NANOG Panel
Demystifying Submarine Cables

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Nanog43 Demystifying Undersea Cables

TATA

Agenda

How do Cable Systems work

- Fiber Optics
- Landing Stations
- Segments
- Repeaters
- Cable Laying
- Cable Faults

Products and Services

Backhaul & terrestrial Networks

Network Operators

Looking Ahead

Other New Systems

How Do Cable Systems Work

Fiber Optics

Repeaters

Cable Landing Stations

High Power Constant Current DC Power Supplies
Single End Fed
Dual Fed Systems

Cable Laying (& Re-Lay)
Oceanographic Survey
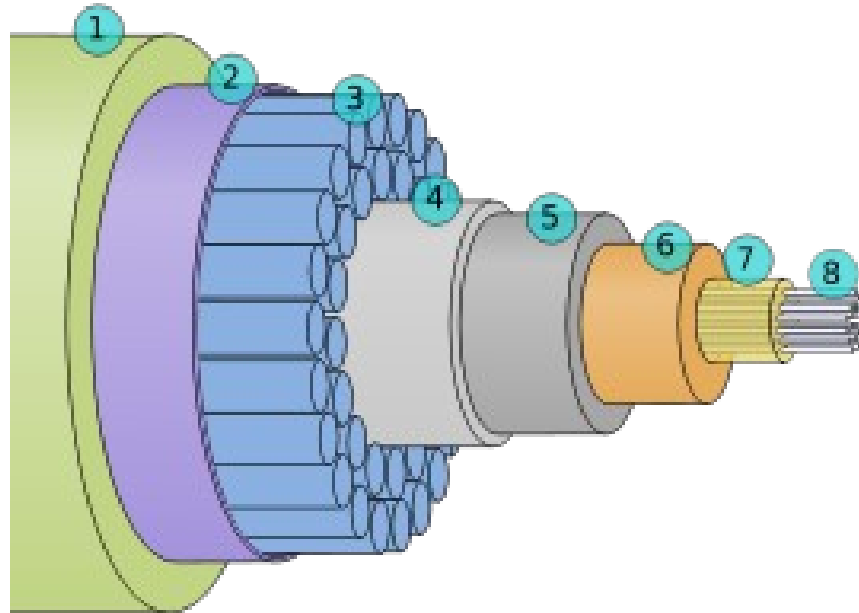Beach Landing
Cable Trenching
Cable Lay

Repeaters

Designed for extremely high MTBF, 25 year life and to withstand immense pressures.

Typical Submarine Fiber Optic Cable

Cable Landing Station

Cable Laying

Specialist Ships – Laying, Repair, ROVs

Several Key Players

Specialist Equipment

Burial capability,
Work to 2500m,
Most Cables now trenched offshore where permitted,
Pre/Post Lay Inspections

Cable Faults

JOLT - external aggression, anchor or skid from commercial fishing net but not actually breaking cable.

Sometimes the bend is so sharp fibers will attenuate but not break, other times cable will part elsewhere along the cable.

Planned restoration and repair required.

Shunt Fault – external aggression, friction damage has caused damage to

the cable but not actually breaking the cable. The damage extends to the core power cable causing a leakage to ground; though not always traffic affecting indicative of a larger problem.

Planned Restoration and Repair required.

Cable Break – immediate restoration and repair required
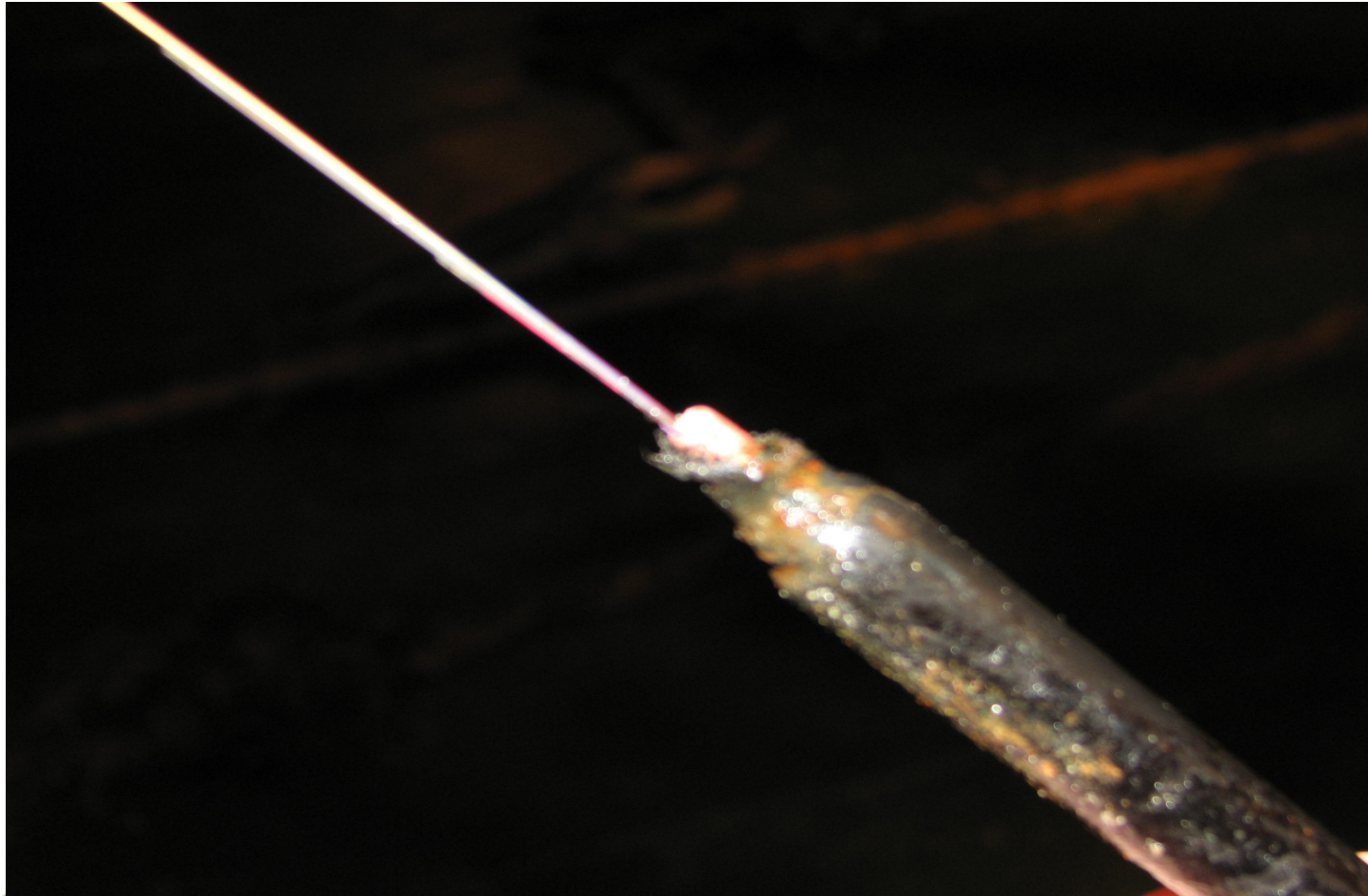Executed by Cable Administrator and RCO/RLO.

