Optical Packet and Circuit Integrated Network (OPCI Net)

National Institute of Information and Communications Technology (NICT), Japan

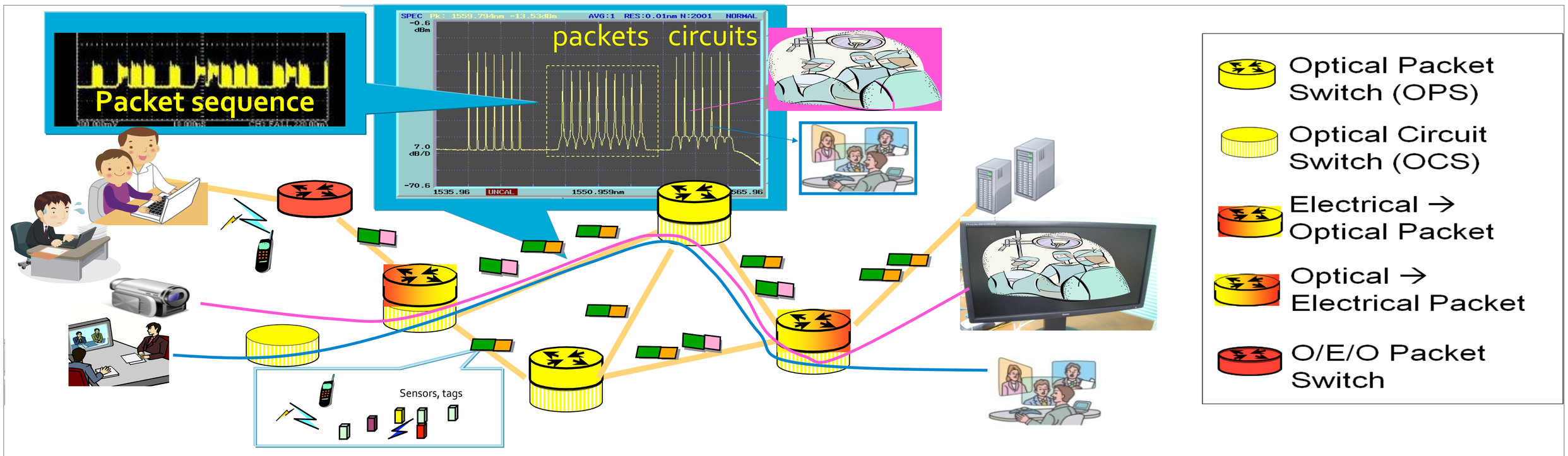


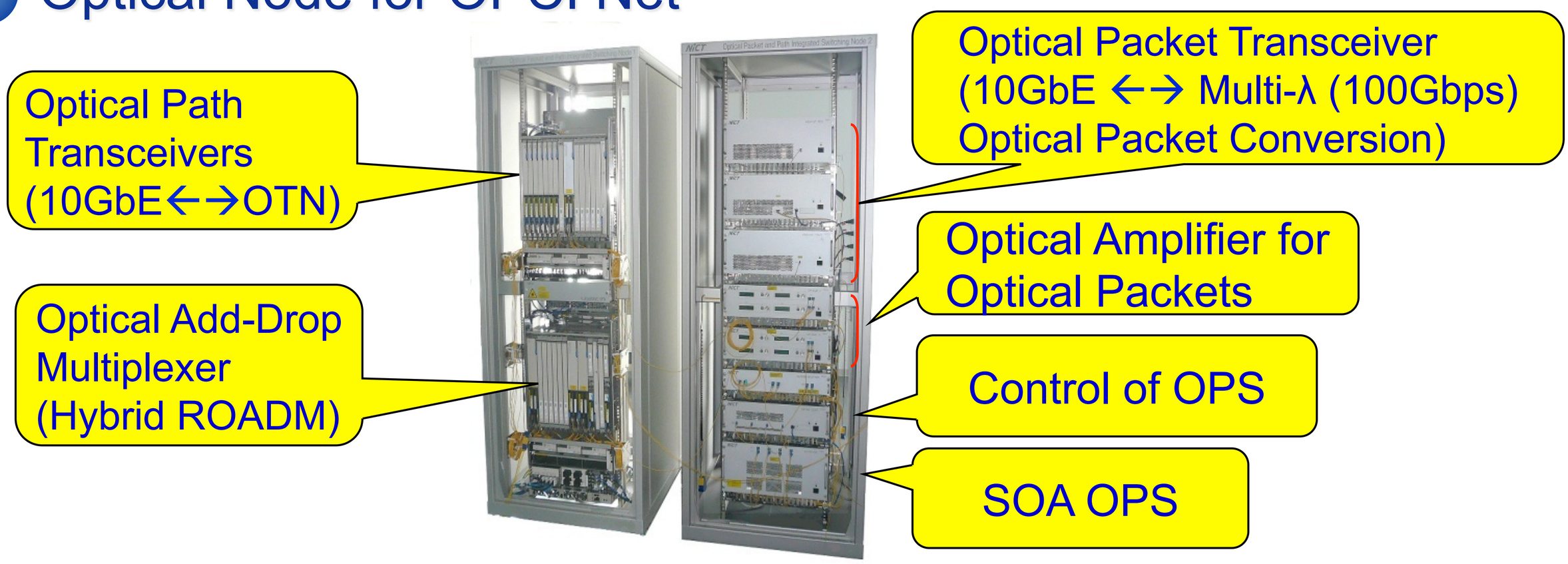
Fig. An image of optical packet and circuit integrated network (OPCI Net)

