Sustainable 400G Data Center Networking

Cisco Knowledge Network

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Agenda

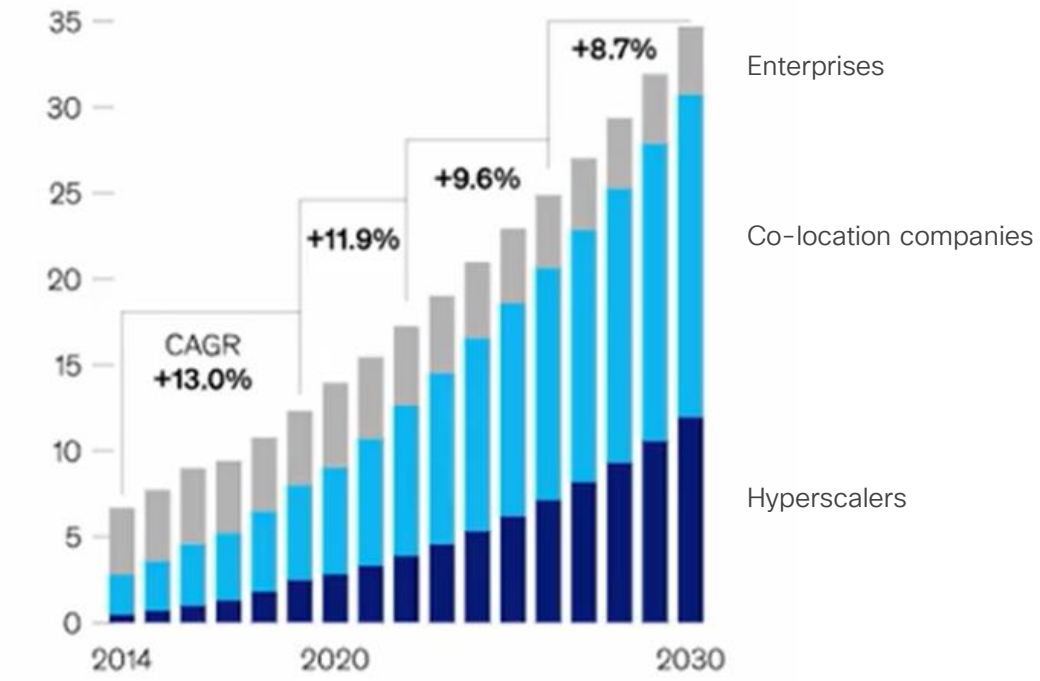
- Why sustainability?
- Technology enablers
- Nexus platform evolution
- Rack space design
- Summary

Why Sustainability?

Demand for data center power and speed

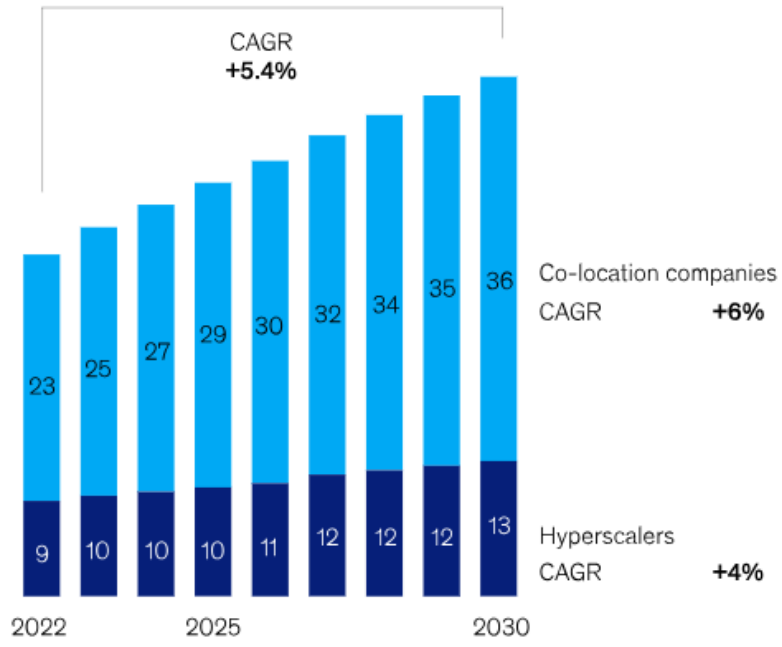
US data center power demand forecast to grow 10% a year through 2030

Data Center Power Consumption by Providers/Enterprises (gigawatts)



Global spend on data center construction to reach $49B by 2030

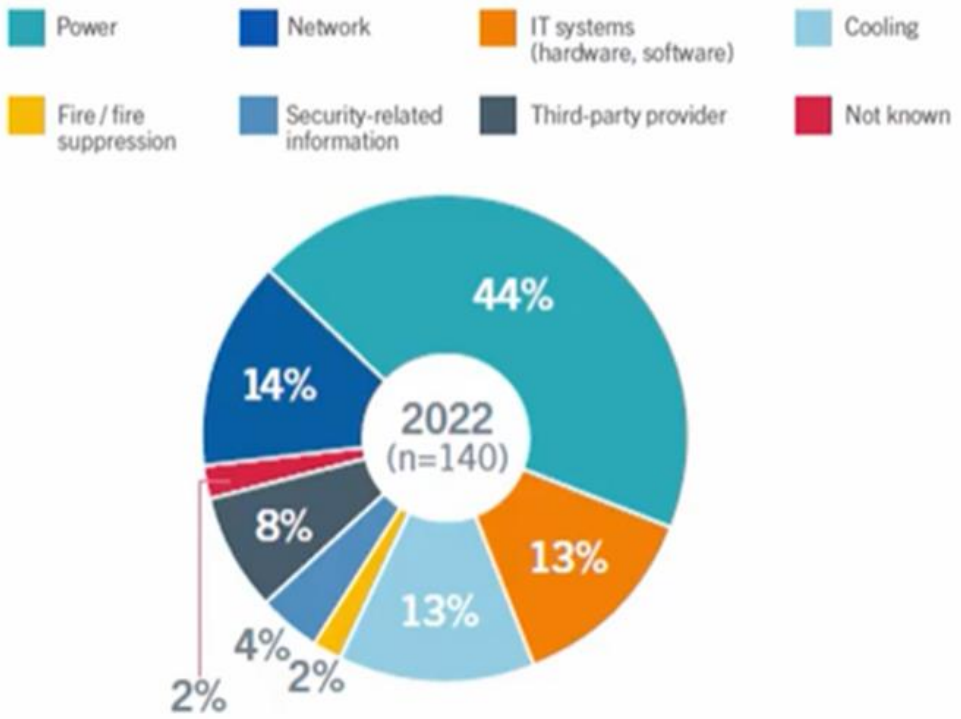
Data Center Construction Spending (Billions)



