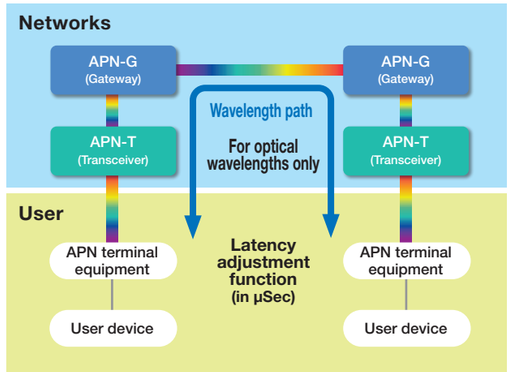
Innovative Optical and Wireless Network

IOWN

Launch of APN IOWN 1.0

In March 2023, NTT East and NTT West initiated the first commercial service under the IOWN framework. This high-speed broadband access service, powered by IOWN, is called the All-Photonics Network (APN). APN provides an optical-wavelength-exclusive service across the entire communications network. By implementing OTU4[*1], which uses optical wavelengths exclusively in all sections of the communications network and enables multi-accommodation within the optical transmission network at the interface level, we have achieved a latency that is an astounding 1/200th of conventional latency[*2], as well as zero signal fluctuation[*3].

With conventional IP/Ethernet services, the way latency occurred was inconsistent, making it difficult to predict and thereby complicating intricate remote tasks. With APN, the absence of signal fluctuations and a consistent latency level have made it possible to predict delays, thereby enabling a wide range of applications. Furthermore, adjustments and visualization of latency make it possible to synchronize timing between remote locations.



*1 A standardized optical transmission network protocol recognized by ITU-T. Provided as an interface for high-speed broadband access services

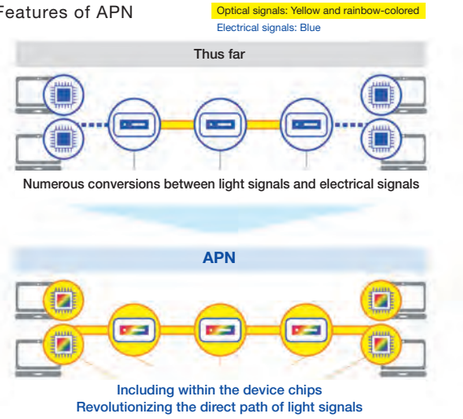
*2 Latency within the same prefecture where no video compression is required

*3 Suppression of latency and packet loss due to traffic conditions by adopting time-division multiplexing (sending signals at fixed times to distinguish information)

What is APN?

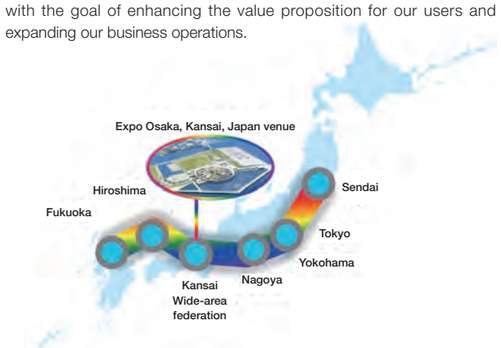
Current networks consume a significant amount of energy by repeatedly converting between optical and electrical signals. Moreover, latency issues arise due to communication traffic management. APNs seek to overcome these limitations by converting all signals into optical signals, thereby creating a network with higher capacity, lower latency, and more reduced energy consumption than now.

● Features of APN



● Expansion of APN services

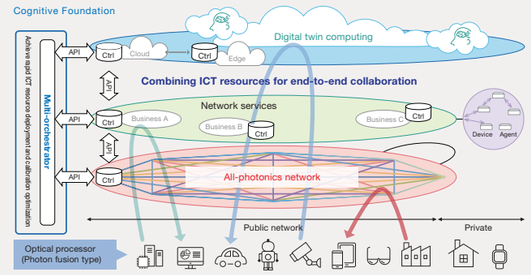
We plan to incrementally expand APN services between major cities with the goal of enhancing the value proposition for our users and expanding our business operations.



* This diagram is for illustrative purposes, and APN deployment to the areas mentioned is undecided at this point.

What is the IOWN (Innovative Optical and Wireless Network) Concept?

IOWN is a framework involving devices, networks and information processing infrastructure built on optical and other innovative technologies, to deliver high-speed and high-capacity communications, and vast computing resources. IOWN consists of three key areas of technology: the All Photonics Network (APN), which applies optical technology; Digital Twin Computing (DTC), which enables advanced, real-time interaction between objects and people in cyberspace; and the Cognitive Foundation (CF), which deploys various ICT resources efficiently, including the aforementioned.



