Submarine Internet Cable Vulnerabilities

Natural Disaster and Maritime Threats to Internet Network Cable Infrastructure

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Introduction

What are the key elements that affect global internet connectivity? According to documents released on NSA surveillance, 99% of the world's communications passes through undersea internet cables. The modular nature of the internet means that there is automatic redundancy should any cable be damaged. In the event of damage, end users experience service slowdown.

A 2012 *Wired* article identified three threats to submarine cables: 1) ship anchors, 2) fishing, and 3) earthquakes. In most parts around the world, cable areas are protected because of threats cables face. Still, repair is now expected in cable operations to ensure continued operations.

This geospatial analysis approximates what sections of the undersea cables are vulnerable to disruption.

Methodology

Fishing risk is approximated through global data on fishing zones, highlighting cable portions in these zones.

Anchoring data was constructing using port location data, assuming a 20 km "risk zone" around ports where ships may be more likely to anchor. Cables near coasts were assumed to be at higher risk due to a higher likelihood of anchoring by commercial or personal vessels.

A decade of detailed earthquake data from USGS was used to model earthquake risk. Affected areas of magnitude 5-9 earthquakes are overlaid, weighting earthquake types equally.

Results

Many cables are vulnerable to external threats. Earthquakes are an ongoing threat that is more predictable. Maritime traffic is also a problem, but less predictable.

With cable landing points often being located near port areas, shipping threats are a key threat, requiring management by local authorities in order to protect cables.

As many maritime charts are only available for purchase, and not available for free, commercial and professional operators are more likely to be able to successfully be able to act as good stewards than casual or smaller operators.

East Asia faces particular vulnerabilities, from frequent maritime traffic and high risk of earthquakes. Earthquakes are a particular issue as multiple cables may be affected at once.

Limitations

Because of data limitations, this map analysis has made significant assumptions, and is not useful for close area risk identification.

Due to the limits in data available on a global scale, this study provides very general areas of vulnerability.

Further Investigations

The global nature of this investigation has meant that the resulting map is not useful on a local basis. In depth analysis into the three risk areas using detailed, local data would help build a more robust model useful on an individual country level.

Detailed anchoring data which takes into account restricted areas would significantly reduce over identification of high risk areas.

The earthquake data does not take into account where the highest magnitude earthquakes will occur in the future. More information on earthquake occurrences would help build more robust predictions.

Least Vunerable Cables

Russian Optical Trans-Arctic Cable System (ROTACS)

Oceania

Most Vunerable Cables

South American Crossing (SAC)

PC-1

APCN2

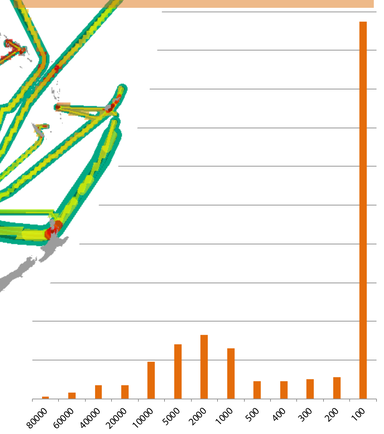
ROTACS

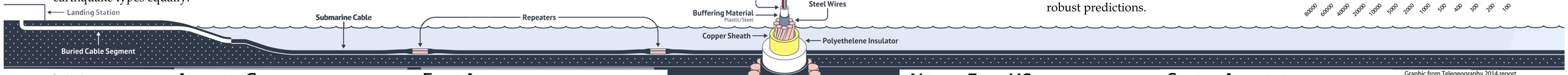
Japan-US

CUCN

Sam-1

Cable Capacity Frequency (Tbps)





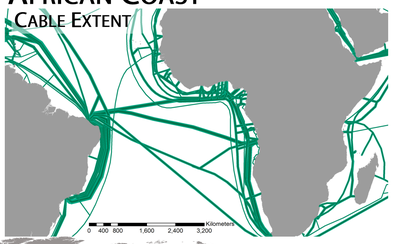
What Is a Submarine Cable?

