

Revolutionizing Communications and Infrastructure with IOWN Technology

Innovative Optical and Wireless Network

VNNIC2023

Presented by: Binh Lam - NTT



Agenda

Challenges

**IOWN
Global
Forum**

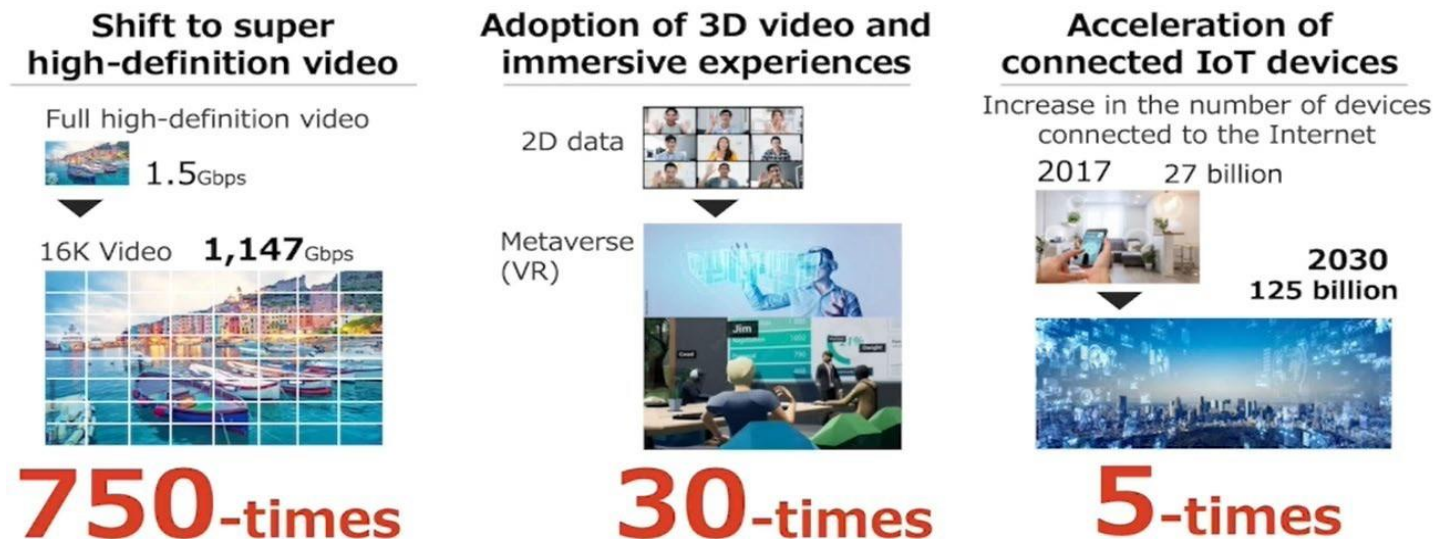
**Innovative
Optical and
Wireless
Network**

Challenge 1: Data volume will increase

"To watch a video in full high definition requires broadband speeds of 1.5Gbps, but to watch the same video in 16K requires speeds approximately 750 times faster.

It is also anticipated that extended reality of the metaverse will grow rapidly, and the move from 2D to 3D data will necessitate an approximately 30-fold increase in data volume.

