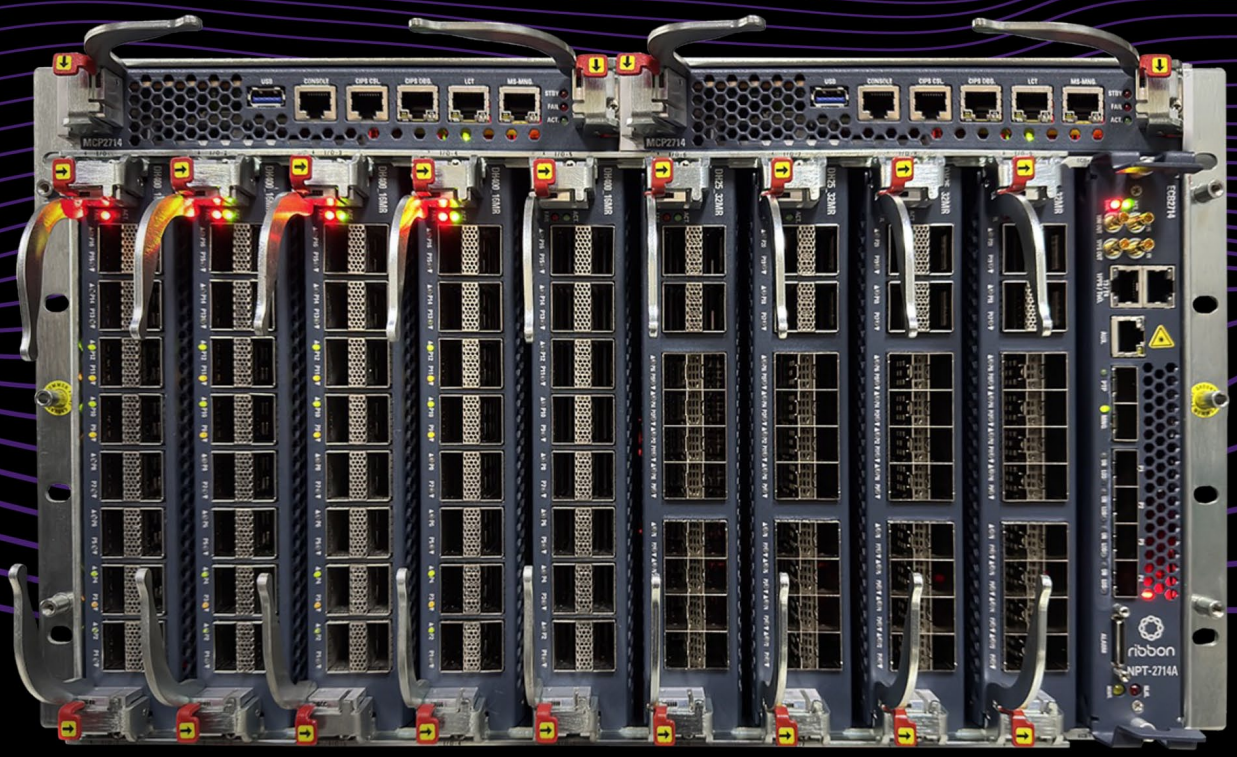
Accelerate Your Network Transformation

NPT 2714 Overview

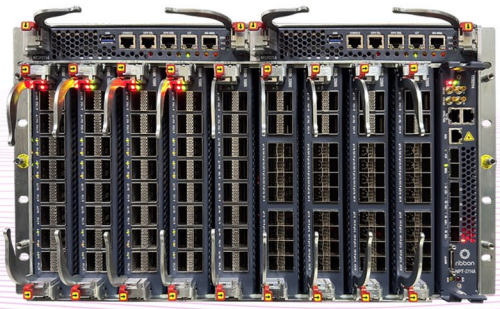


1. NPT 2714 Overview

The NPT 2714 is the latest addition to Ribbon's NPT XDR2000 series of aggregation routers.

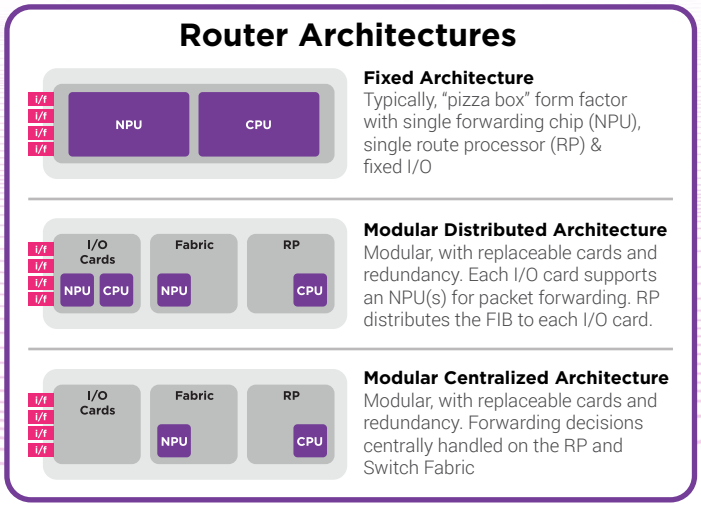
It features a new, innovative, orthogonal architecture for modular centralized routers, merging the best aspects of modular and fixed systems. The NPT 2714 combines the redundancy and I/O diversity of modular systems with the simplicity and cost-efficiency of fixed systems. Consequently, the NPT 2714 delivers redundancy at an optimized cost while enabling flexibility and expandability through operational continuity.

An innovative orthogonal physical architecture and advanced cooling techniques allow the NPT 2714 to provide full redundancy and 14.4Tbps switching capacity, all packed into a 6RU footprint.



NPT 2714 front view

NPT 2714 rear view



The NPT 2714 router is 6 RU in height and 600mm in depth, it provides 9 slots that accommodate two types of IO cards: High Speed (100G/200G/400G) and Low Speed (25G/10G)

Ribbon's innovative design has enabled the NPT 2714 to deliver unprecedented capacity in a very compact footprint without compromising forwarding performance. Additionally, the NPT 2714 supports true "Pay As You Grow", with "in service" upgrade from 7.2Tbs to 14.4Tbs switching capacity.

The high-power density of the ASIC, combined with high-performance IO transceivers (ZR+), presents challenging thermal conditions. These challenges are effectively addressed through advanced physical innovation and system design, including optimized fans and heat sinks.

