Traffic driven dynamic optical path allocation and IP route rearrange system

(with multi-layer network configuration mechanism)

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acknowledgement

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Contents

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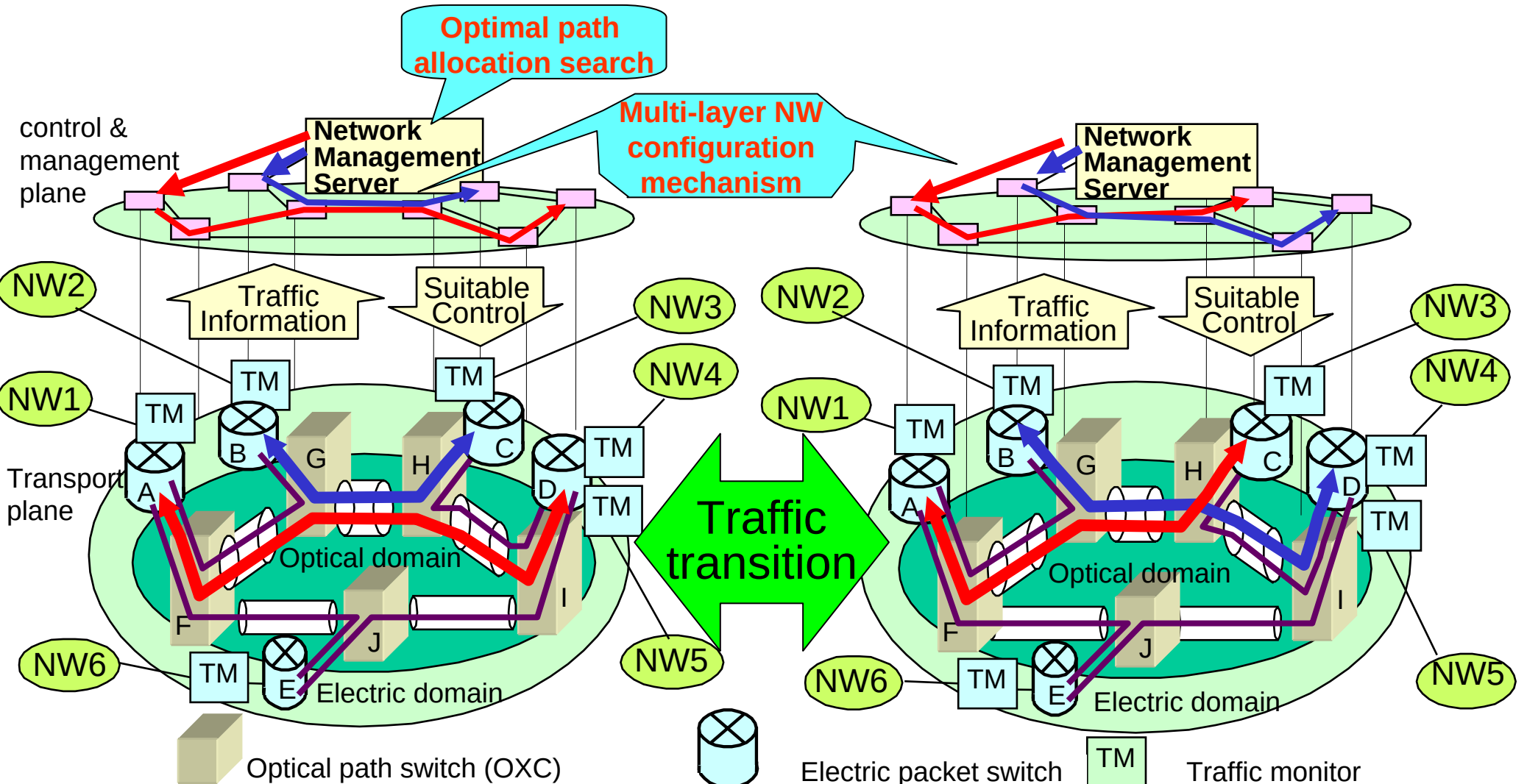
1:Target System

When the traffic between NW1&NW4, NW2&NW3 are heavy

When the traffic between NW1&NW3, NW2&NW4 are heavy



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Objectives

- Maximization of throughput in administrative domain network

How to?