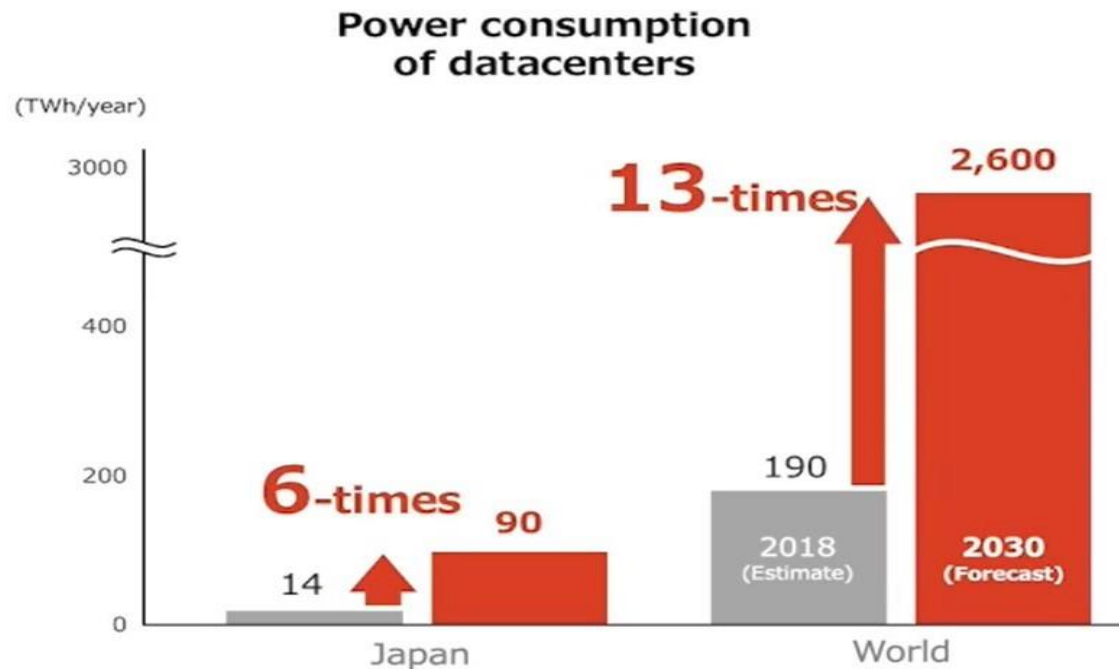
Also in the future more and more aspects of our lives will be networked as part of IoT. It is projected that the number of devices in use will increase five-fold."



Challenge 2: Power Consumption Will Increase

Datcenter Power consumption will increase

"As more data migrates to the cloud, by 2030 it is anticipated that energy consumption will increase significantly, rising six-fold in Japan to 90TWh, and 13-fold globally."

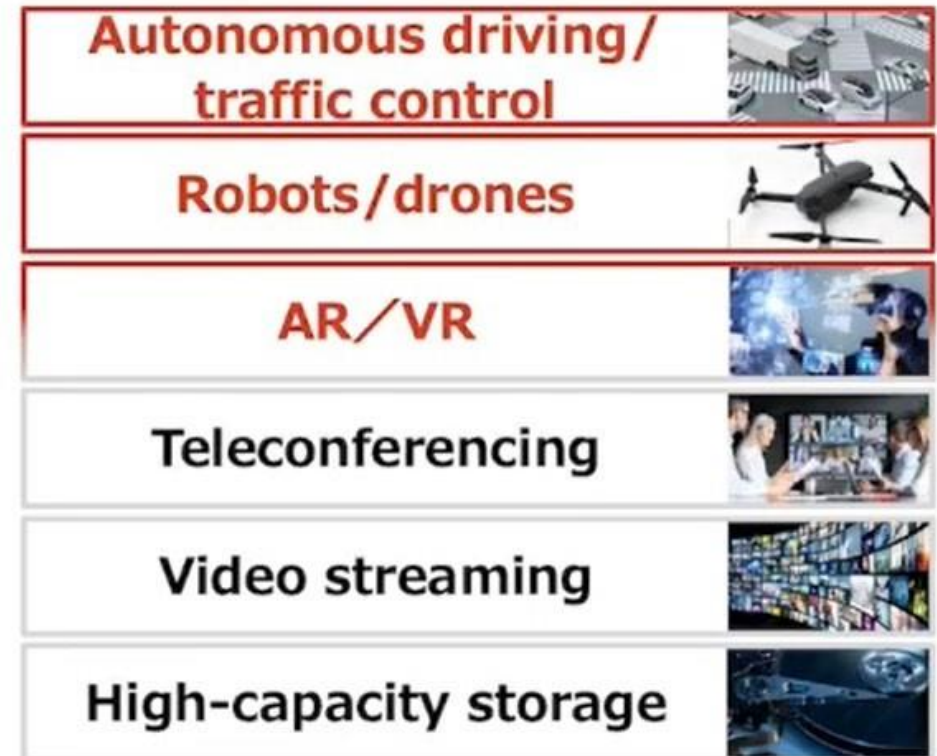


Challenge 3: Network Latency

Reduction of network latency is essential for new services

"Extremely lower latency will be essential in order to enable the adoption of VR, AR, robots and autonomously driven drones.

