

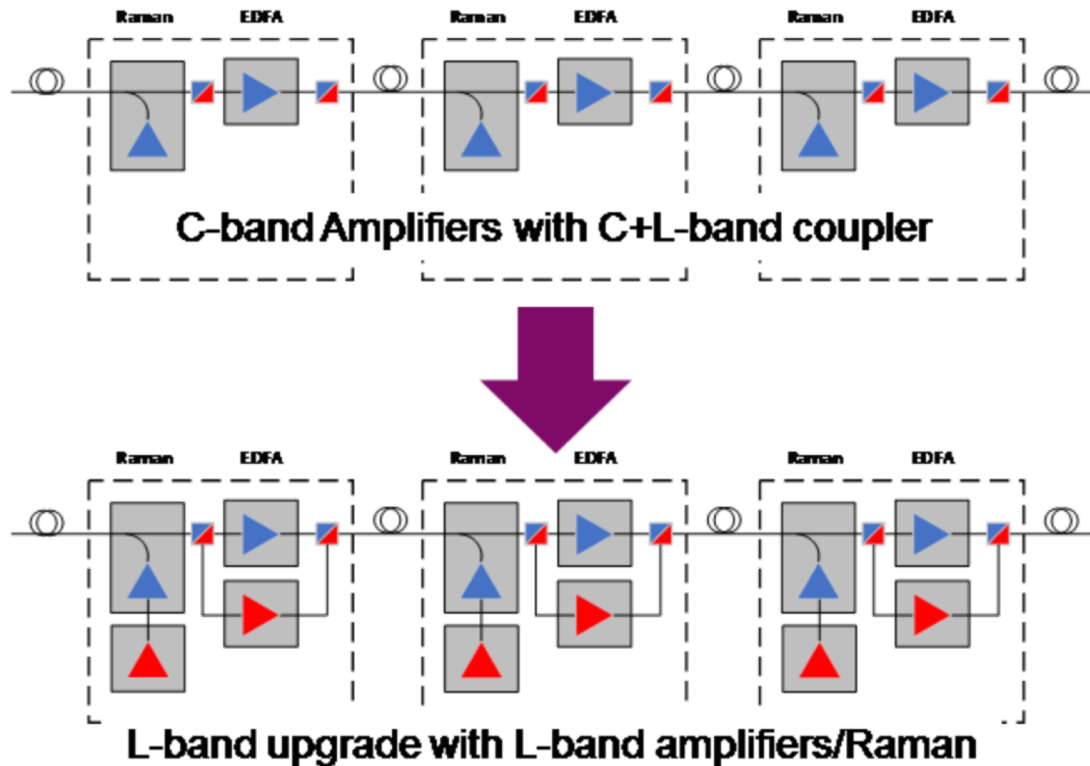
Extended Capacity for Next Generation Long-Haul Networks

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NetLab Group Meeting
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Motivation

- *L-band deployments with minimal up-front cost*
- *Add L-band capacity only when it is actually needed due to C-band exhaustion*
- *Avoid operational complexity and impact to existing services*
- *Maximizing the performance and agility of the overall C+L system*