Source: Investing in the Rising Data Center Economy. Mckinsey & Company

Data center uptime and sustainability priorities

Power accounts for 44% of data center outages

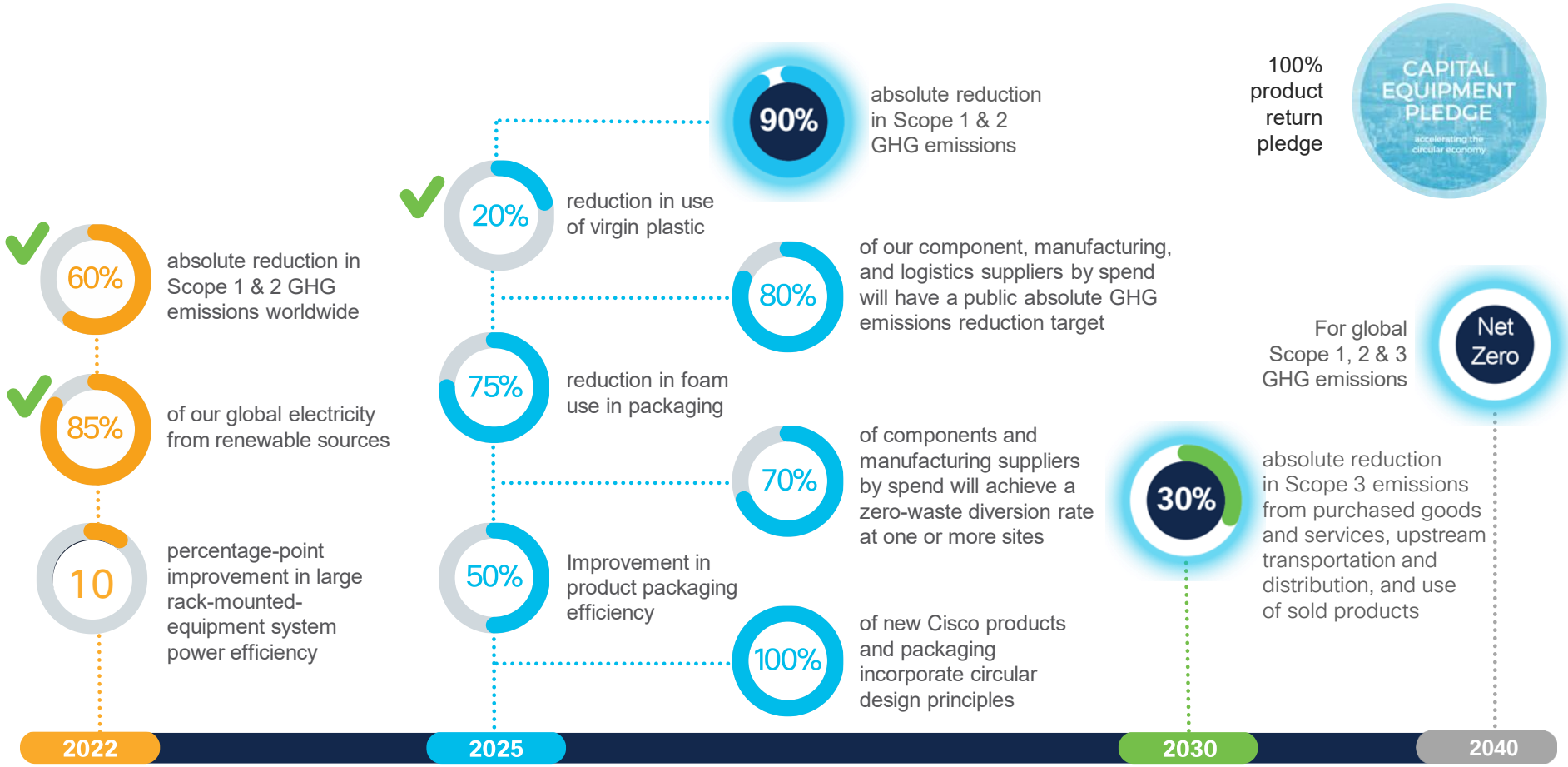


Source: 2023 Outage Analysis Report. Uptime Institute

Ranked benefits of data center sustainability programs

Source: Unlock the business benefits of sustainable IT infrastructure, Gartner May 2023

Cisco public sustainability commitments



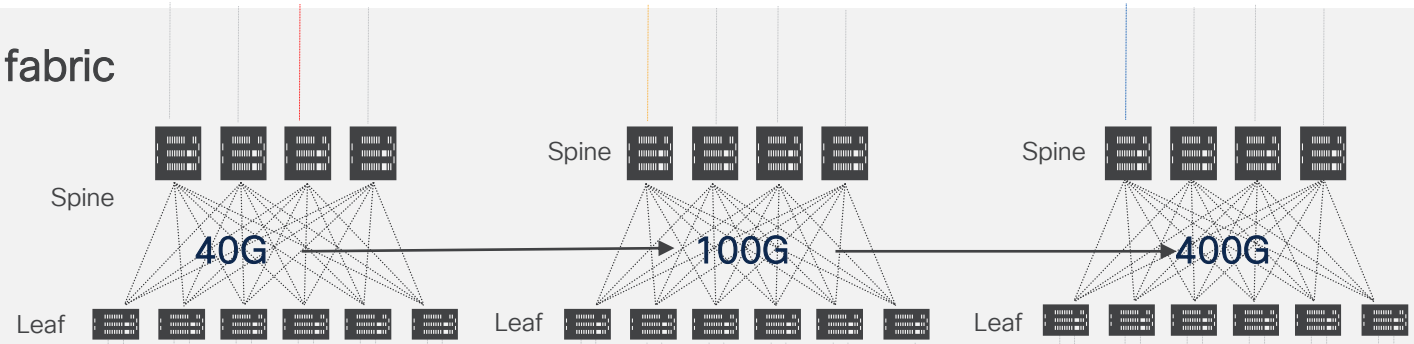
Technology Enablers of Improved Sustainability in the Data Center

Speed evolution in the data center

Inter-Data Center

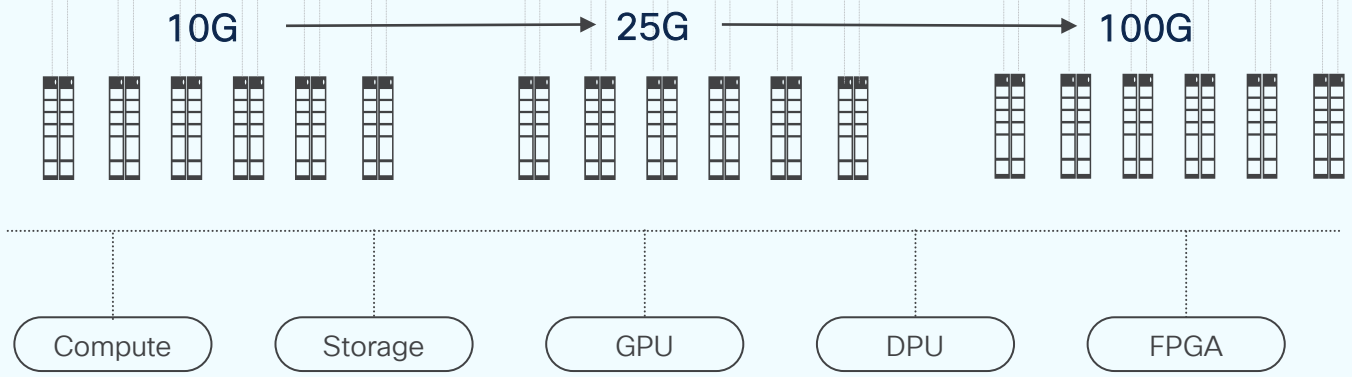
- Transitioning to pluggable DCI (DWDM coherent)
- Open Line System

Switch fabric



- Switch silicon bandwidth growing due to higher Radix and faster Serdes speeds
- Switch ASIC throughput growing: 6.4 Tbps to 12.8 Tbps to 25.6 Tbps to 51.2 Tbps (future)
- Optics increasing from 40Gbps to 100G Gbps to 400Gbps to 800Gbps

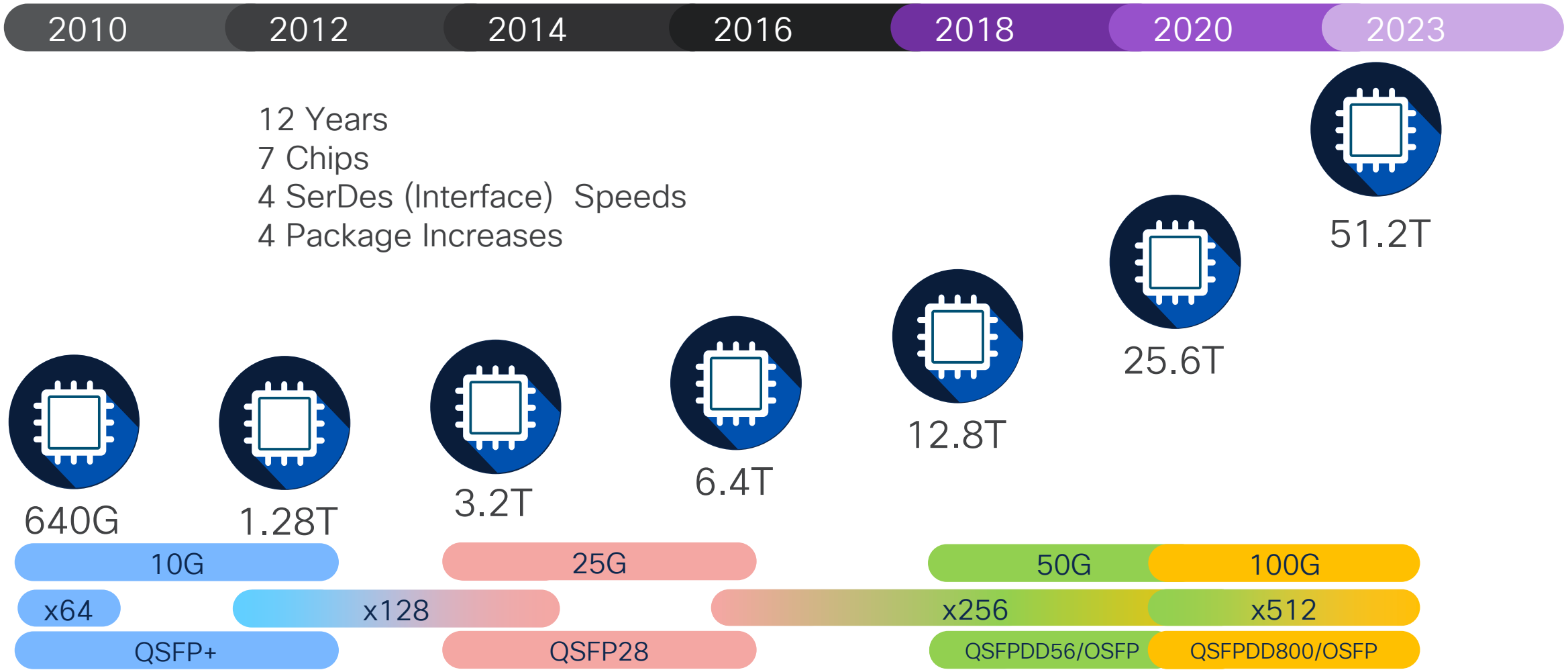
Access



- Server network connectivity evolves with server processor upgrade cycles as data center traffic grows
- Server port speed is transitioning from 1/10 Gbps to 25 Gbps to 100 Gbps
- Storage, GPU, DPU, FPGA driving connectivity bandwidth, PCIe speed increase

