Redefining Metro Networks

Unlock New Profitability and Sustainability with Juniper Networks and NEC Network Transformation Service

White Paper

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Executive summary

Metro networks are changing, and the economics underpinning yesterday's "retro metro" look increasingly unsustainable. Fortunately, a new approach puts service provider networks and operations on a stronger footing for the future: Cloud Metro. By applying cloud principles, state-of-the-art systems, and end-to-end automation, service providers can reimagine metro networks for a cloud-connected, experience-first world.

Now, two of the industry's most trusted longtime leaders, Juniper Networks and NEC, have joined forces to help service providers unleash the value of Cloud Metro. Through the NEC Network Transformation Service, part of the NEC Value Added Network Solution Suite*, you can combine groundbreaking Juniper® Cloud Metro solutions with expert deployment and integration from NEC. You can start transforming your network today, and build a more profitable, sustainable foundation for the future.*

The Growing Metro Challenge

Metro networks aren't what they used to be. Previously, service providers used longer-distance regional networks mostly for aggregation. Today's metro has become the new "edge," where connectivity, distributed cloud computing, and next-generation service experiences converge.

These changes push the critical control point for network services—where throughput, security, and quality of experience (QoE) get defined—out closer to subscribers. And they introduce many new challenges for service providers, including:

- **Explosive traffic growth**: Metro traffic bandwidth is estimated to grow more than 500 percent from 2021 to 2027. According to a 2023 *Heavy Reading survey* of network operators, half expect 10-24 percent metro growth annually. Another 37 percent expect 25 percent or higher growth.

- **Rising customer expectations:** As subscribers consume more video content, real-time communications, and performance-sensitive cloud services, operators face nonstop pressure to increase throughput and provide better QoE.

- **Mounting cybersecurity threats:** Service providers need simple, flexible ways to protect distributed infrastructure and data—including cell sites and other remote locations with little or no onsite staff.

- **Skills shortage:** Even as operators need more advanced networking and software skills, the people who can provide them keep getting harder to acquire. Eighty-six percent of telecom executives named skills shortages as the biggest impediment to network modernization.

- **Sustainability commitments:** Service providers also face mounting pressure to reduce carbon footprint and promote greener operations. The International Telecommunication Union's Net Zero standard, for example, requires operators to reduce greenhouse emissions by 45 percent by 2030.

Add up the impact of these changes, and the economics of traditional metro networks start to collapse. There is simply no way to keep pace with nonstop demand for extreme throughput, agility, and next-generation user experiences with a legacy, device-based approach to scaling metro networks. The cost per bit quickly becomes unsustainable.

These problems don't apply only to conventional metro networks connecting urban markets in Europe, Asia, and the Americas. Operators deploying large regional and national networks in emerging markets face the same set of issues. With new 5G and cloud applications—distributed artificial intelligence (AI), industrial automation, augmented reality and virtual reality (AR/VR), and others—emerging that require even higher throughput and specialized handling at the edge, the challenge will only grow.

Fortunately, service providers don't have to keep doing things the same way, hoping for different results. There's a better approach to tackle these challenges and unlock sustainable growth—for your business, your people, and your zero-carbon goals. It's Cloud Metro, and it applies modern cloud principles to enable more efficient, sustainable metro infrastructures. Now, two of the industry's most trusted service provider partners, Juniper Networks and NEC, can help you implement Cloud Metro as a turnkey end-to-end solution, and position your business for more profitable long-term growth.

Unleash Cloud Metro Transformation

Cloud Metro is a new category of solutions optimized for service provider network transformation and sustainable business growth. It applies cloud principles to architecting, building, and operating metro networks, to help operators meet new requirements that traditional approaches can't address.

