must one be out of service to be considered an outage?
 - If service is rerouted via an undersea cable “protect” pair or wavelengths, is this considered an outage?

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State of Reported Undersea Cable Outages - 2
- The 2007 Tyco/Alcatel-Lucent study (sponsored by SCIG) characterizes data into the following 3 cause categories:
 1. External Aggression (70% to 80% of all faults)
 - a) Fishing gear, such as trawling, dredging, long line fishing, stow net fishing
 - i. 65% of all external aggression faults
 - ii. 0.06 faults per year per 1000km
 - b) Anchors, (20% of all external aggression faults)
 - c) Geological, such as landslides, earthquakes, earth fault lines, sinkholes (10% of all external aggression faults)
 2. Component (2% to 10% of all faults)
 3. Other (2% to 25% of all faults)
- A Telcordia 2008 analysis of publicly reported information on the cause of 72 undersea cable outages reinforces the above findings, in that 83% outages were caused by environmental factors, such as external aggression from fishing

- ■ ■ Reporting Undersea Cable Outages: Observations - 1
 - The lack of openness on outage information is contributing to a lack of understanding of the robustness of the undersea cable infrastructure
 - How can one develop a risk management strategy without full knowledge of the:
 - Extent of major and transient undersea cable outages?
 - Risk mitigation plans that the undersea cable operators themselves are undertaking?

NOTE: ISPs and major enterprise customers are at particular risk due to lack of transparency

- ■ ■ Reporting Undersea Cable Outages: Observations - 2
 - Any “outage” information could be used by competitors against the reporting undersea cable carrier
 - Data is confidential* and restricted to:
 - The specific cable owner
 - Consortia members
 - A regional organization
 - Only the “big” outages that affect many customers are known in the public domain (i.e., media events)
 - There is no single point of contact (SPOC) for the receipt of undersea cable outage information

* **NOTE:** The undersea cable’s maintenance agreement typically restricts providing information to third parties

- ■ ■ Reporting Undersea Cable Outages: Observations - 3
- Examples of separate, independent entities* that receive such information are:
 1. Governmental regulatory bodies, such as the US (FCC), Singapore, Hong Kong, India, Egypt, South Africa, Australia
 2. Third-party industry organizations, focused on service availability, such as:
 - International Cable Protection Committee (ICPC)
 - Submarine Cable Improvement Group (SCIG)
 - United Kingdom Cable Protection Committee (UKCPC)
 - North American Submarine Cable Association (NASCA)
 - Kingfisher Information Service - Cable Awareness

* **NOTE:** Many of these entities treat such outage information as confidential


■ ■ ■ Reporting Undersea Cable Outages: Observations - 4

3. Regional organizations, such as:
 - Atlantic Cable Maintenance Agreement (ACMA)
 - Mediterranean Cable Maintenance Agreement (MECMA)
 - Pacific and Indian Ocean Cable Maintenance Agreement (PIOCMA)
 - South East Asia Indian Ocean Cable Maintenance Agreement (SEAIOCMA)
4. Individual cable consortia (i.e., TAT-14), which report “outages” to their internal management committee*

*** NOTE:** Unless an outage is catastrophic, this information typically goes no further than the cable consortia members

- ■ ■ Reporting Undersea Cable Outages: Observations - 5
 - Lack of Information leads to regulation:
 - Egypt
 - India
 - Malta
 - Singapore
 - Those that route across multiple undersea cables, such as ISPs and major enterprise customers, have an IP routing window into the underlying infrastructure and may be a third-party source of information

NOTE: May consider third-party resources, such as Renesys Corp. and the Internet Traffic Report

-  Hong Kong: Reporting Undersea Cable Outages-1
 - Information to be provided*:
 1. Name of operator
 2. Description of incident
 3. Date and time of onset of the incident
 4. Types & estimated number of customers/end-users affected
 5. Affected areas
 6. Actions taken
 7. Contact person's information:
 - Name of contact person
 - Fixed and mobile telephone numbers
 - E-mail address

* Office of the Telecommunications Authority (OFTA) report, "Guidelines for Cable-based External Fixed Telecommunications Network Services Operators and Internet Service Providers for Reporting Network and Service Outages", Issue 2, 29 January 2008.
http://www.ofta.gov.hk/en/report-paper-guide/guidance-notes/gn_200802.pdf

■ ■ ■ Hong Kong: Reporting Undersea Cable Outages-2

■ Reporting Criteria:

Type	Event	Duration of Outage (minutes)
Fishbone/linear submarine cable systems	Dual failures in two fishbone/linear submarine cable systems causing to be unable to communicate with other places by means of these two systems	> 30
Ring or other types of submarine cable systems	Failure in a ring or other type of submarine cable system causing Hong Kong to be unable to communicate with other places by means of that system	> 30
Backhauls	A loss of more than 50 % of the backhaul capacity of a submarine cable system within	> 30

■ ■ Hong Kong: Reporting Undersea Cable Outages-3

■ Timeframe for Reporting:

Occurrence Time	Initial Report	System Normalization
Between 00:00 and 24:00 of each day	<ul style="list-style-type: none"> • The operator concerned should report the submarine cable system outage to OFTA within 2 hours from the confirmation of the outage or within 4 hours from the happening of the outage, whichever is earlier. • Under critical circumstances, OFTA may request the operator concerned to submit the initial report within a shorter period of time. 	<ul style="list-style-type: none"> • The operator concerned should report to OFTA within 1 day from the completion of system normalization. • Under critical circumstances, OFTA may request the operator concerned to report to OFTA within a shorter period of time.

- ■ ■ Hong Kong: Reporting Undersea Cable Outages-4
 - Examples of Undersea Cable Outages:
 - a) Incidents of submarine cables such as submarine cables being damaged by anchors dropped from ships, dredging fishing nets, earthquakes or other unknown reasons
 - b) Multiple failures in the backhaul links leading to a loss of more than 50 % of the backhaul capacity of a submarine cable system within Hong Kong
 - c) Etc.

- ■ ■ What Information an Undersea Cable Outage Should Contain in Generic Terms?
 - What happened?
 - When did the event start? When did it end?
 - Who was impacted?
 - How were users impacted?
 - Why did it happen?
 - What will prevent it from recurring?

■ ■ ■ Suggestion for Future Action

1. Given the lack of focus on a definition for, and the attributes of an undersea cable outage, a case can be made for a more structured method of:
 - Defining an undersea cable outage
 - Reporting an undersea cable outage
 - Combining undersea cable outage with terrestrial network information (for a true picture of the end-to-end service availability sought after by enterprise customers)
2. Investigate the applicability of methods and procedures for reporting outages in the “land-based” environment for the undersea cable infrastructure environment, such as:
 - Leveraging the current FCC-reportable categorization
 - The proposed NRSC categorization for FCC-reportable outages
 - The OFTA outage categorization
 - Any other existing categorization scheme

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Suggestion for Future Action - 2
- 3. The time is right for a multi-national, cross-industry forum comprised of the undersea cable infrastructure community, major enterprise customers, ISPs, and data hosting centers that monitor their global infrastructure to develop models for global infrastructure resiliency
 - Third parties that lease facilities and offer value-added services tend to be more transparent than the service providers themselves