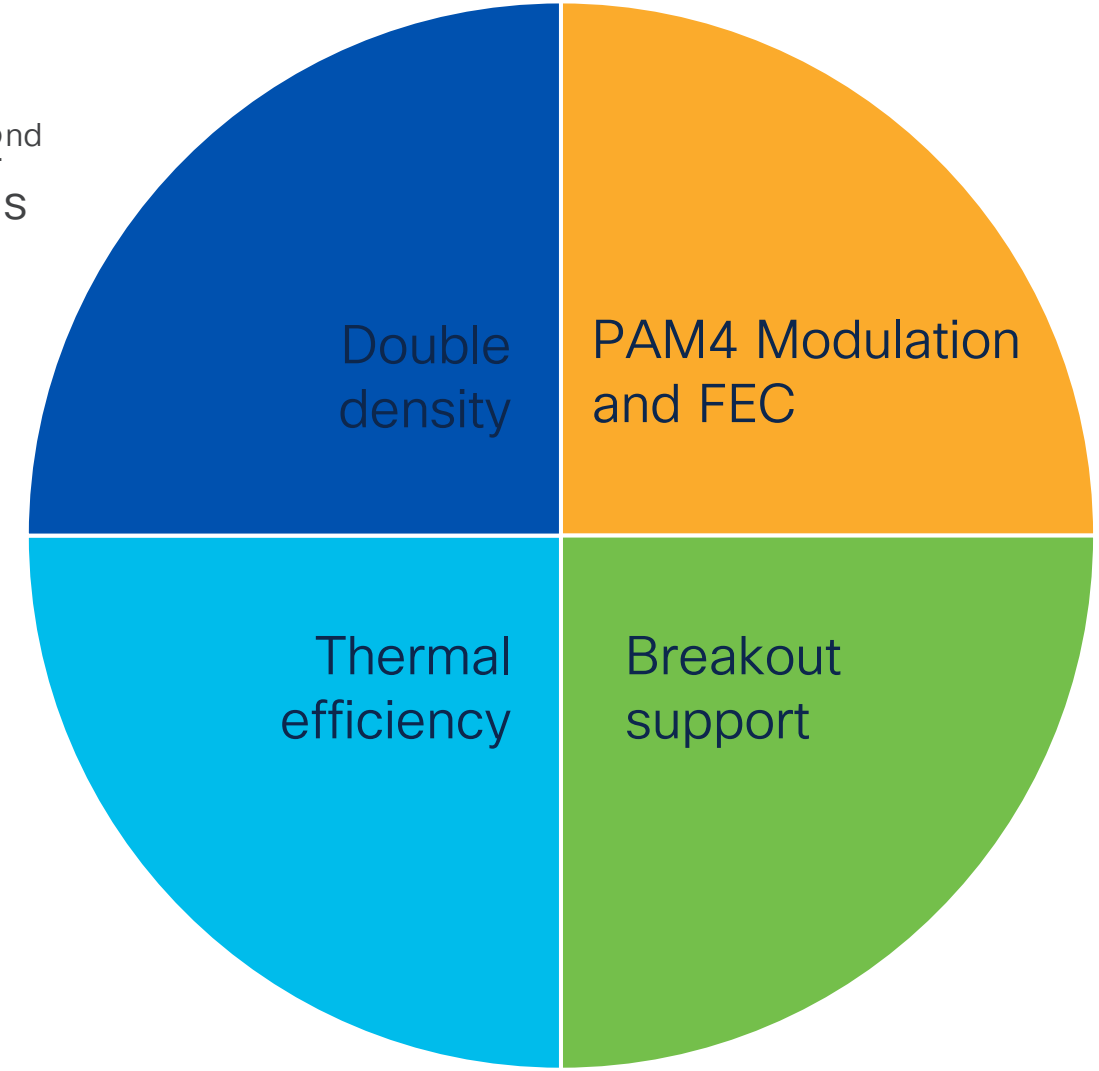
Increasing ASIC capacity drives higher efficiencies

Improving power/watt



QSFP-DD innovations for 400G efficiencies

Same faceplate with 2nd row of pins. Backwards compatibility with QSFP+, QSFP28, and QSFP56

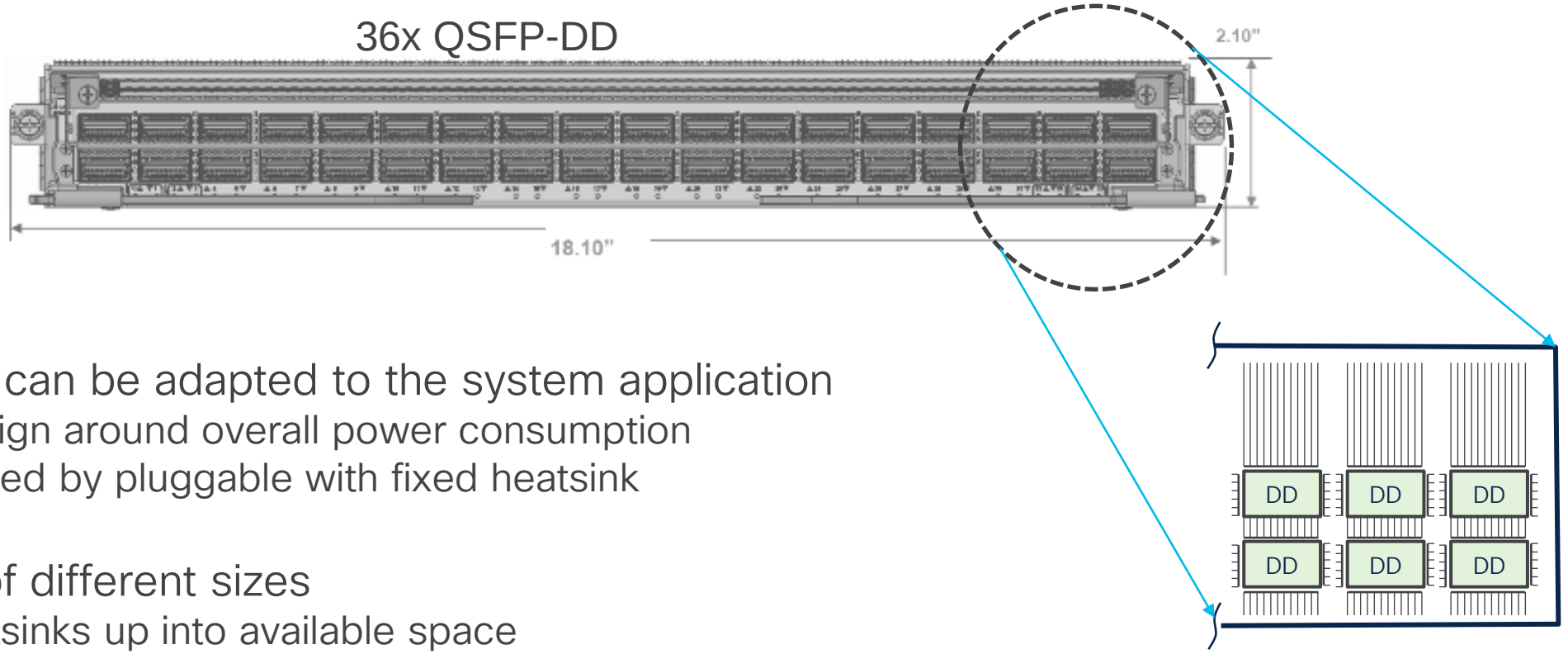


Higher speed interfaces adopted PAM4 modulation. Ubiquitous use of FEC.