JOLT

Severe JOLT

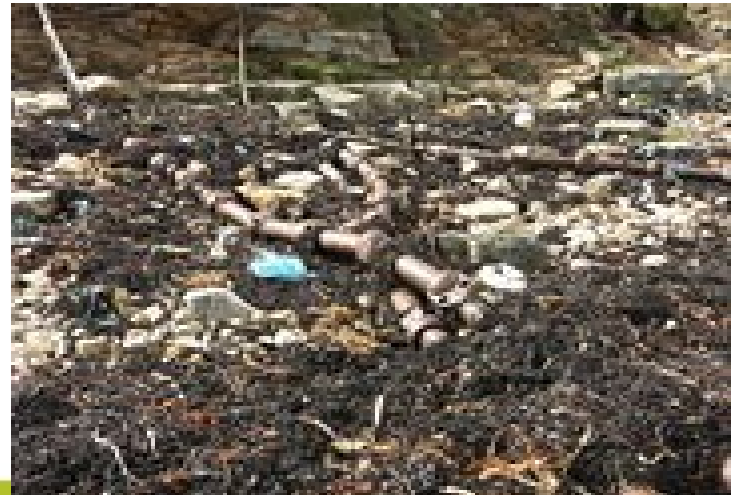# Cable Break

Cable Break – Recovered Internal Section

TGN Break – Net Material

24/03/2008

Backhaul Systems – Terrestrial and Landing

Backhaul Systems – Terrestrial and Landing

Products & Services

IRUs – Indefeasible Rights of Usage

        Usually 15 years

        Pre-paid

        Risk & Reward

        Operations & Maintenance Charges

        MIUs – E1, STM1, STM 4, STM16, 2.5G, 10G

Leased Services

        IPLCs

        Managed Private Lines

        Capital leases – usually 5 years

        DS0 to 10 GBPS, SDH & SONET

        Ethernet Private Line

        VPLS

        Unprotected Wavelengths

        WAN PHY (10GbE)– map to SDH SONET, LAN PHY (10GbE)

Network Operators

Consortium examples:

       TAT 14

       SE-ME-WE 4

       Japan – US

       APCN2

Wholly Owned:

       Tata Communications Atlantic & Pacific

       Intra Asia

       TIC – India to Singapore

       Apollo

       Hibernia

       360 Americas

       GC

       FLAG/RG

       GEMINI Bermuda & Hugo

       Columbus Networks

Looking Ahead

Predicted $2Billion per year for the next 5 years in cables and related infrastructure:

- New Cables
- System Upgrades
- $200 million Intra-Asia cable for the only direct route between Singapore and Japan
- Key partner in the construction of I-ME-WE, new submarine cable linking India, West Asia, and Western Europe

