Nokia multi-access IP aggregation

Converged transport of any service on any access

Application note

Abstract

Broadband access is an essential service. To connect every person, home and office in our digital world requires a multi-access broadband strategy that leverages an expanding range of wireline and wireless access technologies.

This application note discusses the Nokia solution to help network operators like you to efficiently combine new 5G mobile and fixed-wireless access (FWA) deployments with wireline access infrastructure to deliver a seamless and converged multi-access broadband experience anywhere.

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Multi-access broadband evolution

As a network operator, your ultimate goal is to deliver a fast, reliable and affordable broadband experience at home, at work and on the go. End users are access agnostic, and there is no single access technology that can do it all equally well. As a result, you need an all-inclusive multi-access broadband strategy that combines an expanding range of mobile, fixed-wireless and wireline access technologies:

- Fiber access is the preferred, future-ready solution for connecting homes, offices and 5G cell sites. Fiber offers unlimited capacity with low power consumption per bit. However, trenching fiber is costly and time consuming.

- 5G fixed-wireless access (small cells) can be used to connect underserved wireline homes with legacy copper and coaxial access loops. 5G fixed-wireless access (FWA) can also be leveraged to manage cost and deployment lead times for new fiber-to-the-curb deployments.

- 5G radio enables high-capacity mobile broadband and ultra-reliable, low-latency access for industrial Internet of Things (IoT) applications. Mobile users in urban and high-density population centers congregate in hot spots such as sports stadiums, shopping malls, business parks, universities, hospitals and factories. Plenty of fiber access is available in these locations and is perfectly suited to support a rapid and cost-efficient densification of 5G radio networks.

Multi-access aggregation helps you address the challenges and opportunities of cost-efficiently delivering a unified broadband service experience across this combination of fixed and wireless access technologies (see Figure 1).

Figure 1. Multi-access broadband evolution

Brownfield residential

Fiber-to-the-node + 5G FWA

Connect underserved homes on long access loops

Greenfield residential

Fiber–to-the-home + 5G FWA

Manage cost and lead times of fiber broadband

Urban

Fiber + 5G FWA + 5G mobility

Fast, efficient 5G densification

Converged multi-access IP aggregation

Convergence aims to achieve operational simplification and better economies of scale by consolidating network and service requirements, and pooling resources. The ultimate goal is to build an agile and cost-optimized aggregation network that can transport IP service traffic for any broadband access network.

Legacy access technologies forced network operators to accommodate different technology requirements by maintaining dedicated aggregation networks. However, the inherent duplication of functions in these heterogenous aggregation networks becomes increasingly costly and cumbersome as more access technologies are introduced and evolve in parallel.

The new generation of disaggregated wireline and 5G wireless access solutions addresses this issue. By virtualizing and moving access-specific network functions to the distributed edge cloud under a programmable software defined network (SDN) controller, the new access solutions accommodate the introduction of access-agnostic IP/Ethernet transport aggregation.

With all service traffic converging on IP over Ethernet, both wireline and wireless broadband traffic can be aggregated over a common, multi-access aggregation network.

Although wireline and wireless access traffic share many requirements, such as capacity, latency and reliability, there are important differences in service delivery requirements between fixed and mobile traffic that require special considerations. Transport slicing is an important enabler to address all these concerns while reaping the cost synergies of sharing a common network.

Mobile, fixed-wireless and wireline access traffic will have different interconnection points in the aggregation network to accommodate virtualized user and control plane functions in the service path, to insert video caches and broadcast TV content, to offload internet traffic, or to access cloud content. Wireless and wireline traffic will probably converge on different edge gateways; this may even be the case for residential broadband and business users of wireline access.

Nokia multi-access IP aggregation networks

Nokia multi-access IP aggregation (see Figure 2) provides a unified solution for the full range of fixed and wireless access technologies.

- Any access: Supports wireline and wireless access options with minimal impact on aggregation and edge.

- Any generation: Supports 5G and next-generation fiber access as well as previous generations for a smooth evolution.

- Any topology: Supports distributed, centralized and disaggregated access network infrastructures with different functional splits.

- Any service: Supports delivery of any service over any access while assuring a consistent subscriber experience.

