

Cisco Routed Optical Networking

What are Sustainable Network Architectures?

Tomorrow's network is a simpler and more efficient architecture

- Eliminate transponder
- Fewer devices means:
 - Less power use (up to 71% more power efficient)
 - Greater network reliability (up to 71% increase in service assurance process efficiencies)
 - Less product maintenance reduces environmental impacts due to fewer truck rolls
 - Faster to deploy, lowering resource utilization
- Easier to manage (up to 87% faster to perform move and add changes), minimizing resource needs^{1, 2}
- Maximizes wavelength/fiber capacity
- Compared to today's typical network, a Routed Optical Network delivers 35% CapEx reduction and 57% OpEx reduction for a total TCO savings of 46%. Customer savings on space and power (overall footprint) have been ~80%³

Goals and Highlights

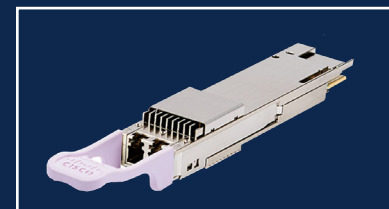
The rise of sustainable infrastructure

Seamless integration of complex network infrastructure and services to accelerate the transformation needed for environmental sustainability.

Routed Optical Networking is an evolution of separate IP and optical-based networks to a single converged infrastructure with coherent pluggables inside routers.

Smaller form factor in QSFP-DD

400G QSFP-DD ZR/ZR+/BZR+



Optimized end state

Fully converged services in the IP layer over a simplified DWDM network with a single control plane.

Cisco Routed Optical Networking Building Blocks

Cisco 8000 Series

Massive scale, cloud-enhanced routers, compact form factors for high efficiencies. Based on the breakthrough Silicon One ASIC.

Coherent Pluggable Optics

Reduced power consumption with silicon photonics technology. Leverages standard line cards for optimized equipment reuse.

NCS 1000 and NCS 2000 Series

Optical Networking delivering next-generation network convergence with high capacity transponders and open optical line systems.

Crosswork Network Automation

Unified workflow efficiencies accelerate services lifecycle management and operations.

Saves on emissions by reducing truck rolls and field intervention. Maximizes usage of network capacity through advanced modeling, planning and traffic engineering.

Learn more

Visit [Environmental compliance](#)

[Cisco ESG Reporting Hub](#)

(cisco.com/c/m/en_us/about/csr/esg-hub/environment/environmental-compliance.html) for Certification and Compliance.

Sustainability: Fewer devices

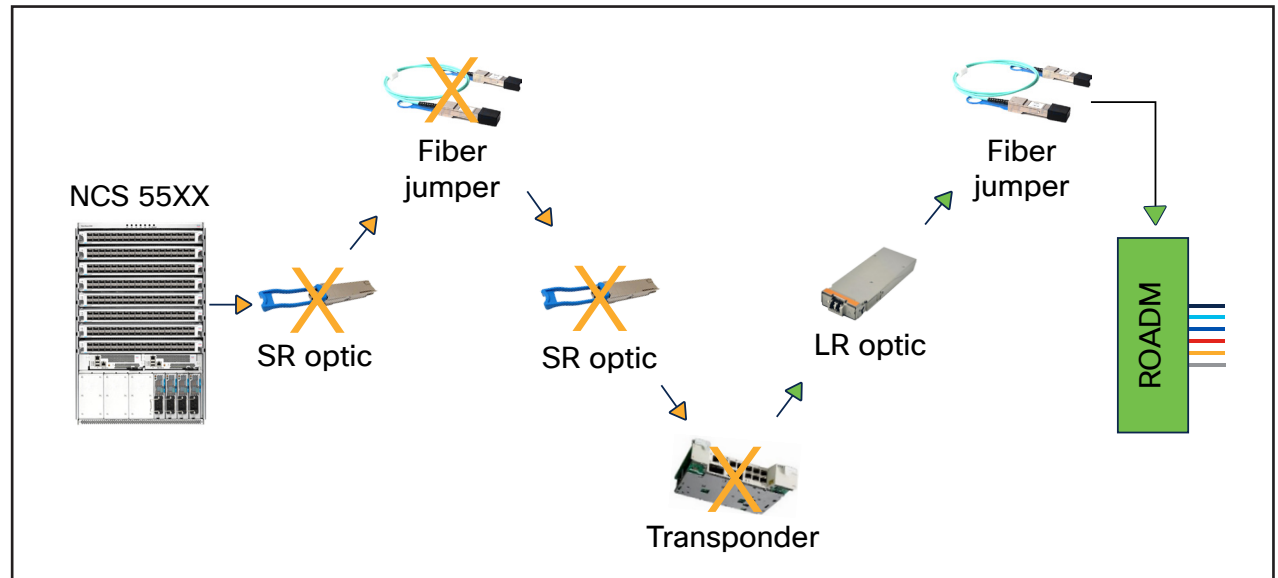


Figure 1. The transformation to simplified and sustainable networks

Solution level

A Routed Optical Networking architecture is pioneering the transformation to simplicity and sustainability.

