New Asian IP backbone architecture using Subsea cable systems

NANOG48

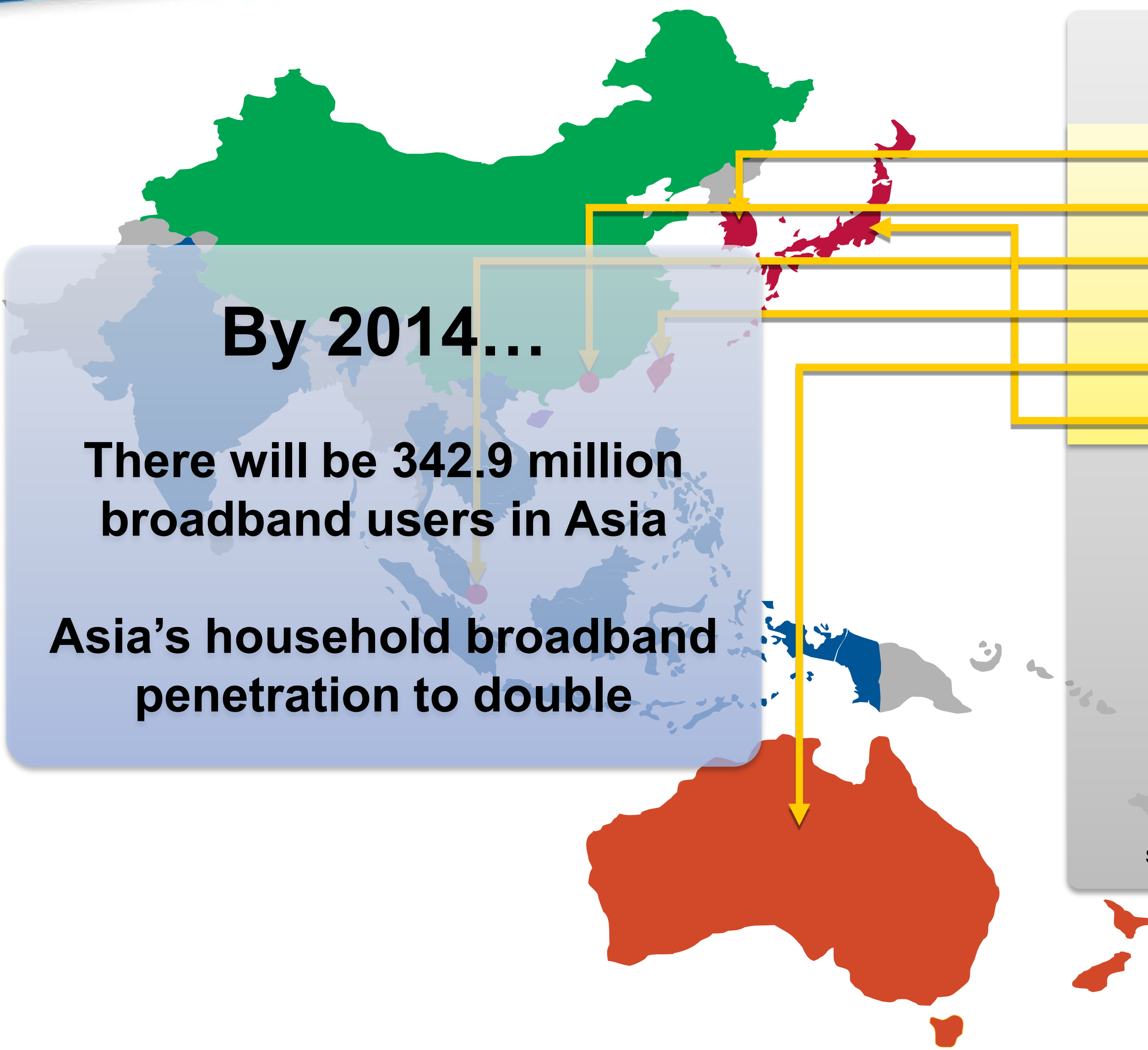
22 February 2010

PACNET

Who is Pacnet?

Combined Statistics
Construction Costs: \$4.0B
Length: 36,800 km
Design capacity: 10.24 Tbps
PoPs: 75 Based in Asia, Europe, USA

The Asian Broadband Explosion Continues…



By 2014…

There will be 342.9 million broadband users in Asia

Asia's household broadband penetration to double

Household Broadband Penetration (2008)

South Korea	92.8%
Hong Kong	85.0%
Singapore	78.5%
Taiwan	66.0%
Australia	63.7%
Japan	62.7%
New Zealand	55.7%
Malaysia	21.4%
China	19.9%
Thailand	7.4%
The Philippines	4.1%
India	2.3%
Indonesia	1.3%

Source: Frost & Sullivan, 2009

International Connectivity in Asia

- Countries in the Asia Pacific region connect to each other primarily using subsea cables – over 95% of intra-Asia traffic is through subsea cables

- Primary gateway for US – Asia traffic is Japan

International Connectivity in Asia

- Unique Positioning
  - Intra-Asia IP communications is mainly over subsea cable systems
  - Typically a RING topology bridging multiple countries is used
  - Cable length between cable landing stations is not too long, for example, between 1,800km – 3,400km (EAC)

Asia <> US IP Backbone Design

A. Layer3 backbone circuits in Asia connect to US via Cable Landing Stations in Japan

B. Layer3 backbone circuits connect to Tokyo/Osaka POPs from Asian countries, then both POP connect to US IP POPs

C. A + B combination

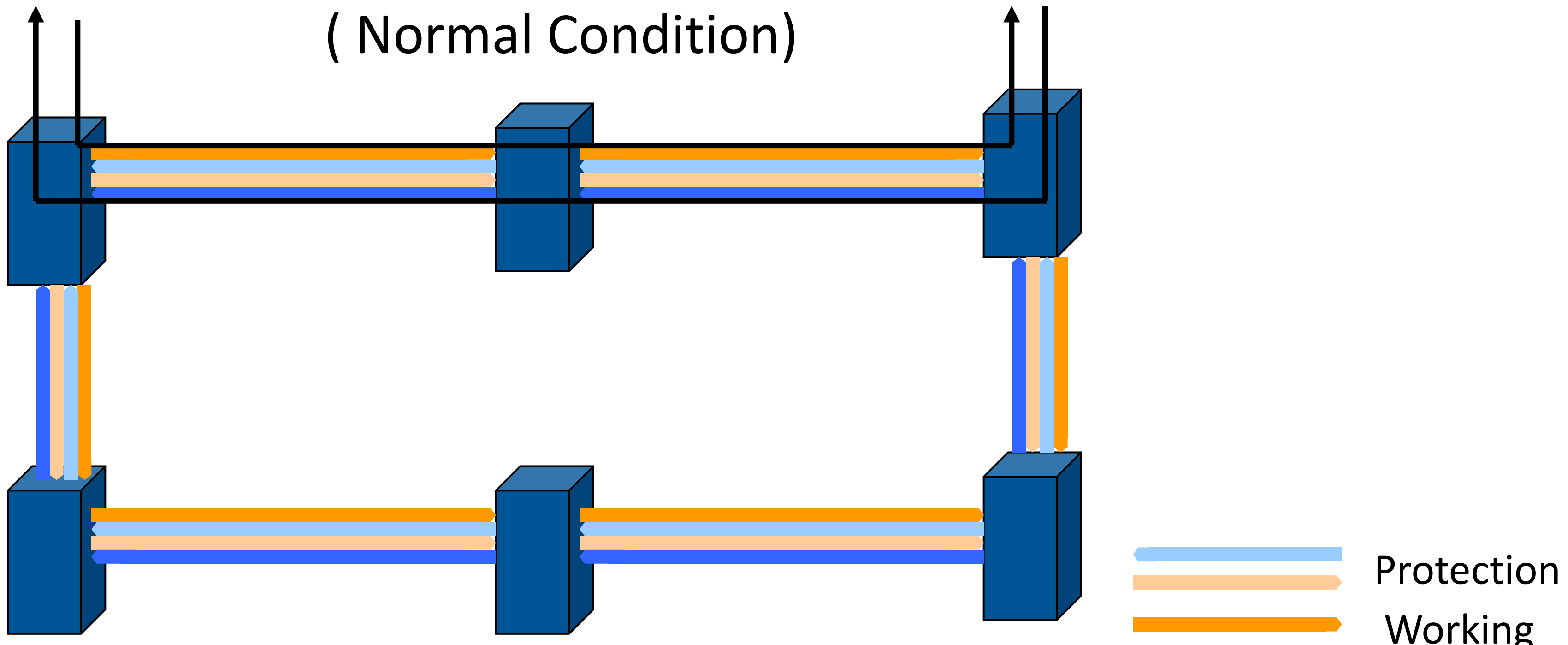
Subsea Network Operations

SDH Ring Protection

- Unidirectional 1+1 subnetwork connection protection (**SNCP**)
- Multiplex Section-Dedicated Protection Rings (**MS-SD Ring**)
- Multiplex Section-Shared Protection Rings (**MS-SP Ring**)

