Cisco Non-Terrestrial Networking

Unleash global connectivity: Cisco breaks network barriers with non-terrestrial networking

Value statement

Cisco Non-Terrestrial Networking enables service providers to deliver seamless connectivity across both terrestrial and satellite networks. This integration unlocks new revenue streams in previously underserved markets such as maritime, aerospace, emergency response, and emerging global connectivity sectors.

Overview

Beyond boundaries: Navigating the complex integration of terrestrial and non-terrestrial networks

The satellite networking market is experiencing explosive growth, yet satellite network operators (SNOs), mobile network operators (MNOs), and wholesale network operators are facing significant challenges in integrating terrestrial and non-terrestrial networks while maintaining assured service levels across challenging global environments.

Cisco's Non-Terrestrial Networking solution addresses these challenges through seamless cross-domain integration. Our comprehensive approach delivers unprecedented interoperability, end-to-end visibility, and optimized performance through a unified management framework that positions satellite connectivity as a natural extension of existing terrestrial services rather than a replacement.

This breakthrough solution empowers service providers to expand their connectivity options and global reach by unlocking new revenue streams in previously underserved markets—from maritime and aerospace to emergency response and remote global regions. Rather than competing with terrestrial networks, satellite integration enhances service portfolios, enabling operators to confidently deliver connectivity anywhere on the planet with the assured performance, security, and reliability their customers demand.

Benefits

Cisco® Non-Terrestrial Networking uniquely bridges terrestrial and non-terrestrial networks through a comprehensive, unified approach that delivers unparalleled end-to-end visibility and performance across network domains. Key benefits of the Cisco Non-Terrestrial Networking solution include:

- **Unified network convergence:** Leveraging decades of terrestrial networking leadership, Cisco Agile Services Networking provides an unprecedented architectural approach that creates a truly unified network ecosystem, drawing on Cisco's proven expertise in complex network design to eliminate traditional silos between terrestrial and non-terrestrial communication infrastructures.
- **Advanced interoperability:** Built upon Cisco's extensive legacy of network integration, this solution offers comprehensive cross-domain connectivity that seamlessly bridges decades of terrestrial networking innovation with innovative non-terrestrial communication technologies, enabling Segment Routing for IP6 (SRv6)/Ethernet VPN (EVPN)-based intelligent routing and consistent performance across diverse network environments.
- **Adaptive resilience:** Drawing on Cisco's long-standing experience in mission-critical network design, the solution provides dynamic network reconfiguration capabilities that automatically reroute and optimize connectivity, applying the same reliability principles that have made Cisco a trusted partner for global enterprise and service provider networks.
- **Intelligent performance optimization:** Extending Cisco's market-leading network analytics and monitoring capabilities, this solution integrates Cisco ThousandEyes® and advanced AI-driven management to provide unprecedented real-time visibility, leveraging the company's deep expertise in network performance intelligence across traditional and emerging network domains.
- **Proactive service assurance:** Cisco Provider Connectivity Assurance delivers real-time, end-to-end visibility and AI-native predictive analytics, enabling proactive management and helping ensure high performance and reliability in non-terrestrial (satellite) networks.

- **Comprehensive security framework:** Applying Cisco's industry-leading security protocols developed through years of terrestrial network protection, the solution extends enterprise-grade security across nontraditional network architectures, helping ensure the same level of robust protection that has defined Cisco's networking solutions for decades.
- **Scalable architecture:** Reflecting Cisco's history of developing flexible, future-ready networking solutions, this architecture provides a modular approach that scales from regional connectivity to global network deployment, demonstrating the company's continued innovation in addressing emerging connectivity challenges.

