Emerging Technologies- Next Gen Architecture

SCTE Seminar

Britton Bowman & Leigh Wade

September 2019

Passive Digital Return Transport Design

‣ Home-run WDM colored optics from node to digital return receiver

‣ Wavelength contention from multiple nodes to single access link

- Complex channel and node planning
- Limited available WDM channels (Optimal 40 channels max)

‣ Fiber constrained with limited optical reach budget

‣ Poor visibility of optical layer and service performance

*Passive DWDM filters used to MUX/DMUX the digital return wavelengths onto a single return transport fiber*
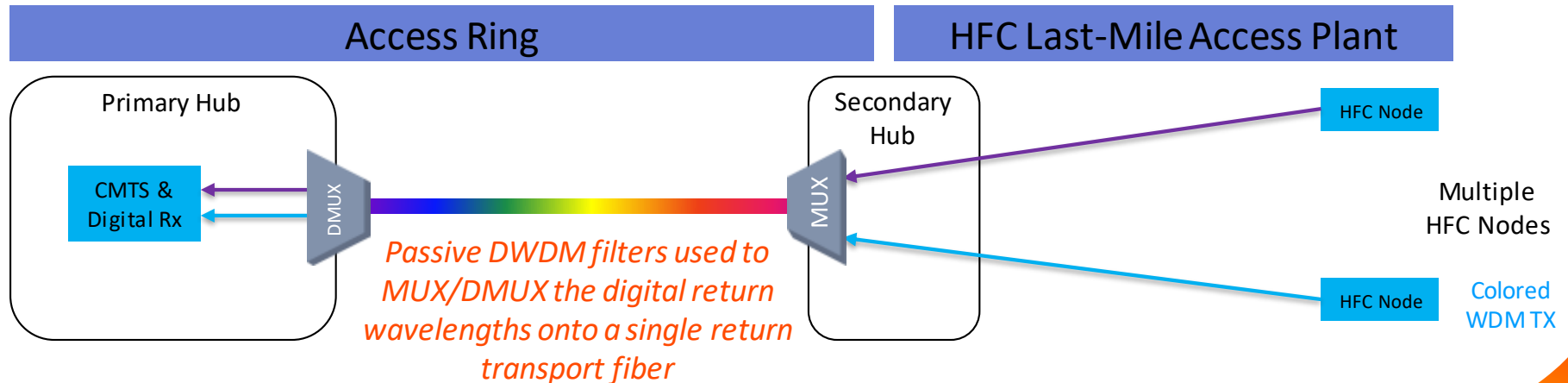
Node Splitting Transport Solution: *Digital Return*

- Clear demarcation for Digital return

- 80 channel path redundant DWDM solution for extended reach (~80 km)

- Unique transponder solution for proprietary signals

- Full network management support for uni-directional services
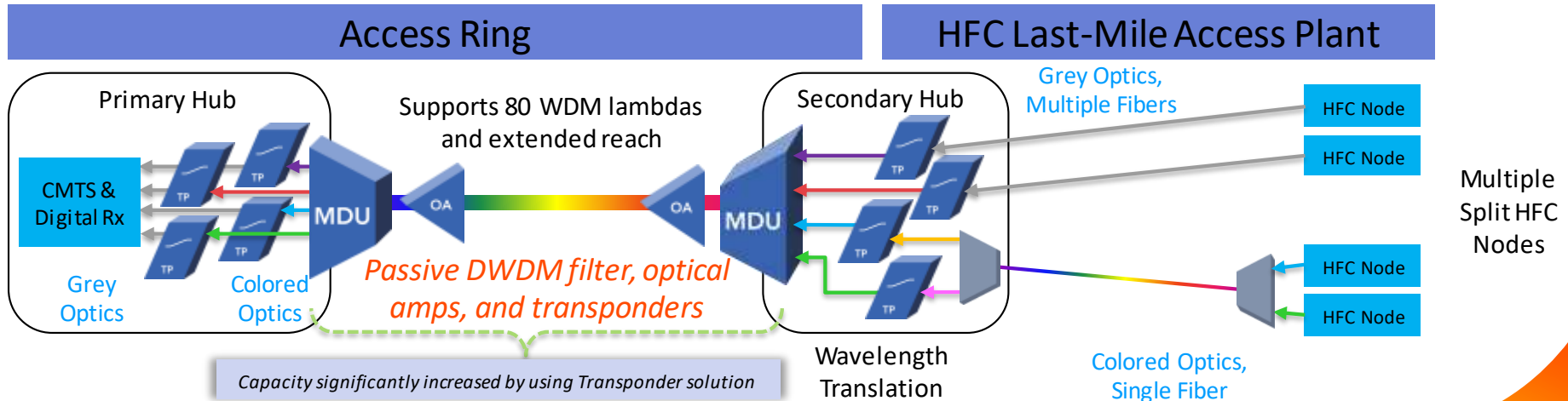
Reduces Fiber Construction

Infinera's node splitting transponder solution for digital return

Return traffic bandwidth doubles with each node split.
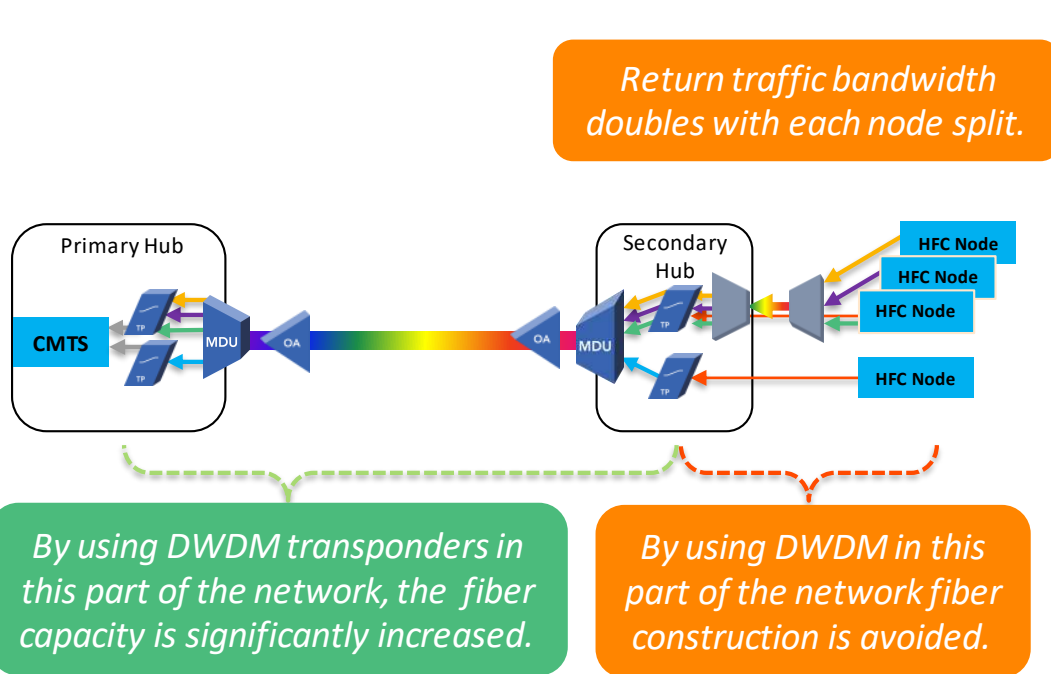
Benefits
- Improves network economics
- Reduces fiber construction throughout the network
- Re-uses scarce fiber resources

Primary Hub

CMTS
MDU
OA

TP

Secondary Hub

OA
MDU

TP

HFC Node
HFC Node
HFC Node
HFC Node

By using DWDM transponders in this part of the network, the fiber capacity is significantly increased.

By using DWDM in this part of the network fiber construction is avoided.

Improves Network Manageability

Infinera's node splitting transponder solution for digital return

Transponders give visibility to optical performance data for each individual digital node return. Performs 3R regeneration of digital signal for improved signal quality.
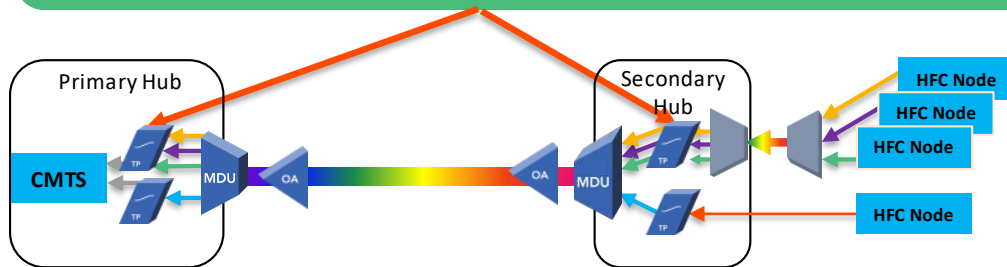
All access nodes use a common architecture with a non-wavelength specific "cookie cutter" design.
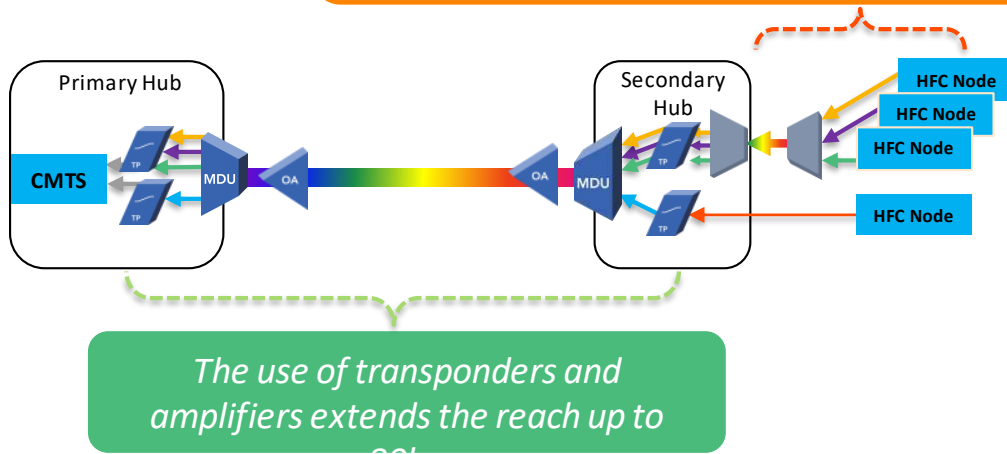
Benefits

- Simplified wavelength planning due to common architecture across nodes

- Performance monitoring data for each individual digital node return

- Easier troubleshooting

Improves Optical Performance

Infinera's node splitting transponder solution for digital return

Optical power budget now only needed between HFC node and Secondary Hub, *and not all the way to the Primary Hub.*

The use of transponders and amplifiers extends the reach up to

Benefits

- Extends reach and enables deep fiber access initiatives
- Enables simplified, flexible wavelength planning

The XTM Toolbox

Each NE can be customized & optimized to meet exact capacity demands.

- Three chassis size options. 300mm

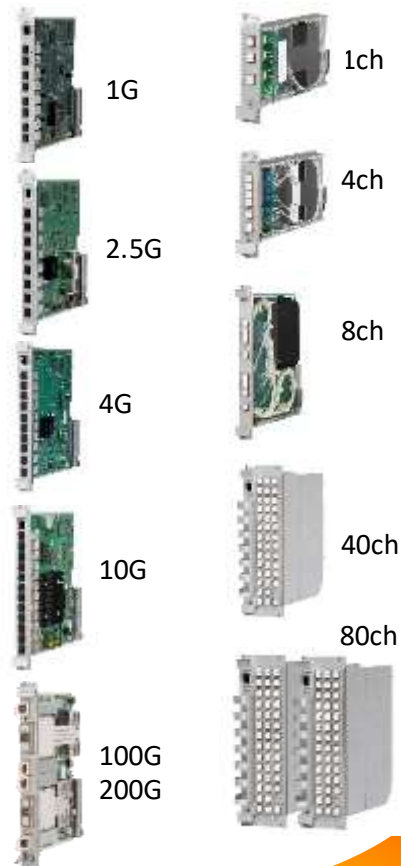- Line rates from 1G up to 200G.