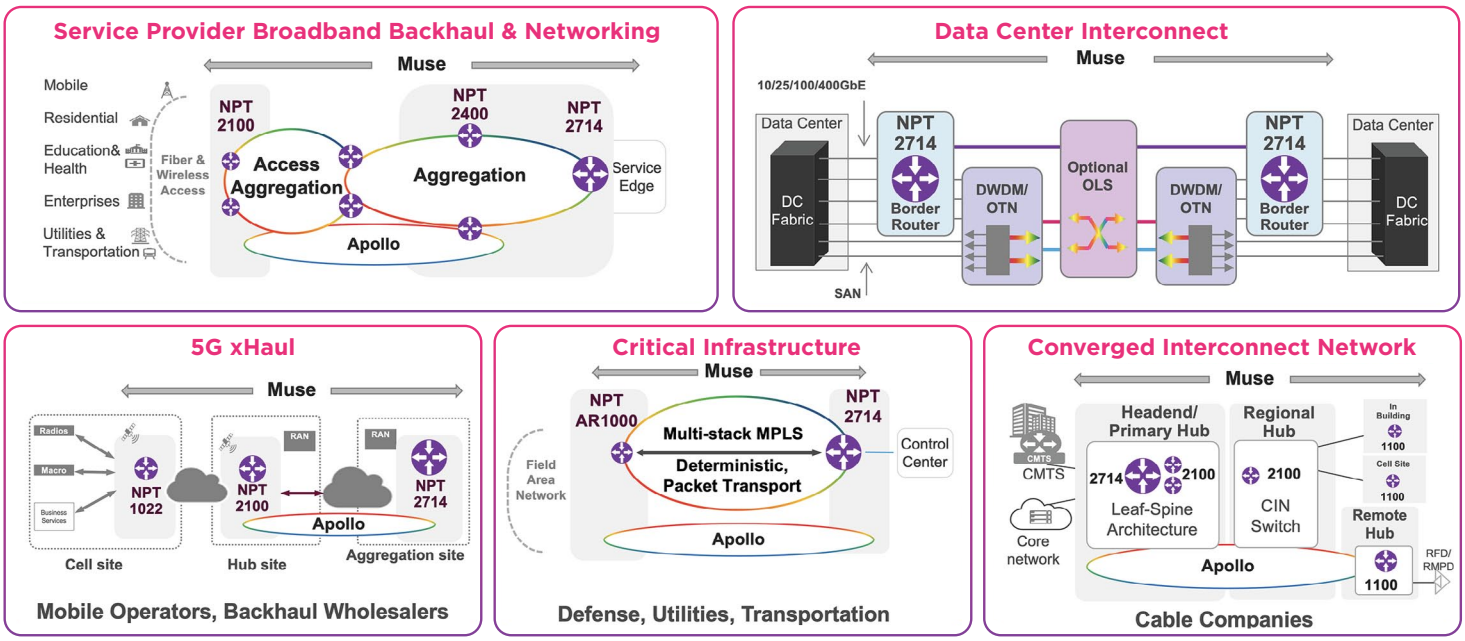
Items	Details
Maximum bandwidth and ASIC	14.4Tbps capacity. 2 x Broadcom J2C+; maximum 9 IO cards each 1.6T 7.2T capacity. Broadcom J2C+; maximum 9 IO cards each 0.8T
Shelf	6RU with depth 600mm and 9 slots for IO Cards
Controller Card	Main processing controller and routing engine card for NPT-2714, can be used in 1+1 configuration for control plane and management redundancy
Switch card	Switch Card hosts ASICS. Two switch cards work in redundant mode for 7.2T capacity Four switch cards work in redundant mode for 14.4T capacity
Power Supply	4 power supplies with 1+1,2+2 redundancy for DC power And 2+1, 3+1 for AC power Available in 4.8KW per DC unit and 3.2KW per AC unit
Fan Units	Two FAN drawers, 5 fans in each drawer with N+1 fan redundancy
IO cards	High speed cards 100G/400G (144x 100G/ 36 x 400G) Low speed cards 10G/25G (288 in total) Extension shelves 1G (90 in total)
Extension Shelf	System modularity is further enhanced by connecting up to three extension shelves supporting: GbE, CES interfaces, optical amplifiers

Table 1. Ribbon NPT 2714 key components

Ribbon NPT 2714 value proposition summary:

- **True "Pay As You Grow"**
  The NPT 2714 offers the unique capability to start as a non-blocking 7.2Tbs switching capacity router and by adding, in-service, another 7.2Tbs switching card become a non-blocking 14.4Tbps router.
- **Investment Protection:**
  The NPT 2714 allows all major components to be upgraded as and when required, enabling customers to cost effectively evolve their network as architectures and technology advance.
- **Redundancy:**
  The NPT 2714 introduces a redundant control plane and redundant data plane in both the 7.2Tbps and 14.4Tbps configurations. The platform can also be configured to operate as non-redundant router.
- **Flexibility:**
  The NPT 2714 also provides flexibility via I/O scalability and interface diversity. It natively supports port speeds from 10 GbE up to 400 GbE hosted in 9 slots with just two I/O card variants. A wide range of optics provides support for multiple customer use cases.
- **Security**:
  MACsec is software driven with no hardware dependency and available for all network interfaces
- **Coherent Routing (IPoDWDM)**:
  IP and DWDM on a single platform with 36 x 400G ZR+ coherent interfaces including plugin amplifiers to extend reach

2. Where NPT 2714 Fits

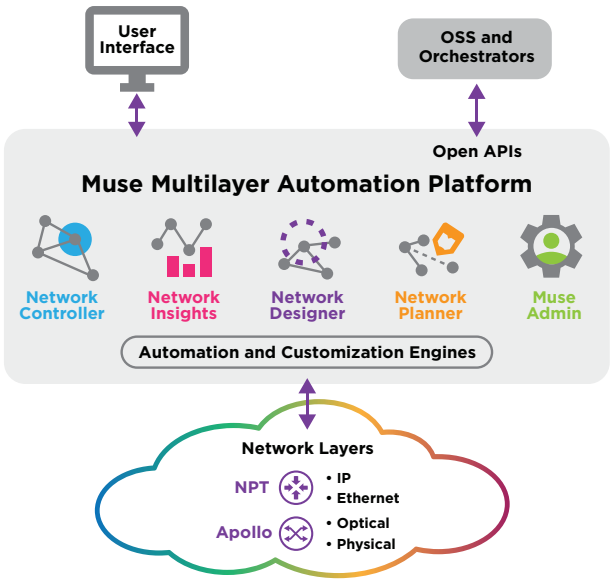


The rollout of high-capacity fixed (e.g. FTTH, DOCSIS4) and mobile (e.g. 5G, WiFi6) access networks, along with cloudification of services has driven the need for higher capacity access aggregation and aggregation networks.

With ever-increasing capacity and service complexity, Service Providers are looking for ways to reduce the cost of their middle mile networks. To achieve this, they are looking to converge onto a single, multiservice, intelligent middle mile network that connects the various access networks and consumers to the services and applications in the core of the network. To cost effectively support the differentiated services, the network resources in the intelligent middle mile need to be optimized in terms of power and footprint, while remaining dynamic and flexible enough to support services, architectures and technology as they evolve.

The NPT 2714 has been architected to provide this scale and flexibility. By using two switching ASICs to provide 14.4Tbps of switching capacity, it not only allows for a true in-service upgrade from 7.2Tbps to 14.4Tbps but also delivers far more power than a single ASIC-based 14.4Tbps solution.

Ribbon's Intelligent Middle Mile



Efficiently connects the access networks to the core network services and applications, meeting service performance requirements for each service

It supports 36 ports of 400G including 400G ZR+ or 144 ports of 100G or 228 ports of low speed 10G/25G. As such, the NPT 2714 is exceptionally well-suited for a wide variety of applications and networking scenarios, including:

- **Multiservice Backhaul Network**
  NPT 2714 offers the high capacity, high performance routing, and IP/MPLS capabilities, required to support voice, video, mobile and data services in a multiservice backhaul network.
- **Dual-Homed Service Provider Architectures**
  NPT 2714 delivers the high-capacity switching required in the metro core in dual-homed architectures
- **CIN Architectures used by MSOs**
  NPT 2714 delivers the high-capacity switching required from the spine node as defined by MSOs for their spine-leaf CIN architectures
- **Border Router for DCI applications**
  NPT 2714 provides flexible optical I/O options, including pluggable coherent interfaces (ZR+) allowing it used with or without Ribbon's Apollo optical layer in DCI applications. A pluggable amplifier allows NPT 2714 to support up to 3.2T per wavelength with a reach of over 130km.
- **Critical Infrastructure**
  NPT 2714 is architected to provide the high-availability and security requirements, mandatory for mission critical networks. High availability is ensured through a fully redundancy architecture while security is provided with MACsec on all ports.

