New Technologies Revamping the ISP landscape

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- Router Optical Networking (RON)
- Router Passive Optical Networking (RPON)

Router Optical Networking (RON)

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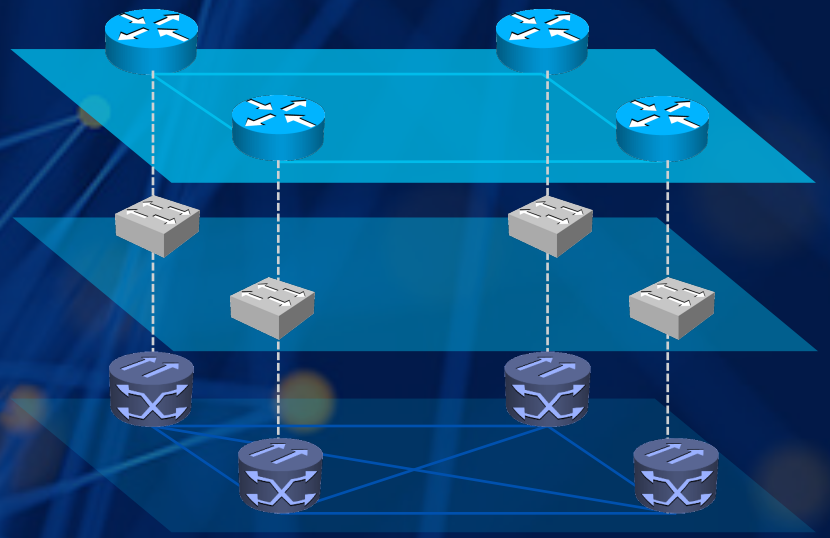
The Complexity of Legacy Architecture

Distinct IP and Optical Networks
Engineered and operated by different internal organizations

Legacy Burden
Accumulation of new and old technologies over time

Asset Utilization
Medium to low utilization of network assets

Mounting OpEx
Automation of complex networks comes with inefficiencies



1. IP Routing
2. OTN
3. Optical (ROADMs)

redundant | complex | expensive

Simplicity is the ultimate sophistication

Leonardo da Vinci

Shifts in Economics and Technologies

Optics and Routing

Routing Scale Evolution

Silicon

3.2Tbps to
51.2Tbps

Router capacity outpaces projected traffic demand

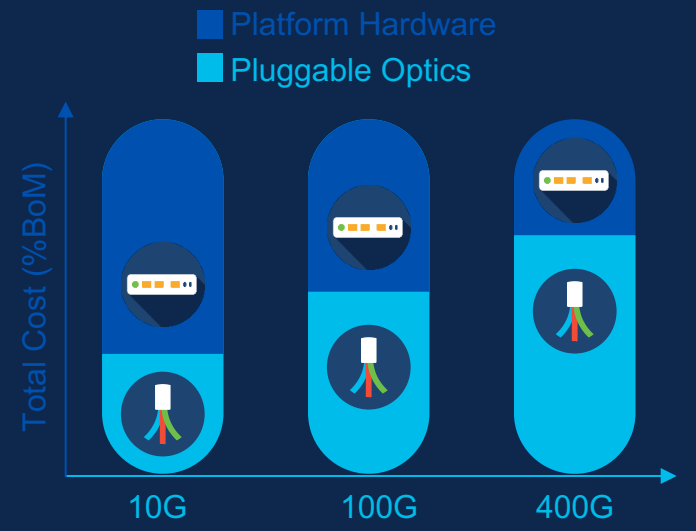
Optical Systems Evolution

Optics

100GbE ZR
400GbE ZR/OpenZR+

Chassis-based solutions replaced by pluggable optics for short to medium distance applications

Shift in Economics



Optics cost becomes greater than router port cost

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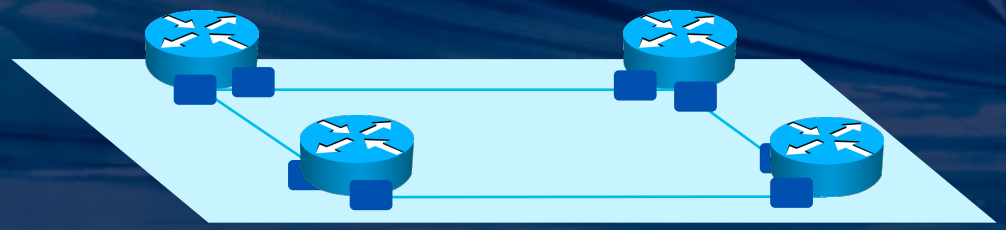
Introducing Routed Optical Networking

