CONVERGENCE OF SUBSEA FIBER, TERRESTRIAL FIBER & DATA CENTERS LEADING TO THE CONTINENTAL EDGE & SUBSEA COLOCATION

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Abstract:

With the ongoing resurgence in subsea industry, upwards of $10 Trillion in transactions takes place every day on subsea cables. Subsea cables are the most important means of global communications. With the explosive growth of the Internet and the ever-increasing generation and consumption of data, in the recent years we have seen an exponential increase in the amount of data transferred through the subsea cables, and this data is stored globally in data centres. There is ongoing paradigm shift in the industry, wherein the landing of the subsea cables in shifting from stand-alone Cable Landing Stations (CLS) to connectivity-rich and carrier-neutral colocation data centers, leading to a very natural convergence of subsea fiber with terrestrial fiber with connectivity-rich data centers. Various aspects of data center interconnection will be discussed, including dark fiber cross connects and Cloud-provider interconnects leading to the developing of a connectivity-rich ecosystem.
This paper will describe the latest advances in the global subsea market, the new subsea operators globally, the role of OTTs, and new business models emerging in this vital part of the Internet Infrastructure. It will also consider as a use case, the role of connectivity in Northern Virginia in making it the #1 data center market in the world, and the impact of subsea developments in Virginia Beach.

1. BACKBONE OF GLOBAL ECONOMY

The sprawling web of submarine cables sitting underneath the oceans of the world, constitute as the backbone of our global economy. The submarine cable systems, approximately 448 in service around the world, are connecting close to 100 countries worldwide, spanning 1.2 million kilometres [1]. Enabling $10 Trillion worth of transactions each day, these cable systems are largely hidden for most of their span, yet are instrumental in driving economic, technological and business advancements globally. As the growth of subsea cables continues full force ahead, content providers, public cloud providers and Internet of Things (IoT) are continuing to produce massive amounts of data globally. According to TeleGeography, it is anticipated that operators will be investing an additional $8.8 billion in new subsea cable systems between 2018 and 2020 in order to keep up the massive demand for data growth.

2. THE HYPERSCALERS, OVER THE TOP (OTT) PROVIDERS AND 'NEW AGE' OF INDEPENDENT INFRASTRUCTURE PROVIDERS (IIP)

With the massive growth of data, the make-up of the subsea cable traffic is also evolving. Presently, more than two-thirds of subsea fiber capacity growth comes from hyperscalers and content providers such as Google, Microsoft, Facebook and Amazon. These hyperscalers and content providers are either single-handedly owning, managing and operating subsea cables or partnering with a local in-country operator. This represents a significant paradigm shift from

the times when we used to see 10-15 international carriers form consortia and engage into complex and lengthy negotiations for getting submarine cable systems off the ground. In addition to the Hyperscalers and the content providers, the Independent Infrastructure Providers or IIPs have quickly evolved to be the 'new age' subsea operators. The IIPs are not your typical traditional carriers, but instead carriers who are completely and solely focused on managing subsea cable systems – some examples of such companies are, Aqua Comms, Seaborne Networks, Crosslake Fiber, IOX, Deep Blue Cable and SAEx to name a few. These IIPs generally have a strong geographic focus and are led by highly recognized and experienced industry veterans with stable financial backing.

3. THE DATA CENTER & TERRESTRIAL NETWORKS CONFLUENCE WITH THE SUBSEA CABLE SYSTEMS

There has been another paradigm shift over the last five years or so, and it continues to evolve in terms of the subsea industry changing their mode of cable landing that used to take place traditionally in stand-alone Cable Landing Stations (CLSs). The next generation design of CLSs is evolving to take advantage of better economics and new technology. In the past, the old wet plant and dry plant models among the subsea cable operators relied extensively on a single vendor for cables, repeaters to Submarine Line Terminal Equipment (SLTE), Power Feed Equipment (PFE), and Line Monitoring Equipment (LME). This 'closed' subsea cable system typically landed far from users, near the beach or in a data center near a large metro. This model has given way to a more 'open' cable system model with a choice of CLS data center locations and vendors in the last five years or so, and this trend continues to evolve.

