JGN-X:
a testbed for Green Networking

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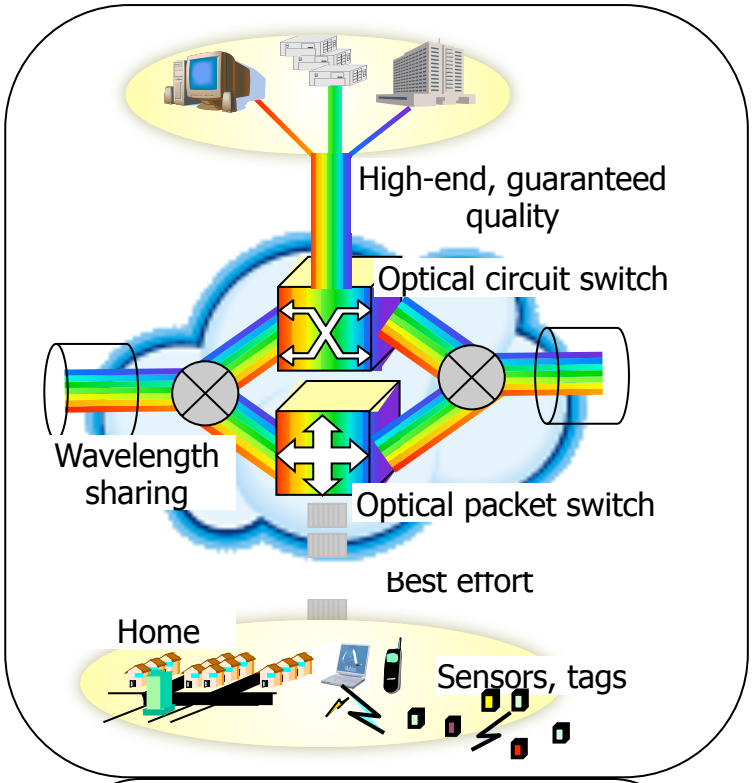
NiCT

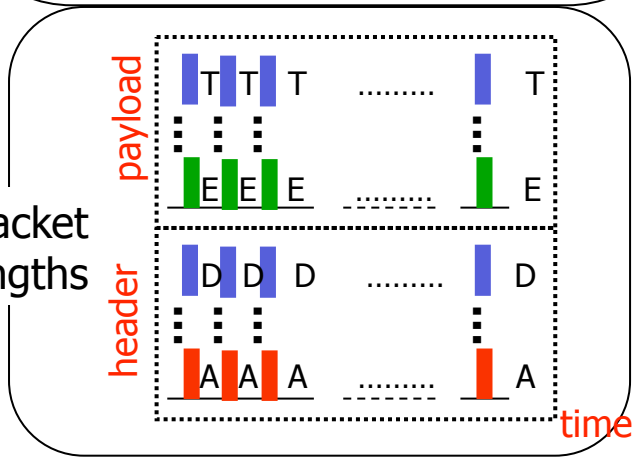
What we can do for reducing energy consumption