35% CapEx Savings*

57% OpEx Savings*

46% TCO Savings*



- Modernized operations and procurement
- Interoperability and standardization
- Efficiency gains

*ACG Research, 2021

Removing Complexity

Router

SR Optic

SR Optic

Fiber Jumper

Transponder

ZR/ZR+ Optic

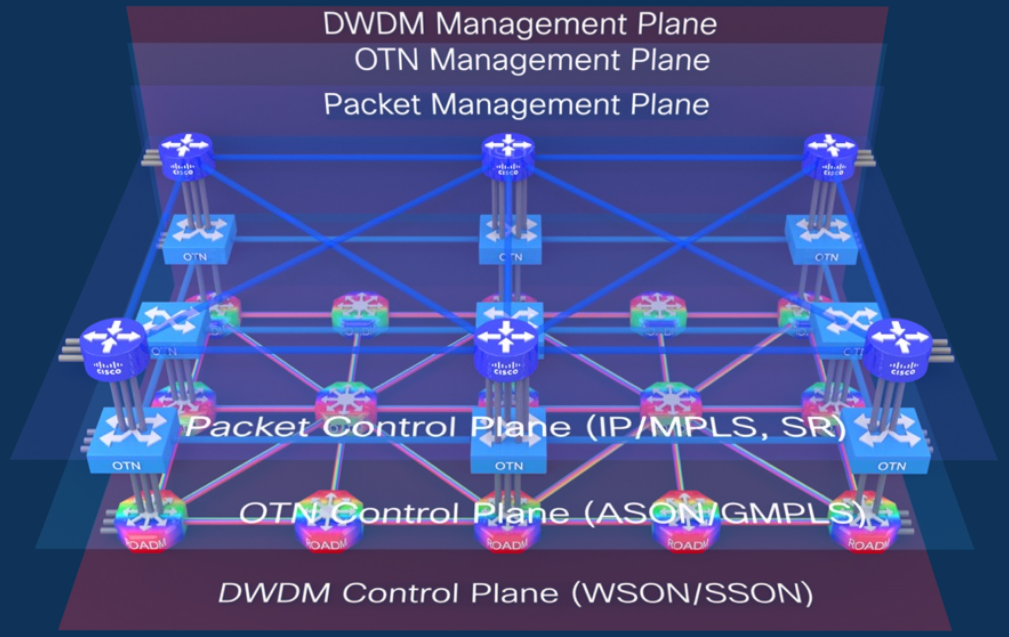
Fiber Jumper

ROADM

Toward a Routed Optical Network Future

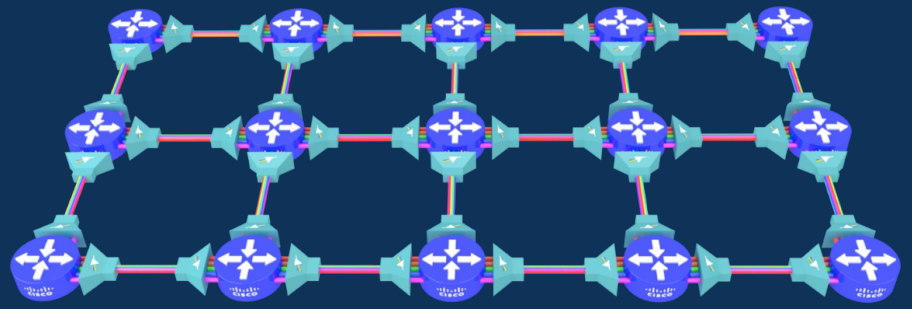
Estimated total TCO savings of 45%

Today's Network
Layered Architecture



Tomorrow's Network
Flat Hop-by-Hop Architecture

Unified Management & Automation Plane



Automation

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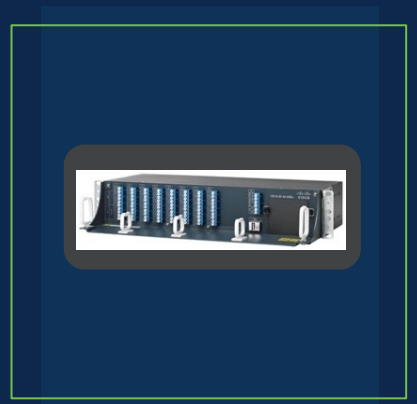
Routed Optical Networking

