

xHaul Transport Automation Solutions

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Abstract

As the importance of networks as social infrastructure grows, Communication Service Providers (CSPs) are focusing on automation solutions that can both accelerate the time to market and reduce operating costs. However, due to the complexities in terms of operation unique to the telecommunications industry, the introduction of automation has not progressed as smoothly as expected. The NEC xHaul Transport Automation Solution is composed of a multi-vendor ecosystem and services to deliver automation aimed at solving the variety of challenges that CSPs face when deploying automation solutions. This paper introduces the details of NEC's xHaul Transport Automation Solution.



network automation, transformation services, operation optimization, transport network, automation solution ecosystem

1. Introduction

The importance of networks as social infrastructure is growing because of the spread of 5G and the prolonged pandemic. CSPs are required to provide a variety of services quickly and at competitive prices to meet diverse user needs. However, networks are becoming increasingly complex as they respond to such diverse needs, and CSPs face challenges such as higher operating costs and increased human error. One of the most effective means of achieving faster time to market and also lower operating costs is to implement an automation solution. This paper discusses the benefits and challenges of delivering automation solutions for transport networks as well as NEC's xHaul transport automation solution that solves these challenges.

2. Challenges in Delivering the NEC xHaul Transport Automation Solution

Automation solutions widely used in the IT and cloud computing sectors are now being implemented in the telecommunications industry. However, delivering au-

tomation solutions in the telecommunications industry poses challenges due to operational complexities unique to the industry, such as large-scale networks spanning entire countries, the criticality of being social infrastructure, and the coexistence of multiple generation systems with specifications that change almost every decade from 3G, 4G to 5G.

Another challenge in adopting automation solutions is that the business processes of CSPs are being individually optimized and managed by different operational departments. The following subsections outline three common challenges encountered in the deployment of automation solutions.

2.1 Difficulty in determining where to introduce automation solutions

In CSPs' extensive networks with diverse functionalities, multiple organizations are often responsible for building and operating them, each having their own distinct business processes in most cases. It is important to gain a comprehensive understanding of the existing network infrastructure and business processes to identify

the optimal areas for deploying automation solutions and maximizing return on investment (ROI). However, in such a complex environment, determining these areas poses a challenge.

2.2 Difficulty in selecting a solution to realize automation

Network technology is rapidly evolving, and the CSPs' networks are a complex mix of new and old technologies from multiple vendors. Networking equipment vendors offer a wide range of automation solutions, so selecting the most suitable solution for CSPs' specific problems is a challenge within such complex networks.

2.3 Difficulty in customizing the solutions to be deployed

Deploying an automation solution in an optical/IP transport network involves addressing multiple challenges. First, from the perspective of processes, different organizations may be responsible for each optical and IP network domain, leading to varying operations and approval flows. Second, from the perspective of network infrastructure, the optical and IP networks consist of multi-vendor products with diverse operating models and automation methods. Automating the operational process in such cases requires advanced customization to accommodate the wide range of organizations and vendor products involved. Lastly, a third challenge involves acquiring and training personnel with the necessary skill set for implementing these customizations. This includes proficiency in architectural design and operational skills to understand the entire network comprehensively, as well as software engineering expertise to customize the solution.

3. NEC's xHaul Transport Automation Solution

The NEC xHaul Transport Automation Solution addresses the challenges faced by CSPs when deploying automation solutions. With our extensive experience in transport networks and software development, we offer integrated solutions to address the aforementioned challenges such as identifying suitable areas for automation, selecting the most appropriate solution, and customizing it to meet each CSP's requirements. By implementing these solutions, we enhance operational efficiency.

The solution introduced here consists of a multi-vendor automation solution ecosystem and support services that leverage this ecosystem to help customers introduce automation to their networks (**Fig. 1**).