2.1. Coherent Routing (IPoDWDM)

Ribbon's Intelligent Middle Mile is a converged, automated IP Optical network providing connectivity between last mile access networks and the services and applications in the core of the network. This advanced network enables Service Providers to introduce new differentiated services more quickly than their competitors, while maximizing return on investment (RoI) by optimizing network utilization.

Ribbon's MUSE Multilayer Automation Platform (Muse MAP) is a fundamental building block of the Ribbon's intelligent middle mile. It delivers the automation and analytics essential for operating a modern IP Optical network, seamlessly integrating the IP and Optical layers into a unified set of network resources. This IP Optical integration enables network operators to build IP and Optical architectures to meet their customers' current needs while ensuring a smooth network evolution as operational and business requirements evolve.

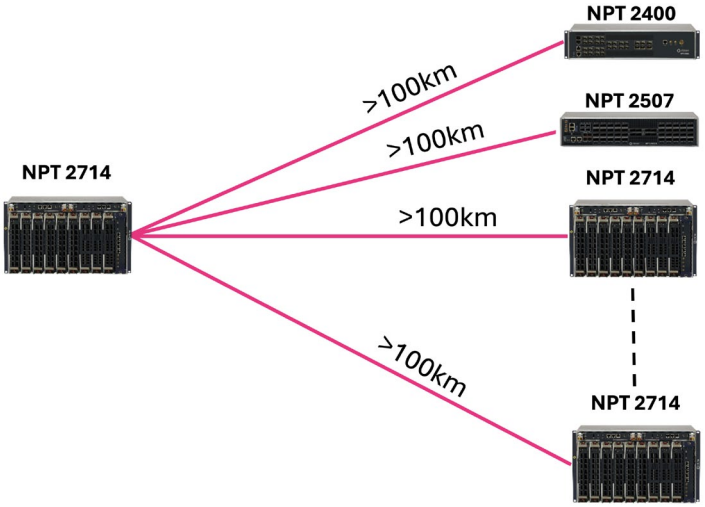
Coherent routing, operating in conjunction with Muse, is key to allowing the IP and Optical resources to be treated as a single set of network resources. This allows Ribbon's intelligent middle mile to support both:

- Network architectures with separate IP and DWDM layers/networks – Muse provides fully integrated, seamless management of both layers. It offers network-aware fulfilment and assurance for the services transported across the network, ensuring that the operator and automation engine are aware of the optical underlay when provisioning or fault-finding the IP layer.
- Network architecture with coherent pluggables in the routers providing the DWDM layer - Muse provides full optical management of the coherent pluggable and the same integrated IP Optical management as provided for architectures with IP and DWDM in separate layers

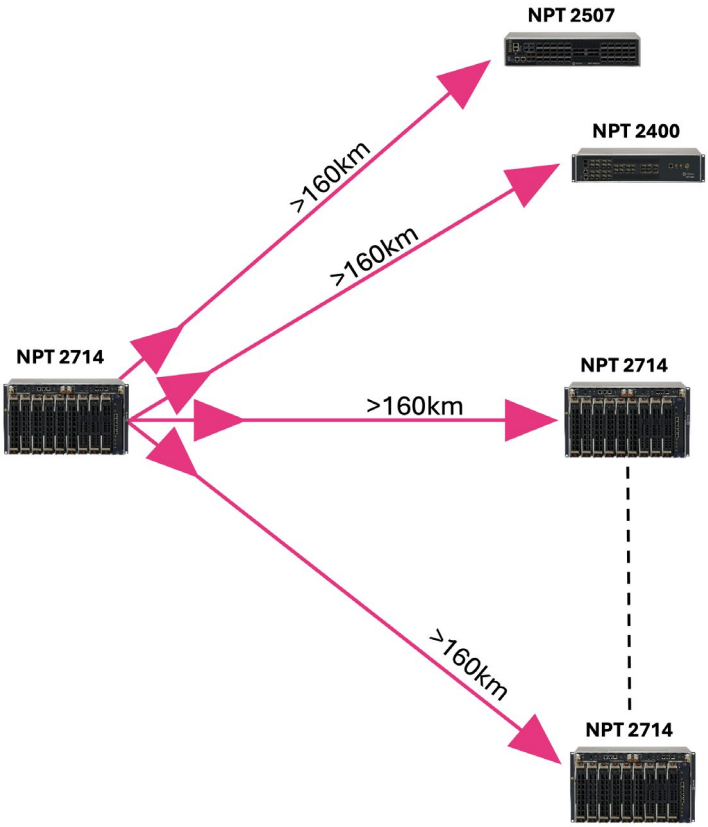
2.1.1. 400G Coherent Interface

The NPT 2714 uses standardized 400G ZR/ZR+ coherent pluggable optics, and can provide optical solutions for various scenarios such as:

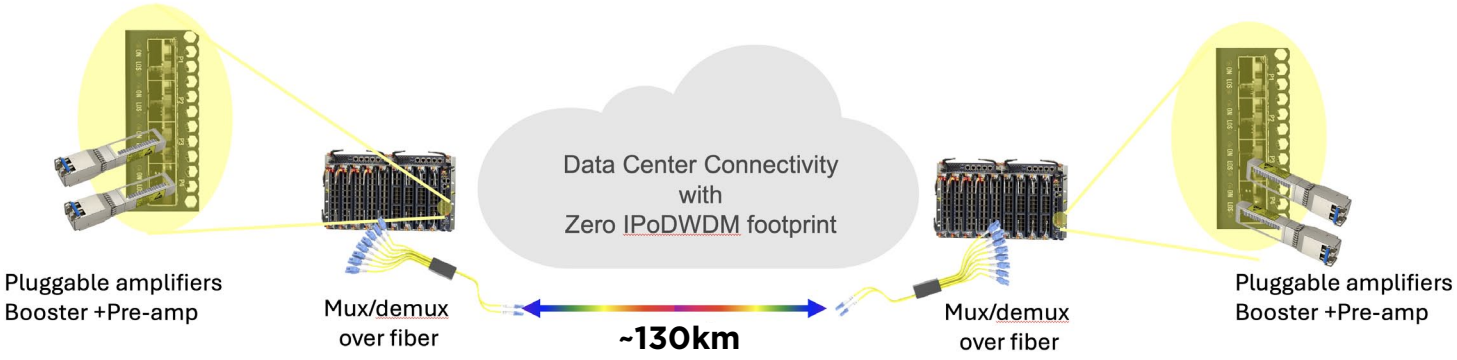
Single channel Point to point connectivity, up to 36, 400G ZR+, point-to-point direct connections to other NPT routers over distances exceeding 100km without the need for any amplification.