Characteristics of OPCI Net

1. Both packet- and circuit-switching on the same fiber network infrastructure
   → Providing diverse services
2. Dynamic wavelength-resource allocation to OPS & OCS
   → Autonomous distributed resource allocation
3. Path control messages are transferred by means of optical packets
   → Unified control interface for OPS & OCS
4. Advanced optical switching technologies → Contribution to higher energy efficiency

Cf. H. Harai, *IEICE Transactions on Commun.*, vol. E95-B, no.3, pp.714-722, Mar. 2012.
H. Furukawa, et al., *Optics Express*, vol.19, iss.26, pp.B242-B250, Dec. 2011.
T. Miyazawa, et al., *IEEE/OSA JOCN*, vol.4, no.1, pp.25-37, Jan. 2012.

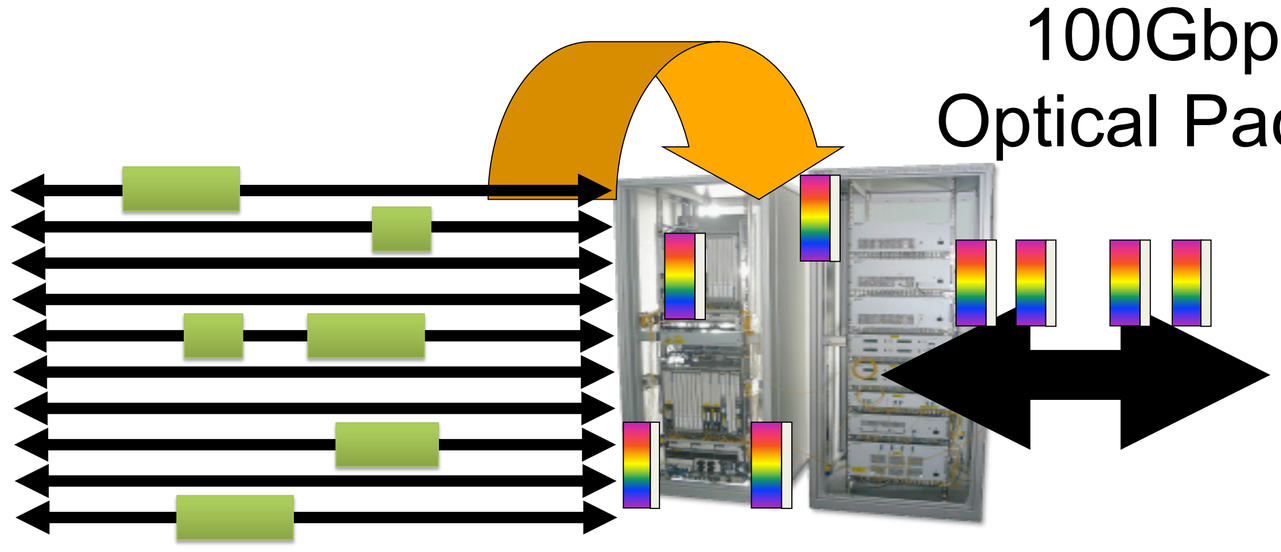
Optical Node for OPCI Net



Stable simultaneous transfer of both optical packets and optical path signals

Contact: Takaya Miyazawa
E-mail: takaya@nict.go.jp

Multi-ports 10GbE ←→ 100Gbps Optical Packet conversion

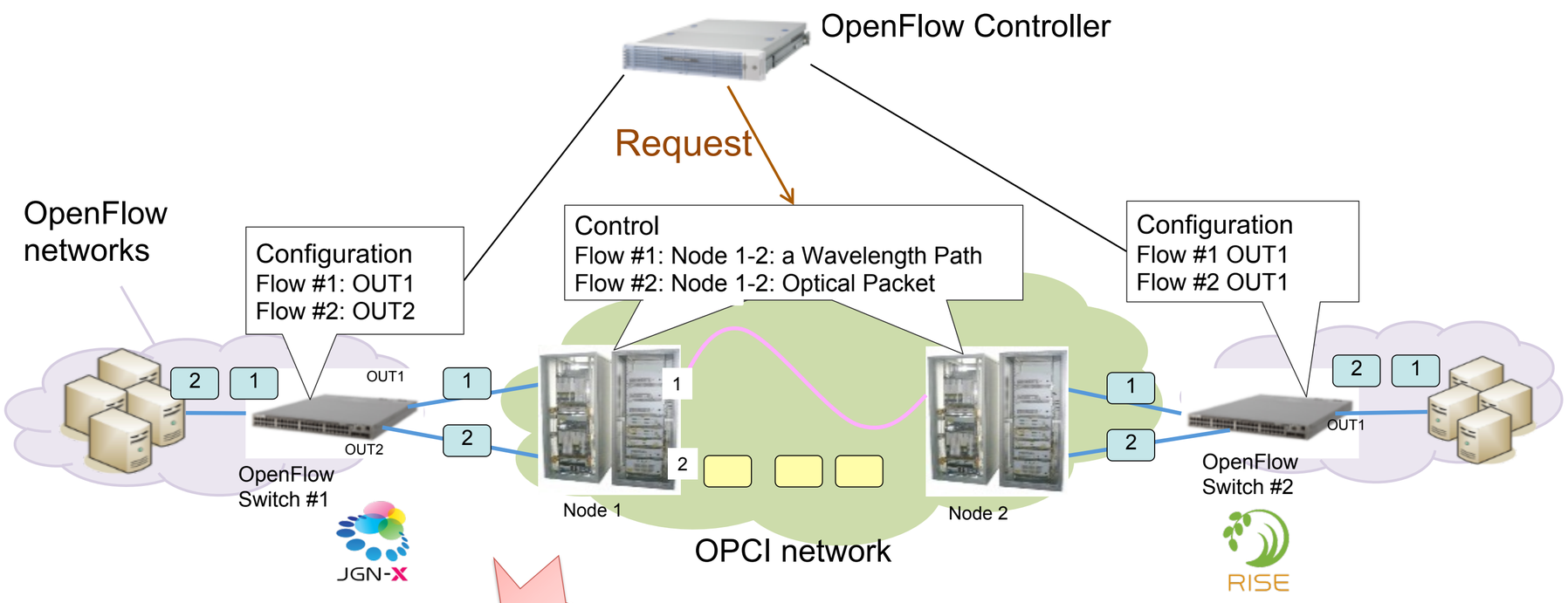


Client Ports	10Gbps Ethernet × 10 ports
Network Port	100Gbps Optical Packet
IP	IPv4, IPv6
ARP	ARP, ND (solicitation/ advertisement)
MAC Table	64 (deleted after 10-minutes aging)
ICMP	Echo request/reply support, ICMP/ICMPv6
VLAN	Available (VLAN-Tag Rewriting support)

Demonstrations and Development for SDN

OpenFlow Corroboration Demonstrations on JGN-X (RISE)