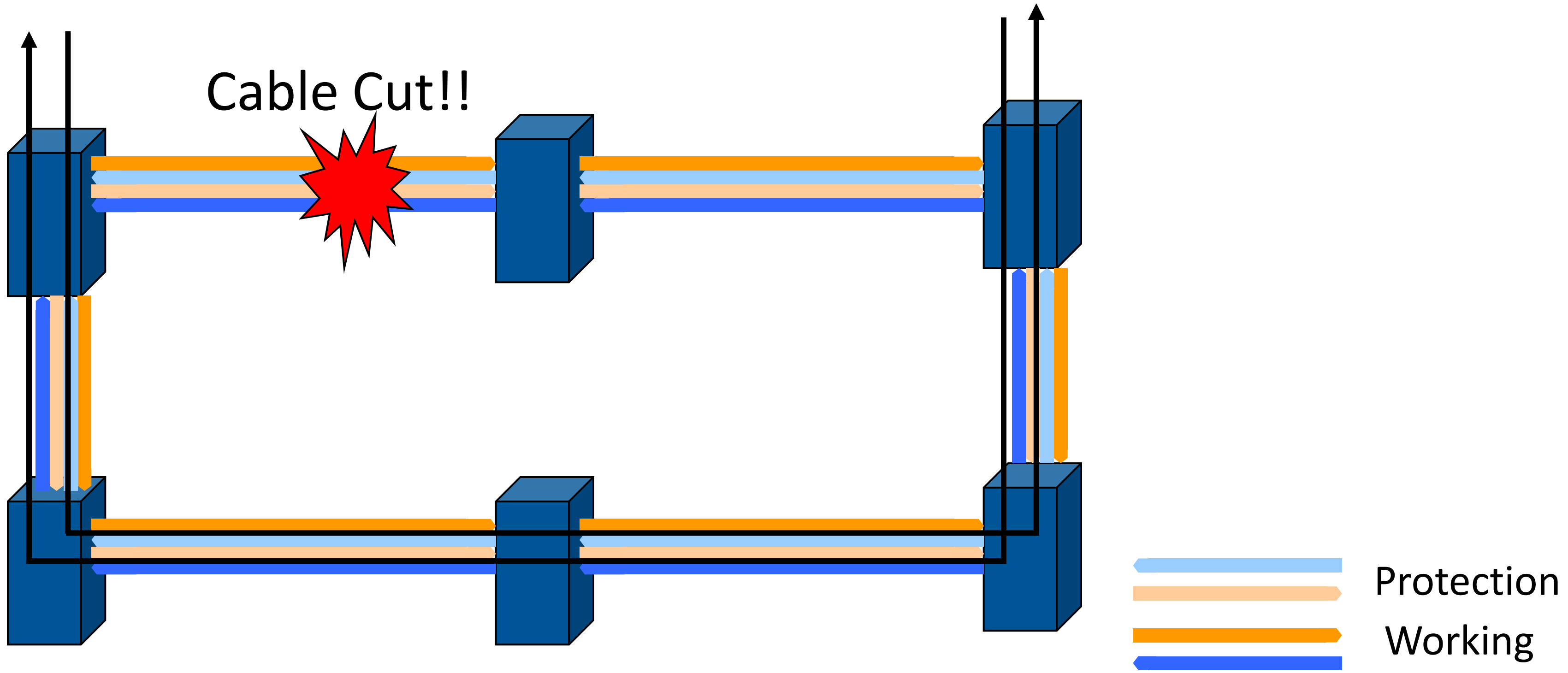
SDH Ring Protection

- MS-SP Ring Protection

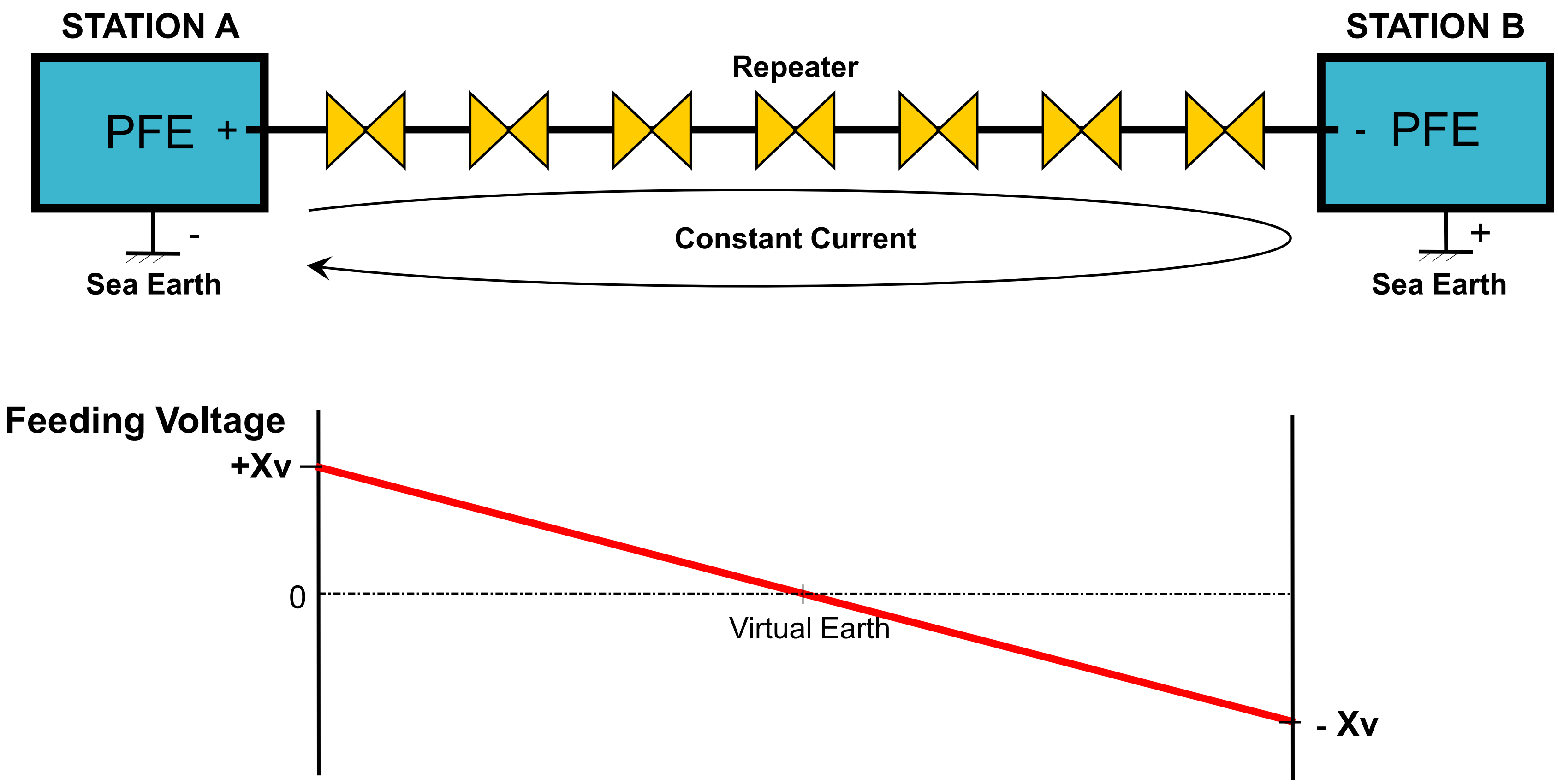


SDH Ring Protection

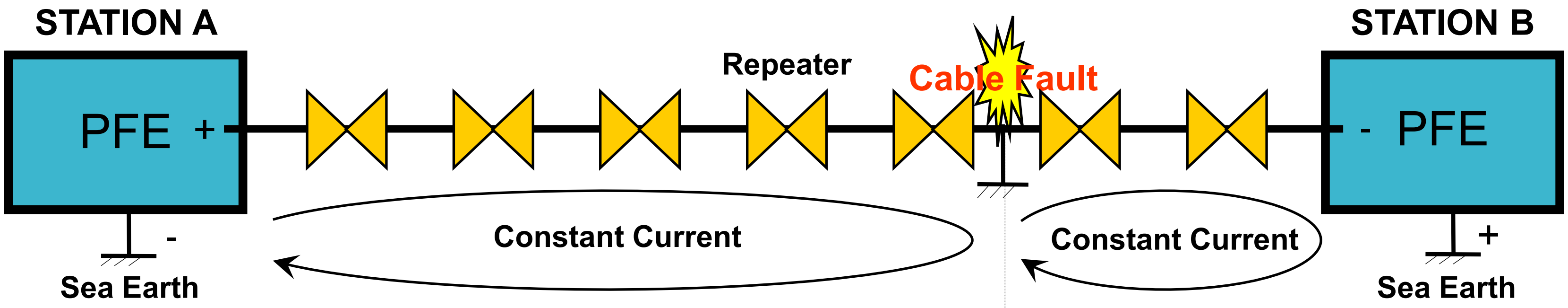
- MS-SP Ring Protection + TOP (TransOceanic Protocol)



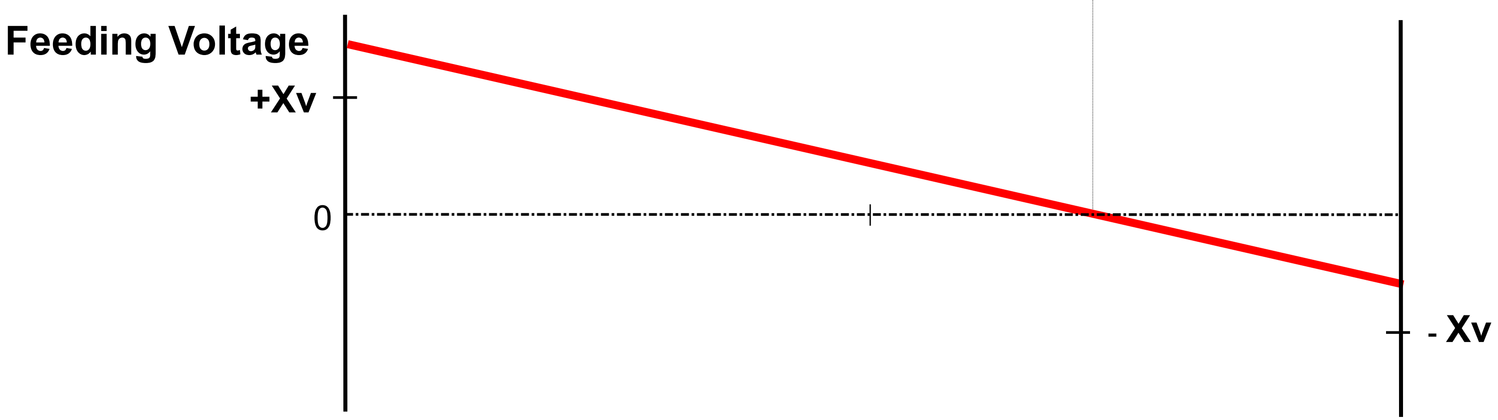
Power Feeding (Normal)



