

Cisco Network Convergence System 540 Fronthaul Routers

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Overview

Radio Access Network (RAN) decisions are important and deserve a lot of attention. Given the large number of cell sites already in their networks, and those that will be added to meet the growing bandwidth demands from subscribers, RAN purchases can account for up to 80 percent of mobile operators' Capital Expenditures (CapEx). Additionally, it is estimated that RAN Operating Expenses (OpEx) account for 60 percent of TCO. Consequently, there is tremendous pressure on mobile operators to operate more efficiently and improve operational economics while meeting the increasing demands of legacy wireline, wireless services, and new 5G offerings.

Up to now, the RAN has been based on legacy network technology. However, the increase in base stations to support 4G LTE expansions, and new 5G service introductions, is driving Mobile Network Operators (MNOs) to seek out new densification strategies. It is time for the RAN to evolve to become cloud scale, software defined, and virtualized. To this end, industry forums such as the Open RAN Alliance, IEEE Subcommittees, and the CPRI Cooperation, are working with Service Providers (SPs), to develop and test new densification strategies that can help them realize their business objectives and improve their TCO.

These densification strategies have been focused on demand for Cloud RAN or Centralized RAN (CRAN) architectures that are open, software defined, virtualized, and cloud scalable. CRAN disaggregates base stations by separating Radio Units (RUs) from Radio Equipment Controllers (RECs) and centrally locates these REC functions in regional/distributed data centers. This approach helps lower costs and improve performance and scalability.

The Cisco Network Convergence Systems 540 Fronthaul Routers (NCS540) are key elements of the Cisco Converged SDN Transport architecture. The solution and the routers are designed to meet and exceed stringent bandwidth, latency, and scalability performance demands of 5G now and in the foreseeable future. This solution simplifies the mobile network architecture end to end and significantly reduces operator TCO.

The Cisco Network Convergence Systems 540 Fronthaul Router portfolio is fully programmable, permitting customers to extend xHaul capabilities as specifications continue to evolve. They are based on high-performance, low-latency, next-generation Application Specific Integrated Circuits (ASICs) extended with a Field-Programmable Gate Array (FPGA) that permits the flexibility for quickly adapting to evolving radio interface processing specifications for CPRI, eCPRI, and Radio over Ethernet (ROE). Cisco has built these platforms with requisite hardware resources to permit operators to add RAN functions in a hosted model leveraging the built-in powerful FPGA. Leveraging a FPGA-enhanced architecture over a fixed ASIC pipeline, the Cisco Fronthaul Router product family offers the flexibility required to address both short-term and long-term mobile transport requirements. The new Cisco Fronthaul Router portfolio is truly designed to protect your investments in 5G and beyond.

These fronthaul routers are extensions of the comprehensive Cisco Network Convergence Systems Router portfolio designed for cost-effective delivery of next-generation services and applications. As such these routers are temperature-hardened, high-throughput, small form factor, low-power-consumption devices suitable for a number of deployments and configurations. They are powered by the industry-leading carrier-class version of Cisco IOS XR Software designed for operational efficiency and service agility.

Cisco IOS XR Software offers advanced features such as programmability, application awareness, network visibility, and automation. The Cisco NCS 540 series of routers is an intelligent converged access platform which enables service providers to deliver next-level business and entertainment experiences.

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Key product benefits

- High-speed and ultra-low latency forwarding to meet stringent radio transport requirements
- Converged services with optimized transport performance for fronthaul
- Flexible and fully programmable architecture to support evolving standards
- Precise timing and synchronization capabilities to support new radio techniques
- Consistent end-to-end IP network to simplify architecture and operations
- Open and automated management
- Lowest TCO for fronthaul

Key technical product highlights

- 1 RU small form factor with depth <600mm
- Front-to-back airflow
- Temperature hardened, suitable for deployments in indoor or outdoor cabinets*
- Power consumption,
 - Cell Site: NCS 540-FH-CSR-SYS: minimum <250W, typical <285W, maximum 325W
 - Aggregation: NCS 540-FH-AGG-SYS: minimum <650W, typical <675W, maximum 700W
- Versatile Ethernet interface options: 10/25/100G
- CPRI interface options: Rates 3/4/5/6/7/8
- Low latency forwarding, typically <10 μ s
- Precise frequency and phase/time synchronization using the latest industry standards
- Integrated GNSS receiver
- Rich Quality of Service capabilities for different SLAs
- MEF 3.0 Compliant
- Excellent manageability
- Flexible consumption model