TGN - Intra Asia - 2008

Length: 6,800 km
# of Fiber Pairs: 4
Initial Capacity: 320Gbps
Design Capacity: 3.84Tbps
Speeds available: STM-1/4/16 & 10G
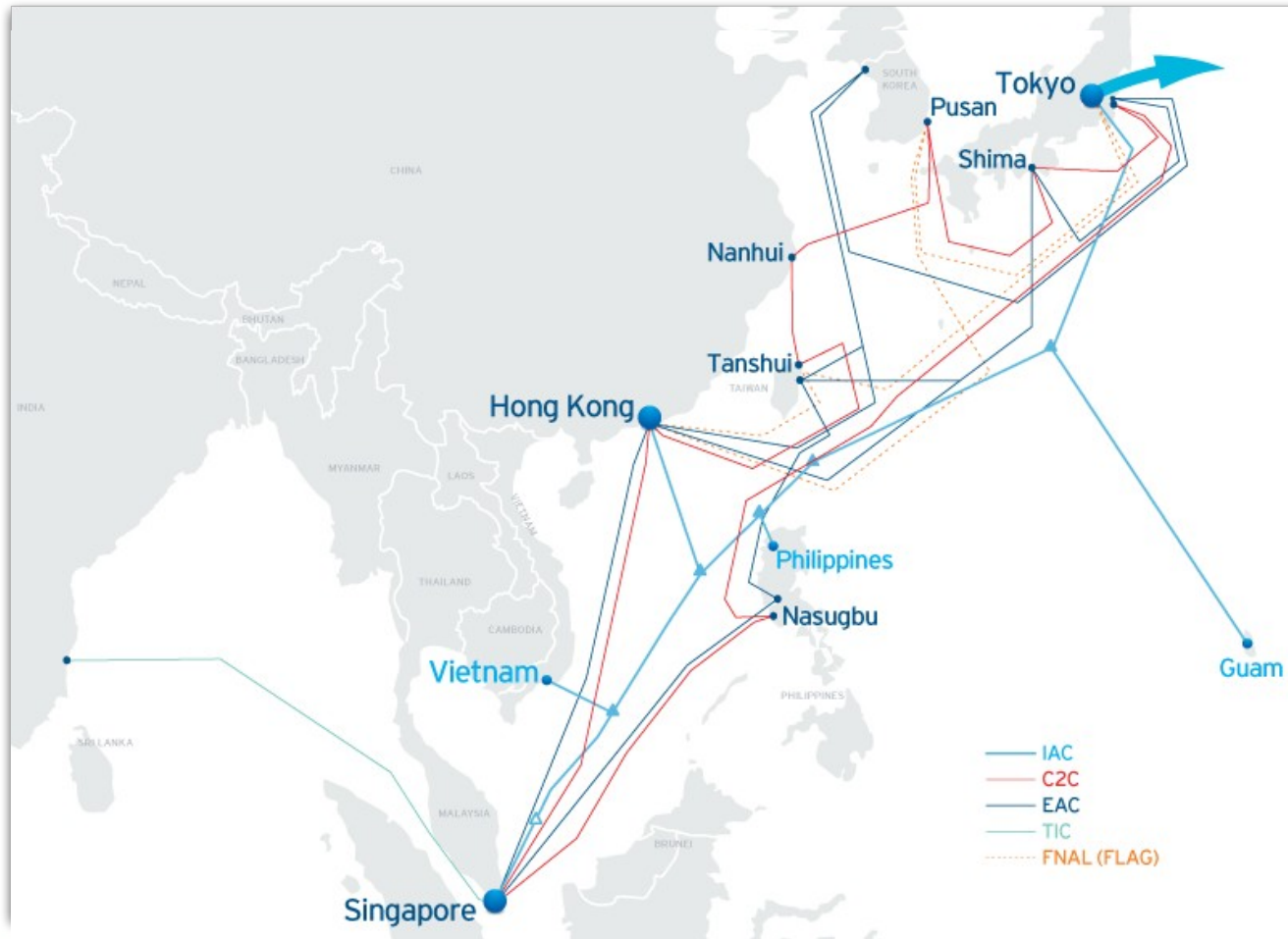**Day One Landing Points:**
- Singapore
- Tokyo
- Guam
- Philippines
- Hong Kong
- Vietnam

Expected Latencies
- SNG– JP = 63msec RTD
- SNG – HK = 33msec RTD
- HK – JP = 45msec RTD
- SNG – Vietnam CLS= 16.5msec RTD
- Vietnam CLS – Philippines CLS = 24msec RTD
- Philippines CLS – Japan = 33msec RTD

