TATA COMMUNICATIONS

Cable systems

Arteries of the global Internet

CORPORATE

SANOG XII
Kathmandu, Nepal ,
August 13-14th 2008

Yves Poppe,
Director Business Development
IP Services

TATA

Member of the Tata Group

125-year old largest private sector group

$55 billion in revenues

Acquired VSNL in February 2002
- VSNL acquired Tyco in Nov 2004
- VSNL acquired Teleglobe in Feb 2006

Teleglobe, Tyco, VSNL and VSNL International become Tata Communications on February 13th 2008
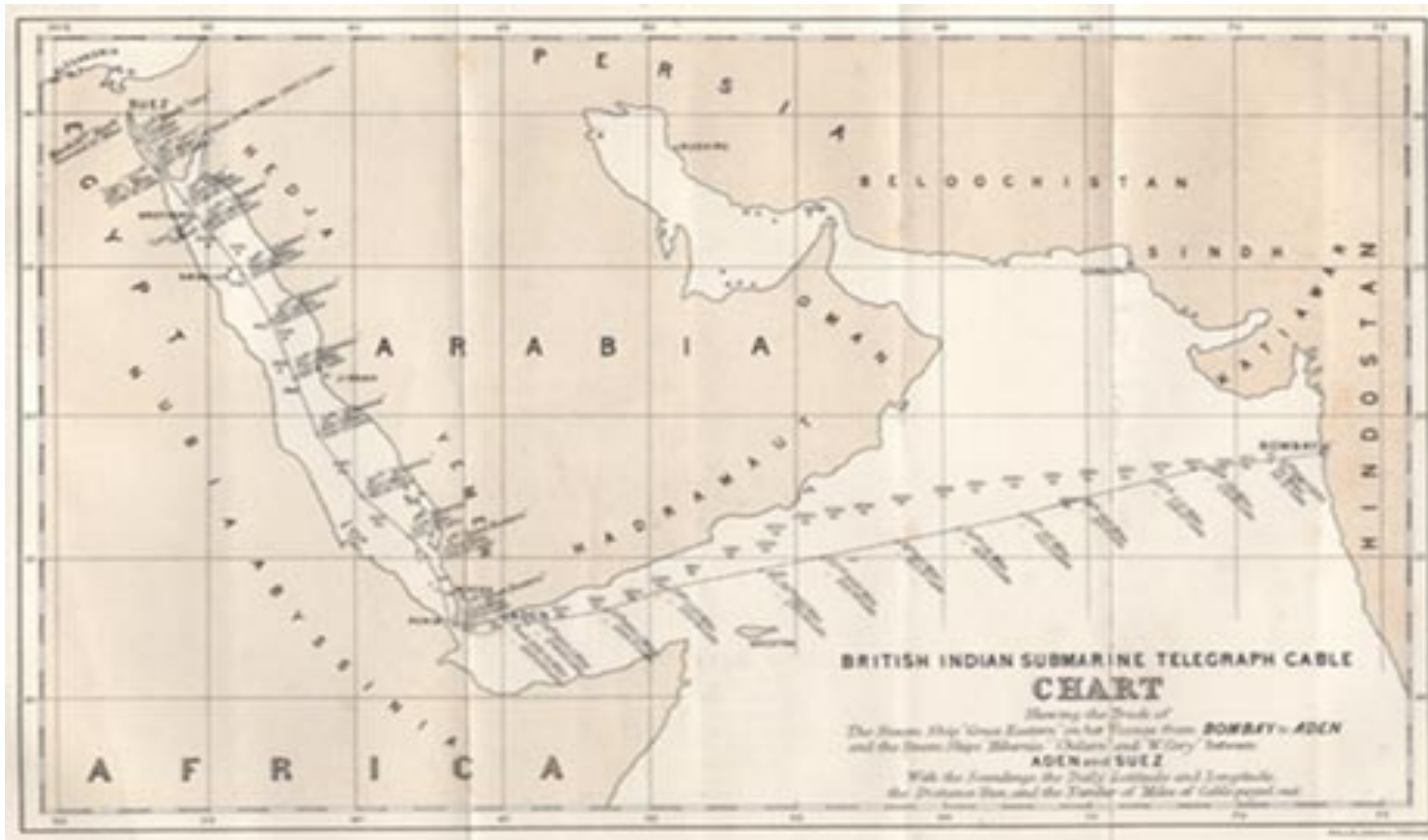
Tata Consultancy Services (TCS)

High speed connectivity circa 1870

They obviously already had cable landing stations…
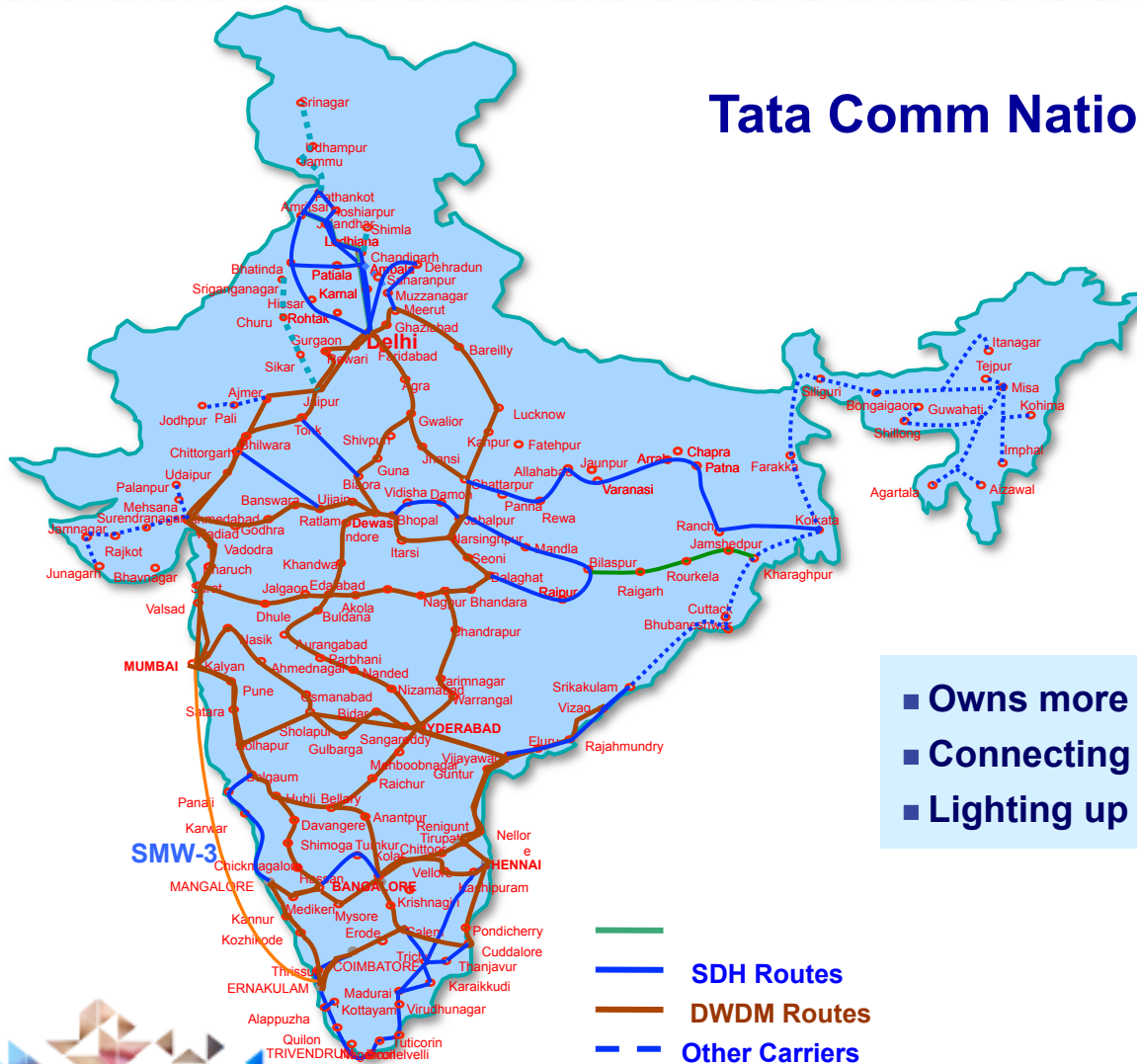

