*I*P+Optical network architecture for low cost and highly efficient network

NTT

Current Issues

Large capacity IP network

Various service networks
- *Wide-area LAN service*
- *ISP service*
- *IP-VPN service*
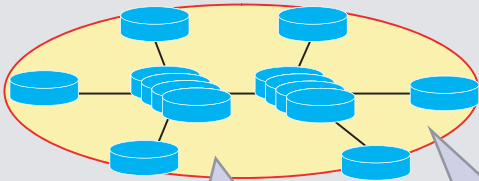
Issue 1
Fixed layer 1 network topology
(Inefficient resource usage)
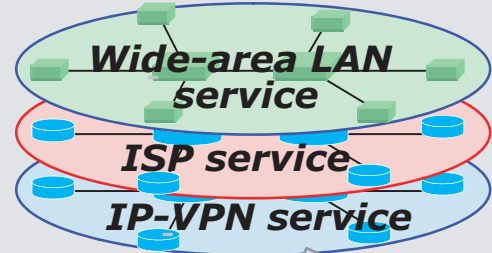
Issue 2
High cost for reliable network
(Many redundant resources)

Issue 3
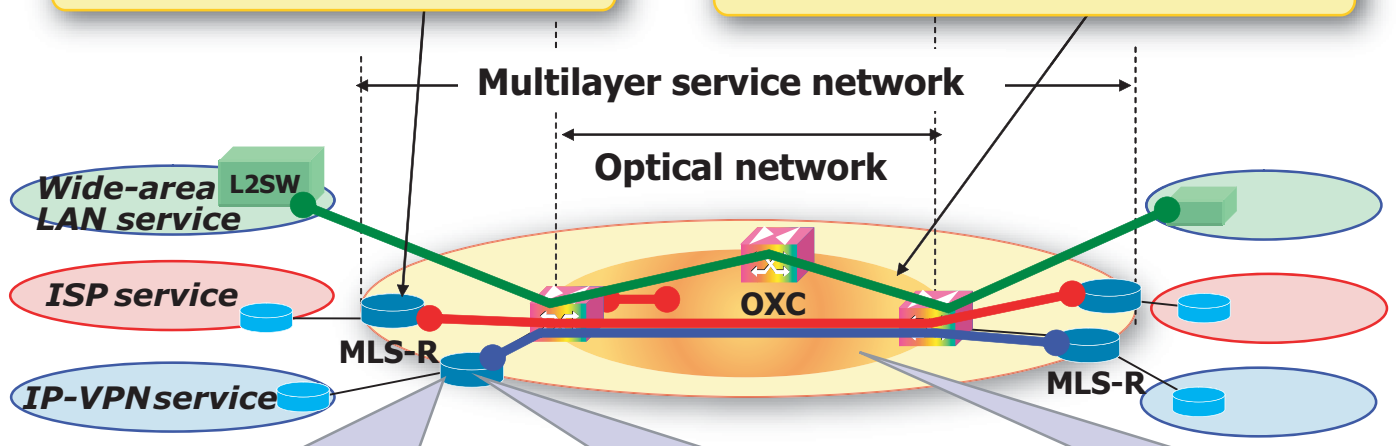**Separate networks**
(Expensive CAPEX and OPEX)

Our solution - Multilayer service network

Multilayer coordination
- •Efficient resource usage with high reliability

L1VPN
- •Independent operation over shared infrastructure

Multilayer service network

Optical network

Wide-area LAN service — L2SW

ISP service

IP-VPN service

MLS-R

OXC

MLS-R

Multilayer pass-through
Dynamic resource allocation for burst traffic (Issue 1)

Multilayer recovery
Recovery considering service network topology (Issue 2)

L1VPN
Flexible layer 1 network provisioning (Issue 3)

OXC | Multilayer service router (MLS-R) | IP router | L2SW Layer 2 switch | Optical path

# *M*ultilayer service network technology and deployment

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Technology

Multilayer pass-through
- **Automatic path creation based on burst traffic**
- **Traffic switch-over using multilayer path control**