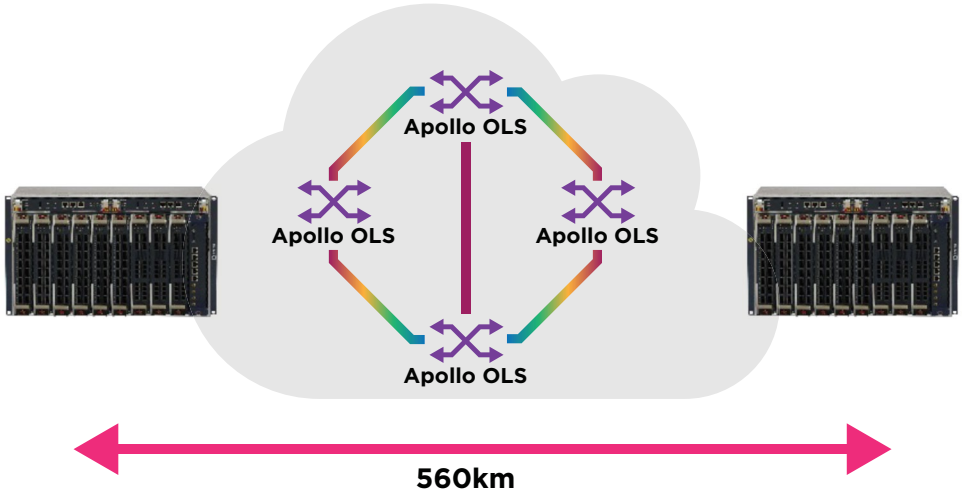
The reach is extended to over 160km per span when NPT amplifiers are added (either pluggable or in the expansion shelf).



The NPT 2714 supports 3.2T over a single fiber pair, with a reach of approximately 130km, when Mux/Demux units and pluggable amplifiers are added.



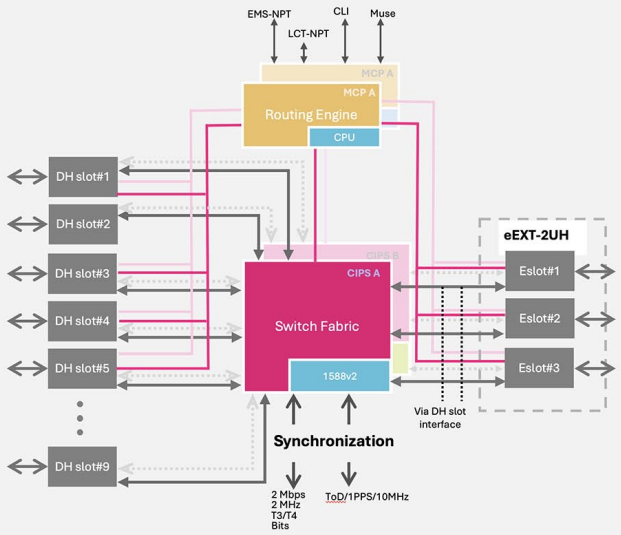
The NPT 2714 supports up to 36 off 400G ZR+ connections, with a reach of over 560km, when Ribbon's Apollo OLS system is added.



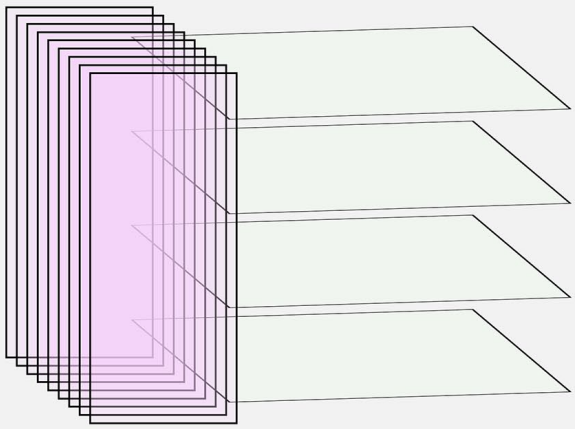
3. Platform Description

3.1. Innovative Hardware Design

The NPT 2714 combines a modular centralized router architecture with state-of-the-art orthogonal hardware design, advanced cooling techniques, cost-efficient merchant silicon, and proven networking software to deliver a fully redundant, high-capacity aggregation router.



Modular Centralized Architecture

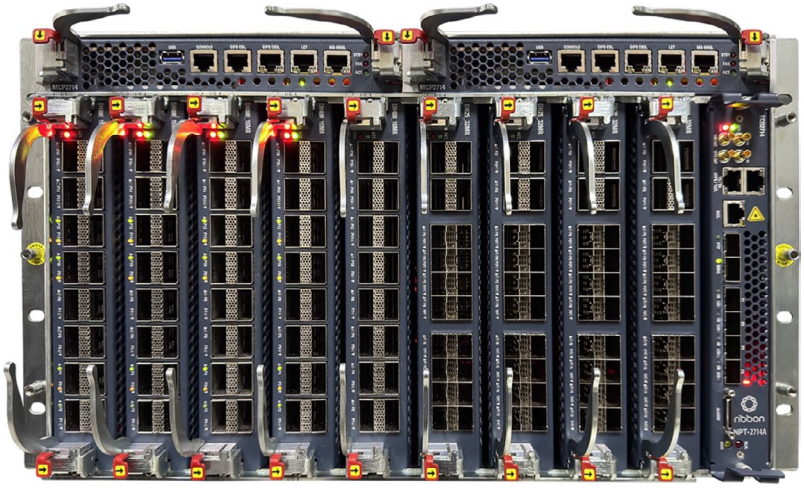


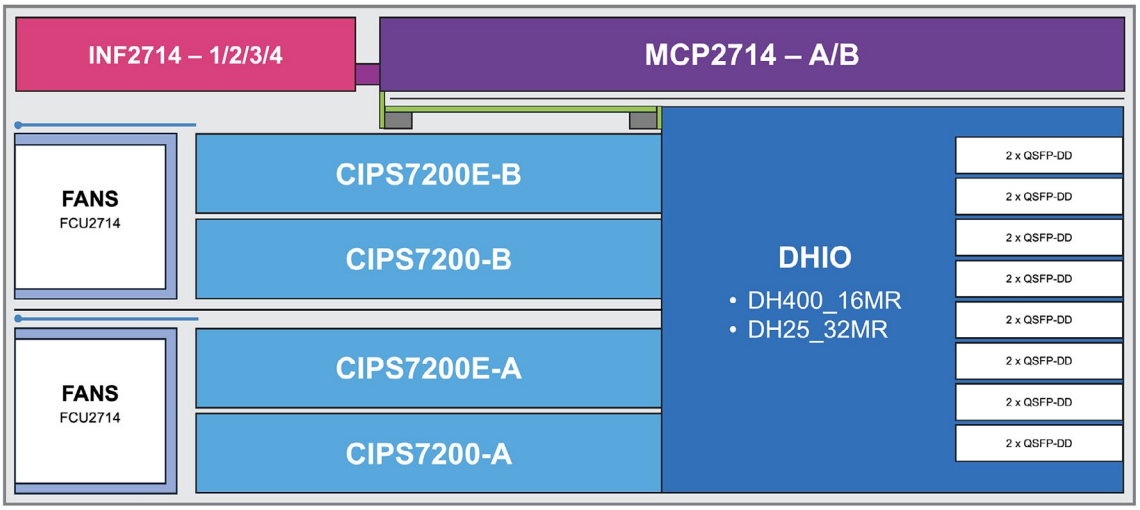
Orthogonal Hardware Design

The hardware design of the NPT 2714 is notable for its full hardware redundancy and in-service pay-as-you-grow capabilities. To further optimize Service Provider Total Cost of Ownership (TCO), only two I/O card variants are needed to support the wide range of interfaces offered by the NPT 2714. Recognizing the rapid pace of networking technology evolution, Ribbon has designed the NPT 2714 with a focus on investment protection. The nine vertically oriented card slots connect directly to the four horizontally oriented switch cards, eliminating the necessity for a backplane or midplane. This unique design allows for seamless integration of new technologies, such as 800G coherent interfaces, into the existing chassis.