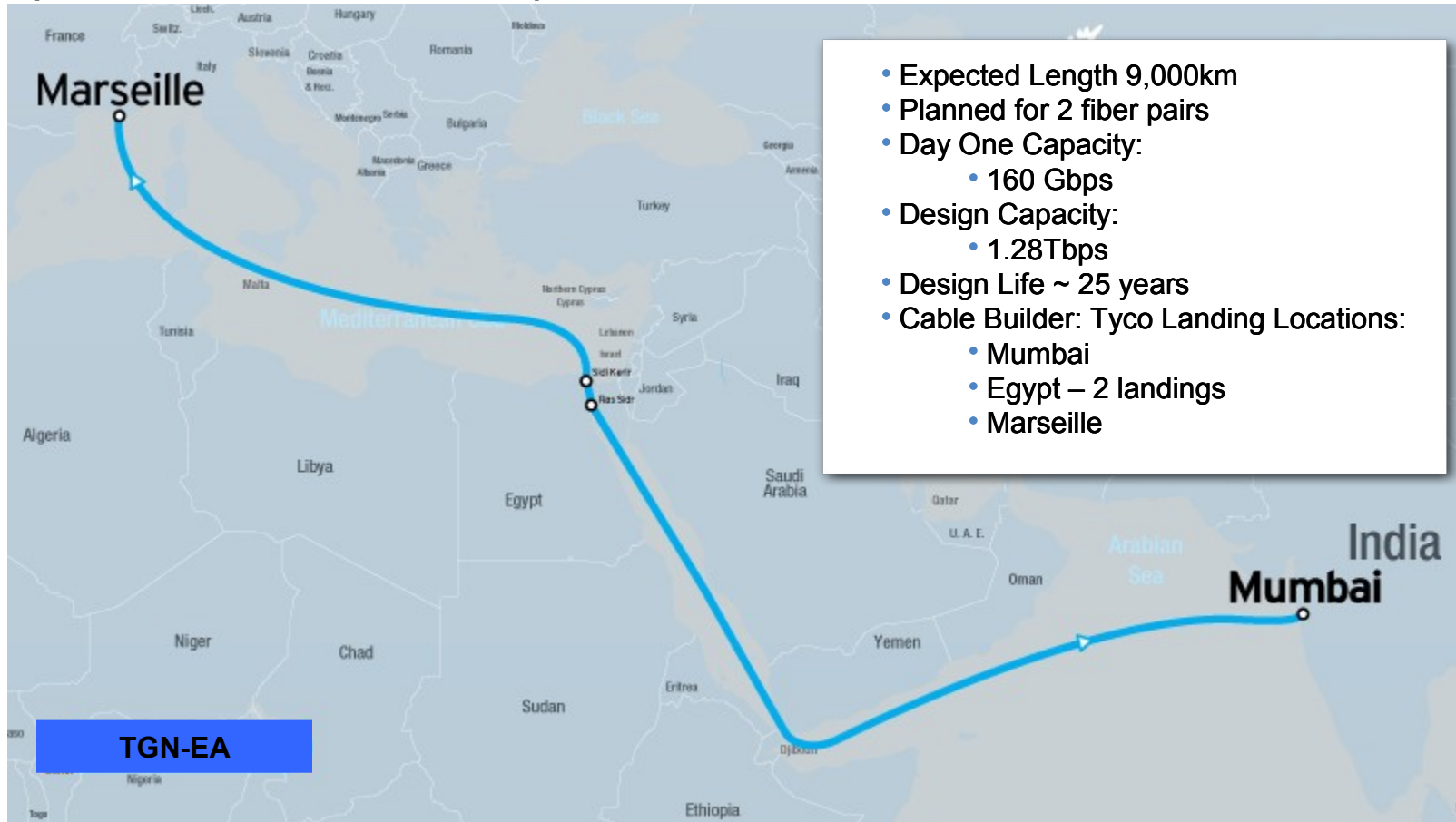**Expected Ready For Service: 3Q2008**

Intra-Asia Network- 2008

TGN – EurAsia - 2009

An Express route cable from India to Europe

TGN-EA

- 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

I-ME-WE - 2009
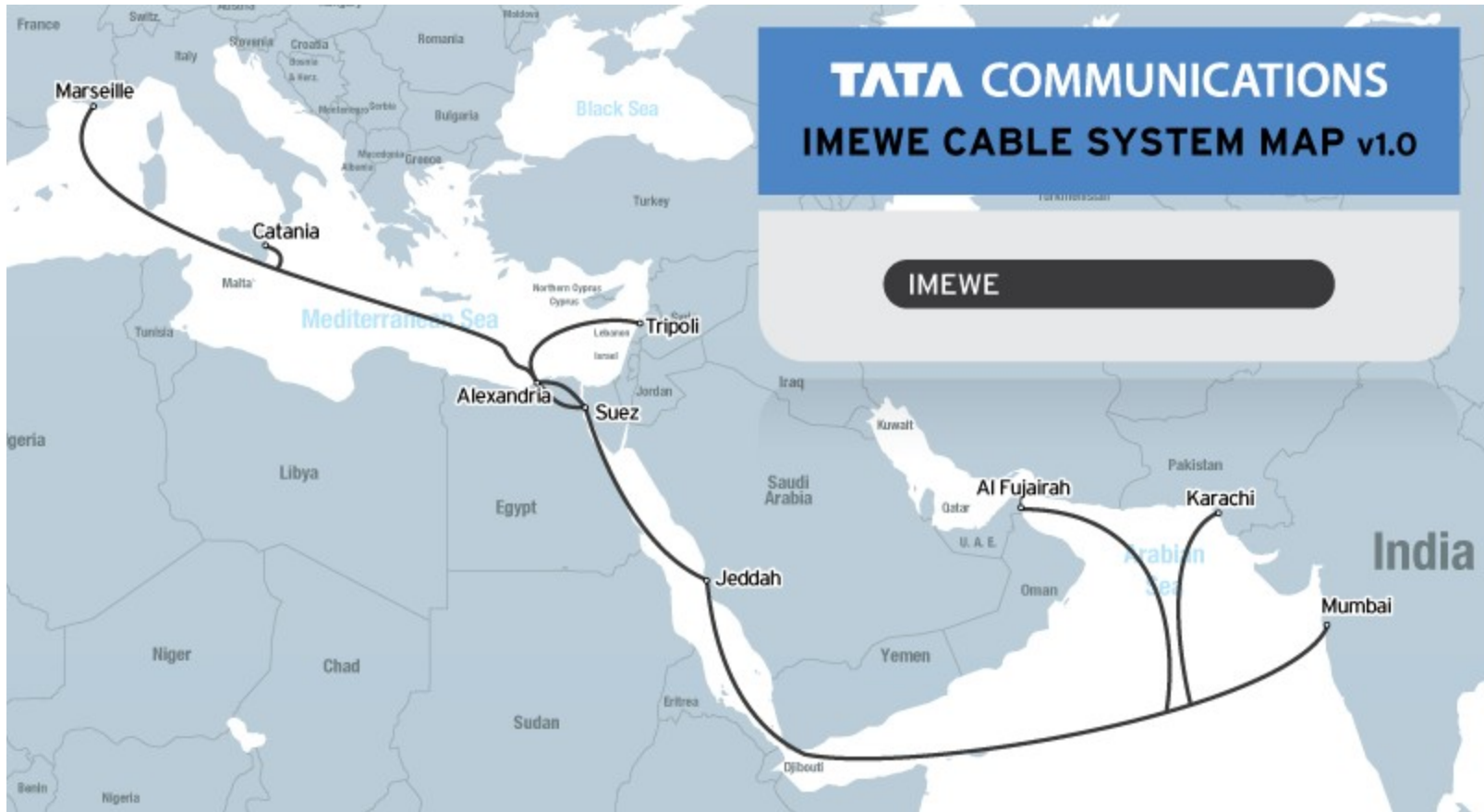
SEACom Cable System - 2009