- Routed Optical Networking increases capacity and reduces power utilization with fewer wavelengths.
- Simplified and efficient network and services lifecycle management covering planning, design, implementation, monitoring optimization and assurance. See the metrics on cost savings and other business benefits from automating converged transport networks from this whitepaper (cisco.com/c/dam/en/us/products/collateral/cloud-systems-management/crosswork-network-automation/white-paper-sp-appledore-hierarchical-controller.pdf)
- Delivers better availability, higher link utilization, increased service availability, and faster restoration of impacted services, making the solution more sustainable.
- Impact: Fewer truck rolls, less packaging, recycling, and lower carbon footprint as a result.

Component level



Transitioning from separate dynamic and static random-access memory modules to on-package high-bandwidth memory systems for reduced energy and power consumption.



Advancements in optics and silicon enable the Routed Optical Networking architecture to deliver higher utilization of wavelengths, thus decreasing the number of wavelengths needed.



Fan speed control algorithms based on component temperature and altitude sensors prevent fans from using more energy than necessary.



New ASICs that provide additional efficiencies by improving the design and reducing the node size to lessen the amount of power the ASIC uses.



80 Plus Platinum or Titanium power supplies.



Intelligent power management features to power only those functions needed at any given time.

CMOS manufacturing

Highly efficient 7-nm manufacturing process supporting increased traffic with reduced power consumption.



NCS 5700 Series

High density, with systems delivering lower power consumption.

ASR 9000 Series

Optimized to balance performance with a 100x capacity increase and a 96% power reduction per Gbps.

Private Line Emulation

Enables private line services to be carried over the IP network for non-Ethernet type services like SONET/SDH and Fibre Channel.

IOS XR

Optimized for maximizing resource utilization.

Reduces operational complexity via a simplified networking stack as well as proactive operations and cloud-enhanced automation.

Power efficiency

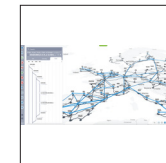
Optimized for less space/power per bit. Has the benefits of zero port density trade-offs, reducing waste.



Operations

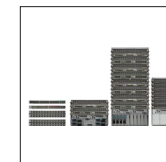
Solution leverages unified planning and service orchestration across both IP and Optical layers. Leaner operations with unified software tooling, automated workflows, and more agile organization.

Crosswork network automation



Backward compatibility

Platforms with QSFP-DD ports allow customers to buy the latest platforms with the latest features while managing their migration over time on a per port basis and reducing waste.



Cisco Approach

Product design



Products are designed with easily separable components that use similar materials to facilitate reuse, repair, remanufacturing, and recycling

Smart energy consumption



Routed Optical Networking provides more than 60% power efficiency gains than traditional layered networks⁴

Optimized procurement and utilization



Cisco Flexible Consumption Models deliver better utilization of resources, eliminating waste



Cisco Smart Licensing for a consistent and sustainable purchasing lifecycle

Circular: Reuse, repurpose, recycle



Cisco Takeback and Reuse is helping address the challenge to reduce waste in our industry's environmental footprint



Cisco Refresh (remanufacturing equipment) for increased product lifecycle

Packaging



Cisco is reducing, and where possible, eliminating, foam and plastics in our packaging. Leveraging fiber-based designs and focusing on increasing packaging efficiency with more recycling options, we have set a goal of 100% for new Cisco products and packaging to incorporate Circular Design Principles by our fiscal year 2025.

¹ The Business Benefits of Automation and Orchestration White Paper: [cisco.com/c/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/white-paper-c11-738289.html](https://www.cisco.com/c/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/white-paper-c11-738289.html)

² Understanding the value of modern end-to-end IP/MPLS transport networks: [cisco.com/c/en/us/products/collateral/routed-optical-networking/routed-optical-networking-wp.pdf](https://www.cisco.com/c/en/us/products/collateral/routed-optical-networking/routed-optical-networking-wp.pdf)

³ ACG Research: The Economic Benefits of IP Transport at 400G: [cisco.com/c/dam/en/us/solutions/collateral/service-provider/routed-optical-networking/white-paper-sp-acg-400g-ip-transport.pdf](https://www.cisco.com/c/dam/en/us/solutions/collateral/service-provider/routed-optical-networking/white-paper-sp-acg-400g-ip-transport.pdf)

⁴ The Business Benefits of Automation and Orchestration White Paper: [cisco.com/c/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/white-paper-c11-738289.html](https://www.cisco.com/c/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/white-paper-c11-738289.html)



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