Moreover, the NPT 2714 supports coherent routing with OpenZR+ and utilizes built-in SFP+ pluggable amplifiers to extend reach.

3.2. Chassis





The NPT 2714 consists of the following units:

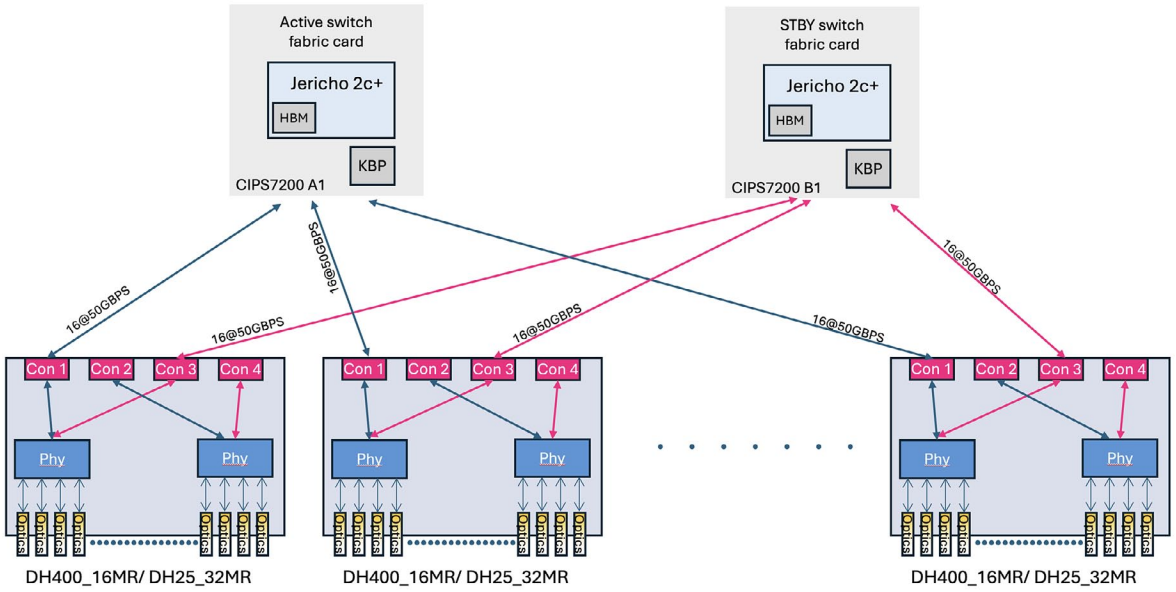
- **Data High-Capacity Input/Output Cards (DHIO)**
  Located vertically in the front of the chassis
- **Main Controller and Processing Cards (MCP)**
  Located horizontally in the front of the chassis
- **Centralized IP Switch Cards (CIPS)**
  Located horizontally between I/O slots and fan drawers, if the CIPS card is not used (in non-redundant configuration or 7.2T capacity), it is replaced by a dummy CIPS plate to maintain the airflow.
- **Fan Control Unit (FCU)**
  Provides front to back airflow and cooling

- **Input power and Filter (INF)**
  DC power module
- **AC Power supply (AC_PS)**
  AC power modules
- **Extension Shelf (eEXT-2UH)**
  Up to 3 off eEXT-2UH expansion shelves can be directly connected to NPT 2714 to provide GbE, CES interfaces, optical amplifiers.

All I/O cards support MACsec regardless of their position in the shelf. The I/O cards house the physical interfaces (PHYs) and the optical pluggables for user/line connectivity. For protection purposes, each card is connected to both switch fabric cards.

The figure below depicts the connectivity between I/O cards and the switch cards. For simplicity, only the 7.2T matrix is shown connected to 3 I/O cards.

16x50Gbps SerDes to each switch card provides 800G capacity to each I/O card. Once the second CIPS switch card is added, it is connected by an additional 16x50Gbps SerDes to the remaining connectors, providing up to 1.6T capacity per I/O card.



3.3. Data High-Capacity Input/Output Cards (DHIO)

The NPT 2714 supports two different DHIO cards which can be inserted into slots 1-9. All ports support MACsec. The DHIO cards can be inserted into any slot of the chassis without any restriction.

DHIO Card	Bandwidth	400GbE Ports	100GbE Ports	10G/25G Ports	Timing
DH400_16MR	1.6T	4	16		Class C
DH25_32MR	800G		4	32	Class C

DH400_16MR

- Multi rate card with up to 1.6T capacity
  - 800G capacity in 7.2T configuration – half of the interfaces can be used
  - 1.6T in 14.4T capacity
- Supports up to 4x400G, 8x200G, 16x100G and mix of rates up to total available capacity
  - MACsec per port is hardware ready
  - Supports the full range of NPT transceivers
  - Coherent ZR+ interfaces are available (upper row)
  - 100G Coherent low power QSFP28 interfaces in all ports
  - All ports support SyncE and 1588 PTP.
  - All upper row ports support 4x10G/25G breakout interfaces

- Up to 9 cards configured in NPT 2714 shelf
- Supports 16 QSFP-DD cages
- P2/P6/P10/P14 can support 100G/200G/400G and 100G*4, 25G*4, 10G*4 breakout
- P4/P8/P12/P16 can support 100G/200G and 25G*4, 10G*4 breakout
- P1/P3/P5/P7/P9/P11/P13/P15 can support 100G
- Only the even ports can house high power coherent optics
- Half of the ports are supported in 7.2T configuration – P1-P4, P9-P12

DH25_32MR

- A Multi rate card with up to 800G capacity (400G capacity in 7.2T configuration)
  - Up to 9 cards can be configured in NPT 2714 shelf
  - 10G/25G selection is available per port
  - MACsec per port is hardware ready
  - Supports the full range of NPT transceivers
  - All ports support SyncE and 1588 PTP.
- 16xSFP28+ multi rate interfaces for 10G/25G
  - SFP28 interfaces for 25G rates and SFP+ interfaces for 10G rates
- 4xQSFP28 interfaces for 4x100G (gray and Coherent low power QSFP28 interfaces) or 4x10G/25G fanout (activate only in 14.4T configuration)

3.4. Main Controller and Processing Card (MCP)

The NPT 2714 supports two different DHIO cards which can be inserted into slots 1-9. All ports support MACsec. The DHIO cards can be inserted into any slot of the chassis without any restriction.

