Lighting the Way to Bandwidth Equality

The Role of Submarine Connectivity in Bridging the Bandwidth Divide

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Prior to joining Terabit, he oversaw submarine research at Pioneer Consulting and was a fiber optics market analyst at Kessler Marketing Intelligence (KMI).

He has directed dozens of submarine and terrestrial market studies in every region of the world, most recently in 2016 on behalf of the World Bank and the United Nations as well as multiple private investors.

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Less Developed Markets: Key to the Continued Growth of the Submarine Industry

• The submarine communications market is strong
  • Direct investment in new systems averages $1.5-$2 bil & 35k km/yr.
  • Upgrade market exceeds $100 mil/yr.
• The industry owes much of its continued well-being to growth in less-developed markets
The Submarine Industry’s Historical Aversion to Serving Developing Markets with Fiber

- Prior to the dot-com bubble burst, the expansion of submarine fiber connectivity to less-developed markets was a secondary consequence of more lucrative intentions.

Maps: 2016 Undersea Cable Report (Terabit Consulting)
Connecting the Unconnected & Improving Connectivity to the Under-Connected Offered a Path to Recovery for the Submarine Market

The opportunity:
One-third of the world’s countries and territories lacked fiber connectivity as of 2003, and many others were “under-connected.”

Improving their connectivity required a new approach:
- Long-term commitment
- Development-oriented
- Multilateral
A New Development-Oriented Model of Multilateral Fiber Network Investment

PPP Structures
- SPV w/ Gov’t. Sharehold
- SPV w/ Gov’t Contribution
- BOT Concessions
- Project Mgmt. Contracts

System and Equipment Suppliers
- Appropriate Cost-Sensitive Solutions

Multilateral Development Banks and Other IFIs
- Network Developers
- Fixed & Mobile Operators
- ISPs
- Content Providers
- Private Investors
- Governments
- Multilateral Development Banks and Other IFIs
- System and Equipment Suppliers
Successful Examples of Multilateral Submarine Cable Investment
Expanding Fiber to Unserved Markets

EASSy
- Port Sudan, Sudan
- Djibouti City, Djibouti
- Maputo, Mozambique
- Mtwara (Tullary), Madagascar
- Mombasa, Kenya
- Maasani Peninsula, Dar es Salaam, Tanzania
- Maseda, Grande Comore, Comoros
- Matoya, France (proposed)
- Toliara, Madagascar

TEAMS
- Fujairah, United Arab Emirates
- Mombasa, Kenya

ACE
- St. Croix, United States Virgin Islands
- St. Thomas, United States Virgin Islands
- Puerto Rico
- Trinidad, Trinidad and Tobago
- Martinique
- Guadeloupe
- Dominica
- Antigua and Barbuda
- Montserrat
- St. Kitts and Nevis
- Saint Lucia
- Grenada
- St. Vincent and the Grenadines
- Saba, Saba and St. Eustatius
- Bonaire, St. Eustatius, Saba

Tonga-Fiji
- Vava'u, Vava'u, Tonga
- Sopo'a, Nuku'alofa, Tonga

Maps: 2016 Undersea Cable Report (Terabit Consulting)
Progress in the Expansion of Fiber Connectivity to Unserved Countries

In nominal terms, the industry’s efforts to connect the unconnected have been impressive. Civilian-inhabited countries and territories unserved by fiber:

- 79 in 2005
- 29 in 2015

(0.5% of population)
A Realignment of Regional Submarine Investment toward the Under-Connected

Since 2003, the share of investment serving less-developed and emerging markets has increased from 33% to more than 60%.

The largest gainers:
- Africa
- South Asia/Middle East
- Caribbean
- South Pacific

Regional Share of Total Investment in New Submarine Systems

Source: 2016 Undersea Cable Report (Terabit Consulting)
The Bandwidth Divide: 43% of Countries Have Insufficient Bandwidth

Classification of Countries and Territories by International Bandwidth per Capita, 2015

Source: Terabit Consulting International Bandwidth Databank

Average (10-29.9 Kbps): 29%
High (50-99.9 Kbps): 15%
Very High (100 Kbps or greater): 13%
Low (less than 10 Kbps): 43%

Average Per-Capita GDP of Countries and Territories in Each International Bandwidth Classification, 2015

<table>
<thead>
<tr>
<th>Classification</th>
<th>Average GDP per Capita, 2015 (PPP terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High (100+ Kbps)</td>
<td>$45,776</td>
</tr>
<tr>
<td>High (50-99.9 Kbps)</td>
<td>$38,582</td>
</tr>
<tr>
<td>Average (10-29.9 Kbps)</td>
<td>$22,126</td>
</tr>
<tr>
<td>Low (&lt;10 Kbps)</td>
<td>$6,839</td>
</tr>
</tbody>
</table>