* For an outside plant installation (cell site cabinet, hut etc.), it is required that the Cisco NCS540 Series Router be protected against airborne contaminants, dust, moisture, insects, pests, corrosive gases, polluted air or other reactive elements present in the outside air. To achieve this level of protection, we recommend that the unit be installed in a fully sealed enclosure or cabinet

Images shown NCS 540-FH-CSR-SYS and NCS 540-FH-AGG-SYS



Figure 1.
Cisco NCS 540 Fronthaul Router Family

NCS 540 Fronthaul Router Model Comparison

Chassis PID	NCS 540-FH-CSR-SYS (Remote Indoor CSR)	NCS 540-FH-AGG-SYS (Aggregation Router)
CPU	8-core 1.7Ghz x86 CPU 8GB DRAM	8-core 1.7Ghz x86 CPU 8GB DRAM
Memory Storage	32GB storage	32GB storage
Interfaces	8xCPRI Option 3-8 + *4x1/10G/CPRI 3-8 + 8x1/10G + 4x1/10/25G + 2x10/25G (802.1Qbu) + 2x100G *Universal Port = Port can be used for CPRI, eCPRI, Ethernet (1/10GE)	*24x1G/10G/25G (802.1Qbu, CPRI option 3-8) + 4x100G *Universal Port = Port can be used for CPRI, eCPRI, Ethernet (1/10/25GE)
Throughput	Up to 300 Gbps	Up to 900 Gbps
Power Supplies Fans Airflow	2 hot-swappable AC/DC power supplies provide 1+1 redundancy 6 fans provide 5+1 redundant system cooling Front-to-back airflow	2 hot-swappable AC/DC power supplies provide 1+1 redundancy 6 modular fans provide 5+1 redundant system cooling Front-to-back airflow
Temperature Range	I-Temp: -40° C to+65° C at 1,000ft +60° C at 6,000ft +50° C at 13,000ft	C-Temp: 0° C to +55° C at 1,000ft +50° C at 6,000ft +45° C at 13,000ft
Surge Rating As per IEC 61000-4-5	AC: 1kV DM, 2kV CM DC: 1kV DM, 1kV CM	AC: 1kV DM, 2kV CM DC: 1kV DM, 1kV CM

Chassis PID	NCS 540-FH-CSR-SYS (Remote Indoor CSR)	NCS 540-FH-AGG-SYS (Aggregation Router)
Timing	SyncE, PTP Internal GNSS receiver SW* Interfaces: 1pps, 10MHz, ToD, antenna for GNSS Class C	SyncE, PTP Internal GNSS receiver SW* Interfaces: 1pps, 10MHz, ToD, antenna for GNSS Class C
Physical Specification	1RU Depth: 38.1cm 1.72 in. x 17.5 in. x 15 in (H x W x L) Weight: 7.55 kg	1RU Depth: 58cm 1.72 in. x 17.5 in. x 22.82 in (H x W x L) Weight: 11.3 kg

* Post FCS

Software feature support on NCS 540 Fronthaul Routers in Cisco IOS XR:

Description	Specification
Layer 2	Layer 2 forwarding and bridging Bridge Domains (BD) Ethernet Flow Point (EFP) IEEE 802.1Q VLANs and Q-in-Q Ethernet Link Aggregation Group (LAG) Link Aggregation Control Protocol (LACP) 802.3ad G.8032 Jumbo frames on all ports
Layer 3	IPv4 and IPv6 unicast routing Layer 3 interfaces: physical interfaces and sub-interfaces Virtual Routing and Forwarding (VRF) Open Shortest Path First (OSPFv2, OSPFv3) Intermediate System to Intermediate System (ISIS, ISISv6) Multiprotocol Border Gateway Protocol (MP-BGP) Equal-Cost Multipath (ECMP) Bidirectional Forwarding Detection (BFD) Virtual Router Redundancy Protocol (VRRP) Integrated Routing Bridging (IRB) with Bridge Virtual Interface (BVI) Generic Routing Encapsulation (GRE)
MPLS	Label switching (LER, LSR) Label Distribution Protocol (LDP) BGP Labeled Unicast (BGP-LU) MPLS Traffic Engineering with RSVP-TE Point-to-point L2VPN - Static, T-LDP, EVPN-VPWS Multipoint L2VPN - VPLS, EVPN L2/L3 EVPN with Anycast IRB 6PE, 6VPE IP Loop-Free Alternate (LFA) Fast Reroute (FRR) RSVP-TE Fast Reroute (FRR)

