VICTORIES

Vertically Integrated Center for Technologies of Optical Routing toward Ideal Energy Savings

http://www.aist-victories.org/en

National Institute of
Advanced Industrial Science
and Technology
AIST

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TIA nano
Tsukuba Innovation Arena

The VICTORIES is one of the projects
making use of the TIA-nano facilities.

Project for Developing Innovation Systems
of the Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Creation of innovation centers for advanced interdisciplinary research areas Program

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National Institute of
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NTT

FUJITSU
FUJITSU LABORATORIES

FURUKAWA
ELECTRIC

triMATIZ
Control the light

NEC

FUJITSU

Fujikura

Alnair Labs

SUMITOMO
ELECTRIC

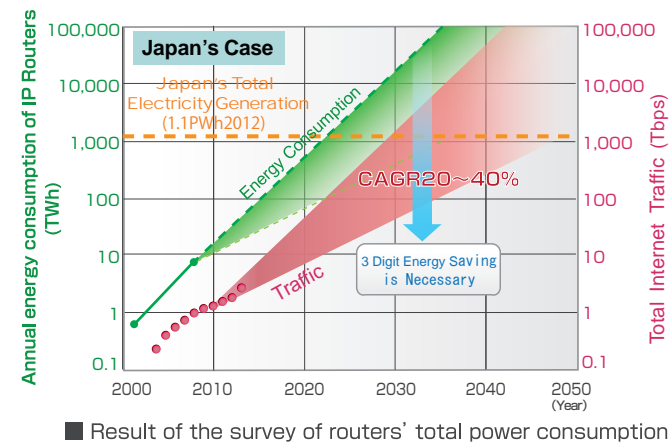*KITANIHON ELECTRIC CABLE CO., LTD.*

VICTORIES : The Vertically Integrated Center for Technologies of Optical Routing toward Ideal Energy Savings
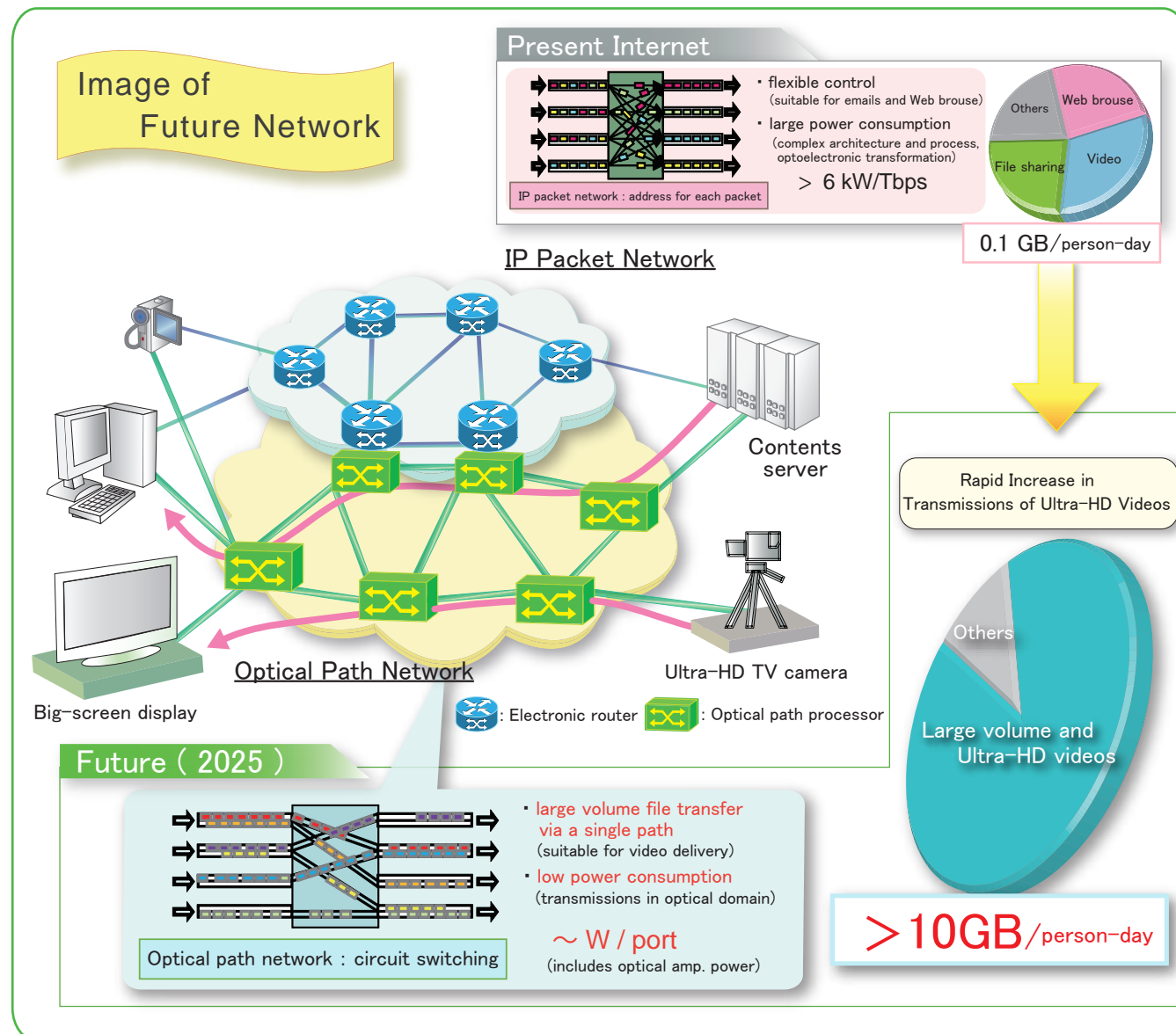
Background

