



The future of networking in 2025 and beyond





5 future trends that will have the biggest impact on CIOs and IT operations

1 Managing a hybrid workforce

The modern workforce will continue to be hybrid as many employees want the flexibility to work fully remotely, at the organization's premises, or a combination of both. This presents several challenges to enterprises. Those that embrace the change will be more successful and attractive to prospective employees. Those that don't will be left behind.

2 Multicloud adoption

Adopting and deploying multicloud architectures that combine on-premises and off-premises infrastructure and applications will remain a critical strategic item for organizations. Deciding what to host where – taking costs and required agility into account – will continue to be part of application and services deployment.

3 Disaggregation of network functions

The shift of networking functions from hardware to software continues at pace. Enterprise operations will require the right skills to support new programmable and orchestrated networks that use software-defined platforms.

4 AI-driven Operations

AIOps will become an essential tool in enterprise operations systems. AIOps will help to mitigate the limited availability of skills, especially as AI engines develop further. Integrating AIOps into existing systems will become mainstream, and organizations will need to consider how they plan for and deploy AIOps.

5 Sustainability in IT

Green and smart buildings, sustainability goals, carbon footprint, energy credits ... as organizations move toward net-zero goals, the integration of environmentally friendly initiatives into IT and the role of IT in sustainability will be crucial metrics for IT executives and leadership.



Network architecture and technology shifted significantly during the pandemic, and the evolution of the network and innovations in related technology show no signs of slowing down. In some cases, the impact of change on networks is only starting to become evident. In others, it's already being felt. But it's clear that keeping up with these changes is business-critical.

We explore the potential impact of these trends on the future of networking as organizations look to leverage new trends to evolve, transform and stay ahead of the rest.

The pandemic sparked irreversible impact on the network

The pandemic may be declining, but it's impact on enterprise network infrastructure continues and the long-term repercussions are significant.

Our ebook [The Future of the Network: The Fabric of Your Digital Organization](#) was compiled in 2021, in the midst of the COVID-19 pandemic, and focused on the changes that IT departments had to make to more effectively enable the sudden shift to a remote workforce.

The rapid deployment of **remote and hybrid working models** was surprisingly successful for proactive enterprises. Both employers and employees have realized these hybrid models can – and do – work. The continued reluctance of workers to return to the daily commute and office has entrenched these models.

What the business model of 2025 and beyond will look like has also changed. Enterprises that do not yet have a **defined transformation and digitization strategy** will struggle to survive as more and more consumers turn to online shopping and interactions instead of visiting brick-and-mortar premises. In addition, as the metaverse vision becomes reality, a virtual business presence will be essential.

As enterprises digitalize more, the volume of data they need to store, process and analyze will increase exponentially. As a result, their digital transformation strategy will need to incorporate a **data-processing strategy** that's designed to meet their forecasted future requirements.



It's time to rethink the way we architect network infrastructure

An increasingly hybrid workforce, multicloud adoption and more intelligent (and complex) networks have given rise to new network architectures.

Cloud played a significant role in the shift to a remote and distributed workforce. **Cloud-based workloads** and **software as a service** allowed organizations to quickly implement new ways of working, enabling users to be productive while working from home and other remote locations. This would not have been easily possible with legacy, noncloud-based architectures.

There's also an increasing shift to **multicloud topologies**, with applications and workloads being deployed on-premises and/or off-premises, depending on their purpose. Data sovereignty is also a major factor in where certain data types are hosted, particularly in sectors like government and financial services.

The **disaggregation of multivendor network functions** will continue as both organizations and service providers adopt this approach to drive scale and to optimize their multicloud networking architecture.

Integrated network security has increased in importance as a major component in network architecture thinking. The new, distributed workforce has created a far larger attack surface for malicious actors to target. There's an urgent need for enterprises to move to more centralized, cloud-based security solutions, such as secure access service edge (SASE), and a more managed endpoint security model.