- Dynamic rearrangement of optical path and packet forwarding route

Technology

- Traffic monitor
- Optimal path allocation and packet forwarding route search
- Multi-layer network configuration mechanism (Today's presentation)

2:Issues

Information un-matching between IP layer and Optical (Lambda Switch Capable) layer

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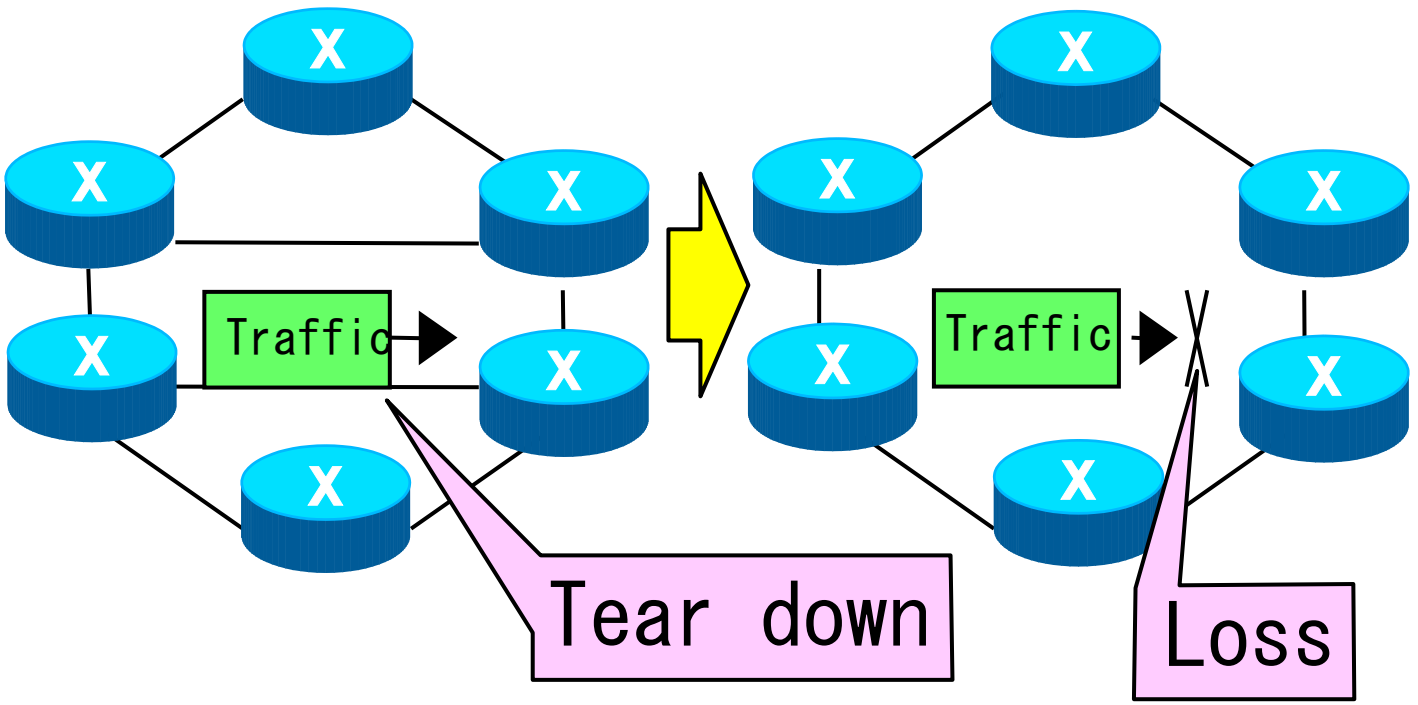
ISSUE-1

Packet loss from a tear down optical path



2:Issues

Information un-matching between IP layer and Optical (Lambda Switch Capable) layer

