



5G Converged SDN Transport

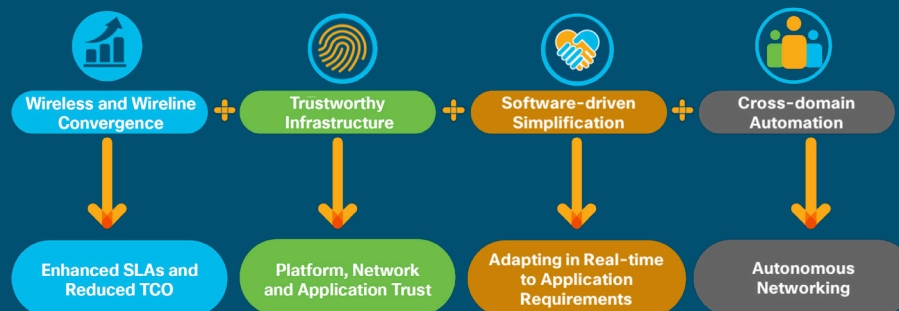
The challenge

Service providers are facing capital and operating expenditure (CapEx and OpEx) pressures, due to the increasing traffic demands at flat average revenue per user (ARPU). 5G requires network transformation to meet the stringent service requirements of 1-ms latency, 1-Gbps bandwidth per user, and billions of connected Internet of Things (IoT) devices with an expanding threat surface.

The solution

Delivering 5G enterprise services leveraging Cisco's industry-leading enterprise and service provider solutions can help generate new revenue streams for operators. Cisco offers a holistic solution, including xHaul transport, 5G packet core, security, automation, and enterprise managed services. Cisco is also driving industry initiatives to help open up the radio access network (RAN). Cisco® Converged SDN Transport is in the center of the 5G transformation and delivers the following capabilities outlined in Figure 1.

Figure 1. Converged SDN Transport capabilities and benefits



Benefits

Grow revenue

- New 5G enterprise services

Reduce cost

- 62% total cost of ownership (TCO) savings with network convergence
- 400% capacity increases
- 36% savings in upfront costs

Enhance customer experience

- 78% faster time to service
- 55% reduction in mean time to repair

Mitigate risk

- Trustworthy platforms with hardware root of trust

What if you can converge all your fixed and mobile services into a single, secure, fully automated network that can adapt in real time to application requirements and stringent SLAs?

The 5G architectural transitions

Cisco's technology allows you to deliver on the stringent 5G requirements and the key 5G architectural changes defined by the Third-Generation Partnership Project (3GPP) described below. Those architectural changes require an evolution from unified Multiprotocol Label Switching (MPLS) towards segment routing (SR) and border gateway protocol virtual private network (BGP VPN) technologies with end-to-end IP all the way to the access layer. This enables wireline and wireless network convergence, enhanced service-level agreements (SLAs), resource-efficient soft network slicing, less than 50 ms of protection against

failures, scalable traffic engineering (TE), and a simplified protocol stack that eliminates protocols like the Label Distribution Protocol (LDP) and the Resource Reservation Protocol (RSVP) TE.

1. Cloud RAN

Moving from a distributed RAN to a cloud RAN can reduce OpEx overhead at cell sites, increase resource efficiency of virtualized baseband units at centralized locations, and reduce overall RAN CapEx investments. Cloud RAN also delivers service agility and spectral efficiency gains. Cisco's 5G converged SDN transport would deliver on the tight time-error budgets and low-latency implications of cloud RAN on the transport network.

2. Mobile edge compute and virtualization

Efficient placement of services between distributed and centralized data centers based on application latency, quality of service, and bandwidth requirements is necessary. Seamless integration between the wide area network (WAN) and the distributed data centers by unifying on SR and BGP-based VPNs simplifies the network. SR MPLS

and SRv6 can enable seamless service chaining for virtual network functions.