The corresponding shift from perimeter security to **identity-based security** has added new functionality to the network and will help simplify the shift from devices to people and things.

'Shifting to a modern, cloud-based, software-defined and data-driven network infrastructure has never been more important.'

Networks form the backbone of our digital world. The explosion in demand for connectivity that arose during the pandemic gave organizations a greater appreciation of this unsung superhero of modern business – and cemented the network's role as a vital contributor to enabling computing applications and achieving business goals.'

[What the evolution of managed network services means for your business](#) by Amit Dhingra, Executive VP, Enterprise Networks – MNCS – Managed Campus





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The pandemic’s impact on network architecture has been profound

Although it may be “over” for most countries, the pandemic it has fundamentally changed the way we look, and will look, at the way we work.

Every day there are news articles on office closures or construction cancellations as companies revisit the necessity and costs of maintaining office space. Many have announced their hybrid working models, allowing employees to spend two or three days a week at company premises and the rest working remotely. Workspaces are being redefined as places to meet and collaborate with colleagues, rather than places where we focus on individual tasks.

This has given rise to a **distributed workforce**, spread across geographic locations and no longer concentrated in campus and branch sites.

Managing the branch of one

The concept of a site is now a “branch of one” as well as a physical office location. Instead of a connection between people and the office, we now have a distributed workforce and thousands of “things” connecting to the cloud. From managing and controlling a small number of physical site locations, the network team now has thousands of “unique” locations and connections to control.

The **security and performance management implications** of this distributed workforce will become part of the strategy and daily workload for IT teams. But monitoring security solutions, visibility and observability management tools adds to the overall burden of IT operations teams.

Solutions such as **SASE** and endpoint visibility engines can help to ease this.

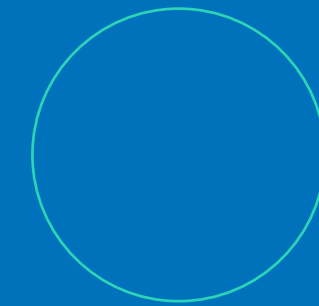
Making the return-to-office more appealing

In addition to managing distributed users, organizations are trying to convince employees to return to the office, either permanently or as part of a hybrid working model.

To do this, they need to **transform** the **user experience** in the office environment, making it more personalized and seamless. Trending solutions for this dilemma include:

- Replicating the “home” environment in terms of comfort and convenience. and simplifying any bring-your-own-device (BYOD) processes.
- Implementing a **smart building** approach which uses integrated technology to improve the experience of working in and visiting offices.
- Implementing a **sustainability approach** to building management and educating users on the benefits of low-carbon-footprint efforts.
- Using **virtual and augmented reality** (VR/AR) to enhance the in-office meeting and collaboration experience.

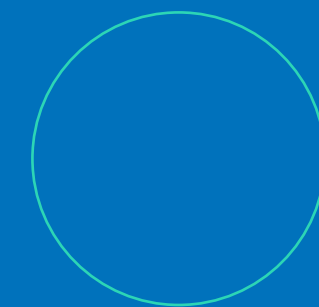




Protecting data

To support a distributed workforce, organizations need to integrate security more tightly into the network connectivity layer to protect enterprise data from unsecured endpoints.

Building zero-trust and detection and response into the network architecture, and deploying a cloud-based **SASE** solution for inline traffic inspection, mitigates many of these risks. The move from perimeter security to **identity-based security** has accelerated, and the days of the “traditional” firewall are numbered.



Managing application performance

Application performance management and associated visibility and observability tools that effectively monitor egress/ingress network traffic for capacity, application and latency issues are another part of the “new” network-management approach and play an important role in managing users’ real-time experience and expectations.



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Connecting people, buildings and things

The adoption of more **Internet of Things** devices and sensors and network-integrated building management systems to support the in-office user experience requires network infrastructure that supports the low-latency, time-sensitive nature of these communications as well as the added management burden.