Mess Quarters, Aden
Cable Station circa 1905

Suez - The Eastern
Telegraph Company Ltd

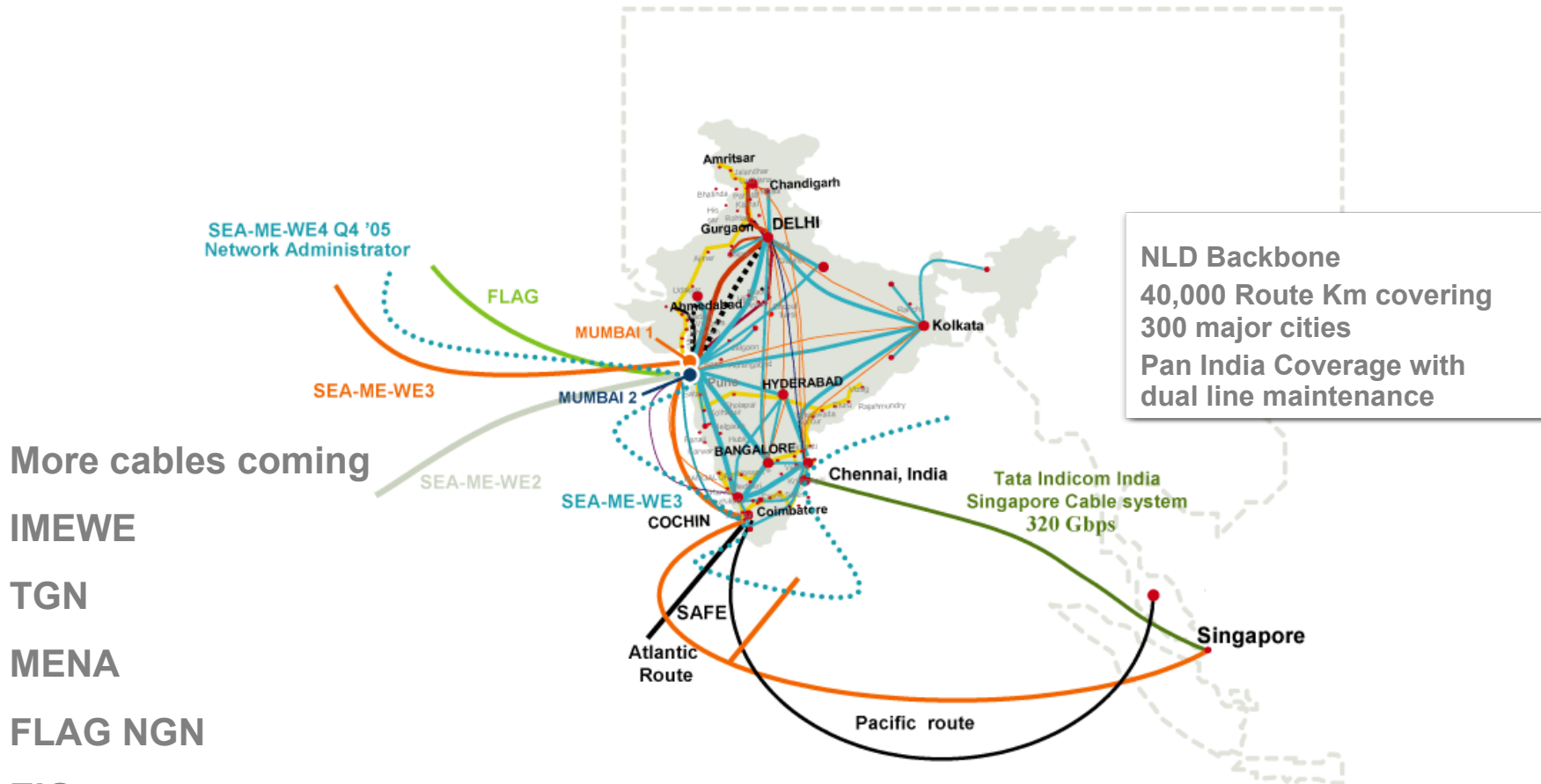http://www.atlantic-cable.com/

Tata Comm National Indian Fiber Network

- Owns more than 25,000 route Km of fiber
- Connecting 200+ cities in India
- Lighting up multi lambda capacity

SDH Routes
DWDM Routes
Other Carriers
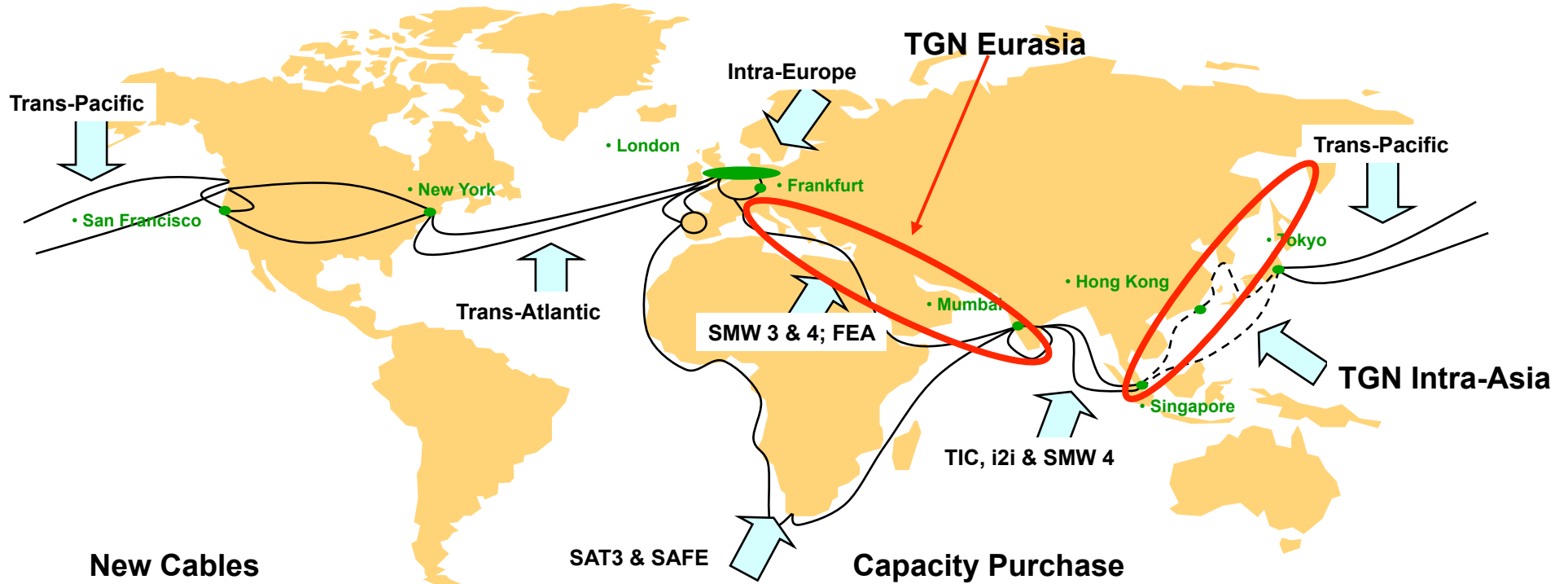
Diverse Connectivity to and from India

SEA-ME-WE4 Q4 '05
Network Administrator

FLAG

SEA-ME-WE3

MUMBAI 1

MUMBAI 2

More cables coming

SEA-ME-WE2

IMEWE

SEA-ME-WE3

TGN

COCHIN

MENA

SAFE

FLAG NGN

Atlantic Route

EIG

Amritsar
Chandigarh
Gurgaon   DELHI
Ahmedabad
Kolkata
Pune   HYDERABAD
BANGALORE
Chennai, India
Coimbatore

Tata Indicom India
Singapore Cable system
320 Gbps

Singapore

Pacific route

NLD Backbone
40,000 Route Km covering
300 major cities
Pan India Coverage with
dual line maintenance

Commencement of New Submarine Cable Projects

TATA COMMUNICATIONS

TGN Eurasia

Intra-Europe

Trans-Pacific

Trans-Pacific

• London

• New York

• San Francisco

• Frankfurt

Trans-Atlantic

SMW 3 & 4; FEA

• Mumbai

• Hong Kong

• Tokyo

TGN Intra-Asia

• Singapore

TIC, i2i & SMW 4

SAT3 & SAFE

New Cables

Cable Name	Connecting	Ownership
TGN-Intra Asia	Singapore Hong Kong, Japan, Vietnam, Philippines	Majority Owner
TGN-Eurasia	India to France via Egypt	Majority Owner

Capacity Purchase

Cable Name	Connecting	Ownership
IMEWE	India, Middle East, Egypt, Italy, France	Consortium Member
SEACOM	India, Egypt, South Africa	Initial Capacity Owner