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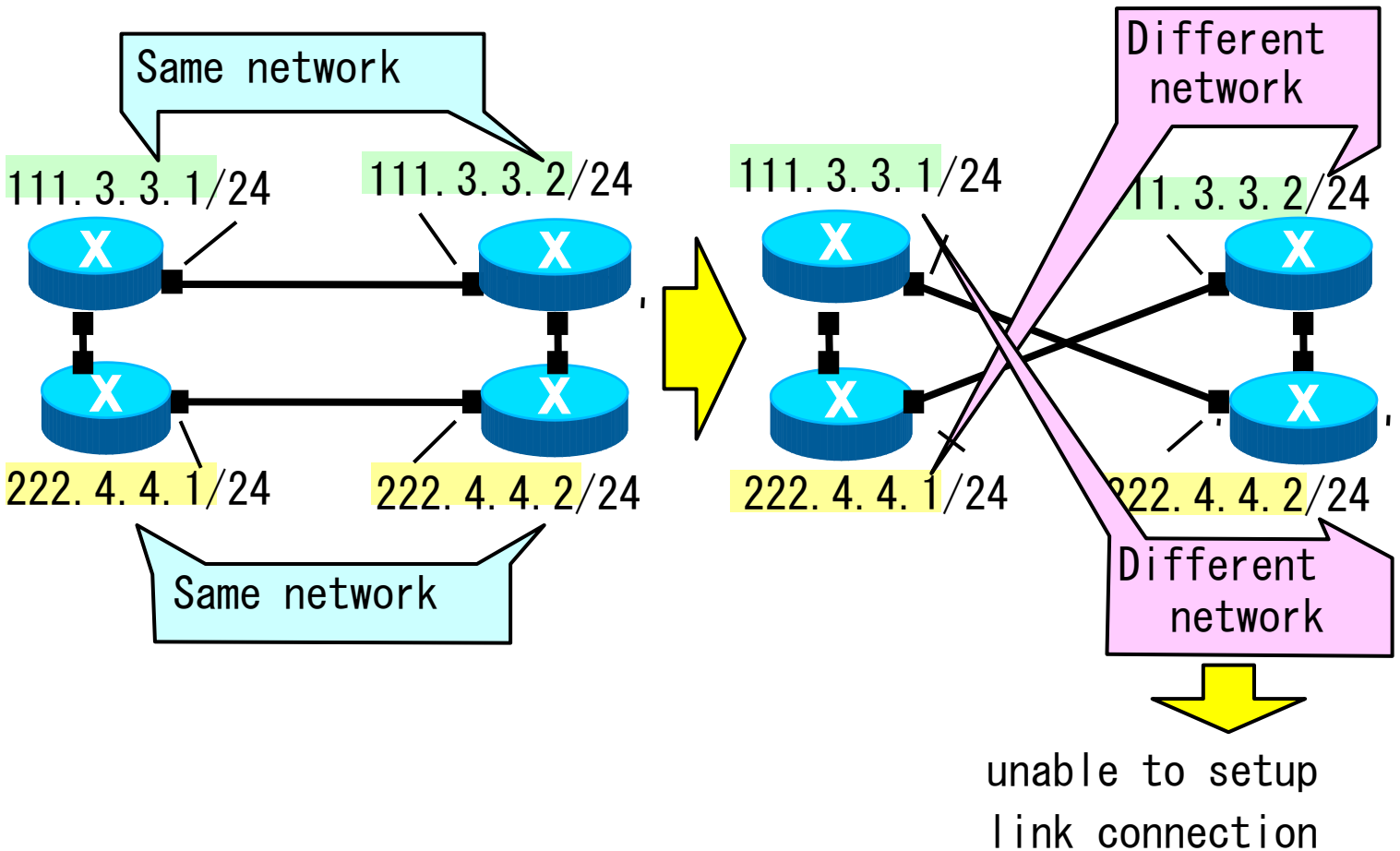
ISSUE-2

Network address un-matching at the faced interfaces



2:Issues

Information un-matching between IP layer and Optical (Lambda Switch Capable) layer

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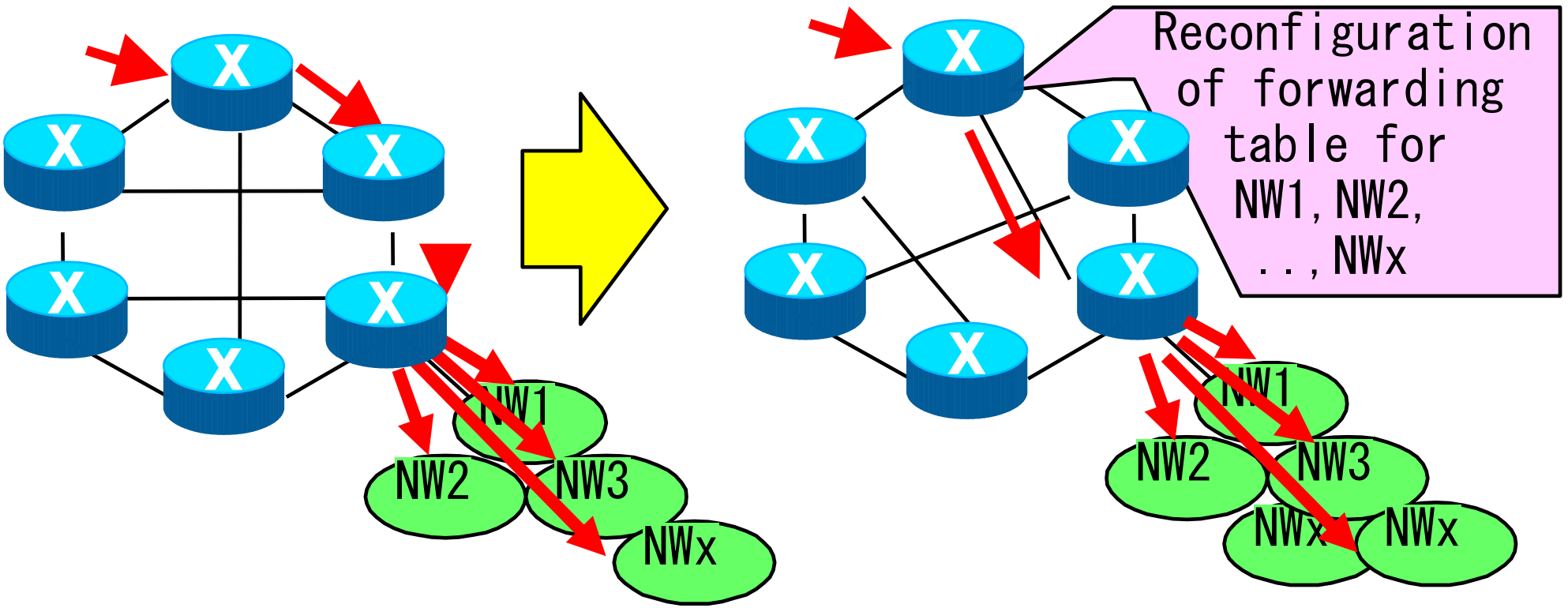
ISSUE-3