In the future, the right network foundation will allow for more innovative solutions to be implemented and deployed, using the network-to-cloud platform to process all data.

Focusing on face time

The use of **video-based collaboration tools**, particularly those using **cloud hyperscale networks**, has increased dramatically since the beginning of the pandemic. Home-based employees are using video collaboration extensively. This, combined with the increased need for room-based video systems on the campus and branch sites, and the use of 4K/8K video, has significantly increased network traffic, both on the local area network (LAN) and wide area network (WAN).

Users expect their video experience to be seamless, with no lag or jitter, increasing the need for a high-performance network infrastructure.

Using the internet as a connectivity medium

The WAN also evolved substantially during the pandemic. **Internet as WAN** (using the internet as an enterprise transport mechanism) has now become widely accepted, and in some cases the requirement for far more expensive connectivity has dramatically diminished. This is a natural result of users using the internet as their sole connectivity medium for two years and finding the overall performance more than satisfactory.

Supporting immersive experiences in the metaverse

Finally, the often-touted concept of the **metaverse** promotes the idea that devices should be people-focused and not app-focused. Immersive experiences with technology such as augmented and virtual reality and smart glasses are being used to build a superior user experience. The impact of the metaverse on the network is not yet fully understood, but the use of high-quality video (4K/8K) will most certainly play a significant role in how enterprises will need to manage network capacity, connected devices/people and things.

'When times are good, companies have the luxury to cast their eyes ahead to what the next 'megatrend' might be. However, as stormy seas set in, we quickly see which companies have used their time wisely and which have wasted the opportunity.'

Ignore consumer expectations at your peril

NTT thought leadership blog





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Digital transformation is consistently listed as a top priority by executives and IT leaders in all industries as they look to accelerate their business digitization.

The rapid move to cloud and mobile first strategies

Looking at the transformation that occurred prior to and during the pandemic, it's clear the shift from a mobile-first strategy to a **cloud-first strategy** quickened with enforced work-from-home policies. The ability to access cloud-based applications, especially software as a service and the business's own cloud-hosted workloads, proved invaluable to ongoing productivity as the geographic location of users changed practically overnight.

Mobile-first strategies allowed organizations to close the gap with their customers by offering mobile apps and using social media to engage with consumers. This not only increased their overall reach but also improved the customer experience. In addition, the ability to extract data from the interactions on these platforms allowed organizations to gather significant insights into customer behavior, buying patterns and trends.



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Where cloud-first is taking the network

With a cloud-first strategy, enterprises gain **greater agility** and can be faster going to market with new products and services, which in turn increases revenue and ensures business sustainability.

Adopting cloud also simplifies data processing for **customer insights**. Data can be captured to the cloud or within the cloud infrastructure, stored and organized in cloud-based databases, and analyzed for reporting purposes and to develop insights that organizations can use to inform product, customer experience and overall business strategies.

Mobile-first and cloud-first strategies must consider that the network has evolved beyond the traditional “campus” boundary and has become a mesh of people and things connecting to each other and to the cloud.

We’re seeing an increase in **sensor-based networks** and the **Internet of Things (IoT)**, and the adoption of **digital twin** simulations. The data-processing requirements for these technologies are ideal for cloud and cloud-like architectures, which allow for a more dynamic data-processing fabric and simpler connectivity from things that are widely geographically distributed.

These approaches also lend themselves to increased **multicloud** or hybrid-cloud adoption. Multicloud in this context can be defined as private cloud, public cloud and cloud-like on-premises data centers. Organizations are embracing these hybrid approaches and placing their critical applications and workloads (such as systems of record, insight or engagement) in the most appropriate location – cloud, hosted or on-premises – to realize better business outcomes.