As a significant portion of new subsea projects are driven by hyperscalers or by IIPs -- they prefer to have their subsea cable capacity terminated on land at a carrier-neutral Colocation or a Cloud data center. There is a significant paradigm shift underway in the Subsea industry wherein the subsea industry is preferring to land their cable systems at a carrier-neutral colocation data center where they have access to multiple terrestrial providers with diverse routes to major markets within the metro and ability for subsea customers to colocate their equipment and source space/power/Cross Connects from the carrier-neutral colocation provider. The subsea industry refers to this as the "PoP to PoP landing".

Established data centers, typically house private, public, hybrid and multi-cloud deployments. For subsea industry to have instant access to these target customers is a very attractive proposition, therefore the subsea industry has been leaning more and more towards terminating their capacity in captive, cloud and colocation data centers. If subsea customers can get a turnkey rack-to-rack solution across the two ends of the subsea cable system eliminating the need for painfully dealing with terrestrial backhaul component, they would much rather prefer that as opposed to taking on the burden of managing backhaul typically associated with subsea connectivity.

Additionally, the OTTs and IIPs are also actively investing in terrestrial backhaul, leading to the growth in dark fiber connectivity from the CLS or data center hosting CLS which is a combination of having the CLS components (PFE & SLTE) and the ability for additional customers to colocate in the same data center facility. The phenomenon of purpose-built metro and long-haul dark fiber networks connecting either a stand-alone CLS or data centers offering CLS + customer colocation, and other data centers will continue to gain traction in years to come.

Clearly, the OTTs remain focused on captive consumption of the subsea capacity for their own native applications. Whereas the IIPs will increasingly opt for dark fiber lease with in-region dark fiber providers to create subsea capacity breakout facilities in data centers where they get a captive and rich environment with prospective customers of subsea capacity.

4. CONTINENTAL EDGE AND SUBSEA COLOCATION

The landing of subsea cables in data centers is a trend that is continuing to gain traction in multiple cities and geographies around the world, and the concept of 'Continental Edge' which refers to establishing the Ecosystem of subsea, terrestrial network carriers, and potentially other eyeball networks, Internet Exchange Points (IXPs), and Software-Defined Network (SDN) providers at the edge where the subsea cable lands is one that will continue to evolve. Subsea Colocation along the same lines is also gaining traction wherein the Subsea cable systems are colocating their PFE + SLTE equipment at a carrier-neutral data center with the ability to establish connectivity to various type of networks including dark fiber, lit wavelength providers, IXPs and SDN-providers.

5. CROSS CONNECTS AND THEIR IMPORTANCE TO SUBSEA INDUSTRY?

Whether in a stand-alone CLS or in a carrier-neutral multi-tenant data center, Cross Connects play an important role in connecting multiple parties together on-site with a jumper fiber cable. An "open" Cross Connect policy facilitates Cross Connects between subsea operators, terrestrial fiber providers, Cloud providers and other potential participants such as IXPs, SDN-providers without any restrictions of any sort.

The Cross Connects or Interconnects also referred to as the private data exchange between businesses. With terminating a subsea cable directly at a data center, it eliminates the delays by eliminating the backhaul between the CLS and a data center or an interconnection hub. This model enables the subsea operator to offer to its customers fast, direct and secure access to cloud, network, content and other ecosystem partners present inside a data center.

Typically, data center operators have charged a Monthly Recurring Charge (MRC) for these Cross Connects. The industry is headed more and more towards a one-time fee for the Cross Connects and not an MRC. That is an important site selection criterion for the subsea operators – whether OTTs or IIPs when evaluating the data center operators that they clearly evaluate the data center operators' Cross Connect policies and pricing strategies.