Putting it all together

>250Tbps +

Coherent Optics +



Simple DWDM Line System +

Modern Software & Control Plane =

New Network Paradigm

Hop-by-Hop Optical Transport

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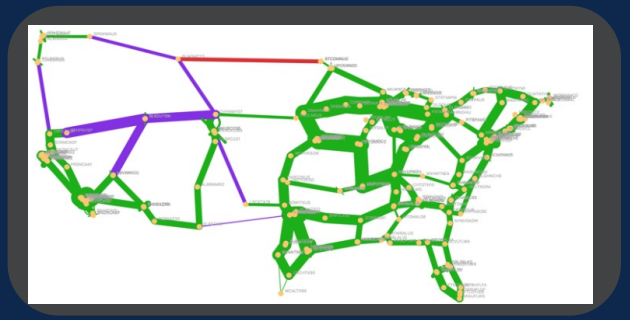
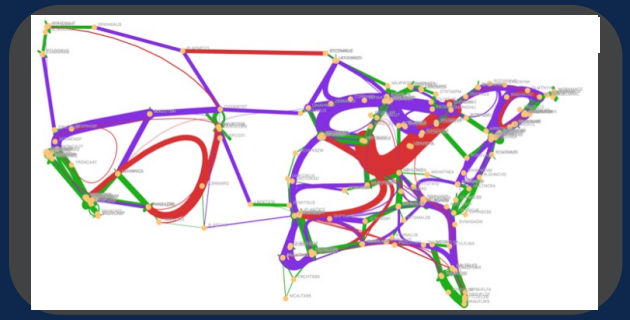
Nationwide Core Network

Routed Optical Network reduces cost of ownership and improves resiliency

Routed Optical Network increases capacity

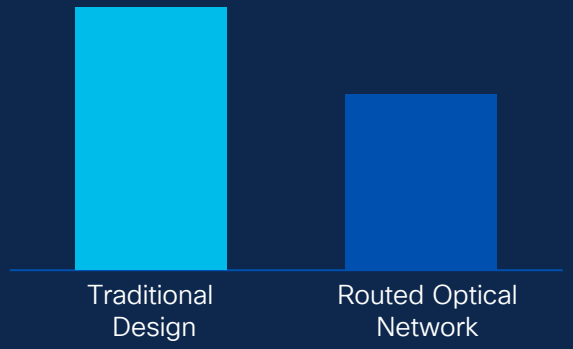


Present mode of operation has capacity constraints



Lower CapEx

Large core network comparison



The capital expense of a Routed Optical Network node can be upto 55% of the cost of today's networks

Lifecycle Savings

Today's typical node vs. a Routed Optical Network node:

- 74% less power
- 58% less rack space
- 35% CapEx reduction
- 56% OpEx reduction