TGN - Intra Asia

Length: 6,800 km

# of Fiber Pairs: 4

Initial Capacity: 320Gbps
Design Capacity: 3.84Tbps
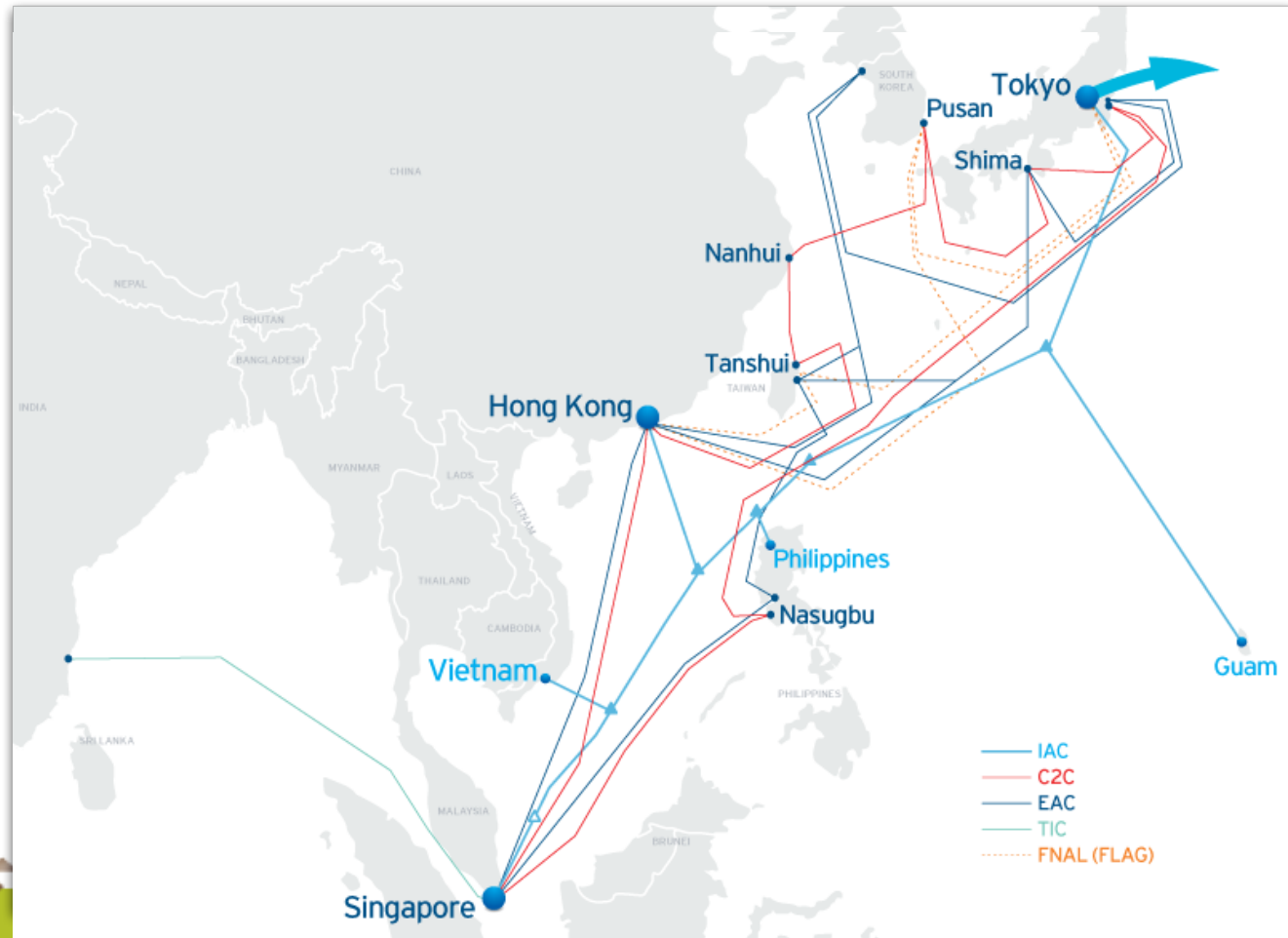**Speeds available: STM-1/4/16 & 10G**
Day One Landing Points:
- Singapore
- Tokyo
- Guam
- Philippines
- Hong Kong
- Vietnam

Expected Latencies
- SIN- JP = 97ms
- SIN- LA = 210ms
- HK- LA = 190ms
- HK – JP = 73ms

Expected Ready For Service: 3Q2008

Intra-Asia Network

IMEWE design as announced in February 2008

Marseille

Palermo

Tetouan

Pentaskhinos

Tartous

Tripoli

Alexandria

Suez

Aqaba

SEG-3

SEG-2

Al Fujairah

Karachi

Jeddah

Mumbai

SEG-1

Expected Length ~ 13,000km
3.84 Tb capacity on 3 fiber pairs
Target RFS: 2H2009

9 parties connecting 8 countries and 10 landing points

- India   -Mumbai (Bharti and Tata Telecom)i
- Pakistan   - Karachi (PTCL)
- UAE   - Fujairah (Etisalat)
- Saudi Arabia   - Jeddah (STC)
- Egypt   - Suez and Alexandria (Ogero Telecom, Telecom Egypt

- Lebanon   - Tripoli
- Italy   - Catania (Sparkle)
- France   - Marseille (France Telecom)

TGN – EurAsia

Tata Communications Joint Build for an express route cable from India to Europe
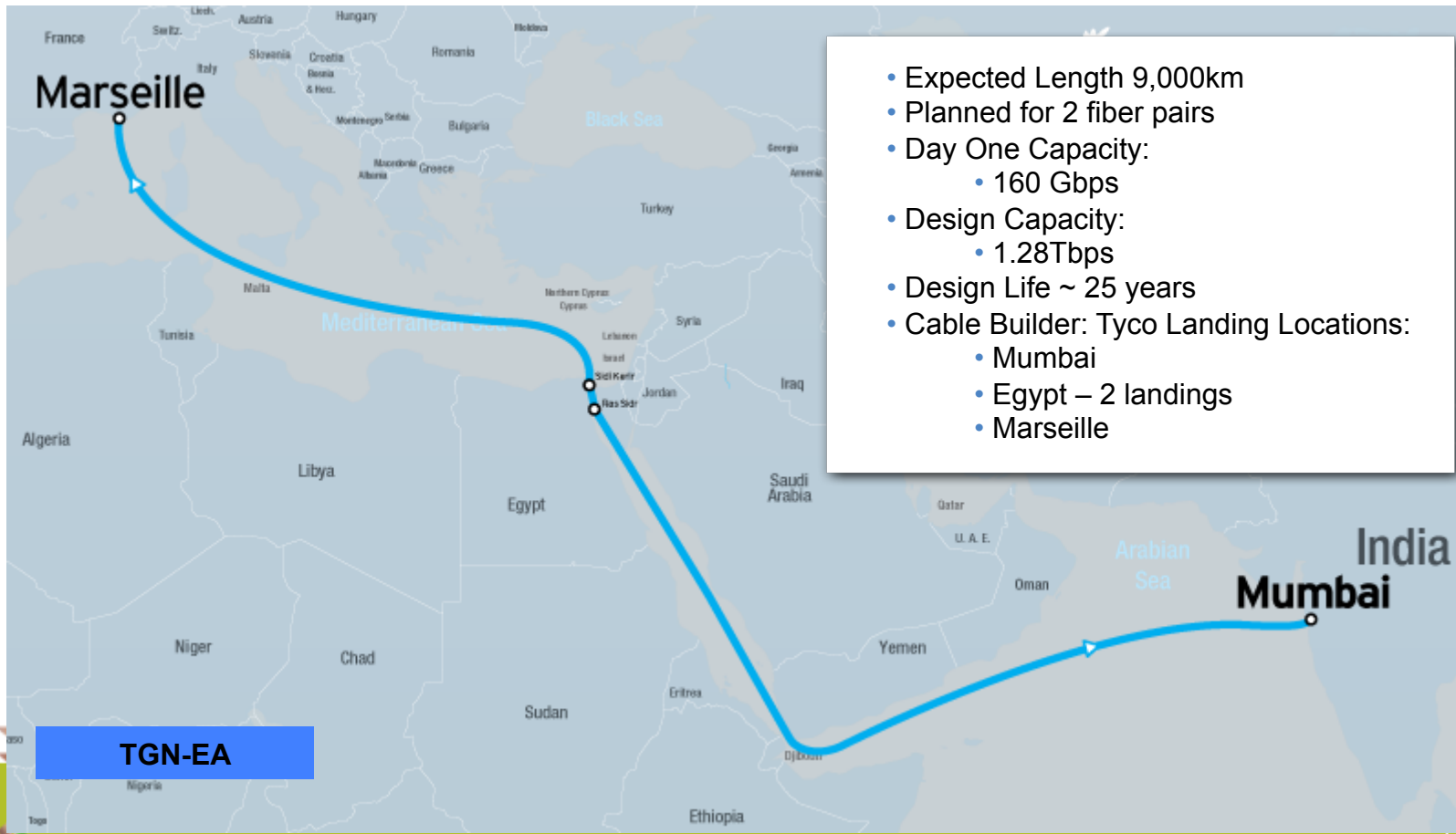
- Expected Length 9,000km
- Planned for 2 fiber pairs
- Day One Capacity:
  - 160 Gbps
- Design Capacity:
  - 1.28Tbps
- Design Life ~ 25 years
- Cable Builder: Tyco Landing Locations:
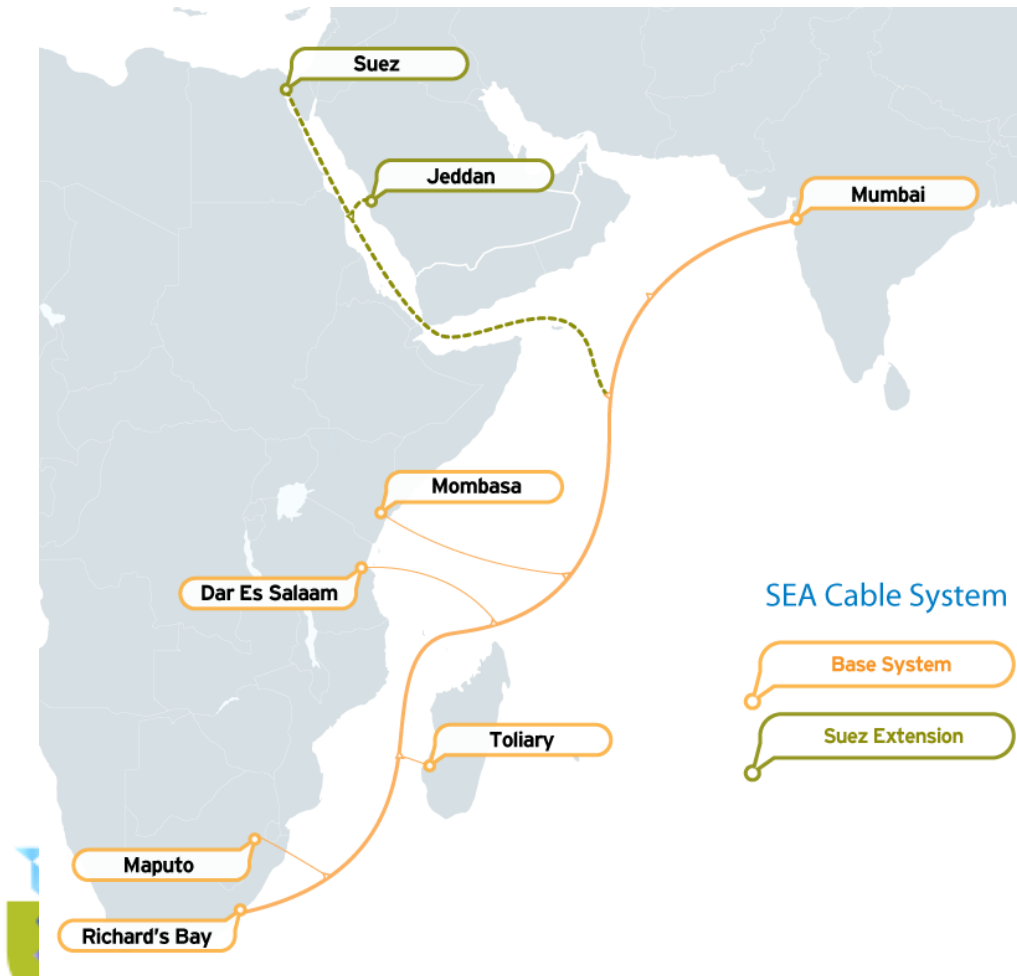 - Mumbai
  - Egypt – 2 landings
  - Marseille