The pandemic also led to the extensive growth of **cloud hyperscale networks**, driven by software as a service and an overwhelming demand for video and voice collaboration. Companies with cloud-based collaboration solutions, like Microsoft Teams, Cisco Webex and Zoom, saw an incredible increase in daily usage – so much so that these services initially suffered outages and capacity constraints. As the distributed workforce remains a trend, the need for cloud-based collaboration continues to grow.

Leading on from the enforced user adoption of internet as WAN is the increasing need for **heterogenous wireless access**, where traditional telco connections are supplemented by alternative access connections such as internet links and 5G. This trend has been highlighted by several incidents in the past 12 months in which telco-line outages have severed enterprise communications for extended periods. The cost to business of these types of outages negates the cost of adopting heterogenous network architectures.

'The client-led bank of the future will allow data to flow securely between services, enriched and enhanced by artificial intelligence. This will deliver a customer experience that differentiates the banks of the future and ensures customer loyalty in the changing banking industry. It's time to step forward with an accelerated digital transformation strategy or risk being left behind.'

NTT's Andy Mayock, Principle Architect

Read [How financial services institutions can take bolder steps towards digital transformation](#)





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From software-defined to intent-based networking

Software-defined networking (SDN) has been a buzzword for several years now, and many theories of how it would evolve networking have been published. Our ebook [The Future of the Network](#), published in 2021, focused on the automation and programmability aspects of the modern network and predicted that intelligent operations would become more of a focus for enterprise transformation.

SDN allows for a more **business-outcome-based network**, where smarter network infrastructure uses business-aligned policies and rules to control behavior and performance – for example, increasing video capacity and priority during virtual campus sessions or CEO video addresses.

The term “**intelligent networking**” (or “**intent-based networking**”) has become more widespread and generally refers to edge networks that implement automation, programmability, predictive analytics and orchestration to make the network architecture more proactive and dynamic. Future networks will most certainly **self-heal and self-optimize**, using AIOps, automation and orchestration as the fundamentals of operations.

An intelligent network is far more agile than legacy infrastructure, allowing organizations to adjust to market changes and cultural shifts.

The changing face of campus and branch networks

The campus and branch local and wide area networks will look very different in the short to medium term as organizations upgrade legacy infrastructure. Integrated into these architectures are **SDN practices**, which will continue to mature and fuel the drive to more automated and intelligent networks.

The use of **detailed and predictive analytics** to proactively monitor and measure the network and its performance is proving to be a valuable feature of integrated network management, shaping the foundation of a better user experience.

Trends like “the great resignation” can lead to significant **skills gaps** in IT operational staffing. The adoption of more automated network operations, which use elements of the intelligent network concept, can ease the pressure of finding, hiring and retaining skilled operational staff.

Network-integrated security will include technologies and services such as proactive detection and response solutions, zero-trust networking, and identity-based security and authentication. This approach will protect and secure people and things as they communicate across the network layer. The combination of identity-based authentication, SASE and network security creates an end-to-end, **secure-by-design** approach for the future network.

Making network operations easier

Enterprises have operational concerns about running networks that are inherently more complex and intelligent. Limited programming skills in the internal operations team makes it difficult to take full advantage of programmable networks. And while AIOps and automation solutions may simplify ongoing network operations, they’re complex to deploy and configure initially.

The complexity associated with managing legacy and transformed environments can be simplified by adopting automation and orchestration.

Cloud-based solutions, such as SASE and identity and access management, and managed services make the task of operations simpler, allowing internal operations staff to focus on projects rather than reacting to network incidents.

"70% of companies surveyed, struggle to keep up with the pace because of rising technical debt and a lack of expertise."

[2022-23 Global Network Report](#)





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The combination of new ways of working, multicloud adoption and more intelligent networks has created a need for updated network architecture models.

Connecting the hyper-distributed enterprise

The hyperdistributed enterprise will consist of physical sites as well as virtual campuses and branches, all of which will affect the network.

Enterprise branches and campuses are no longer clustered in controlled office and enterprise spaces. Refreshed and consolidated campus environments, along with the far more distributed workforce existing in branches of one, will challenge the traditional view of architecting associated local and wide area networks.

