

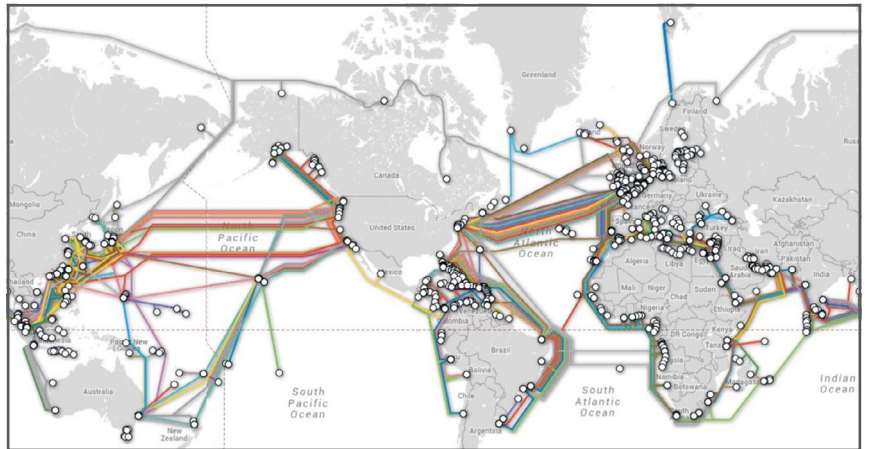
# Apollo Maximum Capacity 140Gbaud Submarine Transport

With a unique capability to combine controls for continuous baud rate to an industry leading 140Gbaud, with continuous modulation, Apollo coherent optical transport extracts the *maximum spectral capacity* from submarine fiber optic cables *with fewer wavelengths*. Apollo delivers the most capacity for any distance at the lowest cost.

## Priority One – Maximizing the Capacity of Submarine Fiber Optic Plant

Oceans and seas account for 70% of the surface of our planet, so it is no surprise that submarine cables carry the bulk of the world’s international telecommunications traffic. About 450 international and 100 intra-country submarine cables spanning nearly one-million kilometers provide the connectivity fabric for our global Internet and cloud economy.

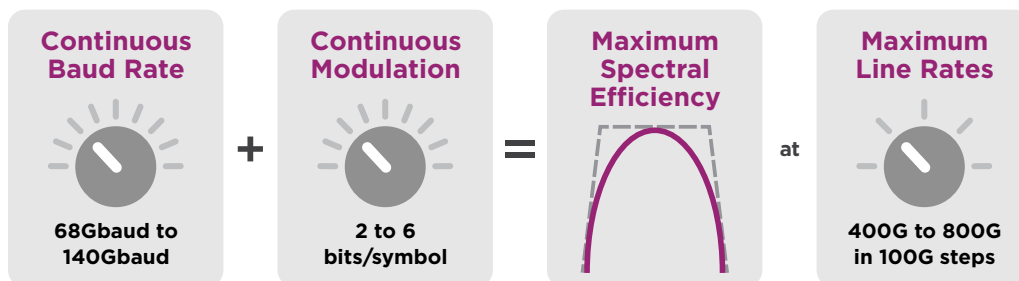
A distinguishing feature of submarine fiber optic cable is its high cost. Starting with premium low loss fiber, submarine cables incorporate integrated waterproof amplification electronics and are specially reinforced to protect them during installation and against harsh marine conditions. Repairing breaks and servicing faulty electronics requires raising the cable to the surface, which is a costly operation and can lead to further complications. This all translates to a priority for service providers to extend the life and extract the maximum spectral capacity from their submarine fiber optic plant, done of course, as economically as possible.



## Maximum Submarine Capacity with Fewer Wavelengths

Ribbon’s Apollo optical networking system extracts the maximum spectral capacity at the lowest cost for submarine fiber optic transmission using two powerful programmable capabilities:

1. **Continuous baud rate** in increments of one Gbaud up to an industry fastest 140Gbaud;
2. **Continuous modulation** from 2 to 6 bits per symbol, in increments of 0.1 bits.