System Details:

Length: 13,000km Cable

Locations:

- South Africa (Mtunzini)
- Mozambique (Maputo)
- Madagascar (Toliary),
- Tanzania (Dar es Salaam)
- Kenya (Mombasa)
- India (Mumbai)
- Middle East

Ultimate Capacity: 1,280 Gbps

Build contract awarded to Tyco Electronics

Expected RFS: 2H2009

Other Systems

TPE – Trans Pacific Express - 2008

      China, Korea, Taiwan, USA

CFX-1

      USA, Colombia, Jamaica - 2008

PIPE – PPC 1 - 2009

      Australia, PNG, Guam

AAG – Asia-America Gateway - 2009

      South East Asia to Guam and USA

Hugo - 2008

      UK-Guernsey-France

Gemini Bermuda - 2008

      USA - Bermuda

EIG - Europe India Gateway - 2010

      UK to India via Mediterranean and ME landings
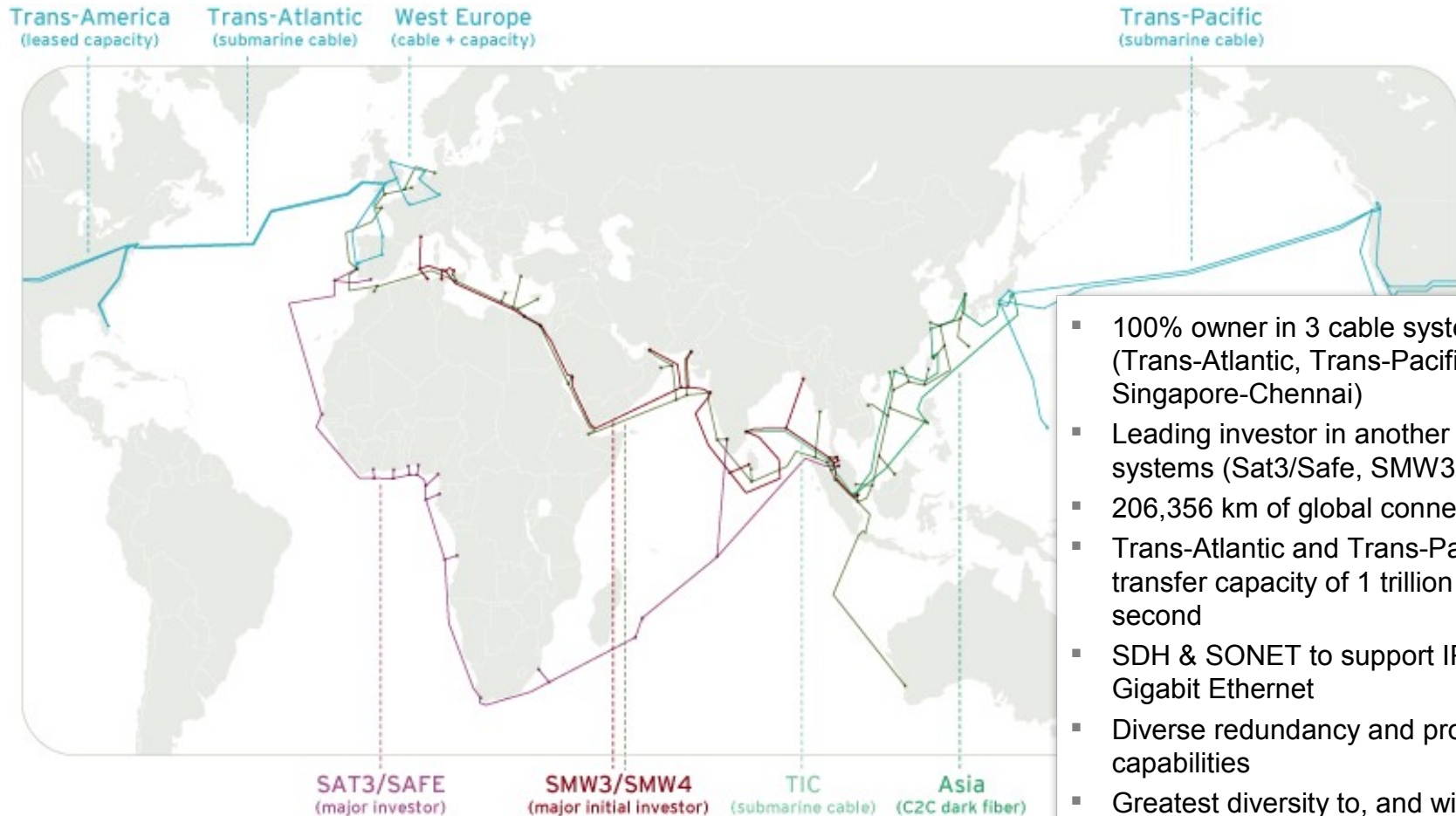
Unity -2010