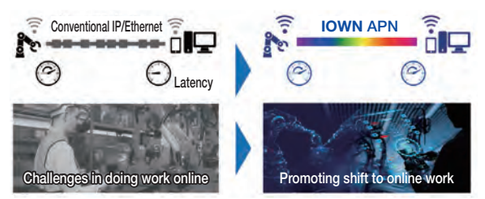
APN IOWN 1.0 Applications

Telemedicine

● Complex surgeries can now be performed remotely thanks to high-capacity, low-latency, and zero-fluctuation communications

Smart factories

● Minimization of latency and fluctuations allows for remote operations that are as intricate as human touch



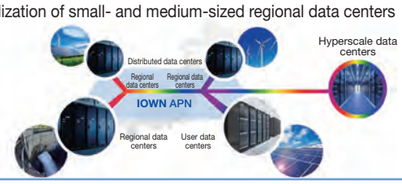
e-Sports

● Even in e-Sports, where slight latency can affect the outcome, fair competitions between remote venues is enabled

Data center interconnectivity

● Interconnecting data centers via APN makes it possible for functional distribution and increases availability

● The use of renewable energy is encouraged through the utilization of small- and medium-sized regional data centers



Collaboration with Partners

We are in discussions with various potential partners, including companies and organizations that are considering using APN IOWN 1.0 on a paid basis (as shown in the figure on the right). We aim to promote business demonstrations and new business creation using APN IOWN 1.0 together with our partners.

- Oracle Corporation
- Amazon Web Services Japan LLC
- NVIDIA Japan LLC
- Google Cloud Japan LLC
- RIKEN, Institute of Physical and Chemical Research
- National Institute of Informatics
- Shibuya Ward
- Tokyu Land Corporation
- Japan Exchange Group, Inc.
- Mitsubishi Corporation
- Medicaroid Corporation
- Yoshimoto Kogyo Co., Ltd.

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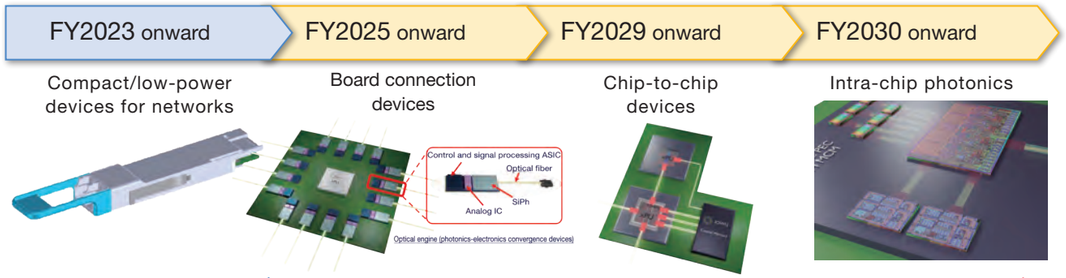
Future Developments of Photonics-Electronics Convergence Devices

APN IOWN 1.0, which we launched in March 2023, offers ultra-low latency as a significant value. Still, the most distinctive feature of APN is its improved energy efficiency, the key to which is photonics-electronics convergence devices. Photonics-electronics convergence means fusing optical and electrical circuits to achieve various performance improvements, including miniaturization and economization as well as high speed and low power consumption. We aim to apply this not just to networks, but also to the computing realm to significantly reduce power consumption.

For photonics-electronics convergence devices, we plan to start by commercializing low-power devices for network applications in fiscal 2023. This involves integrating multiple devices that used to be separate into a single package, thereby significantly reducing the size and achieving lower power consumption.

Next, we plan to commercialize photonics-electronics convergence devices for board connections in fiscal 2025, enabling optical connections between boards and between boards and external interfaces. This will allow for the use of light not only in networks, but also in computing.

Subsequently, with an eye toward fiscal 2029, we plan to make chip-to-chip connections within boards possible using photonics-electronics convergence technology, and beyond fiscal 2030, we aim for connections within the chips themselves to be optical.



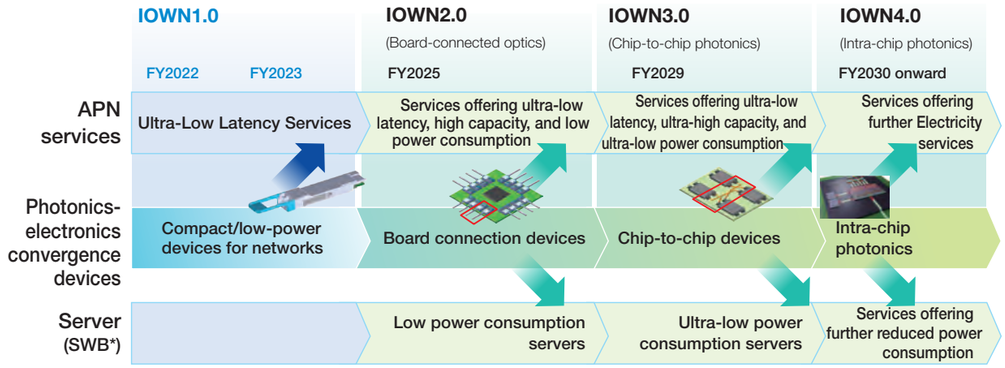
We aim to refine IOWN by applying the aforementioned photonics-electronics convergence devices to both APN services and servers.

