



# Rethinking Optical Access The XR Optics Initiative

Geoff Bennett, Infinera



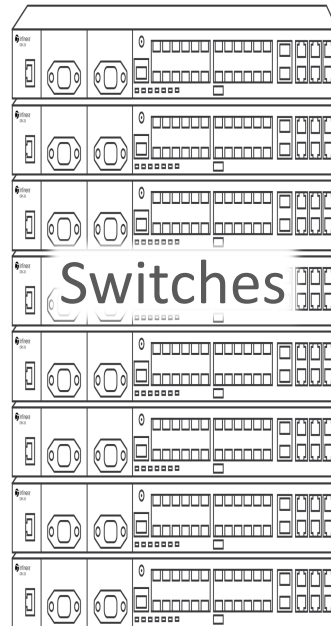
# What we just heard...

## Data Centre

### Inside

- Client I/F
- Pluggable
- Grey optics

100GbE – 400GbE



## This is the bit I'll be talking about

### Outside

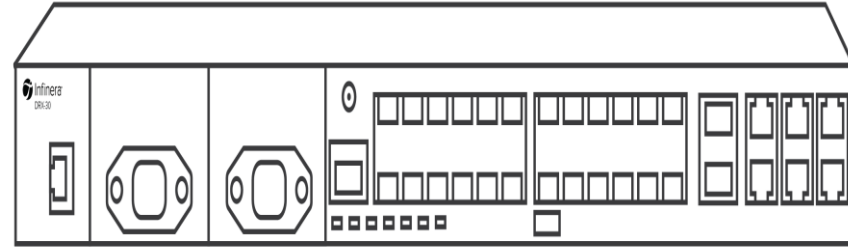


- Line side I/F
- Integrated → Pluggable
- WDM optics



But I won't be talking about this very much

# Why won't I be talking about 400ZR much?



## Client optics vs Line Side optics

- *Cost*
- *Size*
- *Power*
- *Plug format*
- *Impact on faceplate density*

One of the goals of 400ZR is to make these factors less relevant

But there are 3 problems with 400ZR...

# The three basic problems with 400ZR

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It's 400 Gb/s

*It's too high a data rate for short reach applications*

It's P2P



*Why is this a problem?*

Very short reach

*It's too short a reach for applications that need 400G data rates*

# Let's Look at an Access Network

Fiber from here,  
inwards to the core

The stuff we need to  
connect into the network

4G/5G



Next Gen  
Cable Access

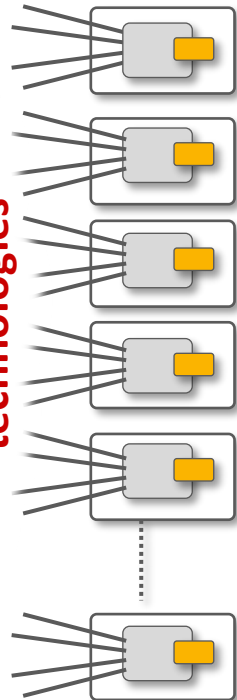


Next Gen  
Enterprise  
Access



## OPTICAL EDGE

Various access  
technologies



You may know these locations as...

**4G/5G:** Radio Masts → Hub sites

**Cable:** Street Cabinets → Hub sites

**Enterprise:** In-Building → Local Exchange

CORE

# Let's Look at an Access Network

10G → 25G → 50G → 100G { Data rate here determined by economics }  
400G → 600G → 800G { Data rate here determined by economics }