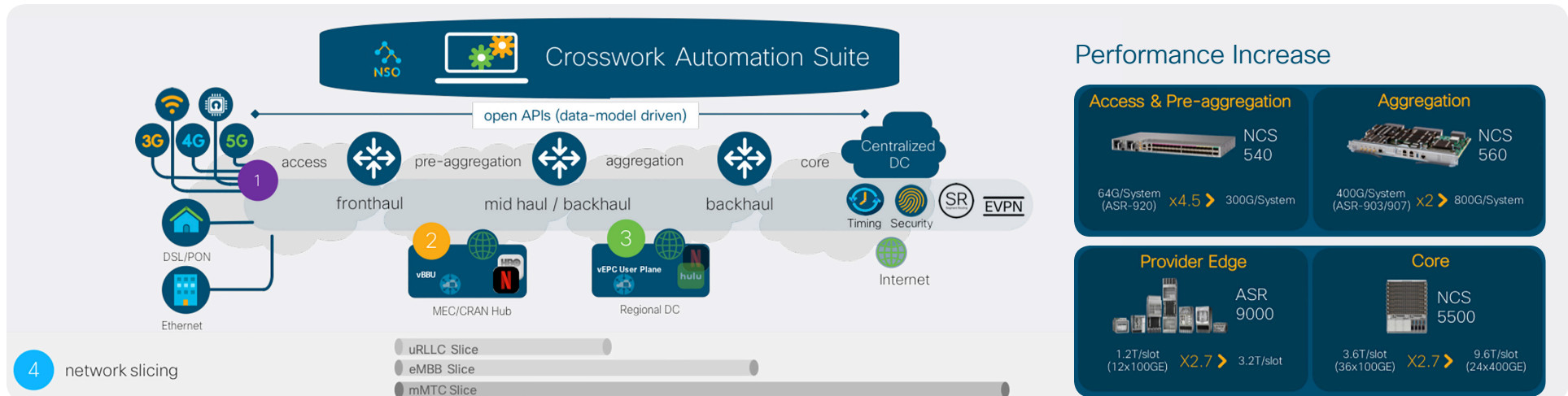
3. Cloud-native Control and User Plane Separation (CUPS)

Cisco's cloud-native packet core and distributed SDN architecture enable CUPS, so you can partition your network and position functions and services exactly where you need them. This can enable latency-sensitive services and content caching to move closer to end users.

4. Network slicing

Network slicing is the ability to build what looks like discrete end-to-end networks for different 5G services or customers. Segment routing Flexible Algorithm (Flex- Algo) and a cross-domain multi-vendor services orchestrator enable soft slicing, while maximizing resource efficiency. Flex-Algo provides per-user, per-application traffic steering with routing isolation to meet any required SLA and end-user slice visibility. Figure 2 shows an overview of the converged SDN transport solution for 5G.

Figure 2. Converged SDN Transport solution overview.



5G converged SDN transport solution pillars

Cisco converged SDN transport solution to meet the 5G requirements is based on the five pillars illustrated in Figure 3.

Figure 3. Five pillars of converged SDN transport



Network convergence - Cisco's 5G transport portfolio enables network convergence across wireless and wireline services, allowing service providers to save money.

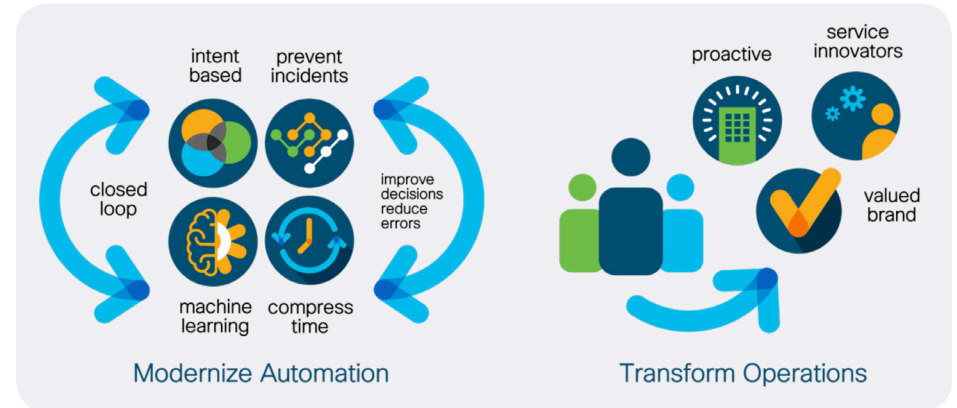
Trustworthy infrastructure - Cisco's 5G products are designed from their foundation with security in mind, starting from the component-level in-box security to deliver platform trust, network trust, and application trust. The trustworthy systems have a chip called the Trust Anchor Module (TAM) for securely storing unique cryptographic keys in hardware, enabling capabilities like secure boot. Moreover, Cisco has a complete security portfolio to address the 5G threat surface across the network and user equipment.