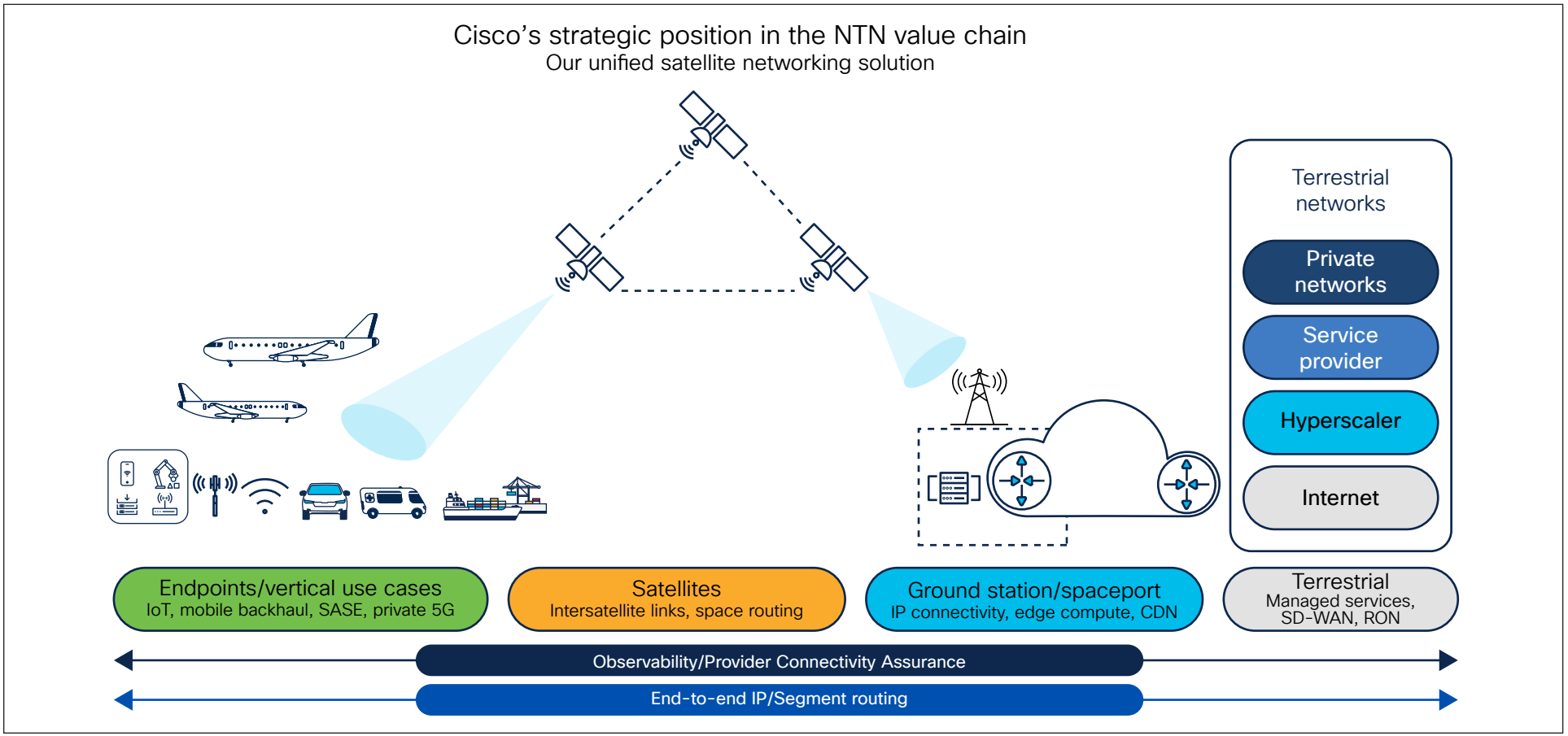

Figure 1. Bridging worlds: Cisco's unified approach to terrestrial and nonterrestrial network integration

Converging skies and ground: Pivotal trends reshaping satellite communications

Explosive growth and expanding applications

The satellite networking market is experiencing unprecedented expansion as demand for global connectivity intensifies. New satellite constellations in low earth orbit (LEO) are dramatically increasing to offer high bandwidth and improved latency performance. This proliferation is opening applications beyond traditional use cases to include IoT networks, support for autonomous vehicles, and enhanced mobile broadband in previously unreachable locations.

Convergence of terrestrial and nonterrestrial networks

The industry is rapidly moving toward integrated network architectures that blend network connectivity using both satellite and terrestrial capabilities. This trend represents both a significant opportunity and a challenge, as operators must fundamentally harmonize different network types while maintaining consistent quality of service.

Challenges and opportunities for service providers

Integration complexity

SNOs and MNOs face considerable technical hurdles in creating unified management frameworks across heterogeneous networks with disparate protocols, latency profiles, and bandwidth characteristics. Those who master this integration gain significant competitive advantages in service breadth and resilience.

Quality-of-service (QoS) management

Maintaining assured service levels across hybrid networks presents substantial challenges, particularly in managing seamless handovers and optimizing traffic routing between terrestrial and nonterrestrial segments. Operators who solve this challenge can deliver truly ubiquitous connectivity experiences.

Revenue diversification

The ability to extend reliable services to underserved markets—maritime, aerospace, emergency response scenarios, and remote global regions—offers substantial revenue opportunities for service providers willing to invest in integrated solutions. This expansion capability is increasingly becoming a competitive necessity rather than a differentiator.

Operational complexity

Managing expanded and diversified networks increases operational complexity, requiring new skills and tools. However, providers who develop these capabilities position themselves at the forefront of the next connectivity revolution.