- Introduction of all-optical network
- smarter data center/Cloud
- smarter home

Optical Packet & Circuit Integrated Networking

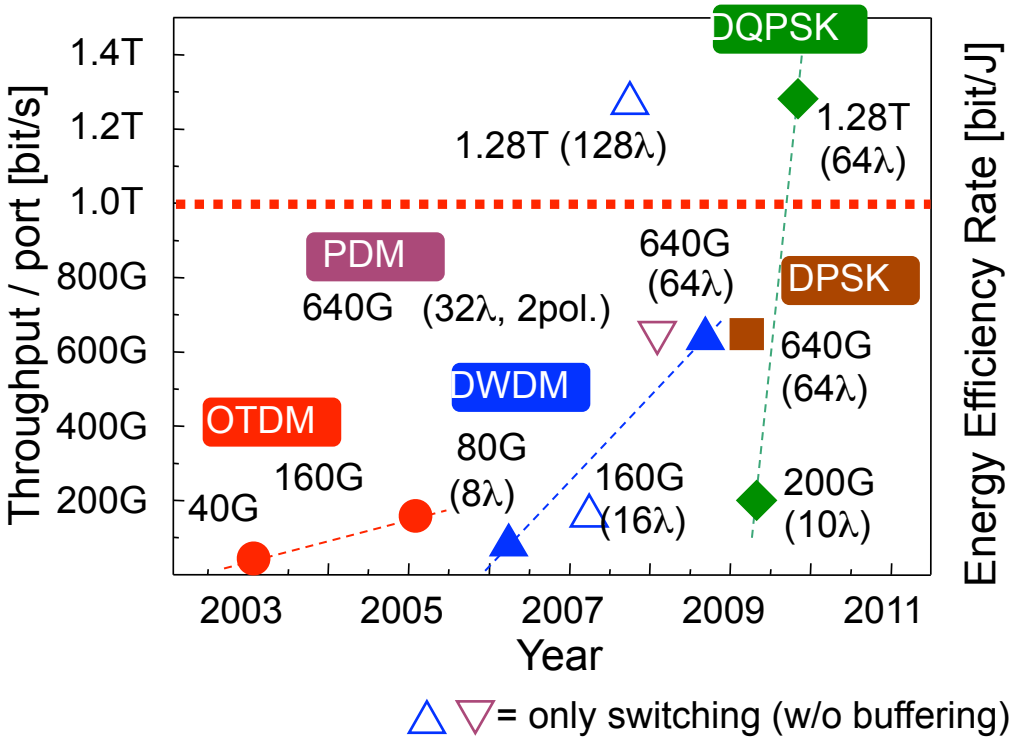
- Objective
  - Providing diverse user requirements w/ large capacity
- Advantage
  - High switching capacity
  - Energy saving
  - Using common WDM infrastructure
  - Simple control plane
- Design principle
  - Crystal synthesis (quality & best effort)
  - Sustainable (throughput, power, usage)