Power Feeding in Cable Fault



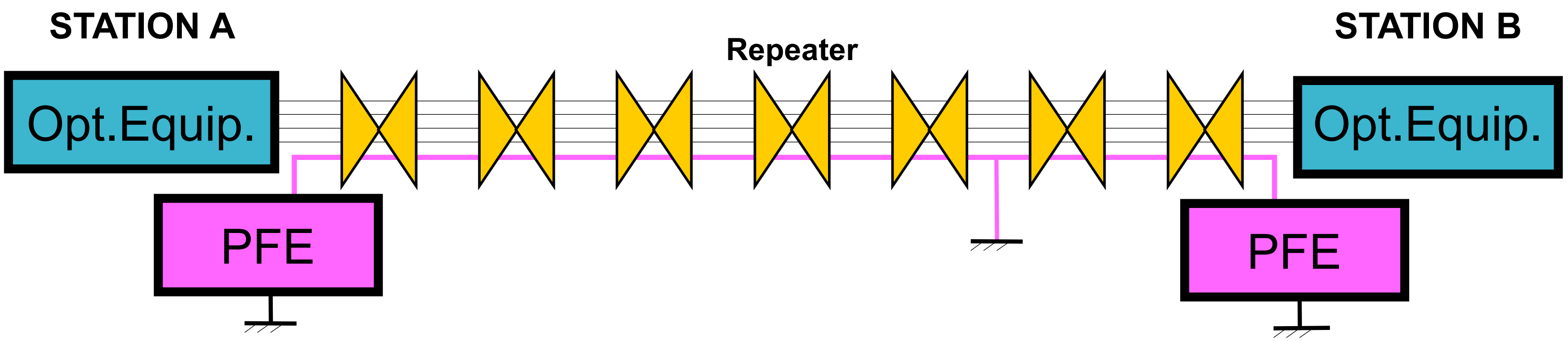
PFE: Power Feeding Equipment



Fault location (1)

1. Shunt Fault

   DC current into the ocean → **Voltage measurement**

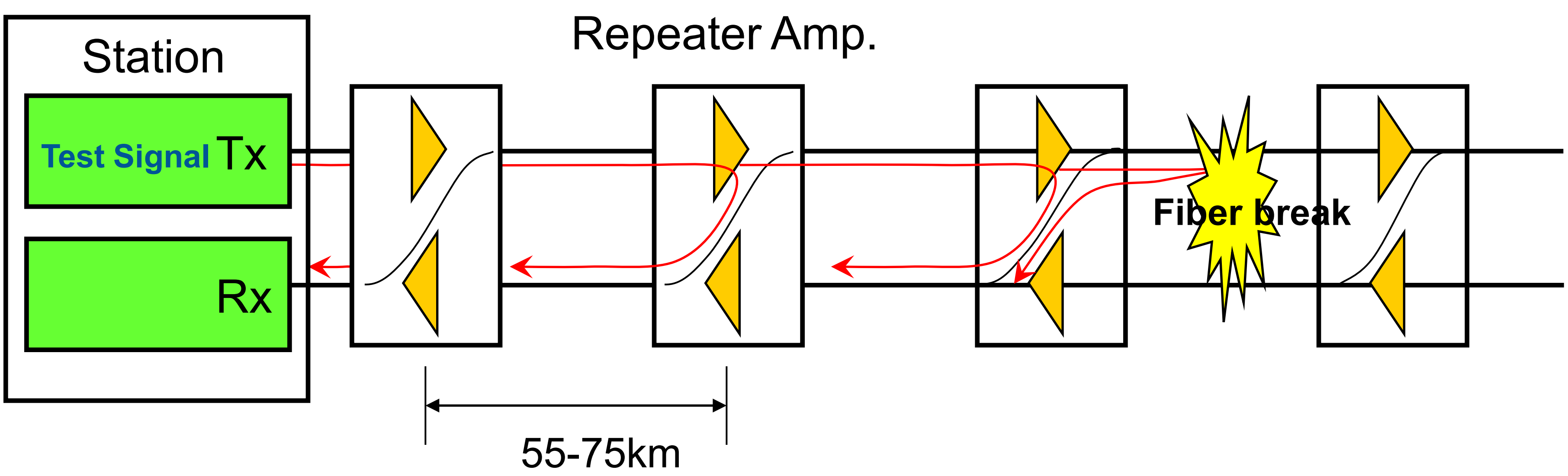


Fault location (2)