Figure 2. Nokia multi-access IP aggregation
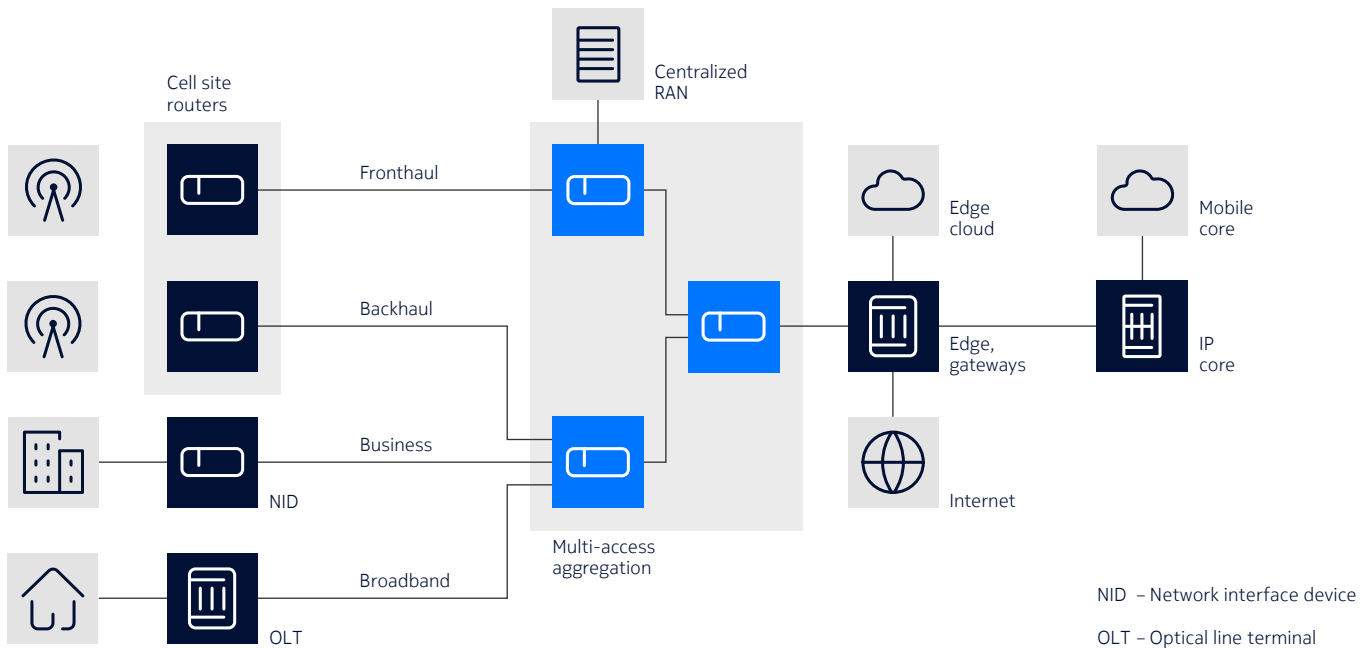
Network operators are deploying multi-access IP aggregation networks to provide ample capacity for future growth and to support any type of traffic: mobile, business or residential broadband.

Nokia multi-access IP aggregation networks have numerous features.

Broad selection of routers

Nokia offers a broad selection of routers designed specifically to address all multi-access aggregation requirements in a scalable, flexible and cost-optimized manner.

The Nokia 7250 Interconnect Routers (IXR) are used for access and all layers of aggregation. Models are available to provide a cost-effective fit from small to large densities and for a variety of architectures, including leaf-spine designs.

Nokia 7730 Service Interconnect Router (SXR) routers complement existing routing products for the most demanding IP access, aggregation and edge applications. Built from the ground-up for a new era of network operations, based on Nokia FPcx silicon, they deliver secure, assured & sustainable IP services.

Nokia 7750 Service Router (SR) routers based on Nokia FP silicon are used when highly scalable, deterministic performance and advanced security are required. They support up to 800GE port speeds. The 7750 SR routers also offer additional edge routing and specialized services, such as broadband network gateways (BNGs), making them highly versatile to fulfill multiple roles in the network.

Scalability and pay as you grow

Nokia routers offer scalability and the option to pay as you grow. Multi-speed ports (10/25/50GE or 40/100GE) allow you to increase bandwidth over time without needing to upgrade routers, extending the router life and lowering total cost of ownership. Licensing is another way to minimize initial cost and benefit from a pay-as-you-grow financing model.

Long product life

High system throughput means that Nokia routers will have ample bandwidth for many years to come. When combined with efficient power and cooling designs, these platforms are designed to accommodate high-powered optics that will be available in the future. Printed circuit board (PCB) enhanced plating on the 7250 IXR-R6 and R6d models mitigates corrosion, extending product life in harsh environments.