Cloud Metro puts the end-user front and center, employing experience-first networking principles to deliver the highest-quality subscriber experiences. It uses automation and AI to reimagine network operations. It delivers the performance and capacity to meet insatiable customer demand, with groundbreaking energy efficiency and system longevity. And, unlike yesterday's retro metro, it combines groundbreaking efficiencies and networking innovations to enable sustainable business growth. Using the latest silicon and systems, automated security and assurance, and next-generation IP and optical convergence, a Cloud Metro can deliver up to 71 percent lower Total Cost of Ownership (TCO).

	Retro Metro	Cloud Metro	Profit	People	Planet
Operations	Focus on devices	Focus on service experiences	✓	✓	
	Manual, "DIY" operations	Experience-first network automation	✓	✓	
	Individual expertise	Experience augmented with virtual network assist	✓	✓	
Systems	Traffic aggregation only	"Smart" rich features and scale plus aggregation	✓		✓
	Monolithic power design	Energy-efficient adaptive power design	✓		✓
	Rip and replace 3-5 years	PAYG, 7-12 years	✓		✓
Architecture	Scale up	Scale out and scale up	✓		✓
	Network silos: mobile vs. business vs. consumer	Network convergence with network slicing	✓		✓
	Passive assurance	Embedded active assurance	✓	✓	✓
	"Bolt-on" secuity	Built-in zero trust security	✓	✓	

Figure 1: Cloud Metro delivers advantages to help operators that a retro metro can't address

Cloud Metro combines:

- **Sustainable systems:** Cloud Metro systems, based on the groundbreaking Juniper Networks® ACX7000 line of Cloud Metro Routers, provide the throughput and scale to meet insatiable customer demand for cloud-, 5G-, and AI-enabled digital experiences. These systems provide up to 54 ports of concurrent 400GbE capacity—up to 21.6 Tbps—with support for the latest XR/ZR/ZR+ coherent optics to efficiently deliver 400GbE and beyond. At the same time, Cloud Metro solutions use advanced chassis designs and adaptive power innovations to achieve breakthrough performance with up to 77 percent lower power consumption, in up to 64 percent less space, with an expected service life 4 to 7 years longer than other solutions.

- **Sustainable architecture:** A Cloud Metro supports all residential, business, and mobile services on a single, converged IP services fabric. It can support both scale-up and scale-out architectures, enabling "pay-as-you-grow" network expansion that continually aligns investment with customer demand. It embeds Zero Trust security and active assurance directly into the network fabric. And, it provides a converged framework to collapse previously siloed optical and IP network layers—eliminating dedicated optical equipment and freeing huge amounts of reserve bandwidth.

- **Sustainable operations:** You can't rearchitect metro networks without reimagining the operational approach supporting them. Through its global Network Transformation Service, NEC can provide end-to-end transport automation as a turnkey solution. This includes everything needed to simplify day-to-day workflows, accelerate provisioning, and minimize network outages and service issues. NEC can help you reinvent metro network

operations, including using the AI-for-operations (AIOps) intelligence in Juniper platforms to drive down manual effort and timelines for Day-2 network operations, and diagnose problems more quickly. You can overcome industrywide skills shortages, accelerate time-to-revenue, and dramatically improve efficiency across network operations.

These are among the benefits you can expect from a Cloud Metro. By working with NEC and Juniper, you can also tap into capabilities like:

- **Built-in Zero Trust security:** Cloud Metro embeds Zero Trust security principles throughout the IP services fabric to protect your network and customers. For example, select Juniper ACX7000 platforms provide line-rate MACsec, along with native file encryption. Every Cloud Metro platform also includes a unique, cryptographically signed device ID that complies with the IEEE 802.1AR standard for secure device identity, stored in Trusted Platform Module (TPM) 2.0 silicon. The moment a Cloud Metro platform boots, it automatically verifies device authenticity and integrity, verifying that neither hardware nor software has been tampered with.