The rapid geographic spread of the “branch” network to users’ homes, office-sharing locations and mobile devices will continue to be a challenge.

Operations teams will need to find more efficient ways to manage the new topology while continuing to improve the speed and agility of operations responses.

Another trend that will affect the network is the introduction of **virtual campuses**, where users connect to and can collaborate within a virtual construct of an office – an environment similar to that of online conferences held during the pandemic. In these spaces, users become a person within a virtual setting and can engage virtually with other people and surroundings. This could become one manifestation of the **metaverse in corporate terms**.

And these virtual campus architectures will evolve and scale as higher-quality video (8k) and cloud-processing become more widely accessible. In the next few years, immersive technologies that use 4k/8K video and hologram-type experiences will reduce the need for physical face-to-face interactions, while still allowing employees of an enterprise to be “physically” engaged.

The challenge for network-design architects and operations teams is to maintain a consistent level of performance to ensure the quality of experience of the virtual campus.





Bringing the security boundary closer

New security models, like SASE, will allow organizations to secure this new, distributed network and user base. Perimeter security that protected the campus and branch networks will always be required to some extent, but the security boundary will need to move closer to users, things and cloud-based workloads and applications.

Integrating security directly into the networking layer is an approach that makes sense, combined with endpoint security and the adoption of cloud-based security.

Ensuring new network features translate into business benefits

The increased adoption of **software-defined** intelligent networks, with the added benefits of AIOps and automation, will continue to influence technology decision-making and refresh timelines.

With the new business-outcome benefits that the future network layer offers comes the need to ensure the network infrastructure can support the features that enable those benefits. **Organizations should be taking the opportunity to use the network device lifecycle process to transform the network architecture.**



Industry 4.0, sustainability and the data conundrum

Industry 4.0 continues to drive the digitization of manufacturing and certain areas of the enterprise. IoT provides the ability to connect myriad sensors to manufacturing equipment and devices; heating, ventilation and air conditioning (HVAC) systems for buildings; climate control systems and including those that provide the platform for smart buildings.

Sustainable buildings will be an important part of an organization's carbon-neutral goals. Smart and sustainable-building use cases are becoming more prevalent, and although activity in this area declined during and since the pandemic, it's almost certain that new building developments will require sustainable architecture and features.

The amount of data that will be generated in future years will be immense. The conundrum with this is that processing these huge volumes of data – particularly when it comes to AI and the need to analyze large data sources – will require significantly more computing power, which is detrimental to **carbon-footprint** goals. Organizations will need to find a balance between more accurate AI processing and the carbon-footprint goals they have set for themselves, or that have been legislated.

A single view of the network is possible

The use of **APIs** to integrate various software packages and solutions makes it much easier to implement a single view of the network for management and monitoring. Wired and wireless infrastructure, AIOps, automation, building management and application-visibility and performance applications can now be consolidated into a single view that alerts operations to events and incidents in real time. The addition of **predictive analytics** that can predict network failures and bottlenecks allows for preventive action to be taken prior to any business outage occurring.

'The number of cloud environments has grown – yet, many organizations underestimate the requirement for network transformation when deploying cloud solutions. A sound IT strategy that includes hybrid cloud, underpinned by the network, is essential to achieving business agility and providing a stronger footing for future growth.'

The importance of optimized cloud network infrastructure





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New ICT innovations continue to become more mainstream and will have a significant impact on the way we build, manage and operate networks in 2025 and beyond.

Blockchain and cryptocurrency

Organizations continue to find compelling use cases to adopt blockchain methodologies, particularly in the financial sector, but also in healthcare and government. Blockchain can play a role in financial transactions, cybersecurity, IoT sensor and device authentication, and communications (email, voice calling).