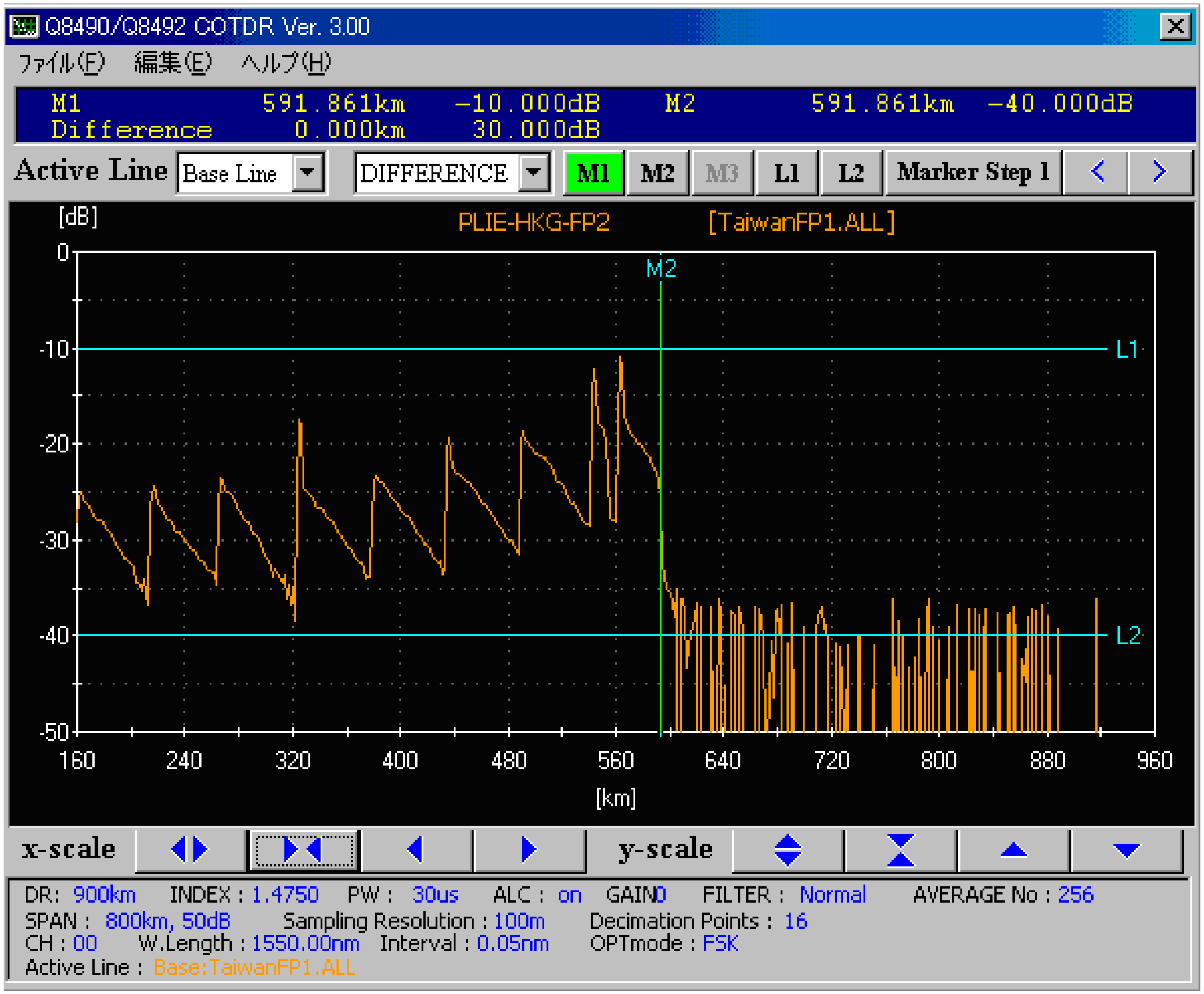
1. Cable cut

   (1) Fiber Break → **Optical measurement**

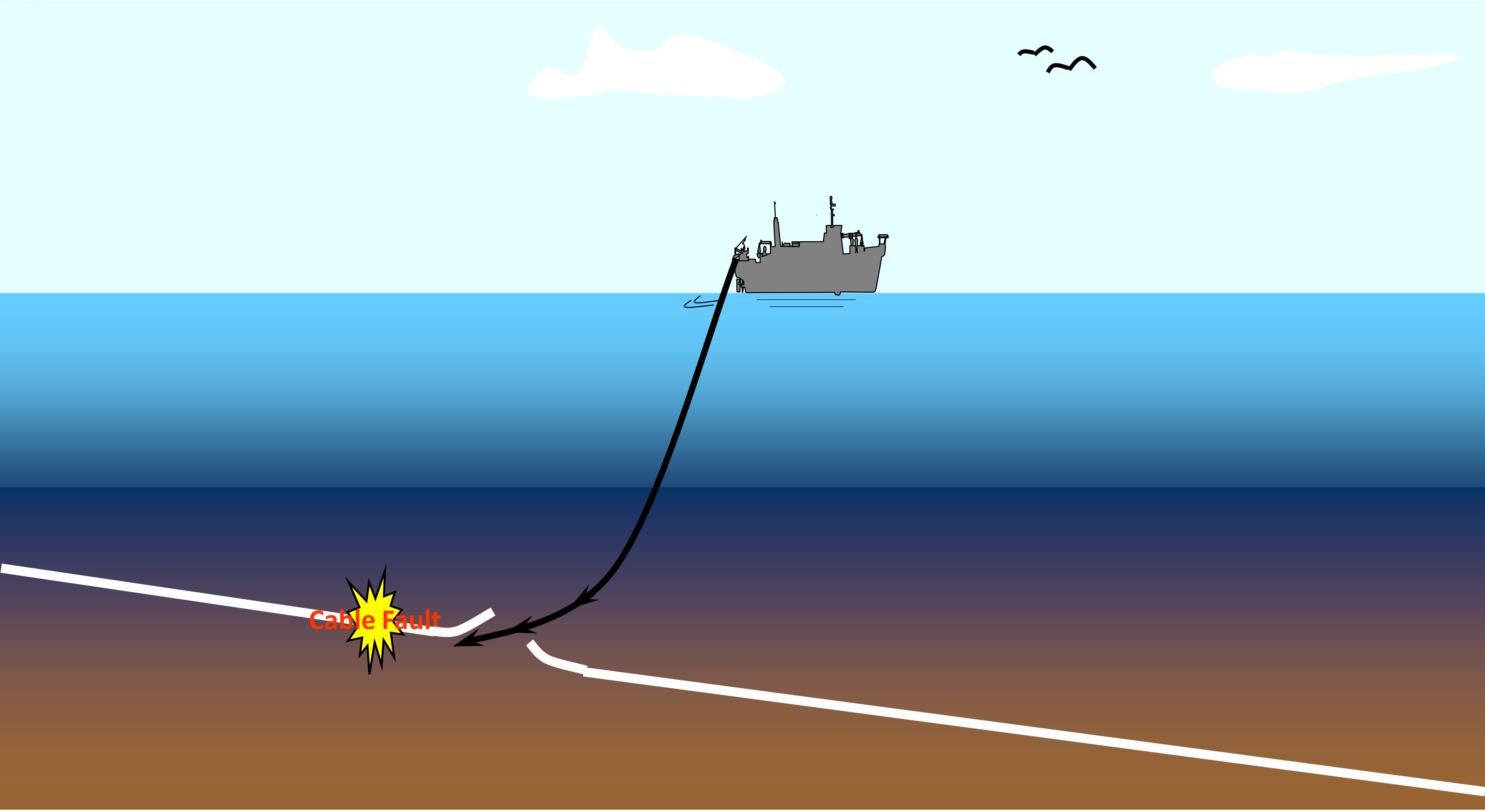
   (2) DC current into the ocean → **Voltage measurement**



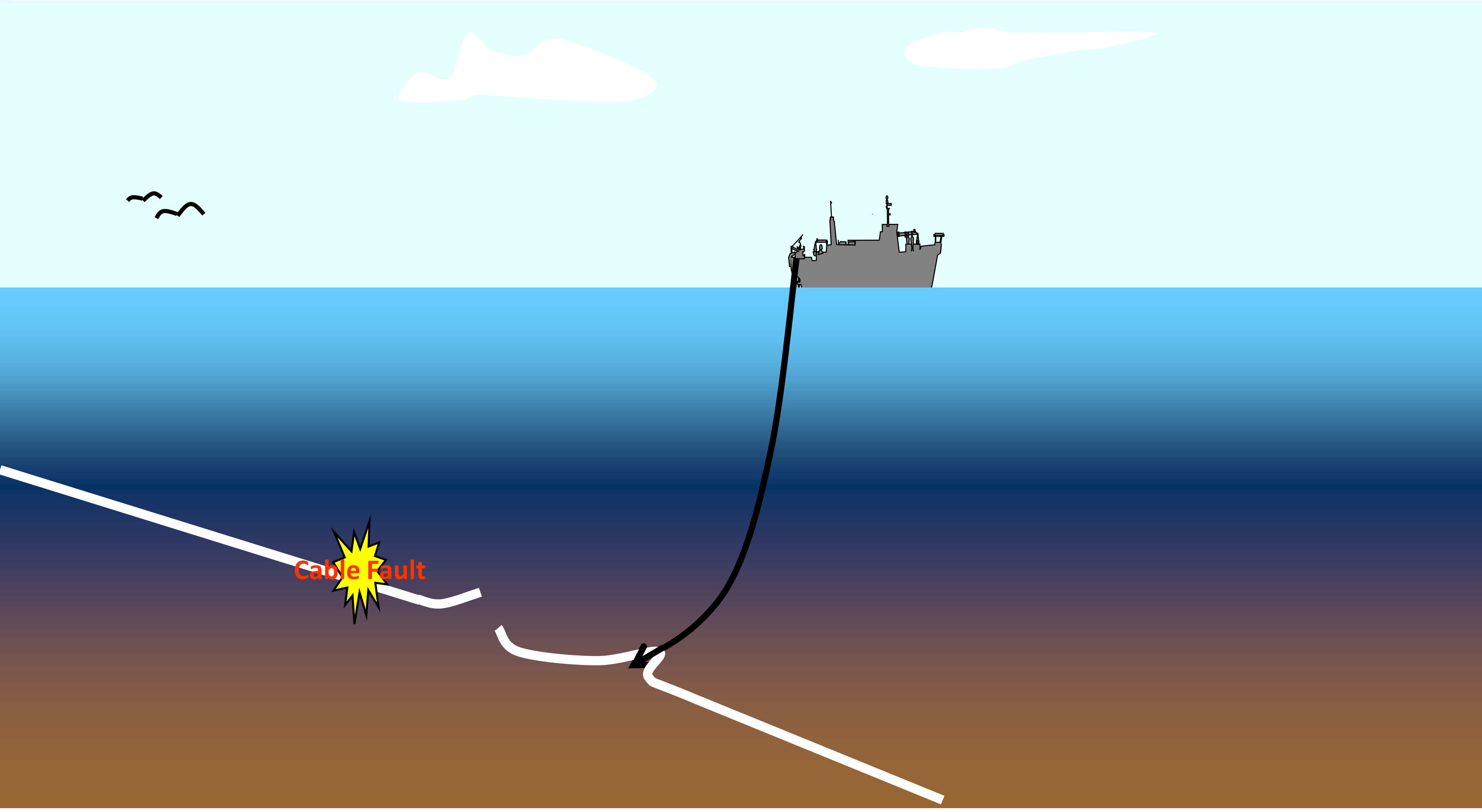
COTDR (Coherent Optical Time Domain Reflectance)