- Optical filters from 1-80channels

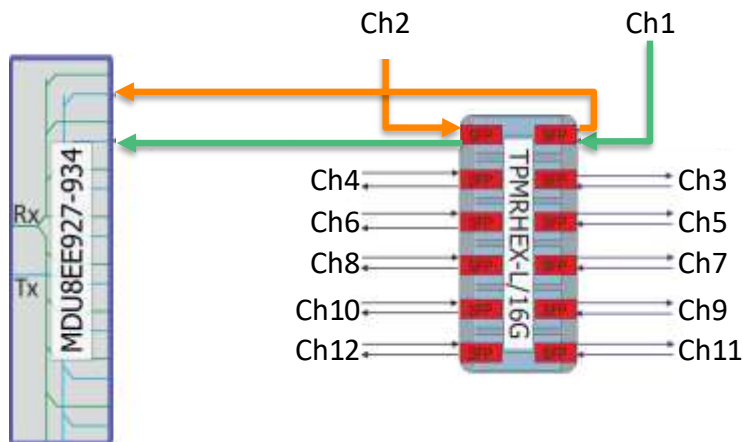TM-102/II (1U)
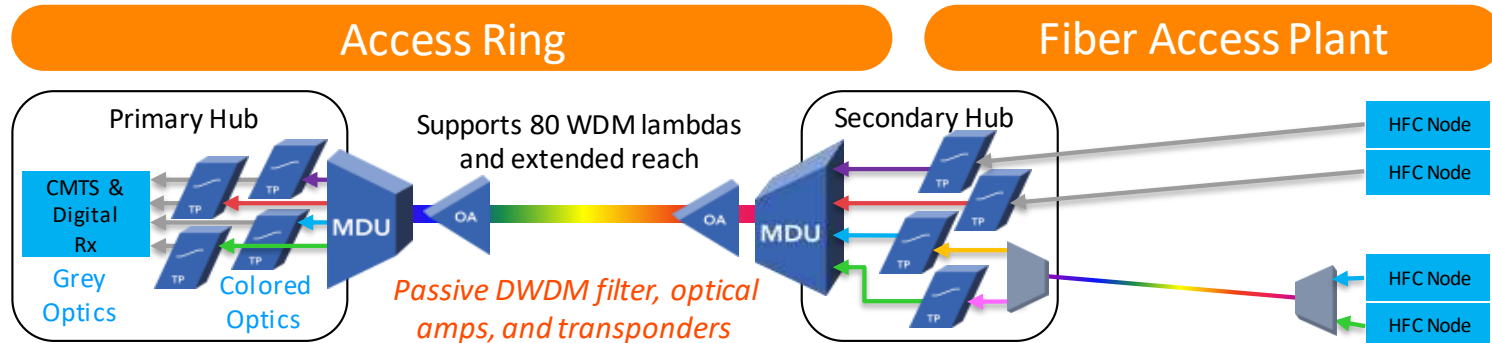<90W
Up to 400G/chassis

TM-301/II (3U)
Up to 4 full-sized
Up to 4 half-sized
<500W nominal
600W worst case
Up to 1.6T /chassis

TM-3000/II (11U)
Up to 16 full-sized
Up to 10 half-sized
< 900W nominal
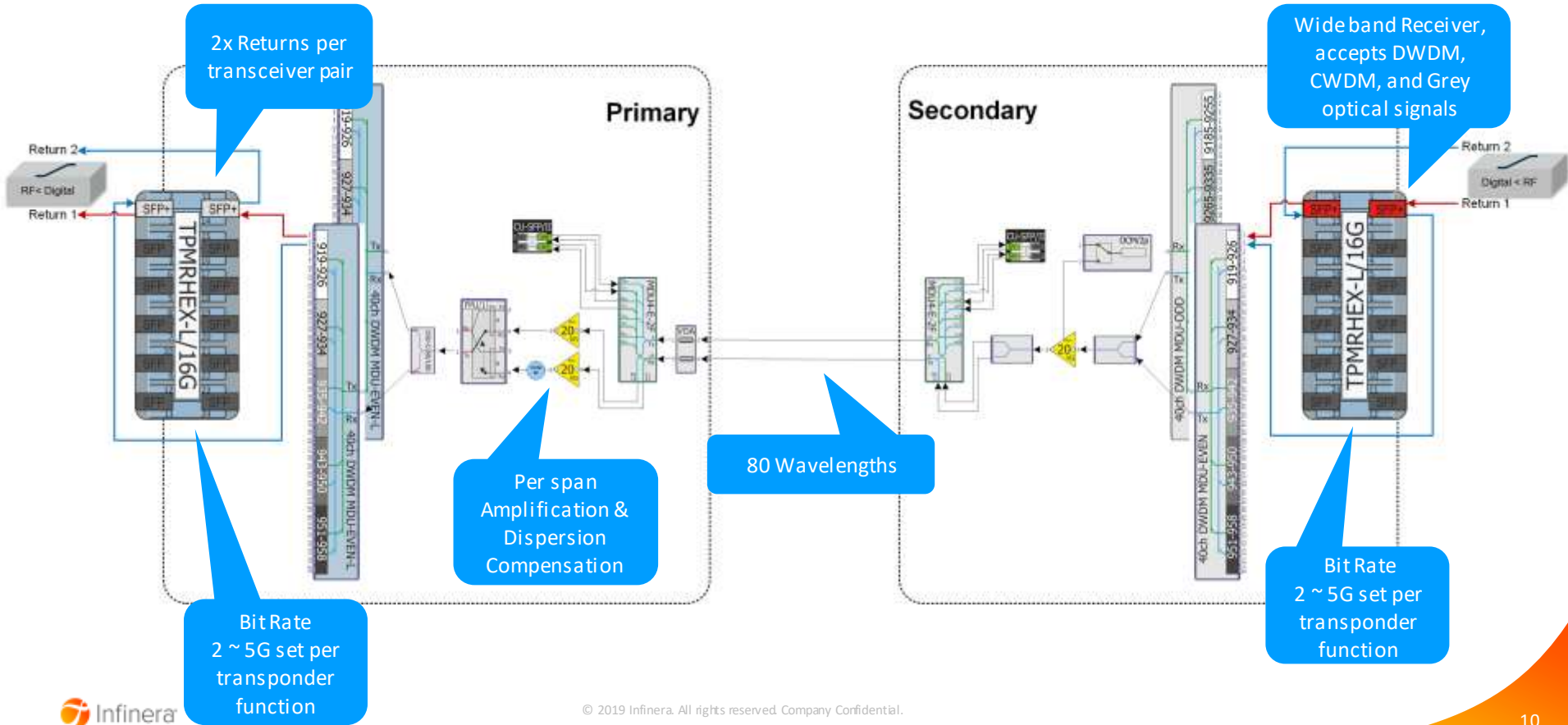1kW worst case
Up to 4T /chassis

1G

2.5G

4G

10G

100G
200G

1ch

4ch

8ch

40ch

80ch

Infinera

Uni-Directional Digital Return – Detailed HEX-L/16G

Access Ring

Fiber Access Plant

Primary Hub

Supports 80 WDM lambdas and extended reach

Secondary Hub

CMTS & Digital Rx

Grey Optics

Colored Optics

Passive DWDM filter, optical amps, and transponders

HFC Node
HFC Node
HFC Node
HFC Node

Ch2   Ch1

Ch4   Ch3
Ch6   Ch5
Ch8   Ch7
Ch10   Ch9
Ch12   Ch11

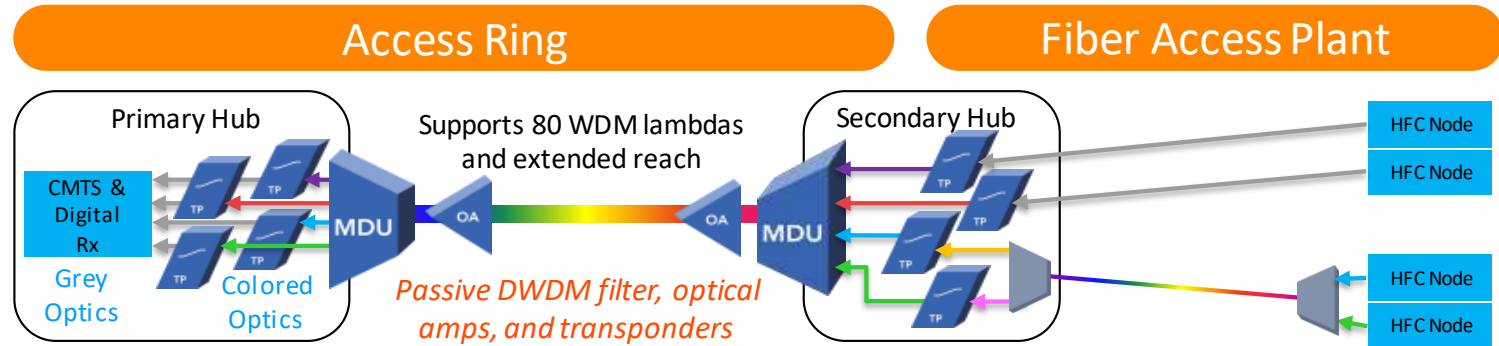MDU8EE927-934
Rx
Tx

TPMRHEX-L/16G

- Typical application is for digital return path in Cable HFC Access Networks.

- Unidirectional mode on TPMRHEX-L/16G enables each Transponder function to be used for 2x unidirectional Transponder functions.

- Enables 12x unidirectional functions per TPMRHEX-L/16G.

Infinera

Unidirectional Digital Return – Detailed HEX-L/16G

Digital Node Return

Access Ring

Fiber Access Plant

Primary Hub

CMTS & Digital Rx

Grey Optics

Colored Optics

MDU

Supports 80 WDM lambdas and extended reach

OA

Passive DWDM filter, optical amps, and transponders

OA

Secondary Hub

MDU

HFC Node

HFC Node

HFC Node

HFC Node

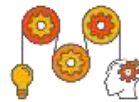**SIMPLIFYING OPERATIONAL PROCESSES AND PROCEDURES**

IMPROVE PERFORMANCE AND AVOID FIBER CONSTRUCTION

Innovative Approach

Easy Deployment
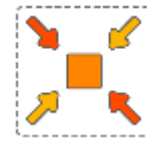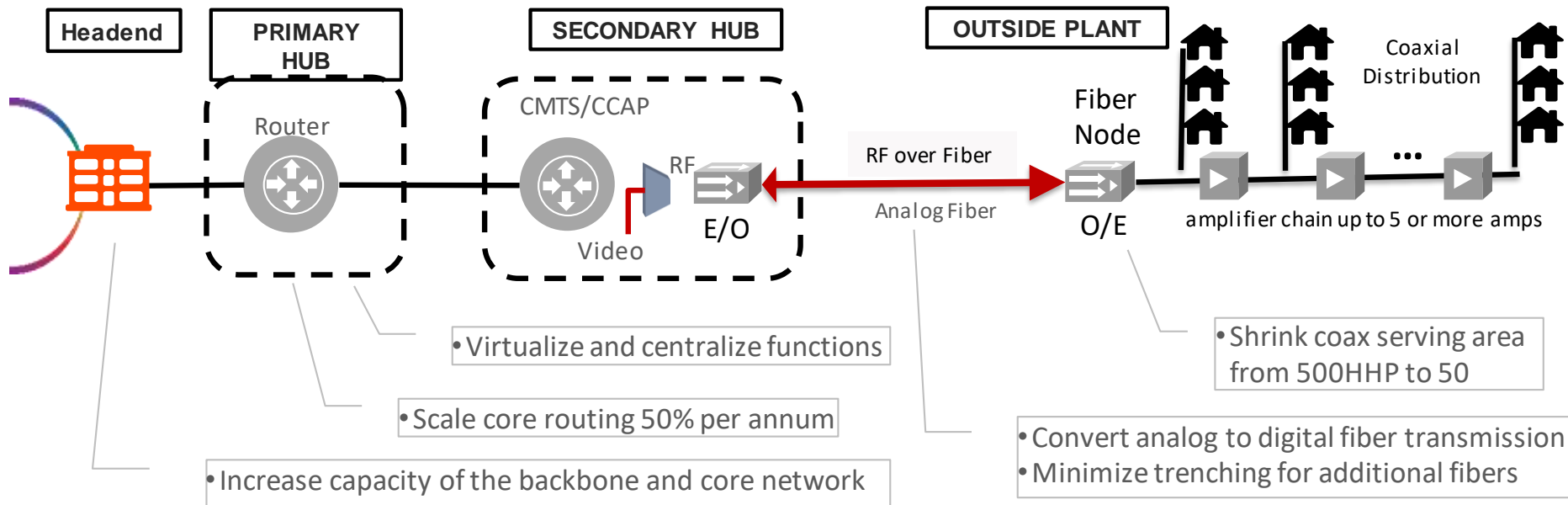
Performance Tools

Business Velocity

Power Efficient

Infinera

Cable/MSO Network Transformational Challenges

Headend

PRIMARY HUB
Router

SECONDARY HUB
CMTS/CCAP
RF
E/O
Video

RF over Fiber
Analog Fiber

OUTSIDE PLANT
Fiber Node
O/E
amplifier chain up to 5 or more amps

Coaxial Distribution

...