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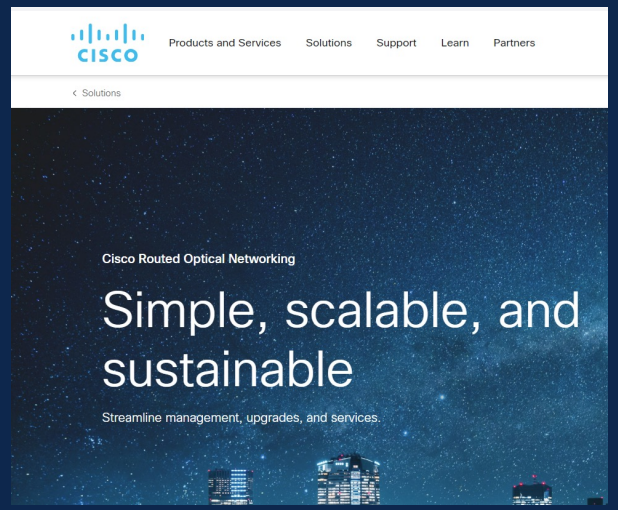
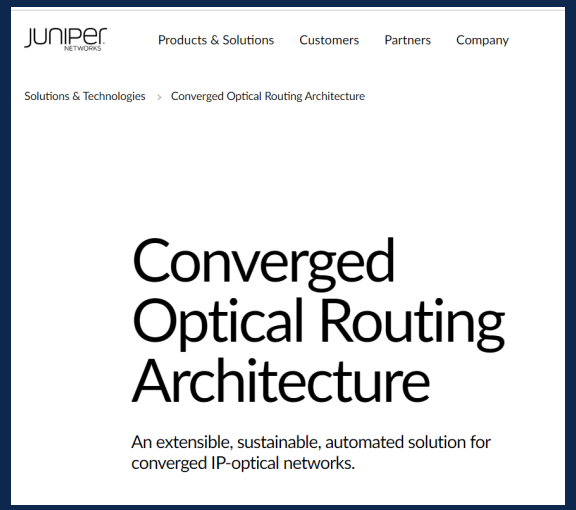
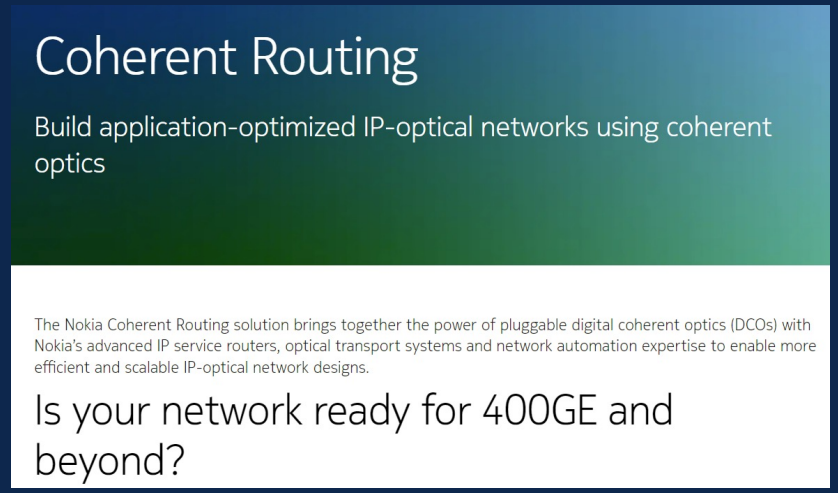
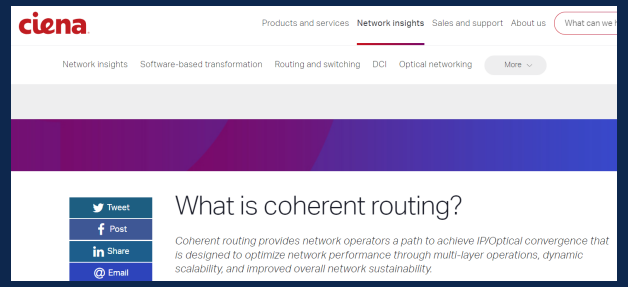
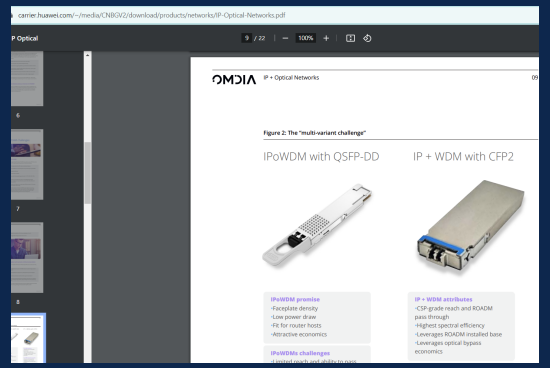
Entire industry is following the trend..

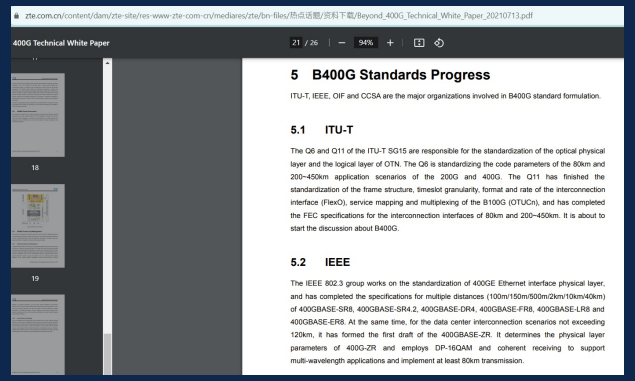












Architecture Link
https://www.cisco.com/site/us/en/solutions/routed-optical-networking/index.html
https://www.juniper.net/us/en/solutions/converged-optical-routing-architecture-cora.html
https://www.nokia.com/networks/ip-networks/coherent-routing/#:~:text=The%20Nokia%20Coherent%20Routing%20solution,scalable%20IP%2Doptical%20network%20designs.
https://www.ciena.com/insights/what-is/what-is-coherent-routing