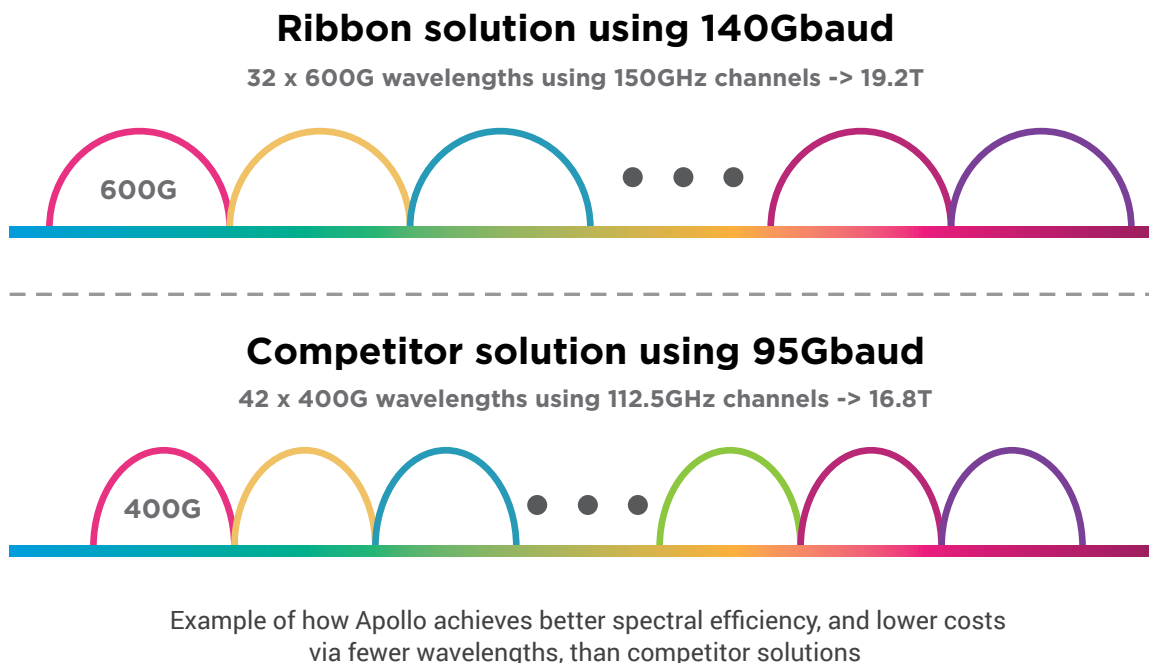


## Maximum Spectral Efficiency

By uniquely combining fine controls on both the baud rate and the modulation, Apollo is able to shape the optical signal right to the edge of the Shannon Limit, taking into account different spectral loss profiles along the fiber. Apollo also applies proprietary non-linear equalization algorithms to maximize capacity on older fibers.

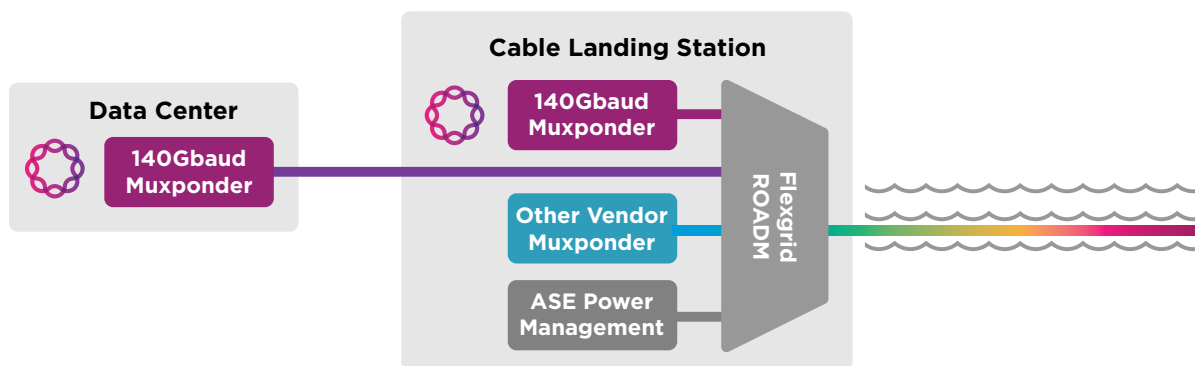
## Lower Cost via Fewer Wavelengths

For any given fiber distance communications theory dictates a maximum modulation density, beyond which a signal is no longer recoverable from the underlying noise. The only way then to increase the line rate is by boosting the baud or symbol rate. By supporting an industry-fastest 140Gbaud, Apollo is able to achieve industry-fastest line rates for a given modulation. This translates directly into fewer wavelengths and lower costs.



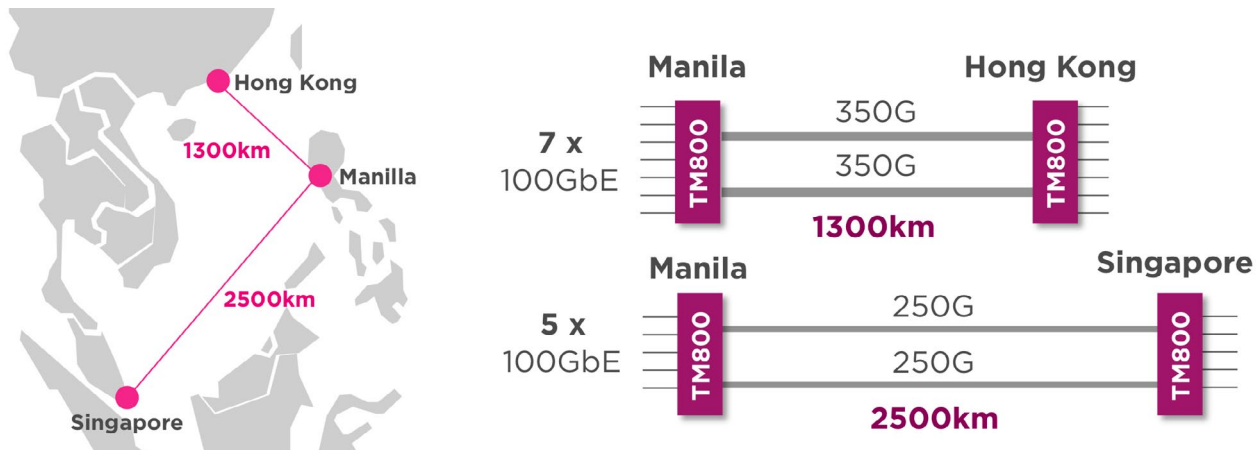
## Maximum Submarine Capacity with Fewer Wavelengths

Apollo delivers this superlative submarine transmission solution for 100GbE and 400GbE clients on its 9600 series optical networking platform using two line cards. As shown below, Apollo submarine transmission is deployable both at the landing station and in the data center, and can be deployed as an overlay alongside existing wavelengths from other vendors.