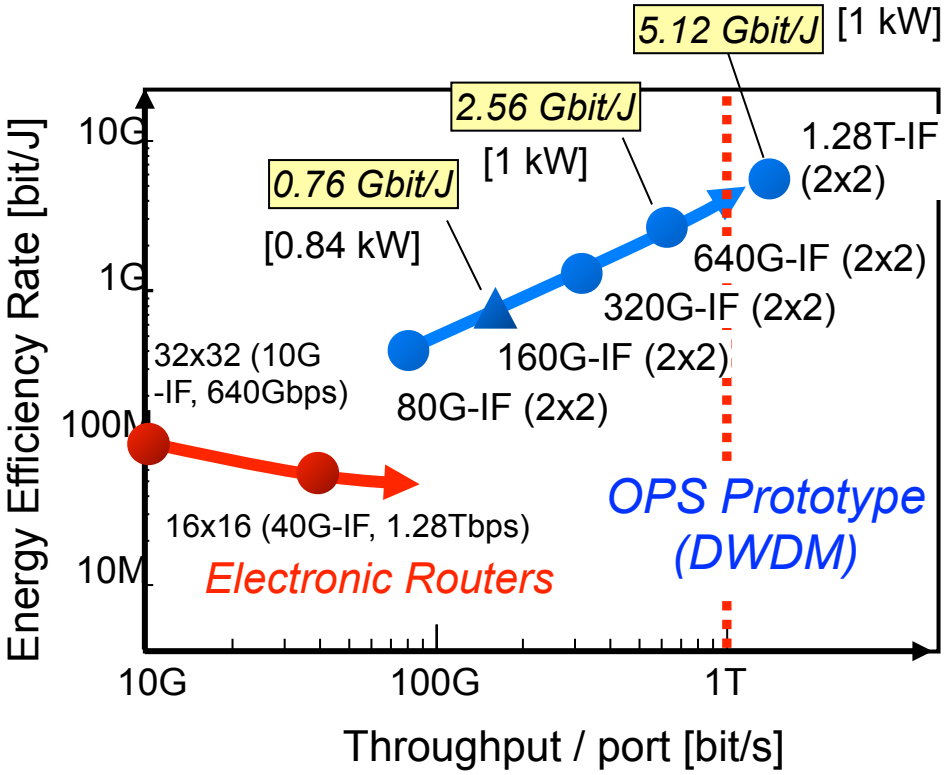




Optical packet by many wavelengths

Throughput and Energy Efficiency





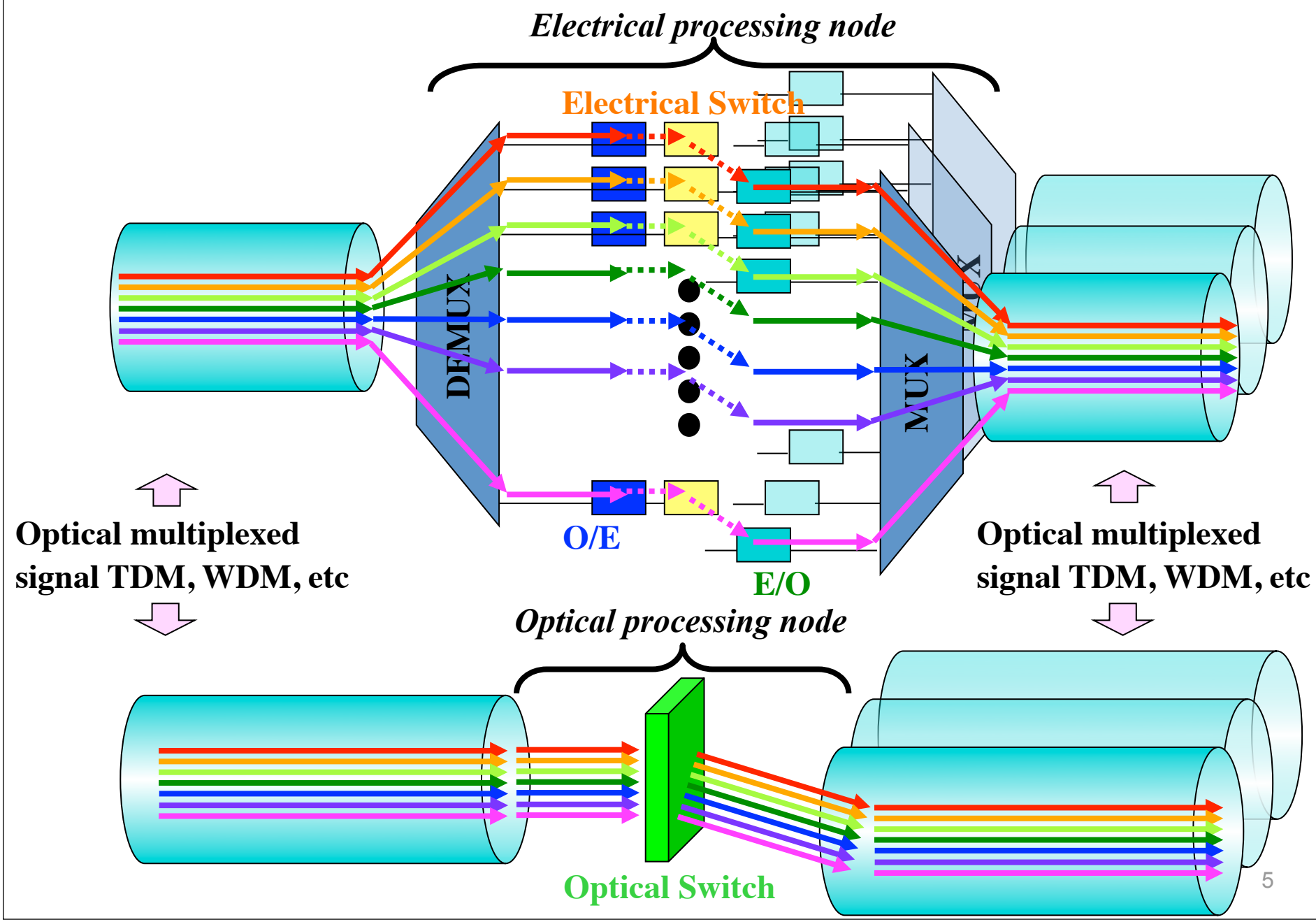
Throughput / port > 1 Tbps (DWDM/DQPSK) Multi-phase-modulation is good match.

Energy-Efficiency-Rate was improved (x2) without increase in power consumption.

