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Converged IP Bearer Networks

SRv6 and tenant-level slicing enable premium value

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Executive summary

New service demands are growing for both business and residential end-user clients. The new advanced service demands put pressure on IP networks in multiple ways, including high bandwidth with enhanced latency, jitter, and uptime performance requirements.

Communication service providers (CSPs) can take advantage of new converged access-backhaul, metro, and backbone networks. Functional integration, paired with capacity and system density improvements, support more functions with a constrained physical space with power/bit improvements.

Segment routing and tenant-level network slicing (Mbps level at a minimum) are two new key core technologies that enable network convergence. Network convergence enables next-generation service-level agreements (SLAs) and performance for converged access to metro and core networks, helping CSPs improve the TCO and support their sustainability goal of low carbon emissions.

CSP business-network challenges and requirements

Advanced service demands with heightened SLAs

New service demands are growing for both business and residential end-user clients. The new advanced service demands put pressure on core networks in multiple ways, including high bandwidth with enhanced latency, jitter, and uptime performance requirements.

- Providing a private line for business services has become more mission critical in verticals such as healthcare and manufacturing. Medical imaging is bandwidth intensive. Automated manufacturing requires very low latency for production line processes.
- 5G RAN deployments have been significant and rapid. 5G access enables more bandwidth per user. New applications have stringent low-latency requirements.
- Similarly, FTTx has also enabled tremendous bandwidth into homes for “infotainment.” Advanced cloud gaming and VR applications have demanding latency and jitter requirements.

Summation of new IP network requirements

The complete set of next-generation services places stringent demands on the new IP core network throughout all network segments, from access-backhaul to metro and backbone cores, and need the following:

- Very high bandwidth with low latency and minimal jitter
- High utilization rates to optimize TCO
- To be highly automated for rapid service activation and optimized operations
- To be ultra reliable with high availability
- To support sustainability goals of low carbon emissions per bit.

Converged network attributes and new capabilities

Converged IP bearer network

Multiple end-user access types of 5G RAN, FTTx, and high-capacity business services can be aggregated onto a converged network at the first point of network aggregation. The converged network will enable superior network utilization compared to legacy, disparate networks. All services will transit an aggregated and converged metro core and a highly reliable and stable converged backbone.

Segment routing SRv6 intelligent connectivity

Segment routing is a next-generation protocol that simplifies and modernizes the IP network and introduces determinism and high-performance SLAs to the IP layer.

Tenant-level network slicing provides the clients with an end-to-end committed level of bandwidth, enabling stringent SLAs. Committed bandwidth can be very fine grained from the Mbps level at a minimum up to Gbps for larger flows.

Network digital map: Visualizing intelligent operation, administration, and maintenance

Next-generation visualization tools are available that portray a network-wide digital map. Advanced multilayer alarm correlation capabilities can aid in rapid identification of individual faults, pinpointing the core fault and weeding out the noisy alarms.

Low carbon networks via converged architecture

Support of sustainability objectives has risen to the top of society's agenda. Reducing power consumed per network bit can be accomplished by updating operational practices, updating network architectures, and evolving to power-saving devices and network elements.

Network evolution

Access and backhaul networks

CSPs have multiple challenges in the access-backhaul environment. CSPs may have fiber constraints and have an imperative to preserve capex. Access is a diverse mix of 5G RAN, FTTx, and business private line. RAN sites are transitioning from 10GE to 25GE per site to support capabilities such as millimeter wave. PON uplinks are also evolving from 10GE to 25GE, and private line services to support cloud applications for business services continue to grow as well. Customers do require access diversity. A ring-based system can be deployed in 50GE or 100GE configurations dependent on current traffic requirements. 50GE backhaul technology can lower the cost per bit of services. 50GE can be supported with 1×25GE transceiver with a PAM4 DSP. 50GE also has a smooth upgrade path to 100GE as bandwidth requirements rise. Bidirectional transmission can also be used in the access network for additional capex savings.

To support the multiple access configurations and the many end customer types, network slicing can also be extended through the backhaul network, enabling high-performance SLAs for the customers.

Metro networks

With segment routing and tenant-level network slicing, CSPs can evolve to an integrated, multi-service metro core. In a metro core, COs enable service delivery and aggregation at scale. Metro COs today house both content delivery networks (CDNs) and Edge Compute. CO physical space and power consumption are always at a premium. All aggregation, service types, and functions must be supported, including BRAS, CGN, IPSec, SR, and 5G SA core. Functional integration, paired with capacity and system density improvements, support more functions with a constrained physical space and power/bit improvements.

On the network monitoring telemetry side, next-generation digital network maps are available to rapidly pinpoint and isolate service situations.

Network cores

The key item in the network core is stability and reliability. Network uptime is crucial and CSPs need strong resiliency strategies. CSPs want to work with vendor partners that have a strong track record of core network reliability. Key to a resiliency strategy is awareness of threats and risks, risk-isolation, and automatic recovery abilities.

Green networks

A network's sustainability footing can be improved at device, network, and operation levels. New network devices have deeper sleep options to reduce the power consumption of underutilized resources. Intelligent fan control can more closely match heat dissipation needs. Network architectures can utilize more traffic bypass and reduce unnecessary burden in network elements. New power draw visualization tools can be used to gain deeper insights into time-of-day and day-of-week patterns.

Appendix

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