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Optical Submarine Network Evolution Leading Global Communications Transformation

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Waves of change are sweeping through global submarine networks as emerging optical transmission technologies transform the ultra-long-haul networks that carry the vast majority of the world's internet traffic. The level of complexity in these undersea cable networks is compounding as innovative signaling techniques enable the expansion of individual optical wavelength capacity from 10-Gigabits per second (Gbps) to 100G+ and beyond.

Governments and businesses are clamoring to deploy new services and take advantage of the explosive global bandwidth growth, but increased demand is putting a strain on carriers and networking vendors who must be flexible to harness the changes that are coming down the line. Carriers are in a particularly tough spot because they assume most of the challenges that arise as submarine cable networks are stretched and re-engineered to keep up with a constantly rising demand for global capacity.

Optical submarine networks carry more than 95 percent of all intercontinental traffic and the total bandwidth contribution of these undersea cables is growing at a compound annual growth rate of 40 percent globally. It's no wonder, submarine networks have become increasingly critical for business and government. They are directly responsible for $10 trillion in transactions every day. Scaling the capacity of these undersea networks to meet rising bandwidth demand has become a crucial challenge for carriers across the globe. Doing so while providing best-in-class speeds in a secure and reliable manner without skyrocketing costs requires flexibility and foresight.

How submarine networks are evolving

The global footprint of undersea cables is exploding as more carriers, vendors, and global technology firms make significant investments in the networks that will transmit the bulk of data to and from all points of the globe. Just last month, Google announced plans to build and operate three new subsea cables to expand the capabilities and reach of its Google Cloud infrastructure. One of the cables, named Curie, after the Nobel prize-winning scientist Marie Curie, will cross over 6,200 miles from Los Angeles to Chile. All told, the tech giant has now directly invested in 11 submarine cables and it leases capacity on several others.

These massive infrastructure projects often involve multiple partners that are pooling resources to support the rising need for bandwidth to flow between networks and regions with greater resiliency, capacity and room to grow. A few decades ago, there wasn't much demand for data traffic to travel from one continent to another. Satellites and other methods that were used to accommodate lower data needs for voice, for example, have waned. While satellites still provide some interesting use cases, they are incredibly expensive and decline in value as they age.

Submarine networks are fueling the global tech economy. Indeed, the backbone of international business, trading and communications is under sea. And these ultra-long-haul fiber cables will continue to meet the objectives of modern business.

In years past, submarine networks were handled much differently than terrestrial networks. As the complexity of the global communications network has increased, the differences between terrestrial and submarine networks have narrowed. Monitoring applications and targeted big data analytics, previously largely reserved for regional networks, are being applied to submarine networks so that better informed, real-time data-driven decisions can be made. With these advanced tools applied to the submarine network, operators are improving their ability to proactively address potential global network service disruptions before they happen, create more profitable services, and make more informed capacity decisions.

As the world becomes more reliant on these massive networks that run along the ocean floor, service providers are making the submarine network smarter. The solutions being used in metro core networks, such as optical mesh networks, are now being utilized in the submarine cable network. The maintenance programs, operations, and techniques being deployed to undersea cables are also progressively improving over time. The ability to drive higher optical speeds longer distances has dramatically decreased costs and given carriers a more clear path to upgrade these networks to achieve greater bandwidth and capacity. Newer optical signaling techniques like 100G+ Coherent have made it possible for many ultra-long-haul cables to cross thousands of miles without the need for expensive repeaters or amplifiers on that path.

How carriers can overcome the challenges

Carriers no longer face difficult decisions about how to unlock long-term value from these undersea cables. The latest equipment from infrastructure vendors can increase speeds by at least tenfold and render some of the interim pieces of hardware that amplify signals in the middle of that path no longer necessary. Reusing already deployed infrastructure by upgrading equipment on both sides of the network is a strong business case for carriers and one that's increasingly common in the world of undersea cables.

During the last 20 years, dense wavelength division multiplexing has enabled multiple optical signals to be transported in the same cable. Whereas submarine cables used to be limited to a single optical signal, carriers can now transmit hundreds of signals on a single fiber with each running 100G+ Coherent. This new technology is enabling multiple terabits of traffic on a single optical fiber.

When a carrier invests heavily in a submarine fiber network, it can't afford to have it be out of date in five or ten years. But keeping up with the latest technology is a challenge for carriers on numerous fronts. Many signal technologies being used to drive traffic further distances at higher speeds are proprietary to equipment vendors and carriers have to navigate those limitations while book-ending their networks with common solutions that will interoperate with other vendors equipment.

Proprietary technologies drive up costs and create lock-in, which puts carriers in a tough negotiating spot. There's a big push underway for common standards to take hold in submarine cables, but as long as equipment vendors keep leapfrogging each other, carriers will be hard pressed not to pick the best technology available. Ultimately, carriers are building these networks to sell highly secure, stable bandwidth at ever-increasing speeds. Any competitive advantage they can gain will go a long way toward selling new services and being at the forefront of global communications.

Other advancements can be gained through software-defined networking, which is of critical importance to submarine fiber. Key analytics from undersea cables are helping carriers make more intelligent decisions about how to set up their gear and manage the network accordingly. SDN and other self-optimizing techniques can also predict failures in the network before they occur and automatically reroute traffic to avoid disruptions. Managing these networks to most efficiently use the infrastructure in place has become a key component of every carrier's strategy for good reason.

If carriers confront these challenges with the best solutions available and implement programs to upgrade and extract more value out of their deployed submarine networks at a regular cadence, they can lower the total cost of ownership and meet the most complex and demanding customer requests for decades to come.