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The bridge to possible

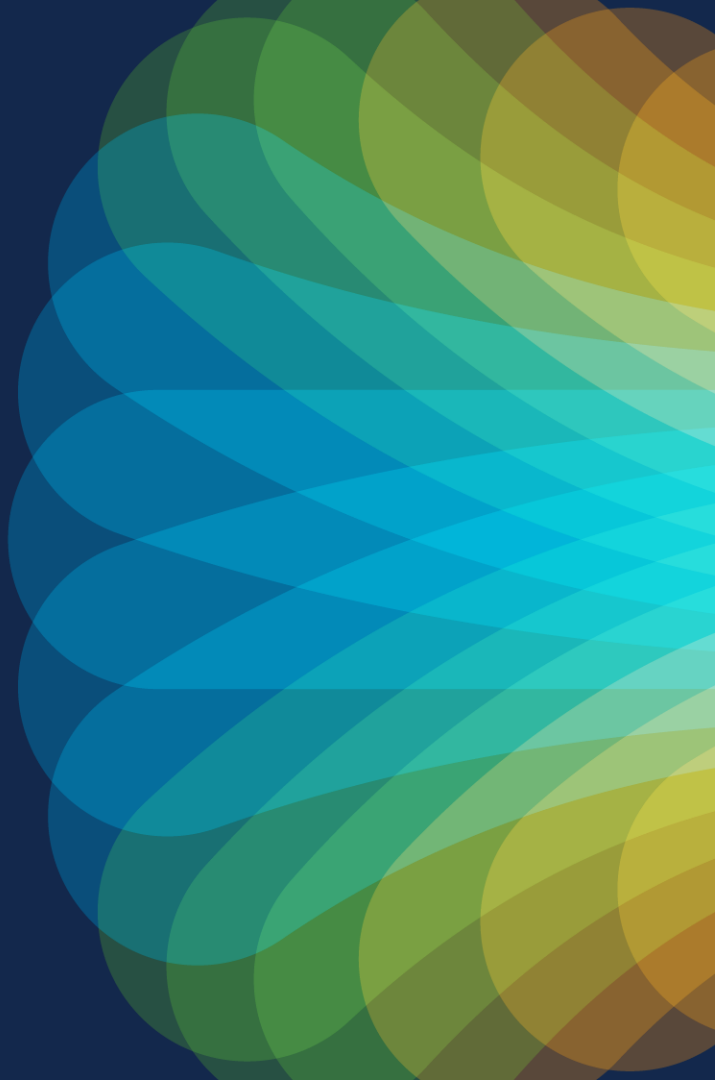
Unified Access and Aggregation with Cisco Routed PON

Tejas Lad, Provider Connectivity TME

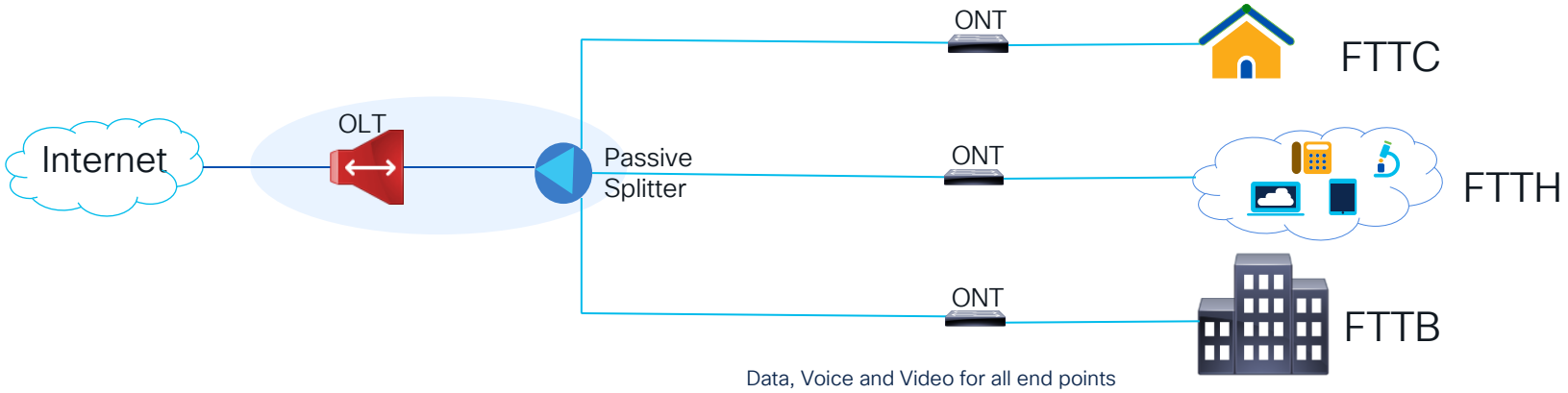
Agenda

- PON Introduction
- PON Market Trends
- Cisco Routed PON Solution & its components
- PON Co-existence
- Demonstration
- Summary

PON Introduction



What is Passive Optical Networking – PON



- Provides connectivity to end users by running fiber optic cable from an internet source to users at home or business
- Based on ITU-T G.984 - GPON , ITU-T G.987 - XG-PON, ITU-T G.9807.1 - XGS-PON
- Transmits ATM, Ethernet and TDM Traffic
- Single feeding fiber from the provider's central office to serve multiple homes and small businesses