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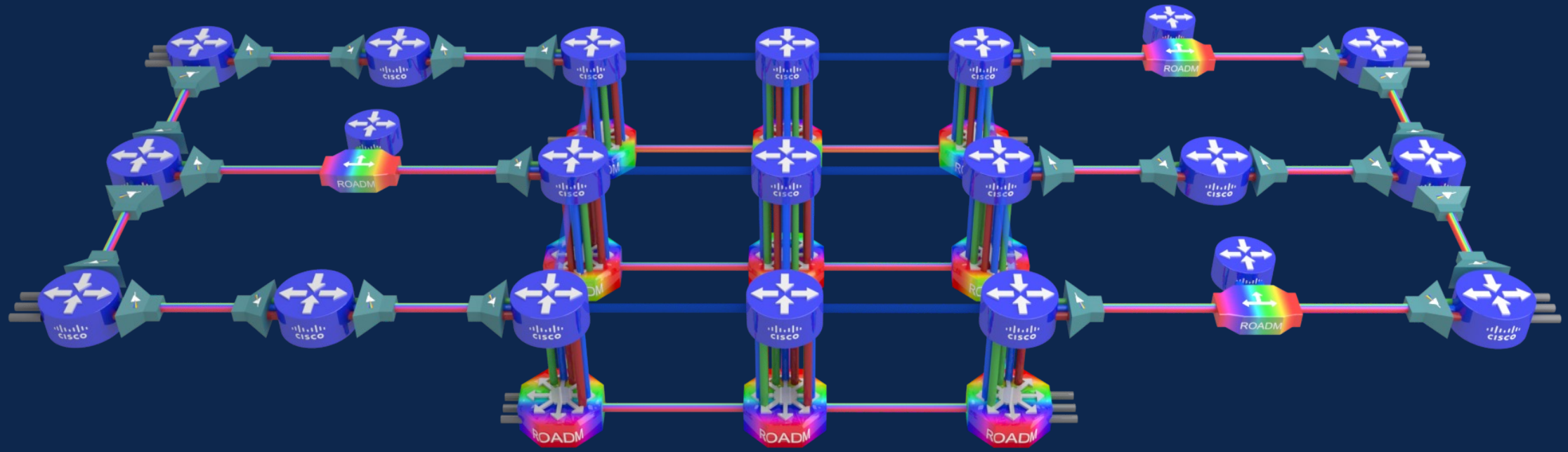
Where Do I Start?

Routed Optical Networking can be deployed in these three different scenarios



Greenfield

Existing DWDM Layer

Coherent optics over 3rd Party line systems

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Cost Saving Factors

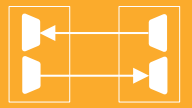
Dense Routing

$ - W - RU

Digital Coherent Optics

Siliconization

Line System



Simplified

Routed Optical Networking Solution

Easier to Plan, Deploy, Operate, Troubleshoot, Scale

Drives Highest Fiber Utilization – Efficient 400G Packing

Entirely Standards Based

More Resilient to Multiple Failures & Maintenance Activity

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Router Passive Optical Networking (RPON)

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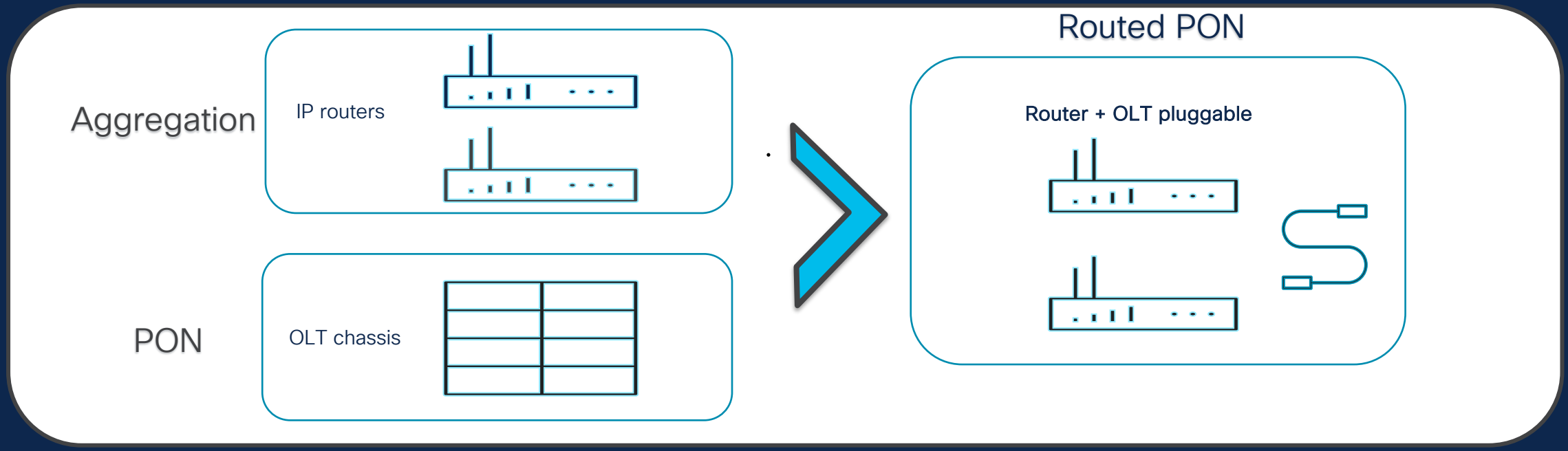
Routed PON Solution

