

APPLICATION NOTE

Modern, Agile Networks for the Super-high-bandwidth Age

Rapid adoption of cloud services, video streaming, 4G and 5G wireless backhaul, and a range of other high-bandwidth applications and use cases are putting unprecedented pressure on carriers' networks. But it is not just the sheer volume of traffic that is challenging operators. As more and more users access their applications and content in the cloud, the speed and quality of their experience depends on fast, high-bandwidth traffic aggregation and switching at the network edge.

To meet the seemingly insatiable bandwidth demands of businesses and consumers, many forward-thinking carriers are challenging traditional networking models. Instead of adding larger and increasingly complex and high-touch network infrastructure, many are looking to Ethernet for a simpler, more architecturally elegant, and—crucially—more cost-effective alternative.

This paper examines the key benefits of packet aggregation and switching over simply expanding the current, complex infrastructure. Focusing on four key use cases, it shows how Ethernet technologies make networks simpler to design, deploy, and operate. It also explains how Ethernet aggregation and switching deliver extremely high bandwidth at the network edge—exactly where businesses and consumers need it.

Use case 1: Ethernet aggregation and switching for Tier 2 and 3 carriers

As customer bandwidth demands continue to increase exponentially, carriers need to adapt their networks to support 10G and 100G aggregation and switching. While this is technically possible in legacy network environments, upgrading to these transport speeds often requires complex, costly additional infrastructure and specialist support skills.

One way to reduce the cost and complexity of managing and running sprawling legacy network infrastructure is to deploy Ethernet aggregation and switching equipment in the metro network. By taking this approach, carriers can increase

How operators can build agile, scalable, future-proof networks with latest-generation Ethernet aggregation and switching infrastructure

Simplify service deployment.
Assure performance. Decrease your time to revenue.

Read more about
Ciena's packet-
based products



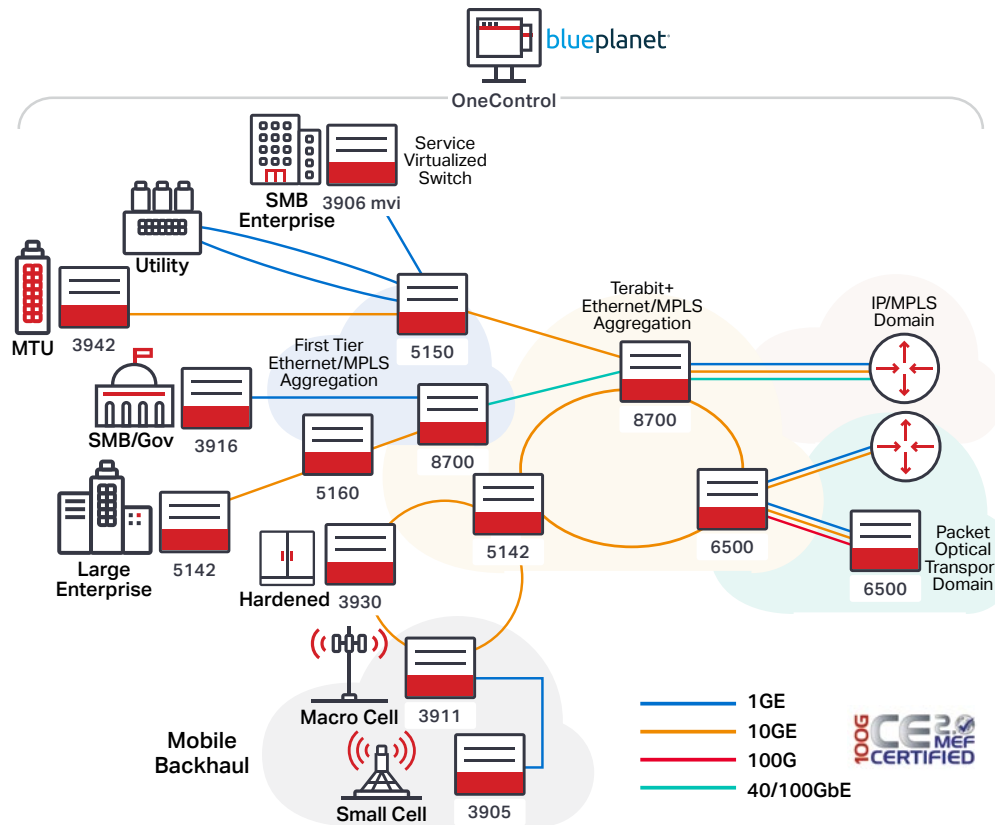


Figure 1. Sample metro aggregation network

technology and business agility based on a simpler network topology that can adapt more quickly to shifting technology and business needs.