Introducing Cisco's Non-Terrestrial Networking solution

Bridging new frontiers in connectivity

Cisco's Non-Terrestrial Networking (NTN) solution introduces a revolutionary cross-architectural approach that seamlessly integrates satellite communications with terrestrial infrastructure. This comprehensive solution addresses the surging demand for expanded connectivity across previously unreachable or economically unviable locations.

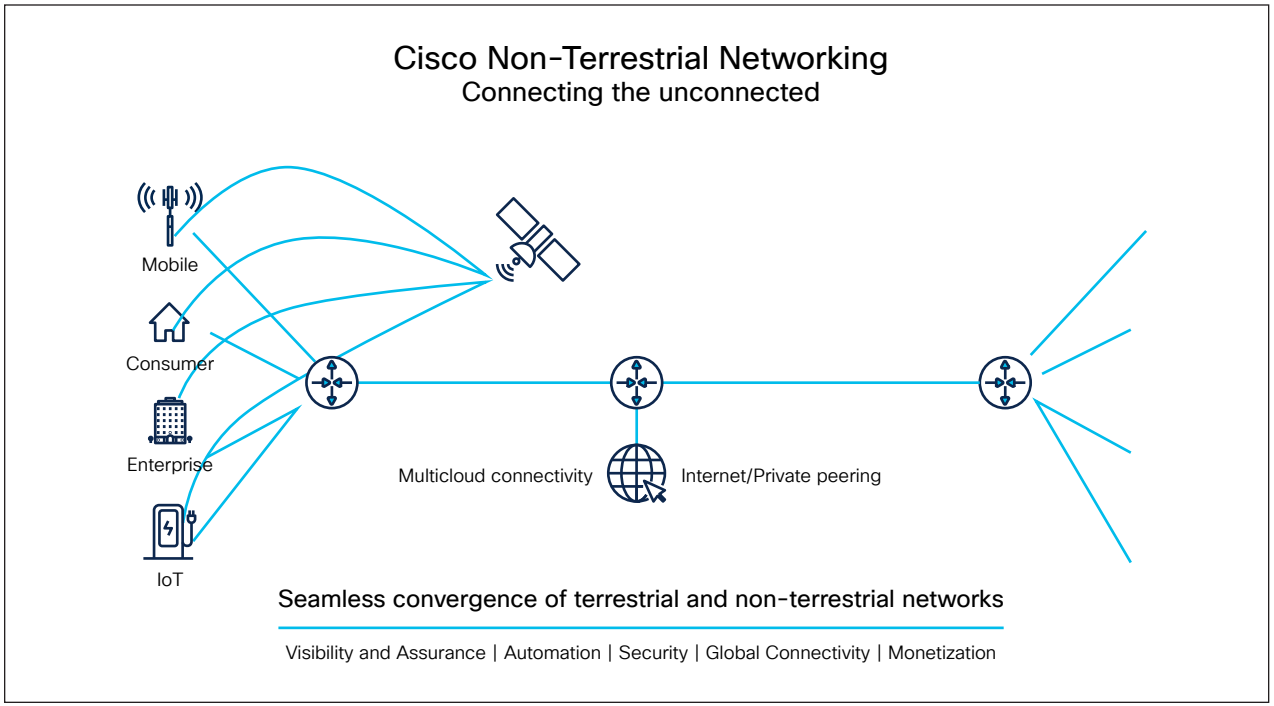

Figure 2. Cisco Non-Terrestrial Networking

The power of Cisco's integrated approach. Our solution unifies traditionally siloed network domains through a full-stack integration of Cisco's industry-leading technologies.

- **Cisco service provider routing and switching (NCS family and 8000 Series routers)** delivers carrier-grade routing with ultra-high throughput and minimal latency, specifically optimized for satellite ground-station gateway routers, point-of-presence (POP) data center fabric, and peering solutions. These routers feature specialized protocol support, QoS and security capabilities, and rugged construction to withstand extreme outdoor conditions, serving as cornerstone components that enable seamless integration between terrestrial and non-terrestrial networks.
- **The Cisco NTN connectivity solution enhances network reliability**, scalability, and security by integrating advanced technologies and helping ensure interoperability, enabling service providers to deliver superior services while optimizing costs.