Support for coherent modules with over 25w of power dissipation in riding heatsink on platform

Connect to multiple lower speed interfaces

System design optimization for higher power dissipation
QSFP-DD riding heatsink

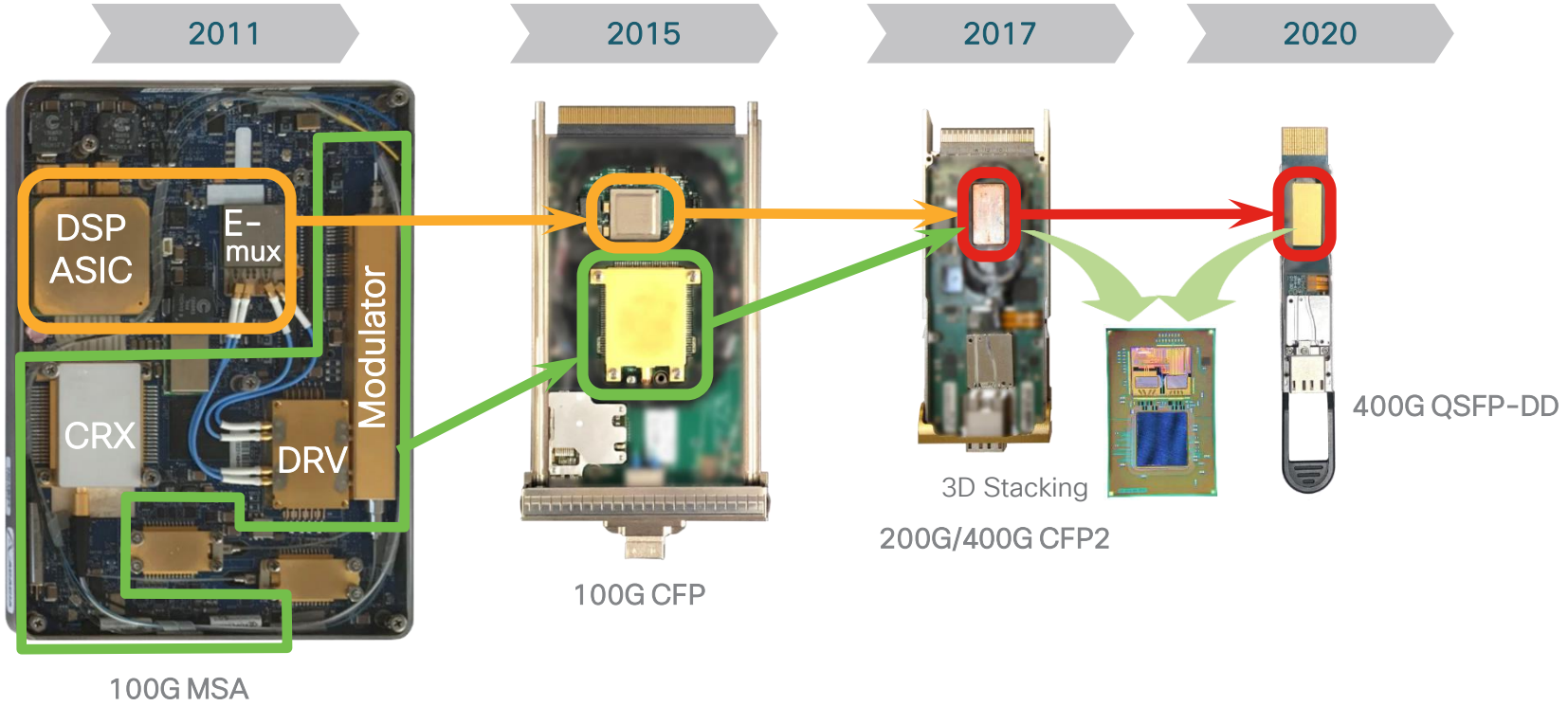


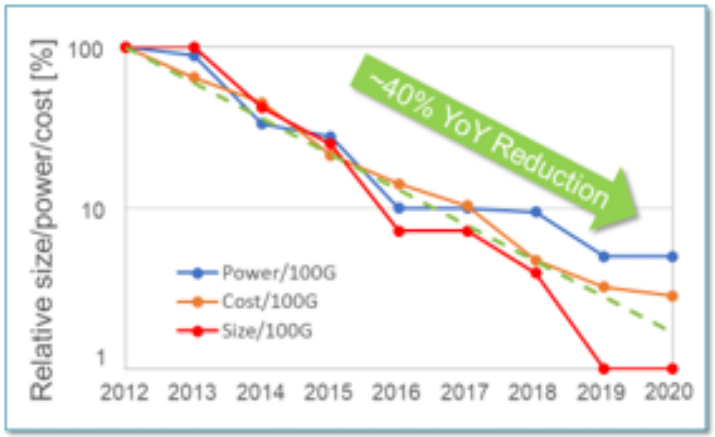
- Thermal design can be adapted to the system application
  - Optimize design around overall power consumption
  - Not constrained by pluggable with fixed heatsink

- Add heatsinks of different sizes
  - Extend heatsinks up into available space
  - High-power row, low-power row

Reducing power, size, and cost with increased integration

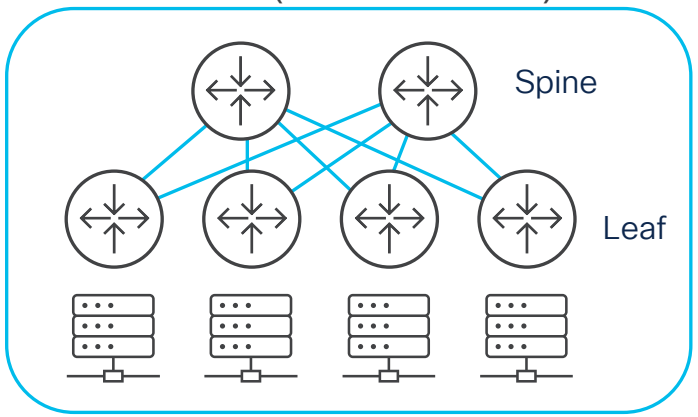
400G coherent optics and silicon photonics





Increase sustainability with high density 400GbE systems

25.6T user capacity using multiple switches with 12.8T ASICs (32x 400 GbE)



50 Gb/s ASIC IO (SerDes)
32 ports of 400GbE
(128 ports of 100 GbE)

~3000 Watts
26,280 kWh/year

25.6T user capacity using single switch with 25.6T ASIC (32x 800G)

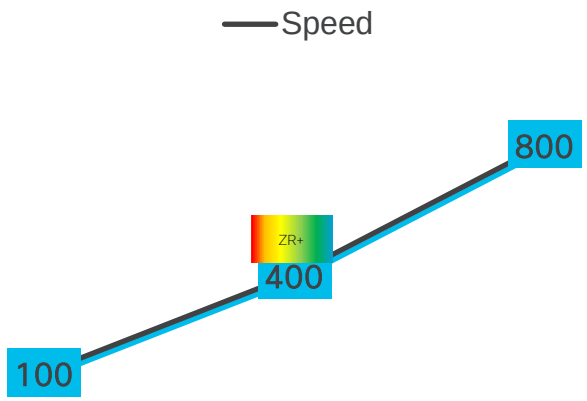
100 Gb/s ASIC IO (SerDes)
32 ports of 800G
(64 ports of 400 GbE
256ports of 100 GbE)

~400 Watts
3,504 kWh/year

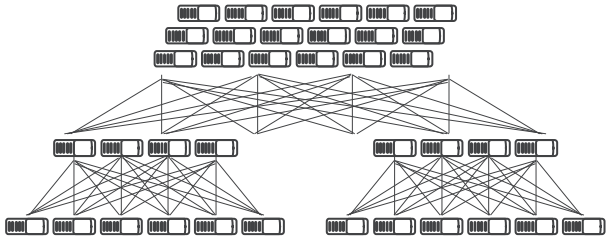
Up to 87%
Energy Savings

83% less space/fans

Increase sustainability with 400G data center fabric



High Scale Leaf/Spine based Designs



Common network architecture between 100G, 400G and 800G

- Same physical port densities, same media reaches
- Continued investment in fiber plant – SM & MM fiber

Flexibility to adopt 400G breakout for high radix 100 GbE design

- Connectivity to 100 GbE equipment

Design flexibility (Switch Platform)

- High bandwidth, high port density platform flexibility w/ fixed, modular
- Link bandwidth distribution
- Port flexibility – non-coherent / coherent use cases, and mixed data rates
- Cabling flexibility

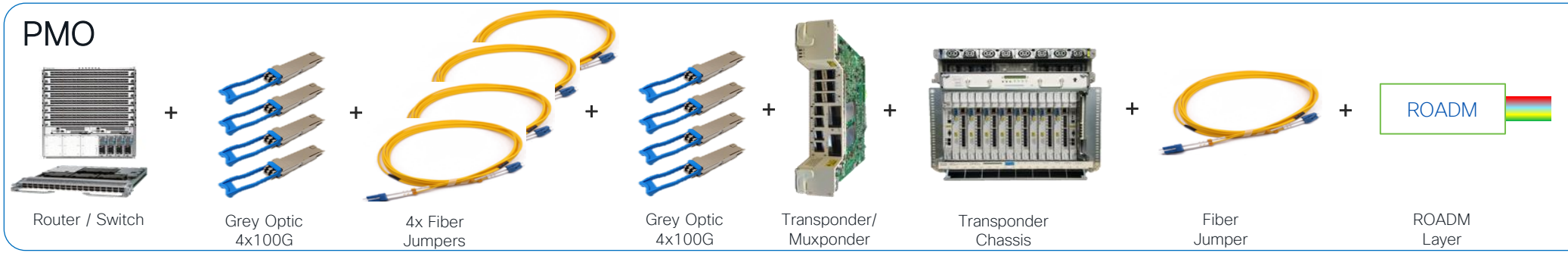
Backward and forward compatibility (QSFP, QD-DD)