3.1 NEC's xHaul Transport Automation Solution ecosystem

The NEC xHaul Transport Automation Solution ecosystem is applicable to a variety of automation use cases and network environments. NEC selects and evaluates multi-vendor compatible solutions that are available in the market in advance, and then incorporates those that meet certain criteria into the ecosystem. Evaluations are based on comprehensive metrics that include performance, maintainability, and functionality. A range of automation use cases are examined during preliminary evaluations to efficiently identify optimal solutions tailored to each customer's requirements. In addition, we conduct pre-validation of a combination of solutions to mitigate deployment risks and ensure secure implementation.

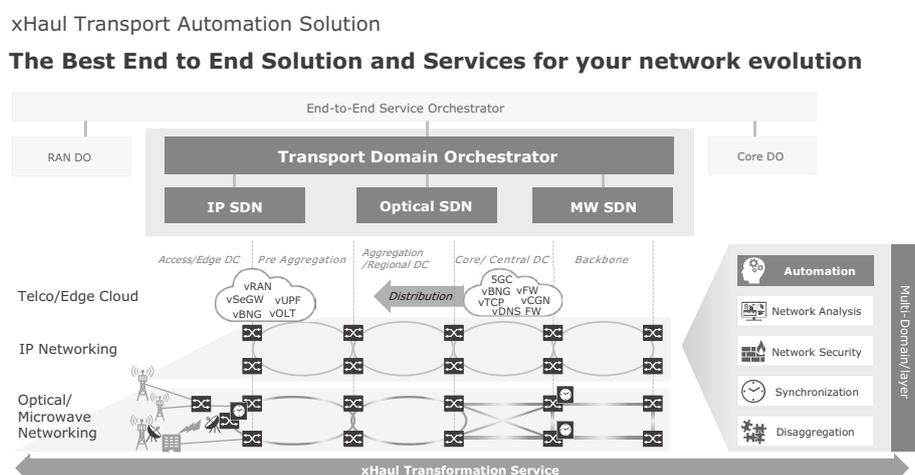


Fig. 1 Outline of the NEC xHaul Transport Automation Solution.

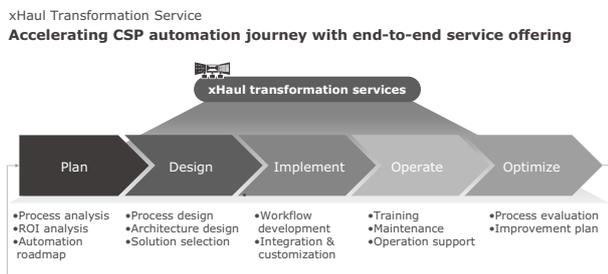


Fig. 2 NEC xHaul transformation services for delivery support of automation solutions.

3.2 NEC's xHaul transformation services

NEC integrates support service for delivering automation solutions within the NEC xHaul transformation services to provide an environment in which CSPs can successfully introduce automation solutions.

These services define the automation delivery processes across five phases: Plan, Design, Implement, Operate, and Optimize. They offer support in efficiently implementing automation solutions in each phase (Fig. 2). Depending on the CSP's requirements, the services can be provided as a comprehensive one-stop solution covering all phases or tailored to specific phases.

3.2.1 Plan

This is a step to identify the scope of automation solution to be applied. It is important to identify the most cost-effective areas among various business processes and narrow down the scope of automation.

Flow to identify the optimal scope of automation application:

- Operation process analysis: The current operation processes are analyzed and broken down, and the costs and time associated with each process are quantified. Areas that require human intervention, and thus are difficult to automate, are identified.
- Rough cost estimate: The approximate costs of applying automation to each of the operation processes are estimated. These costs include the solution purchase, integration, and operational expenses.
- Calculation of expected benefits: The expected benefits are calculated based on two indicators: the reduction of operating costs and increases in revenue. It is also important to consider how process improvements can increase revenue by accelerating the time to market.
- Definition of the scope of automation and KPI set-

ting: The scope for the application of automation is defined, and key performance indicators (KPIs) as goals are set based on the calculated costs, expected benefits, as well as the execution priorities and risks.