In VR, unless latency of less than 20msec is achieved, images appear slower than human movement, causing VR motion sickness."



Innovative Optical and Wireless Network



NTT R&D is preparing for the arrival of **new smart societies that are not yet possible with today's internet.**

In this smart world, people's lives as well as their relationship with technology will be revolutionized.

Creating this new world requires innovation that is more than a simple extension of current technologies; we need to realize **ultra-low power consumption, high-speed signal processing and the fusion of virtual worlds that can equal or surpass reality with sophisticated prediction technologies.**

The Innovative Optical and Wireless Network (IOWN) aims to transform existing information and communications systems and implement a new infrastructure that transcends the limitations of current information and communications technology (ICT)

IOWN Global Forum



IOWN Global ForSponsor

As of June 30, 2021



Here is the latest information
<https://iowngf.org/members/>

General Members

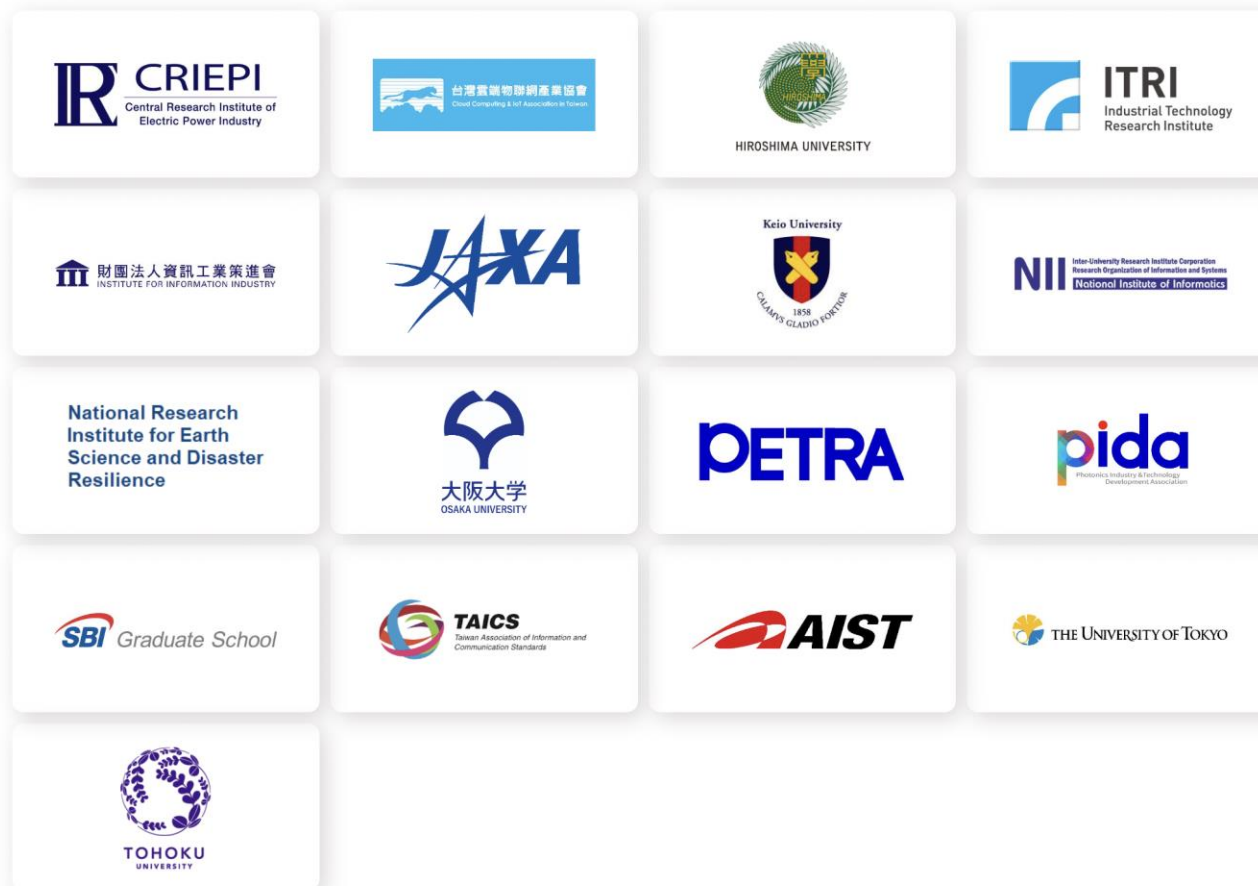
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Academic or Research Members