- **The Cisco NCS and 8000 Series**-based access and aggregation portfolio provides a comprehensive feature set that seamlessly integrates NTN connectivity as last-mile access into service provider metro architecture. Both product lines emphasize energy efficiency, programmability, and flexible deployment options, enabling providers to optimize operations while delivering exceptional services.
- **Built on the industry-leading** carrier-grade operating system Cisco IOS® XR, these platforms continue to evolve to meet technological transitions. IOS XR delivers best-in-class routing protocols and features, with a focus on intent-based transport technologies such as segment routing and EVPN, making it the leading choice for web-scale and large-scale service providers across network segments.
- **Cisco Routed Optical Networking** integrates IP and optical layers to simplify terrestrial network architecture and reduce equipment needs. Leveraging high-performance coherent optics, these solutions enhance cost efficiency and operational simplicity while maintaining scalability and performance.
- **Cisco coherent optics** provide a unique solution to interconnect satellites in space and route the traffic. Cisco technology also allows SNOs to build reliable space-to-ground links using laser-based optics.
- **Cisco ThousandEyes** enhances the management of NTNs by providing comprehensive network visibility and performance monitoring. It offers end-to-end insights into network paths, benchmarks performance, detects outages in real time, and analyzes user experience to identify bottlenecks. Additionally, it provides detailed metrics and visualizations of network paths, which are crucial for optimizing NTN operations and providing reliable service delivery. These capabilities make ThousandEyes an invaluable tool for maintaining efficient and robust NTN environments.
- **Cisco Provider Connectivity Assurance** delivers proactive service assurance through real-time, continuous visibility across networks. Its AI-powered analytics identify and isolate issues before users experience impact, while enhancing visibility into satellite link performance through automated monitoring and assurance mechanisms. The solution provides comprehensive performance trend analysis, service-level agreement (SLA) management tools specifically designed for variable satellite conditions, and end-to-end service activation testing capabilities. By accelerating troubleshooting and issue identification, this technology significantly reduces operational complexity and minimizes service interruptions across integrated terrestrial and non-terrestrial networks.
- **Cisco SD-WAN** capabilities provide intelligent path selection and application-aware routing to optimize traffic across available links, automatically prioritizing terrestrial paths when available and seamlessly transitioning to satellite connections when necessary. The system includes advanced QoS mechanisms designed specifically for high-latency satellite environments, dynamic bandwidth allocation, and centralized management across hybrid networks, all protected by an integrated security architecture with end-to-end encryption and zero-trust network access.

- **Cisco Mobility Services Platform for NTN** enables SNOs and MNOs to seamlessly integrate with open ecosystems and deliver progressive services—from low-data messaging (NB-IoT) to voice and 5G NR connectivity. This software-as-a-service solution leverages proven Cisco technologies, including Cisco IoT Control Center, Packet Core, and unified APIs, to reduce complexity while accelerating time to market. Together with Cisco NTN, the platform unlocks new direct-to-device connectivity use cases, enabling smartphones and IoT devices to connect directly to satellites when terrestrial networks are unavailable, while also extending private 5G coverage to previously unreachable locations such as remote industrial sites, maritime operations, and emergency response scenarios. The platform features ready-made templates for instant service activation and a unified API that simplifies network configuration, service activation, and subscriber management by abstracting complex technologies. With preintegrated value-added services, communication service providers can immediately launch and monetize offerings across these diverse terrestrial and satellite-enabled use cases.
- **Cisco CX Professional Services** empowers service providers to effectively plan, design, and operate NTNs and seamlessly integrate them with terrestrial infrastructure. Our team of consultants, architects, and engineers brings deep expertise to accelerate technology transformations while minimizing risks. We provide expert guidance throughout the entire journey—from solution planning and design to validation, deployment, and adoption. By helping ensure smooth integration across multidomain and multivendor environments, we enhance your network's flexibility, reliability, and scalability. This comprehensive support delivers faster business outcomes and enables continuous innovation in even the most complex network ecosystems.