- Virtualize and centralize functions
- Scale core routing 50% per annum
- Increase capacity of the backbone and core network

- Shrink coax serving area from 500HHP to 50
- Convert analog to digital fiber transmission
- Minimize trenching for additional fibers

Drive 10G to the home, digitize optical transport, lower CAPEX, automate to reduce OPEX

Infinera

The Infinite Edge for DAA/CIN

Enable new emerging applications

Support dramatically changing traffic patterns & distributed compute

Support cost-effective high bandwidth solutions

ACCESS & AGGREGATION

METRO / REGIONAL

CORE & SUBSEA

Today

Future

INNOVATIVE SOLUTIONS

L0 – L3 w / optical integration

Application-optimized packet

Multi-layer service automation
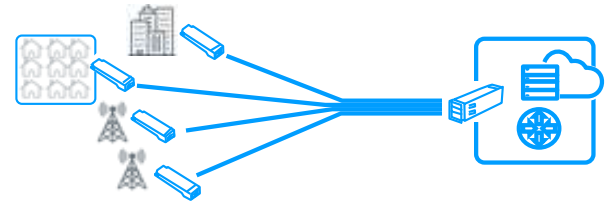
PARADIGM CHANGING PACKET EDGE

Density, synchronization + Industry's only carrier-grade disaggregated router

DIFFERENTIATED AUTOMATION

Self-identifying, self-tuning lasers + multi-layer, application-aware automation

DISRUPTIVE INNOVATION

Pluggable coherent optics

Instant Bandwidth to the edge

Virtualization of lasers

Infinera

The Infinite Edge for DAA/CIN

5G Enable new emerging applications

Support dramatically changing traffic patterns & distributed compute

Support cost-effective high bandwidth solutions

ACCESS · METRO / REGIONAL · CORE & SUBSEA

XTM

Active / Passive / Autotuning Edge Solutions

FAMILY OF APPLICATION OPTIMIZED TRANSPORT SOLUTIONS WITH INDUSTRY-LEADING DENSITY & AUTOMATION

Versatile family of solutions optimized and ideal for **DAA** and **5G** applications
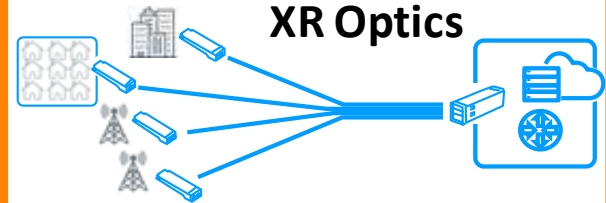
DRX

Disaggregated L3/L2 Router Solution

CNOS

GAME CHANGING OPENNESS, FLEXIBILITY, & SCALABILITY

440

90

30

BREAK VENDOR LOCK-IN

DRIVE DOWN COSTS

INCREASE FLEXIBILITY

XR Optics

DISRUPTIVE INNOVATION

Pluggable coherent optics

Instant Bandwidth to the edge

Virtualization of lasers

Infinera

The Infinite Edge: XTM/XTG

Active

- Supports Layer 0/1/2/2.5
- Fixed and/or flexible networking
- Multi-rate, "anything" up to 100G clients
- Multi-service, e.g. Ethernet, CPRI, SONET/SDH, OTN, Fibre Channel
- Multi-reach, up to 1500 km
- Low Power Design
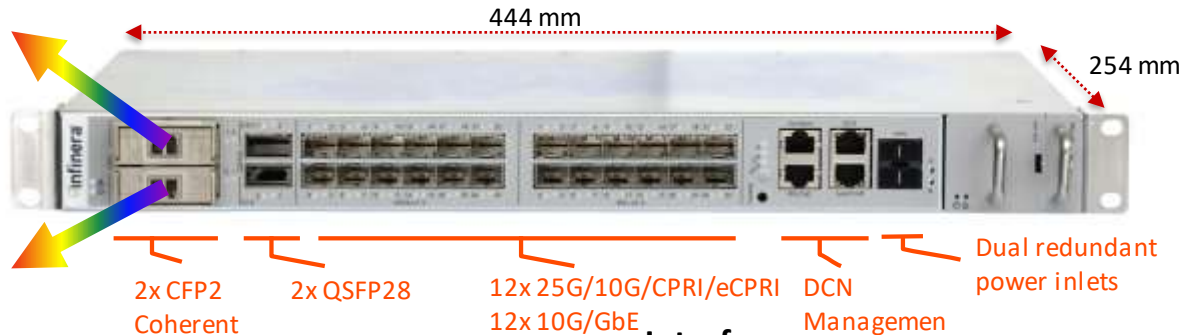- High Density Design
- CWDM and/or DWDM

Passive

- Passive CWDM, DWDM and WDM-PON
- High density for small footprint
- Flexible upgrades with passive filters
- Broad temperature range

Autotuneable

- Autotuneable DWDM pluggables
- 10G DWDM
- 25G DWDM and beyond…
- Enable DWDM on grey optic ports

Infinera

The Infinite Edge: High Density 10G/25G RPD Aggregation

444 mm

254 mm

2x CFP2 Coherent

2x QSFP28

12x 25G/10G/CPRI/eCPRI
12x 10G/GbE

DCN Management

Dual redundant power inlets

800G L2 Switch

Fronthaul

- Ultra low power and latency
- TSN support
- CPRI support
- eCPRI support

Power
200W / max (2.5W/10G) including DWDM optics
Redundant power feeds
Redundant fans and replaceable air filter

Dimensions
1RU (H) x 17.4" (W) x 10.0" (D)
Fits into an ETSI 300, 19" or 23" ANSI rack

Environmental
Environmentally Harden: -40 to 65 degrees Celsius
General NEBS level 3 compliance
Right-to-left airflow

Interfaces
2 x 100GE QSFP28
2 x 100G/200G CFP2 (coherent)
12x 25G/10G/CPRI/eCPRI SFP+
12x 10G/GbE SFP+/SFP
Optics hot swappable
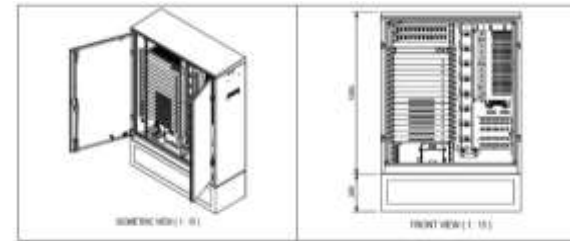Support for CPRI option 3 to 10
PPS/ToD interface

Management
Local Access (RS232, Local Craft)
Redundant DCN
NETCONF, OpenConfig

Outdoor cabinet option:
Environmentally Hardened
-40 to 65 degrees Celsius
1RU (H) x 17.4" (W) x 10.0" (D)
Fits ETSI 300, 19" or 23" ANSI
Max Power 200W

Layer 2 for outside plant or secondary hub RPD Aggregation

The Infinite Edge: Disaggregated Routing

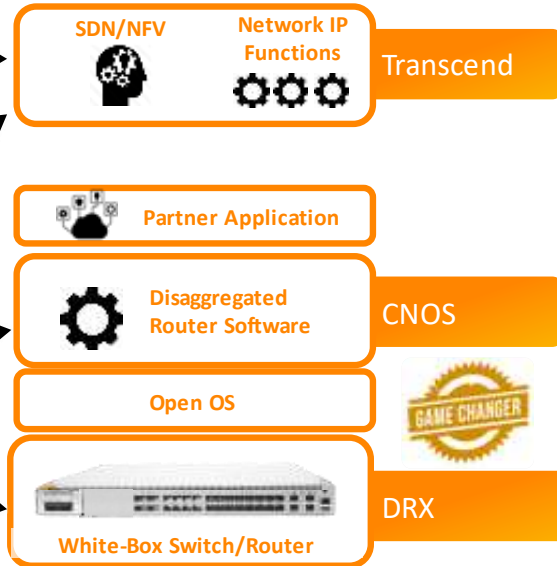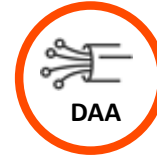## TRADITIONAL APPROACH

Single Vendor Fully Loaded NMS

NMS

Software

VENDOR LOCK-IN
Custom Hardware
Embedded Software

DISAGGREGATED APPROACH

SDN/NFV   **Network IP Functions**

Transcend

Partner Application

Disaggregated Router Software

CNOS

Open OS

GAME CHANGER

White-Box Switch/Router

DRX

OPEN ECOSYSTEM
Best in Class Platform

KEY APPLICATIONS

DAA

5G

KEY BENEFITS

More choice

Modular scalability and cost

Increased network velocity

Lower CAPEX and OPEX

Support application hosting

Infinera

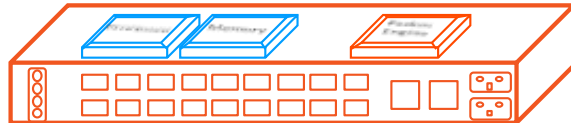# Infinite Edge: Disaggregated Routing Building Blocks

INFINERA DRX SERIES

Infinera CNOS
Open Portable IP
Software Stack

Network Applications

Open Network Linux
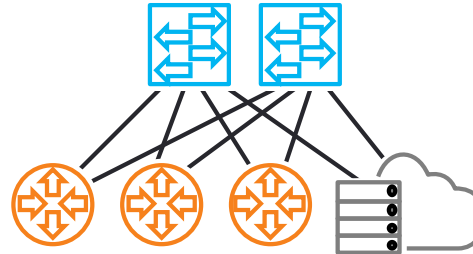
OS

Infinera DRX Series

OPEN ECOSYSTEM
- Break vendor lock-in
- Drive down cost
- Increase flexibility
- Accelerate Innovation