- 40G, 100G, 400G, 800G

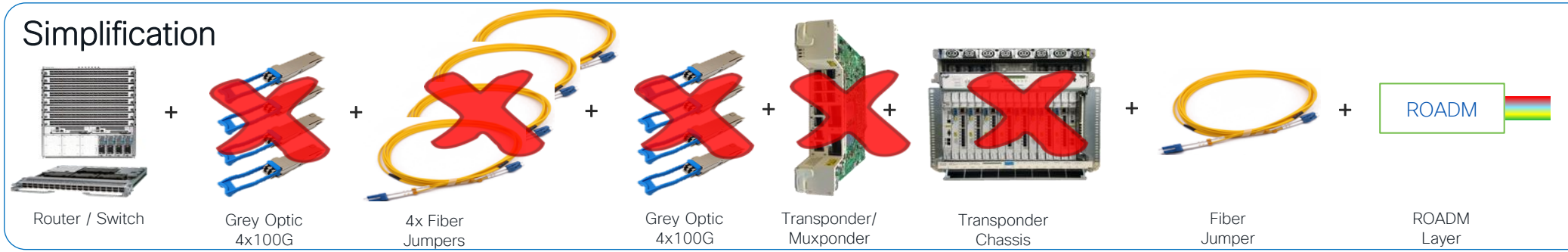
Increase sustainability with 400G data center interconnect

Simplification, savings and sustainability

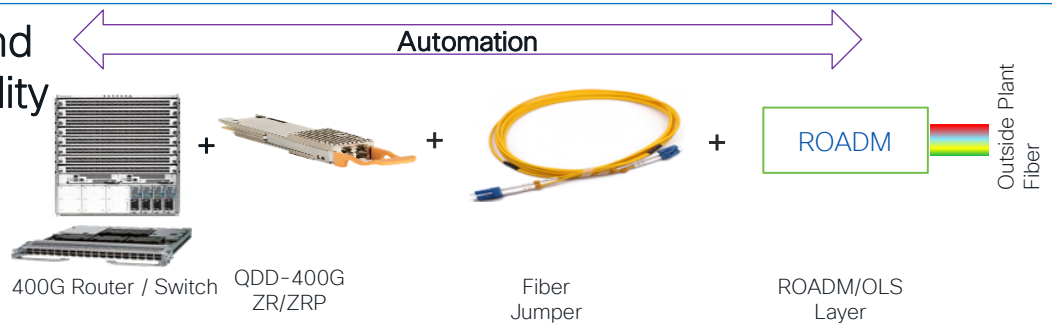
PMO



Simplification



Savings and Sustainability

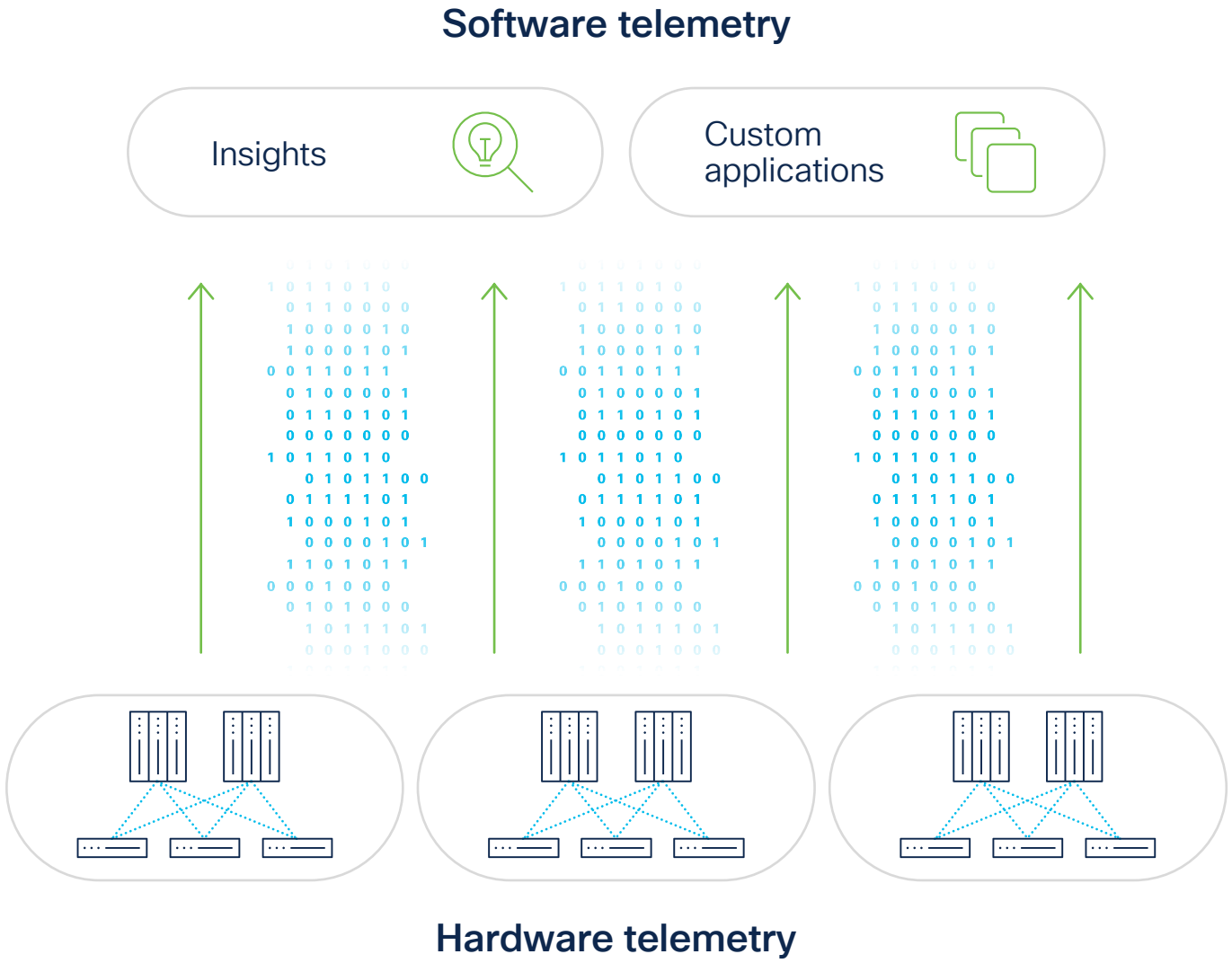


Routed Optical Networking Benefits

- Over 66% in Cost Optimization
- Up to 90% in Power Savings
- 100% TXP Shelf Reduction

Improve Sustainability with Nexus Platform Evolution

It starts with **telemetry**



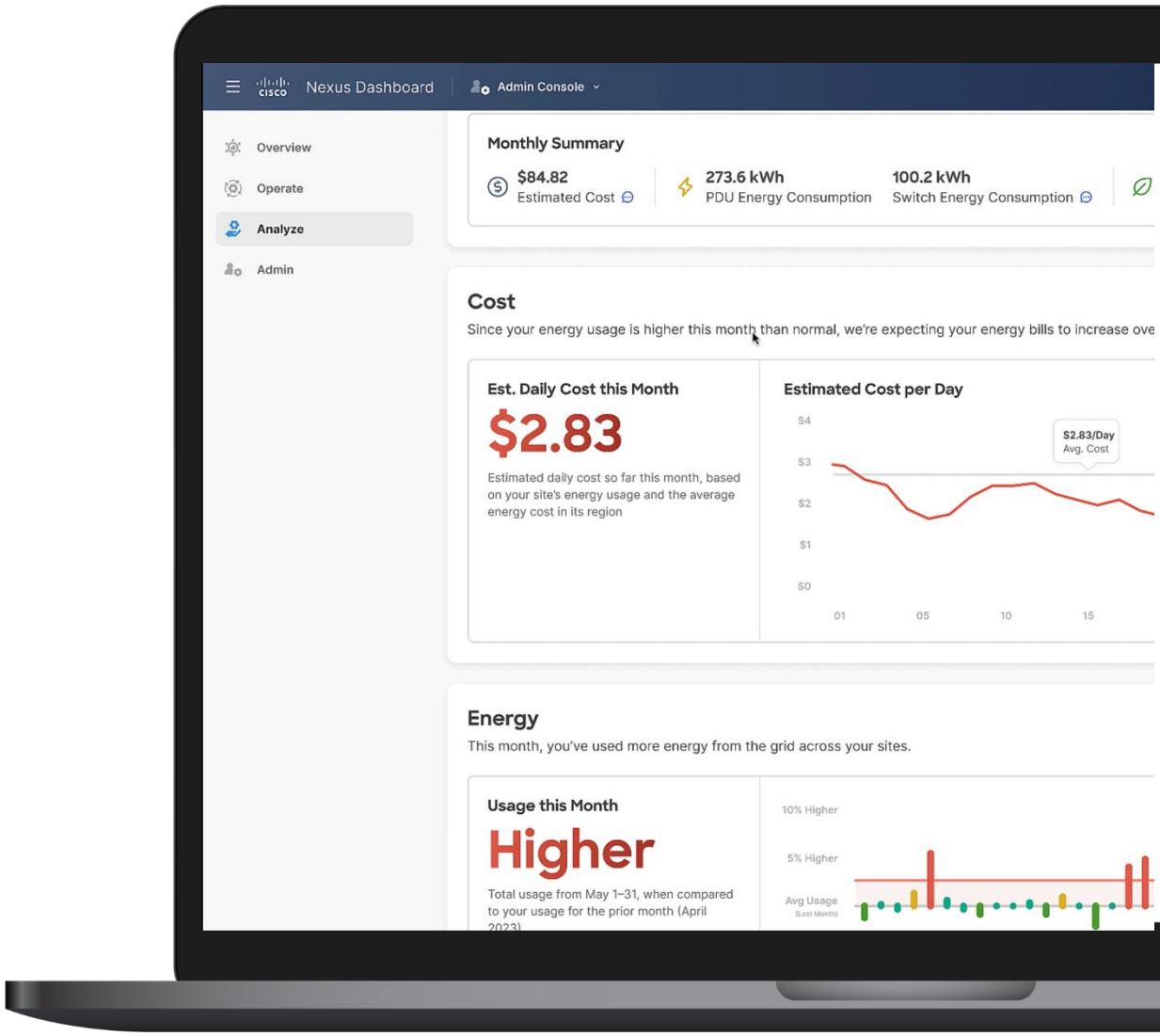
It continues with **visibility**

Visibility into network energy consumption and cost

Understand **carbon footprint (GHG)** of managed devices

Key sustainability metrics, Top impacting devices

Green path determination (future)