Ciena



Revisiting sites

More cards to manage and spare

Scalability limitations

Performance impacts: SRS tilt

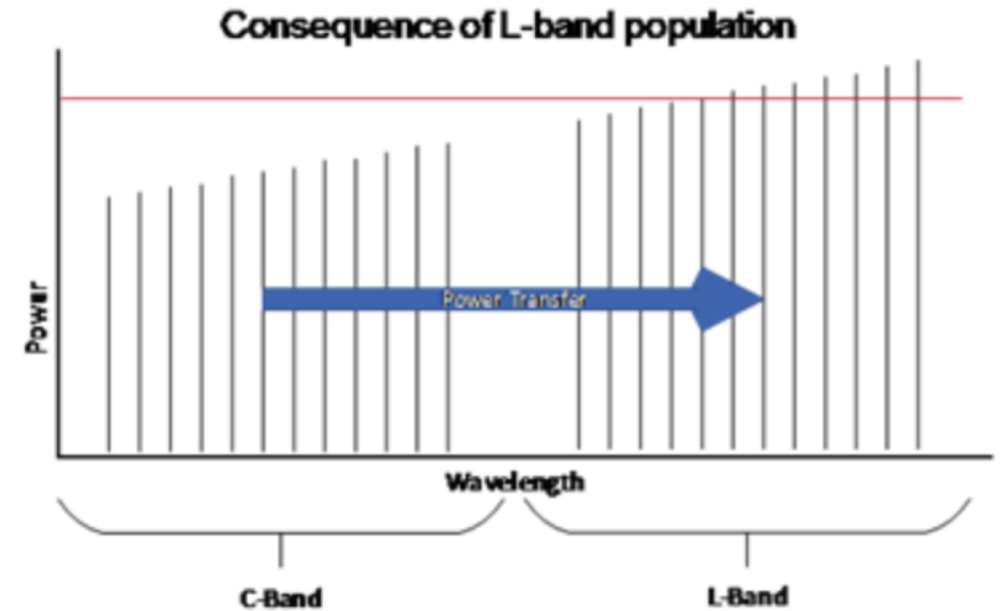


Fig. Historical C + L band upgrade solution



Ciena

- With the 6500 Reconfigurable Line System (RLS), network operators deploy, day 1, C&L-band optimized equipment that uses integrated channelized Amplified Spontaneous Emission (ASE) loading to ensure maximum fiber capacity, optimal system performance and guaranteed in-service upgrade

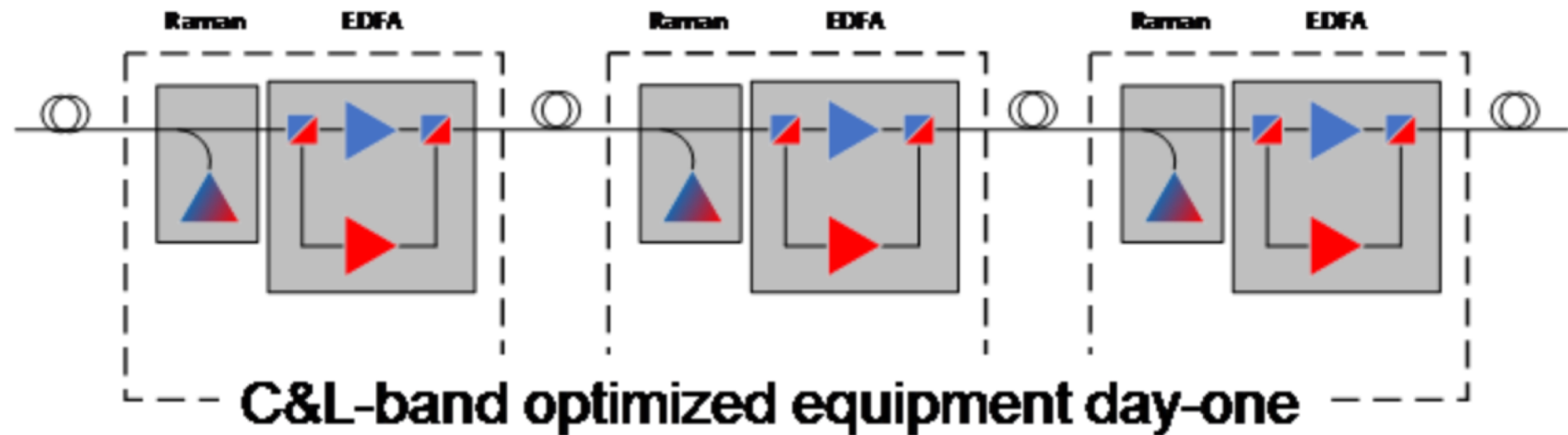
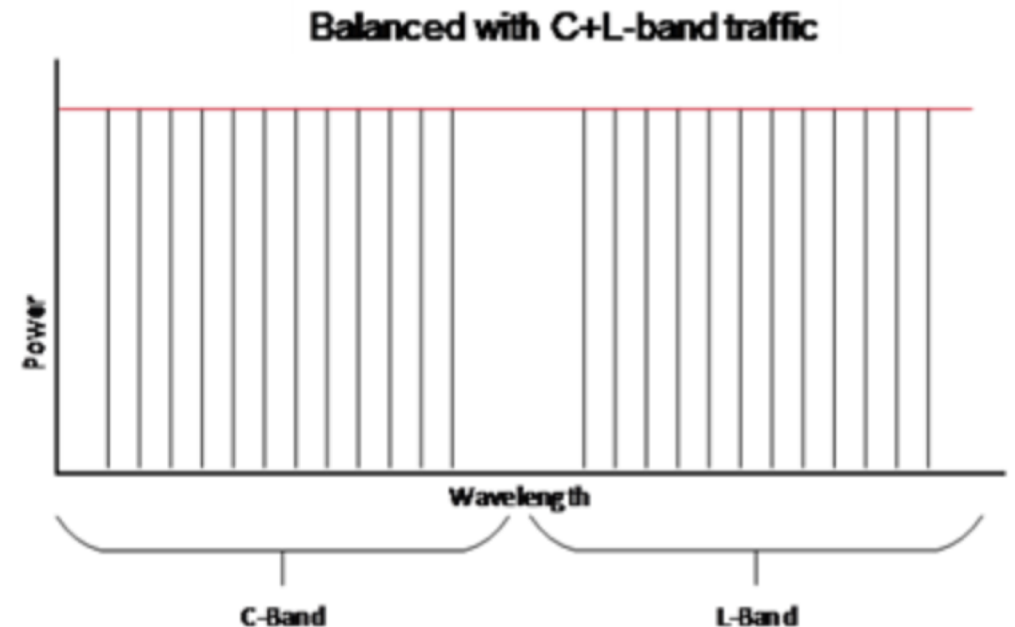