Accurate synchronization

5G radio and centralized radio access networks (C-RANs) require highly accurate synchronization for proper RAN operation, particularly to support coordinated RAN functions. Nokia IP Anyhaul routers comply with the latest timing standards required by these applications. Several models have Global Navigation Satellite System (GNSS) receivers and provide IEEE 1588v2 (Precision Time Protocol) grand master capability to provide cost-effective timing sources at the remote edges of the network.

Reliability

Nokia routers offer a full suite of IP routing load balancing and resiliency features as well as automated performance management tools. The Nokia Service Router Operating System (SR OS) software has proven reliability and built-in, self-protecting network security. This ongoing heritage of field-hardened functionality is continued within the Nokia Service Router Linux (SR Linux) network operating system. Many customers who have come to trust the reliability of our BNG solutions have chosen Nokia as a supplier for their multi-access aggregation networks based on this trust.

Transport slicing

Transport slicing is essential to support different users as well as different access and service requirements on a converged multi-access IP aggregation network. Slicing builds flexibility into the network to optimize application and network performance while lowering cost. The routers create transport network slices (virtual connections) on top of a common shared physical infrastructure to serve the specific requirements of each service.

Different slices may include a low-bandwidth slice connecting IoT devices, a high-bandwidth slice to support mobile broadband applications, and an ultra-low latency slice for real-time applications. Quality of services (QoS) features define the attributes for each slice. As separate instances within the same network, slices provide better network utilization to help reduce costs while providing the flexibility and scalability needed to address growing demand.

With multiple services riding over the shared transport network, proper traffic engineering and traffic isolation is needed to ensure that service level agreement (SLA) requirements are met for each service.

Nokia routers implement traffic isolation using Layer 2 Ethernet VPNs (EVPNs) or Layer 3 IP virtual private routed networks (VPRNs). Traffic engineering protocols such as segment routing with traffic engineering are used to create tunnels that constrain the QoS impact of traffic on other services. SDN controllers with path computational elements compute paths through the network based on specific application requirements.

Benefits of Nokia multi-access IP aggregation

In addition to capacity growth, the one thing you can be sure of is change—both expected and unexpected—affecting your network. A well-designed Nokia multi-access IP aggregation network provides the routing features and flexibility to anticipate and quickly respond to emerging needs and disruptive changes that affect your business goals.

With 5G, operators are looking for new and long-term revenue sources. IP routing and QoS features, combined with the advanced automation capabilities of the Nokia Network Services Platform management system, support new requirements from emerging applications and enable fast deployment of new services.

Operators need to support 5G business-critical functions and safety-related applications for enterprise and public-sector end customers. Network intelligence and analytics, combined with automation, provide service assurance and reliability for the most mission-critical applications.

The convergence of fixed and mobile networks provides a seamless experience for customers as well as the potential for cost savings, simplified operations and improved network performance management.

Summary

As a network operator, you need to modernize your IP metro and regional aggregation networks to prepare for changing requirements and traffic growth in the coming years. Nokia multi-access IP aggregation networks provide world-class aggregation using the latest innovations in silicon, hardware and software. These technology innovations provide a cutting-edge foundation to help you enter the next chapter in your growth. Nokia multi-access IP aggregation networks are being widely adopted by network operators, large and small, around the world.

Nokia—A trusted partner

Nokia has been a major supplier of mobile backhaul, enterprise services and residential broadband solutions for many years, and we thoroughly understand network operators' business needs. Our deep expertise in mobile and fixed networks, along with industry-leading Nokia Bell Labs research, enables us to understand changing industry trends and technologies.

Nokia IP solutions are deployed in hundreds of networks worldwide, including all major North American mobile networks. With Nokia, you can rest assured that your investment will safely accommodate future growth.

We complement our product offering with a full set of services to help our customers plan, build, integrate and operate their networks with a holistic view of the entire network. Our global reach, expertise, operational consistency and agility make us a trusted partner.

Learn more

To learn more about Nokia IP network solutions for 5G mobile transport and fixed broadband growth, visit the following web pages:

- IP Anyhaul
- Residential Broadband Services
- IP Networks

Abbreviations

BNG	broadband network gateway
FWA	fixed-wireless access
IoT	Internet of Things
IP	Internet Protocol
IXR	Nokia 7250 Interconnect Routers
QoS	Quality of Service
RAN	radio access network
SDN	software defined network
SR	Nokia 7750 Service Routers
VPN	virtual private network