MCP2714

The MCO card integrates functions such as the IP/MPLS control plane, the platform management and control functions, the management communication channels, and timing:

- **Shelf Control:** includes software version management, software downloads on managed I/O cards, performance monitoring (PM) and log information collection
- **Shelf Management:** includes connectivity to management systems via management interfaces located on the ECB2714 card and via the DCN network, support of DCN network functionality & support of internal Ethernet communication network for intra chassis communication.

- **Shelf Timing:** includes ability to lock on one of the clock sources (i.e. T3, Sync-E and 1588v2), distributing timing information to all cards on the shelf (i.e. Frequency, Phase, Time), synchronizing 3rd party equipment via external timing interfaces located on ECB2714 card and distributing timing information to remote devices via Packet network (using Sync-E and 1588v2 protocols).
- **High Availability (HA):** allows MCP2714 redundancy, with two MCP2714 cards operating in 1:1 protection mode. While one of the MCP2714 cards is functioning as an active card, the other is synchronized with the active card's state (stand-by MCP2714), and ready to take control on the shelf. Protection switching is done upon user command or software/hardware failure of the active MCP2714 card.

3.5. Centralized IP Switch Card (CIPS)

The NPT 2714 can accommodate up to four CIPS cards, located behind the fan trays. In area A, two CIPS cards (CIPS7200 and CIPS7200E) provide a processing capacity of 7.2T, which can be expanded to 14.4T when both the CIPS7200 and its 7.2T expansion card (CIPS7200E) are installed. Area B can host an additional pair of CIPS7200 and CIPS7200E cards for a redundant configuration. Each CIPS card is powered by a Jericho 2c+ Network processor, responsible for packet processing and forwarding.

CIPS7200 Switch Card

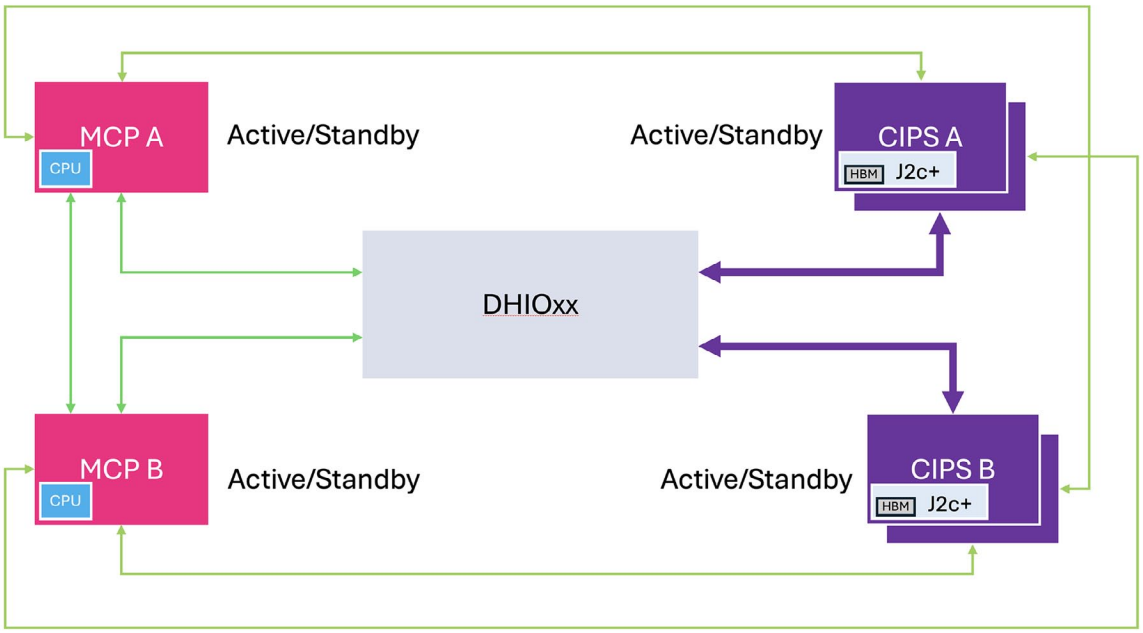
There are 9 connectors, at the back of the matrix, which link to the 9 I/O cards positioned at the front of the shelf.

The NPT 2714 can operate in one of the following 4 configurations

1. 7.2T non redundant – only CIPS7200 is installed
2. 7.2T redundant – CIPS7200 in area A and CIPS7200 in area B are installed
3. 14.4T non redundant – CIPS7200 and CIPS7200E are installed
4. 14.4T redundant – CIPS7200 and CIPS7200E in area A and CIPS7200 and CIPS7200E in area B are installed

Each of the above configurations can be installed with either a single MCP2714 card or two MCP2714 cards for full control plane redundancy.

The CIPS cards and MCP cards are connected in a full mesh configuration, ensuring that even in the event of dual failures (any CIPS failure and any MCP failure), a pair of operating MCP and CIPS cards will still be able to process and forward route the packet streams. This architecture is significantly more robust than a simple matrix and controller pair redundancy, where a failure in both a matrix and its mate controller would cause the entire shelf to fail.



Redundant System with high availability

The CIPS cards are installed between the I/O cards and fan modules. If any of the CIPS matrixes are not installed, a dummy CIPS card should be used to maintain proper airflow within the system.

3.6. Power Supply Modules

The NPT 2714 can be installed with up to four 3200W AC or 4800W DC power supplies in the chassis.

NOTE: a mix of AC and DC power supplies is not supported in NPT 2714

AC Power Supply Module (AC_PS2714)

- The AC power modules are single feed with 3200W capacity at 220V. They also support operation at 110V with reduced capacity.
- AC power modules are rated at 3200W maximum at 230V AC high line input, and 1200W maximum at 110V AC low line input.
- AC nominal range: 100 to 127V AC and 200 to 240V AC

AC power supply module (AC_PS2714) in High Voltage DC

- The AC power module support also operation in High Voltage DC (HVDC), with 3200W capacity with nominal voltage range from 220Vdc to 300Vdc

DC Power Supply Module (INF2714)

- The DC power supply modules are dual feed with 4800W capacity at any input voltage in the applicable range. each single feed provides up to up to 2400W maximum capacity
- DC power input range: -40.8 to -57.6V DC

Each power supply is equipped with its own fan to ensure front-to-back airflow heat dissipation. The available power for NPT 2714 operation depends on the number of power supply modules installed and their redundancy scheme.