TGN-EA

South Asia - Gulf States/Middle-East- Europe Network Diversity

In addition to FLAG, SMW-3 and SMW4, the upcoming IMEWE, TGN-EA, Orascom s MENA and the planned new FLAG cable will provide the region vastly increased South Asia – Middle East – Europe capacity and diversity
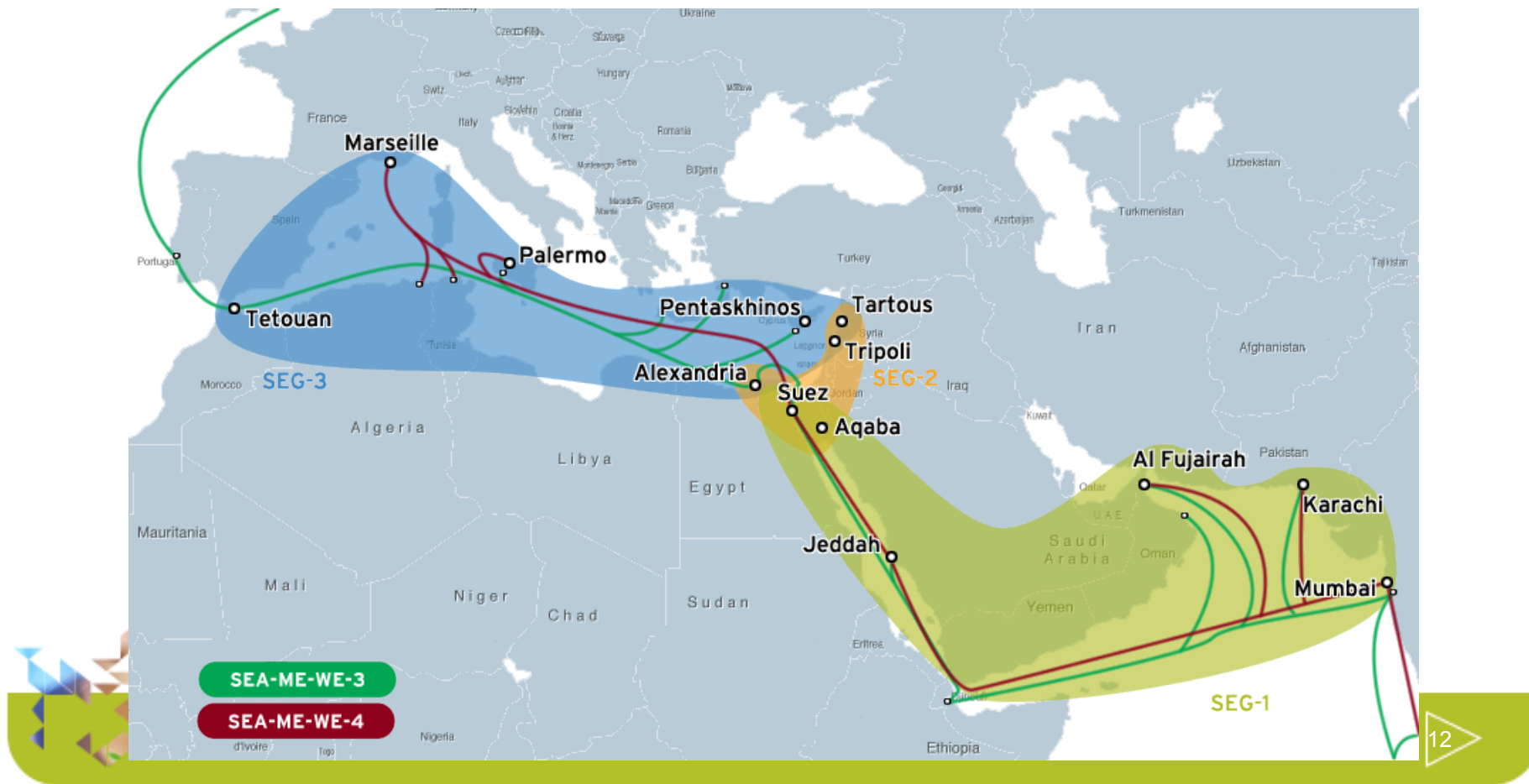
SEACom Cable