      USA – Japan

Thank you

Q&A

Nanog43 Demystifying Undersea Cables

Leveraging Major Infrastructure Ownership

- 100% owner in 3 cable systems (Trans-Atlantic, Trans-Pacific, Singapore-Chennai)
- Leading investor in another 3 cable systems (Sat3/Safe, SMW3 and SMW4)
- 206,356 km of global connectivity
- Trans-Atlantic and Trans-Pacific data transfer capacity of 1 trillion bits per second
- SDH & SONET to support IP, ATM, Gigabit Ethernet
- Diverse redundancy and protection capabilities
- Greatest diversity to, and within, India

Tata Indicom Cable (TIC)

Newest and Highest Capacity Cable System into India (320 GBPs)

Offers Hardware and Wavelength Protection on Wet Segment

Deep Shore-end Burial

Ring-Protected Backhaul in Singapore

Leading SLAs for Service Availability

Linked Directly to Tata Communications' Redundant Network in India

Onward Connectivity from Singapore to Hong Kong, Tokyo, and USA

Chennai

Singapore

TGN - Atlantic

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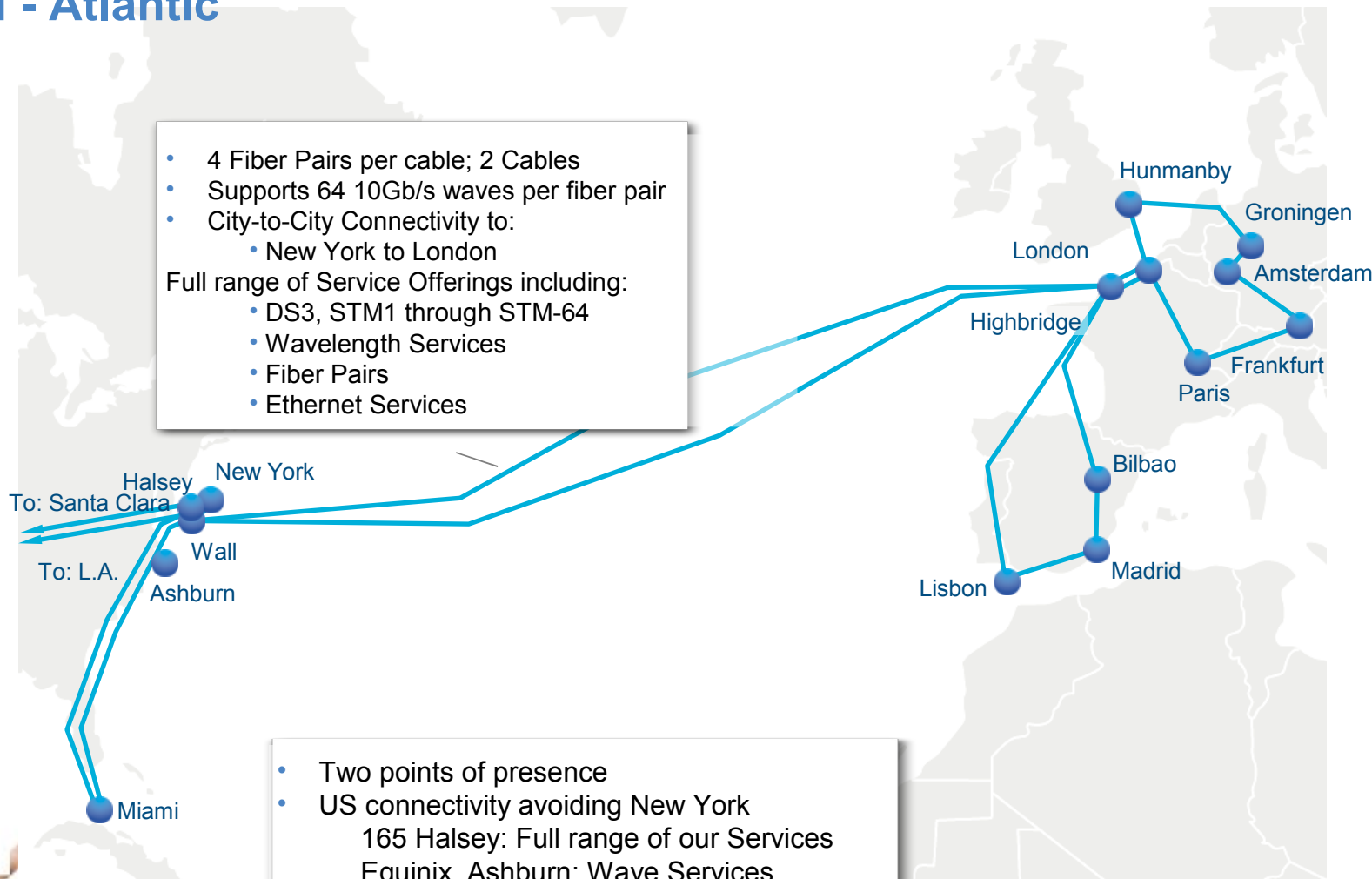
- Two points of presence
- US connectivity avoiding New York
  - 165 Halsey: Full range of our Services
  - Equinix, Ashburn: Wave Services

