



# Level 3<sup>®</sup> Transoceanic and EU Network Services



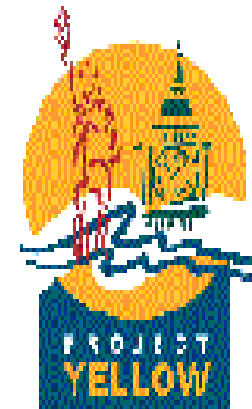
## Meeting Objective

- Brief history in time
- Sub-sea design and reliability
- Network; sub-sea and terrestrial
- Risks and how to mitigate them
- Future technologies

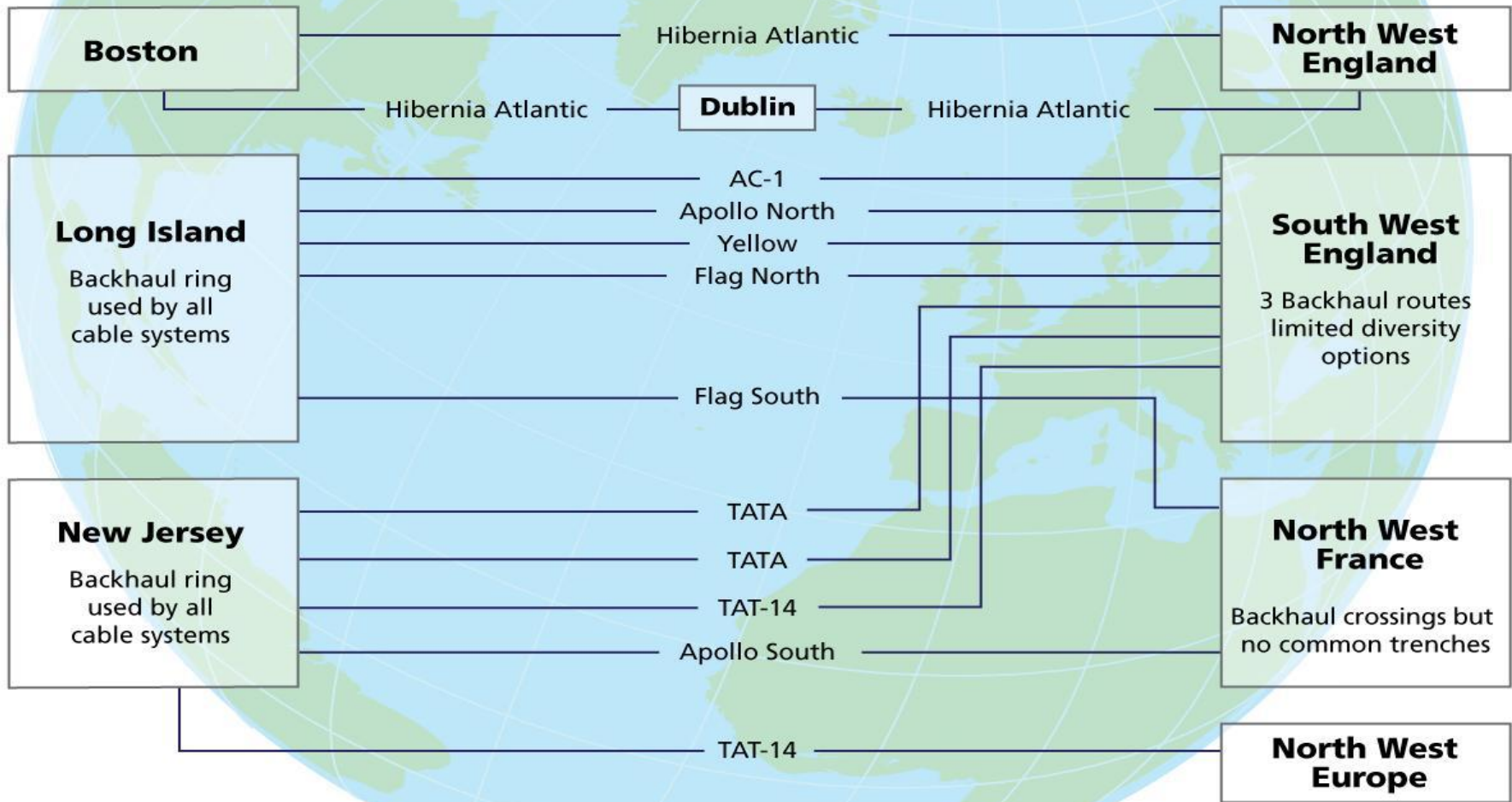


## TA History

- ❖ 1998
  - Fully redundant, three ring SDH networks deployed – i.e Gemini.
  