Announced March 2007

Financing closed in November

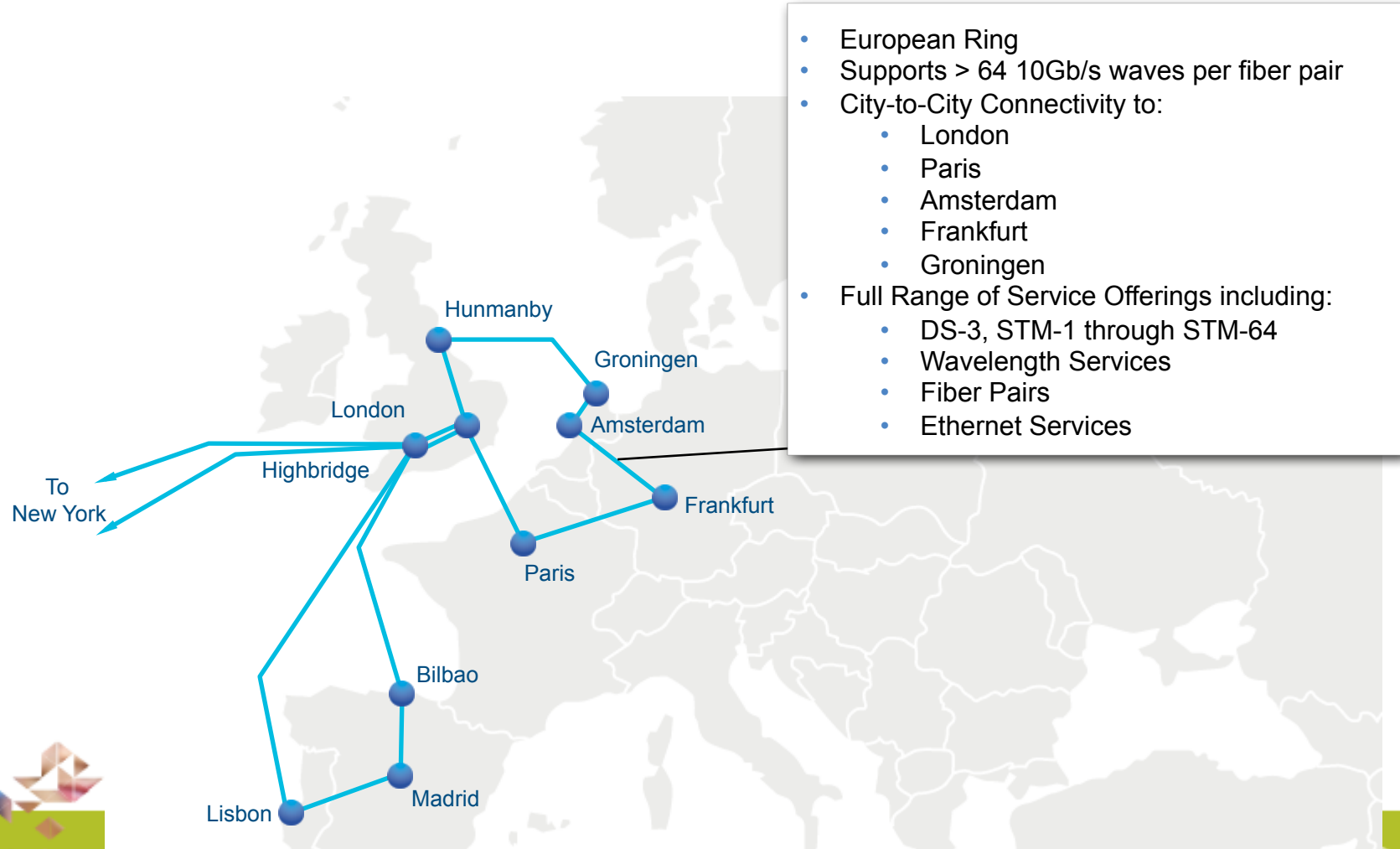**Length: 13,000km**

Locations:

- South Africa, Mozambique Madagascar, Tanzania ,Kenya, India, Saudi Arabia, Egypt
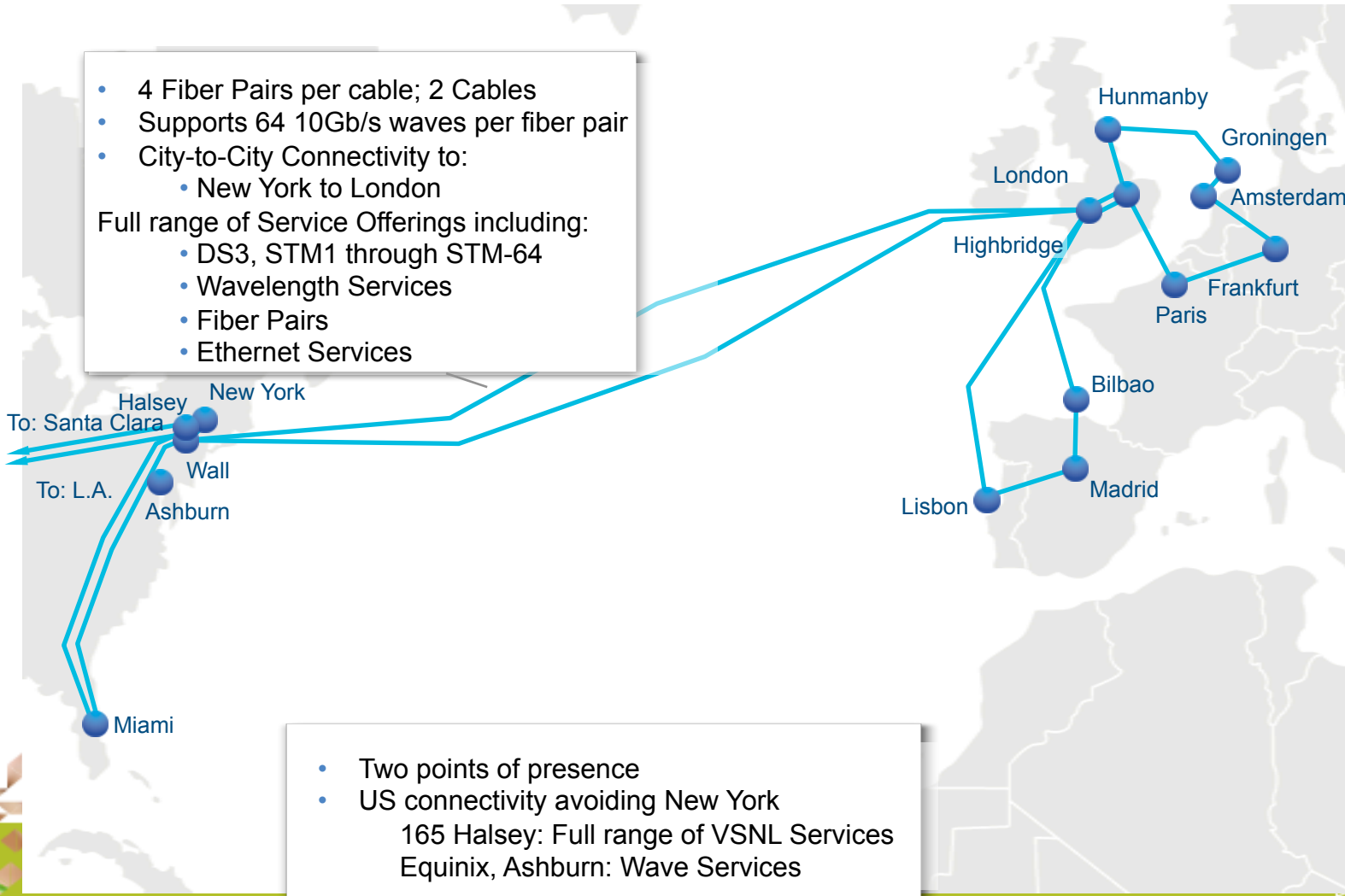
Design Capacity: 1.28Tbps

Expected RFS: 2H2009

Tata Communications handles Mumbai cable stations, Neotel the Mtunzini cable station and backhaul, VGSL manages cable.

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TGN - Europe

- European Ring
- Supports > 64 10Gb/s waves per fiber pair
- City-to-City Connectivity to:
  - London
  - Paris
  - Amsterdam
  - Frankfurt
  - Groningen
- Full Range of Service Offerings including:
  - DS-3, STM-1 through STM-64
  - Wavelength Services
  - Fiber Pairs
  - Ethernet Services

Map labels: Hunmanby, Groningen, London, Amsterdam, Highbridge, To New York, Frankfurt, Paris, Bilbao, Madrid, Lisbon

TGN - Atlantic

TATA COMMUNICATIONS

- 4 Fiber Pairs per cable; 2 Cables
- Supports 64 10Gb/s waves per fiber pair
- City-to-City Connectivity to:
  - New York to London

Full range of Service Offerings including:
  - DS3, STM1 through STM-64
  - Wavelength Services
  - Fiber Pairs
  - Ethernet Services

- Two points of presence
- US connectivity avoiding New York
  - 165 Halsey: Full range of VSNL Services
  - Equinix, Ashburn: Wave Services

Hunmanby
Groningen
London
Amsterdam
Highbridge
Frankfurt
Paris
Bilbao
Halsey
New York
To: Santa Clara
Wall
To: L.A.
Ashburn
Madrid
Lisbon
Miami

Trans-America Connections

- City-to-City Connectivity to:
  - New York City (multiple locations)
  - Los Angeles
  - Santa Clara
  - Portland
  - Seattle
  - Miami
- Full Range of Service Offerings including:
  - DS-3, STM-1 through STM-64
  - Wavelength Services
  - Fiber Plans
  - Ethernet Services

Seattle
Hillsboro (x2)
Portland
To Tokyo
Santa Clara (x2)
Los Angeles (x2)
New York (x2)
To London
Wall Twp (x2)
Miami

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TGN - Pacific

- 8 Fiber Pairs Cable
- Supports 96 10Gb/s waves per fiber pair

- 8 Fiber Pairs Cable
- Supports 96 10Gb/s waves per fiber pair

- 8 Fiber Pairs Per Cable Ring
- Supports 64 10Gb/s waves per fiber pair
- City-to-City Connectivity to:
  - Portland
  - Seattle
  - Los Angeles
  - Santa Clara
  - Tokyo
- Full Range of Service Offerings including:
  - DS-3, STM-1 through STM-64
  - Wavelength Services
  - Fiber Plans
  - Ethernet Services

Seattle
Portland
Santa Clara
Hillsboro
To New York
Tokyo
Emi
Toyohashi
Maruyama
Los Angeles
Guam

Close to 80% of international bandwidth is for internet!