The stuff we need to connect into the network

4G/5G



Next Gen Cable Access

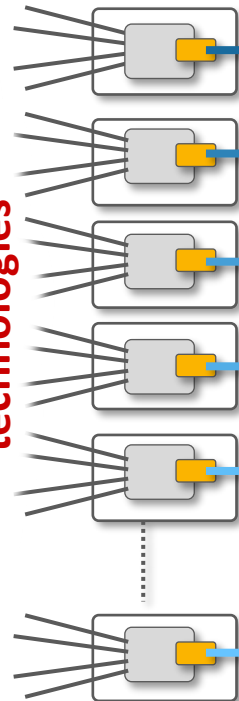


Next Gen Enterprise Access

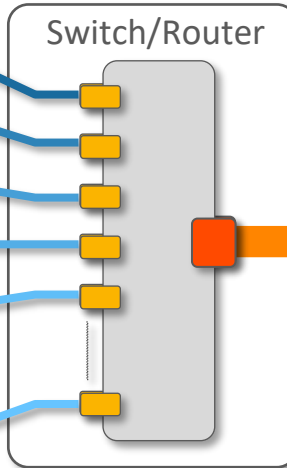


Various access technologies

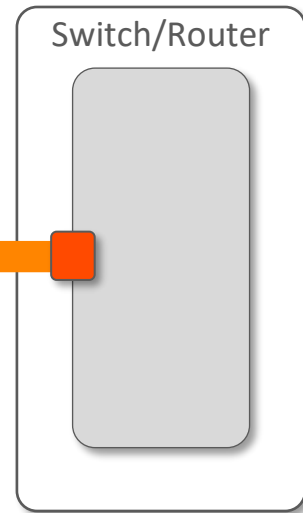
OPTICAL EDGE



ELECTRICAL AGGREGATION



HUB



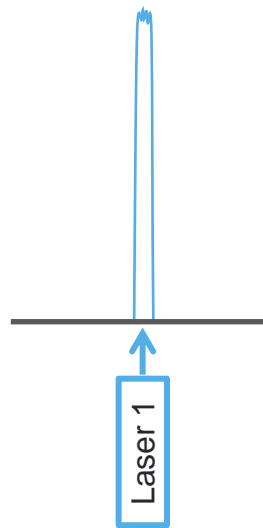
All these optical links are P2P, but the traffic isn't

# Why can't we just plug them into each other?

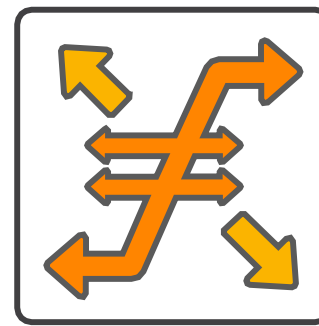
Also...this would be **framed** as 25 GbE



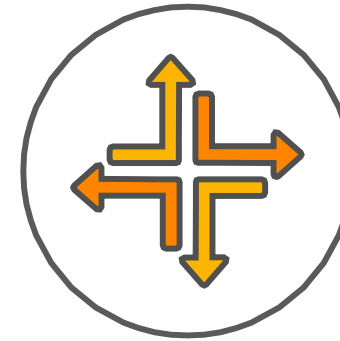
This is what a 25 Gb/s carrier would look like...



So you would need a **switch/router** for the data rate translation



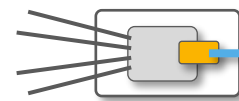
or



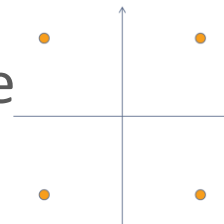
And this would be **framed** as 400 GbE



...and this is a 400 Gb/s carrier



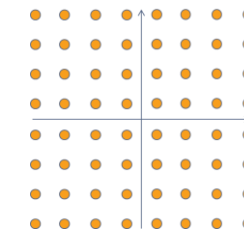
...it may use different modulations



QPSK



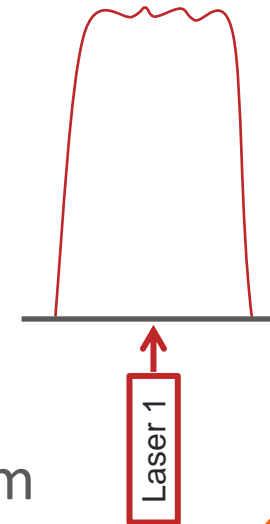
...