SEAMLESS SCALABILITY
- Unique stacking capability
- Horizontally Scalable Router
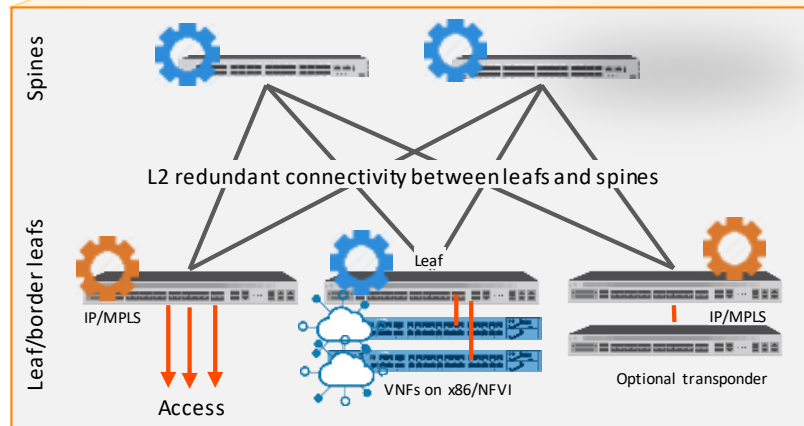- Spine & Leaf POD
- Compute integration

INFINERA DRX SERIES

DRX-30

DRX-90

DRX-400 / DRX-440

DRX-960 / DRX-1920

Infinera

Infinite Core: NFV POD and Horizontally Scalable Router

NFV POD

CNOS/DRX, L2 Spine & VNFs

vPOD Manager

Transcend HSR view and CNOS router behavior

NFV POD diagram

Spines

Leaf/border leafs

L2 redundant connectivity between leafs and spines

Leaf

IP/MPLS

IP/MPLS

VNFs on x86/NFVI

Optional transponder

Access

Horizontally Scalable Router diagram

Spines

Switch cards

Switch cards

CNOS

Virtual backplane connections

Leaf elements

Line cards

Horizontally Scalable Router (HSR)
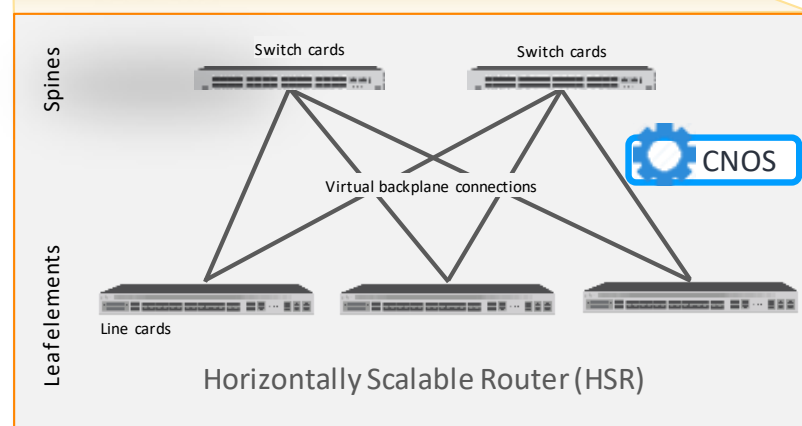
Utilize CNOS, DRX, Transcend and 3rd party ecosystem to build NFV POD and multi-terabit router

Infinera

Infinite Core: DRX Horizontally Scalable Router

- DRX-400/440 + DRX-960 Switch Matrix (up to 230.4Tbps)

Logical DRX-960 Matrix

Logical DRX-4xx Mesh

Up to 24x DRX-4xx (Total)

X #1

X #2

X #12

Up to 12x DRX-960

960 #1

n x 400G

n x 400G

DRX-960 Switch Matrix

Logical Mesh

Up to 24x DRX-4xx (Total)

X #13

X #14

X #24

n x 400G

n x 400G
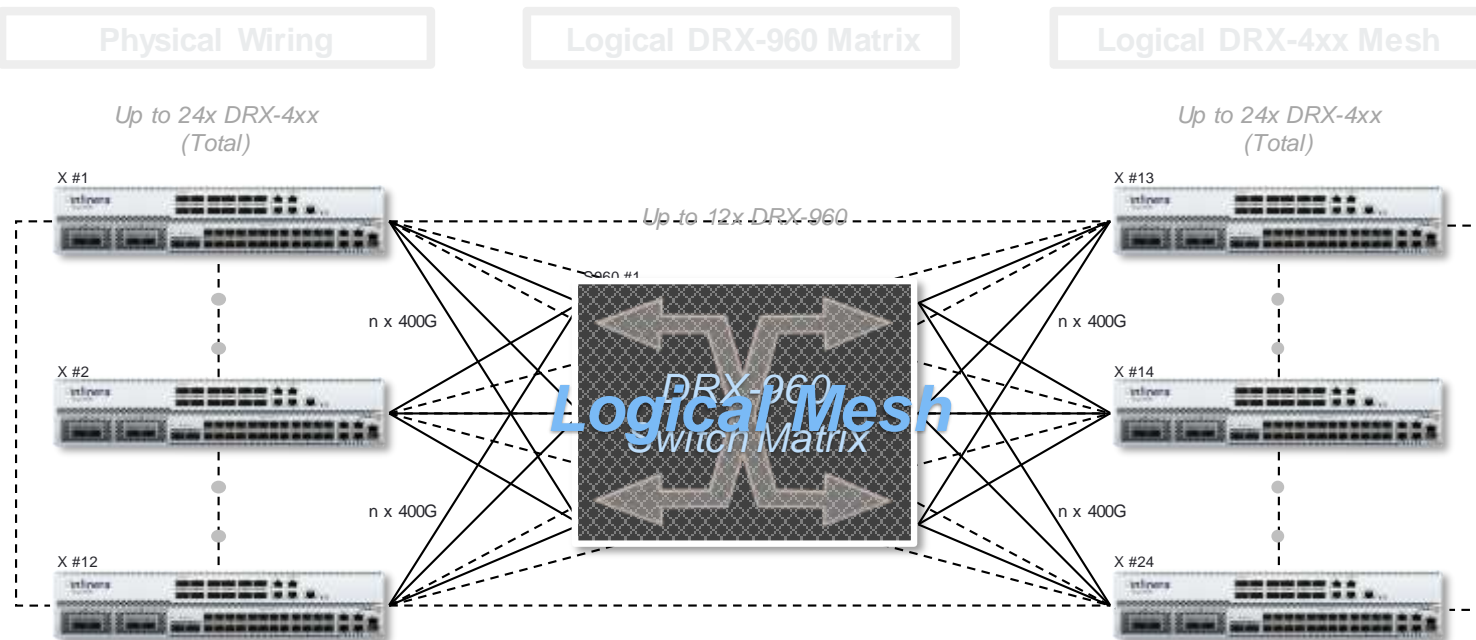
Note: 1920 supports 48 x DRX-400/440 (up to 230.4Tbps)

Node stacking on steroids with the DRX-960/1920 as switch matrix

Infinera

Intelligent Automation

New Easily Implementable Operational Model

FASTER **EASIER** **MORE EFFICIENT** **MULTI-LAYER** **APPLICATION AWARE**

ACCESS & AGG
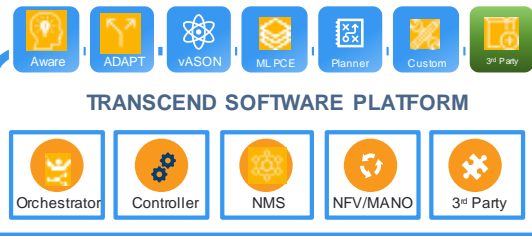
METRO / REGIONAL

CORE & SUBSEA

Now

Simplified Approach to Network Automation
Differentiated discrete "App" approach enables easy access to advanced network functions

Use resources more efficiently with multi-layer (0-3) visualization & automation and deep optical layer awareness
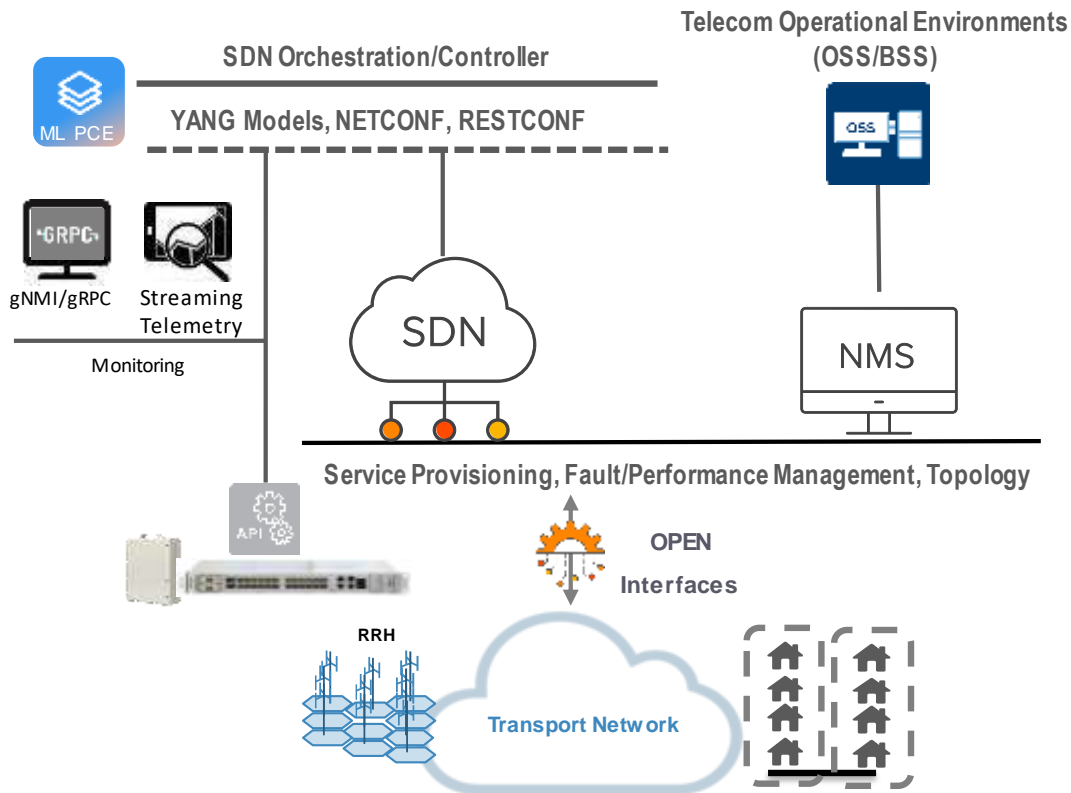
Aware ADAPT vASON ML PCE Planner Custom 3rd Party

TRANSCEND SOFTWARE PLATFORM

Orchestrator Controller NMS NFV/MANO 3rd Party

Future

Self-optimize across layers, domains & vendors
APPs everywhere
Microservices & DevOps