Globe Circling Global IP network

IP BACKBONE

Explosive growth

- OC48/192 MPLS backbone
- 70% year over year traffic growth
- Courtesy of User generated Content and p2p Youtube, Myspace etc

IP Network at a glance

- 700+Gbps of Backbone Capacity
- Carries around 400 Petabits globally per month;
- 500+Gbps of customer connectivity

In response to the Alexandria cable breaks:

- More than two additional STM16's worth of capacity activated within 24 hours on SMW-3, SMW4 and TIC to route Middle-East and Indian Internet traffic eastward.
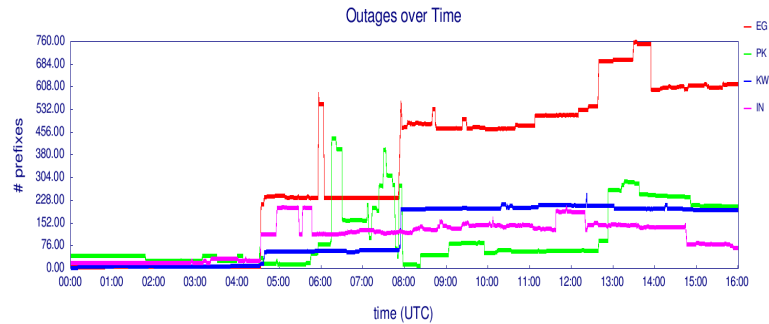
January 30th 2008

4:30 am Flag cable cut 8.3 km off Alexandria

8:00 am Seamewe-4 cable cut 12 km off Alexandria

Then on February 1st 5:59 GMT cable break 56km of Dubai

Outages over Time

Outaged Networks by Country

Percentage of Outaged Networks
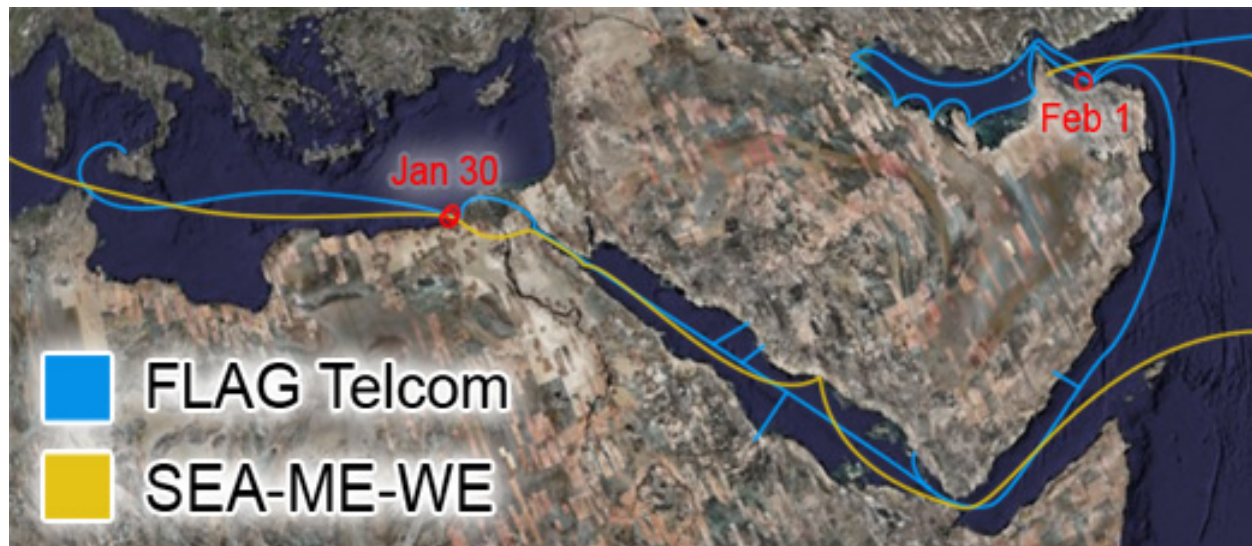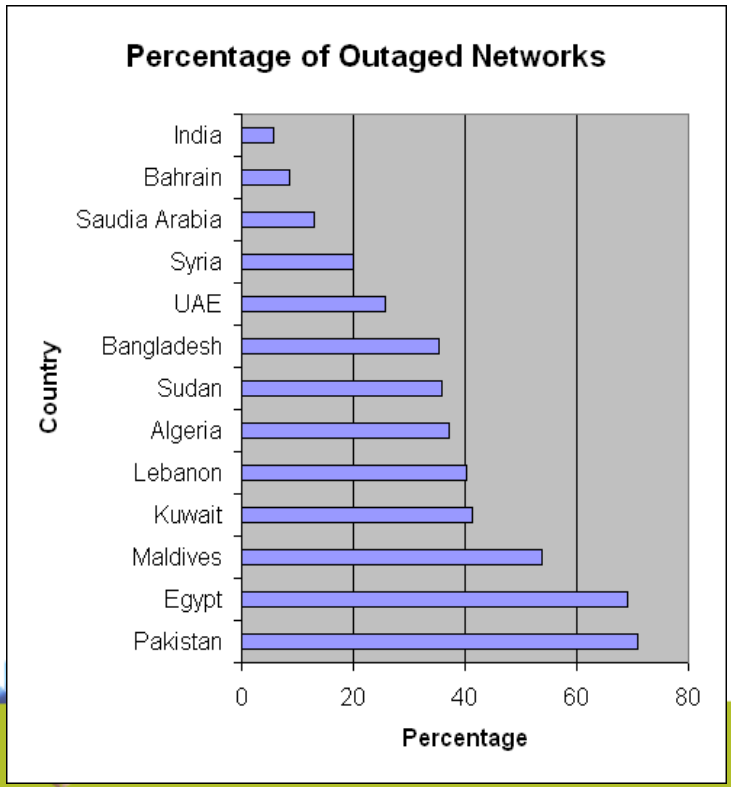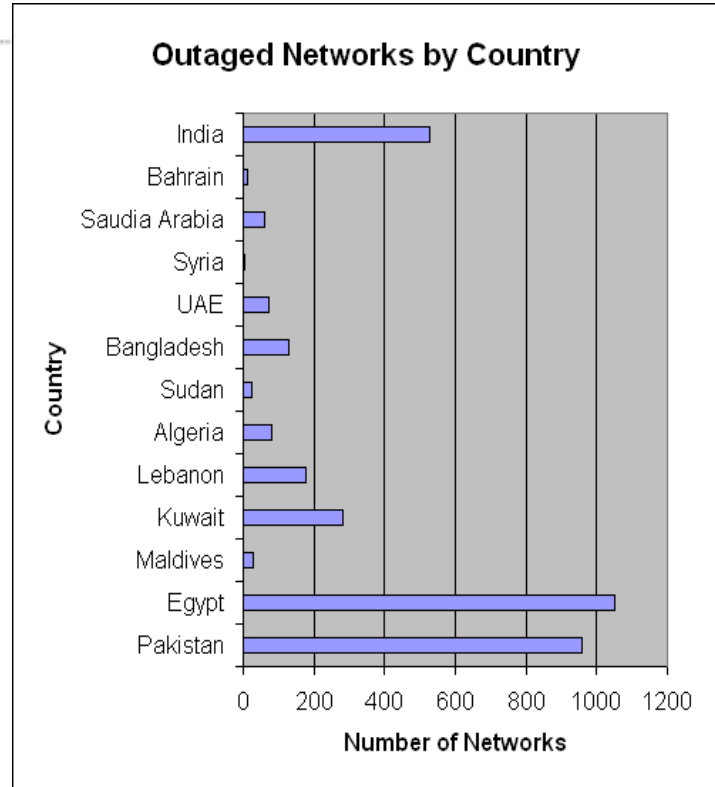
**Cables and global Internet :
Alexandria cable cut impact as per
Renesys**

Earthquake Magnitude 7.1 – Dec 26th 2006 12:26:21 UTC - TAIWAN REGION

Earthquake Details

Magnitude	7.1 (Major)
Date-Time	**Tuesday, December 26, 2006 at 12:26:21 (UTC)** = Coordinated Universal Time **Tuesday, December 26, 2006 at 8:26:21 PM** = local time at epicenter Time of Earthquake in other Time Zones
Location	21.825°N, 120.538°E
Depth	10 km (6.2 miles) set by location program
Region	TAIWAN REGION
Distances	90 km (55 miles) SSE of **Kao-hsiung, Taiwan** 120 km (75 miles) SSW of **T'ai-tung, Taiwan** 375 km (235 miles) SSW of **T'AI-PEI, Taiwan** 800 km (495 miles) N of **MANILA, Philippines**
Location Uncertainty	horizontal +/- 4.8 km (3.0 miles); depth fixed by location program
Parameters	Nst=222, Nph=222, Dmin=282.4 km, Rmss=0.93 sec, Gp= 32°, M-type=teleseismic moment magnitude (Mw), Version=Q
Source	USGS NEIC (WDCS-D)
Event ID	uswtai

This event has been reviewed by a seismologist.