Disaggregated and scalable PON deployment



14%-20% CapEx savings*

**Compared to Standard PON access concentrators*

OpEx benefits:

- Broadband service providers can converge the IP and optical on single layer

Leverage a rich feature set of NOS and the cost-effectiveness of passive optical networking

- Reduction and simplification of OLT hardware from dedicated shelf to pluggable
- Port-based scalable model enabling deployments to be rolled out as per XGS-PON standards

Path to future upgrades - 10G to 25G PON

Reference: DELL'ORO Broadband Access Report Q124

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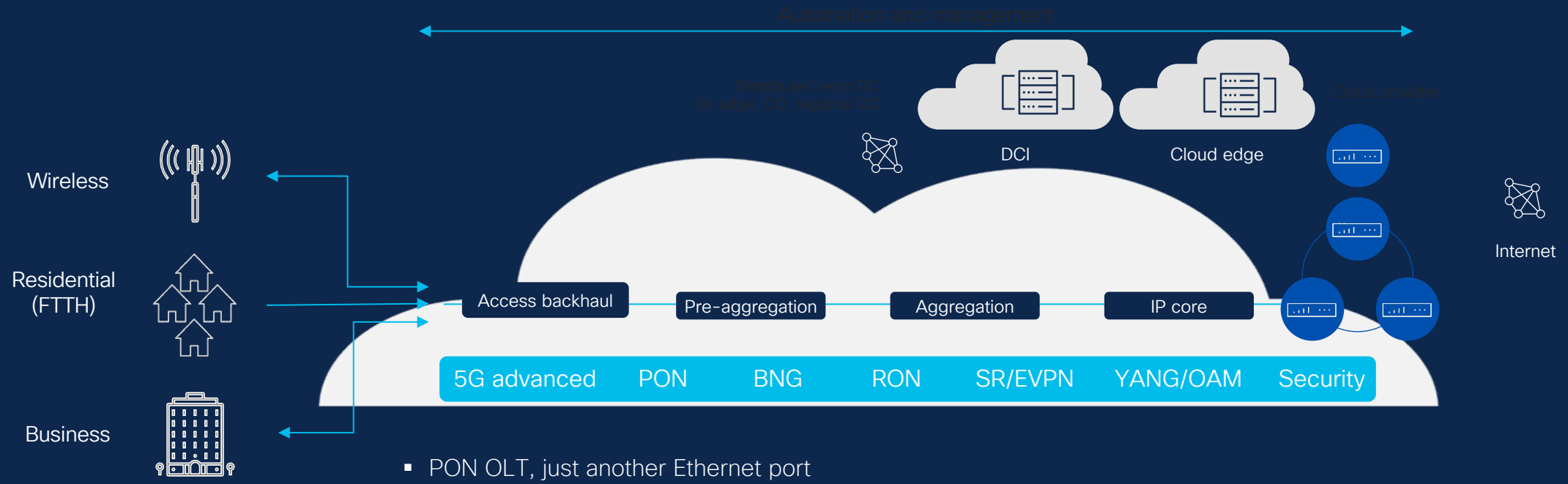
Converge services on Metro Architecture



- PON OLT, just another Ethernet port
- Seamlessly integrate PON with the existing metro architecture
- Deliver PON services with open standards
- Maintain single operating system for operational simplicity
- Leverage EVPN and segment routing to provide a diverse and feature-rich access network servicing multi- and single-tenant residential, commercial business and mobile backhaul networks
- Better subscriber policy management with distributed BNG
- In-built hardware security with TAM chips

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Routed PON + Assurance Architecture