- **Embedded active assurance:** Traditional metro networks require complex standalone solutions to validate that devices are configured correctly and provide the service quality that users expect. Cloud Metro takes a different approach, embedding active assurance test agents directly into the Junos® OS Evolved software in every ACX7000 platform. The network itself becomes a distributed sensor that proactively tests and validates end-user experience—without requiring specialized tooling or expertise. You can proactively enable end-to-end services, such as verifying ahead of time that a new cell site is ready to serve customers or that an edge cloud meets performance requirements for a new network slice. And, if there's a problem, this distributed sensor capability can cut incident resolution times in half.

- **Use case flexibility:** Metro networks can encompass a range of locations and facilities, operating under different environmental conditions with different requirements for capacity, scale, and port configuration. With Juniper's broad portfolio of ACX7000 platforms, you can extend the right performance and service scale to the right location—while maintaining the same consistent feature set and operational experience everywhere. Choose from hardened solutions built for cell sites and industrial environments, modular chassis with extreme scale for edge access and aggregation, and fixed platforms that are perfect for scale-out architectures.
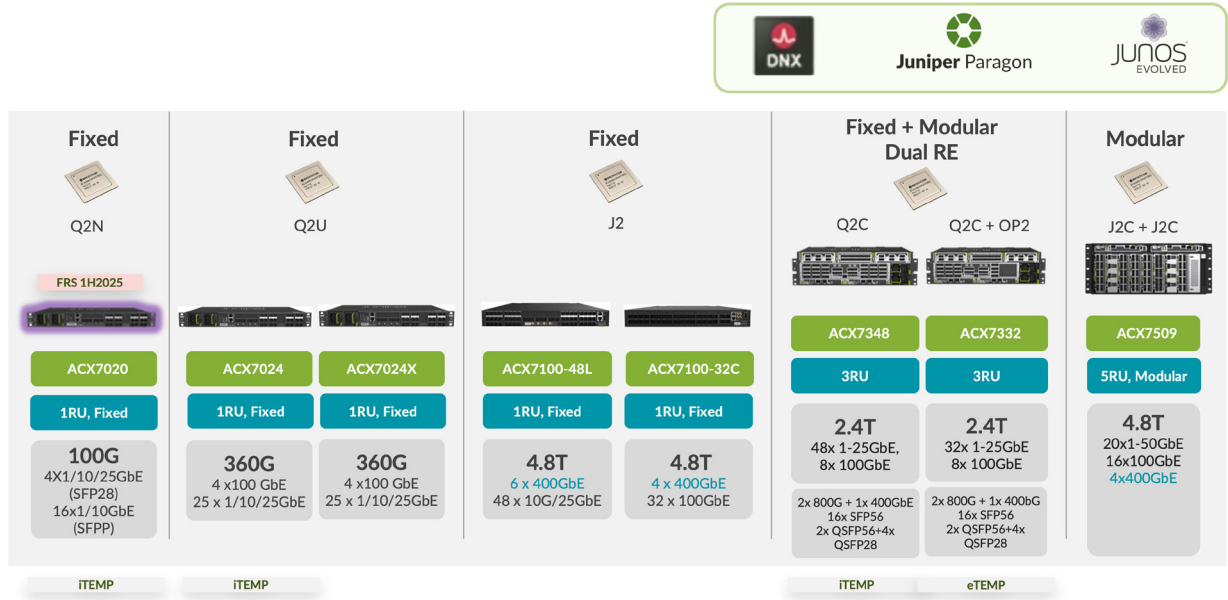
Fixed	Fixed		Fixed		Fixed + Modular Dual RE		Modular
Q2N	Q2U		J2		Q2C	Q2C + OP2	J2C + J2C
FRS 1H2025							
ACX7020	ACX7024	ACX7024X	ACX7100-48L	ACX7100-32C	ACX7348	ACX7332	ACX7509
1RU, Fixed	1RU, Fixed	1RU, Fixed	1RU, Fixed	1RU, Fixed	3RU	3RU	5RU, Modular
100G 4X1/10/25GbE (SFP28) 16x1/10GbE (SFPP)	360G 4 x100 GbE 25 x 1/10/25GbE	360G 4 x100 GbE 25 x 1/10/25GbE	4.8T 6 x 400GbE 48 x 10G/25GbE	4.8T 4 x 400GbE 32 x 100GbE	2.4T 48x 1-25GbE, 8x 100GbE 2x 800G + 1x 400GbE 16x SFP56 2x QSFP56+4x QSFP28	2.4T 32x 1-25GbE 8x 100GbE 2x 800G + 1x 400bG 16x SFP56 2x QSFP56+4x QSFP28	4.8T 20x1-50GbE 16x100GbE 4x400GbE
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Figure 2: ACX7000 portfolio