Time to re-configure packet forwarding data table



3:Proposal

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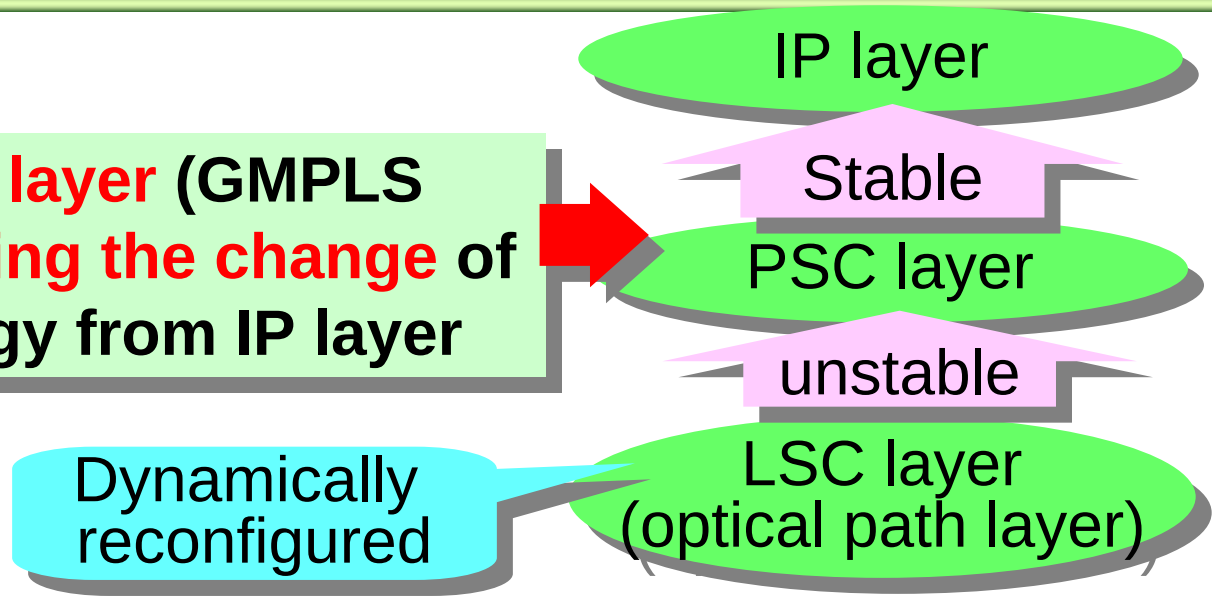
Basic Concept

Inter-working using a thin layer (GMPLS PSC-layer) which concealing the change of optical (LSC) layer topology from IP layer



(1) Against packet loss → **Traffic refuge from tear-down paths**

(2) Against network address un-matching → **Logical full-mesh permanent connection given by packet path (PSC-LSP)**

(3) Against the time to re-configure the nodes → **Aggregation of destination of route into packet paths(PSC paths)**