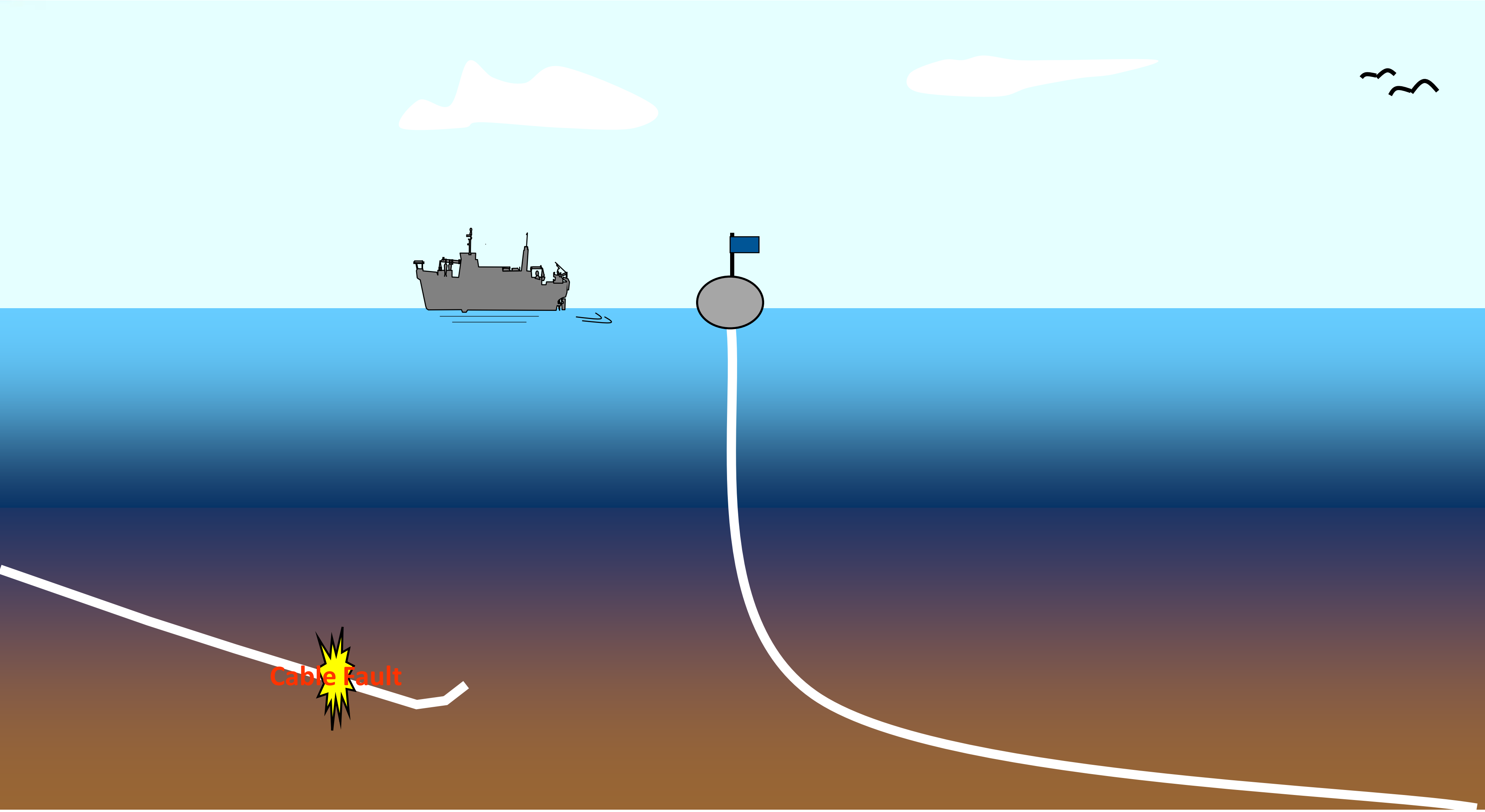
Cutting Drive



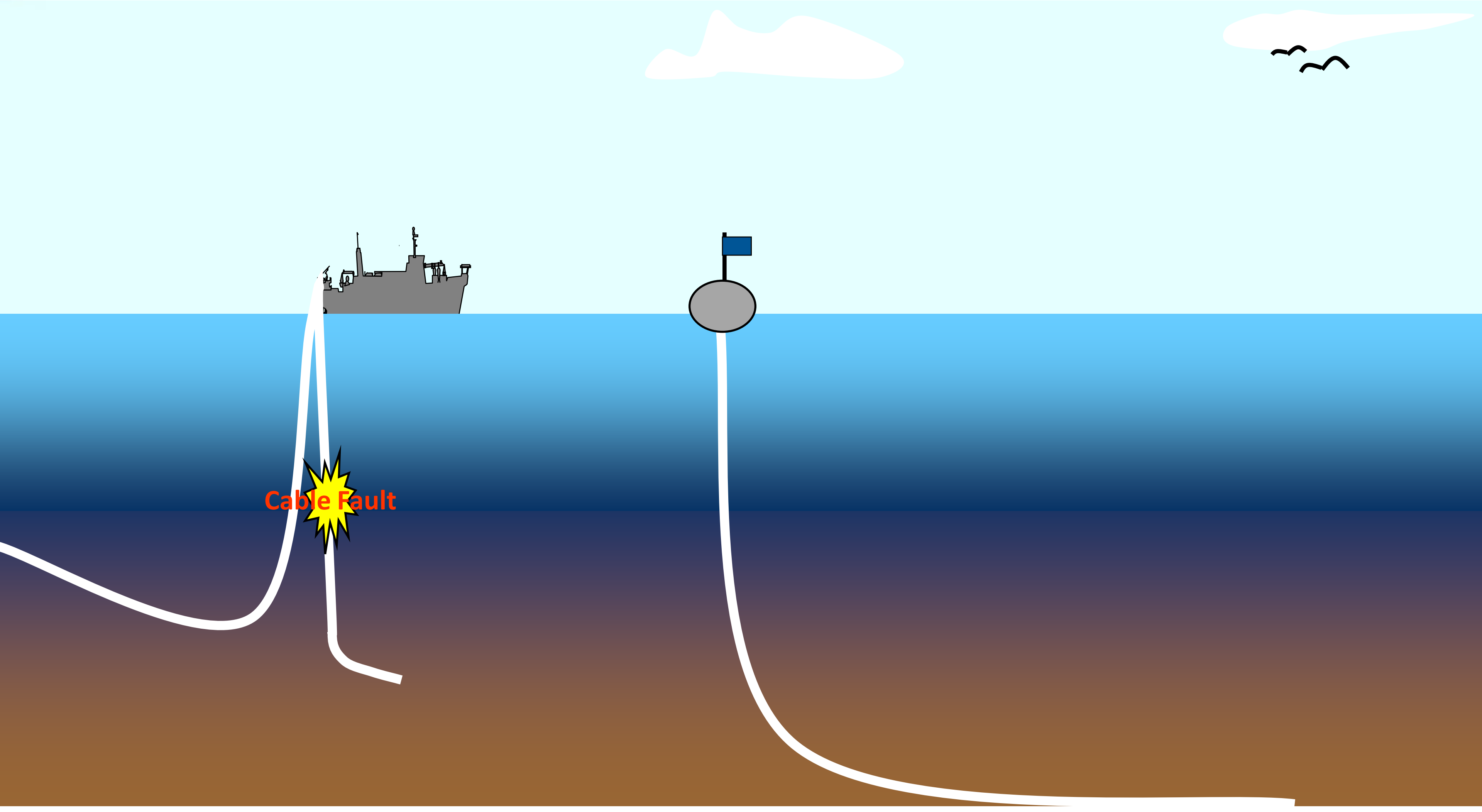
Holding Drive-1



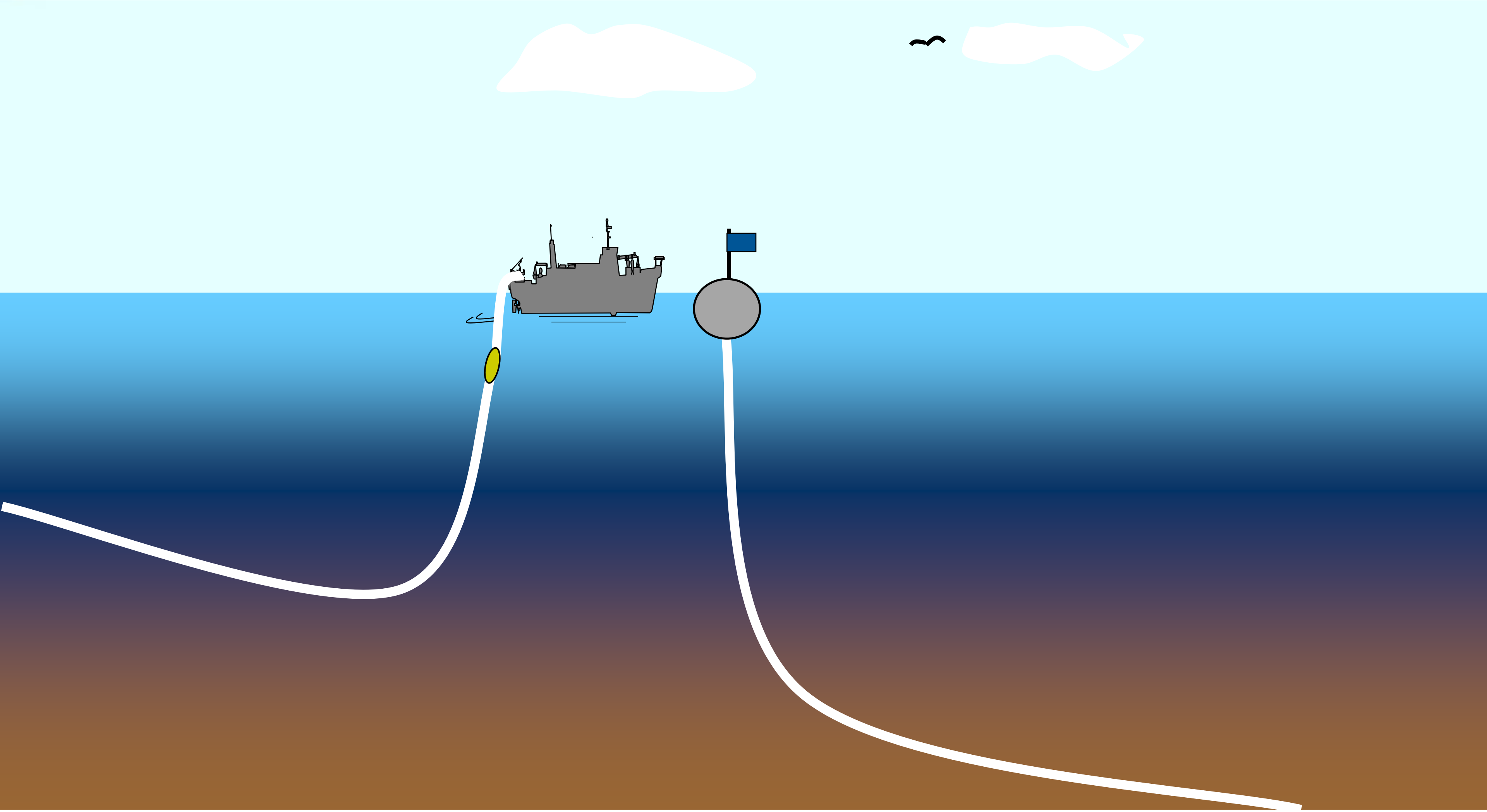
Buoying



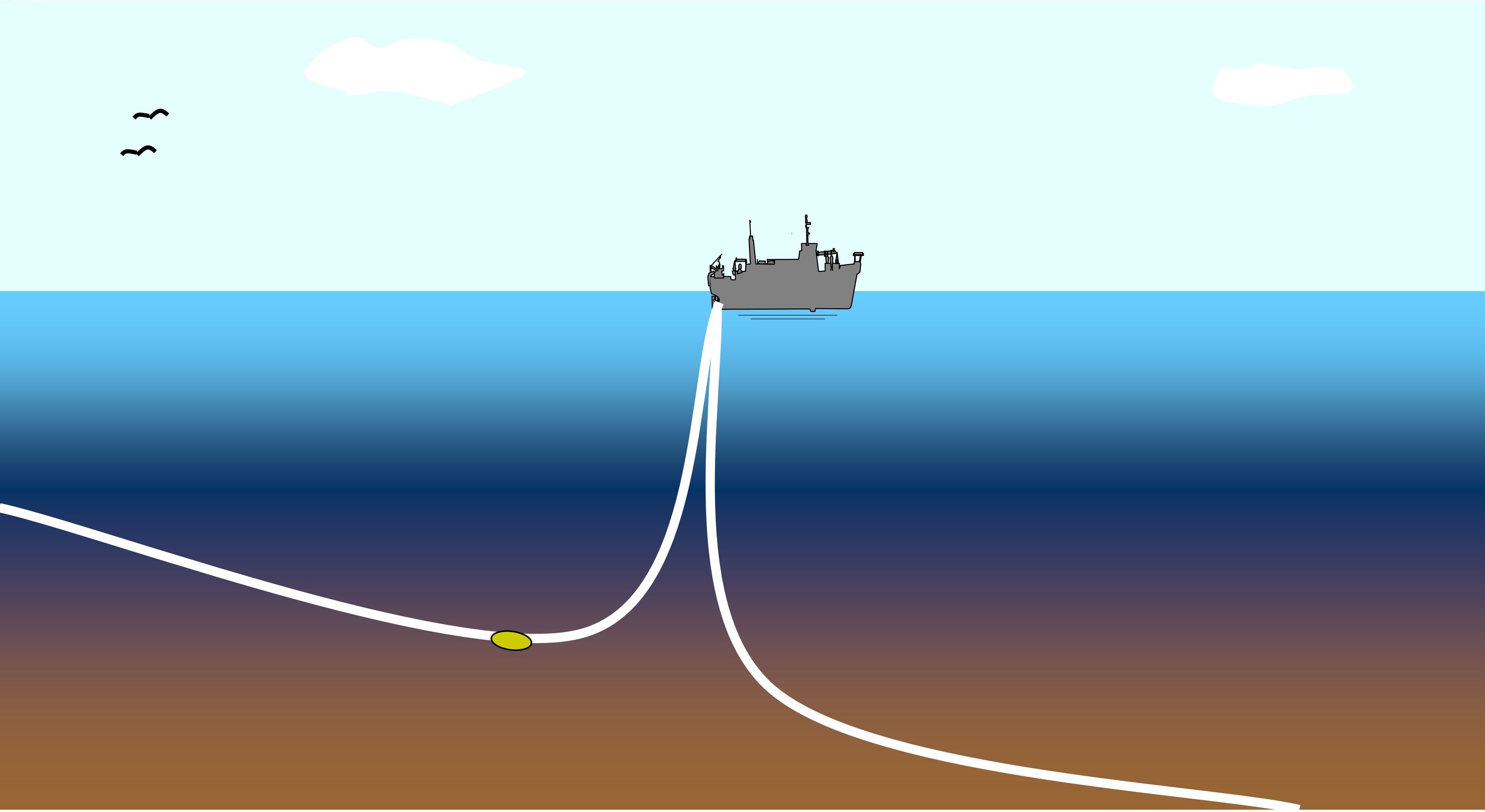
Holding Drive-2



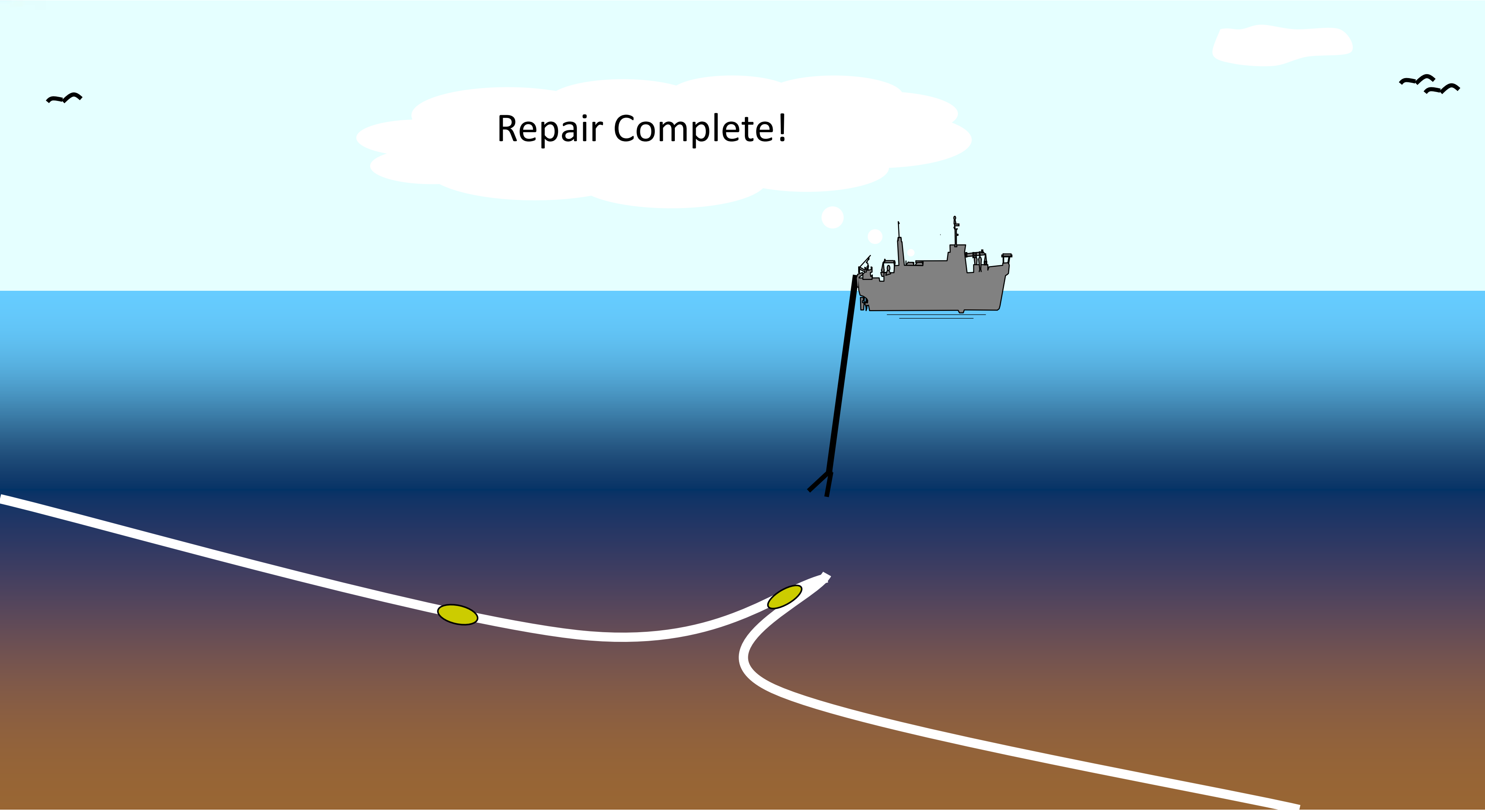
First Splice & Laying



Final Splice



Final Bight Release



IP Backbone in Asia

Design Challenges in Asia

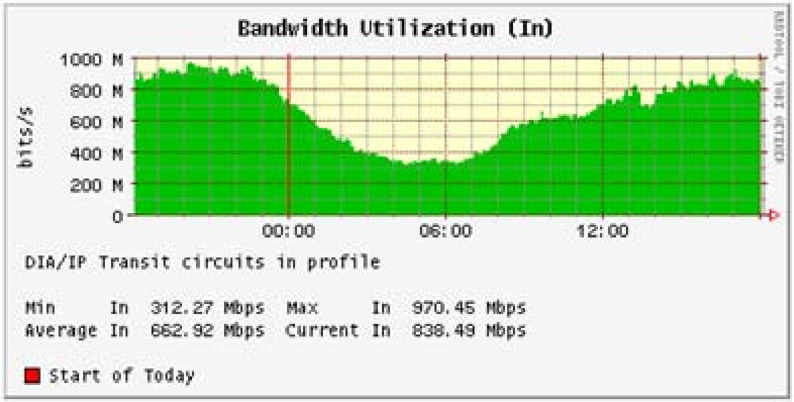
- Internet traffic volume, as well as traffic direction from each Asian country is different – therefore Internet backbone design is not efficient now