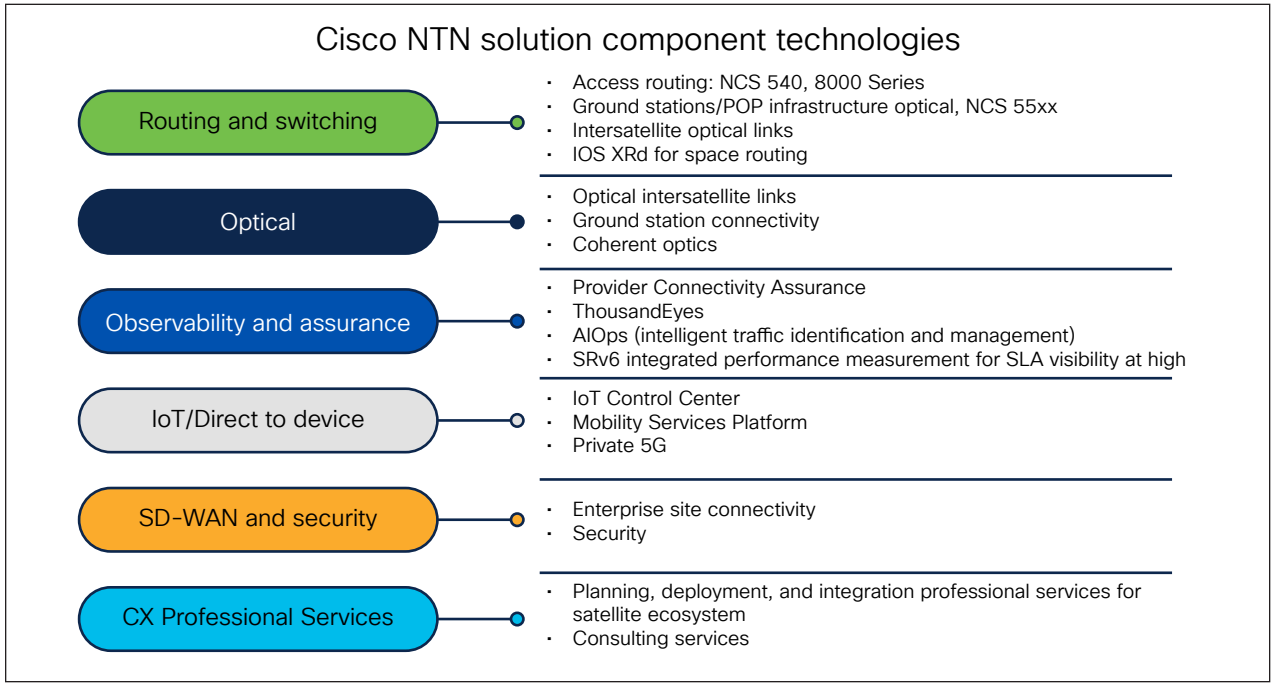

Figure 3. Key component technologies for Cisco's Non-Terrestrial Networking solution

The unified advantage: Cisco NTN's seamless architecture

Traditional converged networks force end-to-end services through siloed terrestrial and non-terrestrial systems, creating confusion around service ownership, security vulnerabilities, and SLA accountability. Cisco's NTN solution stands apart through a unified architecture that provides complete visibility and optimized performance across all network domains. By eliminating the traditional divide between satellite and terrestrial networks, we deliver truly ubiquitous, uninterrupted communication—the foundation of next-generation global connectivity.