- ❖ 2000
  - Gemini network sliced in two – TA went unprotected.
  - Yellow, Level 3 built cable RFS
  - TAT-14 RFS
  
- ❖ 2001 onwards
  - Large number of private TA systems deployment, Flag Atlantic, TATA Communications (Tyco), and Hibernia.
  
- ❖ 2003
  - Apollo, latest transatlantic went into service
  - Designed for the unprotected 10G wavelength market and served a need to avoid Manhattan with its direct connection to Washington.
  
- ❖ 2008
  - Technology advances meant additional capacity and new products available; 10Ge wavelengths
  
- ❖ 2009
  - Product enhancements 40Gbit/s trial, protected waves, Gige over wave
  
- ❖ 2010
  - 40G waves deployed on TA systems for capacity benefit.

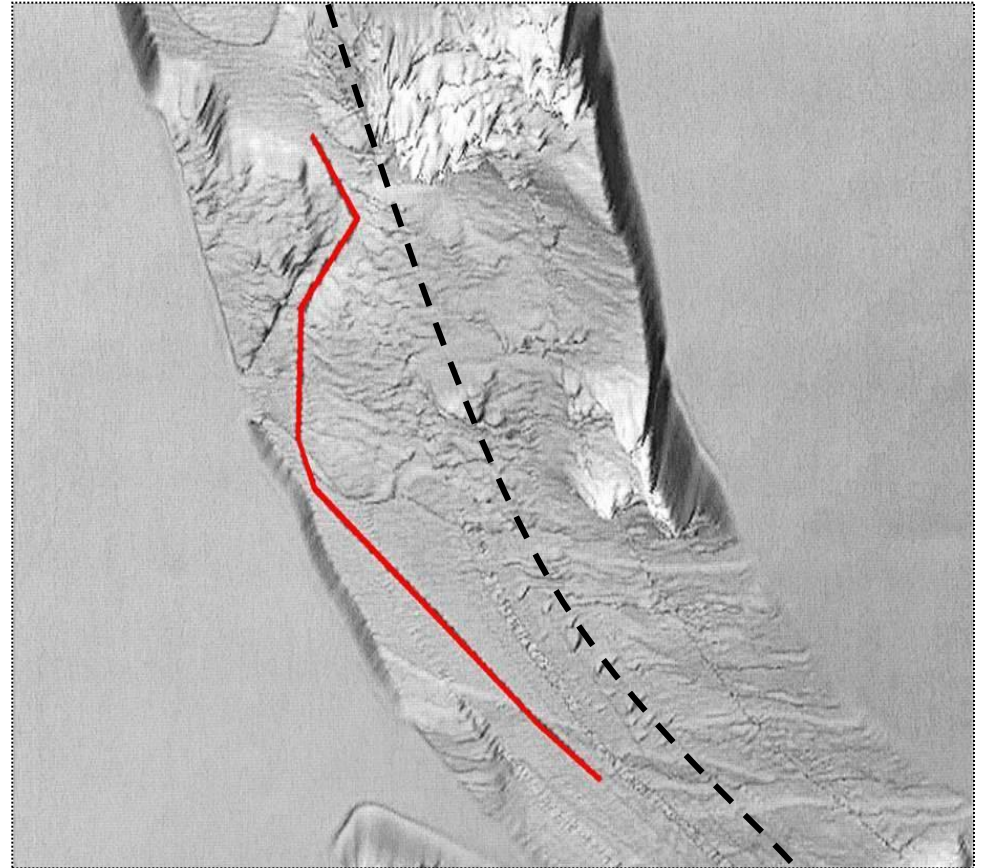


## Current Transatlantic Cables -- Diversity Challenge



## Cable routing and design...

- ∴ Inherently reliable
- ∴ Improvements in route selection, survey and installation.
- ∴ New cable design also enhanced the reliability of TA systems.
- ∴ Fault rates low, combination of improvements in deployment, after installation management and fishing trends.