Simplified way to deploy next-gen passive optical networks

Hardware+ PON Controller

- Leverage your existing Routing Platforms
- PON Controller simply runs as a container on these Router
- Future compatibility to 25G PON

OLT

- Pluggable hot swappable form factor
- SFP+ contains both L1 optics and L2 PON MAC
- Roadmap for low power i-temp version based DML laser

ONT/ONU

- G.9807.1 XGS PON Compliance
- 10G/1G/POTS/POE/POE++
- Pluggable Capability

PON Manager

- A powerful network management software for Routed PON Solution
- Configure and monitor end-to-end devices, including OLT and ONT

Service Assurance

- Network Performance observability and SA
- KPIs from the PON Manager and relevant correlations

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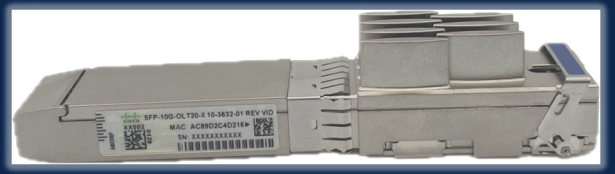
XGS-PON OLT SFP+ Module

Enabling Software Defined Broadband Network



- Simplifies the network with hot swappable pluggable form factor with embedded Ethernet-PON OLT MAC bridge
- Open and Disaggregated Software
- Compliant with ITU-T G.9807.1 XGS-PON specifications
- Interoperable with non-proprietary ONTs supporting OMCI standards
- Ideal for converging PON services along with existing Ethernet services onto a single transport network, delivering high bandwidth PON connectivity, High density PON aggregation
- RoHS 6 compliant

Quick Facts	
Dimension(H x W x D)	8.55mm x 13.4mm x 80.65mm
PID	SFP-10G-OLT20-X
Data rate	Symmetric rates: 9.95G upstream/9.95G downstream
Connector Type	SC/UPC
Maximum Distance	20 km
Operating Temperature	-20°C to 75°C
Typical Power Consumption	2.475W
Cable Type	Single Mode Fiber
ODN Class	N2

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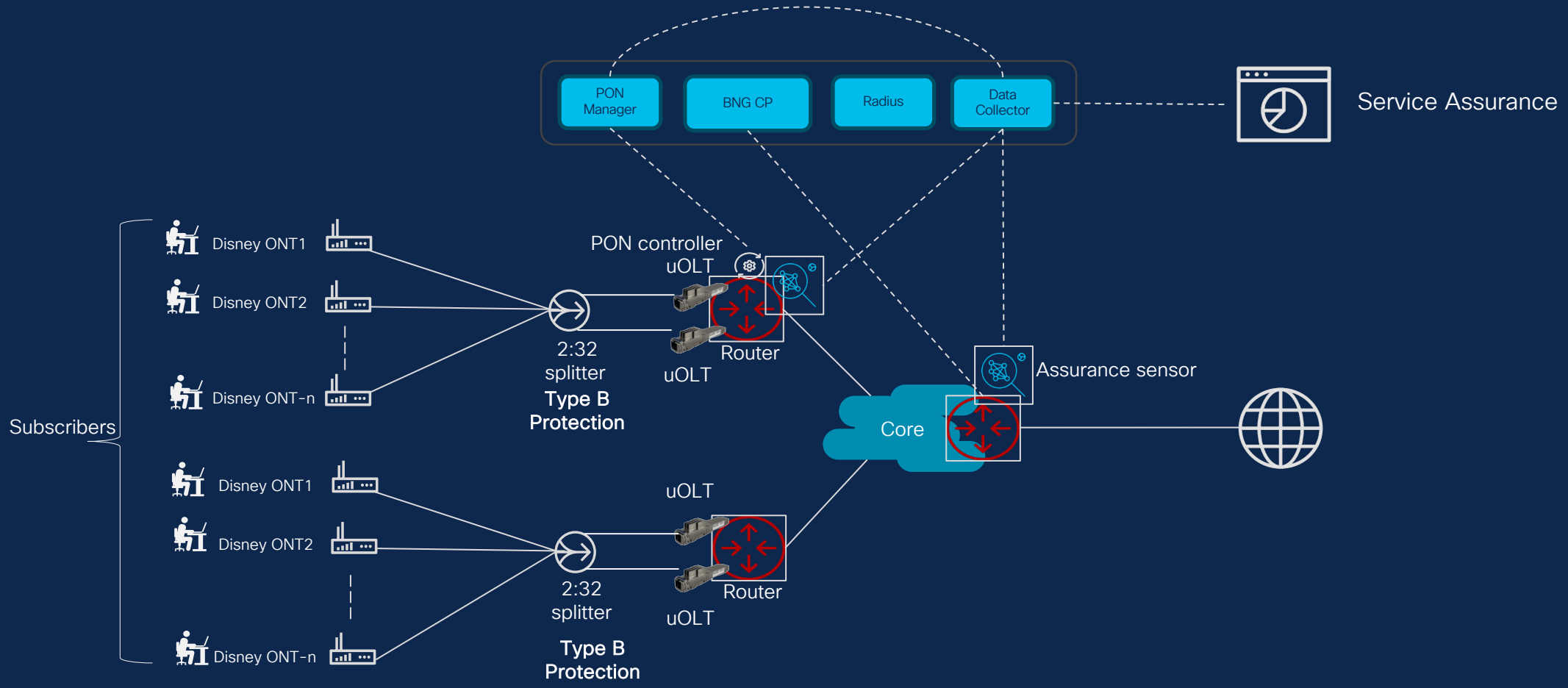
Single Chassis Protection