Cisco Nexus 9800 series

Performance, flexibility and efficiency

8-slot shipping

4-slot mid CY23

12.8 Tbps per slot | 36 400G ports per slot

New PSUs
Higher efficiency, improved single-feed power

Heat sink innovation

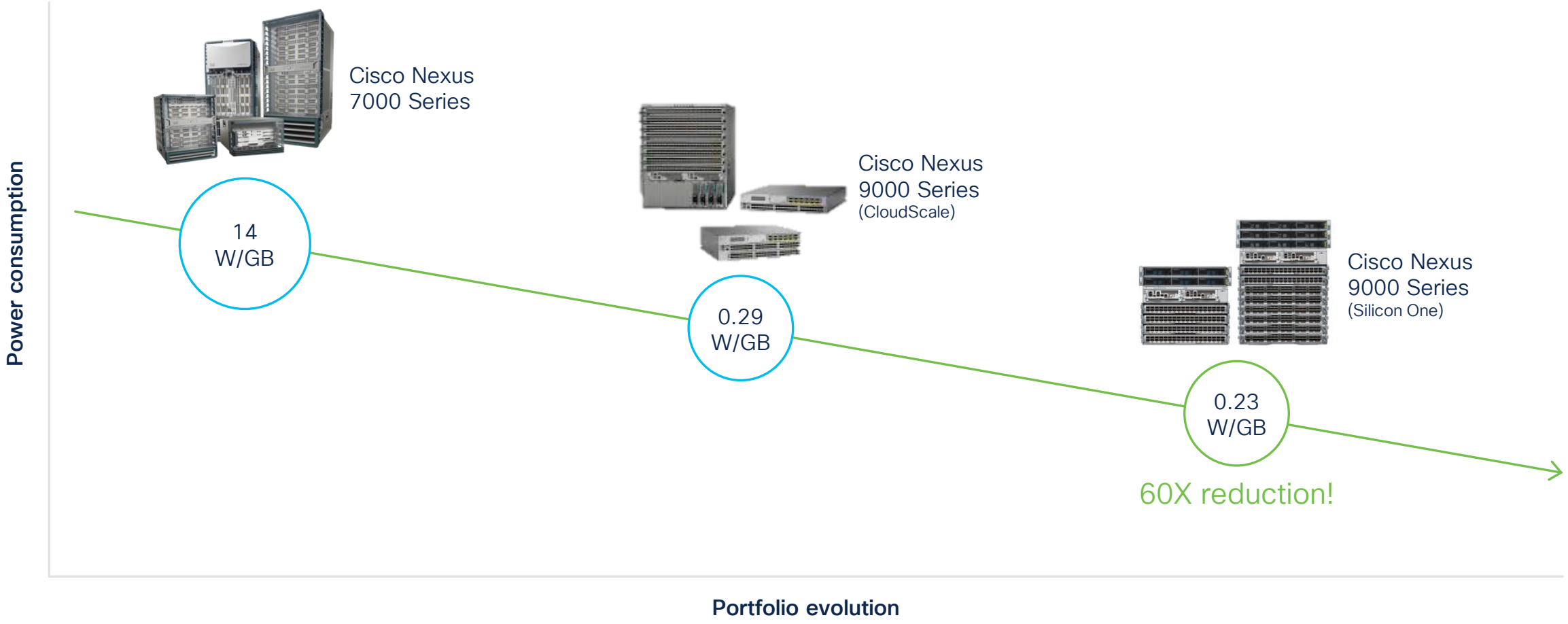
54V → 3.3V
Removed intermediate voltage conversion

Our hardware difference

Cisco Nexus 9400

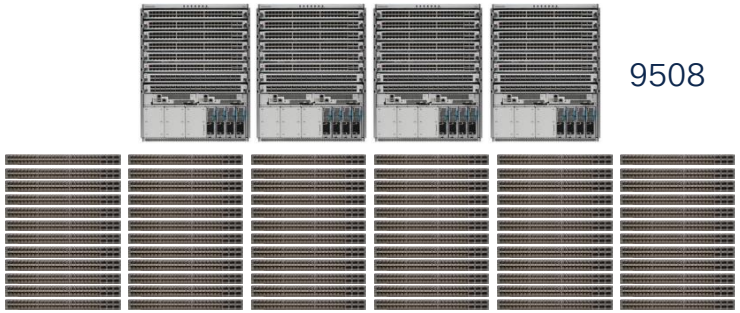
- **Single 25.6T Cisco ASIC**
- **Scalable | Compact 4 RU design, 24in depth**
  Max 64 400G ports or 128 100/200G ports
- **Low power**
  7.5W/100G
- **Field replaceable switch and supervisor**