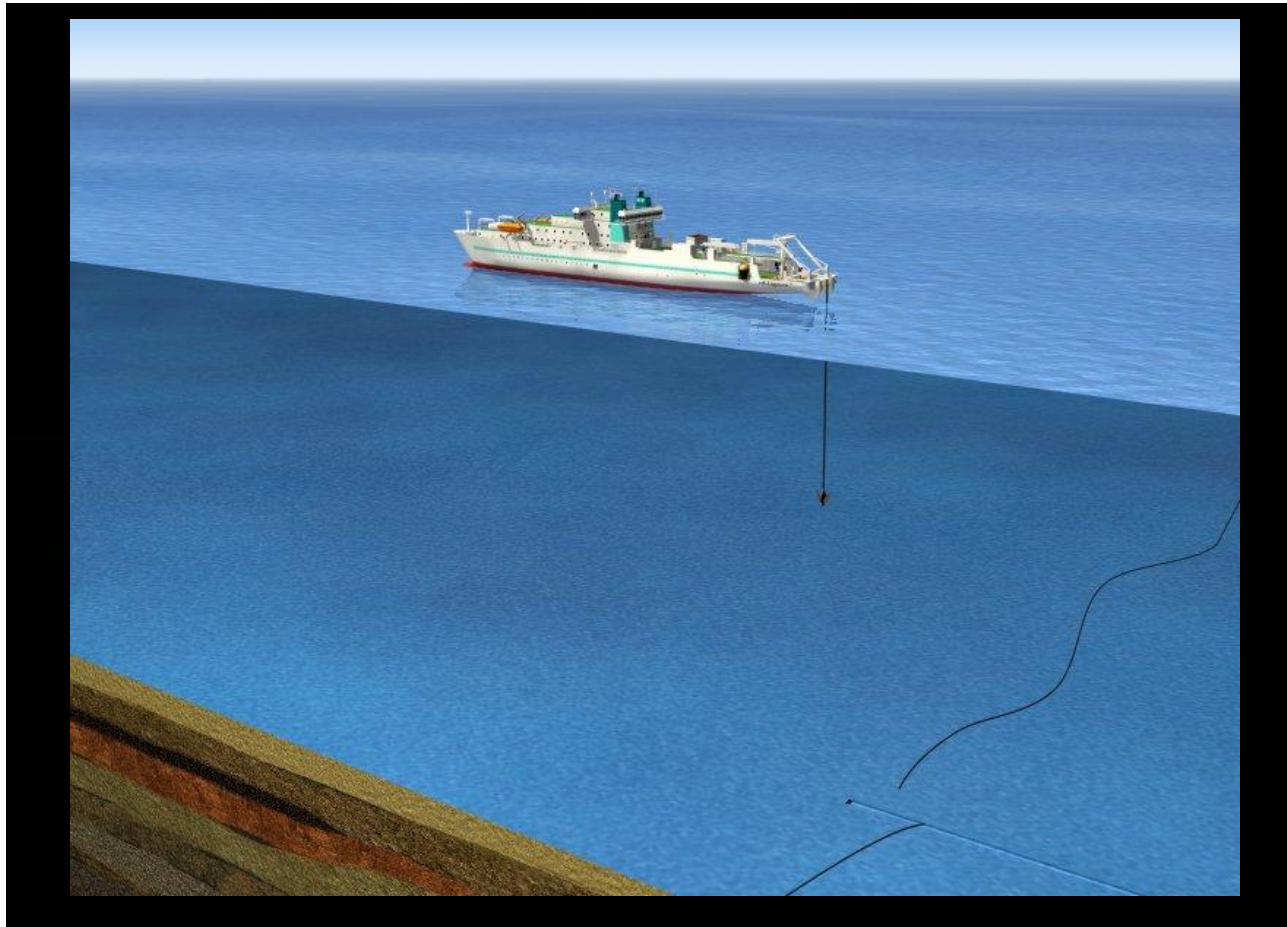
# What on earth could go wrong?