OLT Optical Line Terminal
ONT Optical Network Terminal

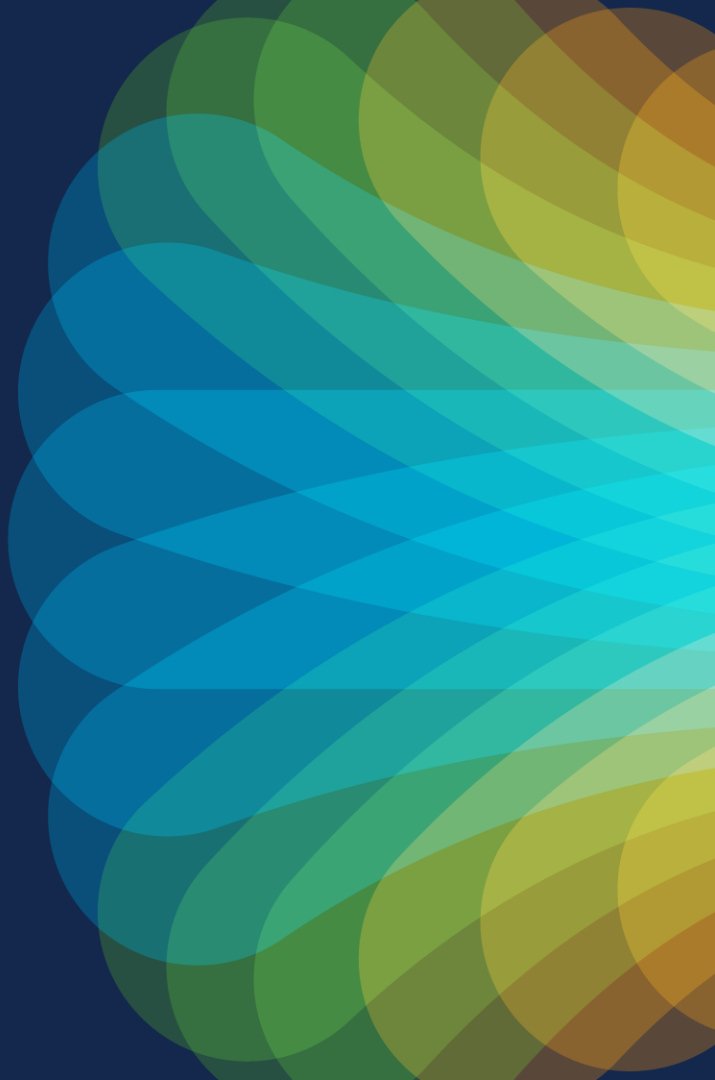
PON Evolution

	GPON	XG-PON	XGS-PON	50G PON
Standards	ITU-T G.984	ITU-T G.987	ITU-T G.9807.1	ITU-T G.9804.3
Downstream Rate	2.488 Gbps	10 Gbps	10 Gbps	50 Gbps
Upstream Rate	1.244 Gbps	2.5 Gbps	10 Gbps	12.5/25 Gbps
Upstream Wavelength	1300 to 1320 nm	1260 to 1280 nm	1260 to 1280 nm	1340 to 1344 nm
Downstream Wavelength	1480 to 1500 nm	1575 to 1580 nm	1575 to 1580 nm	1260 to 1280 nm
Split Ratio	1:128	1:256	1:256	1:256

How PON works ?

OLTs & ONTs	• OLTs placed at the head end of the network • Single fiber from OLT to splitter • Signal is relayed many ONTs • End users are connected to ONTs
Splitters	• Splitters take single light source • Duplicate it multiple times to outbound fibers known as wave splitting
Multiplexing	• Takes advantage of WDM and TDM • WDM allows bidirectional traffic across a single fiber by using a different wavelength for each direction of traffic • TDM allows multiple end devices to transmit and receive independent signals across a single fiber by reserving time slots in a stream of data
Cabling	• Single Mode Fiber for cabling

Market Trends



What's Driving the Need for Broadband Network Transformation?

8K and 12K Video

Immersive experience requires pushing streaming content distribution closer to the subscriber

Augmented / Virtual Reality

Business to consumer applications and advertising evolve to create a more realistic experience. Examples: Retail, real estate, social media

Enhanced Gaming Experience

Low latency, high bandwidth, application-layer coordination with Service Provider networks

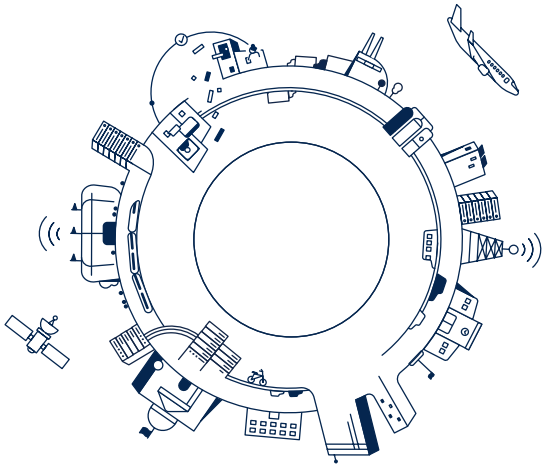
Enhanced Business Services

Business quality access to collaboration tools and applications, SD-WAN SLAs

The need for broadband network transformation

20x increase in data demand by 2032, driven by metaverse and streaming video[1]

75% of enterprise-generated data will be created and processed at the edge by 2025[2]



75% of people think hybrid work requires broadband services to improve dramatically[4]

29.3B networked devices in 2023 – up from 18.4B in 2018[5]

50% average percentage of CSP's total OpEx will be network-related[3]

10% growth in power consumption by network operators in 2021[6]

This is a demand-side view. Is it how the broadband market really works though...?

Sources: 1: A Guide to the Next-Gen Internet, Credit Suisse, 2022 | 2: Gartner analysis | 3: Telco Opex Analyzer, 2016-21, MTN Consulting | 4: Cisco Global Broadband Index 2022 | 5: Cisco Annual Internet Report, 2018-2023 | 6: MTN Consulting analysis

Broadband Funding Program Worldwide

Europe is Aggressively Utilizing Broadband Stimulus Programs to Drive Fiber Growth

Currently announced broadband initiatives in the UK and EU countries:

- UK – Project Gigabit ($8 Billion (US))
- Germany – BVMI ($14 Billion (US))
- France – Tres Haut Debit ($24 Billion (US))
- Austria – Symmetric Gigabit ($2 Billion (US))
- Italy – Italia 1 Giga ($8 Billion (US))

State aid: Commission approves €2 billion Austrian scheme under Recovery and Resilience Facility to support roll out of broadband networks

More than half a billion pounds in connectivity investment this year to benefit more than 330,000 homes and businesses

More than £530 million in investment this year will boost broadband for over 330,000 hard-to-reach homes and businesses across the country.

Italy dangles €3.7 billion in broadband funding

Italy has launched a major ultra-broadband tender worth €3.7 billion just days after it failed to attract interest in its first attempt to allocate EU funding.

France to invest €240m in funding public fibre networks

The French Government allocates €240m to public initiative fibre networks with the aim of reaching 100% fibre coverage in France.