- Not easy to change “traffic aggregation point”
- Low statistical multiplexing effect on international circuits due to backbone bandwidth and customer port bandwidth being the same

Design Challenges in Asia

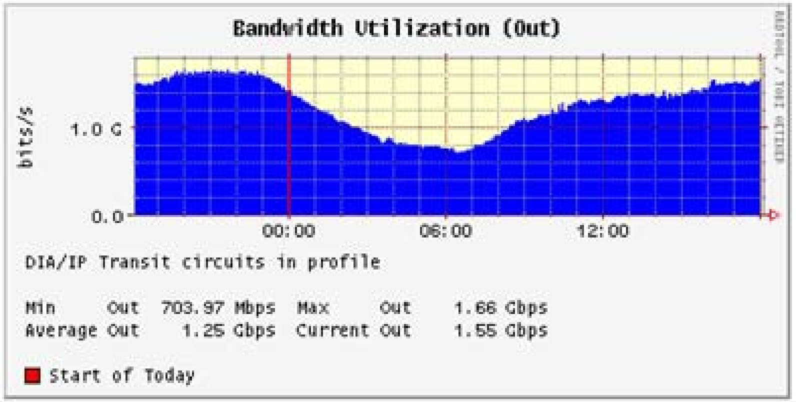
Generated at: **GMT 2009/12/08 10:06 AM**
Graph in Time Zone: **Asia/Hong_Kong**

All - DIA/IP Transit circuits in profile

Daily Graph (5 minute averages)



Daily Graph (5 minute averages)

