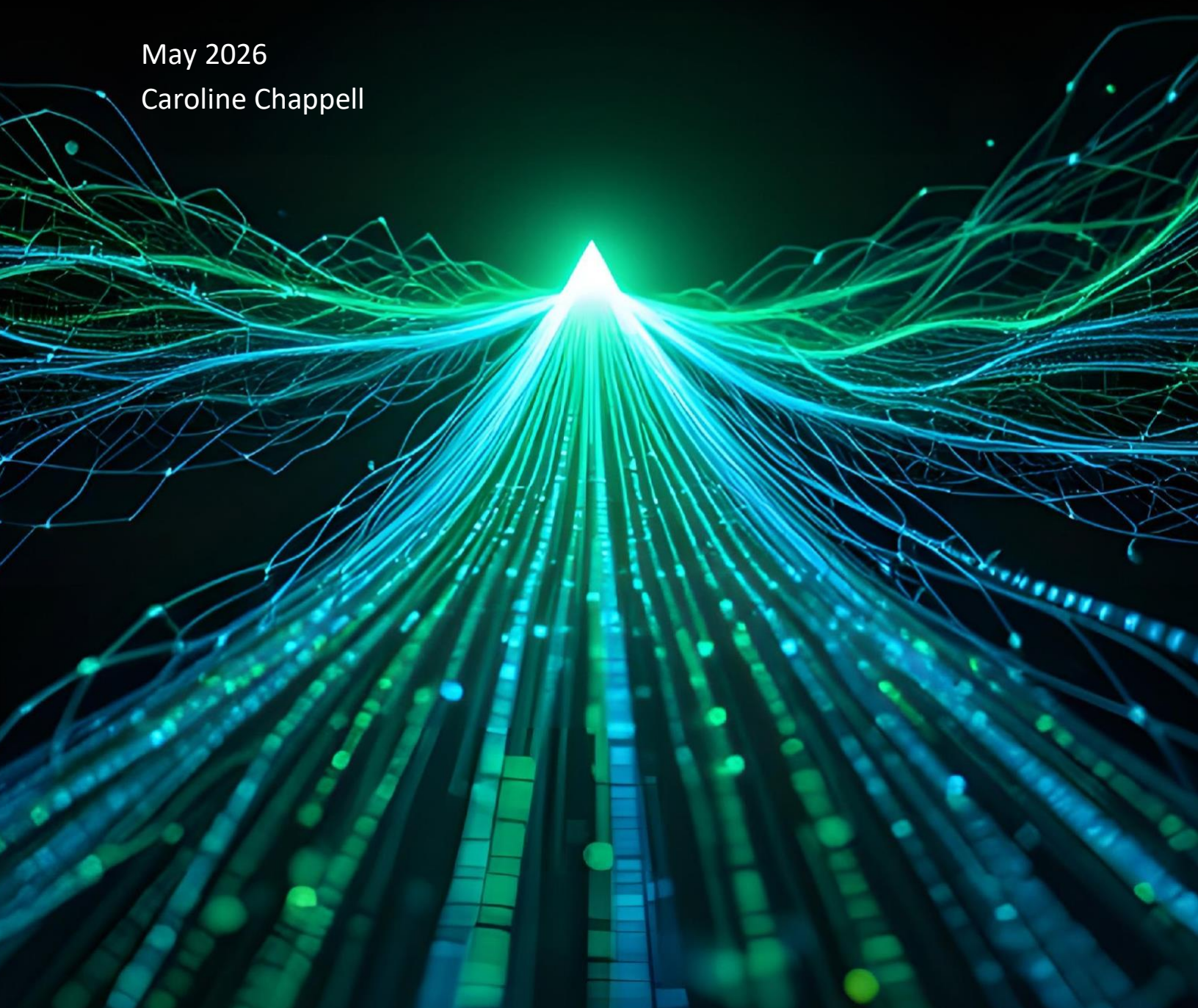




The network federation opportunity for infra owners: from pipes to service providers

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1. Executive Summary

1.1 The benefits of network federation

Global carriers, regional fiber providers and colocation companies that federate their networks have an unprecedented opportunity to increase revenues by encouraging greater utilization of their infrastructure and expanding their service portfolios.

Enterprise demand for access to public clouds and the AI models, tools and applications that run on those clouds is growing. No single network infrastructure owner can connect individual enterprises to all the cloud locations and customer sites they need to reach. Network infrastructure owners should adopt a federation strategy for this fast-moving market which ensures that they maximise the value of their infrastructure. Regional fiber providers can become providers of high margin enterprise connectivity services rather than selling commoditized pipes, colocation companies can become interconnection hubs and global carriers can increase utilization both of their infrastructure and of their valuable connectivity services if they have a simple and fast way of interconnecting with one another.