64QAM



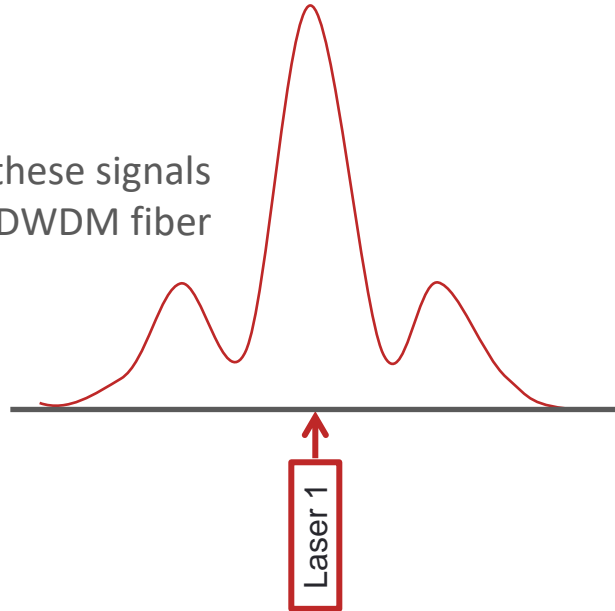
...it's spectrum may be wider



# I need to tell you about subcarriers...

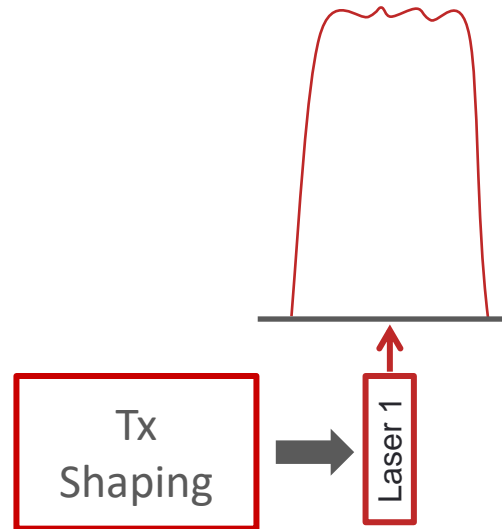
The output from a single laser is called a *carrier*

Lots of these signals on a DWDM fiber



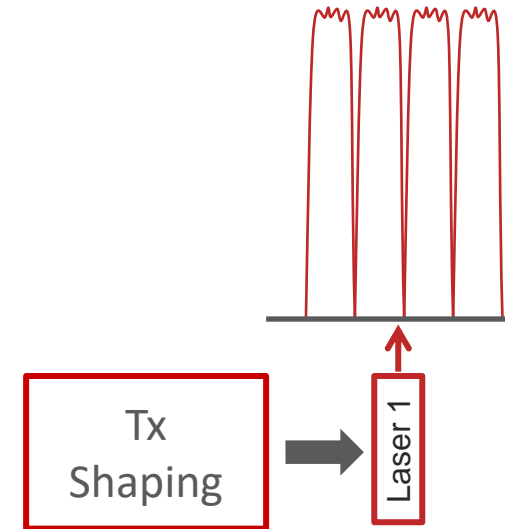
1<sup>st</sup> Gen Coherent  
Circa 2010

Signal narrower –  
pack more on a fiber



2<sup>nd</sup> Gen Coherent  
Circa 2014  
(Nyquist Shaping)

Same width, but  
better performance

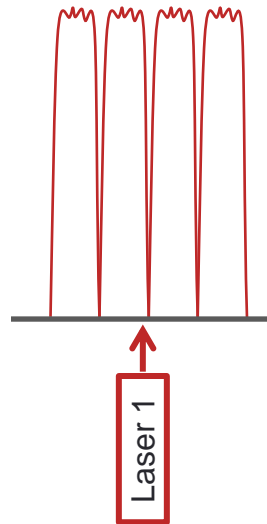


2<sup>nd</sup> Gen Coherent  
Circa 2016  
(Nyquist Subcarriers)

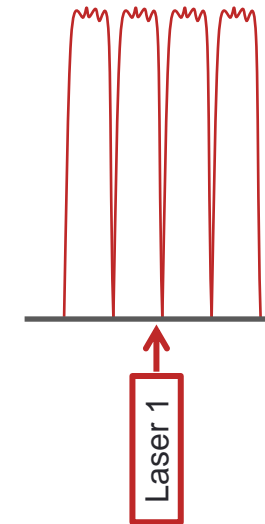


# Subcarriers for long haul networks

Same width, but  
better performance



All of the subcarriers within one wavelength travel  
between the same two endpoints – even in a  
network with ROADMs (optical switches)