Information and telecommunications network traffic has been increasing dramatically at an annual rate of 20-40%. Given the spread of video sites and video chat sites on the Internet that is underway and the integration of broadcasting and communications that will follow the digitization of terrestrial broadcasting in 2011, this expansion of traffic volume is expected to continue for many years in the future. Consequently, a 1000-fold increase in the current total network capacity will be required.
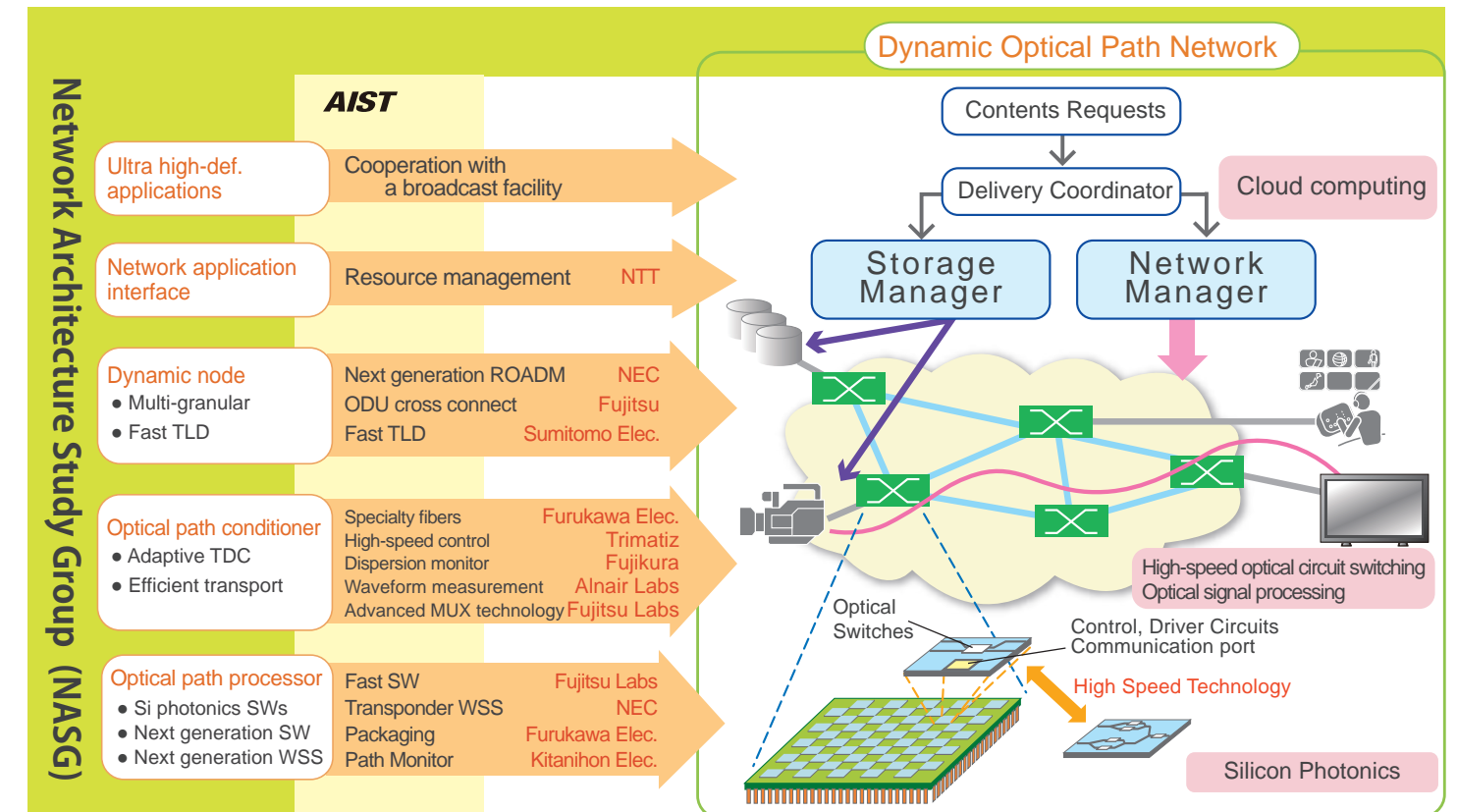
Estimates based on surveys conducted to ascertain the total power consumption of routers, which are the main components of information and telecommunications networks in Japan, suggest that routers consumed 700 million kWh in 2001. By 2006, this figure had risen more than 10-fold. Given that the total power production in Japan was about 1 trillion kWh in 2006, routers consumed 1% of the electric power produced. At the same time, Internet traffic also increased more than 10-fold during this period. In accordance with these trends, to achieve a 1000-fold increase in the current level of network traffic, more routers with improved performance will need to be introduced and a 1000-fold increase in power supply will be required. This is not realistic, however, because routers alone will require a power supply in excess of the total power production.