The leading Ethernet aggregation and switching solutions can also scale available bandwidth on demand to handle dramatically increasing data volumes, allowing carriers to support the next-generation of high-bandwidth services with 10G and 100G aggregation and switching at the network edge.

By replacing costly legacy network technologies with Ethernet aggregation and switching technologies, Tier 2 and 3 operators can:

- **Reduce real estate, power, and cooling costs** by replacing complex, over-featured routers and other legacy network technologies with high-density, low-footprint Ethernet switching and aggregation. These Layer 2 solutions significantly reduce energy consumption, helping carriers minimize their operating costs and protect and grow margins on voice and data services.
- **Reduce support complexity and costs** by replacing complex legacy network equipment with simple, cost-effective Ethernet aggregation switches that require no specialist skills to maintain and support.

- **Reduce overall data transport costs** based on aggregation of multiple 1G services and ports to a smaller number of 10G and 100G Ethernet ports. Typical utilization is around 70 percent for 10G ports compared to just 40 percent for multiple 1G ports, delivering major aggregation efficiencies that directly benefit the carriers' bottom line. These benefits not only apply to the Ethernet aggregation network, they also allow cost reduction in the IP Core by aggregating traffic onto fewer, higher-capacity router ports.
- **Modernize their networks** based on a simpler architecture that can scale programmatically to meet future growth in bandwidth requirements, with no need for additional hardware or software deployments. In tandem with Software-Defined Networking (SDN) and orchestration technologies, next-generation Ethernet aggregation and switching infrastructure also supports carriers' journeys to Network Functions Virtualization (NFV) and the automated, adaptive networks of the future.

Use case 2: Maximizing cloud connectivity and NFV opportunities at data centers and data hotels

The rapid adoption of cloud services is creating a range of new traffic aggregation and cloud interconnect challenges for data centers and data hotels. At the same time, major opportunities also exist for facilities that can provide cost-effective NFV and cloud-connectivity solutions to their carrier and enterprise customers.

The latest-generation Ethernet aggregation and switching technologies can help data centers and carrier hotels maximize rapidly growing cloud and NFV opportunities.

By choosing Ethernet aggregation, they can:

- **Reduce cloud and NFV interconnect footprints and operating costs** based on the ability to replace a large number of routers and other legacy network infrastructure with consolidated, efficient Ethernet aggregation and switching solutions that provide 10G or 100G connectivity with cloud infrastructure providers. The same cost- and space-efficient approach can also help data centers and data hotels build efficient interconnects into server clusters hosting NFV services onsite and remotely, allowing them to deliver new, revenue-generating NFV services to their tenants.
- **Provide super-fast cloud and NFV connectivity for customers**, with fast aggregation and switching of native Ethernet traffic to support the most demanding performance SLAs and deliver great experiences for end-users accessing data and services in the cloud.
- **Take full advantage of cloud and NFV market opportunities** by providing a range of new, high-performance cloud interconnect and NFV services to carrier and enterprise tenants. These can either be hosted on x86 clusters in the data center or in remote locations as required.
- **Maximize efficiency and margins with NFV automation** by using innovative network orchestration and automation technologies, such as Ciena's Blue Planet®, to set up and run customers' NFV services quickly, simply, and cost-effectively.
- **Retain customers and grow revenue** by offering a range of innovative cloud connectivity and NFV services that help carrier and enterprise tenants streamline their own environments, retire legacy infrastructure, and reduce their own operational costs.