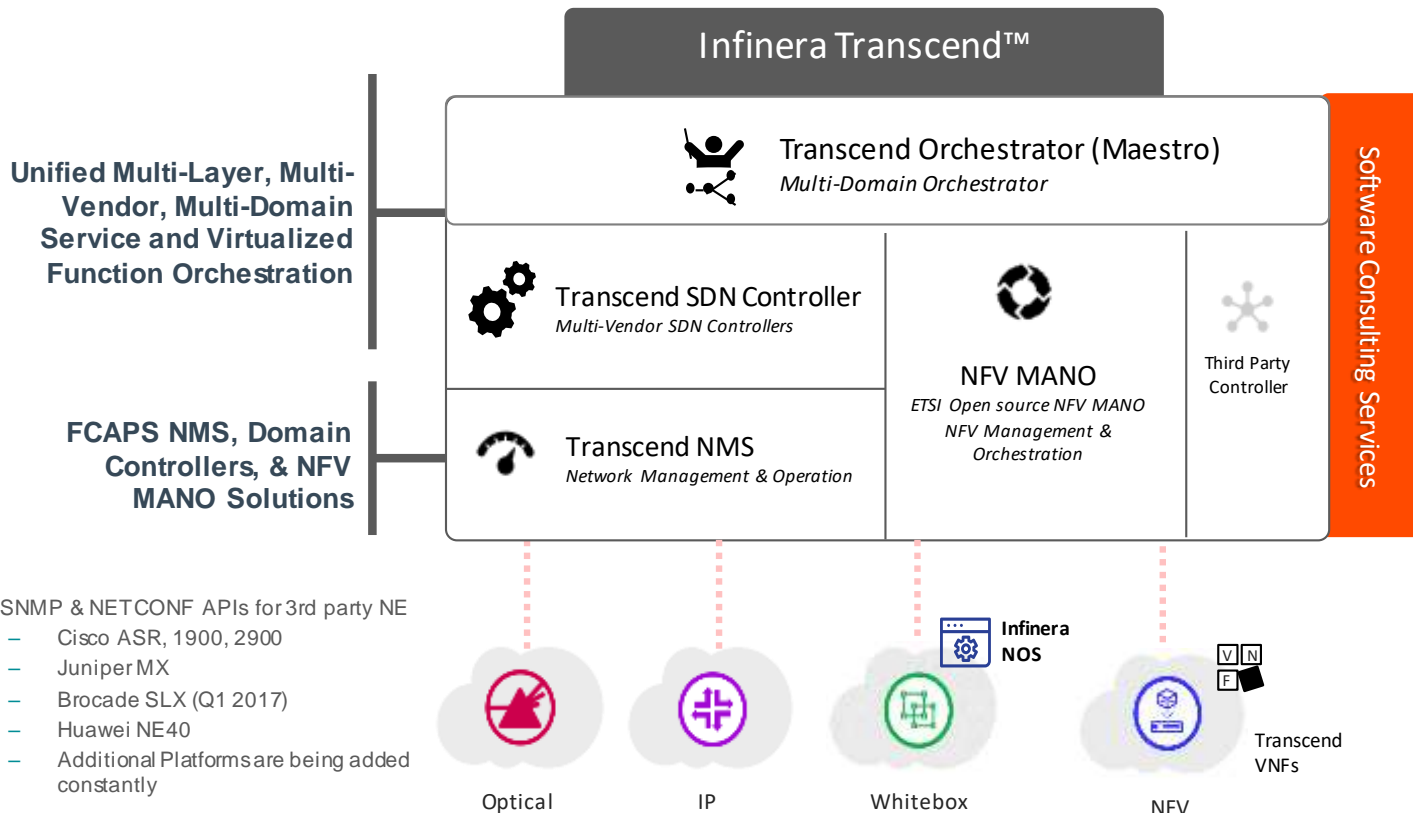Self-Forming Networks
Predictive Insights
Real Time Planning

Prescriptive Actions
Power of ML/AI/Data
Self healing Networks
Intent Driven

Infinera

Intelligent Automation with Transcend Software Suite

SDN Orchestration/Controller

YANG Models, NETCONF, RESTCONF

ML PCE

gNMI/gRPC   Streaming Telemetry

Monitoring

SDN

Telecom Operational Environments (OSS/BSS)

NMS

Service Provisioning, Fault/Performance Management, Topology

OPEN Interfaces

RRH

Transport Network

- Transcend Software Suite:
  - Orchestrator
  - SDN Controller
  - NMS (TNMS)

- Designed for software automation
  - Open, modular, extensible: multi-NBI
  - YANG models, RESTCONF, NETCONF and OpenConfig
  - Windows or Linux Operating Systems
    » Support for software virtualization
  - Applications that can be supported include: ML-PCE, ADAPT, vASON, Aware, Planner

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Infinera Transcend Software Suite

Infinera Transcend™

Transcend Orchestrator (Maestro)
Multi-Domain Orchestrator

Unified Multi-Layer, Multi-Vendor, Multi-Domain Service and Virtualized Function Orchestration

Transcend SDN Controller
Multi-Vendor SDN Controllers

NFV MANO
ETSI Open source NFV MANO
NFV Management & Orchestration

Third Party Controller

FCAPS NMS, Domain Controllers, & NFV MANO Solutions

Transcend NMS
Network Management & Operation

Software Consulting Services

SNMP & NETCONF APIs for 3rd party NE
- Cisco ASR, 1900, 2900
- Juniper MX
- Brocade SLX (Q1 2017)
- Huawei NE40
- Additional Platforms are being added constantly

Infinera NOS

Optical

IP

Whitebox

NFV

Transcend VNFs

TRANSCEND Orchestrator

Multi-layer & multi-domain path computation element (PCE)

- Multi-layer network management & control
- IP-MPLS/Packet-Optical integration
- Multi-domain controller management

Integrates multiple south-bound controllers through REST APIs

Integrated Multi-layer visualization and management tools

Infinera

# Maestro – Key Capabilities

Network Visualization

Multi-Vendor, Multi-Domain, Multi-Layer discovery and visualization
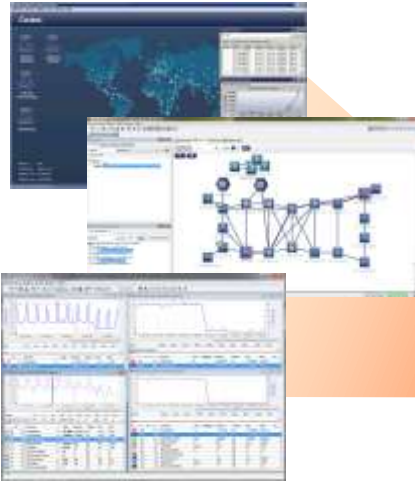
Service Automation

Multi-Domain, Multi-Vendor service provisioning and resilience

Multi-Layer service provisioning and resilience with **Infinera vASON**

SRLG-aware routing and router Bypass

Optical performance awareness with **Infinera Aware**

Dynamic Optimization

Multi-Domain & Multi-Layer restoration

Self-Optimizing networks (e.g. Latency-sensitive services)

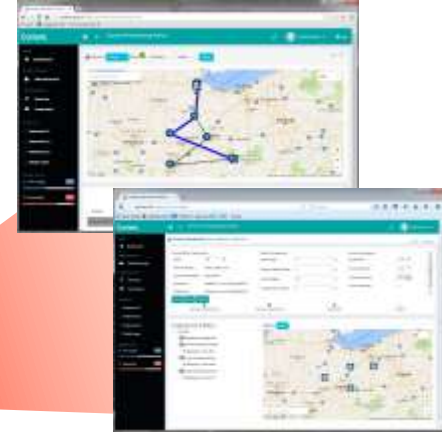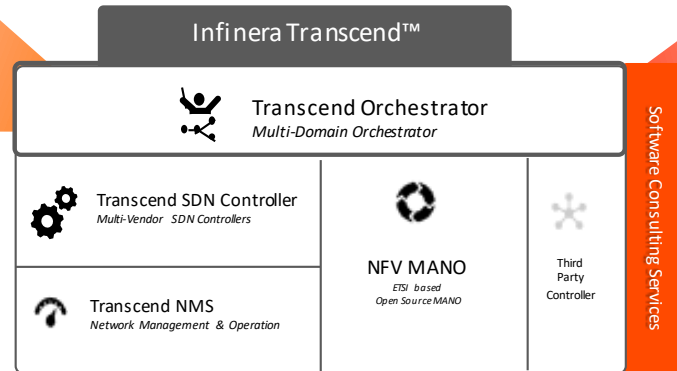**Infinera ADAPT** rule engine (event based action triggering)

Infinera
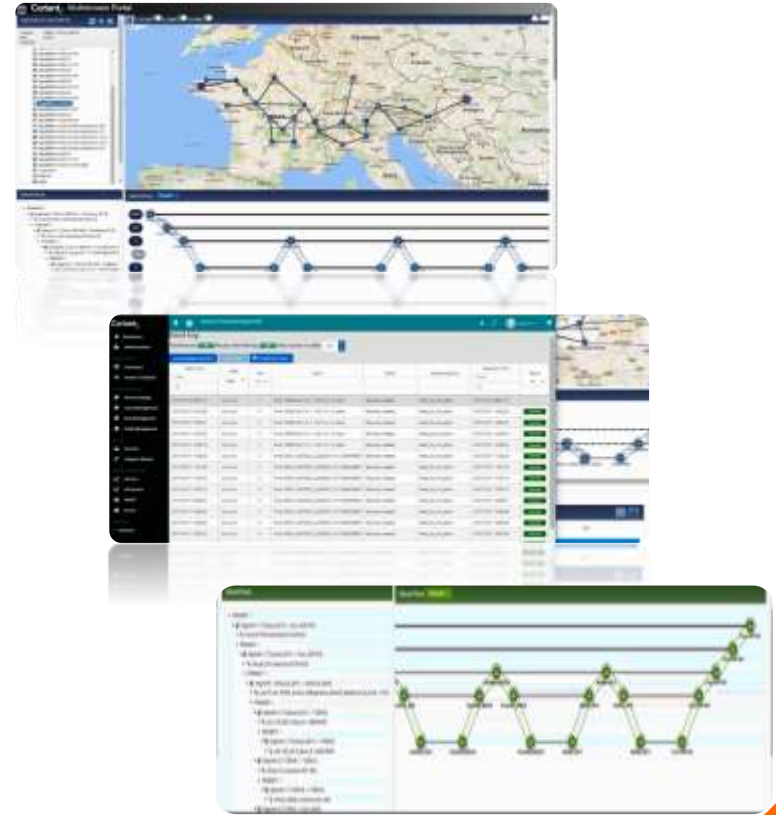
Transcend User Interfaces

All GUIs are automatically fully in sync
Same multi-user support as in Symphony

Infinera Transcend™

Transcend Orchestrator
Multi-Domain Orchestrator

Transcend SDN Controller
Multi-Vendor SDN Controllers

NFV MANO
*ETSI based
Open Source MANO*

Third Party Controller

Transcend NMS
Network Management & Operation

Software Consulting Services

Transcend ProGUI is a full set of monitoring, provisioning, troubleshooting and configuration tools and shared with Transcend Chorus for Packet

Transcend Portal is a "Zero-Touch" service provisioning Portal for quickly adding new services based on templates

Infinera

Summary

- Infinera is developing and rolling out next generation solution
  - Open, Disaggregated, Innovative, Software-centric, lower cost

- Infinera is following all relevant industry standards
  - fully embrace Open APIs
  - continues to actively participated in MEF Presto API definition
  - gained enormous working knowledge with AT&T ECOMP and others
  - CORD architecture

- Infinera Transcend SDN is truly multi-vendor via open interfaces
  - supporting many competitor routers and controllers
  - can connect to multiple optical Controllers
  - Transcend NFV-MANO for Infinera's NFV, open source or partner NFVs