Fig. Ciena's integrated C + L band upgrade solution

Ciena

- Simplified operations: Operators initially deploy integrated C&L-band amplifiers, then when L-band is needed, only the ROADM sites need to be upgraded
- Optimal performance and capacity: regardless of channel loading conditions – whether the L-band is carrying live traffic or not, the system behaves as if it is fully loaded from day one.
- In-service upgrade
- Same number of cards



Ciena

“With Ciena’s 6500 RLS, network operators can efficiently scale their networks to meet the most demanding photonic layer requirements with a fully in-service upgradable, optimized C&L-band solution that is optimized to provide maximum performance and capacity, minimize footprint, and improve density.”

Infinera

- Glenn Laxdal, Infinera Senior Vice President and General Manager, Product Management says, *"By deploying the Infinera C+L Solution now, Windstream is leading the industry, providing a powerful example of how to prepare for future growth and business success."*
- In addition to the L-band-expandable line system, Infinera has developed advanced, innovative **control software** that tackles the challenges of **dynamic power balancing** and allows the addition of L-band capacity without complex planning restrictions *and* without service impact

<http://investors.infinera.com/new-releases/press-release-details/2018/Windstream-Deploys-Infinera-CL-Solution-Sets-Foundation-to-Double-Fiber-Capacity/default.aspx>

Infinera

Doubles capacity without a hit: Infinera C+L Solution allows Windstream to use **entire C-band** before starting L-band deployments, while still protecting existing traffic from any **service-impacting outages**. This enables operators to minimize up-front capital investment, increase return on investment, and reduce operational complexity and cost

Extends ICE's advantages to the L-band: INFINITE CAPACITY ENGINE (ICE) delivers **cloud scale capacity** for Infinera Intelligent Transport Networks. ICE also supports Infinera Instant Bandwidth for **flexible software defined capacity on demand**. The new ICE L-band optical engines will bring all these benefits of **vertical integration, leading optical performance and software defined capacity to the L-band**

[http://investors.infinera.com/new-releases/press-release-details/2018/Windstream-Deploys-Infinera-CL-Solution-Sets-Foundation-to-Double-](http://investors.infinera.com/new-releases/press-release-details/2018/Windstream-Deploys-Infinera-CL-Solution-Sets-Foundation-to-Double-Fiber-Capacity/default.aspx)

[Fiber-Capacity/default.aspx](http://investors.infinera.com/new-releases/press-release-details/2018/Windstream-Deploys-Infinera-CL-Solution-Sets-Foundation-to-Double-Fiber-Capacity/default.aspx)