Projection: Winkle II
Data Range : 2004-2014

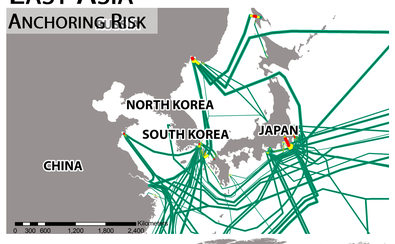
Capacity (Tbps)
- 0 - 880
- 881 - 3200
- 3201 - 12800
- 12801 - 32000
- 32001 - 80000

Anchoring Risk
- High Risk (10 km port/coast)
- Medium Risk (20 km)
- Low Risk (30 km)

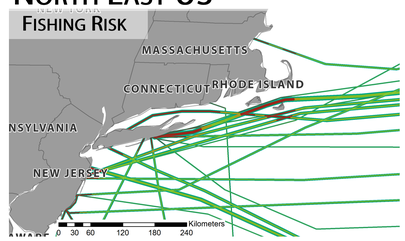
African Coast
Cable Extent



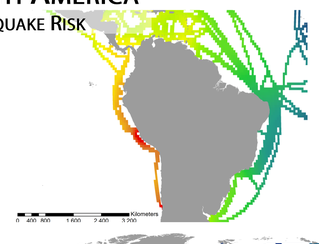
East Asia
Anchoring Risk



North East US
Fishing Risk



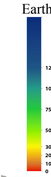
South America
Earthquake Risk

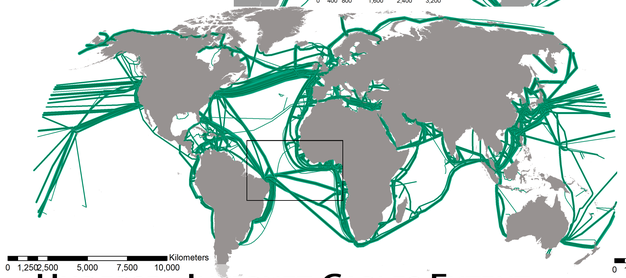


Graphic from Telegeography 2014 report

Fishing Risk
- High Risk (10 km port/coast)
- Medium Risk (20 km)
- Low Risk (30 km)

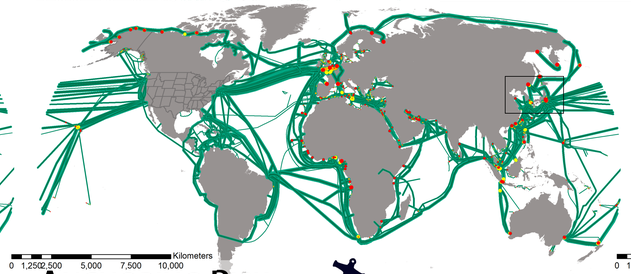
Earthquake Risk
Distance from earthquake (in km)





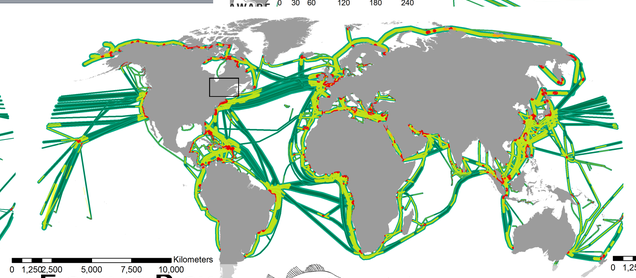
Undersea Internet Cables Extent

Sources: Telegeography, Greg's Cable Map



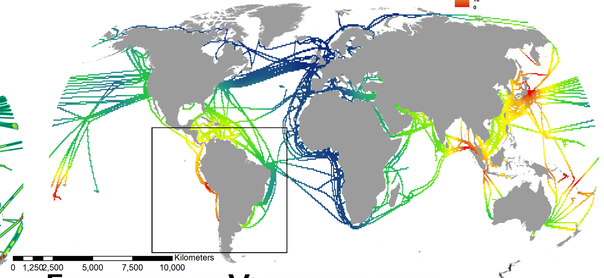
Anchoring Risk

Sources: NGA Ports records 2014, Coastlines



Fishing Risk

Sources: UN FAO Fishing Regions, FAO EEZ regions



Earthquake Vunerabilities

Sources: USGS Earthquake data 2004-2014