SDN/NFV

DISAGGREGATION

PROGRAMMABLE
PACKET
PLATFORMS

PHOTONIC INNOVATION

Auto-Lambda

How to operate easier

Infinera®

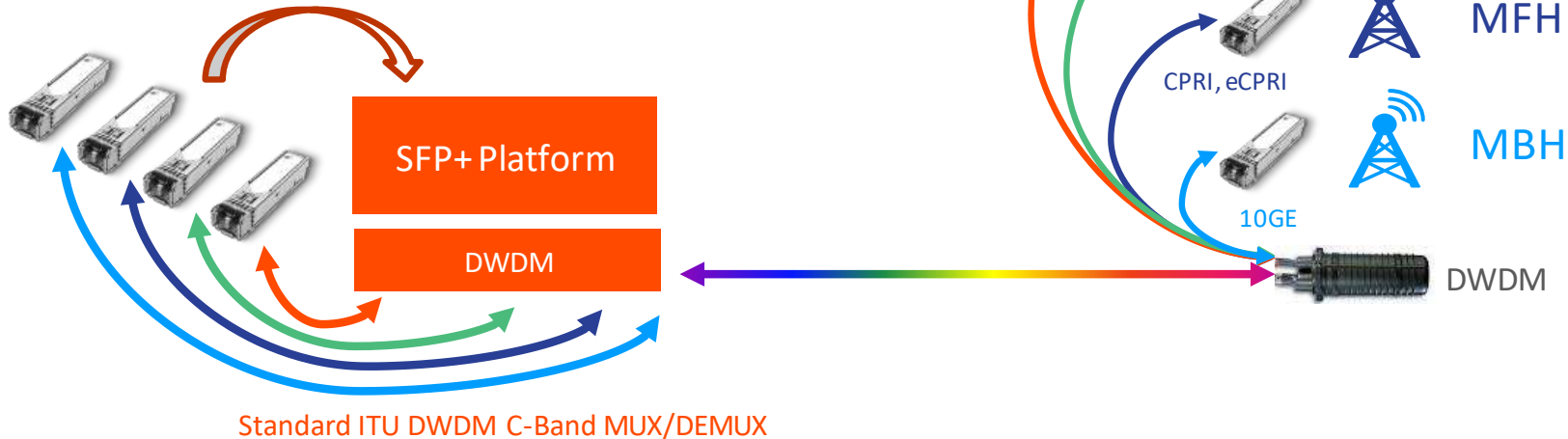# Current Challenges in Access Networks

- Telco/Cable MSO Fiber Deep Networks:
  - Driven by new 5G & DAA/CIN architectures
  - Proliferation of DWDM end points
    - » DWDM training for expanded field force
    - » 1000s of nodes, 1000s x every $ saved
  - Space and power limitations
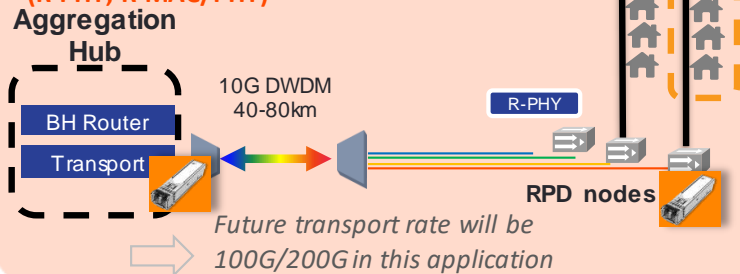   - » Pushing DWDM into locations that were never designed to support it

Metro Packet Optical Network

Existing hut

Fiber Deep DWDM

Infinera
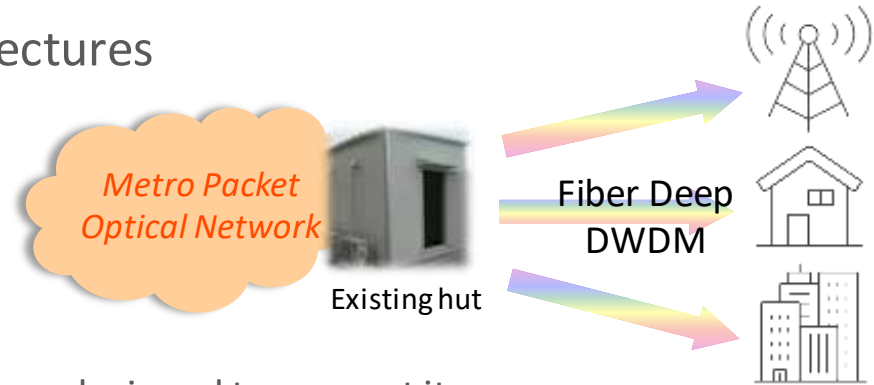
An Introduction to "Auto-Lambda"

- Host agnostic self-tuning DWDM SFP+
  - Enables DWDM directly in the host, **removing the cost of transponders**
  - Automation greatly **reduces operational cost/complexity and reduces errors**
- Dual ended self-tuning
  - Single part number for all locations
- The Auto-Lambda is an Infinera patented algorithm
  - Simple firmware upgrade to commercially available optics
  - No impact to optical performance
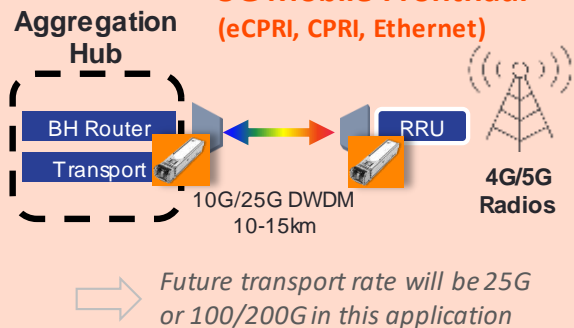 - Supports amplification and multiple architectures – pt-to-pt, rings etc

DAA

RPD/ RMD

10GE

Enterprise

10G/OTU-2

MFH

CPRI, eCPRI

MBH

10GE

DWDM

SFP+ Platform

DWDM

Standard ITU DWDM C-Band MUX/DEMUX

Infinera

Primary Telecoms/Cable MSO Applications

Distributed Access Architecture (DAA)
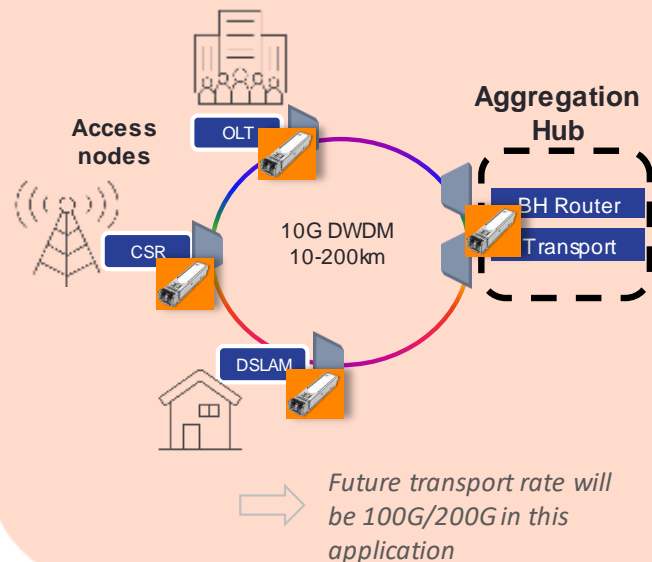## Converged Interconnect Network (CIN)
(R-PHY, R-MAC/PHY)

Aggregation Hub

BH Router

Transport

10G DWDM
40-80km

R-PHY

RPD nodes

Future transport rate will be 100G/200G in this application

5G Mobile Fronthaul
(eCPRI, CPRI, Ethernet)

Aggregation Hub

BH Router

Transport

RRU

4G/5G Radios

10G/25G DWDM
10-15km

Future transport rate will be 25G or 100/200G in this application

- 5G and DAA/CIN are the main drivers for fiber deep access
- Also driven by OLT or DSLAM backhaul applications

Backhaul and Aggregation
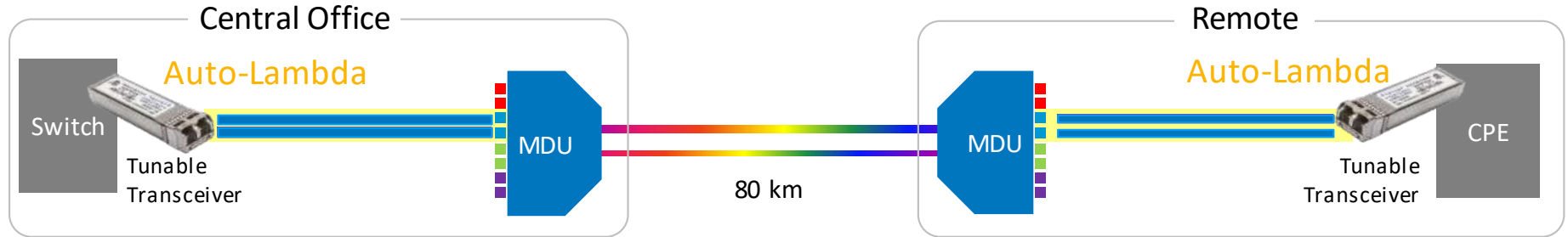**(4G, 5G, Business Services, DSLAM, OLT etc)**

Access nodes

OLT

CSR

DSLAM

Aggregation Hub

BH Router

Transport

10G DWDM
10-200km

Future transport rate will be 100G/200G in this application

Infinera

The Infinite Edge: Auto-Lambda Self-Tuning DWDM Pluggables

Central Office

Auto-Lambda

Switch

Tunable
Transceiver

MDU

80 km

Remote

Auto-Lambda

MDU

Tunable
Transceiver

CPE

Transceivers automatically tune to matching wavelengths

SIMPLIFYING OPERATIONAL PROCESSES AND PROCEDURES

REARCHITECT DAA AND FIBER DEEP NETWORKS

Innovative Approach

Easy Deployment

Intelligent Automation

Business Velocity

Compact & Power Efficient

Infinera

Auto-Lambda: A Complete Optical Access Solution

- Auto-Lambda based Optical Access:
  - XTG Series range of hardened filters
    - » Extensive range driven by real world access network challenges
    - » Hardened outside plant filter options
    - » Over 140,000 units deployed
  - XTM semi-passive wavelength management
    - » Optical Channel Monitor (OCM)
    - » Optical Time-Domain Reflectometer (OTDR)
    - » DNA-M Auto-Lambda management functions such as alarming/monitoring, service awareness etc
  - XTM optional add-ons
    - » Optical Amplifiers (OA)
    - » EMXP440 for 10G to 100G pre-aggregation
    - » EMXP XH800 for eCPRI fronthaul

Auto-Lambda DWDM upgrade to legacy mobile routing network

Infinera
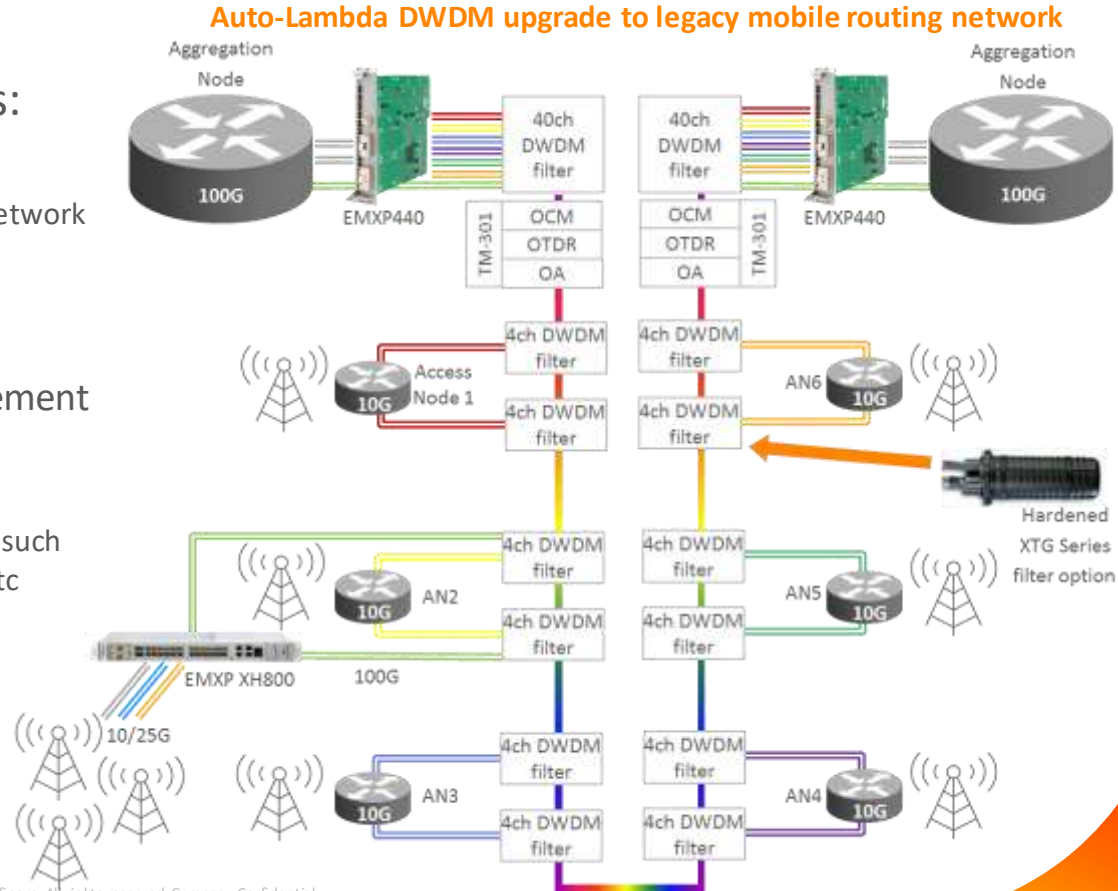
Auto-Lambda Opex Savings Value Proposition

Save 1,000's of man-hrs. in optical access mass deployment

Auto-Lambda	Standard Tunable SFP+
Plug-n-Play	Channel planning for 8000 ports
Plug-n-Play	Installation method of procedure (MOP) for channel to WDM port alignment
Plug-n-Play	Prestaging RPD/RMD with assigned channel
Plug-n-Play	Programming assigned channel to WDM port at DAA Ethernet switch/router
No mistakes	Mismatch mistake?! Reprogram in field?