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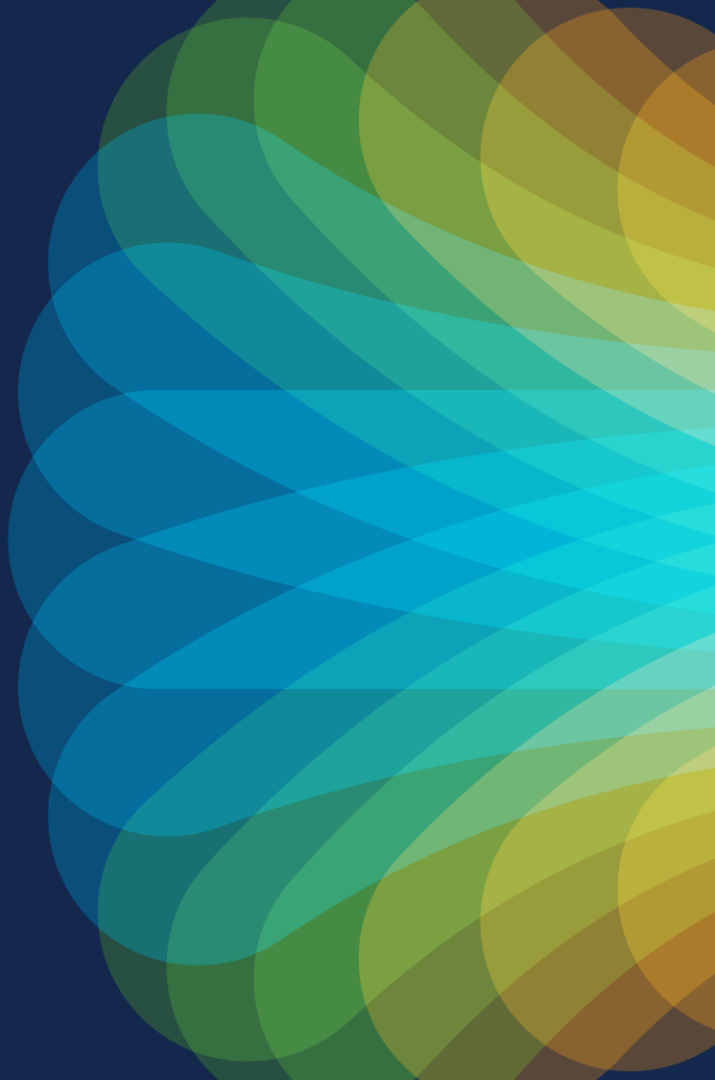
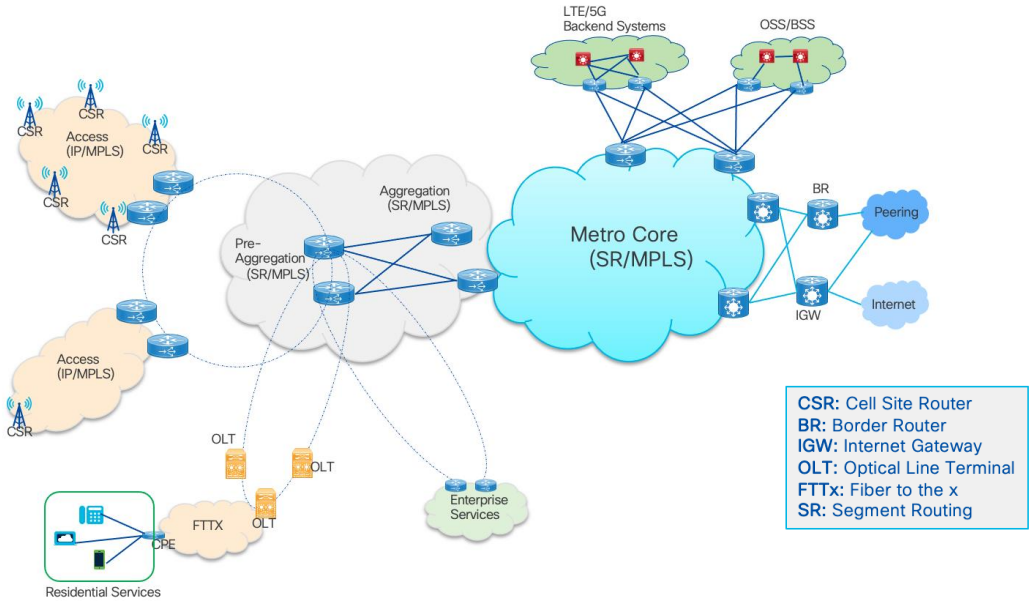
Current Deployments



Traditional Deployments



- Traditional OLT chassis for PON functionalities
- Aggregating the PON layer to providers access rings
- Requires large Layer2 domains

Challenges of chassis based deployment

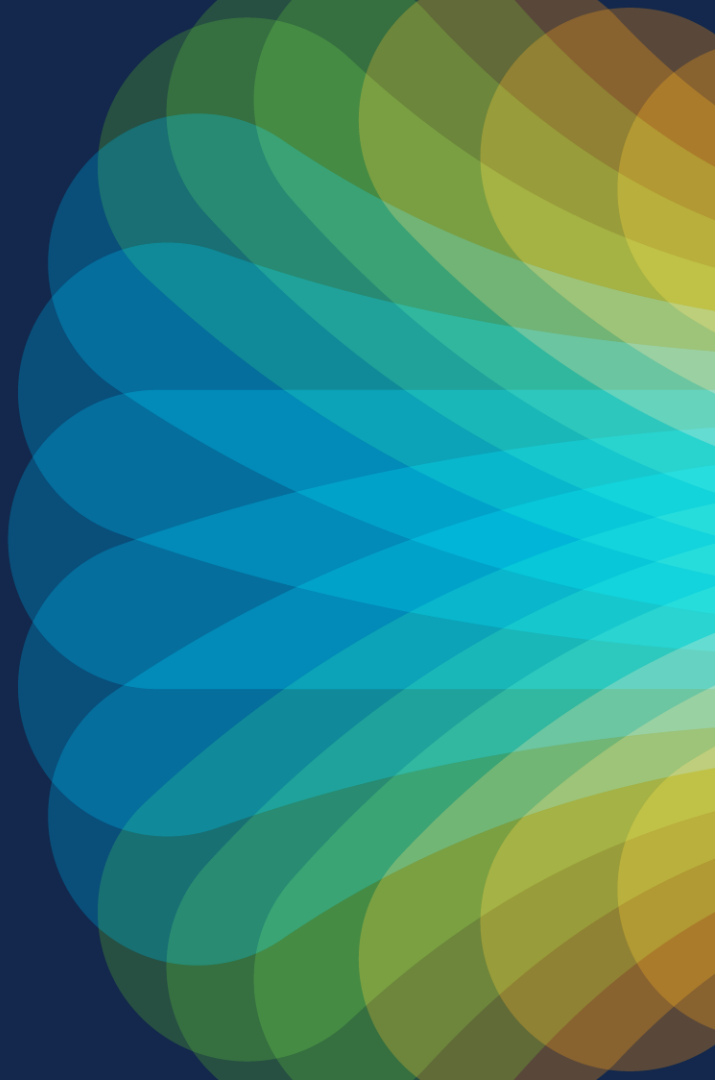
Existing Deployments:

- Proprietary vendor issues
- Space and power challenges
- Lack of pay as you grow model
- High investment in upgrading to higher speeds
- Lack of overall subscriber management
- Maintaining separate lifecycles for OLT and network devices
- Lack of minimal or no support for MPLS/Segment routing/EVPN
- Deploying services as per MEF standards
- Platform security
- Lack of support for Telemetry

New Deployments:

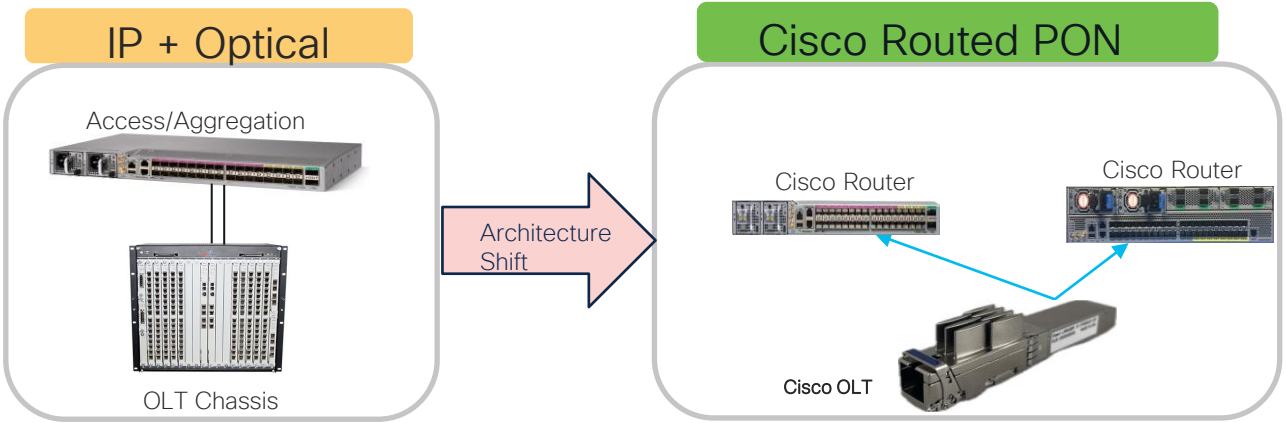
- Broadband Providers looking for deploying faster, simpler & economical way of churning services

Cisco’s Solution



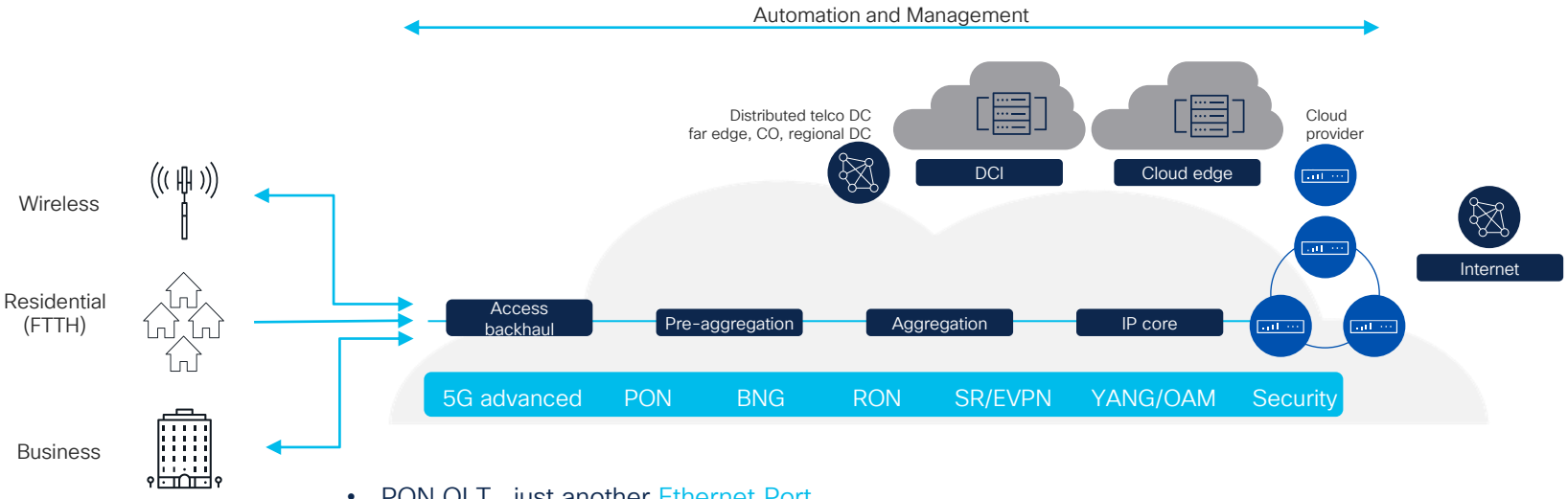
Cisco’s Routed PON Solution

Disaggregated & Scalable PON Deployment



- Broadband Service Providers can converge the IP and Optical on single layer
- 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
- Reducing power and space requirements of dedicated PON shelves
- Path to future upgrades to 25G/50G PON
- Take advantage of rich feature set of IOS-XR and the cost effectiveness of passive optical networking

Converge Services on a Cisco 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 across 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

Cisco Routed PON Solution Components

Simplified way to deploy next-gen passive optical networks

PON Controller

Hardware+ PON Controller

- Leverage your existing Cisco Routing Platforms– NCS 540/NCS 5500/5700
- PON Controller simply runs as a container on these Router

OLT

- Pluggable form factor
- SFP+ contains both L1 optics and L2 PON MAC
- Interoperable with non-proprietary ONTs