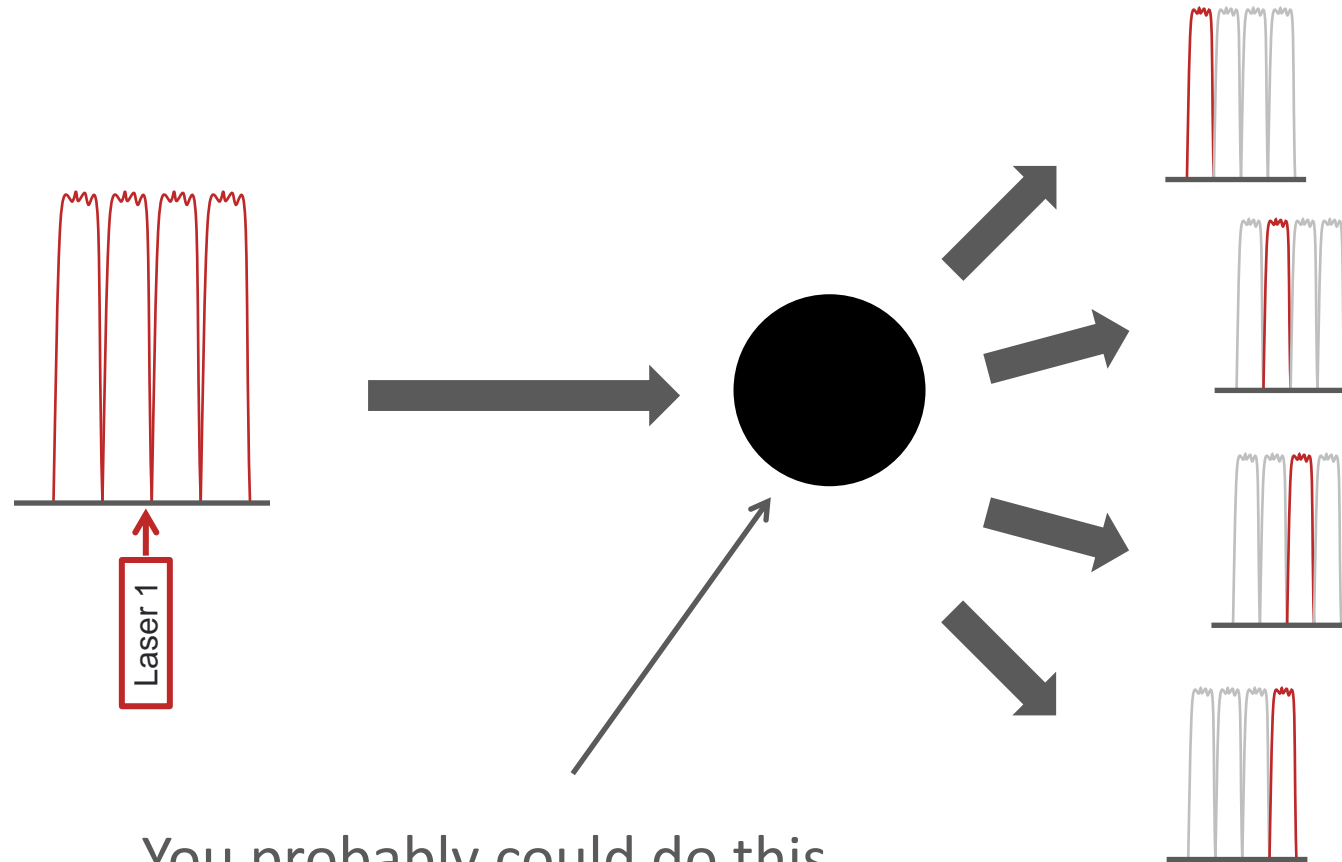


2<sup>nd</sup> Gen Coherent  
Circa 2016  
(Nyquist Subcarriers)