The DHCP of optics - no mistakes to fix in the field

Infinera

Read the White Paper

- 3rd Party white paper by Broadband Success Partners
- Evaluating the Opex savings of Auto-Lambda in DAA Networks
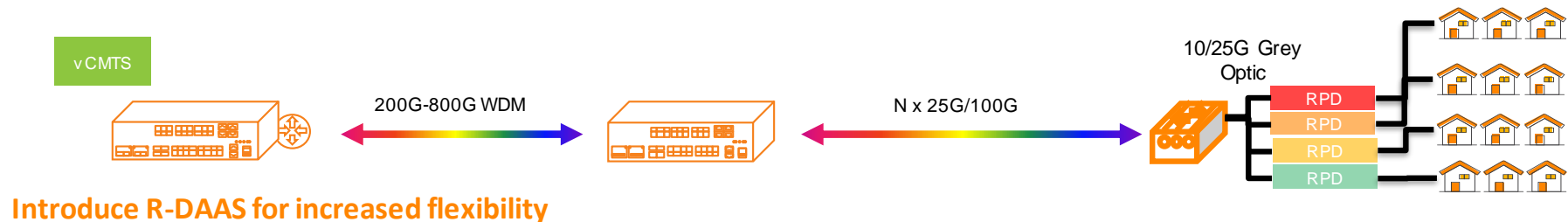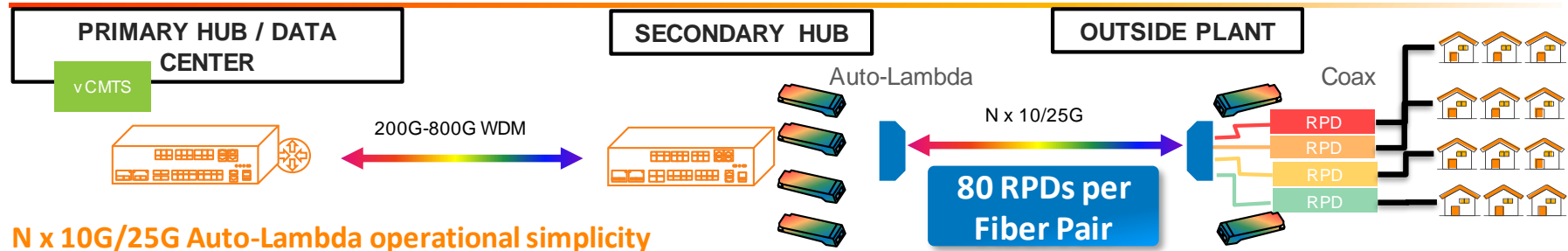- https://www.infinera.com/white-paper/Cognitive-Networking-in-the-Access-Deploy-DAA-Faster-than-Ever

Digital Subcarriers

Increase capacity on existing plant

Infinera®

Cable/MSO Network Reference Architecture

Infinite Core

Infinite Edge

Auto-Lambda
XR Optics

PRIMARY HUB / DATA CENTER

vCMTS

DRX
Spine and leaf POD w/ Integrated App Servers

Backbone

Core

200G-800G WDM

200G-800G WDM

SECONDARY HUB

DRX
Edge POD - White Box Router/Switch + Server

Nx100G WDM

OUTSIDE PLANT

DRX
White Box Router/Switch

Nx100G WDM

MOBILITY

10/25G

L3

L2

SMB

10/25G

XTM (HDEA)
HD Operationally Simplified L2 Aggregation

XHAUL-800
Edge Optimized L2 Switch

N x RPD
N x RMD

RESIDENTIAL

Auto-Lambda
XR Optics

**POD Configuration
HSR DRX Scalability
High Performance DWDM**

**Edge POD
Stackable Scalability
Ethernet Aggregation**

**Fiber Efficient
Flexible Options
Environmentally Hardened**

Infinera

Infinite Edge: DAA/CIN Evolution including **XR Optics**

PRIMARY HUB / DATA CENTER — vCMTS — 200G-800G WDM — **SECONDARY HUB** — Auto-Lambda — N x 10/25G — **OUTSIDE PLANT** — Coax — RPD, RPD, RPD, RPD — **80 RPDs per Fiber Pair**

N x 10G/25G Auto-Lambda operational simplicity

vCMTS — 200G-800G WDM — N x 25G/100G — 10/25G Grey Optic — RPD, RPD, RPD, RPD

Introduce R-DAAS for increased flexibility

vCMTS — 1 x 400G XR Optic — N x 400G/800G with Digital Subcarriers — N x 25G subcarriers — RPD, RPD, RPD, RPD — Optical Splitter/Combiner

Eliminate intermediate aggregation for up to 70% 5-year TCO savings

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Infinite Edge: **Disruptive Innovation** with **XR Optics**

For 50+ years, the industry has been
USING A POINT TO POINT TECHNOLOGY FOR A POINT TO MULTI-POINT APPLICATION

INTERMEDIATE AGG devices/locations w/ **Nx2 TRANSCEIVERS** required to "up-speed" signal

Upgrades require **RIP AND REPLACE OF BOTH ENDS** (OpEx, time, truck-rolls)

COHERENT EDGE

ELECTRICAL AGGREGATION

Switch/Router
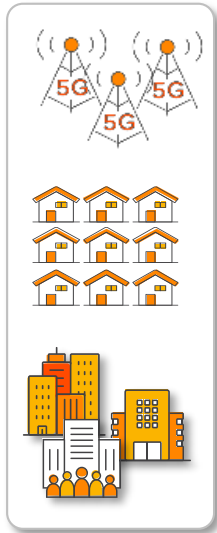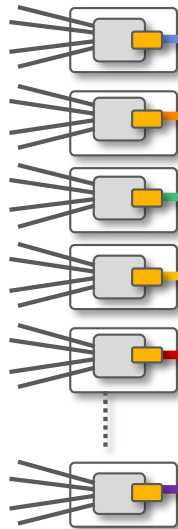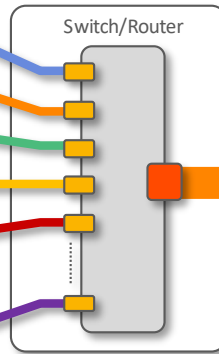
HUB
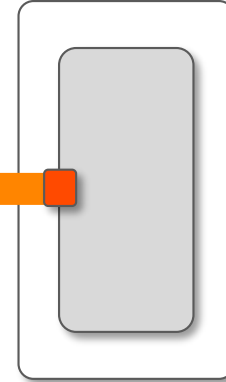
Nx 2 TRANSCEIVERS

Infinera

Infinite Edge: **Disruptive Innovation** with **XR Optics**

THE WORLDS FIRST
COHERENT POINT TO MULTI-POINT
OPTICAL SOLUTION

INDIVIDUAL XR OPTICS TRANSCEIVER
XR OPTICS TRANSCEIVER

That generates numerous independent optical signals with dedicated data streams that can be routed to different destinations

COHERENT EDGE

ELECTRICAL
AGGREGATION

Switch/Router

HUB

N+1 TRANSCEIVERS

Infinera
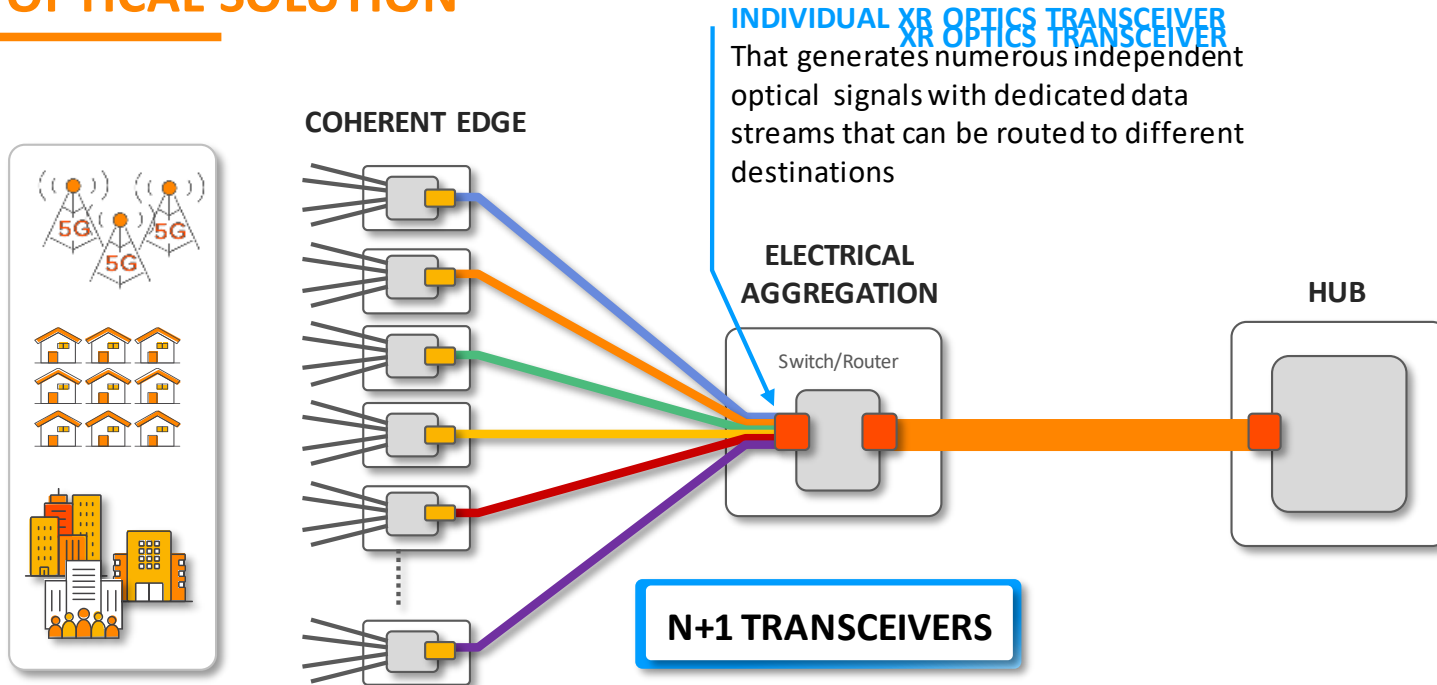
The Solution: **Disruptive Innovation XR Optics**