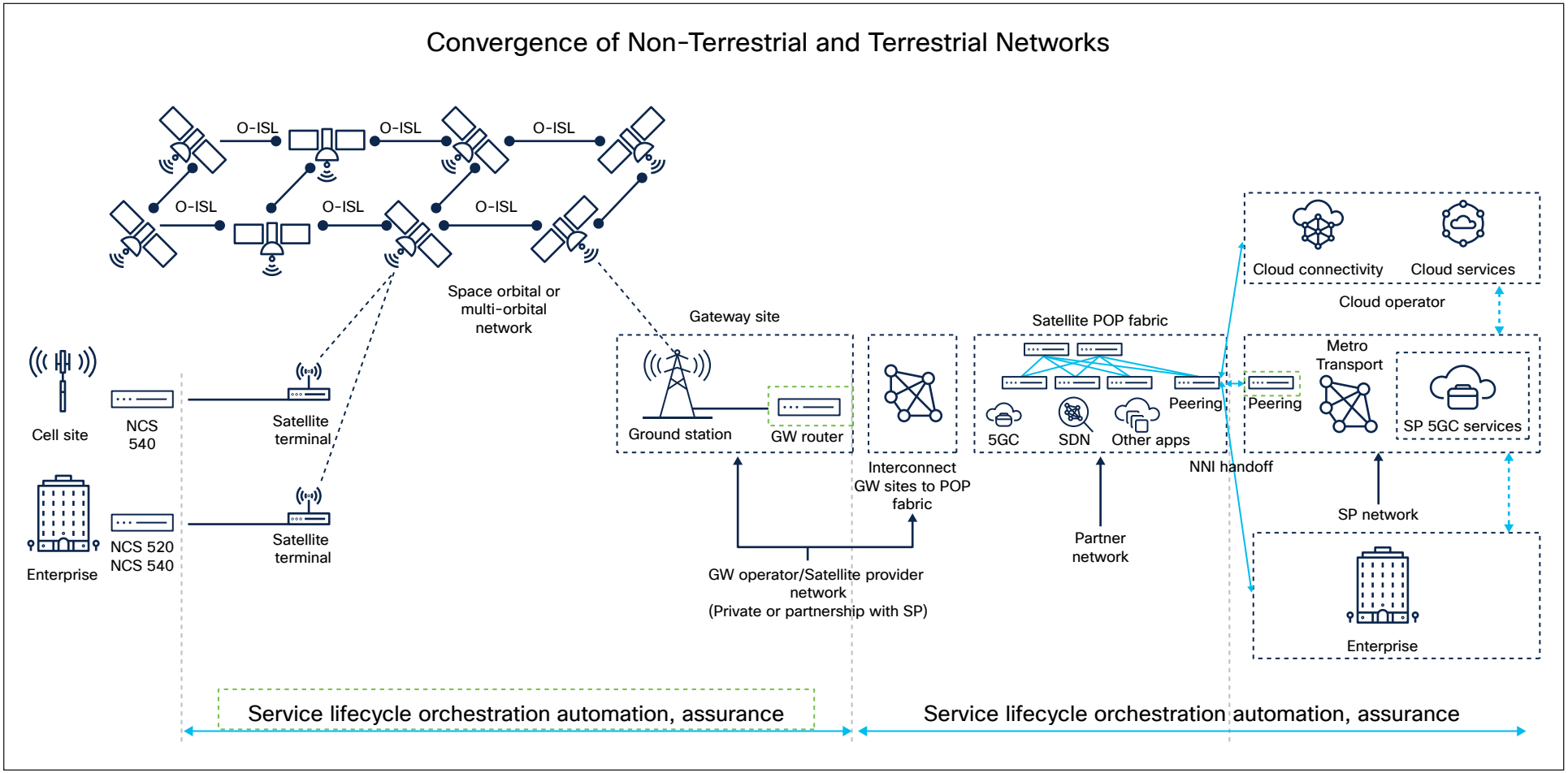

Figure 4. Cisco NTN's integrated architecture spans network domains

The architecture foundation: Cisco Agile Services Networking

At the core of this unified approach lies the proven Agile Services Networking architecture foundation that transforms how satellite and terrestrial networks interact. Cisco Agile Services Networking enables organizations to monetize services by connecting and seamlessly integrating them into an intelligent service delivery architecture with a simplified network that converges non-terrestrial and terrestrial networks.

This architecture provides three key advantages:

Simplified convergence: By integrating access technologies and services into a unified, automated infrastructure, the solution eliminates traditional silos between terrestrial and non-terrestrial domains. This convergence creates a seamless experience regardless of connection type.

Enhanced resilience: The architecture intelligently bridges traditional cellular technologies with advanced satellite systems, automatically adapting to dynamic conditions. This eliminates connectivity gaps and helps ensure continuous service delivery in even the most challenging environments.

Optimized deployment: Service providers can now deploy and manage services closer to end users with unprecedented agility. This proximity-based approach makes the network more responsive, autonomous, and cost-effective to scale—particularly valuable for emerging satellite-enabled markets.

This architectural foundation delivers on the promise of truly unified, ubiquitous communication, with a single metro fabric that extends from deep space to the network edge, maintaining consistent performance regardless of physical location or transmission medium.