- **IP-Optical convergence:** One of the highest-impact changes service providers can make is to converge siloed network layers with IP over Dense Wavelength Division Multiplexing (IPoDWDM). With the ability to plug next-generation coherent optics directly into Cloud Metro routers, you can bring 400GbE capacity and beyond to every corner of your network. Using Juniper's Converged Optical Routing Architecture (CORA) to consolidate everything onto an IP mesh architecture, you can also liberate vast reserves of idle lambdas traditionally set aside for optical network protection, freeing up as much as 50 percent more bandwidth. At the same time, you eliminate the need for external DWDM transponders for many applications—slashing power and space requirements, driving down capital expenses, and reducing TCO by more than 45 percent.

Together, these capabilities help you create a more scalable, assured, and secure IP services fabric that's optimized for the explosion of new devices and applications at the metro edge. You gain a versatile foundation to deliver new 5G-, cloud-, and AI-enabled services, with more sustainable profitability.

Build an End-to-End Converged Metro Fabric with NEC

For service providers in every market, the opportunity to reinvent legacy networks and operations sounds extremely compelling. Actually doing it, however—bridging the gap between current networks and a scalable, converged Cloud Metro—can seem like a daunting challenge. Fortunately, you don't have to go it alone. One of the world's most innovative and respected service provider partners, NEC, can deliver end-to-end Cloud Metro transformation as a turnkey, Value Added Network Solution.

NEC and Juniper Networks have collaborated for more than 15 years, working together to support leading service providers in deployments around the world. Our companies share a common vision of open networks and a commitment to helping service providers deploy best-of-breed, multivendor solutions that are fully integrated, validated, and orchestrated end-to-end. This open approach fosters innovation, giving service providers the ability to move more quickly, deliver more innovative services, and unleash cloud economics.

With NEC's Network Transformation Service, part of the NEC Value Added Network Solution Suite, you can implement a comprehensive Cloud Metro solution, including networking products and services, network management, cloud-based services, and end-to-end automation. You can:

- **Use an end-to-end NEC service for your unique network transformation journey while achieving sustainability goals:** NEC's multivendor/multidomain Network Transformation Service, including Juniper Cloud Metro solutions, combines network and software expertise to address your unique pain points and maximize ROI. The service also focuses on contributing to sustainable growth by providing energy-efficient offerings with longer life cycles.

- **Simplify deployment with automation and updates at scale:** Drawing on the diverse capabilities embedded in Juniper Cloud Metro solutions, NEC can provide a single, unified operating environment. Whether managing ongoing operations yourself or working with NEC, you can use the same common feature set across all locations to automate provisioning and simplify software updates, based on global best practices.

- **Access global support from NEC Centers of Excellence (CoEs):** NEC's Global Centers of Excellence deliver superior services through a team of more than 500 global engineers, empowered by best practices, while ensuring local execution. With a successful footprint in 65 countries, NEC and Juniper offer trusted solutions and services. They provide reliable networking capabilities supported by their combined expertise to help service providers worldwide reimagine their business.