## Marine Environment



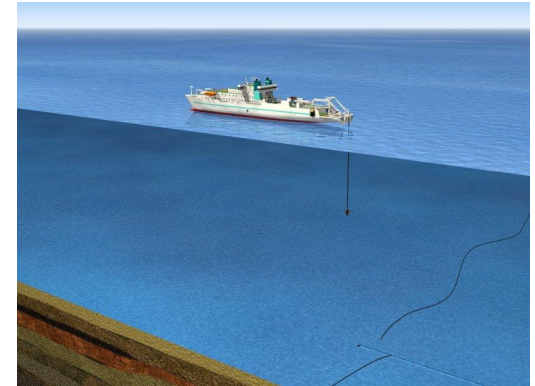
## ...and Repairs





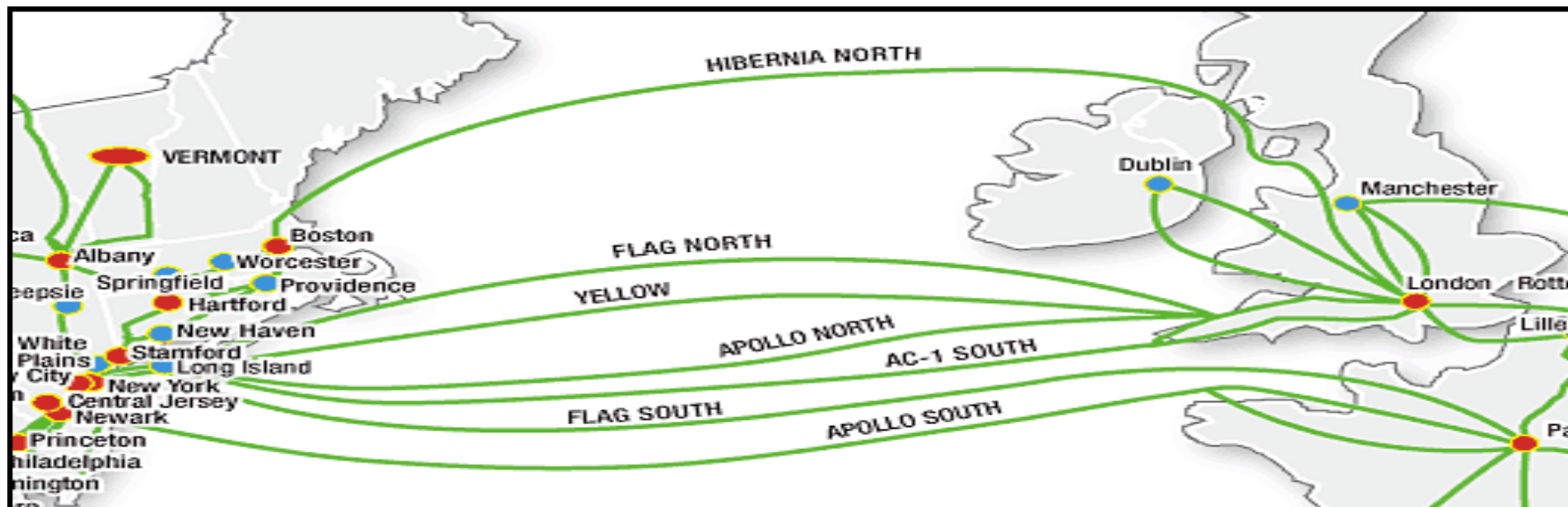
## Resiliency and Priority

- ⚡ Modern TA systems can potentially carry over 1 Terabit – per fiber pair
- ⚡ Faults vary in the type and required repair duration - operators will assess traffic on the effected cable and restore as appropriate
- ⚡ Terrestrial faults more frequent; important to know the diversity and precise routes utilised.
- ⚡ Operators do not know what is contained within the wavelengths; advice required
- ⚡ FCC recently undertook a review of sub-sea systems “Voluntary Request for Cable Status Information” – early warning and situation awareness
- ⚡ Level 3 fully complies with FCC requirements and provides information regarding the submarine cable integrity of Yellow.