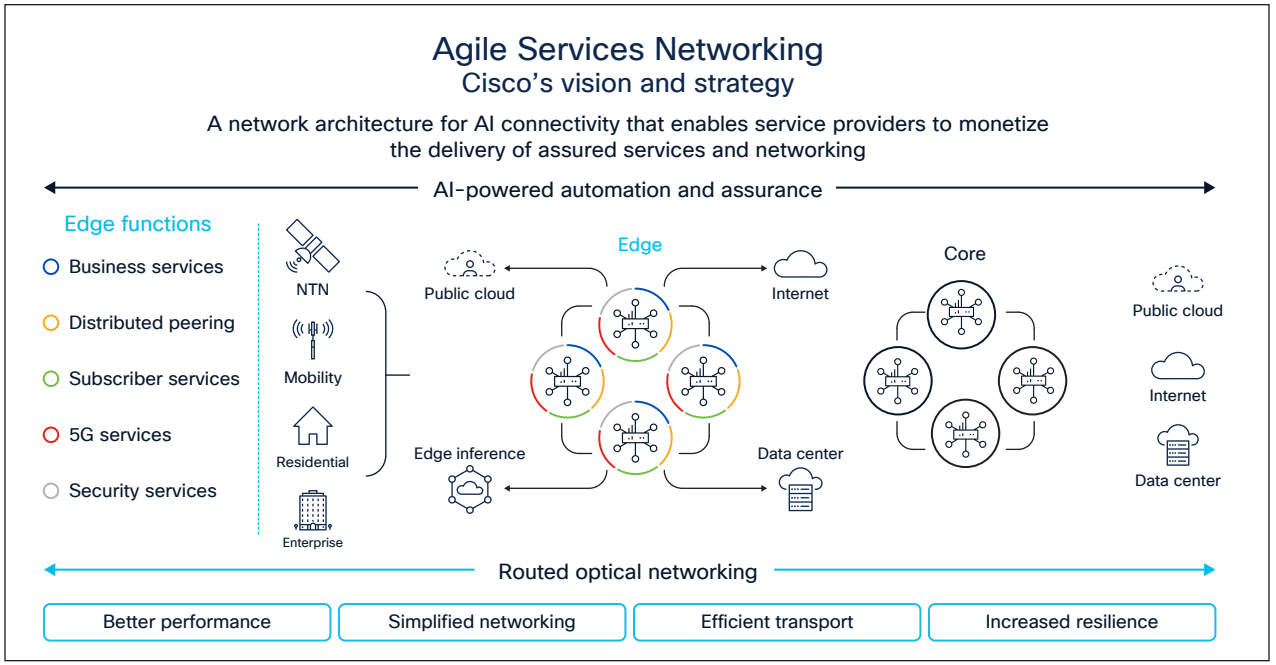

Figure 5. Cisco Agile Services Networking

NTN use cases

Satellite and non-terrestrial networks are creating powerful new connectivity options. These key use cases demonstrate how NTN technology is addressing critical gaps and opening new market opportunities.

Table 1. Use cases for NTN technology

NTN industry use case	Description
Rural consumer broadband	Eliminates the digital divide while allowing providers to maintain their brand identity and customer experience without massive infrastructure investments. A key element for service provider copper replacement strategies in rural areas.
SD-WAN managed service	Incorporates satellite links into SD-WAN architectures, enabling secure VPN over internet for remote sites to deliver terrestrial-quality performance.
Premium enterprise connectivity	Delivers Layer 2/3 Metro Ethernet (MEF) services with SLAs over satellite, and enables low-latency, high-throughput secure networks for enterprise and public sector use cases.
Digital resilience/disaster recovery	Provides critical redundancy for subsea cables, mobile infrastructure, and data centers when terrestrial systems fail.
Mobile backhaul	Rapidly connects remote cell sites and accelerates network deployments without waiting for fiber, extending coverage to previously uneconomical areas. This is also an alternative option to replace costly microwave links or provide alternate connectivity during natural disaster situations.
3GPP 5G NTN direct-to-device services	5G NTN-IoT using NB-IoT and REDCap protocols enables the use of IoT applications anywhere in the world. These technologies allow devices and smartphones to connect reliably via satellite networks to enable IoT connectivity in areas with limited or no terrestrial coverage.
Terrestrial services for satellite constellations	Supports satellite operators with ground-station connectivity, cloud integration, and edge computing for applications like Earth observation.
IoT expansion	Extends IoT beyond urban areas for applications from connected vehicles to remote monitoring, supporting both low-bandwidth and broadband use cases.

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These diverse use cases offer substantial new revenue opportunities by leveraging existing network assets and extending capabilities beyond traditional boundaries. Success hinges on seamlessly integrating satellite connectivity with terrestrial infrastructure, creating unified solutions that customers can deploy with confidence.