Cisco PON Manager

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

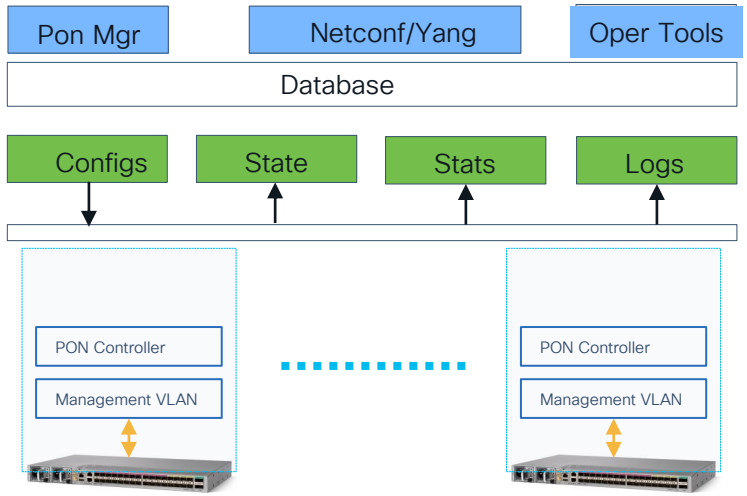
Cisco XGS-PON OLT SFP+ Module

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

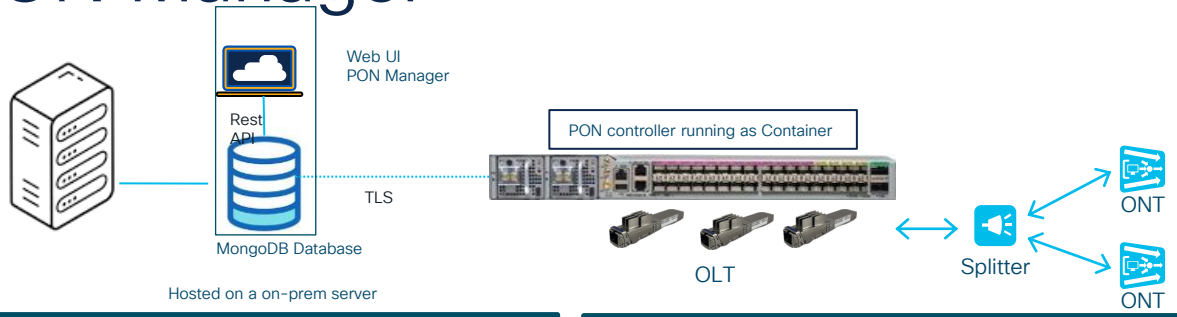
Quick Facts	
Dimension(H x W x D)	8.55mm x 13.4mm x 80.65mm
PID	SFP-10G-OLT20-X
Data rate	Symmetric rates: 9.95G upstream/9.95G downstream
Connector Type	SC/UPC
Maximum Distance	20 km
Operating Temperature	-20° C to 75° C
Typical Power Consumption	2.475W
Cable Type	Single Mode Fiber
ODN Class	N2

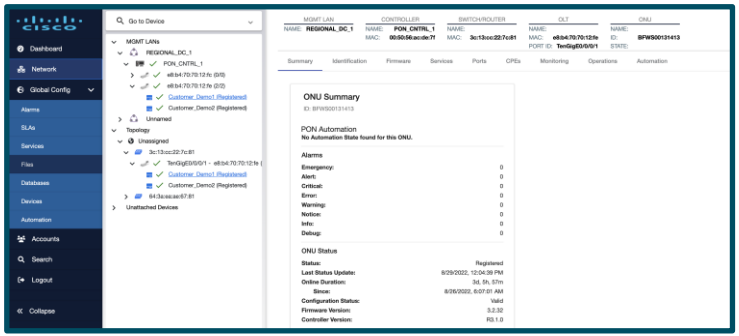
Cisco PON Controller

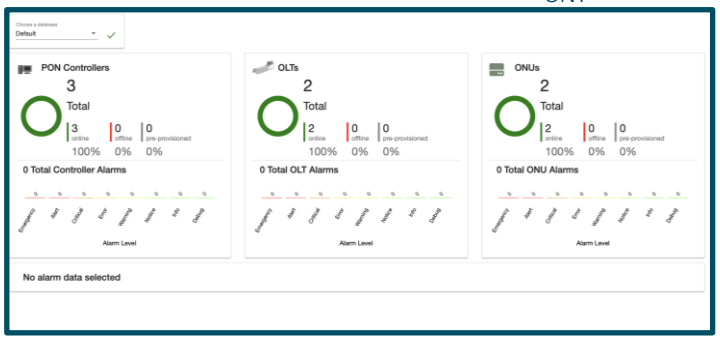


- Lightweight application (without storage) running as a docker container on the router
- A single controller can serve several ONUs
- Moves configuration from Database to PON devices
- Moves state/status/statistics from PON devices to Database

Cisco PON Manager







Provisioning and Management

Automatically configure and provision device and service

Monitoring and Diagnostics

Device monitoring and statistics

Diagnosis and Troubleshooting

Service Configuration

Service configuration, including VLANs, Service Level Agreements (SLAs), 802.1X

Authentication, DHCP Relay, and PPPoE

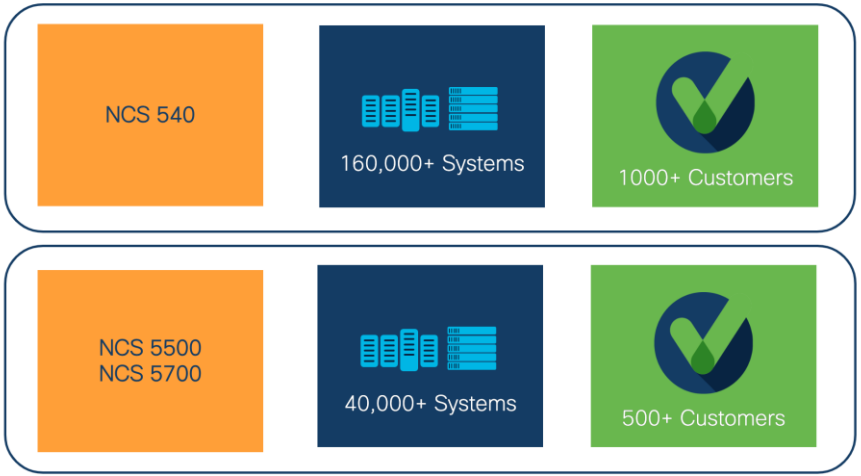
Platform Support

NCS 540

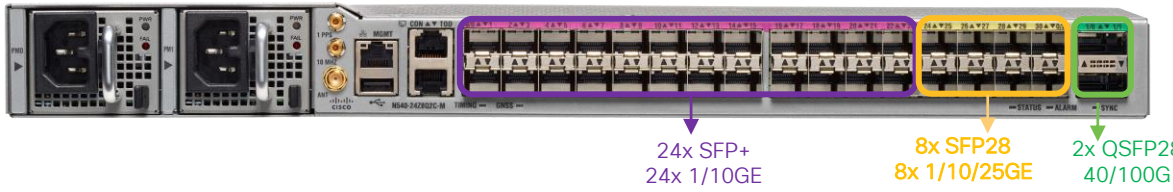
- N540-24Z8Q2C-SYS, N540-ACC-SYS
- N540-24Q8L2DD-SYS
- N540X-16Z4G8Q2C-D/A
- N540-28Z4C-SYS-D/A

NCS 5500/5700

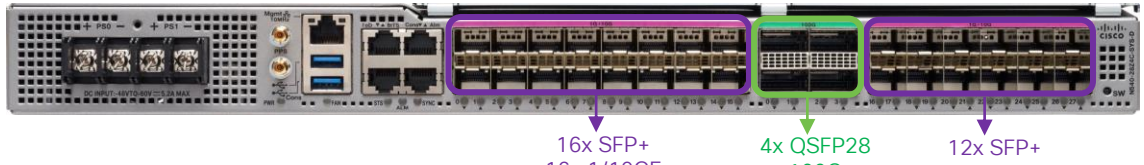
- NCS-55A2-MOD-S
- NCS-57C1-48Q6D
- NCS-55A1-24Q6H-SS