- Flow mapping between flow entries and OPS/OCS controls



- Results

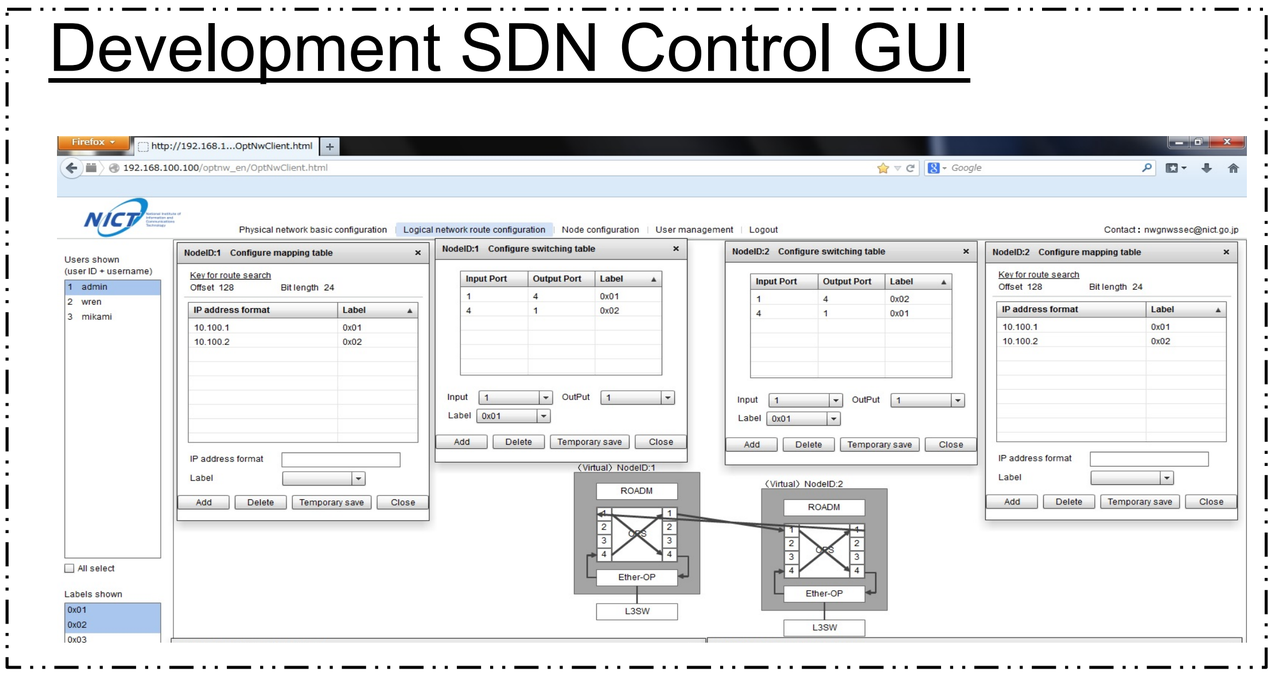
No.	Time	Source	Destination	Protocol	Info	
1	0.000000	172.18.0.1	172.18.0.2	ICMP	Echo (ping) request	26.3 ms
2	0.026304	172.18.0.2	172.18.0.1	ICMP	Echo (ping) reply	
3	1.000465	172.18.0.1	172.18.0.2	ICMP	Echo (ping) request	1.9 ms
4	1.002329	172.18.0.2	172.18.0.1	ICMP	Echo (ping) reply	
5	2.001429	172.18.0.1	172.18.0.2	ICMP	Echo (ping) request	1.9 ms
6	2.003361	172.18.0.2	172.18.0.1	ICMP	Echo (ping) reply	
7	3.001393	172.18.0.1	172.18.0.2	ICMP	Echo (ping) request	1.9 ms
8	3.003269	172.18.0.2	172.18.0.1	ICMP	Echo (ping) reply	

Path Route

No.	Time	Source	Destination	Protocol	Info	
1	0.000000	172.19.0.1	172.19.0.2	ICMP	Echo (ping) request	33.5 ms
2	0.033468	172.19.0.2	172.19.0.1	ICMP	Echo (ping) reply	
3	1.000100	172.19.0.1	172.19.0.2	ICMP	Echo (ping) request	1.8 ms
4	1.001875	172.19.0.2	172.19.0.1	ICMP	Echo (ping) reply	
5	2.001058	172.19.0.1	172.19.0.2	ICMP	Echo (ping) request	1.7 ms
6	2.002781	172.19.0.2	172.19.0.1	ICMP	Echo (ping) reply	
7	3.002025	172.19.0.1	172.19.0.2	ICMP	Echo (ping) request	1.8 ms
8	3.003815	172.19.0.2	172.19.0.1	ICMP	Echo (ping) reply	

Packet Route

Development SDN Control GUI



Future Challenges

- Practical trials on network testbed
- Development for stable operation on JGN-X
  - Improvement stability of management and optical transport systems
  - Establishment the guideline for operators

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