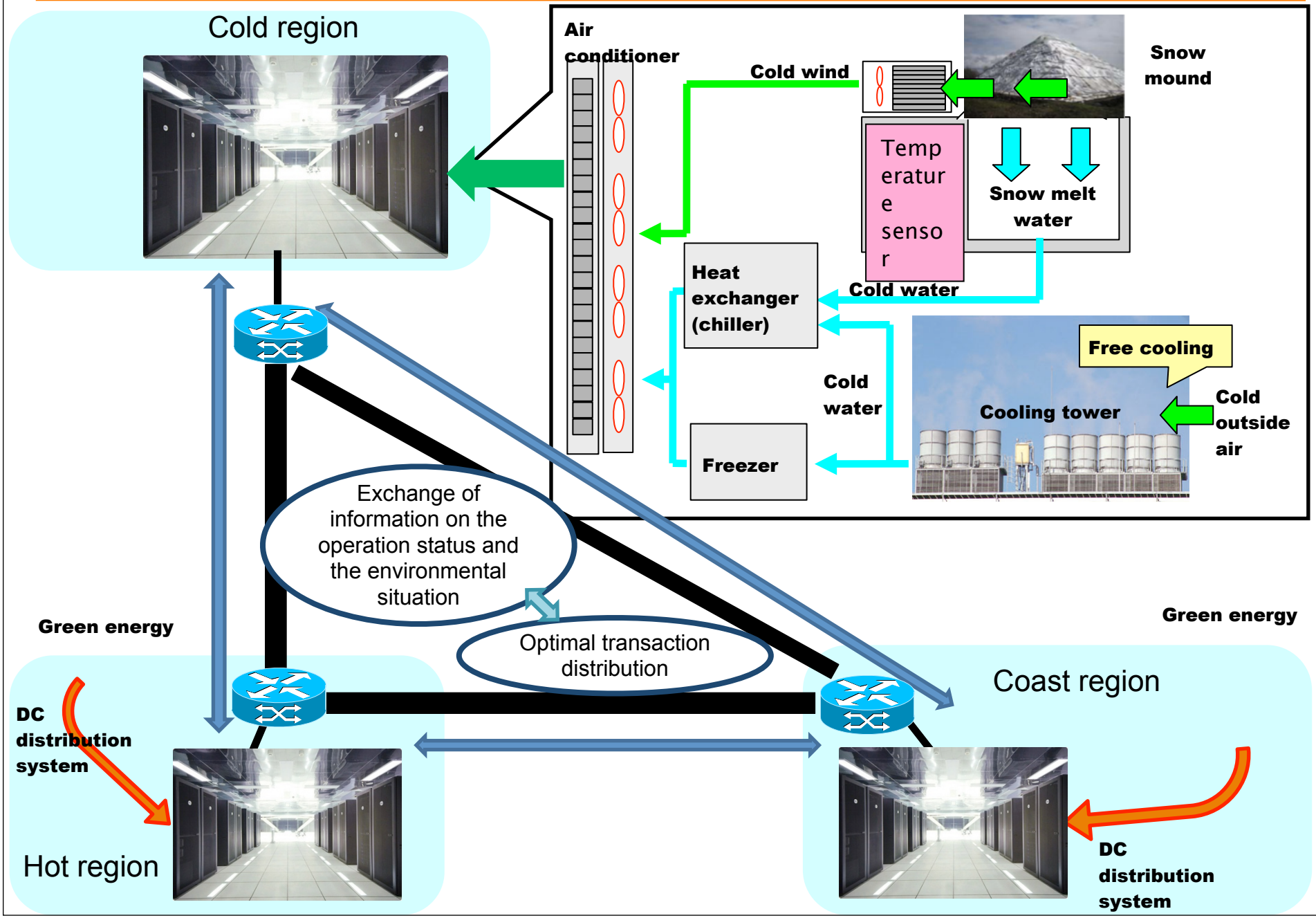
(Power consumption was kept <1 kW)

Wada

Wideband switching (Electrical vs. Optical)