Source: Terabit Consulting International Bandwidth Databank
The Bandwidth ‘Haves’ and the Bandwidth ‘Have-Nots’

- The data very clearly indicate the existence of a “bandwidth divide” that blocks the inhabitants of 43 percent of the world’s countries and territories from basic levels of affordable, reliable, quality access
  - Weak int’l. bandwidth is often accompanied by high prices and low competition
- Even within countries with average, high, or very high levels of per-capita bandwidth, reliable and affordable bandwidth is often limited in its geographic reach
  - Broadband concentrated within affluent, coastal, and urban communities
- There is a strong correlation between international bandwidth and per-capita GDP: bandwidth inequality serves to perpetuate economic inequality
  - Digital communications: a fundamental economic ‘flow’ (w/ transport, trade, finance)
The Bandwidth Divide is Most Pronounced in Asia

In the ASEAN region, the difference between the “bandwidth-richest” country and the “bandwidth poorest” country is 925x.

In more than half of countries, bandwidth is so low as to be a serious obstacle to overall development.

(based on Terabit Consulting threshold of <10 Kbps YE14)
Weak International Bandwidth Infrastructure Keeps Wholesale Prices High

Wholesale bandwidth prices are 10 to 100 times higher in some Asian markets than in North America.

Landlocked countries, in particular, have been deprived of affordable, reliable international bandwidth.
The Impacts of Weak International Bandwidth

• A constrained telecom environment
  • High wholesale and consumer prices
  • Lower broadband penetration rates
  • Compromised services and applications with lower reliability and utility
• More importantly, at the macro level:
  a major obstacle to economic and human development
  • Detachment from the digital economy
  • Continued economic inefficiencies and restrained growth
  • Lack of access to critical social development tools including telemedicine, distance learning, scientific/research networks
In the Developing World, Challenges & Obstacles Are Present Throughout the Supply Chain Between Int’l. Bandwidth and the End-User

- Challenges of Financing Submarine Cables
- Limited Competition in Backhaul Network
- Strict Control of Int’l. Gateway
- Weak or Uncompetitive Intercity Terrestrial Connectivity
- Restricted local access & Expensive Consumer Broadband Services
- Lack of ICT Equipment, Lack of Electricity
Policy Solutions for Addressing the Bandwidth Divide #1: Multilateral Projects

- In cases of market failure, pursue multilateral solutions for network development.
- Identify and involve key stakeholders on mutually-beneficial terms
  - governments, MDBs / IFIs & international organizations
    - able to provide coordination, guidance, and financing for the project
  - network operators and network developers
  - national regulatory authorities
  - incumbent operators and major international gateway providers
  - competitive telecommunications operators and ISPs
  - owners and overseers of complementary linear infrastructure assets
    - highway, rail, and power distribution infrastructure
  - suppliers and contractors
Policy Solutions for Addressing the Bandwidth Divide #2: Regional Cooperation

- In developing markets, encourage greater regional cooperation in the telecommunications and Internet sectors.
- Focus on the coordination of submarine and terrestrial fiber optic network development and investment, as well as pan-regional harmonization
  - Creation of regional working groups
  - Progressing to the exploration of streamlined regulatory, licensing, & interconnection regimes
    (as well as exploration and development of common telecom market)
Policy Solutions for Addressing the Bandwidth Divide #3: Open Access

• In uncompetitive international bandwidth markets, harness the potential of international connectivity by:
  • promoting open access and non-discriminatory terms for international bandwidth whenever possible, and
  • eliminating competitive and technological obstacles that may hinder the industry’s full exploitation of bandwidth.
Policy Solutions for Addressing the Bandwidth Divide #4: Eliminate Downstream Obstacles

- Eliminate “downstream” obstacles to bandwidth utilization, including limited access, price discrimination, market dominance, and geographic limitations at each of the following network elements:
  - Backhaul
  - International gateway
  - Intercity fiber networks
  - Metropolitan and access networks
  - Consumer broadband services
  - End-user ICT equipment & electricity
Key Conclusions

• The submarine communications industry has made tremendous progress in bringing cost-effective international connectivity to the shores of almost all the world’s coastal countries and territories.

• However, the submarine communications industry cannot continue to operate in a vacuum that ignores the bandwidth divide and marketplace failures.

• A seamless and equitable global bandwidth infrastructure can only be fully achieved through a multilateral, policy-driven, public-private approach.