Groundbreaking energy efficiency innovation



Network design difference with consolidation

Networking for AI/ML clusters, HPC, IP Storage



3456 x 25G access layer ports

72 x 93180YC-FX3

56,907W

16.5 watts/25G access port

124 RU

25G → 100G

61% less **total** power

71% less **total** space

3584 x 100G access layer ports

32 x 9332D-GX2B

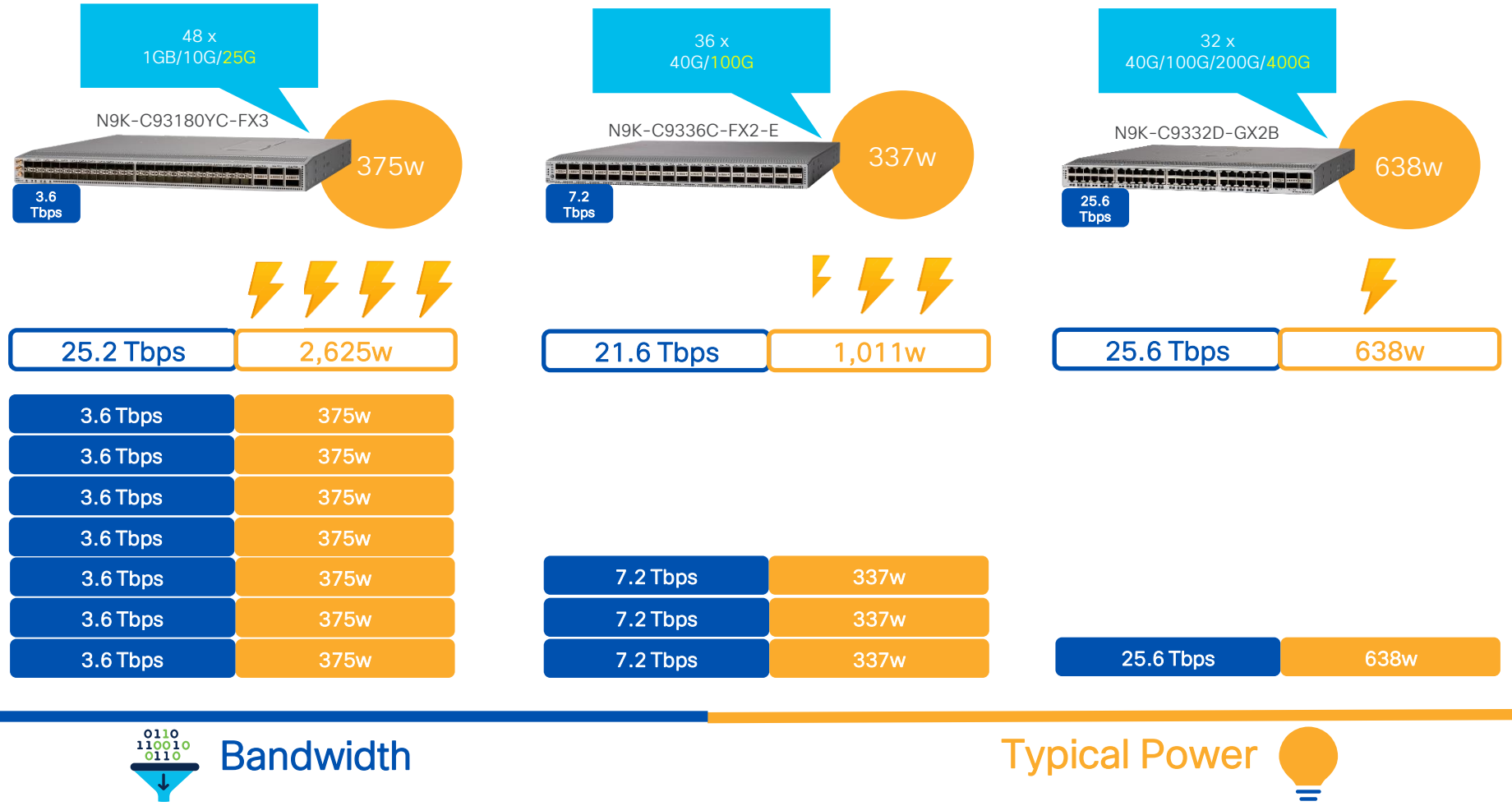
22,968W

6.41 watts/100G access port

36 RU

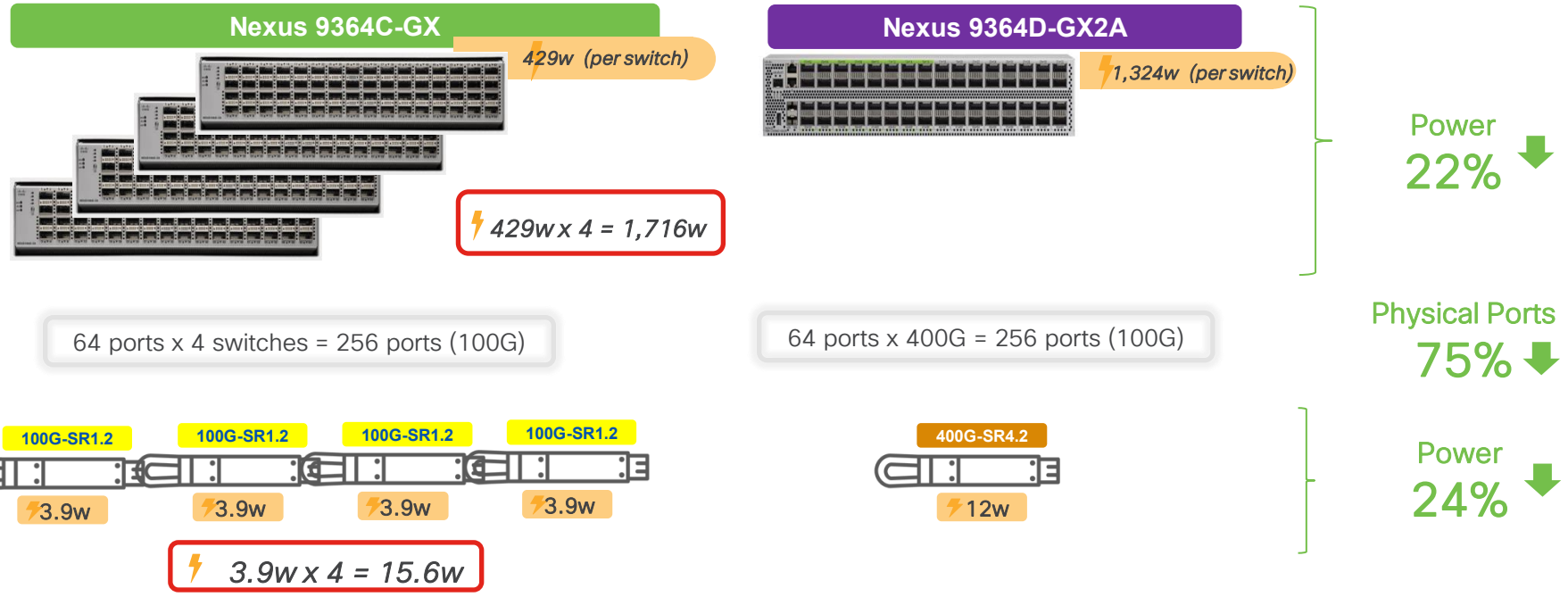
Nexus platform evolution

Save power while increasing bandwidth



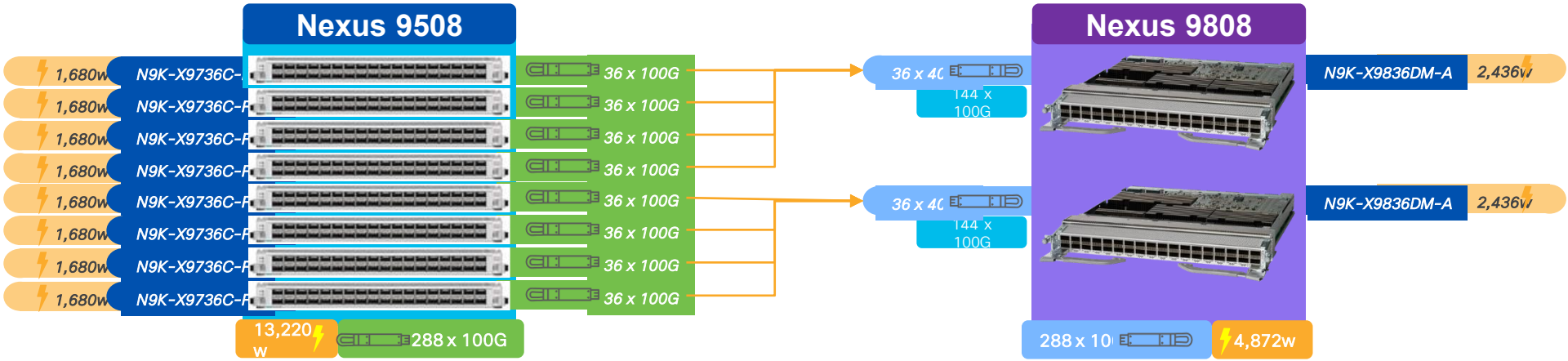
Nexus platform evolution

Increase port density



Nexus platform evolution

Consolidate with modular line cards



36 ports (100G) x 8 linecards = 288 ports (100G)

13,220w

36 ports (400G) x 2 linecards = 288 ports (100G)

4,872w

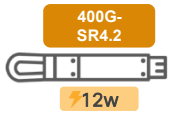
Optics and Ports
75% ⬇

Linecards Power
63% ⬇
(Based on Max. Power)

Nexus platform evolution

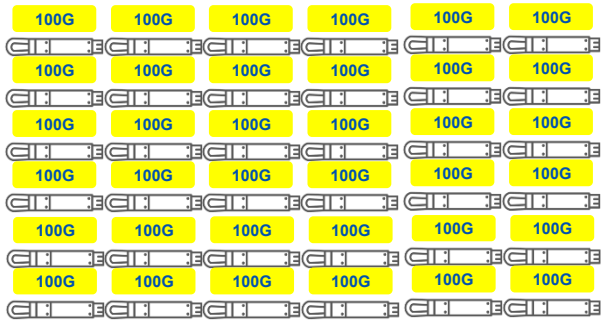
Move to higher speed optics

3.9w x 4 = 15.6w



Power 24%

36 Optics



3.9w x 36 = 140.4w

9 Optics

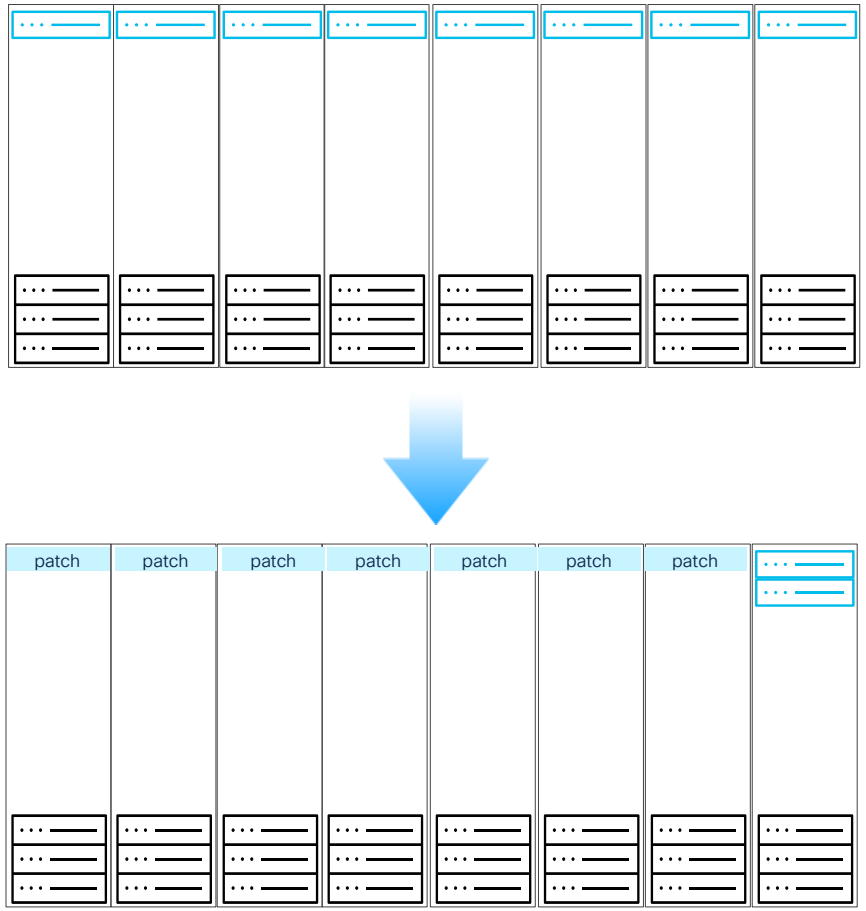
12w x 9 = 108w

Power 24%

Rack Space and Cabling Design for Data Center Sustainability

Improve power efficiency with 400G

Consolidate switches with high density breakout across data center racks



Current Architecture

- One ToR Switch (1RU) per Cabinet
- Provides connectivity to 16-32 servers
- One port per server