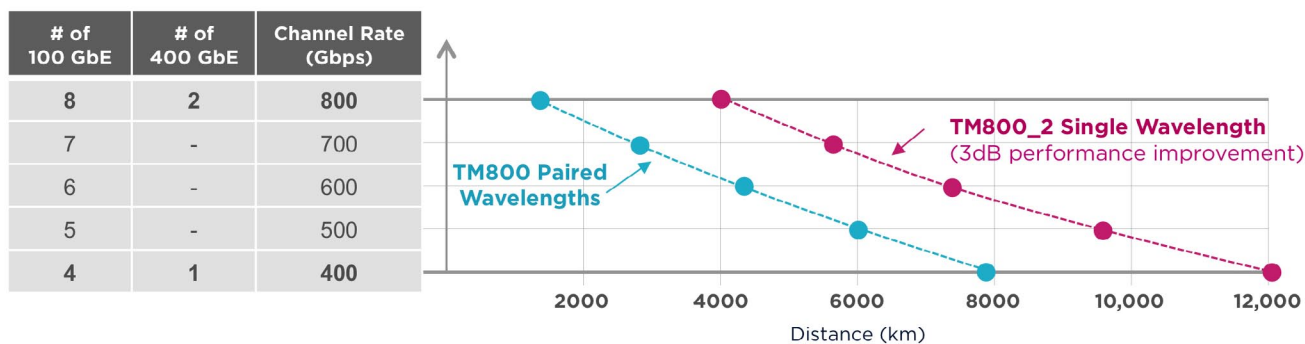
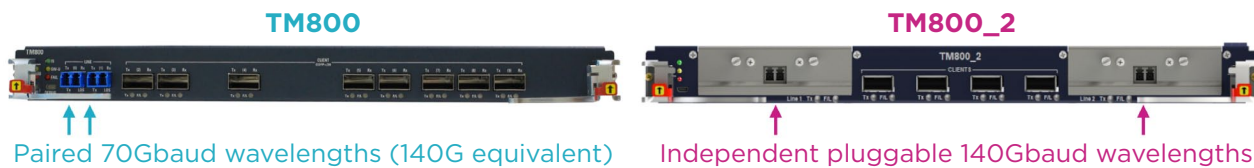
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- TM800.** This *current generation* card pairs two 70Gbaud wavelengths in a single channel providing an effective 140Gbaud transmission capability. An example of this solution is illustrated below, where the customer needed to maximize the number of 100GbE clients on two submarine links. By using paired carriers Apollo was able to extract 25% more capacity than the leading competitor's approach.



- TM800\_2.** This *next generation* card provides two independent 140Gbaud wavelengths. It uses pluggable technology that enables starting with a single wavelength and adding a second one as needed.

This 140Gbaud solution is also available on Apollo's new OT9408 compact modular optical transport platform which would be the preferred approach for data center deployments that feed the submarine cable.



Typical performance of Apollo line cards supporting continuous baud rate and continuous modulation controls over D+ submarine cable

## Total Submarine Transport Solution with Multiple Advantages

Ribbon's Apollo 140Gbaud submarine transport is a total balanced solution with multiple value adds.



**Maximum spectral efficiency with fewer wavelengths.** As discussed above this is the foundation for the solution. By exploiting continuous baud rate and modulation controls, up to a blazingly fast 140Gbaud, Apollo maximizes the line rate for any channel width and fiber condition right to the edge of the Shannon Limit.



**Landing site and data center deployments.** Apollo's 140Gbaud transmission solution can be deployed both at landing sites using conventional telco platforms, or in data centers using the new OT9408 compact modular platform featuring F2B cooling along with telco NEBS.



OT9408 Compact Modular Transport Platform



**Flexible and fixed grid.** All solutions can operate in flexible grid submarine fiber optic cable with no constraints on channel width, as well as in fixed grid applications.



**Disaggregated overlay deployment.** Apollo submarine transport can be deployed as a stand-alone solution using an Apollo NMS or as an overlay to an existing system with OpenConfig control. Moreover, Apollo has a proven record of deploying its native wavelengths running alongside existing competitor system wavelengths.



**Optical performance monitoring.** Built-in monitoring provides continuous feedback on optical power, OSNR, and other performance parameters. By tracking historical trends, potential service affecting issues can be flagged well in advance.

**Contact Us**

Contact Ribbon to learn how we can Optimize your Submarine Optical Transport