First aftershock – 8 min later – 6.9
Second aftershock – 4 min later - 5.2
Third aftershock - 3 hours later - 5.5

Source: earthquake.usgs.gov

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Most cables go through the Luzon Strait

Three routes are available to link South East & Northern Asia (Japan-Korea):

Luzon Strait between Taiwan & Philippines

- 320 km width; 2600m sill depth in Bashi Channel (north)

Route south of the Philippines

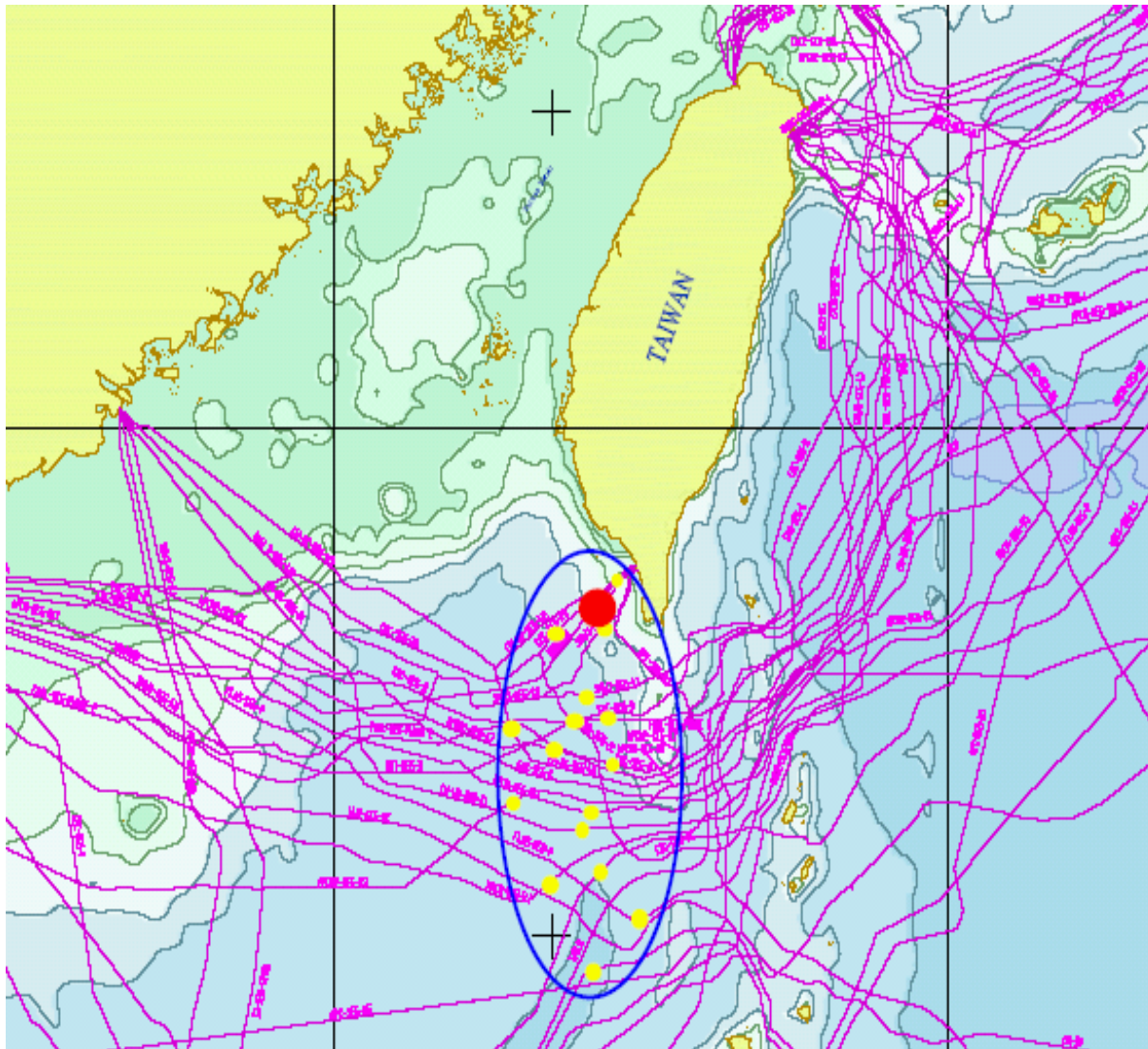- adds lots of mileage & hence latency

Formosa Strait

- Narrowest part is 130 km width
- 70 m depth (too close to fishermen)

the Luzon Strait is the best subsea cable route alternative.

Submarine cables affected by the earthquake

Submarine cables not affected by the earthquake

Earthquake epicenter December 26, 2006

© 2007 TeleGeography Research

Six major cable systems impacted by the Taiwan earthquake

- 6 major cable systems are being affected including resilience path/cable

- Impacted area is around 300km by 150km

- Traffic connecting to Southern Taiwan is severely affected, communication in/out HK, Southeast Asia are severely affected

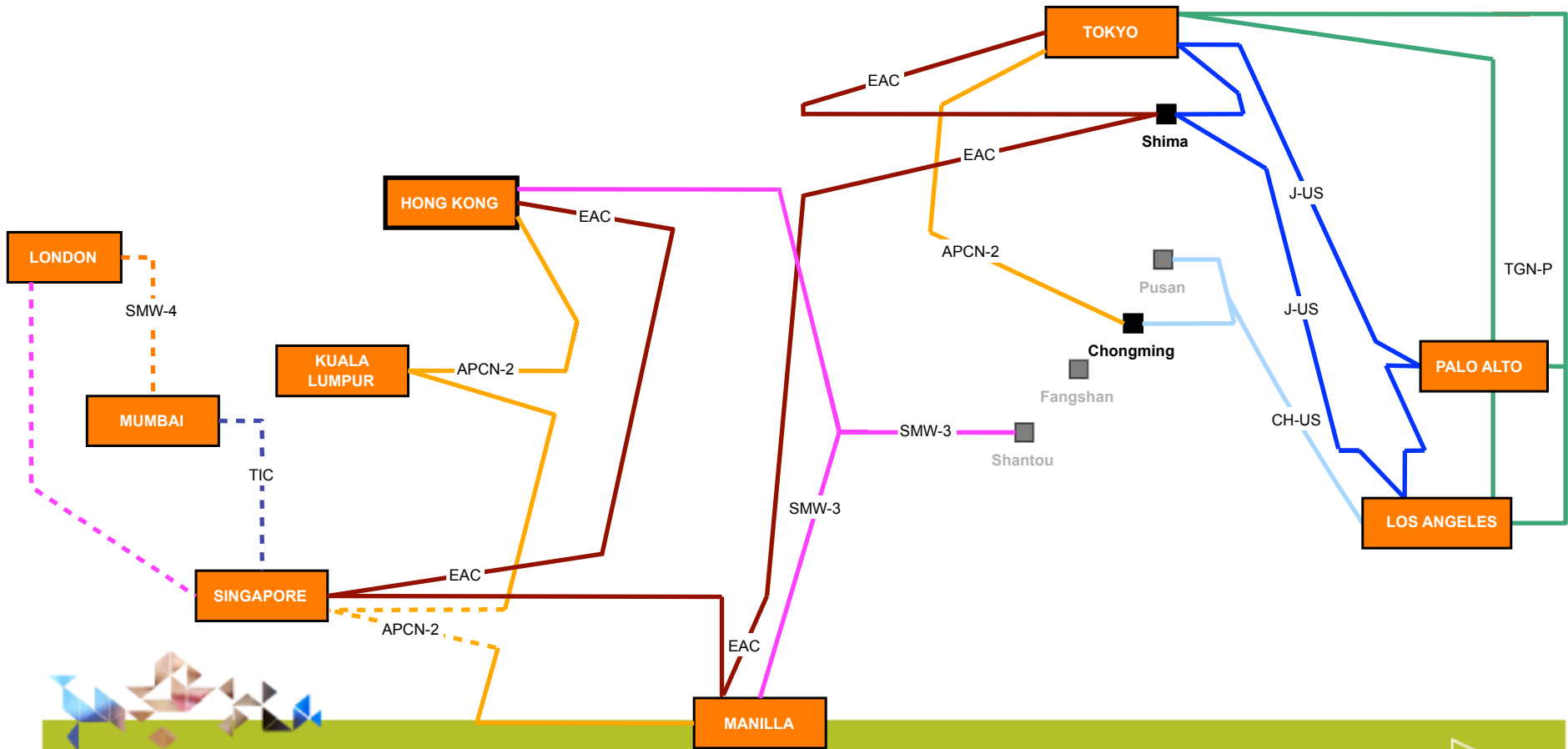- Traffic going thru North Taiwan to Japan is not being affected

Map courtesy of PCCW

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Taiwan Earthquake December 26, 2006 | Cable Faults