New Architecture

- One or two ToR Switches (2RU) per (8) Cabinets
- Provides connectivity to 128-256 servers
- One port can service 4 or 8 servers with 4 to1 (SR4.2) or 8 to1 (SR8) breakouts

Simplify cable management with patch panel cassettes

6 Cassettes
(fully removable front & back)

SOC™ Sleeve
Cable Organizer
Mechanical Protection & Strain Relief

Cable Hanger Brackets
Slack Management

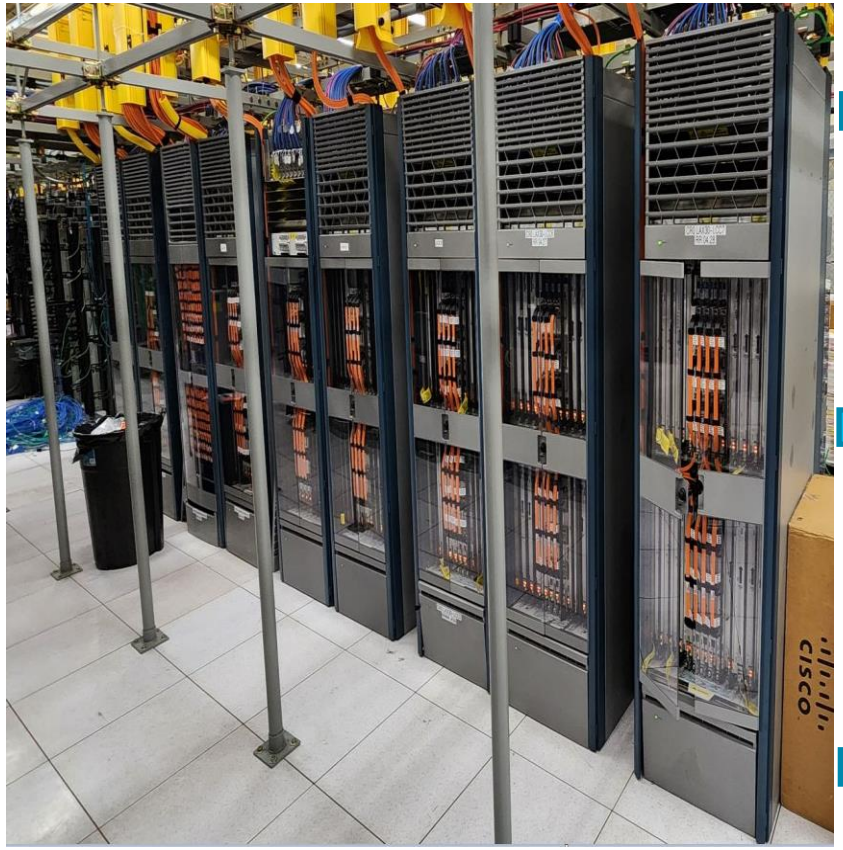
Front view of 1RU chassis with 6 cassettes

Top view of cassette

1 cassette supports (3) MPO-12 in rear that break out into 12 duplex LC ports in front

Data center rack consolidation with patch panel

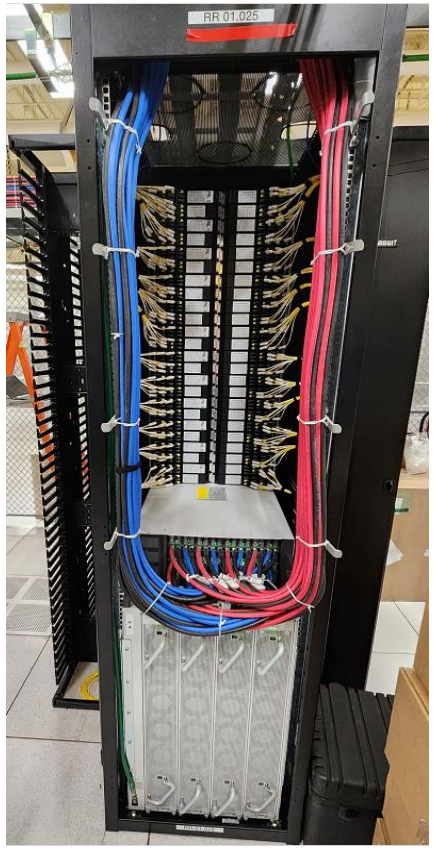
51.2 Tb capacity, 140 x 60amp DC feeds



CRS 8+1
9 full Racks 512 x 100Gb ports

172.8 Tb capacity, 24 x 100amp DC feeds

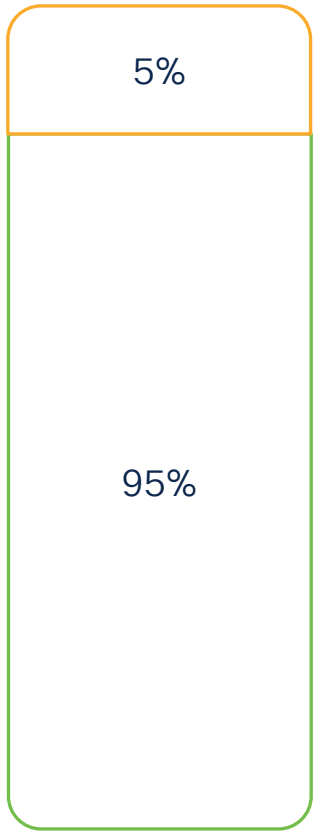
8812 Front w/ Cable Mgmt
1728 x 100Gb ports



8812 Rear w/ Cable Mgmt

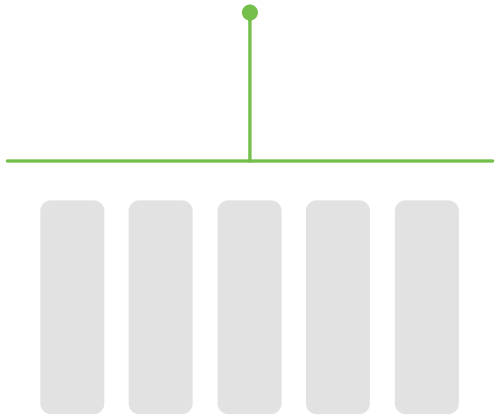
Summary

Cisco Green Pay



Cisco Green Pay
Circular IT payment solution

Predictable fixed payments
Includes option to blend software and services into payments



Up to 20 quarters

Incentive
Up to 5% on hardware

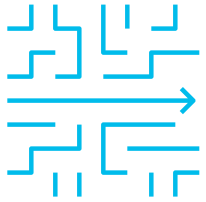
Upgrade
To latest sustainable technologies

Return
Free shipping costs, sustainability certificate

Extend
Keep current equipment month to month or for one year

Cisco product takeback and reuse program

Free removal and transport of equipment at customer end-of-use



Simple

Cisco offers **various tools** to help you create a return request and schedule the free pickup of your used Cisco equipment

Secure

Returned equipment is stored in a secure location and hard drives are cleared according to the **U.S. NIST 800-88 guidelines**

Sustainable

Cisco can help you reach your sustainability goals – we **reuse and recycle 99.9%** of what is returned to our facilities

Cisco Nexus Dashboard PDU integrations

Cisco Nexus Dashboard

Sustainability insights	**Real-time and historical insights** into the energy consumption, energy costs, GHG emissions **Monitor the ambient temperature** to help improve cooling efficiency of the data center **Support for any IT equipment** (servers, switches, storage etc.)
Emission forecast and optimization	**Estimate future** energy consumption, energy cost, GHG emissions **Provide recommendations** to help reduce energy consumption

Get started today

3 Learn more about Cisco sustainability initiatives

cisco.com/c/en/us/about/csr/environmental-sustainability.html

2 Evaluate optical transceivers compatibility and interoperability

www.tmgmatrix.com

1 Explore the Cisco portfolio for Nexus and Optics

www.cisco.com/go/nexus

www.cisco.com/go/optics

The bridge to possible