NEC’s Approach to APN Realization – Field Trials

YAMAUCHI Toshiro, ASAHI Koji, KAGESHIMA Hideo, KISHITA Noriaki

Abstract
Efforts to provide the open architecture for optical networks and All Photonics Networks (APN) are entering the stage where new value is created. This paper introduces NEC’s commitment to developing new value in the market such as the creation of an open ecosystem, integration to optimize the combination of open specification components, and case studies of field trials and other installations.

Keywords
IOWN Global Forum, Open APN (All Photonics Network), disaggregation, Openness ROADMA, open architecture, Telecom Infra Project (TIP)

1. Introduction
The efforts in the implementation of the All Photonics Network (APN) have entered the stage of new value creation. Functional separation (disaggregation) as well as the openness of specifications and interfaces make it possible to accelerate innovation, to avoid vendor lock-in where system configuration flexibility is limited by a specific vendor, and to build optimal networks in accordance with service requirements. Also, it helps create new value such as prompt provision of services, the achievement of high reliability, and hyper-realistic communication that transcends time and space.

In the meantime, there are challenges in transitioning from traditional all-in-one products that are vertically integrated. In order to address this issue, it is essential to manage disaggregated elements provided by multiple vendors, ensure connectivity through open interfaces, and assemble them into a solution — which requires ecosystems and integration providers (Fig. 1). NEC leads the building of open ecosystems and offers new value through integration services.

In this paper, we discuss the building of open ecosystems, the integration of systems, and some field trial examples as well as case studies.

2. Open Ecosystems
The advantage of disaggregation and openness is the freedom to combine components to create new value. It is important to build an ecosystem where participating vendors bring the results of their innovations and
combine the superior features from them, rather than procuring all products and services from a single vendor. As part of our support for building open ecosystems for optical networks, we play the critical role of an integrator that combines individual elements to achieve optimal system integration.

3. Integration

Until now, conventional optical network systems have been provided in the form of vertically integrated, all-in-one products. Because such products were provided by a single vendor, implementation may look easy. However, the serious drawback is that customers have to rely solely on that single vendor in terms of post-implementation operations and maintenance, the lead time for adding new functions and procurement, and support for the latest technologies, no matter how much the vendor would be supportive and cost effective. In the world of open architecture, on the other hand, individual elements can be combined to build an optimal system. Integration of those elements, which conventionally is a task of vertically integrated vendors, is required in any case. Based on our knowledge and experiences accumulated through decades of product development for global tier-1 communication service providers (CSPs) and building of highly reliable networks, NEC offers the integration necessary to build carrier-grade optical networks by combining open-architecture and open-source components (Fig. 2).

At NEC, we are proactively constructing verification labs as well as conducting field trials at customer sites to verify those values of open optical networks and APNs and to raise the market awareness.

In addition, the Telecom Infra Project (TIP) is making great efforts to bring innovation by applying open architecture and disaggregation to telecommunications infrastructure. As a result, we are collaborating with TIP to deploy TIP Phoenix-compliant 400G open transponders (SpectralWave WX-T) in the market.

4. Case Studies and Field Evaluations

4.1 Verification labs

We have established a verification environment in the TIP Community Lab in London, creating an environment where customers from around the world can verify interoperability (Fig. 3). This lab enables customers to perform many kinds of tests in a multi-vendor environment, such as verifying the connectivity with other vendors’ open line systems (OLS) and controllers in addition to confirming the operation of open-source transponders.

4.2 Connection between data centers

As data centers become larger and more distributed, demand for data center interconnections via wavelength-division multiplexing (WDM) is surging (Fig. 4). The following example presents a case study on the deployment of an APN in South Africa.

We helped Teraco, Africa’s largest data center operator, introduce the SpectralWave WX-T series of products compliant with TIP’s Phoenix initiative as the solution to connect between high-capacity, low-latency data centers. According to Teraco, they were having trouble with connecting high-capacity, low-latency data centers. With speed as their top priority, they chose NEC’s Phoenix-compliant products for their ability to be swiftly introduced. They say that they were able to introduce the solution promptly because our team provided the...
supporting system integration and training. As a result, they highly praised NEC’s integration expertise and satisfactory support.

4.3 Integration with existing WDM systems

Among the functions of optical transmission equipment, the transponder portion is undergoing rapid technological innovation. Therefore, the latest transponder functions are highly demanded, especially among data center operators. Today, a solution is needed that uses the newest transponders in existing optical networks. In order to meet this demand, NEC has developed a solution that integrates existing WDM systems with the latest transponders (Fig. 5). Our solution easily upgrades existing optical networks by verifying and guaranteeing interoperability between existing WDM systems of other companies and SpectralWave WX-T transponders compliant with open specifications and this solution has a proven track record of deployment mainly in South America, Africa, Asia, and other regions.