1.2 Federation must overcome infrastructure owners' interconnection challenges

A new approach to network federation must address issues of trust and technical complexity that have blocked initiatives in the past. Network interconnection should be accomplished through an easily deployable, in-network technology. A cloud-based, carrier-neutral marketplace where federated network owners can rapidly discover and do business with partners should protect participants' customer relationships and support end-to-end visibility of and control over partner networks.

A federated approach should also give network infrastructure owners access to additional revenue opportunities, for example, by enabling them to provide new services to enterprise customers, such as connectivity to cloud on-ramps, SaaS services, GPU as a service, cloud storage and other capabilities as the cloud and AI market evolves.

This paper discusses the opportunities that a new era of network federation presents and lays out the requirements for a federation solution which will maximise the benefits for different types of network infrastructure owners.

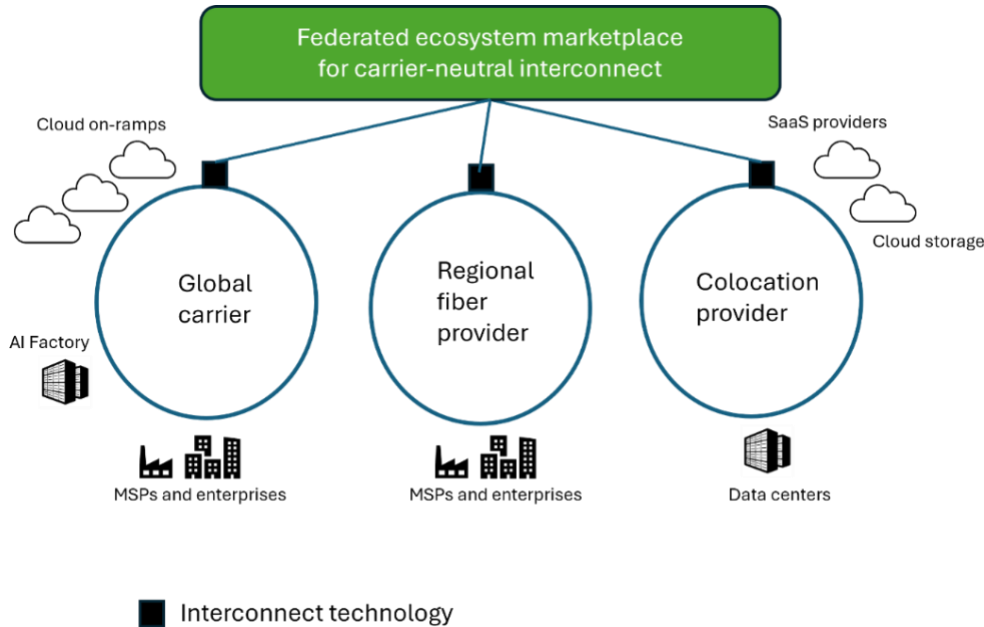
2. The business case for network federation

2.1 Network infrastructure providers need to federate networks to address rapidly evolving customer requirements

No single network infrastructure owner, however large its footprint, can connect individual enterprises to all the cloud locations and customer sites they want to reach in an era of cloud and AI. Enterprises find it difficult, expensive and time-consuming to stitch together connectivity services from different service providers so that they can access an application estate that spans multiple clouds and sites. Network infrastructure owners that fail to address this issue on behalf of enterprise customers are leaving money on the table and risk customer disappointment and churn.

Enterprises' fast-evolving requirements are creating a new opportunity for network owners to federate their networks. This means interconnecting their independent, geographically diverse footprints so that together their networks act as a unified fabric that amplifies each owners' reach. Each global carrier, regional fiber operator or colocation provider in a federated network ecosystem is then able to offer its enterprise customers end-to-end connectivity services that stretch across the fabric to any and every cloud location and site to which their customers want access. Network owners become service providers rather than simply sellers of pipes to wholesale and enterprise customers.

