xHaul Solution Suite for Advanced Transport Networks

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Abstract

The spread of 5G has been enhancing the importance of networks. To fully unlock the potential of end-to-end 5G networks, not only the RAN domain but also the transport network needs to be advanced to align with the 5G era. Communication service providers (CSPs) are required to elevate their transport network to the next level by enhancing flexibility, agility, scalability, and prioritizing the increasingly important aspect of security, while maintaining the speed and capacity required in traditional transport networks as the most important KPIs. This paper introduces the NEC Value Added xHaul Solution Suite that addresses these challenges.

Keywords

Multivendor, open ecosystem, system integration, automation solutions, transformation services, transport network, xHaul

1. Introduction

In recent years, networks have become increasingly important as social infrastructure. This trend has been accelerated by the growing use of networks amid diversifying work styles such as remote and hybrid work, the expansion of industrial applications with the spread of 5G, and the adaptation to new types of communications such as metaverse and digital twins using virtualization technologies. To meet these new network usage needs, networks must fulfill advanced requirements such as high reliability, low latency, and high functionality, while also delivering high speed and large capacity. This paper introduces the challenges of transforming transport networks into advanced networks and NEC's solutions that address these challenges as a global network integrator.

2. What is a Transport Network?

A transport network refers to a network connecting various access networks, such as broadband access for fixed-line communications, mobile access for mobile communications and low-power wide-area (LPWA) networks for the Internet of Things (IoT), with data centers that handle communications processing.

2.1 What is xHaul?

The access and transport networks in mobile communication systems adopt the xHaul architecture. In 4G networks, the connection between the remote radio head (RRH) and the baseband unit (BBU) is known as fronthaul, while the connection between the BBU and the data center handling the communication processing is referred to as backhaul. In 5G networks, the BBU is functionally disaggregated into two separate components: the central unit (CU) and the distributed unit

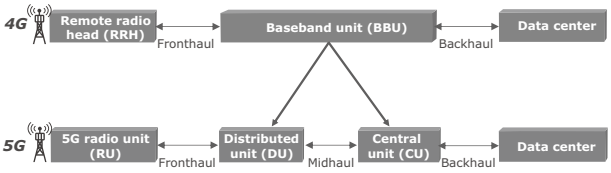

Fig. 1 Positioning of xHaul.

(DU), and the connection between the CU and DU is referred to as midhaul. xHaul is the overarching term used to describe the combined concepts of fronthaul, midhaul, and backhaul (**Fig. 1**).

3. CSP's transport network challenges in the 5G era

As described in section 1, the spread of 5G has led to the diversification of user types and network usage patterns, and networks need to be flexible and agile to meet a variety of needs. In addition, when introducing 5G, it is important to consider the impact on existing networks and enable scalability to achieve a gradual transition from non-standalone (NSA) to standalone (SA) architecture. As a result, CSPs are facing many technical and cost-related challenges toward network transformation.

When we break down the challenges faced by CSPs in the transport network, certain key requirements come to the forefront. In addition to the traditional focus on speed and capacity, transport networks must have a simple architecture to facilitate maintenance and ensure reliability, and also enhance flexibility, agility and scalability. Furthermore, to fully unlock the potential of end-to-end 5G networks, it is essential to enable high capacity and low latency in both the xHaul and the radio domain. CSPs are therefore required to build transport networks with excellent flexibility, agility, and scalability all within the framework of the new xHaul architecture, which includes the midhaul.

4. Importance of Open Ecosystems and System Integration

Open ecosystems with multi-vendor and multi-domain system integration are critical to enable the flexibility, agility, and scalability required in the transport network to meet the challenges faced by CSPs. Traditional network architecture is silo-based and vertically integrated.

4.1 Open ecosystem approach

Following open innovation, cloud computing, and virtualization in the IT world, the network industry is also shifting to open innovation. The term "open innovation" implies a wide variety of features, but in this context, we mean the introduction of multi-vendor networks utilizing open ecosystems. The rapid progress of open innovation has been driven by several factors such as the need to collaborate with specialists in the field of rapidly evolving technology to reap the benefits of the latest technology, mitigation of business risks through diversification of the supply chain for economic security, and the need to avoid an increase in capital expenditures (CAPEX) due to vendor lock-in.

The open ecosystem approach allows for selective application, targeting only the necessary components without applying multi-vendor architecture to the entire existing network all at once. Partial migration can be implemented by introducing new technologies and architectures with new vendor products to only specific segments of the network, for instance, security functions are applied only to newly established metro network requiring network transformation. This approach of partially introducing new vendor products is difficult to achieve in traditional, vertically integrated networks.

4.2 Difficulty of integration in Ecosystems

While an open ecosystem brings several benefits, some CSPs are concerned about increased operating expenses (OPEX), because building a transport network in an open ecosystem requires a high level of expertise, extensive experience, and a sufficient implementation framework. One of the factors that increases the difficulty of integrating open ecosystems is multi-vendor management. It is necessary to understand each vendor's characteristics, technical capabilities, and support framework, have the ability to evaluate and validate vendors' solutions, and have vendor control based on a trusted relationship with each vendor. It also requires a comprehensive understanding of multi-domain networks and end-to-end network skills, along with essential IT skills and software skills required for network operations. Integration within an open ecosystem cannot be achieved without these advanced skills.