NEC has long-standing experience as a network integrator supporting the operations of many CSPs. By leveraging such experience and expertise we have acquired over the years, we efficiently and quickly carry out the planning phase, which is the first step of applying automation, and then identify and propose an appropriate scope of automation to be applied.

3.2.2 Design

In this phase, we consider the proposed changes to the processes to which automation will be applied and select an automation solution capable of realizing those changes. When selecting a solution, it is important to consider not only functional aspects but also performance, reliability, and security requirements. Solutions can be selected from a pre-evaluated solution out of NEC's xHaul Transport Automation Solution ecosystem. However, it is rare to find a solution that can be used as is, and some level of customization is usually required to align with the existing network and business processes. Two approaches are possible: customizing the solution to fit the current processes or modifying the customer's processes. We analyze the level of customization required, the difficulty involved, the extent of changes to the customer's business processes, and the impact and risk associated with them. Based on this analysis, we determine the optimal method of implementation.

3.2.3 Implement

In this phase, the selected solution is integrated into the existing processes.

- Development: We develop customized solutions to be integrated into the customer's business processes. The implementation method depends on the solution, but in most cases, it involves a combination of scripting languages such as Python and PHP, which are widely used in software development, and data formats such as XML and YAML. To ensure high performance and high reliability, it is important to adopt the concepts of secure development and quality control and establish quality standards before development begins.
- Implementation: This customization development is gradually applied to the actual environment

using an agile approach. In the initial stage, we limit the scope of processes and the amount of network equipment involved to minimize the impact on the actual environment while verifying its functionality. We repeat the development and verification several times while gradually expanding the scope and scale, and when the operational behavior is confirmed to be within the defined quality standards, we transition to full-scale implementation across the entire network and all processes. It is also possible to take a phased migration approach depending on the scope of the processes and the scale of the network.

NEC has been engaged in software development and quality control of mission-critical systems over the years. We leverage the knowledge and expertise accumulated throughout our long history to execute the highly reliable customized development required for introducing automation.

3.2.4 Operate/Optimize

In these phases, we monitor the operational status of the automation solution that was introduced, verify its validity, and optimize it. In addition to maintenance to ensure that the solution is operating without any problems, we verify if the expected effects are achieved based on the KPIs set in the Plan phase. Also, we consider expanding the scope of application of the automation solution to further improve operational efficiency. As networks and their operation processes change according to the progress of technology and changes in user requirements, it is necessary to adjust or modify the applied automation solutions accordingly. Also, automation technology itself is evolving every day, so periodic reviews of the processes and scope of automation applied, including the application of the latest technologies, are important to further enhance its effectiveness.

In addition to providing automation solutions, NEC supports the ongoing improvement of the customers' operational processes. Furthermore, NEC's xHaul Transport Automation Solution ecosystem is continuously expanding its portfolio, enabling us to deliver cutting-edge technologies in a timely manner.

3.3 Global scheme supporting xHaul Transport Automation Solutions

The xHaul Transport Automation Solution is supported by our global Centers of Excellence (CoE) that bring together network technologies and software engineering skills.

We established CoEs in June 2021 and have con-

tinuously reviewed its role and functionality to better support our customers. For automation solutions, we are enhancing the software development resources and multi-vendor validation labs. CoEs enable us to evaluate and validate the latest automation solutions and continuously expand and modernize our solution ecosystem.

4. Conclusion

The importance of networks as social infrastructure will continue to grow, and the network operations of CSPs are expected to become more complex in the future. NEC will continue to precisely grasp market needs and challenges, enhance our solutions to address them and contribute to CSP's achievement of greater operational efficiency and improvement of their competitiveness.

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The details about this paper can be seen at the following.

Related URL:

NEC Open Networks xHaul Transport

<https://www.nec.com/en/global/solutions/5g/5G-Transport-Network.html>

NEC gears up 5G xHaul Transformation Services with Automation Ecosystem

https://www.nec.com/en/press/202202/global_20220224_03.html

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