Figure 2.1 A federated network ecosystem

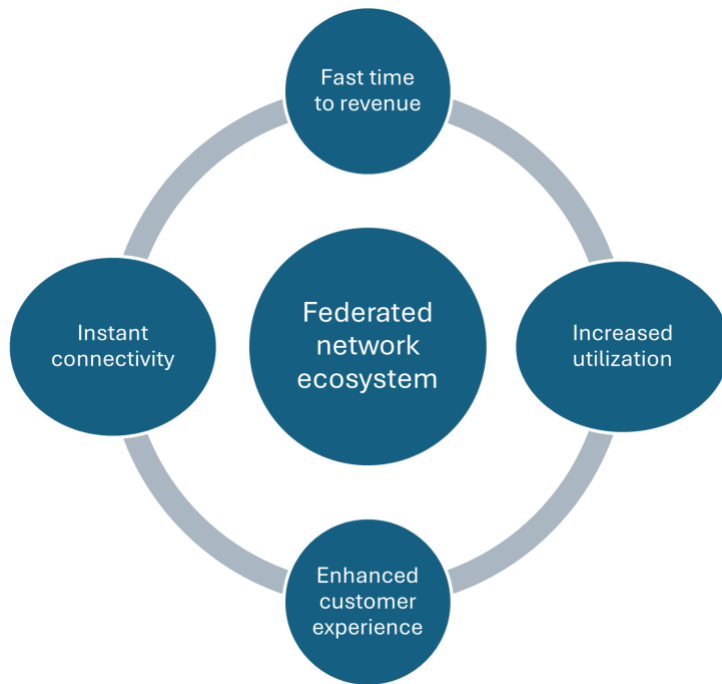


2.2 Network federation brings multiple business benefits to network infrastructure owners

The benefits of participating in a federated network ecosystem are clear. Participants can:

- **Extend their footprint to accelerate time to revenue and improve customer experience.** Network owners can offer enterprises a single point of procurement for a unified network fabric, secure in the knowledge that they can provide end-to-end connectivity services on-demand without sacrificing their customer relationships or expensively overbuilding. Larger carriers can use a federated ecosystem to reach a 'long tail' of locations that do not justify a lengthy network build-out while smaller carriers can instantly service multi-site deals beyond their footprint. All network owners can improve customer experience by accelerating their speed of delivery, reduce the risk of churn and avoid wasting capex on routes where sufficient capacity already exists.
- **Expand access to and monetization of high margin services.** A federated ecosystem enables network infrastructure players to offer high value services such as direct access to cloud-based AI models and tools, cloud on-ramps, cloud storage and SaaS applications by leveraging and reselling partner networks.
- **Turn existing infrastructure into on-demand services that boost utilization.** In a federated network ecosystem, all parties' assets are exposed through APIs so that they are easily discoverable, monetizable and able to be consumed in flexible ways. Regional fiber and colocation providers can make their assets available to a wider market of larger carriers while global carriers with valuable services such as direct cloud access can further monetize them by selling them to smaller players.
- **Build an instant connectivity fabric.** All operators can gain an 'easy button' for seamlessly connecting their own distributed sites and their networks with those of other providers. Smaller colocation providers can become interconnect hubs that provide the same fabric-like experience that the hyperscale colos offer without years of development.

Figure 2.2 Key business benefits of network federation



3. Making network federation a reality

3.1 A new approach to interconnecting networks

Network federation has historically faced three big challenges:

- **The traditional way of building network interconnects is expensive and time-consuming.** The network-to-network interconnects (NNIs) that underpin federation are difficult to build and are typically static and inflexible, unfit for the coming era of programmable, pay-as-you-go connectivity. Today's interconnect topologies based on carrier neutral facilities (CNFs) that are concentrated in relatively few locations were built for the age of voice, as US long haul fiber provider, Lumen, pointed out in a recent report¹. The myriad network infrastructure providers springing up in new locations as cloud and AI workloads disperse across countries and regions do not find it easy to connect through such 'chokepoints'. This results in a fragmented market that reduces choice for enterprise customers and monetization opportunities for infrastructure owners.
- **Network infrastructure owners are fearful that they may sacrifice customer relationships and brand identity.** When network federation efforts are spearheaded by an individual carrier, potential participants are concerned that they may be disintermediated. They do not trust the

¹ Cloud 2.0: because AI won't run on yesterday's internet, Lumen Technologies

dominant provider in the ecosystem and fear that the customers they bring to the federation may gravitate away towards other suppliers.

- **Network infrastructure providers lack visibility of and control over third party networks** which can make it challenging to provide services and SLAs to customers without protracted and complex negotiations with individual partners.

A new approach to network federation is needed to build the diverse and dynamic ecosystem of infrastructure providers that enterprises want. How can a global carrier, regional fiber specialist or colocation company easily, quickly and securely interconnect their infrastructure with any other? A new, flexible and low-cost approach to network federation requires an easily deployable, in-network technology that simplifies network to network interconnection and a cloud-based, carrier-neutral marketplace through which network infrastructure owners can rapidly discover and do business with federated participants.