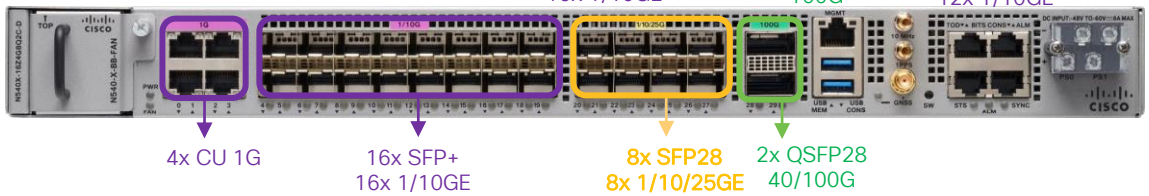
Cisco NCS 540



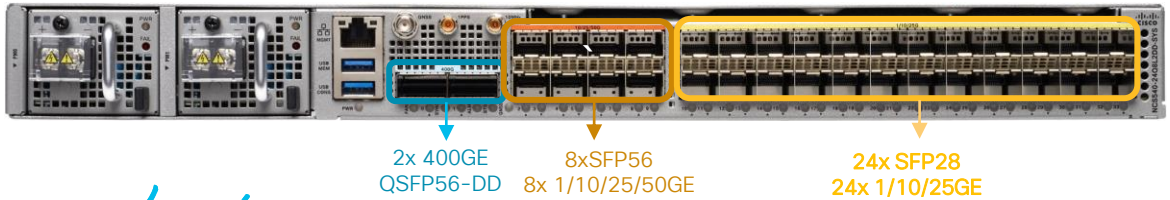
N540-24Z8Q2C-SYS
/N540-ACC-SYS



N540-28Z4C-SYS-D/A

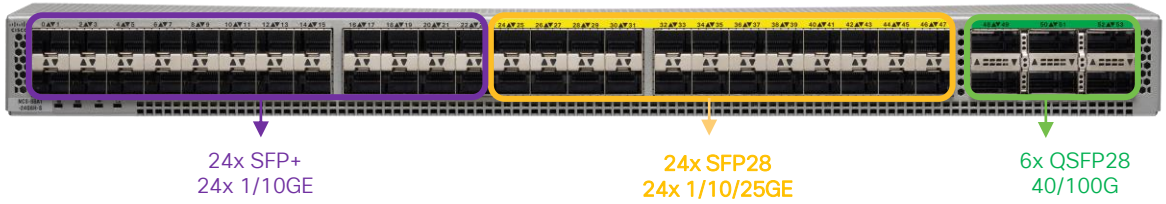


N540X-16Z4G8Q2C-D/A

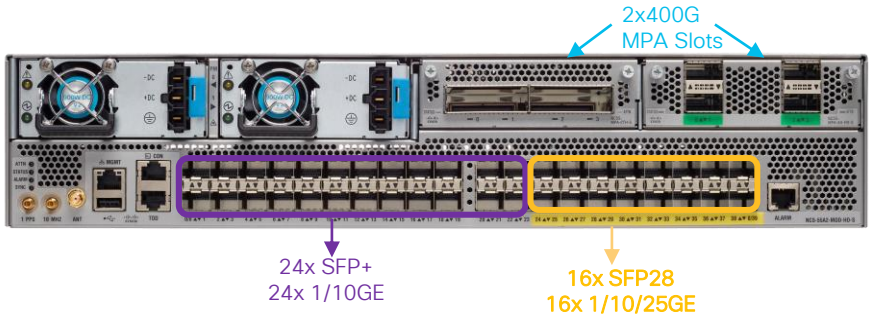


N540-24Q8L2DD-SYS

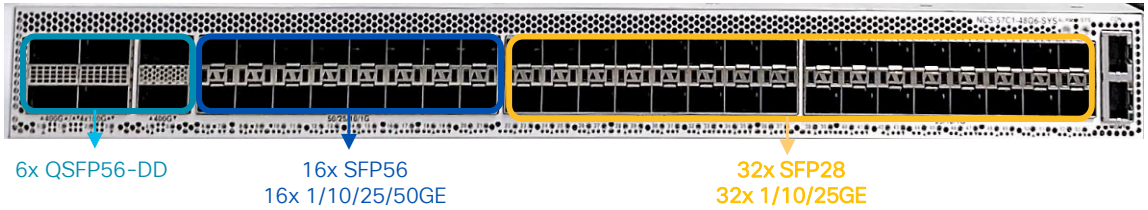
Cisco NCS 5500/5700



NCS-55A1-24Q6H-SS

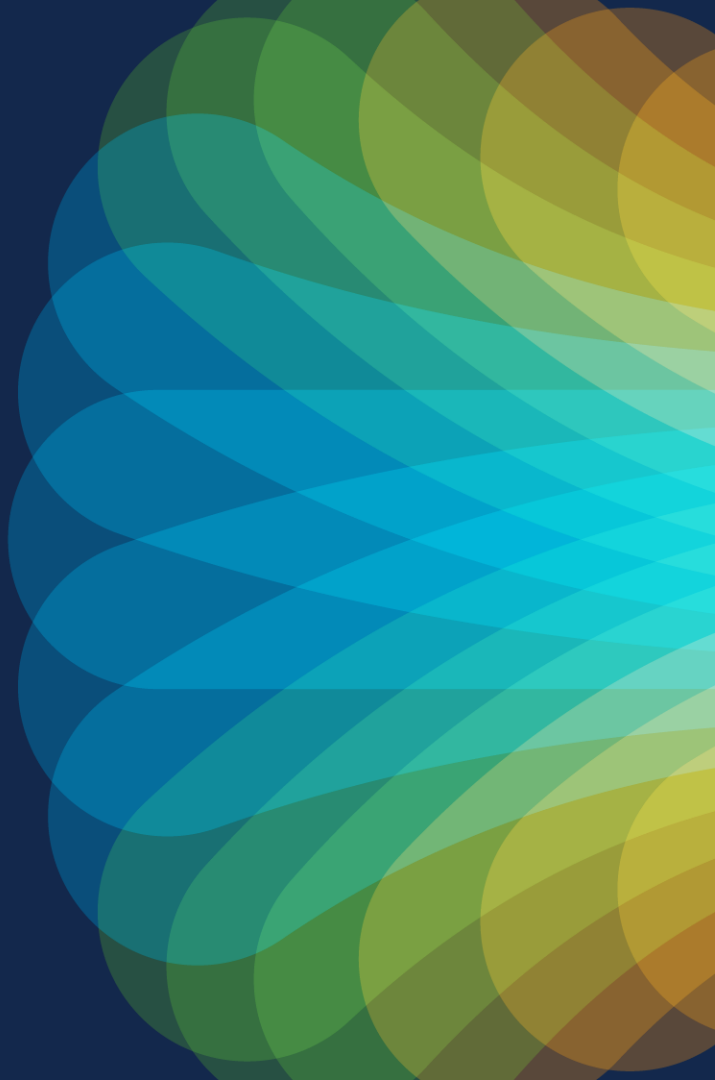


NCS-55A2-MOD-S

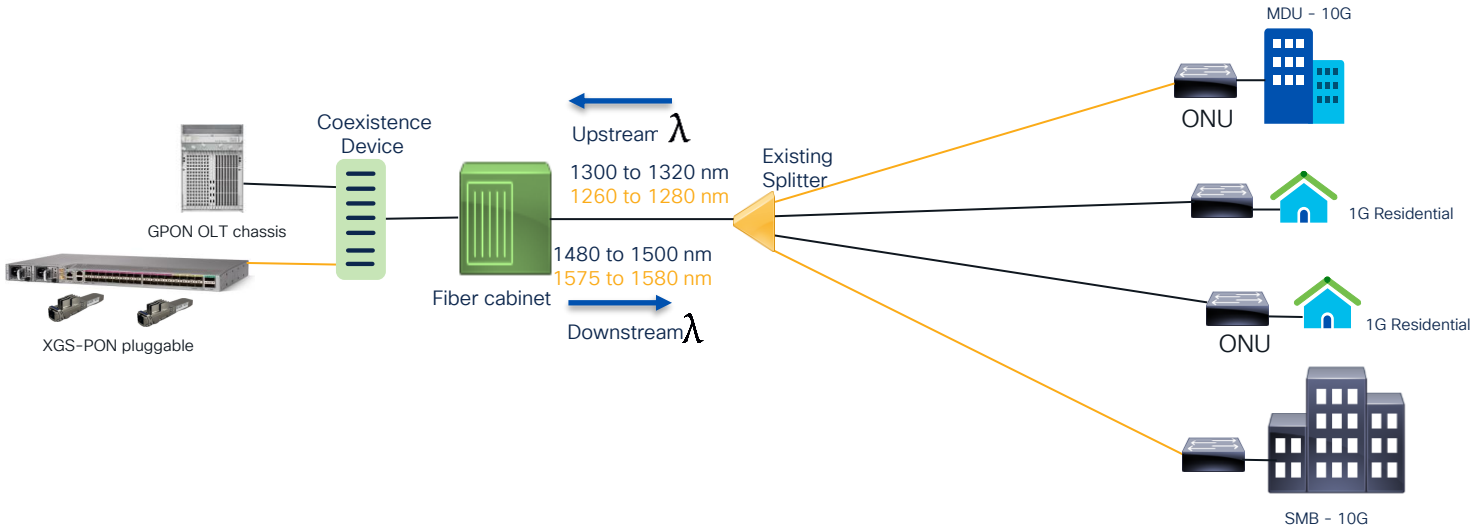