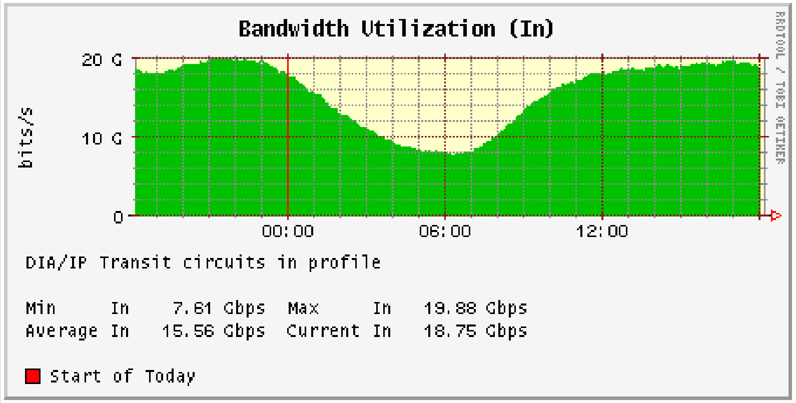


Korea

Generated at: **GMT 2009/12/08 10:09 AM**
Graph in Time Zone: **Asia/Hong_Kong**

All - DIA/IP Transit circuits in profile

Daily Graph (5 minute averages)



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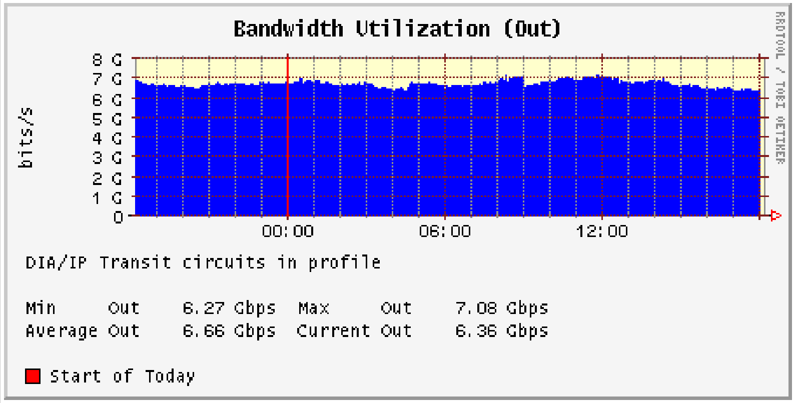
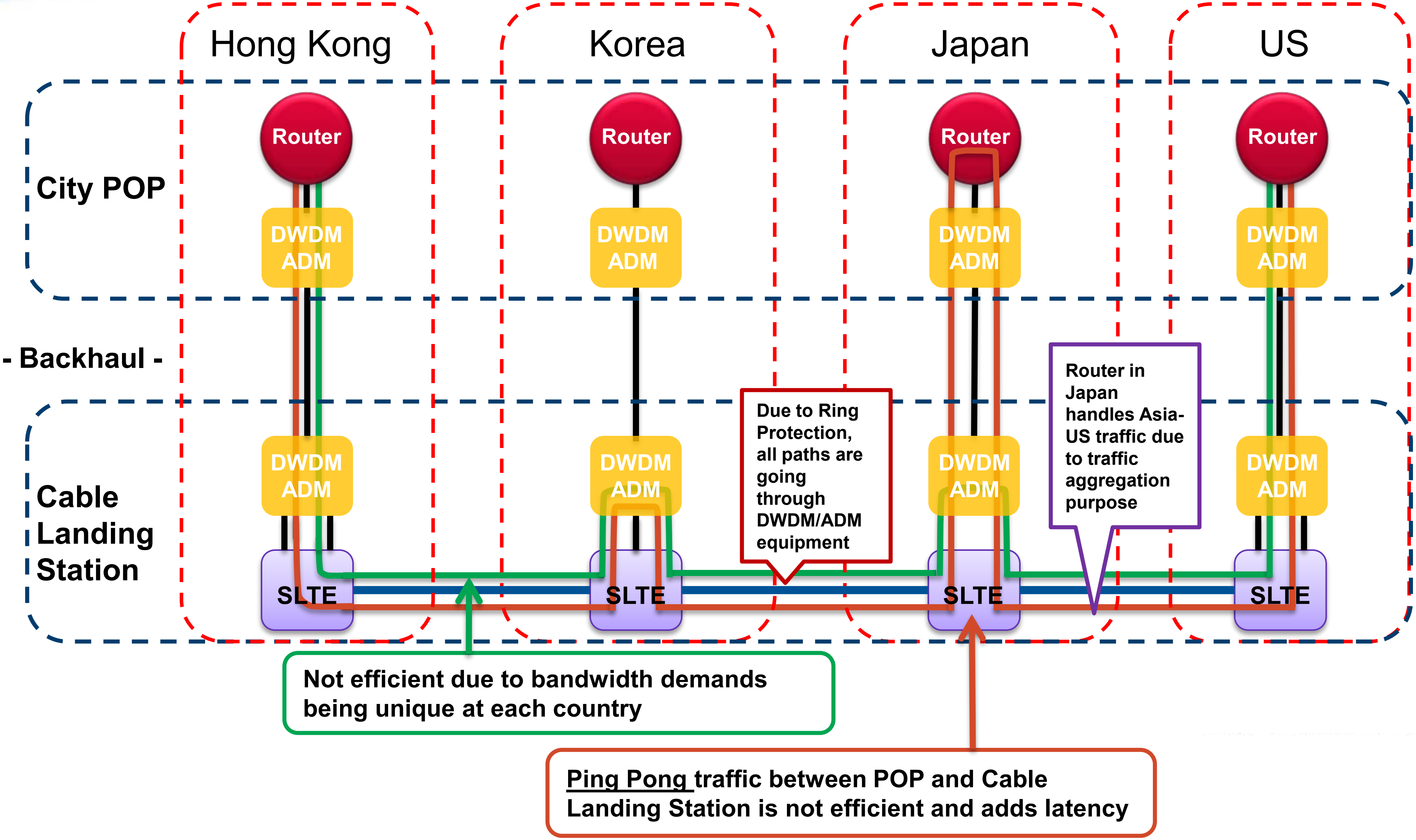
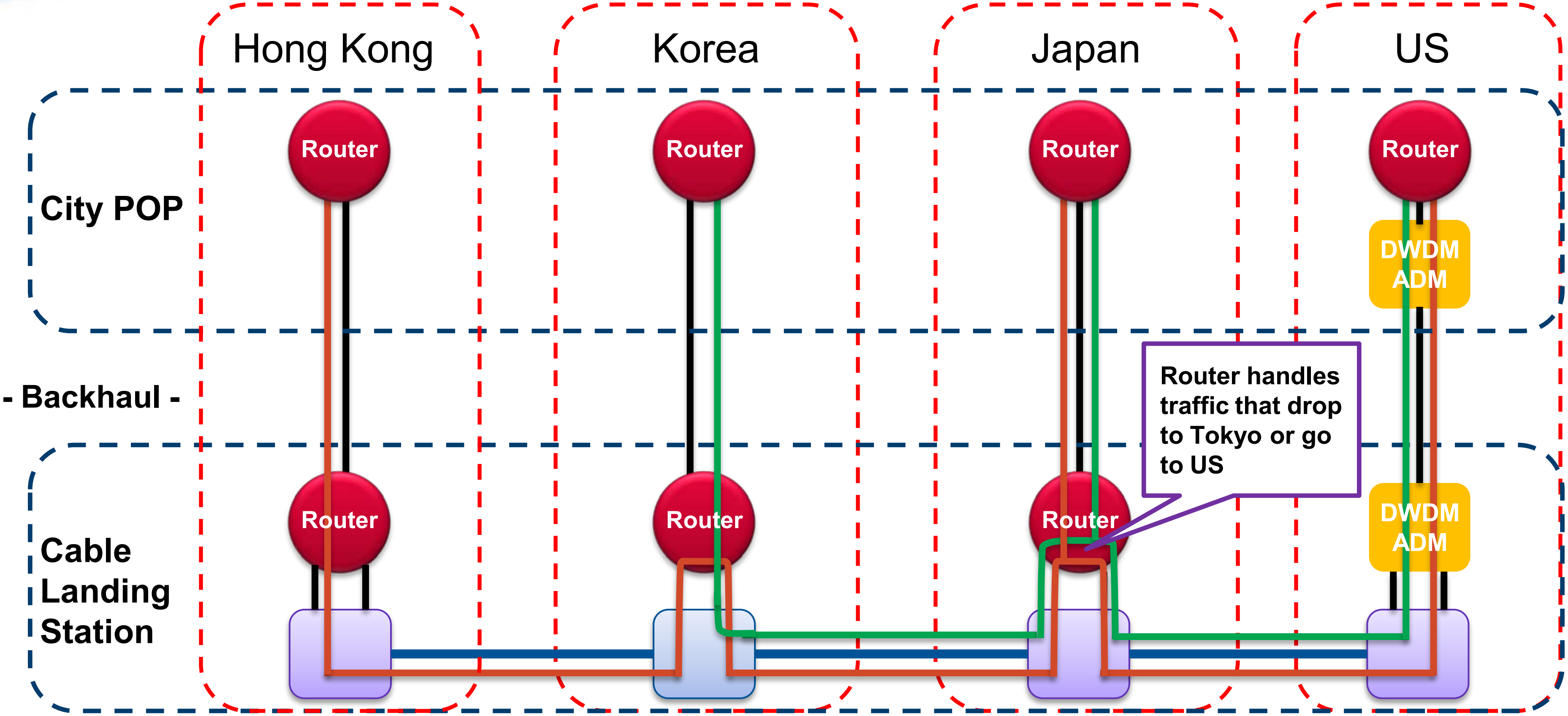