## They are Point to Point\*

\*Which is perfect for long haul and submarine networks

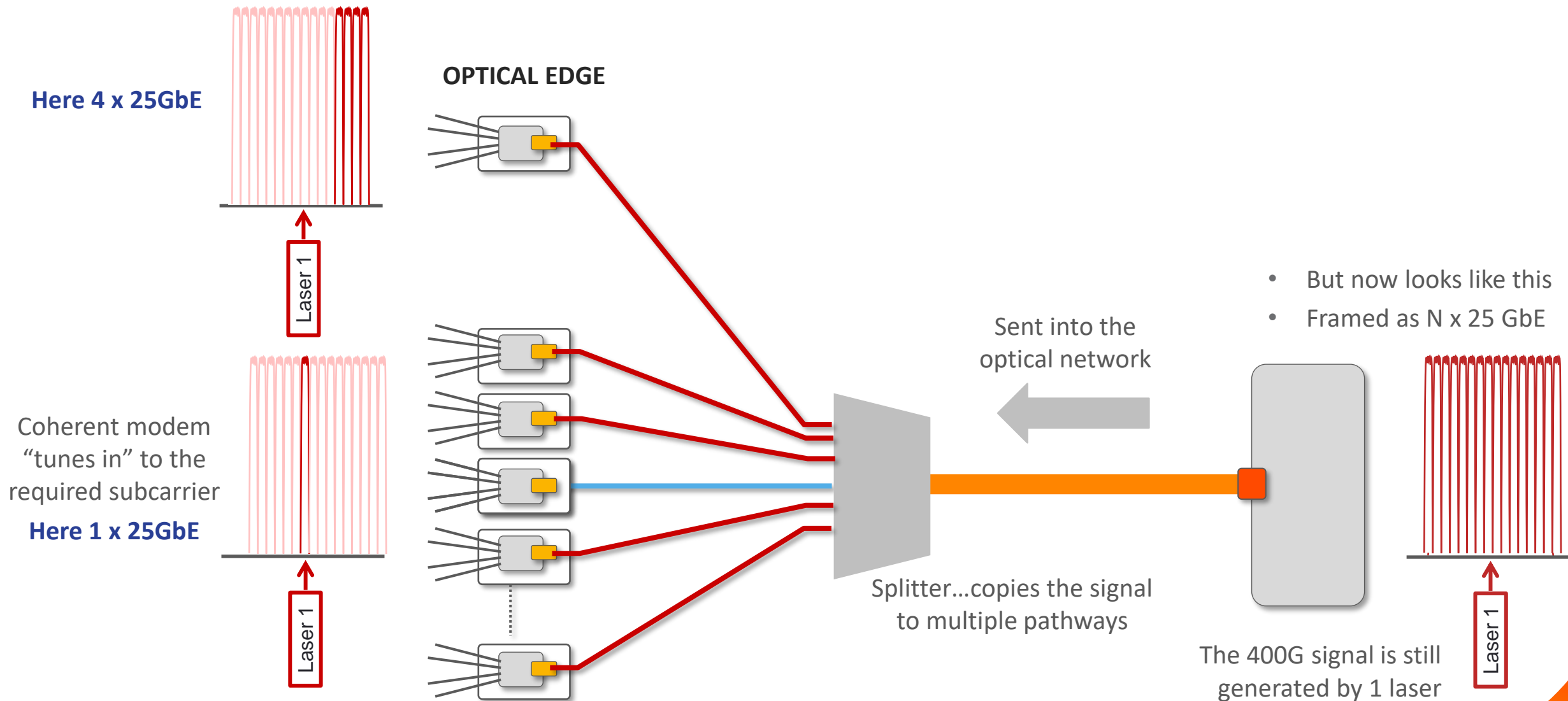
# What if you could send the subcarriers to different places?