Japan's Case

Japan's Total Electricity Generation (1.1PWh2012)

Energy Consumption

CAGR20~40%

Traffic

3 Digit Energy Saving is Necessary

Annual energy consumption of IP Routers (TWh) / Total Internet Traffic (Tbps)

■ Result of the survey of routers' total power consumption

Dynamic Optical Path Network

Image of Future Network

Present Internet

- flexible control (suitable for emails and Web brouse)
- large power consumption (complex architecture and process, optoelectronic transformation) > 6 kW/Tbps

IP packet network : address for each packet

Others / Web brouse / File sharing / Video

IP Packet Network

0.1 GB/person-day

Contents server

Optical Path Network

Ultra-HD TV camera

Big-screen display

⊠ : Electronic router ⊞ : Optical path processor

Rapid Increase in Transmissions of Ultra-HD Videos

Others / Large volume and Ultra-HD videos

Future (2025)

- large volume file transfer via a single path (suitable for video delivery)
- low power consumption (transmissions in optical domain)

Optical path network : circuit switching

~ W / port (includes optical amp. power)

>10GB/person-day

Overview of Research Topics

Network Architecture Study Group (NASG)

AIST

Dynamic Optical Path Network

Topic	Detail	Partner
Ultra high-def. applications	Cooperation with a broadcast facility	
Network application interface	Resource management	NTT
Dynamic node • Multi-granular • Fast TLD	Next generation ROADM / ODU cross connect / Fast TLD	NEC / Fujitsu / Sumitomo Elec.
Optical path conditioner • Adaptive TDC • Efficient transport	Specialty fibers / High-speed control / Dispersion monitor / Waveform measurement / Advanced MUX technology	Furukawa Elec. / Trimatiz / Fujikura / Alnair Labs / Fujitsu Labs
Optical path processor • Si photonics SWs • Next generation SW • Next generation WSS	Fast SW / Transponder WSS / Packaging / Path Monitor	Fujitsu Labs / NEC / Furukawa Elec. / Kitanihon Elec.

Contents Requests → Delivery Coordinator

Cloud computing

Storage Manager / Network Manager

High-speed optical circuit switching / Optical signal processing

Optical Switches

Control, Driver Circuits / Communication port

High Speed Technology

Silicon Photonics

Green IT Society by Optical Path Network (2025)

Creation of Innovation by Remote Coexistence

Ultra-HD Video Conference

Green Datacenter

Ultra-HD Communication, Televisiting

Remote Collaboration, Telework

Optical Network with Ultra-low Energy Consumption

Remote Diagnosis

Public Viewing

Remote Education