# Transatlantic Network

## ∴ Diversity and Latency



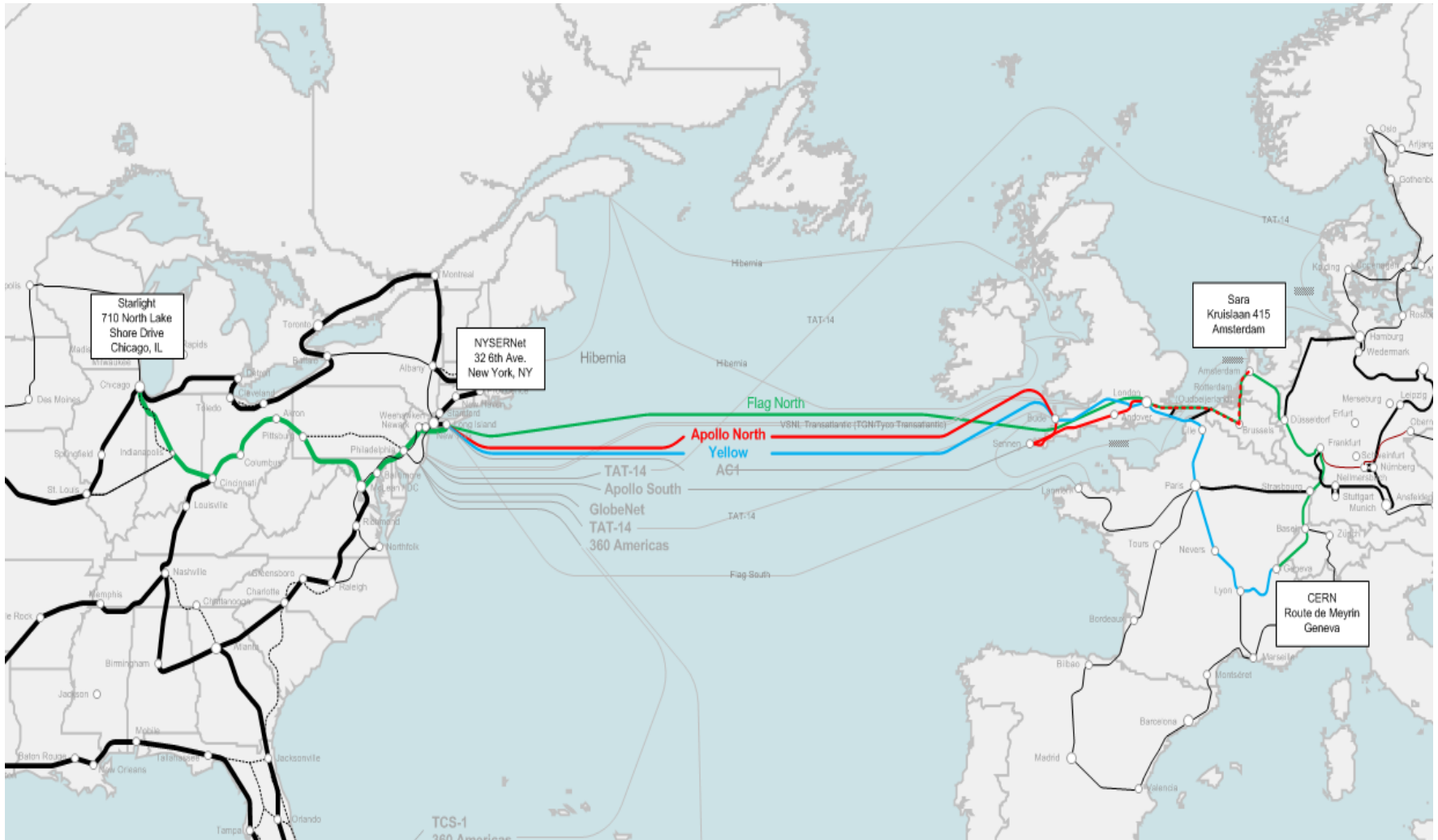
| Cable        | Comment               | New York-London | New York-Frankfurt | Chicago-London * | Chicago-Frankfurt * |
|--------------|-----------------------|-----------------|--------------------|------------------|---------------------|
| Yellow       | Level 3 built         | 68 ms           | 83 ms              | 87 ms            | 101 ms              |
| AC1          | Limited wave capacity | 68 ms           | 82 ms              | 86 ms            | 100 ms              |
| Apollo North |                       | 68 ms           | 82 ms              | 86 ms            | 100 ms              |
| Hibernia     | Can avoid NY          | 81 ms           | 95 ms              | 97 ms            | 111 ms              |
| FLAG North   |                       | 68 ms           | 82 ms              | 86 ms            | 100 ms              |
| Apollo South | Can avoid NY, London  | 84 ms**         | 86 ms**            | 98 ms            | 101 ms              |

Expected Latency (ms)

•Utilizes Liquidity Express Route

\*\*10 Gig only. 2.5 Gig latency is higher

# Caltech Network Design



## The future

- ∴ Strong demand for 10G and 10Ge continues.
- ∴ To date, 40G terrestrially and sub-sea wise market not commercially viable owing to interface costs; signs that this is changing.
- ∴ Question mark over 40G; is this a transient technology? Market now appears to be solidifying but 40G and 10G can run side by side.
- ∴ 100G sub-sea wise some way off still; but developments in the 40G equipment giving positive indications on the ability to transmit 100G on transoceanic distances.
- ∴ Technology advances has delayed to build of a new TA cable and may continue to do so.



**Thank you and Q&A.**