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

TGN - Europe

- European Ring
- City-to-City Connectivity to:
  - London, Paris, Amsterdam, Frankfurt
  - Lisbon, Madrid, Marseille
- Full Range of Service Offerings including:
  - DS-3, STM-1 through STM-64
  - Wavelength Services
  - Fiber Pairs
  - Ethernet Services
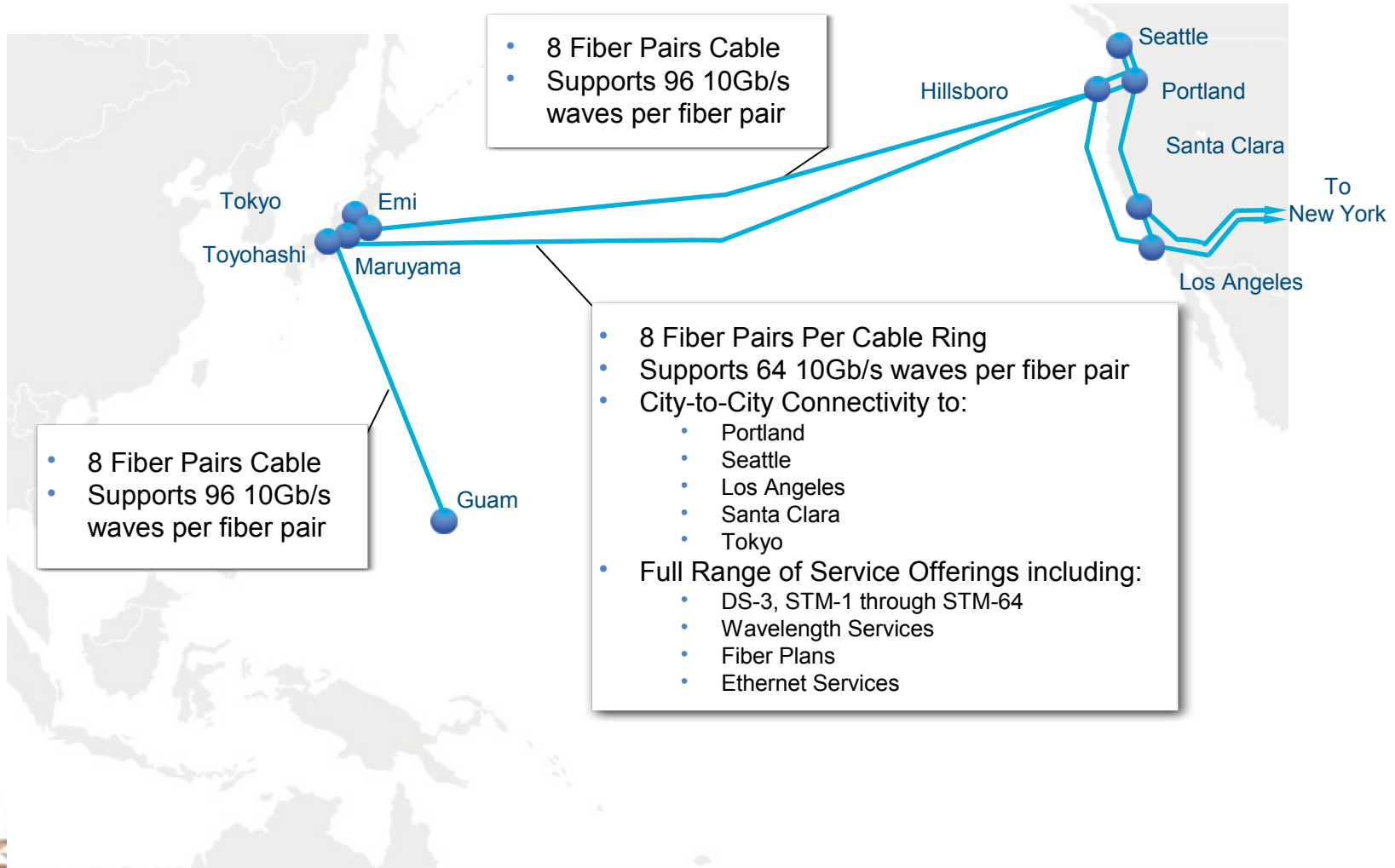- New Connection to Marseille Landings
  - Provides access from Marseille to USA not touching London or Paris.