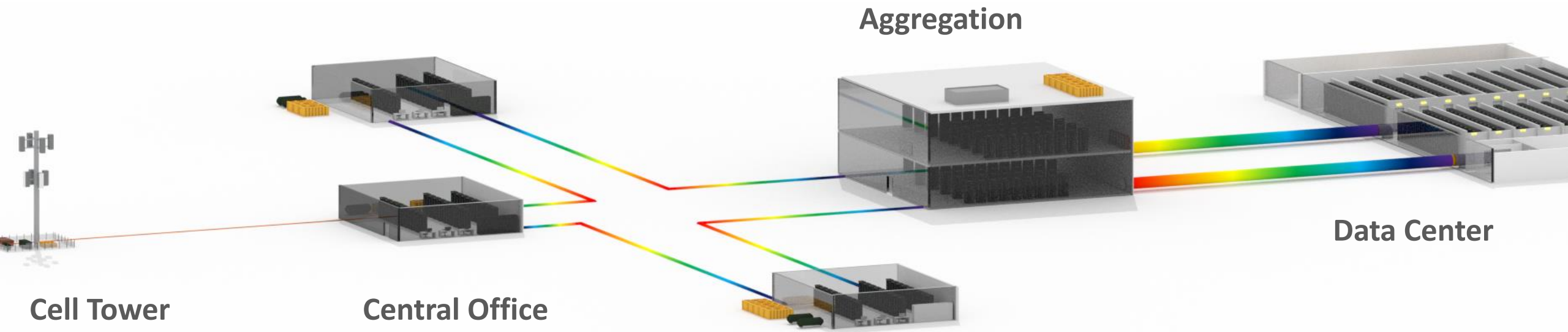
You probably could do this subcarrier separation, but it would be expensive

What could you use this for?

# How We Might Use Subcarriers



# The Vision: From the Tower to the Data Center



# Public Customer Activity - BT



## CAPEX Savings Enabled by Point-to-Multipoint Coherent Pluggable Optics Using Digital Subcarrier Multiplexing in Metro Aggregation Networks

Johan Bäck<sup>(1)</sup>, Paul Wright<sup>(2)</sup>, John Ambrose<sup>(3)</sup>, Aaron Chase<sup>(4)</sup>, Matt Jary<sup>(4)</sup>, Fady Masoud<sup>(5)</sup>, Neil Sugden<sup>(3)</sup>, Gordon Wardrop<sup>(3)</sup>, Antonio Napoli<sup>(6)</sup>, João Pedro<sup>(7)</sup>, Md Asif Iqbal<sup>(2)</sup>, Andrew Lord<sup>(2)</sup>, David Welch<sup>(4)</sup>

(1) Infinera Corp., Sweden (e-mail [jbaeck@infinera.com](mailto:jbaeck@infinera.com)); (2) British Telecom, UK; (3) Infinera Corp., UK; (4) Infinera Corp., United States; (4) Infinera Corp., Germany; (5) Infinera Corp., Canada; (7) Infinera Unipessoal Lda, Portugal

### Modeled 1500+ node / locations

- 74% CAPEX savings when using XR P2MP
- Additional modeling underway
- Did not include potential OPEX savings
  - Reduced space / power costs
  - Reduced Truck Rolls
  - Simplified operations activity

### Lab Trial

- Three span link with total of 55 km reach demonstrated
- Filter-less line system demonstrated
- XR demonstrated over Nokia XGS PON system

### Joint Technical Paper at ECOC 2020

- An Infinera-BT technical paper was presented at ECOC 2020

**LIGHTWAVE** SUBSCRIBE VIDEO  
NETWORK DESIGN FTTX NETWORK AUTOMATION

SUMITOMO ELECTRIC LIGHTWAVE **Q102-M12 Ribbon Fiber Fusion Splicer**  
The Industry's Only Ribbon Splicer with Dual Independent Ovens [LEARN MORE](#)

100G TRANSCEIVERS  
END POINT 1  
END POINT 2  
END POINT 3  
...  
END POINT 15  
END POINT 16

400G TRANSCEIVER  
Splitter/Combiner  
400G  
16 x 25G Subcarriers  
HUB

Transmission  
**BT models, lab trials Infinera's XR optics**  
As the two companies will describe in a paper to be delivered during ECOC 2021, the modelling indicates the use of XR optics in a metro scenario could produce a greater than 70% savings in capex over a five-year period.  
Stephen Hardy Oct 28th, 2020

High-Speed Networks  
**Telstra sets sights on Canada**  
Stephen Hardy Oct 27th, 2020

High-Speed Networks  
**ESnet chooses Infinera for ESnet6 scientific network build**  
Stephen Hardy Oct 27th, 2020

High-Speed Networks  
**Horizon building fiber-optic network in Dayton**  
Stephen Hardy