THE WORLDS FIRST
COHERENT POINT TO MULTI-POINT OPTICAL SOLUTION

XR OPTICS TRANSCEIVER
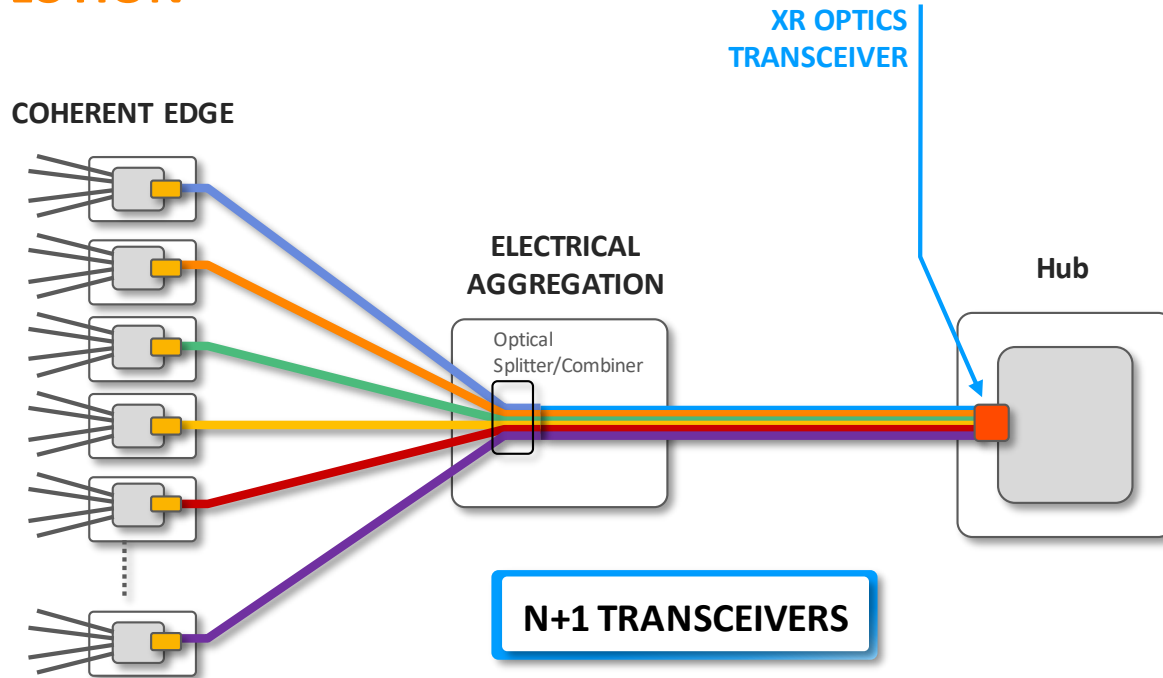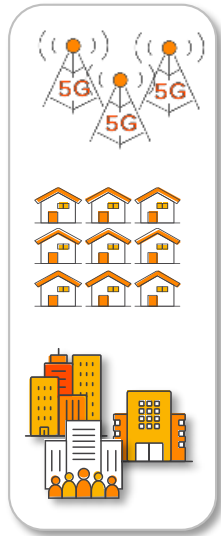
70%+
REDUCTION IN NETWORK COST

>50% Reduction in Transceivers

Eliminate Intermediate Aggregation

COHERENT EDGE

ELECTRICAL AGGREGATION

Optical Splitter/Combiner

Hub

N+1 TRANSCEIVERS

Infinera

Building on Subcarrier Flexibility

XR Optics Transceiver
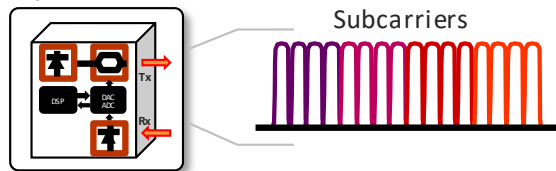
Subcarriers

Subcarriers can be flexibly sized

Examples:

– 25G subcarriers in 64 Ghz at 16QAM, 4 Gbaud

– 10G subcarriers in 64 Ghz at QPSK, 4 Gbaud

Transceivers can be designed with different numbers of subcarriers

Can be supported by a variety of form factors

ALL OPTICS BECOME N by X SUBCARRIERS
(XR optics – optics based on a flexible, interworkable number or "X" subcarriers)

EXAMPLE OF SOLUTIONS USING 25G SUBCARRIERS

25G: 1 x 25G

4 GHz

optical frequency spectrum

SFP28

100G: 4 x 25G

16 GHz

QSFP28

400G: 16 x 25G

64 GHz

QSFP-DD

800G: 32 x 25G

130 GHz

OSFP

Infinera
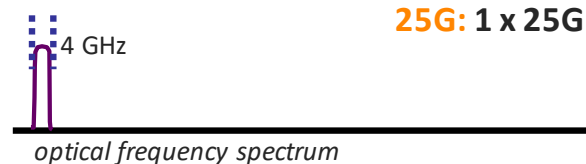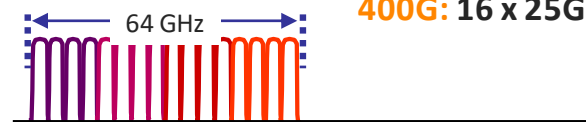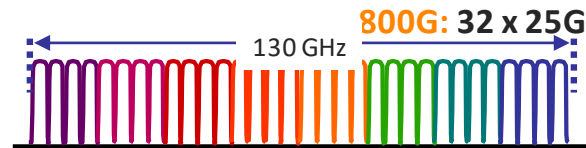
Transforming Point-to-Multipoint Aggregation

POINT-TO-MULTIPOINT SUBCARRIER-BASED TRANSCEIVER TECHNOLOGY

Coherent Optical Engine

Single Laser, Receiver, and DSP

DSP-enabled Spectrum Shaping

XR Optics TRANSCEIVER

25G
25G
25G
25G
25G
25G
50G
100G

Each Subcarrier
25G, 4 Gbaud

400G
16 x Subcarriers

XR Optics TRANSCEIVER

16 Transceivers in One

Splitter

"Listens/transmits" across 64 GHz of spectrum, managing each subcarrier independently

Supports seamless upgrades by simply sending additional subcarriers

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TCO Network Case Study

METRO AGGREGATION NETWORK

76% REDUCTION IN 5-YEAR TCO

Chart axis: 100%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 0%

PMO — XR Optics

REDUCE TRANSCEIVERS BY >50%

ELIMINATE INTERMEDIATE AGGREGATION DEVICES

REDUCE TRUCK ROLLS FOR UPGRADES

IMPROVE EFFICIENCY OF HUB ROUTER WITH HIGHER-DENSITY PORTS

Study performed on actual customer network using real network data

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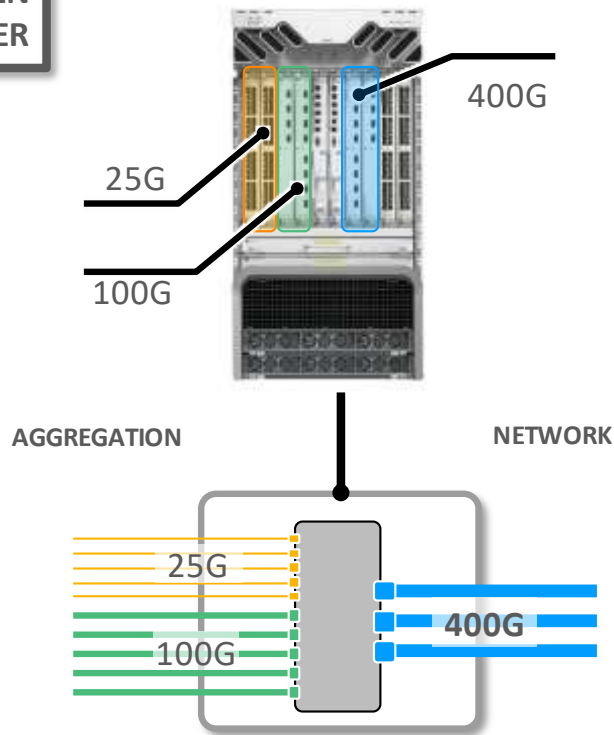
More Efficient and Less Complex Switches/Routers

More Efficient and Less Complex Switches/Routers

All 400G Ports
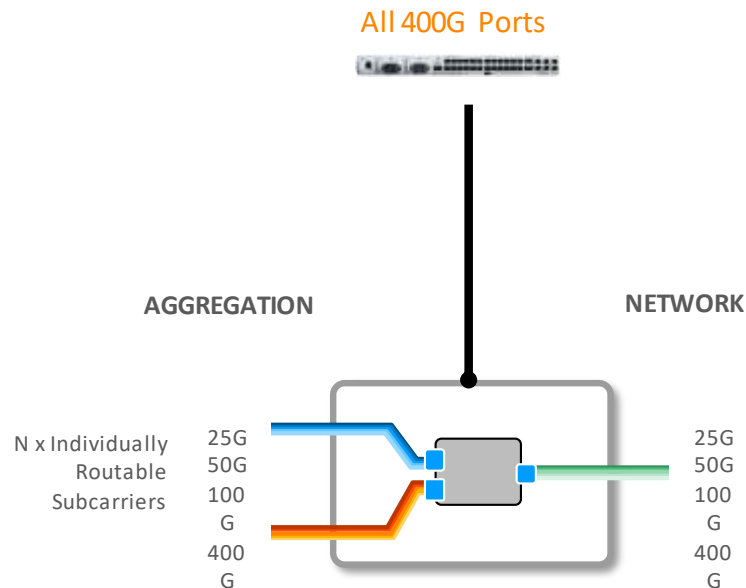
Compact, efficient switch/routers with **ALL HIGH-SPEED PORTS** that can be used for **AGGREGATION OR NETWORK** applications
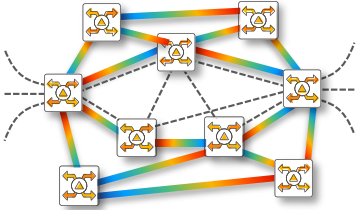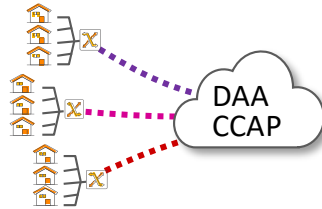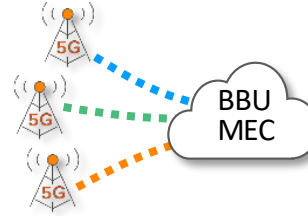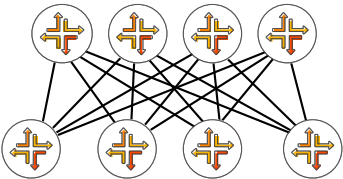
AGGREGATION

NETWORK

N x Individually Routable Subcarriers

25G
50G
100G
400G

25G
50G
100G
400G

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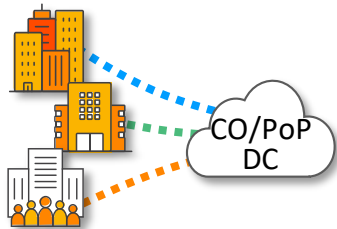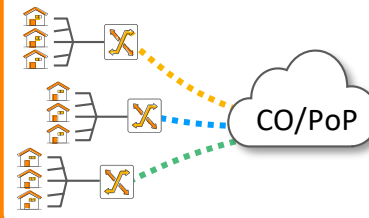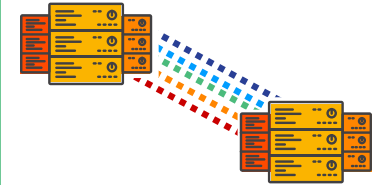
Network Applications

The Infinite Network

A disruptive, end-to-end network architecture paving the way to instantly scalable, self-optimizing networks that dynamically adapt to the demands of users and applications.

ACCESS & AGG　　**TRANSCEND**　　**METRO / REGIONAL**　　**CORE & SUBSEA**

BUSINESS

MOBILITY

RESIDENTIAL

COGNITIVE NETWORKING

Transcend NMS

Transcend Controller

Transcend Orchestrator

APP CENTER

ADAPT　　vASON　　vPOD

Aware　　ML-PCE

INFINITE EDGE

XTM
Application optimized L2 transport

DRX
Carrier-Grade whitebox router/Switch

INFINITE CORE

Groove
Flexible Compact Modular solutions

XTC
Scalable High-Performance OTN Switch

vPOD & HSR
Expand white box routing/switching

Infinera

Thank You!