- **Use pretested and validated solutions:** NEC's Value Added Network Solution brings together Juniper IP transport solutions, distributed edge intelligence, and everything else needed to tap into Cloud Metro transformation. These solutions come pretested and integrated through NEC's global CoE labs, where Juniper and NEC experts collaborate to design open, automated, multivendor 5G networks and accelerate implementation. n.

Cloud Metro in Action

Since announcing Juniper's Cloud Metro vision less than three years ago, this new approach to metro networking has generated significant industry interest. In a <u>recent survey</u> conducted by *Heavy Reading*, operators named Juniper one of the top innovators shaping the future of metro networking. *Light Reading* also named Juniper's Cloud Metro portfolio the Editor's Choice for "Most Innovative Routing and Switching Solution" in its <u>2022 Leading Lights Awards</u>.

Just as important, service providers around the globe are already benefiting from Cloud Metro innovations. Examples include:

- <u>Tele Columbus</u>: One of Germany's leading service providers worked with NEC to implement a converged Cloud Metro solution that consolidated all consumer and business services onto a single, open infrastructure. By extending optical reach out closer to subscribers, Tele Columbus can continually scale up capacity and capabilities to meet new demands. At the same time, the automated, highly efficient metro network simplifies operations, while helping Tele Columbus reduce CO_2 emissions.

- <u>MetroFibre</u>: As one of South Africa's largest service providers, MetroFibre faced skyrocketing demand for fast, reliable Internet service from hundreds of thousands business and residential customers. With Juniper Cloud Metro solutions and expert assistance from NEC, they were able to dramatically increase scale and efficiency in record time—doubling network speeds at no additional cost to subscribers. Today, the metro network provides a converged edge platform for business, residential, and ISP services. MetroFibre maintains unprecedented density and capacity, even in locations with limited space and power. And, operations teams have seen up to 80 percent fewer network incidents per month.

- Even beyond traditional metro markets, service providers are tapping into the value of Juniper Cloud Metro solutions and NEC expertise. <u>Algeria Telecom</u>, for instance, is deploying a modern nationwide IP network that can accommodate surging traffic demands today and in the future. The operator uses Juniper Cloud Metro technology, with everything implemented as a single, turnkey solution from NEC.

Start Your Network Transformation

Service providers in every market face the same growing challenges:

- Extreme customer demand for higher throughput and better QoE

- High costs and operational complexity to maintain metro networks and safeguard subscriber data

- Network economics that look increasingly unsustainable—especially as customers adopt more distributed 5G, cloud and AI applications

These problems can't be solved by simply deploying new equipment into the same old architectures. They demand a radically different approach to building and operating metro networks.

Juniper Networks and NEC can help you reimagine the retro metro and implement a highly scalable, secure, and efficient converged IP architecture. With groundbreaking Juniper Cloud Metro solutions, you can ramp up capacity and scale everywhere, while driving down costs and CO_2 emissions. You can tap into game-changing innovations like embedded security and assurance, end-to-end automation, and IP-optical convergence. And, with expert integration and services from NEC, you can transform your network more quickly, with less risk, as a single end-to-end solution.

The convergence of next-generation 5G, cloud, and AI experiences at the edge brings massive change to service provider networks—and incredible opportunity. Let Juniper Networks and NEC help you put your business in the best position to capitalize.

To learn more about Juniper Cloud Metro network solutions, visit www.juniper.net/us/en/solutions/ip-transport-solution/metro.html.

For more details about NEC's Value Added Network Solution and the NEC Network Transformation Service, visit www.nec.com/en/global/solutions/5g/5G-Transport-Network.html.

About Juniper Networks

Juniper Networks believes that connectivity is not the same as experiencing a great connection. Juniper's AI-Native Networking Platform is built from the ground up to leverage AI to deliver the best and most secure user experiences from the edge to the data center and cloud. Additional information can be found at Juniper Networks (www.juniper.net) or connect with Juniper on X (Twitter), LinkedIn, and Facebook.

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