It's not just the environmental impact of cryptocurrency mining using graphics processing unit (GPU) scale that impacts the network layer. Transactions involving cryptocurrency trading also require a network that can perform to certain required metrics, such as latency.

Organizations using cryptocurrency at scale will need to consider the foundational requirements and impact on the network.

Establishing the right network foundation to take advantage of this technology and its benefits will become a far wider requirement.

AR/VR/8K with immersive metaverse

With the rise of the metaverse, immersive technologies such as 4K/8K/AR/VR video that could become mainstream – and that use bandwidth-hungry video application – will have an incredible impact not only on the internet backbone but also on organizations that begin to make use of metaverse applications internally.

Quantum networking

Quantum computing has been acknowledged as a trend for several years now but has regained significant interest when associated with the need to balance compute processing and carbon-footprint requirements. This is important, as quantum computing should use less power than traditional computing. The speed and processing power of quantum should lower the power required to process and analyze data.

Photonic computing and networking

The explosion of applications and data places ever-increasing demands on power consumption. There will be severe technical challenges ahead to be balance sustainability and energy consumption.

With this in mind, **NTT's R&D team in Japan are developing an innovative optical and wireless network which is designed to be environmentally friendly and sustainable, and has ultralow power requirements.** This, combined with providing ultrahigh capacity and latency to meet future data requirements, shows the direction these types of networks will follow from 2030 to 2040.





Artificial intelligence (AI) on networking

Most traditional networking vendors have now integrated AI decision-making into their network-management products. **The ability of these AI-driven solutions to identify and respond to network incidents and events will change the shape of network operations in the future.**

'Proactive and bold digital transformation is an imperative, not a choice!'

[Future Disrupted: 2021 technology trends](#)

Beyond 5G/6G

5G and private 5G have become widely available, with spectrum-constrained issues in some regions. Integrating 5G technology into traditional Wi-Fi networks has made certain use cases easier to implement. A small number of 5G “cells” can be deployed far more quickly than the tens or hundreds of wireless access points (APs) that would be required for the same areas.

6G is already in development and, looking beyond 2025, what comes after 5G/6G will be an important factor in designing and deploying new network architectures. It remains to be seen whether traditional wireless will still be a consideration once these future technologies have been released and overcome initial complications and concerns.

Organizations will most certainly have more technology choices to suit their specific requirements. Spectrum usage will be an important factor in this adoption.

Space networking/ nonterrestrial networking

Compact satellite connectivity has been featuring more and more in news briefs in 2022. Nonterrestrial base stations are being used to rapidly establish internet connectivity, irrespective of location or geographic isolation. This has illustrated the compelling nature of this innovation.

Although global coverage is currently limited, from 2025 and beyond this will become less of an issue for space-networking vendors and providers, and it will become more widely deployed.

Network as a service

Finally, the network-as-a-service offering will mature even further beyond 2025, allowing organizations to use customizable commercial models to purchase the entire network stack (hardware, software, design, deployment and operations) from a single provider. This type of service will increase their agility, as they can more easily adopt innovative and leading-edge technology without the need for specialist skills to operate and monitor it.

The network is the foundation for everything the business does and is going to be more critical than ever.





Thank you for reading

The future of the network in 2025 and beyond

The importance of having leading-edge and effective managed service for current network infrastructure is critical, as this allows enterprises to transform their network in a planned and controlled approach. NTT's Managed Campus Network service utilizes AIOps, Automation and continued innovation to be able to operate both today's networks as well as transitioning to the network of the future.

Managed Campus Networks reduces the need to monitor and respond to daily network operational tasks, allowing you to properly focus on implementing new projects and network transformation.

To find out more about how our Network as a Service portfolio helps you transform, [visit our website](#)

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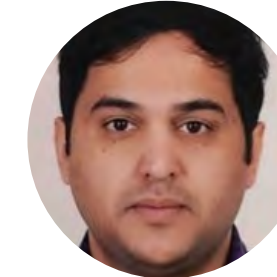
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