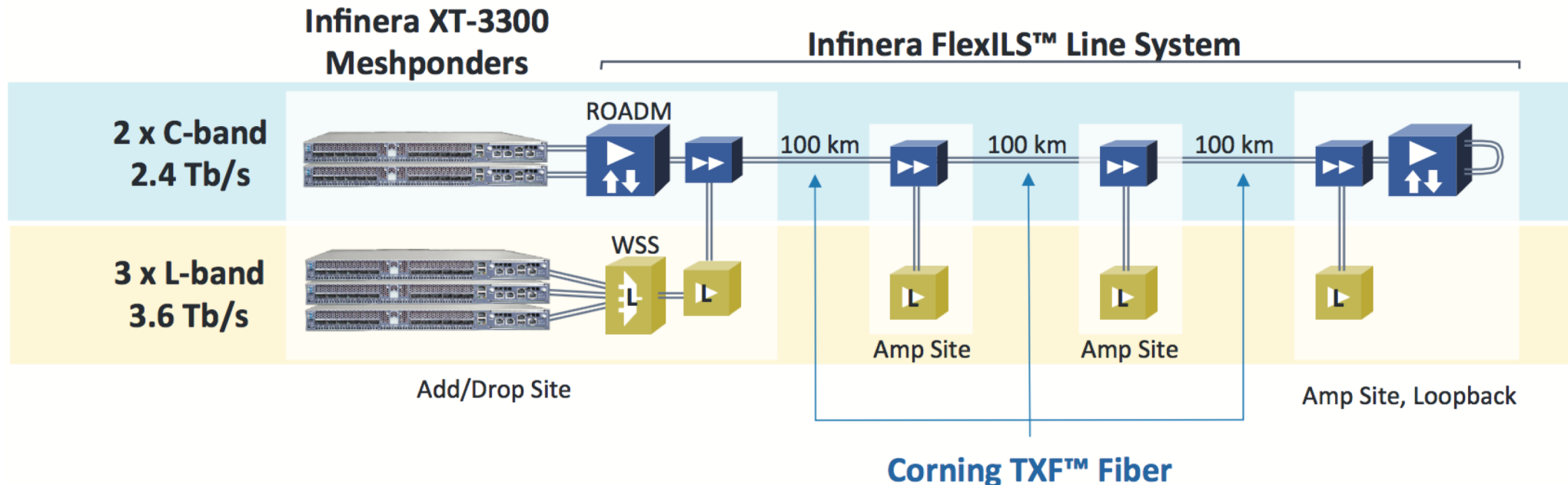
Infinera

- The Infinera C+L Solution incorporates C-band and L-band variants of Infinera's transponders enabled via the company's Infinite Capacity Engine (**ICE**) **coherent DSP** as well as **FlexILS line system** elements
- It also includes end-to-end controls to enable combined C+L operation on a single fiber pair

Infinera

Corning and Infinera demonstrate 55 Tb/s capable transmission equipment operating in C+L bands across 600 km of G.654.E compliant ultra-low-loss, large effective area fiber

Infinera C+L Demonstration with Corning – OFC 2018



Corning® TXFTM Optical Fiber

- Combined benefits of ultra-low-loss and large effective area
- Typically 0.168 dB/km and 125 μm^2 at 1550 nm
- Fully compliant with ITU-T Recommendation G.654.E, a category of advanced fibers for long-haul terrestrial networks
- Exceptional terrestrial reach capability for high channel speed transmission

Infinera XT-3300 Meshponders

- The trial validates ICE4's transmission of 8QAM (quadrature amplitude modulation) 600 gigabits per second (600G) super-channel in 140 gigahertz of spectrum, delivering the highest spectral efficiency of **4.3 bits per second per hertz** with commercial-ready performance margin

Infinera FlexILS

- The Infinera FlexILS flexible grid line system is the industry's most widely deployed **flexible grid** open optical line system delivering future-proof scalability, flexibility and programmability
- Operators can deploy FlexILS for extended C-band capacity today and expand to the L-band with a simple, non- service-impacting upgrade when more capacity is needed