As of June 30, 2021



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IOWN 2030 Objectives

In order to solve various social issues and realize a smarter world, by 2030, IOWN will achieve:



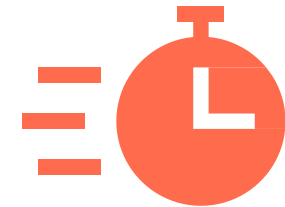
Lower power consumption by

100x



Higher transmission¹ capacity by

125x



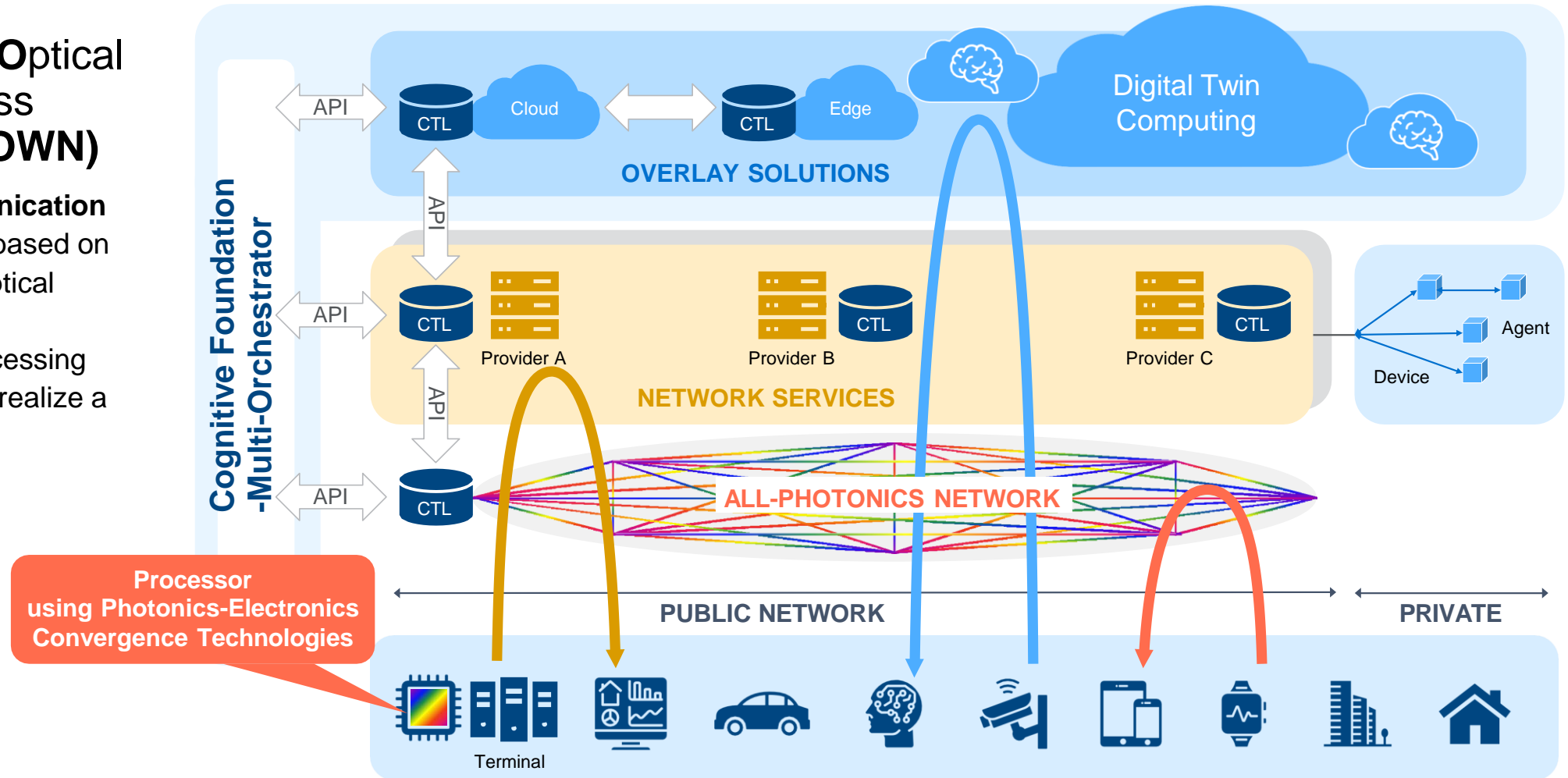
Lower end-to-end latency by

200x

What's IOWN?