AC power feed and HVDC can be configured as:

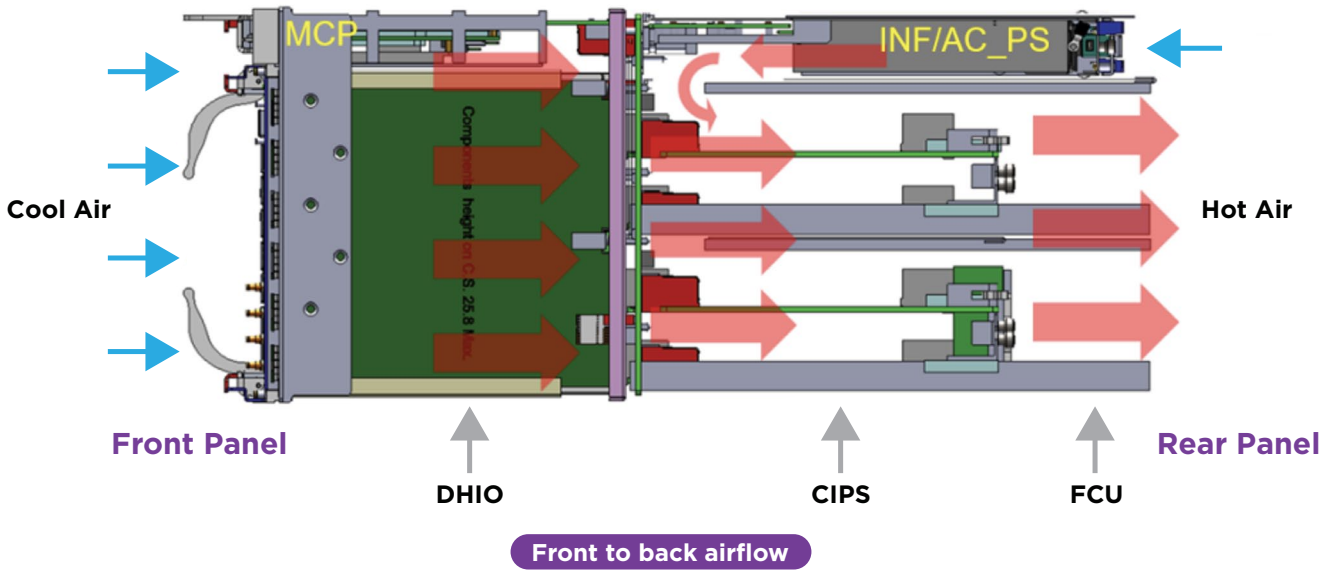
- 2+1 and 6400W
- 3+1 and 9600W

DC power feed can be configured as:

- 1+1 and 4800W
- 2+2 and 9600W

3.7. Cooling system - Fan Control Unit (FCU 2714)

The NPT 2714 utilizes a unified cooling system consisting of two fan drawers, each fan draw contains five fans. These fan drawers are located at the back of the shelf, enabling front-to-back airflow.



The fans are dynamically controlled using a Pulse Width Modulation (PWM) technique, with 16 levels to support the required operating duty cycle. The MCP monitors the temperature of all thermal points on each card in the shelf and runs a fan control algorithm to calculate the duty cycle of the fans.

The cooling system offers N+2 fan redundancy. In the event of a fan failure, the remaining fans, based on temperature control calculation, will increase their duty cycle to compensate for the failed fan.

NOTE: The system must operate with 2 fan drawers in all times - single drawer operation is acceptable for short time for maintenance purposes only

3.8. External Connection Board (ECB): ECB2714 card

The ECB2714 it is a vertical card in the rightmost slot of the NPT 2714. Its primary function is to provide various interfaces for the NPT 2714.

1. NE level Alarm Indication (MJR/MNR)
2. Alarm in/out interfaces – dry contacts (4 inputs, 3 outputs)
3. BITS (T3/T4 interface)
   a. E1/T1 + 2048KHz, IN/OUT
4. Time Sync interfaces (1588v2)
   a. TOD+1PPS (V.11, RJ45), bidirectional
   b. 1PPS-SMB IN/OUT,
   c. 10MHz-SMB IN/OUT
5. OOB DCN
   a. MNG SFP+
   b. AUX 1000Base-T (RJ45)
6. PTP SFP Port (SFP+ - 1G or 10G)

In addition to the traditional alarm, management, and timing interfaces, the ECB2714 features four dedicated SFP+ ports. These ports can house pluggable EDFA amplifiers, enabling zero-footprint IPoDWDM long-reach solutions.

ECB2714 card

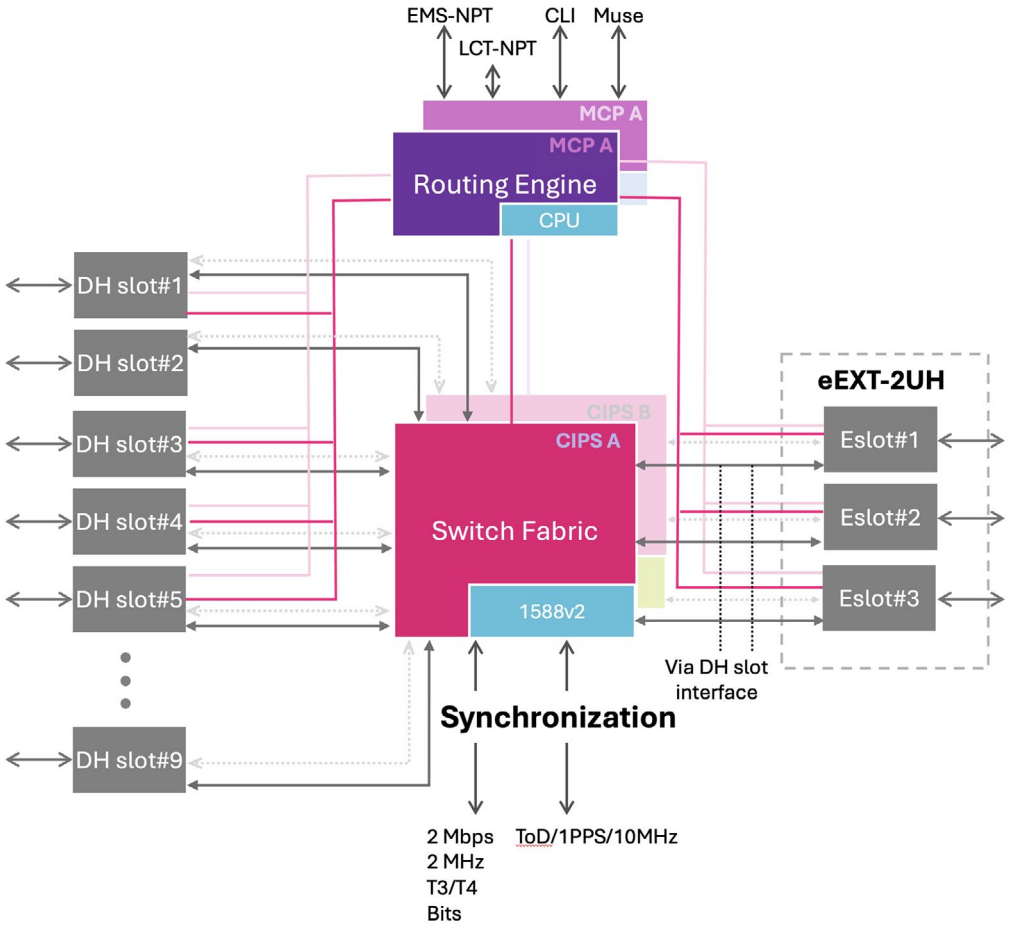
4. Platform Architecture

4.1. System Block Diagram

The NPT 2714 has a unique architecture based on an expandable centralized PE. All packet processing is handled by the central switching fabric cards (CIPS7200/CIPS7200E), which can be installed as a single card or a pair for redundancy. The control plane and L3 forwarding are managed by the MCP2714 cards, with the option to install one or two for redundancy.

The router features 9 I/O cards which provide the physical interfaces to the central processing switch cards. Additionally, the NPT 2714 offers the unique option to add up to 3 eEXT_2UH units, which can provide an additional 9 traffic slots for low-rate GBE and CES interfaces, as well as utilize the NPT set of amplifiers.