NCS-57C1-48Q6D

Coexistence with earlier generations of PON



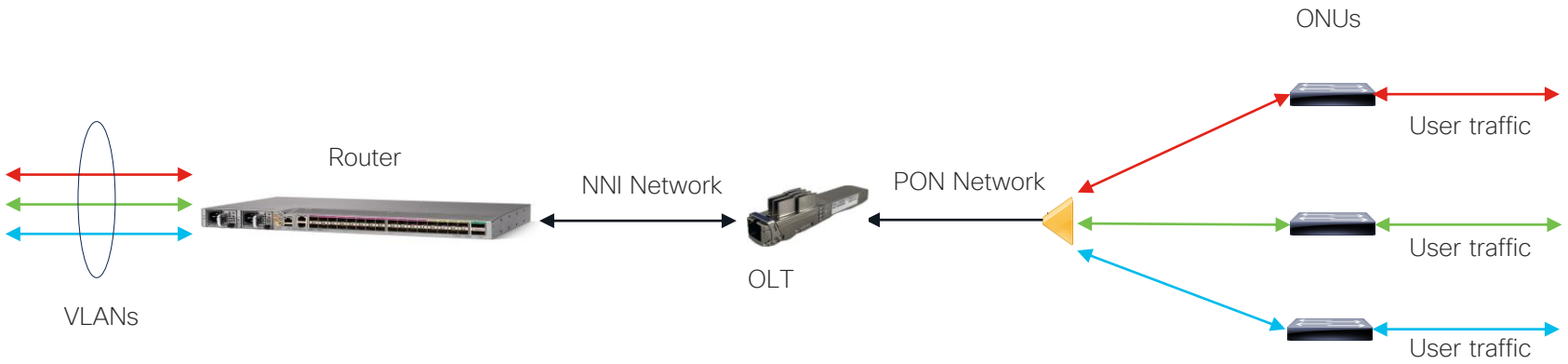
XGS-PON + GPON



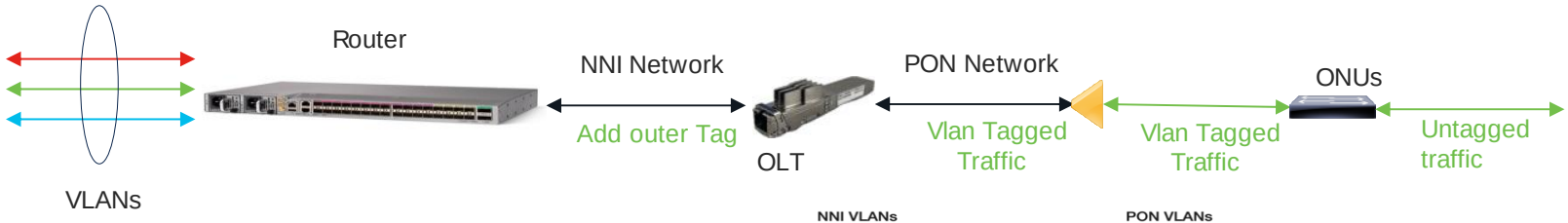
- PHY layer of XGS-PON is based on existing specs operating in the same optical window
- Wide range optical splitters exists which facilitates fiber splitting
- PHY compatible Transmission Convergence (TC) layer allows co-existence of XGS-PON with GPON
- Both technologies use different wavelengths in the ODN