4.4 Real-time remote concert

The major advantages of optical networks are their high capacity and low latency. As a use case to demonstrate these benefits, NTT Art Technology and Tokyo Bunkamura held a “remote concert” to prove the feasibility of musical performance where performers collaborate from multiple locations in real-time by connecting the NEC Abiko Plant and other multiple locations in Tokyo, Osaka, and Kanagawa via IOWN APN3).

NEC provided SpectralWave WX-T and WX-D as components of IOWN’s APN to support the realization of a high-capacity, low-latency APN. This contributed to the realization of remote concerts that made viewers feel as if the performers were right in front of them, demonstrating new possibilities for next-generation networks.

5. Conclusion

In this paper, we introduced NEC’s efforts to develop the SpectralWave WX series, which helps to realize APNs. There is a growing interest in the market for open architecture in general and for APNs in particular. At NEC, we will expand our open optical transport business by leveraging our experiences and expertise in delivering a variety of optical transmission products and solutions to create innovation and contribute to solving social issues.

References
1) Telecom Infra Project https://telecominfraproject.com/

Authors’ Profiles
YAMAUCHI Toshiro
Professional
Transport Network Department
ASAHI Koji
Director
Transport Network Department
KAGESHIMA Hideo
Director
Transport Network Department
KISHITA Noriaki
Professional
Transport Network Department

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

Related URL:
Open Optical Transport
Thank you for reading the paper. If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Information about the NEC Technical Journal

Vol.17 No.1 Special Issue on Open Network Technologies
— Network Technologies and Advanced Solutions at the Heart of an Open and Green Society

Papers for Special Issue

Open RAN and Supporting Virtualization Technologies
Innovations Brought by Open RAN
Reducing Energy Consumption in Mobile Networks
Self-configuring Smart Surfaces
Nuberu: Reliable RAN Virtualization in Shared Platforms
vrAN: Deep Learning based Orchestration for Computing and Radio Resources in vRANs

Wireless Technologies for 5G/Beyond 5G
28 GHz Multi-User Massive Distributed-MIMO with Spatial Division Multiplexing
28 GHz Over-the-Air Measurements Using an OTFS Multi-User Distributed MIMO System
Comprehensive Digital Predistortion for improving Nonlinear Affection and Transceivers Calibration to Maximize Spatial Multiplexing Performance in Massive MIMO with Sub6 GHz Band Active Antenna System
39 GHz 256 Element Hybrid Beam-forming Massive MIMO for 8 Multi-users Multiplexing

Initiatives in Open APN (Open Optical/All Optical)
NEC’s Approach to APN Realization — Towards the Creation of Open Optical Networks
NEC’s Approach to APN Realization — Features of APN Devices (WX Series)
Wavelength Conversion Technology Using Laser Sources with Silicon Photonics for All Photonics Network
Optical Device Technology Supporting NEC Open Networks — Optical Transmission Technology for 800G and Beyond

Initiatives in Core & Value Networks
Technologies Supporting Data Plane Control for a Carbon-Neutral Society
NEC’s Network Slicing Supports People’s Lives in the 5G Era
Application-Aware ICT Control Technology to Support DX Promotion with Active Use of Beyond 5G, IoT, and AI Using Public Cloud for 5G Core Networks for Telecom Operators

Enhancing Network Services through Initiatives in Network Automation and Security
NEC’s Approach to Full Automation of Network Operations in OSS
Autonomous Network Operation Based on User Requirements and Security Response Initiatives
Enhancing Information and Communications Networks Safety through Security Transparency Assurance Technology
Enhancing Supply Chain Management for Network Equipment and Its Operation

Network Utilization Solutions and Supporting Technologies
Positioning Solutions for Communication Service Providers
The Key to Unlocking the Full Potential of 5G with the Traffic Management Solution (TMS)
Introducing the UNIVERGE RV1200, All-in-one Integrated Compact Base Station, and Managed Services for Private 5G
Vertical Services Leveraging Private 5G to Support Industrial DX
Integrated Solution Combining Private 5G and LAN/RAN

Global 5G xHaul Transport Solutions
xHaul Solution Suite for Advanced Transport Networks
xHaul Transformation Services
xHaul Transport Automation Solutions
Fixed Wireless Transport Technologies in the 5G and Beyond 5G Eras
SDN/Automation for Beyond 5G
QAM Mode-Multiplexing Transmission System for High-Efficiency and High-Capacity Wireless Transmission

Toward Beyond 5G/6G
NEC’s Vision and Initiatives towards the Beyond 5G Era

NEC Information
2022 C&C Prize Ceremony