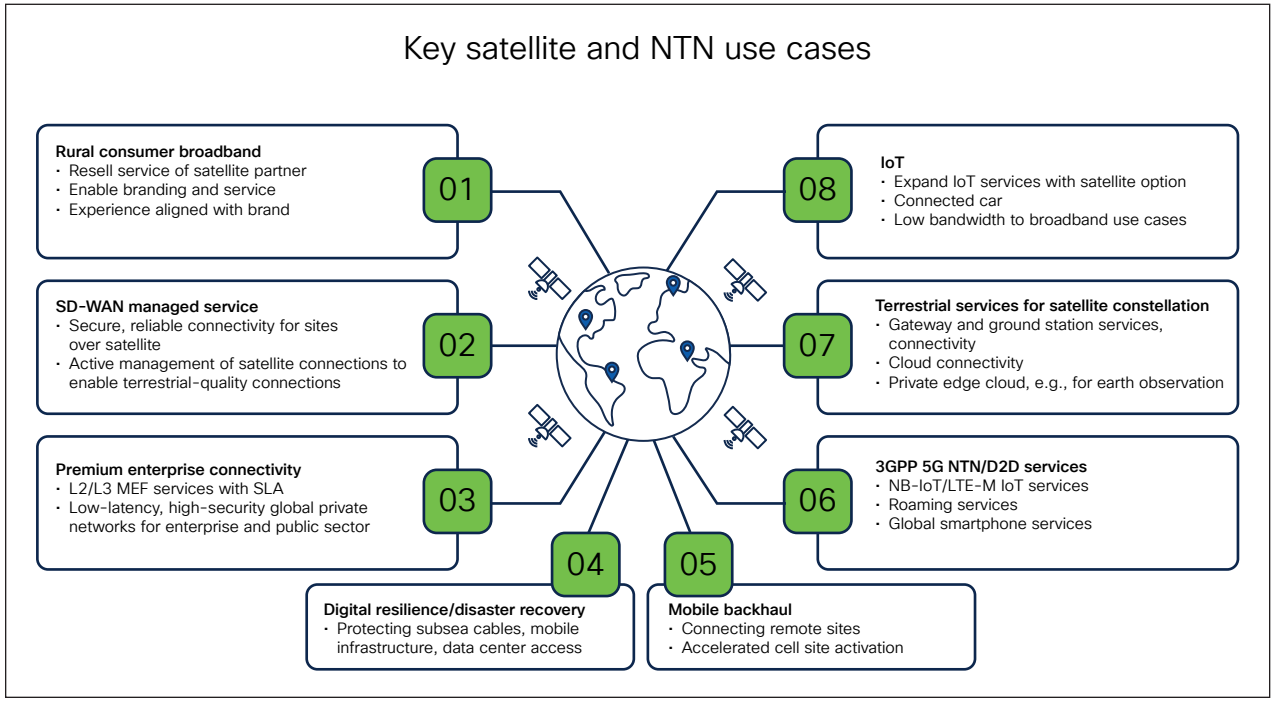

Figure 6. Top NTN use cases

"For decades, Cisco Systems has been a driving force in networking, powering the internet and enabling businesses worldwide to connect and operate more effectively. Now, by providing their advanced networking technology to Rivada Space Networks and their innovative Outernet, Cisco is helping to enable a new era of global connectivity. Utilizing Cisco's technology, Rivada is ready to converge the Outernet with traditional terrestrial networks, challenging the way satellite transport has been utilized in the past."

Declan Ganley
CEO, Rivada Space Networks

The Cisco advantage

Cisco's Non-Terrestrial Networking solution offers unmatched expertise in bridging terrestrial and satellite networks through a unified approach that delivers superior visibility and performance across all network domains.

Why choose Cisco

- **Unified network convergence:** Cisco eliminates traditional silos between terrestrial and satellite networks by applying decades of networking leadership to create a truly integrated ecosystem. Our architectural approach helps ensure seamless communication across previously disconnected infrastructure components.
- **Seamless interoperability:** Our solution connects diverse networking environments without friction, leveraging Cisco's proven integration capabilities to enable intelligent traffic routing and consistent performance between terrestrial and nonterrestrial domains.
- **Built-in resilience:** Cisco's solution automatically reconfigures to maintain optimal connectivity during disruptions, applying the same reliability principles that power mission-critical networks for global enterprises and service providers worldwide.
- **Intelligent performance management:** By extending ThousandEyes and AI-driven analytics across both terrestrial and satellite networks, Cisco provides unmatched visibility into end-to-end performance—something no satellite-only provider can match.
- **Proactive service assurance:** Cisco Provider Connectivity Assurance delivers real-time insights with predictive analytics that identify potential issues before they affect service, helping ensure maximum reliability for satellite connectivity.
- **Enterprise-grade security:** Cisco's comprehensive security framework extends industry-leading protection capabilities across the entire network fabric, securing communications regardless of transmission medium.
- **Future-ready architecture:** Cisco's modular approach scales from targeted deployments to global networks, providing the flexibility to adapt as your nonterrestrial networking needs evolve.

By partnering with Cisco, you gain access to unparalleled networking expertise that spans both worlds—terrestrial and nonterrestrial—enabling you to deliver consistent, secure, and reliable connectivity everywhere your business operates.

"Every endpoint that needs to be connected will have three options to connect to the rest of the world: direct fiber connection, 5G connection, or a satellite connection. We believe it is going to create a new wave of creativity and opportunity."

Masum Mir
SVP, Provider Mobility, Cisco

Learn more

NTNs extend seamless connectivity to the world's most remote and underserved regions while providing continuous service during terrestrial network outages. This transformative technology strengthens network resilience and enables critical applications, from disaster response to global IoT deployments.

Realizing the full potential of NTNs requires strategic collaboration among satellite operators, service providers, equipment vendors, and systems integrators. By partnering with Cisco and implementing our converged network architecture blueprint, service providers and enterprises can position themselves at the forefront of this emerging market.

Ready to transform your connectivity capabilities? Explore the reference links below to discover how Cisco's Non-Terrestrial Networking solution can help you capture this opportunity.

- To learn more about the Cisco's Non-Terrestrial Networking Solution, visit https://www.cisco.com/go/ntn.
- To learn more about Cisco Agile Services Networking, visit https://www.cisco.com/site/us/en/solutions/service-provider/networking/agile-services/index.html.
- To schedule a demonstration of the Cisco Non-Terrestrial Networking solution, contact your Cisco sales representative.

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