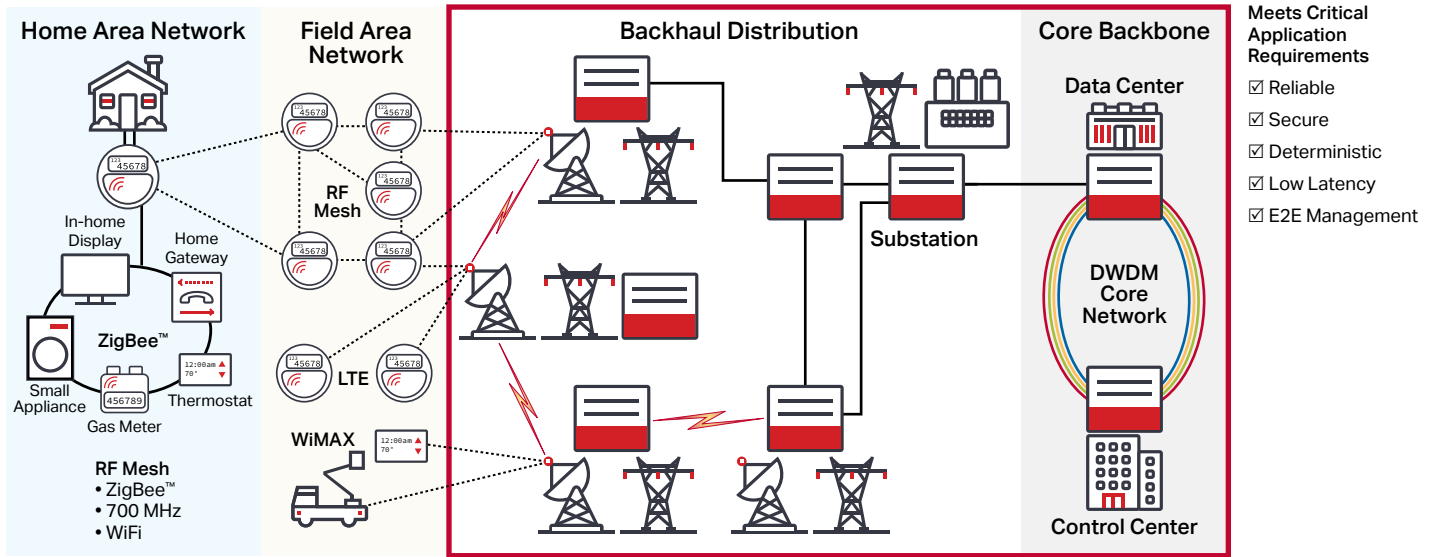
Use case 3: Helping telecommunication providers and utilities modernize their network infrastructure to lower operating costs and meet growing bandwidth demands

Today's utility networks typically are based on legacy SONET/SDH technologies. These are highly reliable and provide the deterministic traffic paths needed to support utility delivery networks. However, TDM technologies such as SONET and SDH are also complex and expensive to maintain, especially as aging infrastructure becomes unsupported, and spare parts and skilled engineers become ever harder to find.

To address these challenges, forward-thinking utilities are migrating from legacy TDM infrastructure to Ethernet aggregation and switching. This approach allows utilities to retain the consistent, deterministic communications they have with SDH/SONET based on traffic-engineered paths and backups, with pre-determined SLAs. The result is reliability and performance that rival SONET/SDH, with scalability on demand to handle new applications and services—all at a much lower cost.

By choosing to migrate legacy TDM infrastructure to Ethernet connections, utilities can:

- **Simplify network modernization initiatives** by replacing aging and discontinued SONET/SDH equipment with latest-generation aggregation and switching technologies that are simpler to install, maintain, support, and scale, with no need for specialist support skills.
- **Reduce modernization risks** with Ethernet infrastructure that can support all existing SONET, SDH, or other services, allowing utilities to transition to updated services gradually based on all the required evaluation, testing, and transition activities.
- **Maximize network efficiency and reduce operating costs** based on lower-cost, highly scalable Ethernet technologies that offer the consistent, deterministic communications utilities need. Typical cost savings compared to legacy SDH and SONET equipment include real estate, power and cooling, maintenance, support, and more.
- **Support specific utilities' requirements, including 'teleprotection'** based on connection protection technologies such as G.8032 Ethernet Ring Protection, which provide the benefits of Ethernet access and aggregation with robust transport provisioning and management.