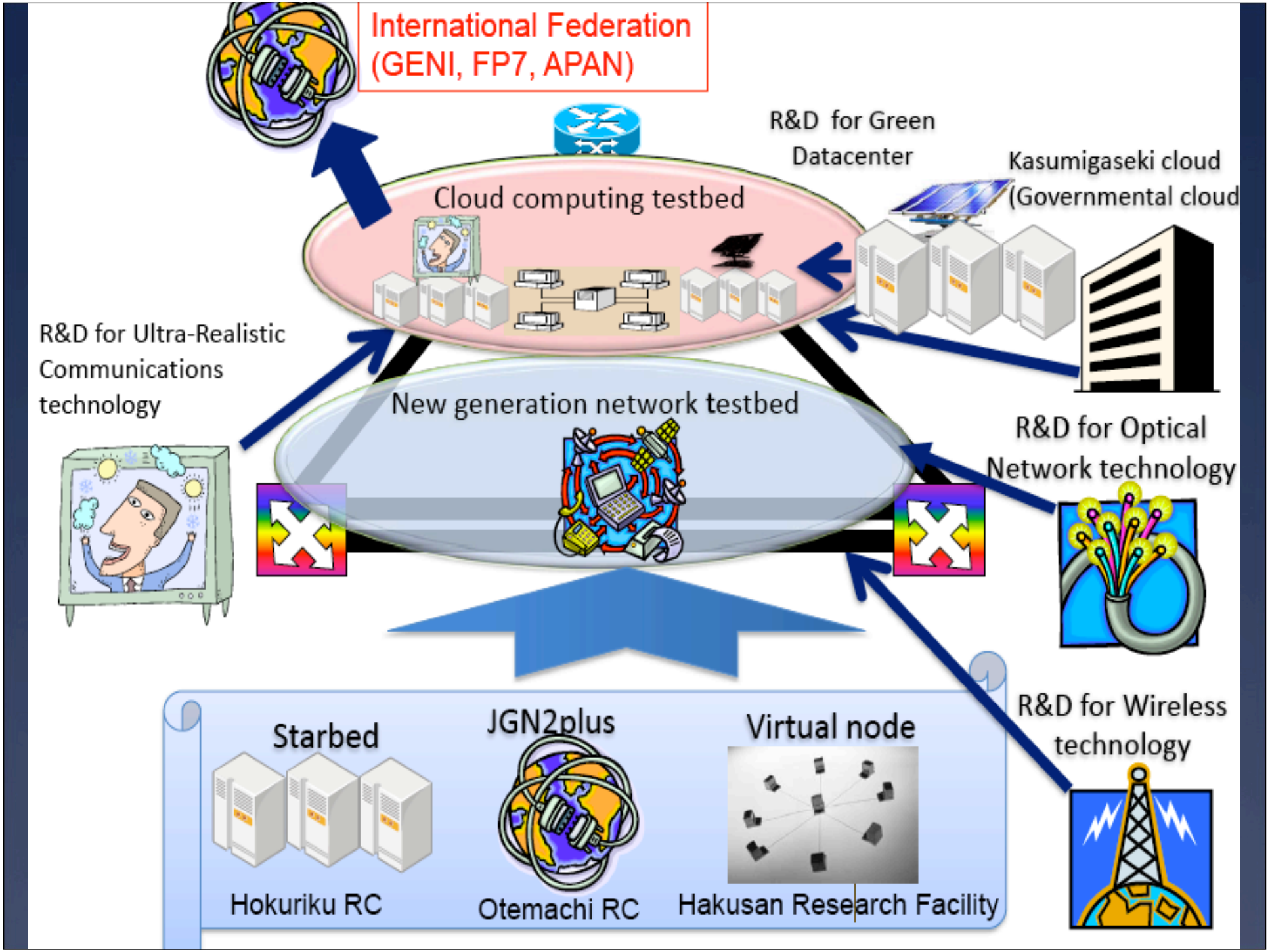
Technologies for Green Cloud Data Center