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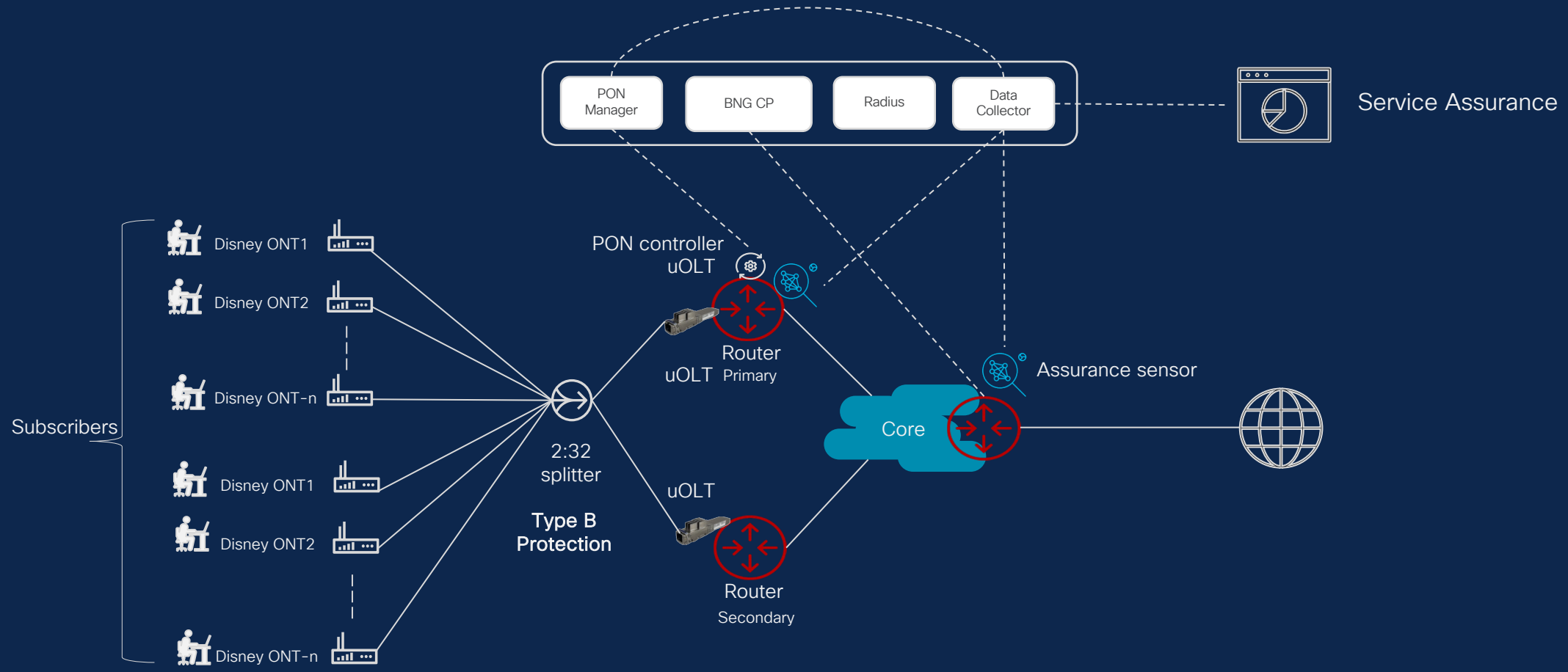
Multi Chassis Protection



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