Innovative Optical and Wireless Network (IOWN)

Future communication infrastructure based on leading-edge optical technology and information processing technologies to realize a smarter world.



IOWN: composed of three elements

Digital Twin Computing

Digital twin computing is a significant advance in existing digital twin technology. This new paradigm allows free interactions between people and things to be recreated and tested.

It can be used to **build virtual societies at a level of precision that has never been achieved before**, enabling the running of prediction and testing on **large-scale, highly accurate futures**, and to provide high-level communications offering new value. The technology is expected to solve various social problems around the world and lead to the **creation of innovative new services**.

All Photonic Networks

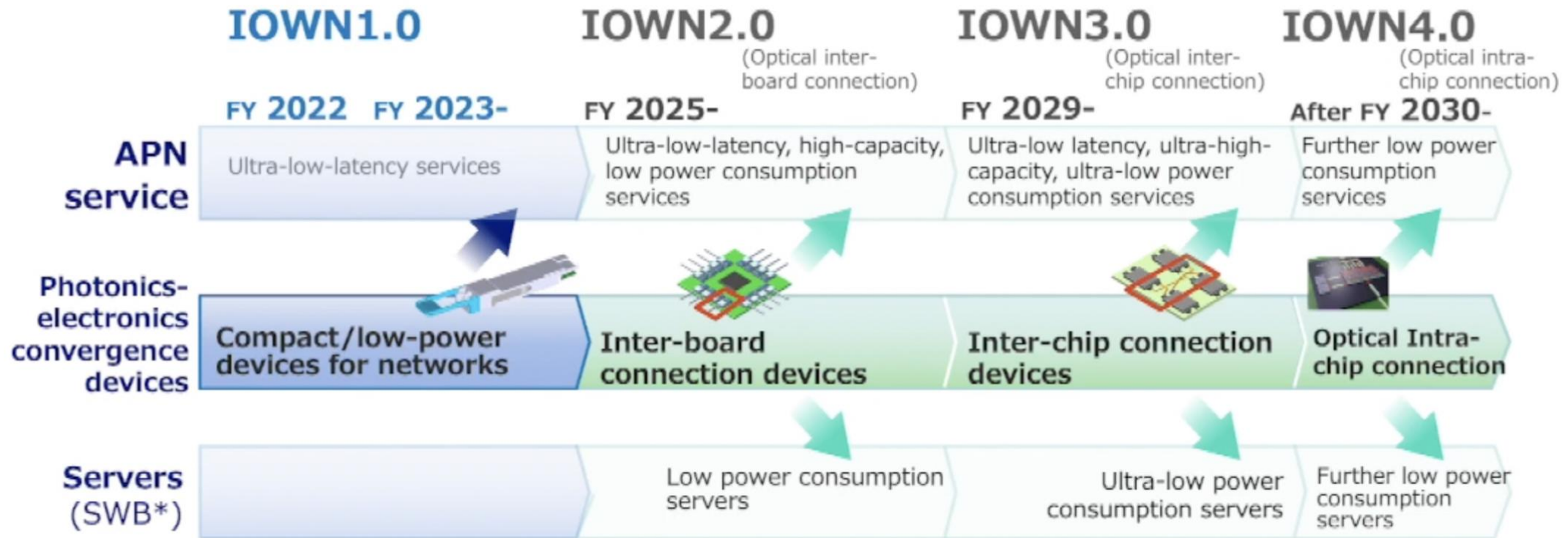
All-photonic networks incorporate **new optical technologies at every level**, from networks to devices and even inside chips, to enable the kind of ultra-low power consumption and ultra-high speed processing that has not been possible until now.

By allocating different wavelengths to different functions in a single optical fiber, it becomes possible to provide multiple functions that support social infrastructure without mutual interference, including information communication functions such as internal sensing functions.