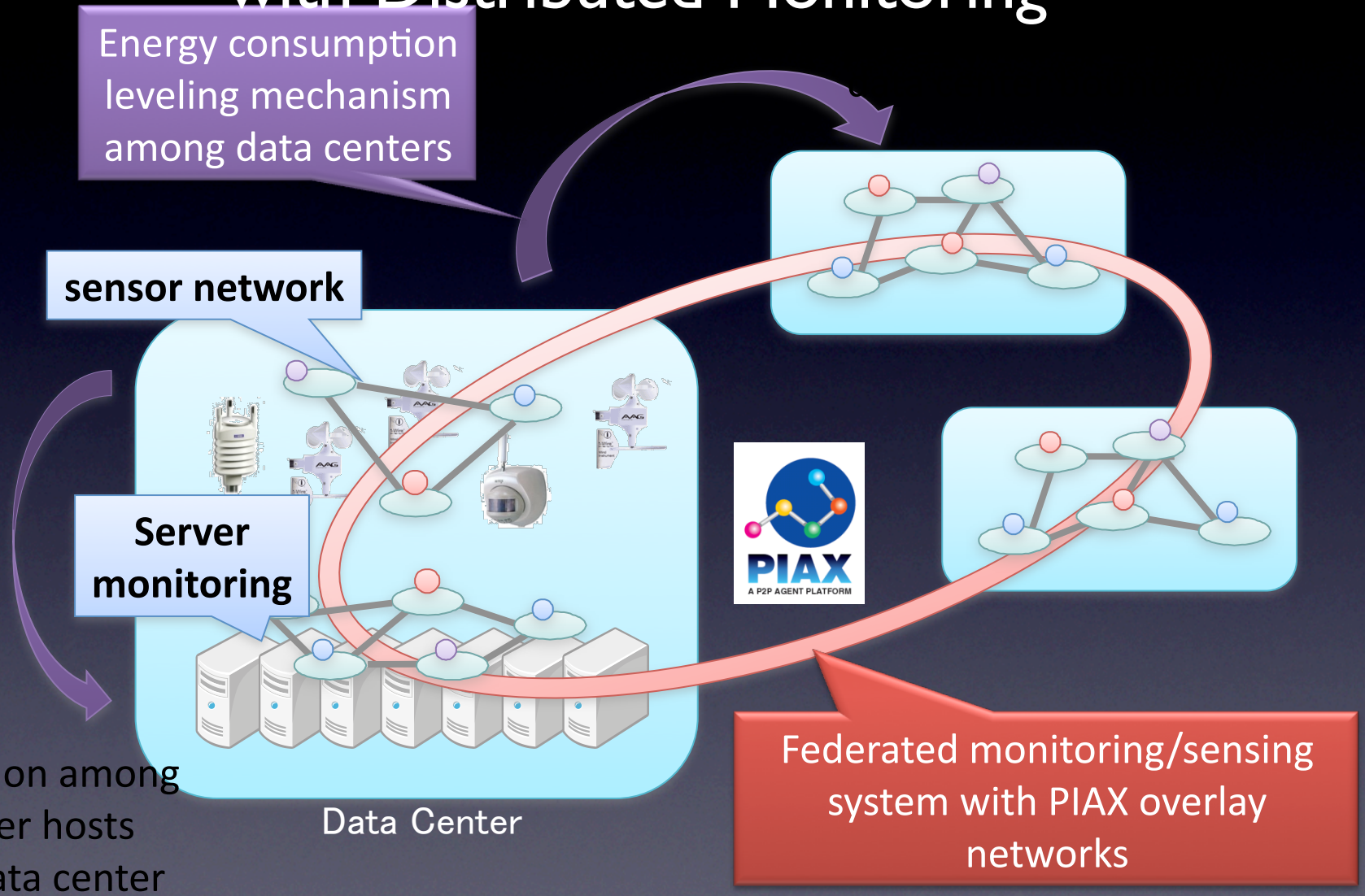
Power Usage Effectiveness (PUE)

$$PUE = \frac{\text{Total facility power}}{\text{ICT equipment power}}$$

Free cooling	Snow mound	Cold outside air	DC distribution system	PUE
O	O	O	O	1.39
O	O	X	O	1.42
X	X	X	X	1.53


International Federation
(GENI, FP7, APAN)
R&D for Green
Datacenter
Kasumigaseki cloud
(Governmental cloud
Cloud computing testbed
R&D for Ultra-Realistic
Communications
technology
New generation network testbed
R&D for Optical
Network technology
R&D for Wireless
technology
Starbed
JGN2plus
Virtual node
Hokuriku RC
Otemachi RC
Hakusan Research Facility

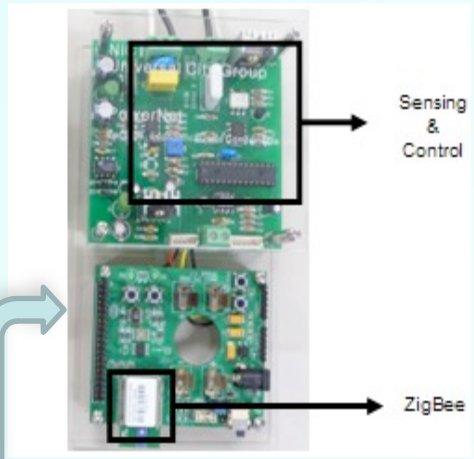
Green Cloud Federation with Distributed Monitoring



Home Energy Management by

A sensor networking module is attached to each electrical appliance and power consumption data are collected.

User life patterns would be estimated and energy management in accordance with the life patterns could make life efficient, economical and safe.



Sensor networking module by NICT
(**Bit-Watt Net Module**)

Efficient energy consumption according to behavior patterns

Home network

The air-conditioner of Study is running with full power for one hour. It will be powered down via network.

I'll set 1000 W for gratin…

Power consumption data collecting server/ database

Surplus electricity will be stored in the battery.

Since the power of micro oven has been up, the others will be powered down via network.

Averaging of power consumption between daytime and night

Electric vehicle

Battery

NiCT
ICT Value Chain

Further research

- Visualization of Energy consumption and effectiveness is a first step.
- Large scale Data gathering and Realtime monitoring
- Federation of these information
- Be smarter