Description	Specification
Segment Routing (SR)	Segment Routing with MPLS data plane (SR-MPLS) Segment Routing with IPv6 data plane (SRv6) ISIS, OSPF, BGP extensions to segment routing BGP Egress Peering Engineering (BGP-EPE) Segment Routing Traffic Engineering (SRTE) Segment Routing Path Computation Element (SR-PCE) Topology Independent Loop-Free Alternate (TI-LFA) Segment Routing On-Demand Next-hop (SR-ODN)
Multicast	IPv4 and IPv6 multicast routing PIM-SM, PIM-SSM IGMPv3, MLDv2 mLDP mVPN P2MP-TE
Quality of Service (QoS)	Class-based 3-level Hierarchical QoS Virtual Output Queueing (VOQ) Policing, Shaping Multi-level priority queuing Classification based on L2/L3/L4 fields Remarking Weighted Random Early Detection (WRED) Deep packet buffer
Timing	SyncE with ESMC Integrated GNSS receiver IEEE 1588-2008 PTP T-GM, T-BC, T-TSC G.8265.1, G.8275.1, G.8275.2 G.8273.2 Class B/C
Security	Control-plane and management plane protection Local Packet Transport Services (LPTS) Authentication, Authorization, and Accounting (AAA) Terminal Access Controller Access-Control System Plus (TACACS+) Secure Shell (SSH) Layer 3 ingress and egress ACLs for IPv4 and IPv6 Layer 2 ingress ACLs Unicast Reverse Path Forwarding (Unicast RPF)
OAM	CDP, LLDP, ICMP, DHCP Relay IP SLA MPLS OAM Ethernet OAM: CFM, Y.1731 DM/SLM TWAMP Model/Event Driven Telemetry Netflow SPAN/ERSPAN
Manageability	CLI SNMP MIB NETCONF/gRPC (XML, JSON, GPB) YANG models (native, open: OpenConfig, IETF) RPM-based SW infrastructure Zero-Touch Provisioning (ZTP) with iPXE 3rd party application hosting on N540-24Z8Q2C-SYS

Supported transceiver modules

Please refer to [Transceiver Module Group \(TMG\) Compatibility Matrix](#) for the NCS 540 Series supported transceivers.

Environment

- Environmental properties for NCS 540 fixed systems

Normal operating temperature	Industrial temperature: -40° C to +65° C (1,000 ft.), +60° C (6,000 ft.), +45° C (13,000 ft.) Commercial temperature: 0° C to +55° C (1,000 ft.), +50° C (6,000 ft.) +45° C (13,000 ft.)
Nonoperating (storage) temperature	-40 to 70° C (-40 to 158° F)
Operating humidity	NCS 540: 15% to 85% (noncondensing) except
Storage (relative) humidity	5% to 95% at 40° C per NEBS GR-63-Core
Altitude	0 to 13,000 ft.
Power	Worldwide ranging AC (90–265V; 50–60 Hz) Worldwide ranging DC (-40V to -72V)

Regulatory standards compliance

- Regulatory standards compliance: safety and EMC at FCS

Specification	Description
Regulatory compliance	Products comply with CE markings according to directives 2004/108/EC and 2006/95/EC
Network Equipment Building Standards (NEBS)	Designed to meet GR-63-CORE, GR-1089-CORE and GR-3108 Class-2
Safety	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition AS/NZS 60950-1 GB4943
EMC standards	47CFR Part 15 (CFR 47) Class A AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A CNS13438 Class A
EMC immunity	EN55024 CISPR24 EN300386 KN 61000-4 series

Specification	Description
ETSI	ETS/EN 300 119 Part 4 ETS/EN 300 019 - Storage: Class 1.2, Transportation: Class 2.3, In-Use/Operational: Class 3.2 ETS/EN 300 753
RoHS	The product is RoHS-6 compliant with exceptions for leaded-ball grid-array (BGA) balls and lead press-fit connectors

Ordering information

Router PID	NCS 540-FH-CSR-SYS (Remote Indoor CSR)	NCS 540-FH-AGG-SYS (Aggregation Router)
Description	8xCPRI Option 3-8 + *4x1/10G/CPRI 3-8 + 8x1/10G + 4x1/10/25G + 2x10/25G (802.1Qbu) + 2x100G *Universal Port = Port can be used for CPRI, eCPRI, Ethernet (1/10GE)	*24x1G/10G/25G (802.1Qbu, CPRI option 3-8) + 4x100G *Universal Port = Port can be used for CPRI, eCPRI, Ethernet (1/10/25GE)
Power Supplies Fans Accessories	Power Supply: N540-PWR400-A N540-PWR400-D Rackmount for AC variant: N540-RCKMT-19 N540-RCKMT-23 N540-RKMT-ETSI	Power Supply: N540-PWR750-A N540-PWR750-D Fan: N540-FAN Rackmount for AC variant: N540-RCKMT-19 N540-RCKMT-23 N540-RKMT-ETSI
Software	XR-6.5-AC-TRK TRK-6.5-54	XR-6.5-AC-TRK TRK-6.5-54