TGN - Pacific

TATA COMMUNICATIONS

- 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

Map labels: Seattle, Portland, Hillsboro, Santa Clara, To New York, Tokyo, Emi, Toyohashi, Maruyama, Los Angeles, Guam

SAT-3 Route Map

Protected On-Net capacity to London

Sesimbra, Portugal CLS

The route distance and latency between SESIMBRA and MELKBOSSTRAND is: 11989.497 km, 59.947485 ms

Melkbosstrand, SA CLS
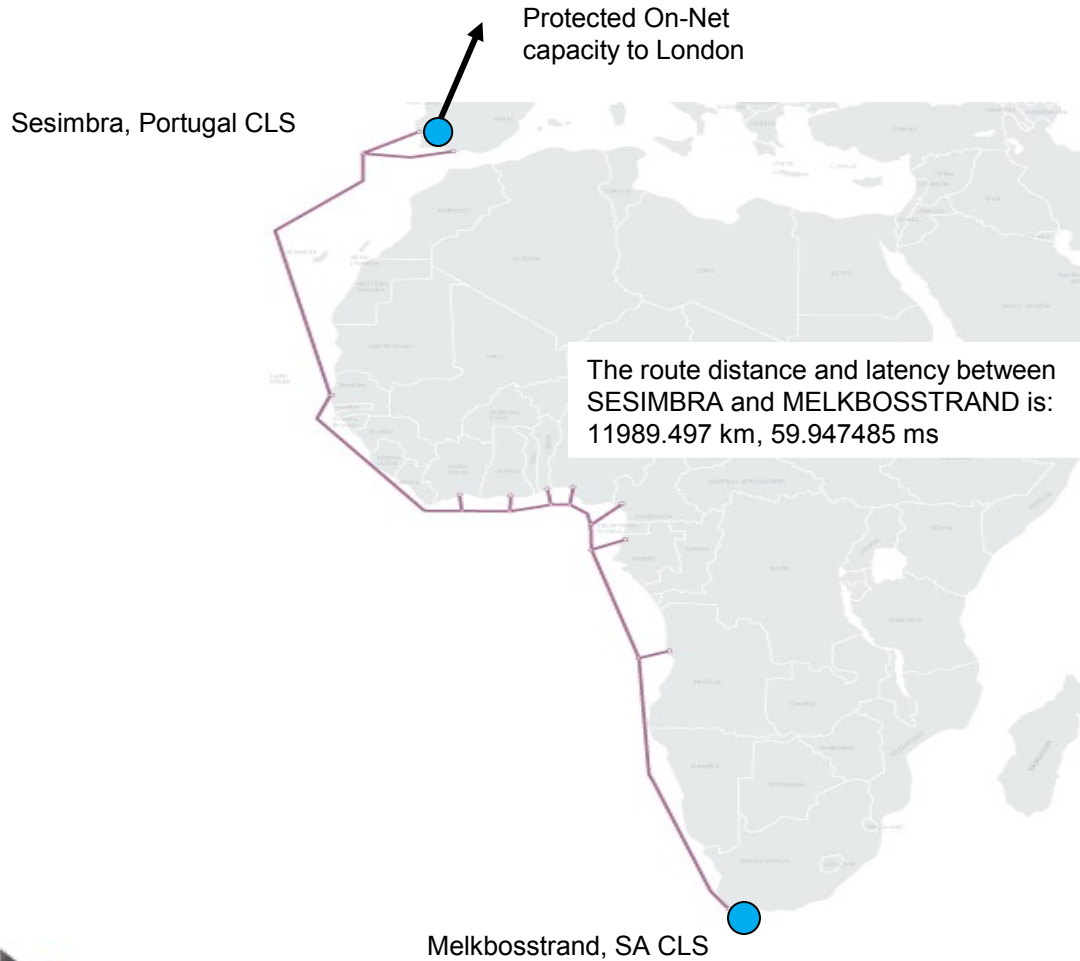
India National Private Line Network

- Optical Terrestrial backbone that spans over 400,000km

- Over 100+ National Private Line PoPs

- Full Range of Service Offerings
  - Sub-rate, E-1, E-3/DS-3, STM-1, STM-4, STM-16, STM-64
  - Ethernet Fast-E and Gig-E

- Annual Lease agreements & IRUs

- Connections to all the major landing stations
  - SMW-3, SMW-4 (Mumbai & Chennai), FEA, TIC

- Connections to neighboring countries
  - Pakistan & Nepal (available today)
  - China (available 1Q2009)

India International Connectivity

- Comprehensive Cable Redundancy
- Capacity on all cables coming into India

NLD Backbone

40,000 Route Km covering 300 major cities

Pan India Coverage with dual line maintenance

Ring Architecture for redundancy

Most vibrant domestic network in India

- SMW4
- Network Administrator
- One of the largest Investors

- Tata Indicom Cable
- 100% Owned and Operated by Tata Communications

SEA-ME-WE4 Q4 '05
Network Administrator

FLAG

SEA-ME-WE3

MUMBAI 1

MUMBAI 2

SEA-ME-WE2

SEA-ME-WE3

COCHIN

SAFE

Atlantic Route

Amritsar

Chandigarh

Gurgaon   DELHI

Ahmedabad

Kolkata

Pune

HYDERABAD

Rajahmundry

BANGALORE

Chennai, India

Coimbatore

Tata Indicom India Singapore Cable system 320 Gbps

Singapore

Pacific route