L1VPN
- **Resource management**
- **VPN topology view**
- **Fast provisioning**
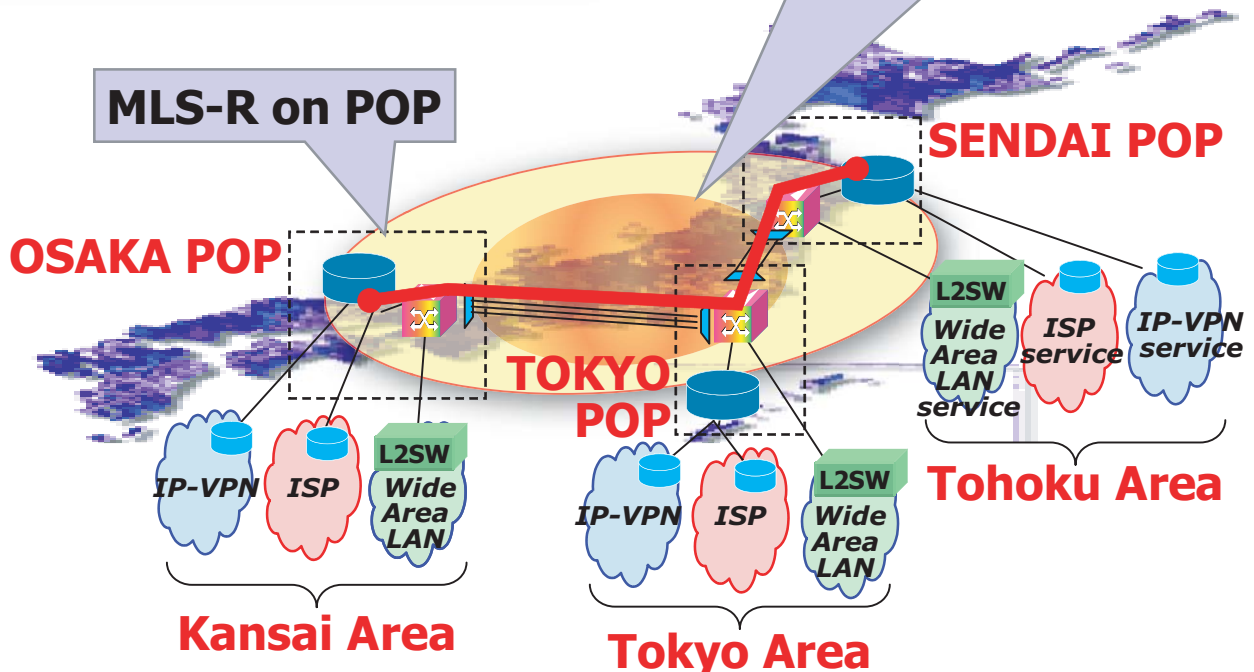- **Resource sharing for various multilayer coordination features**

IP-VPN

IP-VPN

IP-VPN

IP-VPN
Service network

ISP

ISP service network

Shared spare resources
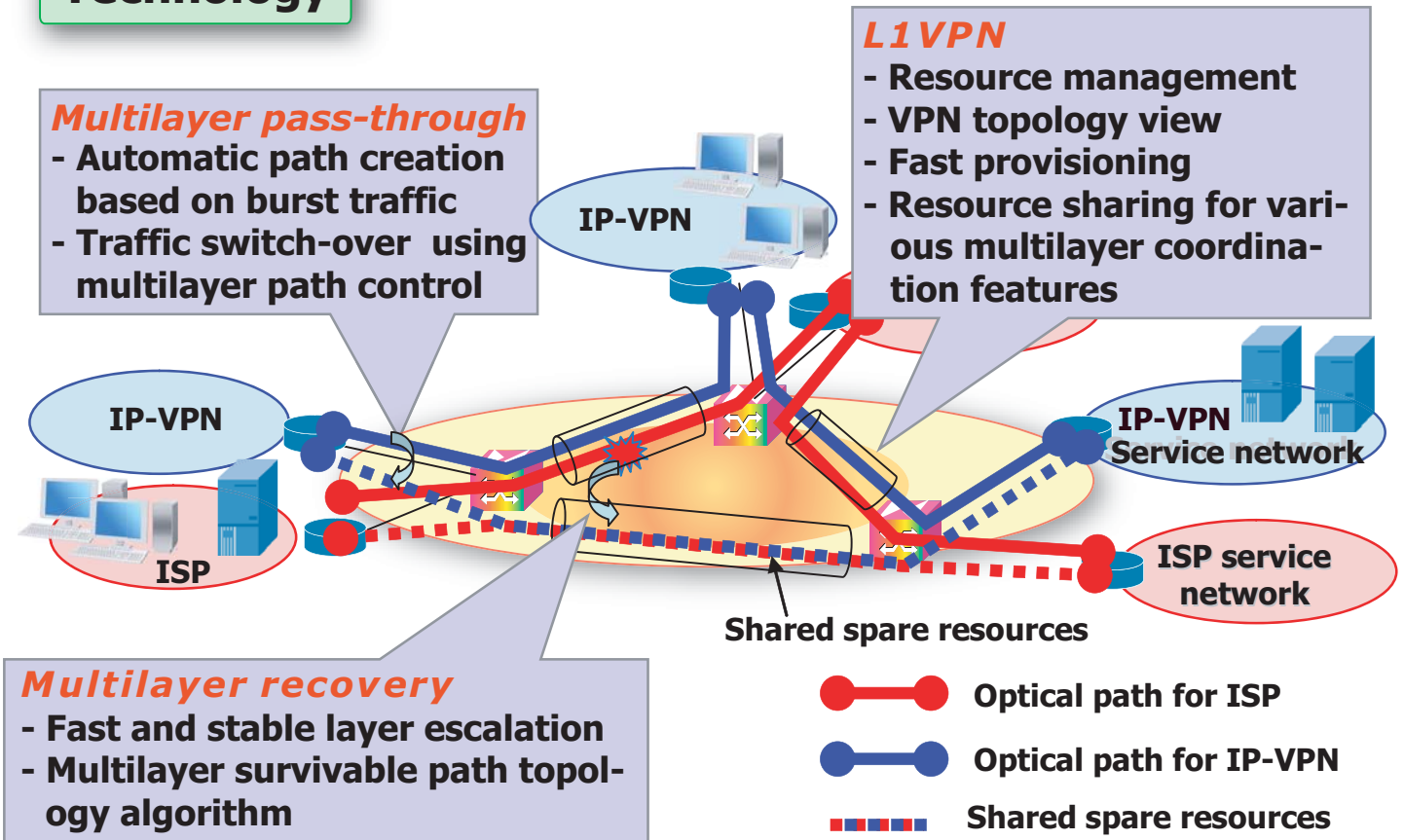
Multilayer recovery
- **Fast and stable layer escalation**
- **Multilayer survivable path topology algorithm**