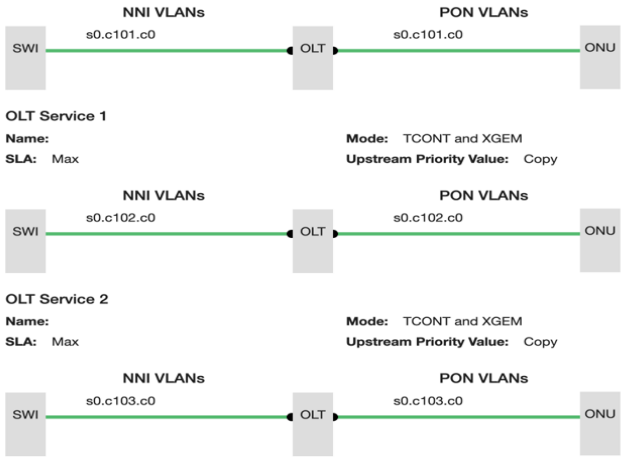
Demonstration

A Simple PON Network

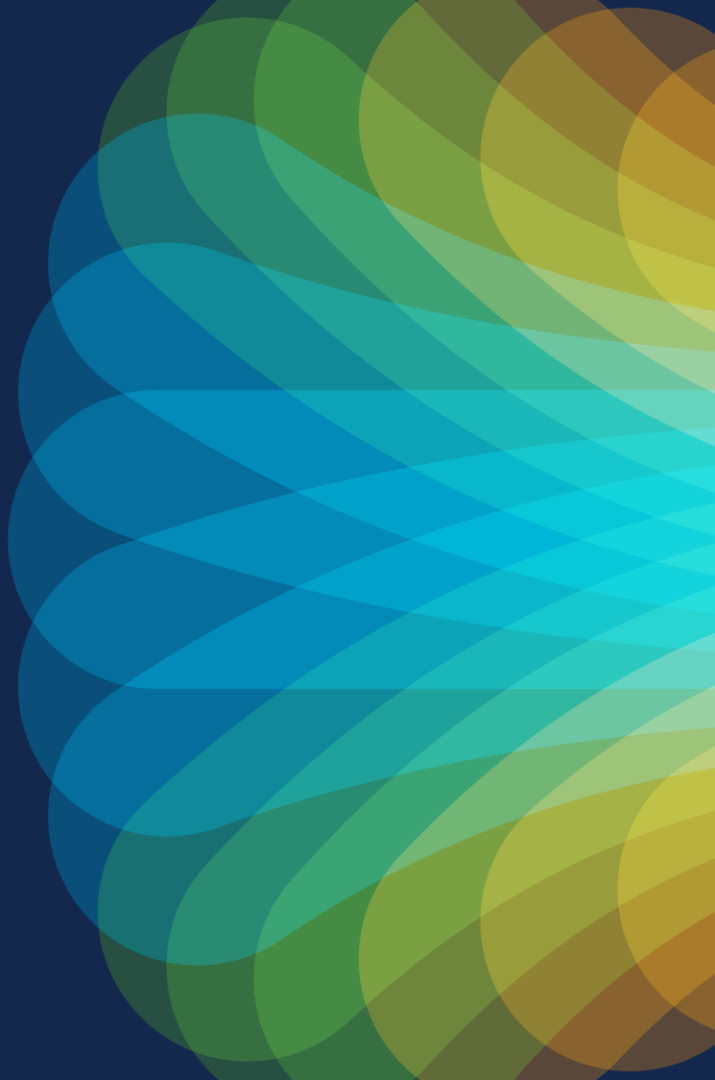


Triple Play Service Configurations

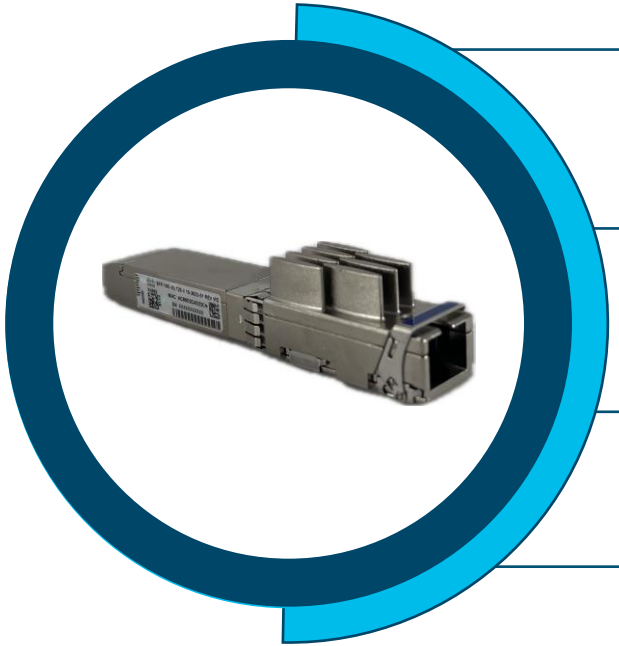




Summary



Transform the economics with Cisco Routed PON



Flexibility

Overlay onto an existing optical distribution network with GPON, with support for ITU-T and a roadmap to 25G/50G-PON. Interop with multiple 3rd party ONTs and avoid vendor lock-in

Investment protection

Grow your network on a port-by-port basis instead of incrementally adding fixed line cards on a chassis-based OLT, ensuring a more effective use of capital

Opex savings, sustainability gains

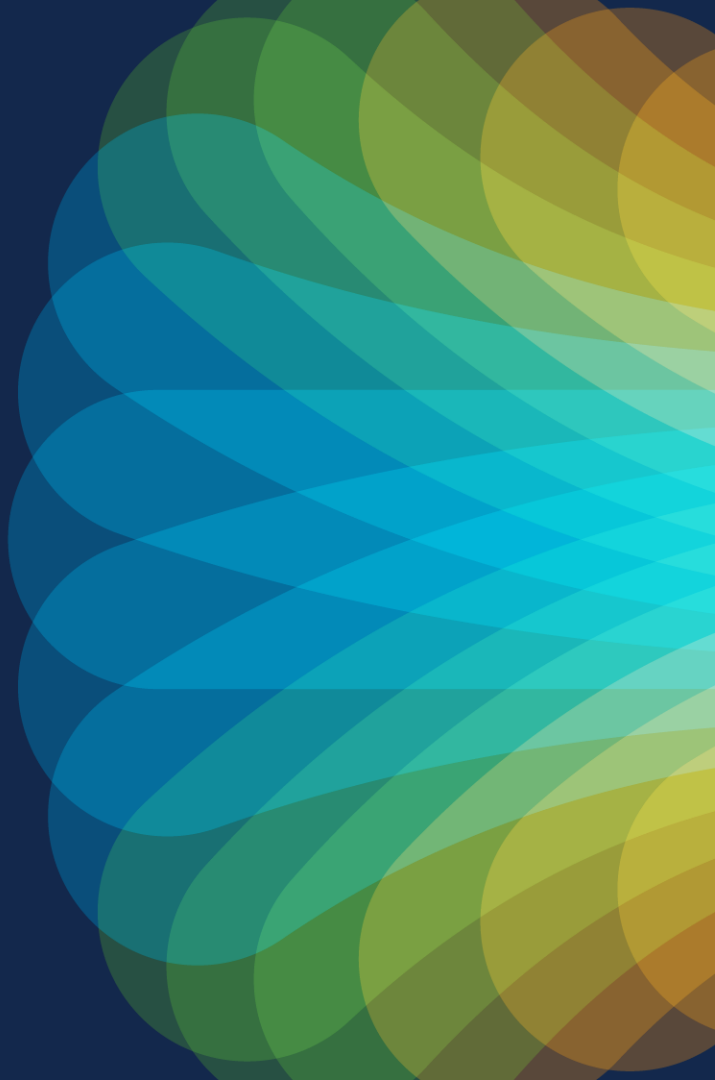
Decrease space and power requirements as a traditional chassis-based OLT is reduced to a pluggable optic

Converged Architecture

Simplify the network with pluggable form factor OLTs and Cisco NCS540/5500/5700 for unified transport and deliver next gen broadband services with MEF compliance

The bridge to possible

Thank you



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