Mass-scale 5G-ready portfolio - To accommodate the high bandwidth of 5G radio and the exponentially increasing number of IoT devices, the network capacity needs to increase by using access platforms supporting 10/25/100 Gigabit Ethernet (GE) and core platforms supporting up to 400 GE interfaces.

Software-driven simplification - Cisco converged SDN transport for 5G permits programmability at every level. It can effectively scale service automation and orchestration by leveraging software Application Programming Interfaces (APIs) and standard data models with associated tools such as YANG, XML, and JSON-related SDKs. The infrastructure also supports real-time monitoring and assurance of the physical and logical network through telemetry.

Cross-domain automation - Cisco provides a suite of automation products for orchestration, automation, and analytics based on Cisco Network Services Orchestrator (NSO) and Cisco Crosswork™. For example, service assurance via Cisco Crosswork Situation Manager derives proactive insights based on artificial intelligence and machine learning (AI/ML) algorithms and can significantly reduce event noise by up to 99 percent. To achieve the scale required by 5G, networks need to be automated to deliver service agility with optimized operational costs, like setting up, modifying, or removing a 5G network slice in minutes or seconds. Figure 4 shows Cisco's intent-based automation framework for proactive remediation.

Figure 4. Cisco's intent-based automation



“Cisco NCS routing technology powered by automation software running traffic over dark fiber offers us an ideal blend of innovative technology to support our LTE Advanced and 5G network,”

- Greg O’Connor

Vice President of Network Core and Access, Sprint

The flexible consumption model

Purchase network capacity as needed in a cost-efficient manner.

Benefits:

- **Reduce upfront capital**
- **Protect investments** – Licenses are transferrable to next-generation hardware
- **Simplify operations** with bundled automation for Cisco EPNM, WAE, and NSO
- **Use capital efficiently** with network-wide license pooling

Cisco’s 5G solution components

5G-ready routers

Cisco’s comprehensive 5G-ready routing portfolio is designed to address indoor and outdoor cell-site, aggregation, edge, and core applications based on the **Cisco Network Convergence System (NCS) 500 and 5500 Series Routers**, and the **Cisco ASR 9000 Series Aggregation Services Routers** for converged mobile and wireline networks. The portfolio offers industry-leading low TCO, using space and power-efficient platforms, leading innovation with capabilities like segment routing, and the highest density in the market today.

5G automation suite

Cisco’s 5G automation suite consists of Cisco NSO for end-to-end service orchestration; **Cisco Crosswork Optimization Engine** as an SDN controller for dynamic path optimization for constraints like latency and bandwidth; **Cisco WAN Automation Engine (WAE)** capacity planning and failure analysis for IP and optical; **Cisco Evolved Programmable Network Manager (EPNM)** for device lifecycle management; and **Cisco Crosswork Situation Manager** for service assurance based on AI/ML technologies. On the RAN side, the **Cisco Crosswork Self-Optimizing Network (SON)** provides a solution for automating the RAN, boosting its performance and improving the RAN quality of experience.

5G security solutions

Cisco’s 5G security technologies provide threat mitigation across end-user devices, air interfaces, RAN, xHaul, the data center, and packet core. Starting with in-box hardware and software security, Cisco 5G routers have a **TAM** chip, which stores all sensitive data encrypted to protect against exploits. **Cisco Stealthwatch®** is leveraged for enhanced visibility and threat detection, **Cisco Umbrella™** for DNS protection, **Cisco Firepower®** for DDoS protection and next-generation firewall capabilities, **Cisco Identity Services Engine (ISE)** for segmentation and isolation, and **Cisco Advanced Malware Protection (AMP)** for malware protection. Cisco security products harness the power of **Talos®** threat intelligence, which daily blocks around 20 billion attacks.

5G mobility solution

Cisco **Ultra Services Platform™ (USP)** is a next-generation 5G packet core for 5G non-standalone (NSA) and Standalone (SA) deployments. It’s an industry-leading, virtualized mobile services platform that is Network Functions Virtualization (NFV) European Telecommunications Standards Institute (ETSI) architecture-compliant. Its distributed SDN architecture provides full CUPS with exceptional performance and scale. USP supports network slicing for maximum customization and flexibility.

For more information go to www.cisco.com/go/5g.