CORPORATE

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As of December 26th, 2006
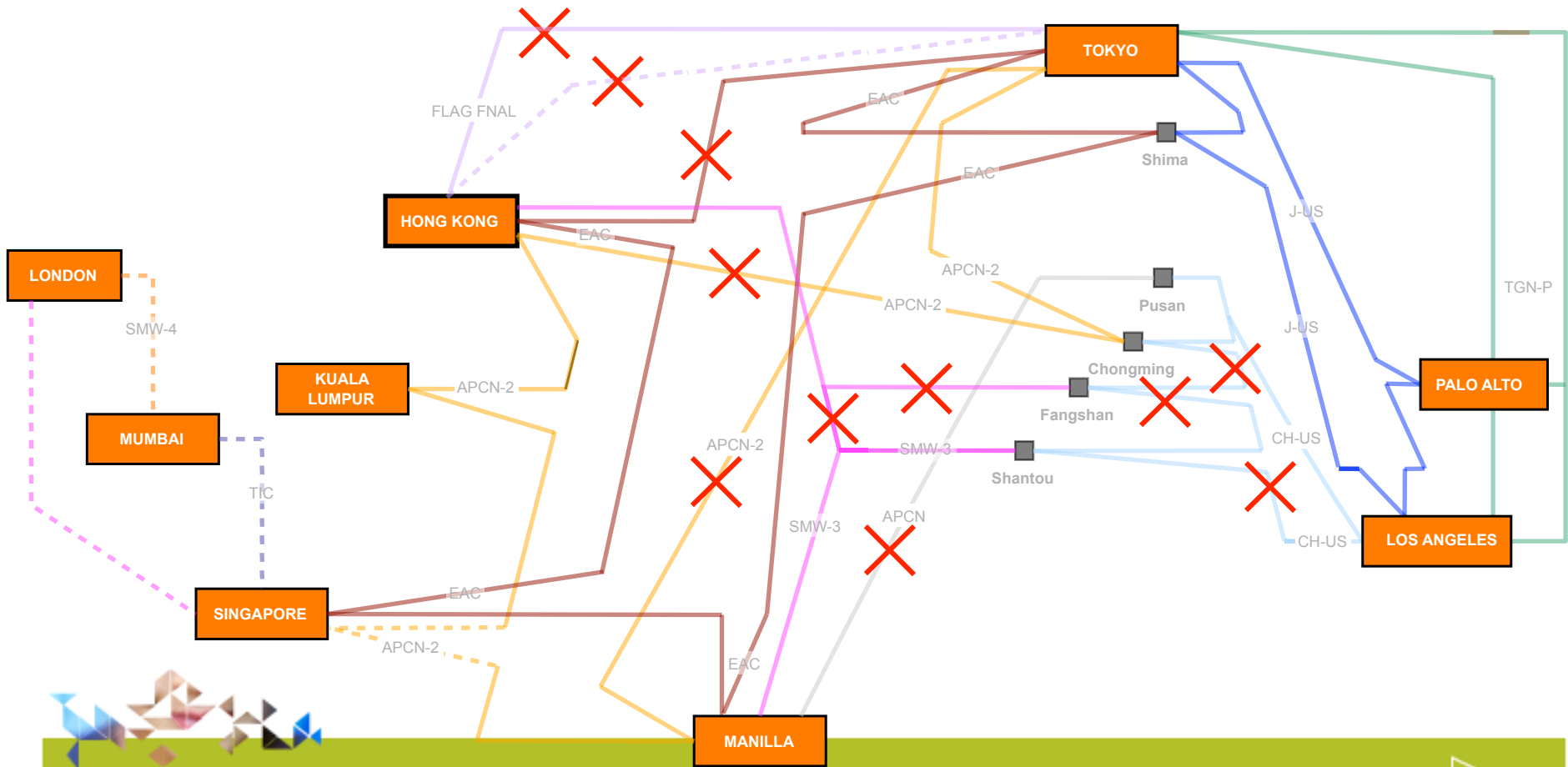
Taiwan Earthquake December 26, 2006 | Remaining Cable Routes

Repairing subsea cable systems

Subsea optical fibers are 21 millimeters in diameter and the cables lay on the ocean floor.

Quakes displace cables from their original location, cause landslides, stir sediment layers and displace and even sometimes bury cables

The Bashi Channel is 2500-4000m deep and a remotely operated underwater robot cannot be operated below a depth of 2000 m, so grapnels had to be used in this case to repair 18 faults. It took 49 days to complete all repairs.

In shallow waters such as was the case for Alexandria cable breaks, robots could be used and repairs take on average ten days allowing for the cable ships to arrive on site.

What do these undersea cables look like?
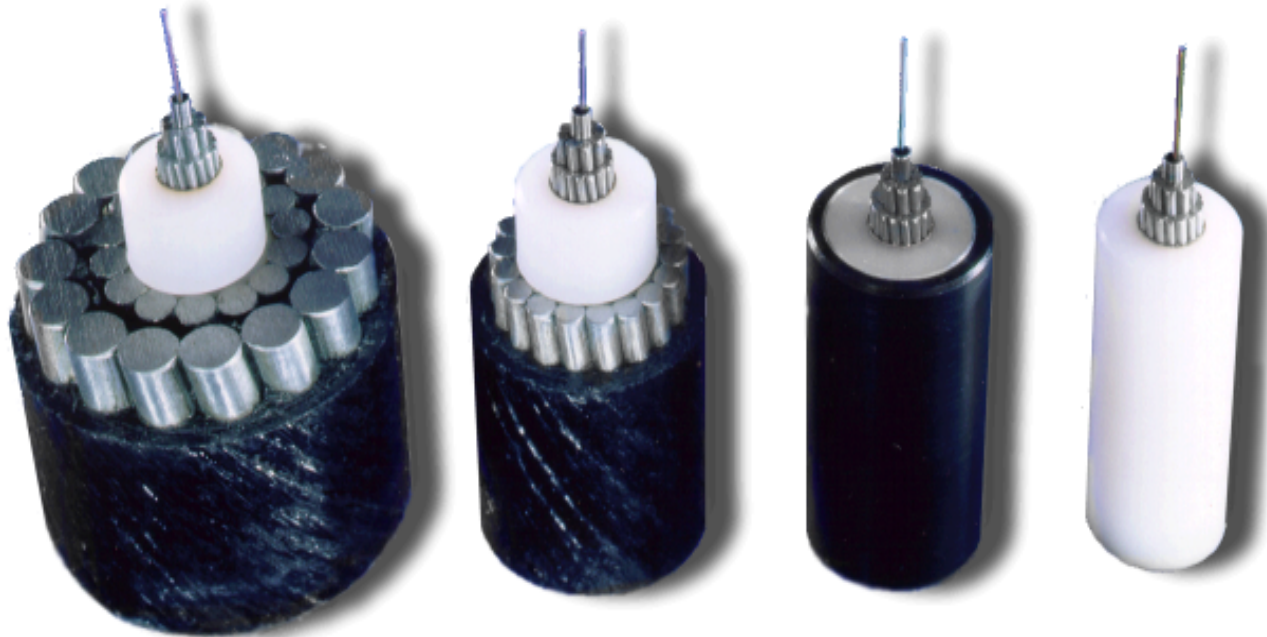
Alcatel OALC4

Up to 12 fibres

Maximum deployment depth: 8000m

Double barrier against hydrogen

High density polyethylene

Adaptable ohmic resistance

Highly reliable over 25 years

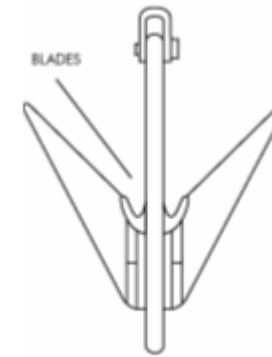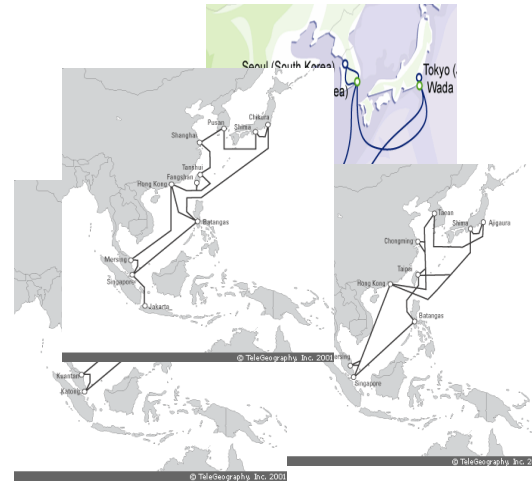Highly resistant to cable breaks

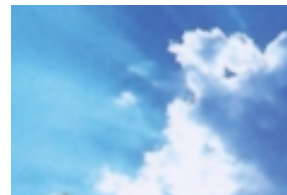Complete range of armouring

Reparing a deep subsea cable system

Cable repair ship

C.S. Charles Brown

Powerful vessel equipped to maintain station and perform cable repair in rough weather conditions.

Not so rough weather

BLADES

FLATFISH FITTED WITH
CUTTING BLADES

A grapnel fitted with a cutter and a grabbing tool.

45 by 60 cm (18 by 24 in)

Dropping grapnel + dragging oceanfloor + recover cable = 16 hours

Average repair duration = 7 days

Reparing a shallow subsea cable system

FLAG Telcom
SEA-ME-WE

Tyco owned Dependable, 2003

the *Dependable's* cable laying and repair equipment includes stern linear and drum engines; dynamometers; traction winches; after deck cranes; buoy handling davits and much more

The ship's navigation aids include Furuno GPS and ECDIS systems, along with a magnetic compass, gyrocompass, track pilot, echo sounders, speed log and X- and S-band radar.

SCARAB IV ROV

Lessons learned: Circle the globe

The deadly earthquake close to the Algerian coast on may 21st 2003 measuring 6.8 cut both the Seamewe-3 and Flag cables forcing most Asia – Europe traffic to go east via North-America.

This Taiwan earthquake forced a lot of Asia–North-America traffic to go west via Europe

The january 30th 2008 Alexandria cable breaks forced traffic east

"A little more towards the West"

Pr. Cuthbert Calculus
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