First, in fiscal 2023, we plan to reduce the power consumption of network-oriented small devices and apply them to APN services to improve their power efficiency.

Next, for IOWN 2.0 starting in fiscal 2025, we will expand the application scope by using the devices for board connections in not only APN services, but also the server sector.

According to the current schedule, our goal is to commercialize low-power servers using these photonics-electronics convergence devices in fiscal 2026.

Further, for IOWN 3.0 starting in fiscal 2029, we aim to develop devices for chip-to-chip connections and, for IOWN 4.0 in fiscal 2030 and beyond, to make the chip interiors themselves optical to drastically reduce power consumption.



* Super White Box

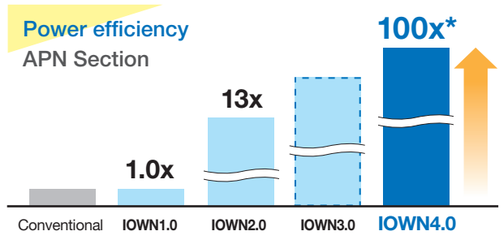
IOWN Performance Targets

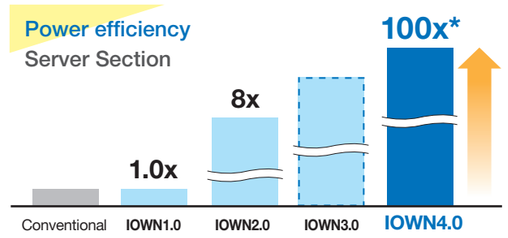
In addition to photonics-electronics convergence devices, we are considering improvements in wavelength technology and optical fiber technology. Starting in fiscal 2025 with IOWN 2.0, we expect a 13-fold improvement in power efficiency in the APN section and an 8-fold improvement in the server section, with a more than 6-fold increase in capacity.

Moreover, in fiscal 2029 with IOWN 3.0, we aim for further performance improvements, reaching up to 125-fold in terms of capacity.

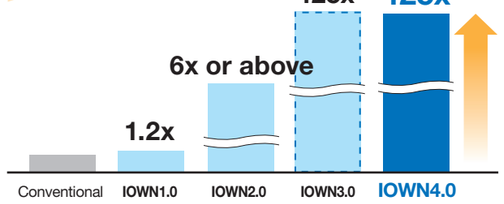
The power efficiency depends on the deployment of the device, but its performance will exceed that of IOWN 2.0, and it is expected to improve performance about 20-fold in the server section compared to existing solutions.

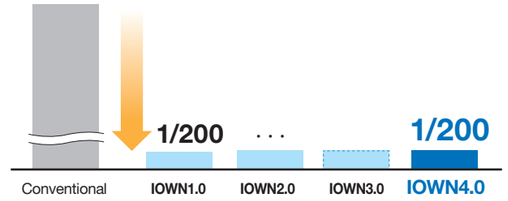
Furthermore, we aim to achieve a 100-fold improvement in overall power efficiency, 125-fold in capacity, and 1/200th of the latency with IOWN 4.0 looking toward fiscal 2030 and beyond.





* Power efficiency values for the entire photonics-applied section, including APNs, servers, etc.



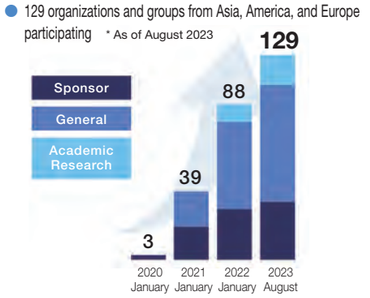


Column

IOWN Global Forum Initiative

To make the IOWN concept a reality, we have been promoting it around the world with partners through the IOWN Global Forum (IOWN GF), and 129 organizations and groups are taking part (as of August 2023).

In April 2023, we held the first annual meeting in Osaka in the post-COVID-19 period, with 396 participants attending in person and 174 attending remotely, mainly from Europe and Asia. Discussions about future developments are steadily evolving, and we have received a message from Prime Minister Kishida as well.



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