The chassis also includes the ECB2714 card, which connects alarm, management, timing, and pluggable EDFA amplifiers. It is equipped with 10 fans in two fan drawers and up to 4 power modules, all of which are field-replaceable.



NPT-2714 architecture building blocks

4.2. CIPS Card - Architecture Details

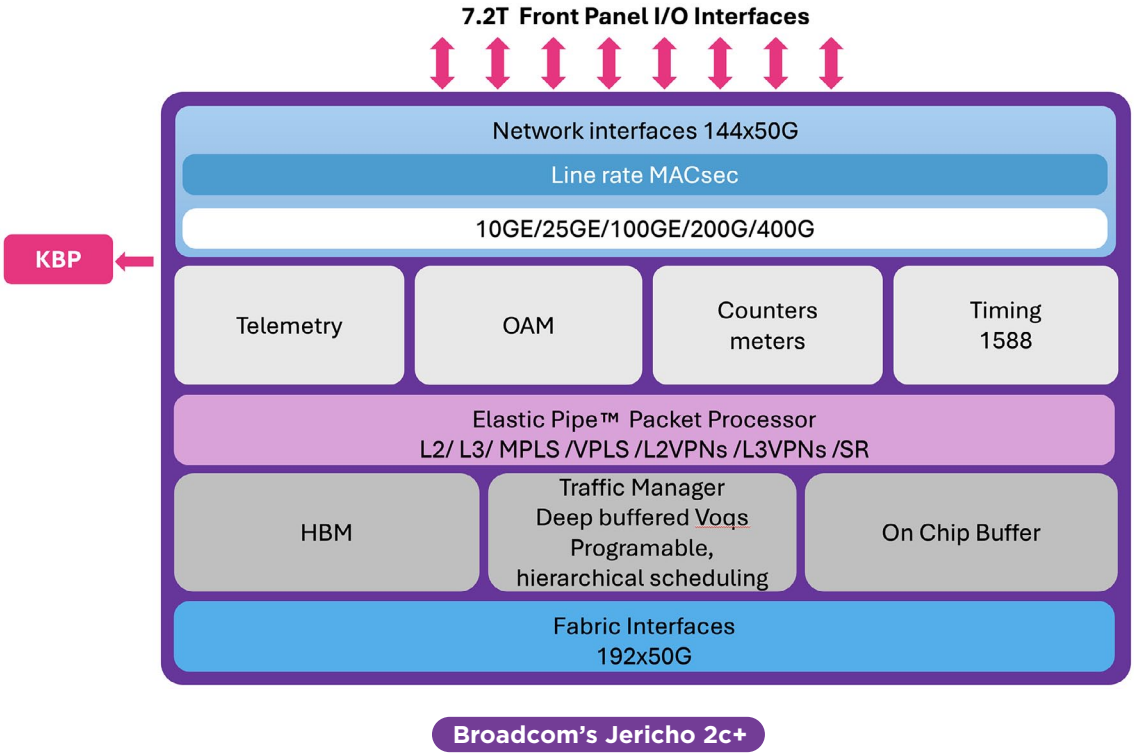
The CIPS7200 card provides 7.2T bandwidth capacity with a 50Gbps SerDes rate, utilizing Broadcoms 8th generation scalable network processor – Jericho 2c+.

The CIPS7200 can be connected back-to-back via Jericho 2c+ fabric interfaces to a CIPS7200E card forming unified switch fabric of 14.4T capacity.

This unified switch support 9xI/O cards with up to 1.6T per slot and 3 EXT_2UH units (9 extension slots) with up to 10G per extension slot.

CIPS cards based on Jericho 2c+ features provide:

- 2x7.2T full duplex switching capacity
- 288x50G front panel Serdes capacity to I/O cards, each capable to operate in 10G/25G rates as well
- 5400 MPPS forwarding rate
- MACsec for all network interfaces
- Multi rate port configuration supporting 10G/25G/100G/200G/400G
- 8GB in package High Bandwidth memory for deep buffering
- Advanced Traffic management and packet processing
- 256K VoQ (Virtual output Queues)
- 384K dedicated counters
- External KBP (Knowledge Based Processor) for increased scale and performance



4.3. Maximum port Fan-out support on NPT 2714

The following table represents the maximum number of ports the NPT 2714 router can support.

	1GBE	10 GbE	25 GbE	100 GbE	400 GbE
Native	90*	144	144	144	36
Native + Breakout		288	288	n/a	n/a

N/A: Not applicable

* with eEXT-2UH shelves

- **GbE**
  Provided by eEXT-2UH extension shelves equipped with DHGE_POE_10 cards.
  The NPT 2714 can connect with up to three extension shelves, each supporting up to three DHGE_POE_10 cards, with each card supporting up to ten GbE interfaces.

- **10 GbE**
  Provided by the DH25_32MR cards.
  The NPT 2714 supports up to nine DH25_32MR cards, each supporting sixteen SFP28+ 10 GbE interfaces. The DH25_32MR card also supports four breakout ports, the breakout ports can each support four 10 GbE interfaces.

- **25 GbE**
  Provided by the DH25_32MR cards.
  The NPT 2714 supports up to nine DH25_32MR cards, each supporting sixteen SFP28+ 25 GbE interfaces. The DH25_32MR card also supports four breakout ports, the breakout ports can each support four 25 GbE interfaces.

- **100 GbE**
  Provided by the DH400_16MR cards.
  The NPT 2714 supports up to nine DH400_16MR cards, each supporting sixteen QSFP_28/QSFP_28DD 100 GbE interfaces. The DH400_16MR card also supports four breakout ports, the breakout ports can each support four 25 GbE interfaces.

- **400 GbE**
  Provided by the DH400_16MR cards.
  The NPT 2714 supports up to nine DH400_16MR cards, each supporting four QSFP_56DD 400 GbE interfaces.

5. Conclusion

The NPT 2714 is an innovative platform which combines the benefits of both modular and fixed systems, optimizing the Total Cost of Ownership (TCO) for customers. This unique design ensures investment protection, pay as you grow, flexibility, scalability, and cost-effectiveness, making it an ideal solution for various networking needs.

Key features include:

- **True "Pay As You Grow"** - with in-service upgrade from 7Tbps to 14.4Tbps by adding another switch card
- **Investment Protection** - with the ability to upgrade major components as and when required (for example 800G support in future)
- **Full Redundancy** - with redundant control and data planes in both 7.2Tbps and 14.4Tbps configurations
- **Flexibility** - with I/O scalability and interface diversity. It natively supports port speeds from 10 GbE up to 400 GbE hosted in 9 slots with just two I/O card variants. A wide range of optics provides support for multiple customer use cases
- **Security** - MACsec is software driven with no hardware dependency and available for all network interfaces
- **Coherent Routing (IPoDWDM)** - IP and DWDM on a single platform with 36 x 400G ZR+ coherent interfaces including plugin amplifiers to extend reach

Contact Us Contact us to learn more about Ribbon solutions.

About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers communications software, IP and optical networking solutions to service providers, enterprises and critical infrastructure sectors globally. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge software-centric solutions, cloud-native offers, leading-edge security and analytics tools, along with IP and optical networking solutions for 5G. We maintain a keen focus on our commitments to Environmental, Social and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders. To learn more about Ribbon visit rbbn.com.