Cognitive Foundation

Cognitive Foundation achieves **multi-orchestration** that ultimately saves and automates the deployment and configuration optimization of the various ICT resources that underpin social infrastructures.

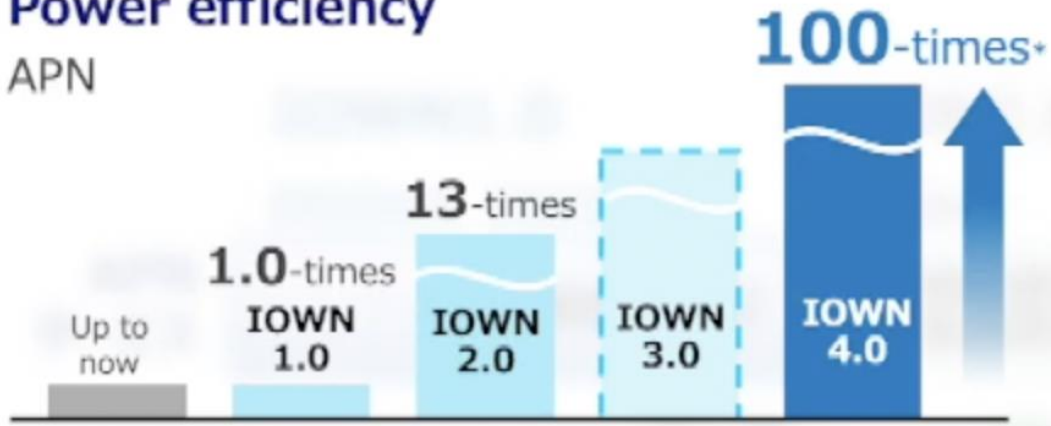
Service for Photonics -Electronics Convergence Device



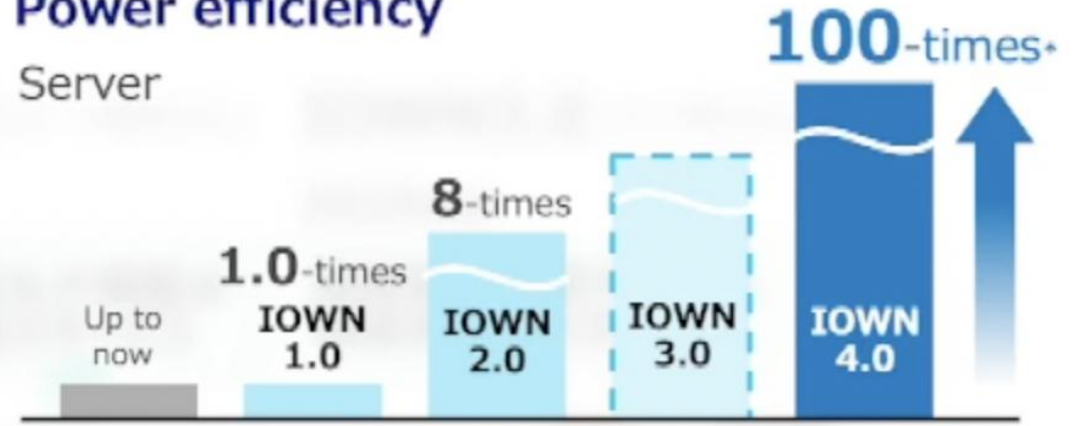
*Super White Box

Future Path for IOWN

Power efficiency APN



Power efficiency Server

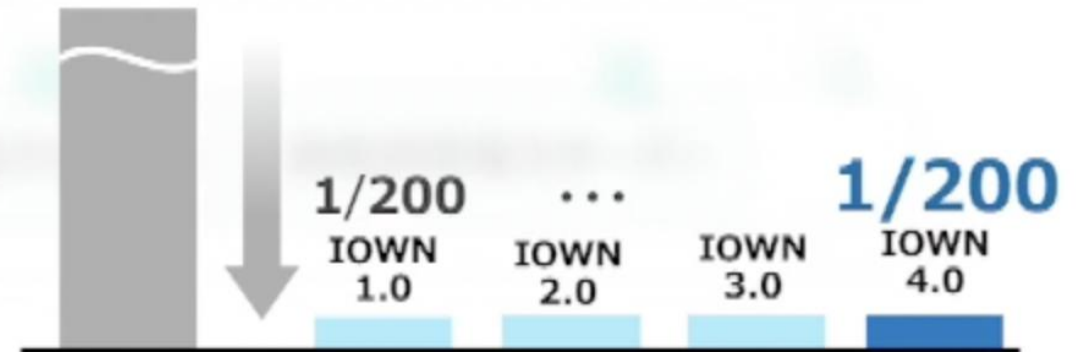


* Power efficiency for the entire photonics-applied area, including the APN, servers, etc