Optical path for ISP

Optical path for IP-VPN

Shared spare resources

Deployment example

L1VPN for inter-prefecture

MLS-R on POP

SENDAI POP

OSAKA POP

TOKYO POP

L2SW
Wide Area LAN service

ISP service

IP-VPN service

Tohoku Area

IP-VPN

ISP

L2SW
Wide Area LAN

IP-VPN

ISP

L2SW
Wide Area LAN

Kansai Area

Tokyo Area

Demo Network Topology

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Multilayer coordination

Multilayer service network

Service NW

Background traffic

Service NW

Background traffic

PCS

MLS-R

MLS-R

MLS-R

Service NW

Viewer

Service NW

Camera
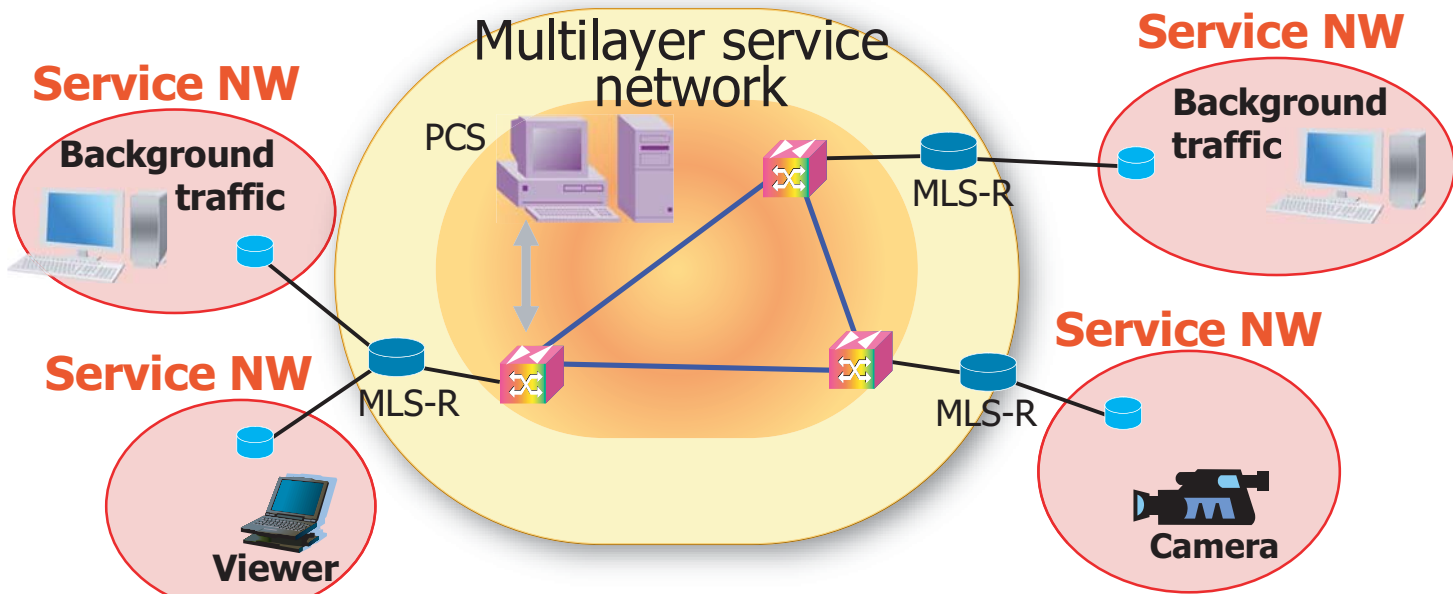
PCS: Path Computation Server

L1VPN

L1NW Operator

L1VPN server

VPN#1 Operator

Camera

VPN#1 (L2NW)

VPN#2 (L3NW)

VPN#2 Operator

VPN#3 (L3NW)

VPN#3 Operator

GMPLS L1NW

Viewer

VPN#1 L2SW

VPN#2 Router

VPN#3 Router

OXC

D/C/M-Plane

M-Plane only