3.2 Key capabilities to check for in a federated network solution

Network infrastructure providers that realize the benefits of federating their networks should evaluate proposed solutions by asking the following questions:

- **Does the solution make it easy to interconnect with partners?** The solution should make it quick and simple to establish network-to-network interconnects, whether the network infrastructure owner starts small with a single interconnect or whether it wishes to federate with multiple partners at scale. The solution's marketplace should enable the 'point and click' addition of partners from a catalog and provide automated, multi-site service activation and management capabilities across network boundaries so that infrastructure owners can configure and deliver end-to-end services across their own and partner networks in the same way.
- **Does the solution protect the network infrastructure owner's customer relationships?** A network infrastructure owner should be able to create self-service portals for its customers to maintain brand awareness and stickiness. Through a self-service portal, customers can see and interact with their service provider, unaware of any federated partners that may be providing elements of their services. In this way, network infrastructure owners protect customers from the complexities of network interconnection, ensuring that participants have strong trust in the federated ecosystem by preserving their customer relationships.
- **Does the solution support end-to-end visibility and control across network boundaries?** Customers trust their service providers to deliver end-to-end services seamlessly and with the right performance regardless of whose infrastructure those services run across. The solution should allow network infrastructure providers to set and monitor policies and SLAs across the 'network fabric' of federated networks they are offering to customers. It should provide infrastructure owners and their customers with visibility over how SLAs are performing and policies are being enforced across their own and partner networks.
- **Does the solution enable network infrastructure providers to grow their business?** The solution should give network infrastructure owners access to new monetization opportunities

by enabling them to provide connectivity services to new destinations that enterprise customers want and need, such as to cloud on-ramps, SaaS services, GPU as a service, cloud storage and others as the cloud and AI market evolves. The solution should give network infrastructure providers a painless path to participate in these valuable services without the high costs involved in developing them themselves.

4. MaiaEdge introduces the Path Border Controller and carrier-neutral routing engine for federated private networks

MaiaEdge has developed a federated network solution for global carriers, regional fiber providers and colocation companies that addresses the past challenges with federation and establishes a new marketplace for network infrastructure owners. The solution has two components:

- A **small footprint (1RU) network appliance, the Path Border Controller**, which sits on a network infrastructure provider's network edge and without any change to its network, enables the provider securely to exchange Ethernet traffic with another infrastructure provider(s) that has deployed the same appliance. Path Border Controllers (PBCs) work as 'virtual cross connects' that federate infrastructure providers' islands of Ethernet without the need to create complex configurations, understand and map to third party IP addressing or VLAN schemes or introduce any other changes into their networks. Traffic forwarded by a PBC is encrypted end-to-end and it supports multiple service types. Infrastructure providers can start with DIA while they wait for fiber connections and then seamlessly switch to fiber-based connectivity services, keeping DIA as back-up. As well as abstracting away the complexities of interconnecting underlay networks, PBCs are automatically provisioned, monitored and managed from MaiaEdge's cloud-hosted service platform.
- A **cloud-managed, carrier-neutral service platform** that provides a catalog of infrastructure providers participating in the federated ecosystem. The platform acts as the routing control plane for federated networks set up between participants. Once an infrastructure provider has agreed to send and receive traffic from an ecosystem partner through their mutual network appliances, it can provision cross-carrier services in minutes on the platform with full end-to-end visibility across its own and partner network(s) while maintaining its own brand towards enterprise customers. MaiaEdge's service platform assigns metadata identities to each packet that the connected PBCs transport. This approach avoids the many challenges of mapping IP addresses between different networks. The platform's explicit visibility of the bandwidth and overprovisioning/class of service policies associated with each PBC link enables its path computation engine (PCE) to route traffic deterministically without the need for complex traffic engineering.

MaiaEdge's platform provides, on a fine-grained, per-tenant basis, hop-by-hop visibility and SLA control across network boundaries, guaranteeing SLAs over partner connections and supporting troubleshooting across multi-carrier paths.

Secure partitioning ensures that infrastructure providers can only see and manipulate the networks they are federated with. MaiaEdge is working with Mplify to ensure platform compatibility with the latter's emerging standards for network federation.

Figure 3.2: MaiaEdge's solution architecture



5. Conclusion

The business case for network federation is compelling in an age of cloud and AI. In the current asymmetric market, networks remain underutilized and enterprise customers are underserved. But in a federated ecosystem where network infrastructure owners can quickly and easily extend their reach through others' networks and serve customers with higher value, high-margin services, everyone wins.

Network infrastructure owners that want to sell end-to-end connectivity services without new builds or complex interconnection work and to optimize the utilization of their infrastructure and services need to assess new federation solutions. A successful federation solution supports multi-provider interconnect, visibility, control and service activation capabilities that enable these goals without network owners having to sacrifice their customer relationships. The solution should enable exceptional customer experience and fast time to revenue. It should be the foundation for an instant connectivity fabric that allows any network infrastructure owner to realize its full commercial potential.

About the Author



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Caroline Chappell is the founder of CCsquared and has over 35 years' experience in the IT and telecoms industry as a software practitioner, industry analyst and consultant. She is a leading expert on new technologies for telecoms networks, network services and network operations.

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