High capacity



Low latency

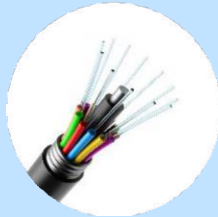


IOWN Enabling Technologies, Examples

Lower power consumption

Transmission media

Optical fiber cables



Transmission systems

Light (wavelengths) throughout



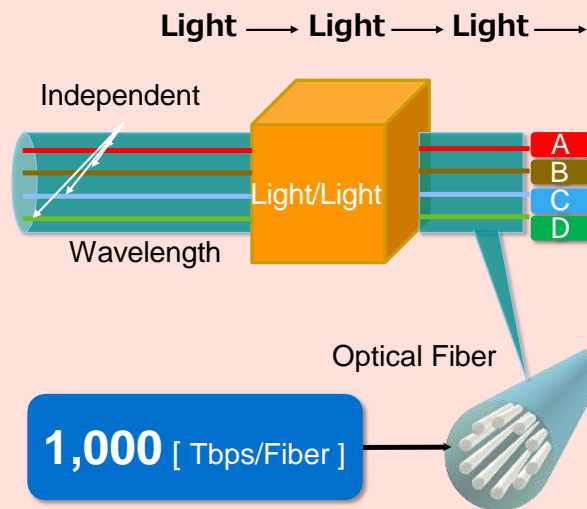
Information processing Platform

Processor using Photonics-Electronics Convergence Technologies



High quality and high capacity

Wavelengths (optical signal)



Low delay

Transmission per wavelength

No queueing

No data compression

Wavelength A 6

High-capacity video (uncompressed)

No processing delay

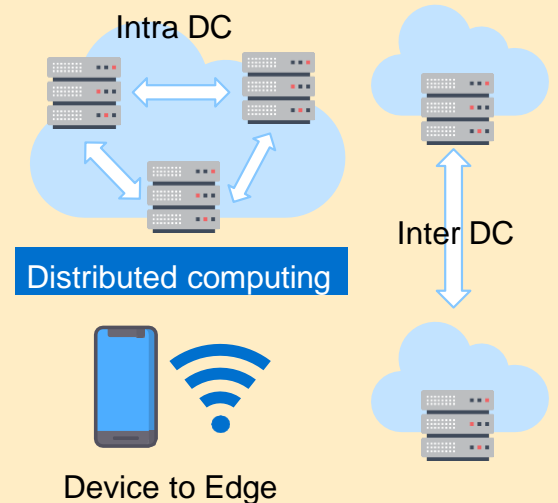
Wavelength B

Speech

Optimization for computing scaling

Intelligent network for computing and data scaling

Enable dynamic workload migration for performance



IOWN -Transport Network for Mobile Network Challenges

IOWN Global Forum use cases enabled by the projected future technologies call for enhanced KPI targets of 10X+ improvement factor:

- Network Throughput
- Network Latency
- Mobile Position

Table 1 Projected 6G KPI Improvement over 5G

E2E KPI	5G	6G	Improvement Factor
Peak Data Rate (Gbps)	10	100-1000	10-100
Connection Density	1/m ²	10-100/m ³	10-100
User Plane Latency (m sec)	1	0.1	10
Jitter (m sec)	N/A	0.0001-1	N/A
Reliability	Five 9s	7 9s – 9 9s	100 – 10000
Synchronization	3μs (cell phase) Three ns for 1-meter position accuracy	<1 ns for <0.2-meter position accuracy	10 ^[1]
Position Accuracy	1m-level	1cm-level ^[2]	100

[1] 10x improvement factor is targeted based on the general expected improvement factor between two wireless generations of technologies

[2] [NTT Docomo 6G]

6G using IOWN Technologies



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