Ordering information for software licenses available on NCS 540 Fronthaul Routers

Part number	Description
ESS-AC-10G-RTU-1	Essentials SW Right-to-Use per 10G
ADV-AC-10G-RTU-1	Advanced SW Right-to-Use per 10G
ESS-10G-SIA-3	Essentials SW Innovation Access per 10G 3-year subscription

Part number	Description
ESS-10G-SIA-4	Essentials SW Innovation Access per 10G 4-year subscription
ESS-10G-SIA-5	Essentials SW Innovation Access per 10G 5-year subscription
ADV-10G-SIA-3	Advanced SW Innovation Access per 10G 3-year subscription
ADV-10G-SIA-4	Advanced SW Innovation Access per 10G 4-year subscription
ADV-10G-SIA-5	Advanced SW Innovation Access per 10G 5-year subscription

Ordering information for power cables supported on NCS 540 Fronthaul Routers

Part number	Description
CAB-AC-SA	Power Cord - South Africa, 16/10A,250V,1830mm, -40C to +85C
CAB-AC-ARG	Power Cord - Argentina, 10A,250V,2500mm, -40C to +85C
CAB-AC-ISR	Power Cord - Israel, 16/10A,250V,2500mm, -40C to +85C
CAB-AC-TAI	Power Cord - Taiwan, 15/10A,125V,2500mm, -40C to +85C
CAB-AC-CHI	Power Cord - China, 10A,250V,2500mm, -40C to +85C
CAB-AC-KOR	Power Cord - Korea, 16/10A,125V,2500mm, -40C to +85C
CAB-AC-EUR	Power Cord - Europe, 16/10A,250V, 2500mm, -40C to +85C
CAB-AC-ITL	Power Cord - Italy, 10A,250V, 2500mm, -40C to +85C
CAB-AC-UK	Power Cord - UK, 13/10A, 250V, 2500mm, -40C to +85C
CAB-AC-AUS	Power Cord - Australia, 10A,250V,2500mm, -40C to +85C
CAB-AC-US	Power Cord - US, 15A,125V,2500mm, -40C to +85C
CAB-AC-BRA	Power Cord - Brazil, 10A,250V,2500mm, -40C to +85C
CAB-AC-IND	Power Cord - India, 16/10A,250V,2500mm, -40C to +85C
CAB-AC-SUI	Power Cord - Swiss, 10A,250V,2500mm, -40C to +85C
CAB-AC-SA	Power Cord - South Africa, 16/10A,250V,1830mm, -40C to +85C
CAB-AC-ARG	Power Cord - Argentina, 10A,250V,2500mm, -40C to +85C
CAB-AC-ISR	Power Cord - Israel, 16/10A,250V,2500mm, -40C to +85C

Service and support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco NCS 540 Fronthaul routers. These innovative Cisco Services offerings are delivered through a unique combination of people, processes, tools, and partners, and they are focused on helping you increase operating efficiency and improve your network operation. Cisco Advanced Services uses an architecture-led approach to help you align your data center infrastructure with your business goals and achieve long-term value. Cisco Services helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning resources.

With this service, you can take advantage of the Cisco Smart Call Home service, which offers proactive diagnostics and real-time alerts on your Cisco NCS 540. Spanning the entire network lifecycle, Cisco Services offerings help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise.

Cisco Capital

Flexible payment solutions to help you achieve your objectives

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments.

[Learn more.](#)

Warranty

Cisco NCS 540 Fronthaul Routers have a 1-year limited hardware warranty. The warranty includes hardware replacement with a 10-day turnaround from receipt of a Return Materials Authorization (RMA).

Cisco environmental sustainability

Information about Cisco's environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the "Environment Sustainability" section of Cisco's [Corporate Social Responsibility](#) (CSR) Report.

Reference links to **information about key environmental sustainability topics** (mentioned in the "Environment Sustainability" section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant, or guarantee that it is complete, accurate, or up to date. This information is subject to change without notice.

For more information

For more information about the Cisco NCS 540, contact your Cisco representative.

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