5. NEC's Value Added xHaul Solution Suite

NEC's Value Added xHaul Solution Suite covers not only IP and optical transport networks but also data center networks for building edge data centers, which are in increasing demand with the spread of 5G. In addition, with 5G, it is important to ensure the security of the entire network as the number of connection points for network equipment increases due to the software-defined dynamic networks. The NEC Solution Suite supports the overall process of xHaul from design to operation and covers the security aspects, as well. It addresses the aforementioned issues and needs of CSPs by offering the multi-vendor open ecosystem and various service portfolios that use software-defined network automation solutions (**Fig. 2**).

5.1 Strategic partners that make up the NEC open ecosystem

NEC has formed an open ecosystem with top ven-

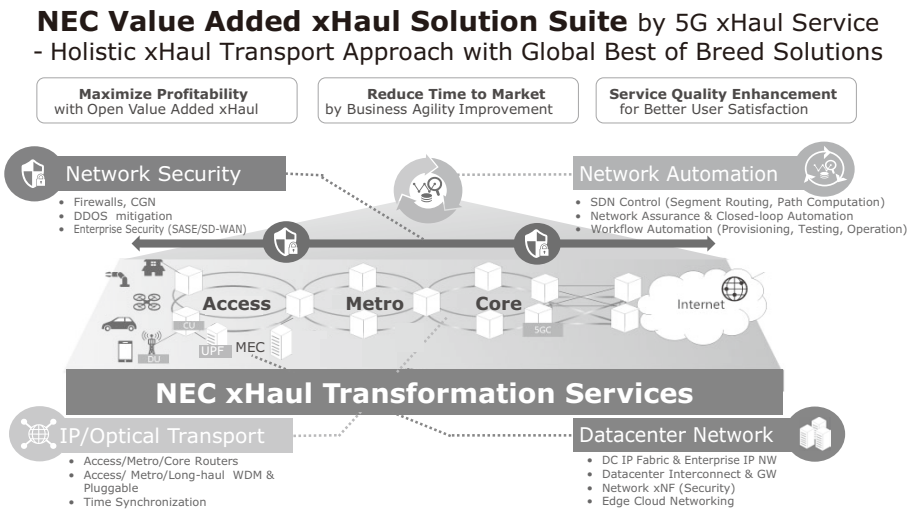

Fig. 2 Overview of the NEC Value Added xHaul Solution Suite.

dors who lead the global transport network market and specialists in specific areas of technology as strategic partners. In particular, we are a unique system integrator who forges strategic partnerships with leading vendors in the global IP transport market. This unique position enables NEC to carefully select and provide the optimal solution that meets the specific requirements of each customer, while maintaining carrier-grade network quality. NEC also offers solutions to a multitude of CSPs by building strong relationships with a diverse range of strategic partners, including leaders in the optical transport market, providers of solutions to enhance network reliability, and specialists in the field of security.

5.2 CoE delivering multi-vendor system integration services for Value Added xHaul transformation

NEC's Center of Excellence (CoE) has accumulated experience and knowledge in building transport networks for customers in more than 150 countries.

With their extensive experience and advanced skills, the CoEs in Europe, the Middle East and Africa (EMEA), and Latin America (LATAM) provide 5G xHaul transformation services[1)] to support the comprehensive process of building transport networks, helping CSPs achieve advanced xHaul transformation. These services support the entire process from network planning to design, construction, and operation by enabling the customer to select the optimal solutions that meet their needs and delivering highly challenging multi-vendor system integration. We accelerate the time to market, reduce costs, and mitigate risks by pre-validating solutions in our CoE labs and building solutions with globally replicable use cases delivered in different countries. Our offerings include services such as network operation training which supports CSPs' operations. This enables CSPs to obtain the skills required for multi-vendor ecosystems, freeing them from the challenges of training and acquiring highly skilled personnel, and enabling them to improve profitability by assigning their own engineers to higher value-added tasks.

5.3 xHaul transport network automation solution for operational efficiency

Meeting the diversified needs of CSPs requires upgrading certain domains and components of networks, large-scale migrations for the entire network, and expanding some sections of the network without affecting existing networks, which leads to numerous and frequent small-scale network modifications. The accumulation of such small changes inevitably leads to a multi-vendor network environment and the tendency for CSPs' networks to become more complex than before. In an environment where multiple vendors' network equipment is mixed, advanced skills and experience are required to deal with the many variations such as transition and unification of network operation policies and integration of networks with different policies. NEC leverages the skill set of the CoE, which has been accumulated based on diverse experiences as the xHaul transport automation solution[2)]. This solution enables greater efficiency of increasingly complex network operations and reduction of surging OPEX in a multi-vendor environment.

NEC has over 120 years of experience in supporting telecommunications around the world. It is a unique entity that combines the capabilities of both a product vendor

that manufactures its own network equipment and an integrator that handles products within a multi-vendor ecosystem. This distinctive position enables NEC to select the best solutions and deliver highly challenging integration services based on an open ecosystem for customers.

6. Conclusion

NEC began offering xHaul transformation services when the CoE was established and has accumulated best practices through customer projects. Then, we expanded our portfolio with the NEC Added Value xHaul Solution Suite by enhancing our focused areas such as edge data center network and security segment.

NEC is committed to staying abreast of market needs and challenges, continually accumulating knowledge and experience within the CoE, and expanding our xHaul transport automation solutions to offer increasingly efficient xHaul transformation services and operational simplicity.

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Related URL:

NEC Open Networks xHaul Transport
https://www.nec.com/en/global/solutions/5g/5G-Transport-Network.html

NEC Launches Value Added xHaul Solution Suite with Open Ecosystem
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