6. USE CASES OF SUBSEA, TERRESTRIAL AND DATA CENTER CONFLUENCE

In a very short period of time, Hillsboro has evolved to become a major data center market in the Pacific North West, and on the west coast of United States. The Subsea cables – both the New Cross Pacific (NCP) and Hawaiki subsea cables – going live in 2018 have been a major catalyst for the Internet Infrastructure and Economic development in Hillsboro by directly connecting Hillsboro with low-latency high-capacity connectivity to 7 countries (China, Japan, Taiwan, Korea, New Zealand, Australia and America Samoa) in the continents of Australia and Asia. This direct connectivity enables the content hosted in Hillsboro data centers to reach Asian and Australian users in the most direct and fastest way. Both NCP and Hawaiki cables land in the Flexential Data Centers in Hillsboro.

In Singapore, Hong Kong, Tokyo or Sydney the subsea cables land in carrier-neutral data centers. This trend is starting to see adoption

in the United States as well – both on the west and the east coast.

As another use case, Google recently announced selecting Equinix Los Angeles data center for landing of its Curie subsea cable system connecting USA to Chile directly; it is the first subsea cable system to land in Chile in two decades. The Curie Subsea Cable system will land directly in Equinix LA4 data center in El Segundo, California.

EdgeConneX was selected to be the landing party for Seaborne Networks' ARBR submarine cable. EdgeConneX's Buenos Aires Edge Data Center (EDC) will be the Point of Presence (PoP) in Argentina for Seaborn's ARBR submarine cable.

7. THE ROLE OF CONNEVTIVITY IN NORTHERN VIRGINIA

It is a known fact that Northern Virginia is the #1 data center market in the world. Up to 70% of the world's Internet traffic flows through Loudoun County's data centers each day. Loudoun County's data centers are home to more than 3,400 technology companies housed with the data center. There is 13.5 million square feet of data center space currently operational with another 4.5 million square feet under development [2].

Recently the new subsea cable landings in the Commonwealth of Virginia have gained a lot of interest in the Internet community of Northern Virginia and worldwide. The first subsea cable to land in Virginia was the MAREA cable co-owned by Microsoft, Facebook and Telxius in mid-2017 followed by the BRUSA cable owned by Telxius. The MAREA cable connects Bilabao, Spain to Virginia Beach; and the BRUSA cable connects Rio de Janerio to Virginia Beach with Branching Units along the way to Fortaleza, Brazil and Puerto Rico, San Juan. Both these subsea cables land at Telxius-owned and operated CLS in Virginia Beach. The CLS hosts the PFE and SLTE for both the cable systems and additionally has attracted a number of terrestrial lit network carriers and dark fiber providers offering wavelength and dark fiber services to major data centers in Virginia including QTS Richmond, and Equinix Ashburn to name a few. Additionally, there are new terrestrial routes under development from Virginia Beach to Richmond, and to Ashburn.

8. IS THERE A CLEAR WINNER?

There is an ongoing debate in the industry about the merits of landing subsea cable system in a carrier-neutral data center as opposed to in a stand-alone CLS. There are some industry veterans that are of the school of thought that a stand-alone CLS providers greater flexibility, independence and hardened built over the 25-year lifespan of the cable system. Additionally, a stand-alone CLS once built can accommodate 3-5 subsea cable system landings. Hence there is an opportunity for monetization and a business model to offer subsea cable landing as a service. As the trend to land subsea cable systems in carrier-neutral multi-tenant data centers will continue to gain traction, the distance from planned landing point of submarine cable systems to carrier-neutral multi-tenant data centers, and the availability of multiple terrestrial fiber network providers will be important factor in site selection of new multi-tenanted data centers by subsea cable system operators.

9. REFERENCES

[1] TeleGeography, "Submarine Cable Frequently Asked Questions," 2018
[2] Loudoun County Economic Development Website, "biz.loudoun.gov" / Business Services / Data Centers