Rest of Asia

Traditional Asia <> US IP Backbone Architecture

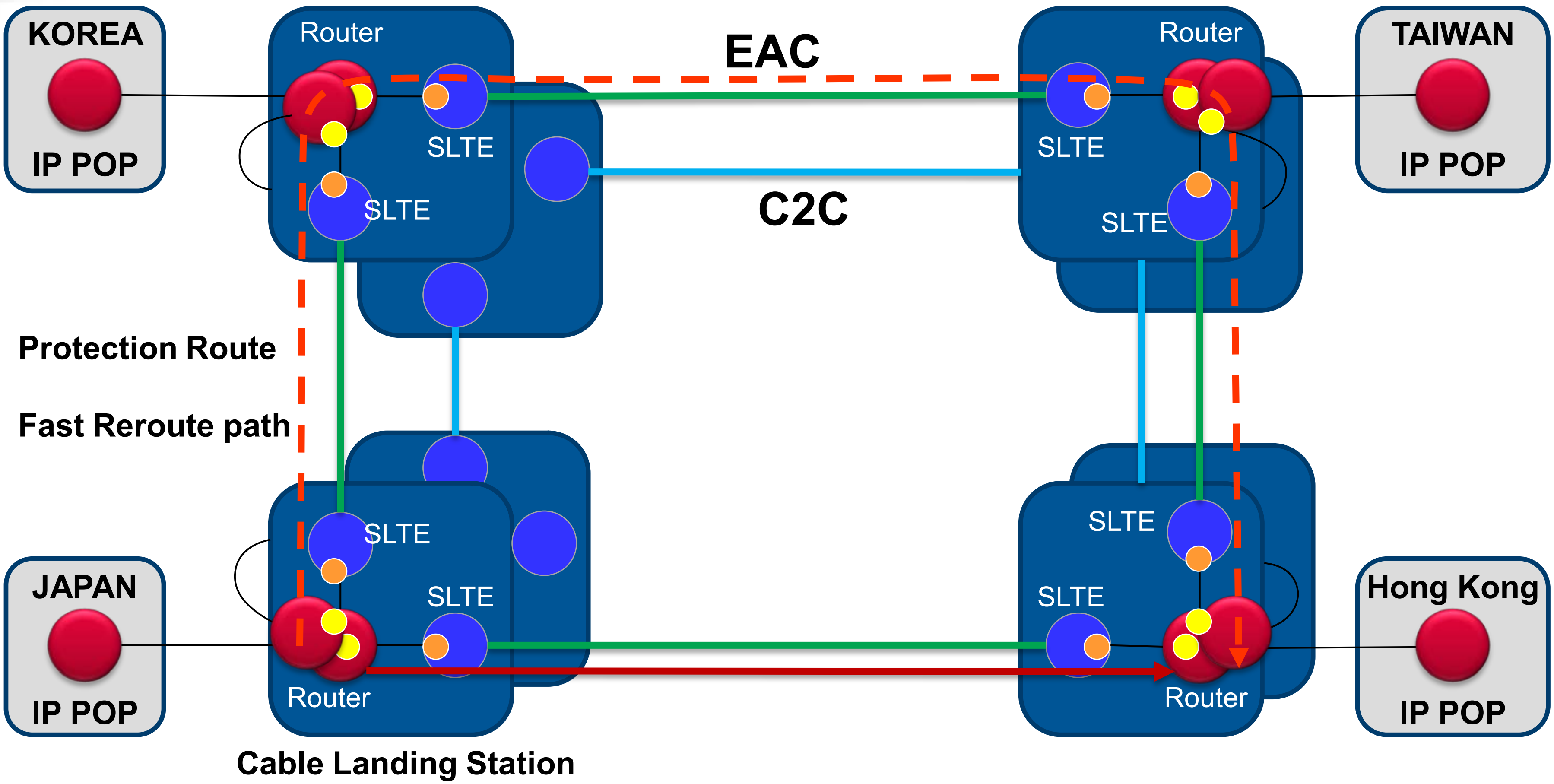


NEW Asia <> US IP Backbone Architecture



Ability to manage traffic flow and capacity utilization

Circuit Protection by Router



- 10GE WAN-PHY
- STM64 SDH Interface

Design Concept

- No longer traditional Ring Protection mechanism on top of subsea cable system
- Use 10GE WAN-PHY since WAN-PHY Interface detects alarm of subsea portion from OTN
- MPLS LSR will perform FRR (Active and Standby LSPs) instead of Ring Protection – Subsea is basically 1+1 conf, Active + standby LSPs therefore is reasonable.
- Traffic monitoring will be based on LSP traffic data
- Additional RR hierarchy
- No GMPLS/ASON "no c-place and d-plane separation"

Network Advantages

- Contingency plan
  - City POP failure and cable cut by Earthquake !
- Route Flexibility
  - Explicit LSP allows us to utilize alternative active paths using “Protection Path”
- Better traffic aggregation by Cable Landing Station routers
  - Eliminate SDH level hierarchy, aggregation is LSP level with flexible BW
- Easy to upgrade subsea portion to 40G or 100G in near future
- Eliminate SDH related CAPEX at Cable Landing Station

Operational Preparation

At Cable Landing Stations

- High performance Router with redundancy
- No Virtual Router
- Single Interface card will be used as much as possible
  - Spare and reusable purpose
- Of course, IPv6 is enabled

Asia Regional IX Capability

Internet Exchange Environment in Asia

- In Asia, commercial IXes are operated by telecom carriers, data center companies or non-profit organizations in each country
- Layer2 IX and MPLS-IX exist in this region but some IXes in Asian countries are **Layer3 IX** which are using Route-Server to receive and advertise BGP routes among IX members

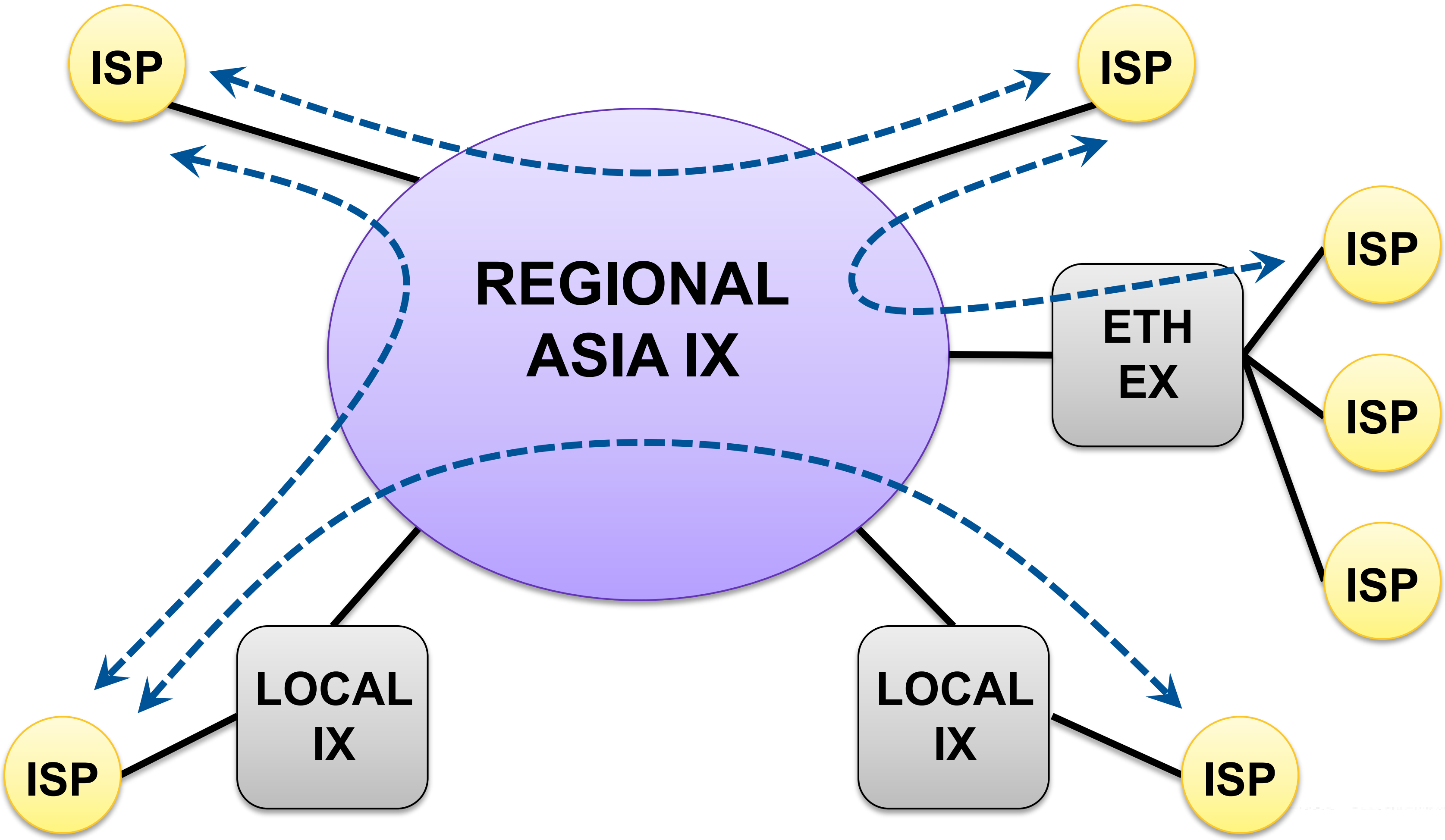
Do we need Asia Regional IX?

- Large subsea capacity allows us to provide Inter-country Internet Exchange in Asia
  - Initial Design Concept
    - No Layer3 IX
    - Use MPLS transport with VPLS solution
    - Peering can be done between POP and POP
    - Member will co-locate at our POP or LL connect to IX port directly

Do we need Asia Regional IX?

- Other possibilities
  - IX’s IX : Bridging two IX points at different country
  - Transit offer between members
  - Provide transit over Regional IX capability
  - Connect to an Ethernet Exchange Point
- Any other ideas and requirements you can provide?

Regional IX Concept



Questions?