Transmission  
**Acacia Communication: demo 400ZR interoperability with DSPs**  
Stephen Hardy



# XR Optics Ecosystem

## Press Releases

February 18, 2020, 8:00 a.m. ET

### Infinera and Lumentum Collaborate to Bring XR Optics-based Networking Solutions to Market



<https://www.infinera.com/wp-content/uploads/pr20200218-Infinera-and-Lumentum-Collaborate-to-Bring-XR-Optics-based-Networking-Solutions-to-Market.pdf>

*“The XR optics concept aligns with our core strategy to provide scalable and flexible coherent optical network solutions that enable higher speeds for next-generation transport networks.”*

### Infinera and II-VI Collaborate to Bring XR Optics-based Networking Solutions to Market

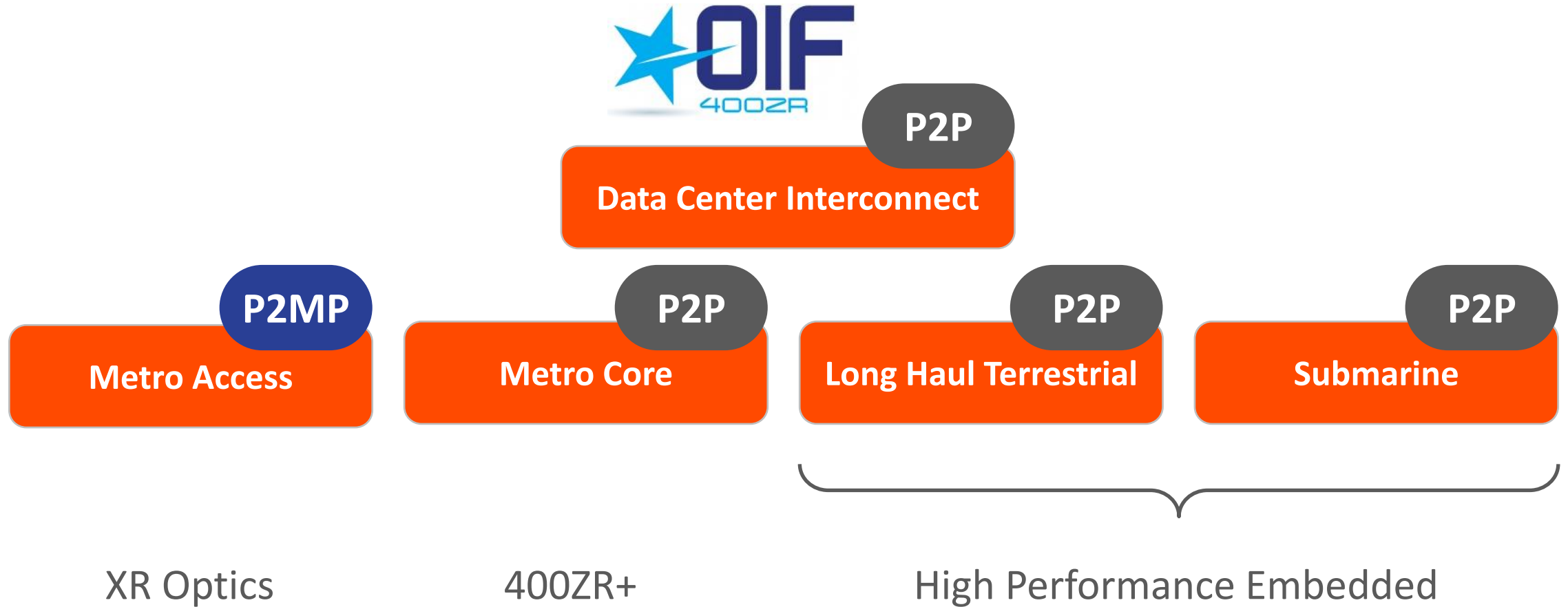


<https://www.infinera.com/wp-content/uploads/pr20200218-Infinera-and-II-VI-Collaborate-to-Bring-XR-Optics-Based-Networking-Solutions-to-Market.pdf>

*“This collaboration will enable us to jointly deliver digital coherent optics in small pluggable form-factors and with low power consumption.”*



# The Coherent Landscape



Thank you!

Q&A

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