Private optical network and leased circuits

Use case 4: Preparing for the super-high-bandwidth 5G future

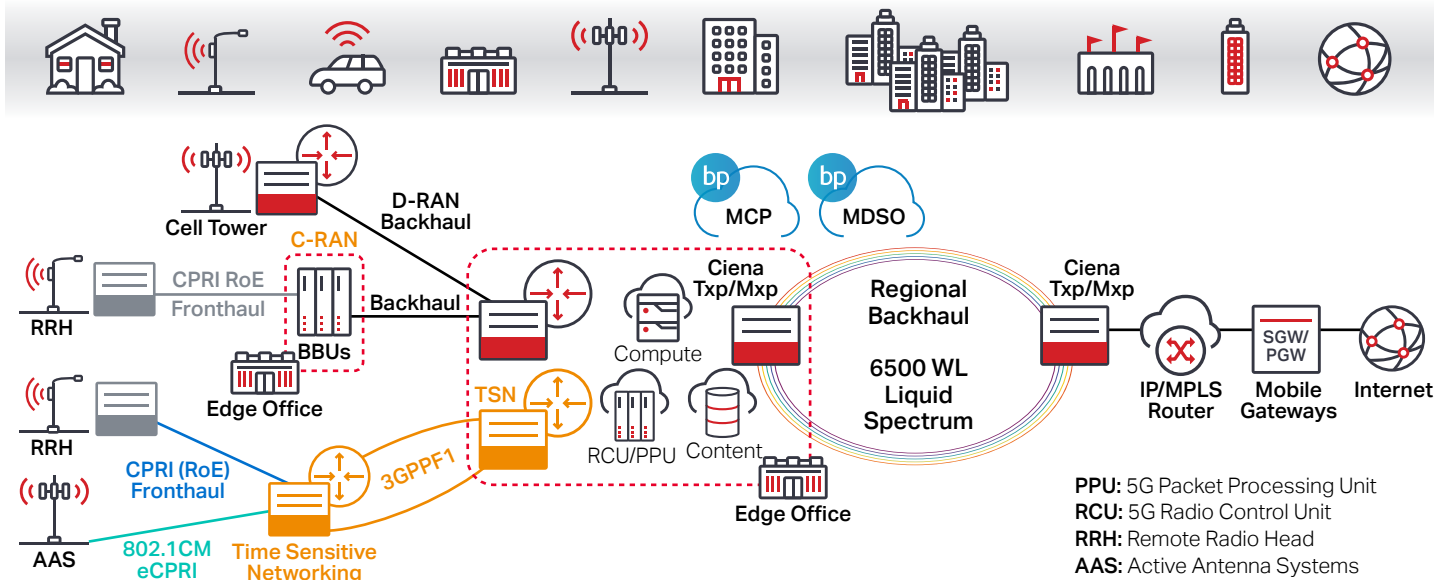
The [GSMA](#) expect 5G networks to cover around a third of the global population by 2025, with adoption reaching 1.1 billion connections. With 100x more connected devices and 1,000x more data expected by 2022, bandwidth demand will continue to grow exponentially.

The challenge for operators is to gear up their networks to support the super-fast 5G radio interface and the high-speed, low-latency services it supports. This will require efficient, cost-effective aggregation of vast traffic volumes, particularly at the network edge.

By choosing to invest in the latest-generation Ethernet aggregation and switching technologies, and intelligent network software, mobile carriers and wireline providers can prepare for the 5G future. In particular, they can:

- **Scale bandwidth cost-effectively on demand to handle vast 5G backhaul requirements**, based on Ethernet aggregation and switching infrastructure that can be scaled up programmatically, with no need for manual interventions or costly additional hardware and software. The ability to scale easily to 100G connections and beyond allows carriers to adopt the latest high-bandwidth mobile applications as soon as they become available.

- **Support super-low-latency 5G applications with hugely scalable wireline infrastructure** such as trading, virtual reality, and other delay-sensitive applications that require huge volumes of data to be transported across the network and, in many cases, cached at the network edge. Latest-generation Ethernet aggregation and switching infrastructure supports this programmable scalability and 10G or 100G links direct into cell towers.
- **Control network costs and increase available margins from 5G services** with a dramatically streamlined network infrastructure compared to legacy switching technologies. With a smaller network footprint, carriers will save on real estate, power and cooling, and equipment CAPEX costs. The simplicity of Ethernet aggregation infrastructure and switches also reduces specialist support needs, cutting staffing requirements and costs.
- **Prioritize network traffic for the perfect balance of 5G service performance and cost-efficiency** by combining scalable Ethernet aggregation and switching infrastructure with intelligent network orchestration and automation software. This makes it possible to allocate bandwidth dynamically to meet the QoS requirements of a range of applications, including high-margin, low-latency applications. Traffic from less time-sensitive applications can also be routed across the network in the most cost-efficient way.



Future-proof the network with Ciena

As demand for high-bandwidth fixed and mobile services continues to soar among residential and business customers, operators need to handle multiple use cases and data streams on the same converged infrastructure. The question for operators is how to keep pace with this challenging demand curve while streamlining their networks to reduce operating costs and protect margins.

By delivering virtually unlimited bandwidth on demand at the network edge—closer to where customers need it—latest-generation Ethernet aggregation and switching infrastructure gives operators an agile, cost-effective platform for delivering high-bandwidth future services.

In particular, migrating from legacy network and SDH/SONET infrastructure unlocks bandwidth on demand to support new, revenue-generating services, from 10G business Ethernet services to IoT applications and 4G and 5G mobile backhaul, and a range of low-latency use cases. At the same time, the simpler network topology enabled by Ethernet aggregation and switching helps reduce operators’ network footprints and power and cooling costs, as well as the cost of maintenance and support.

With the ability to scale up available bandwidth remotely with zero-touch programmability and deploy large numbers of additional services and connections in near-real time, the leading Ethernet aggregation and switching solutions help carriers maximize business agility and respond faster to emerging opportunities.

To enable these benefits, Ciena has created a [leading portfolio of Ethernet aggregation and switching technologies](#).

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