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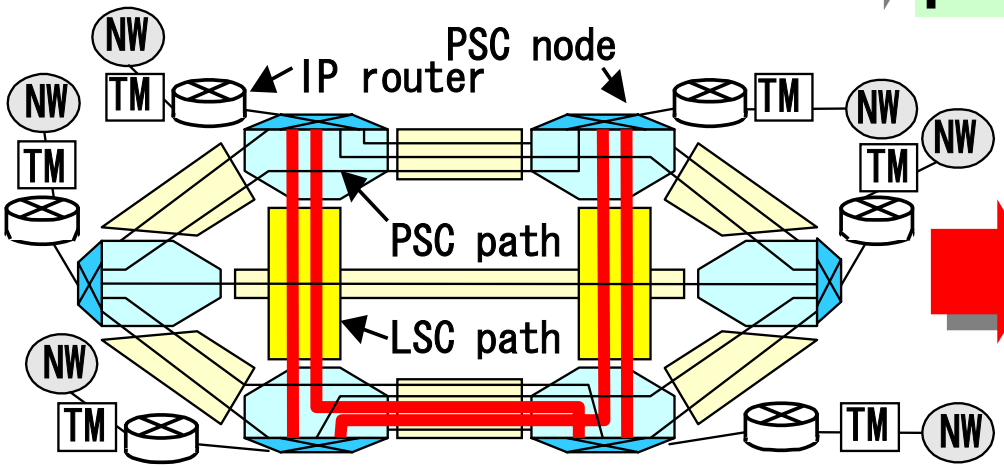
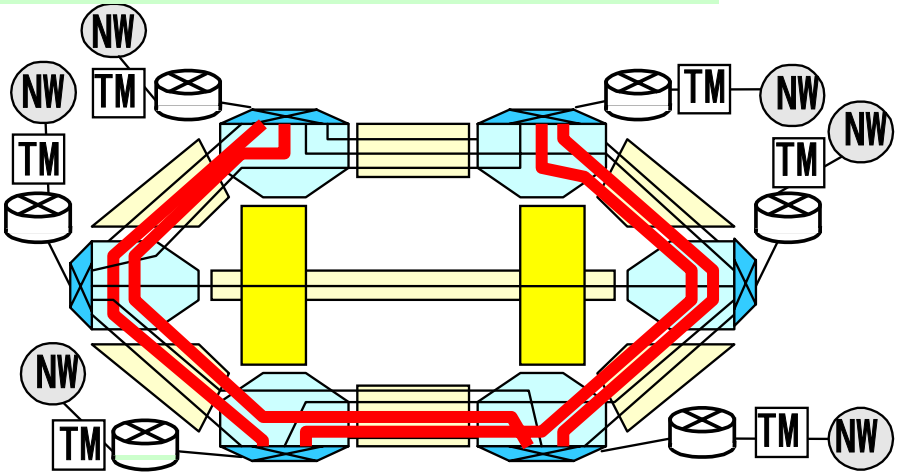
(1) Against packet loss

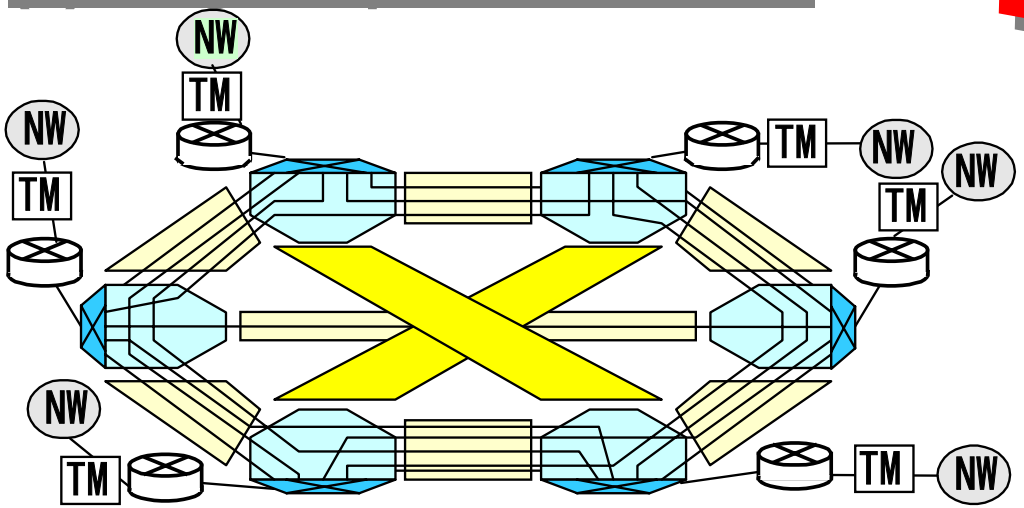
Traffic refuge from tear-down paths using PSC-LSP



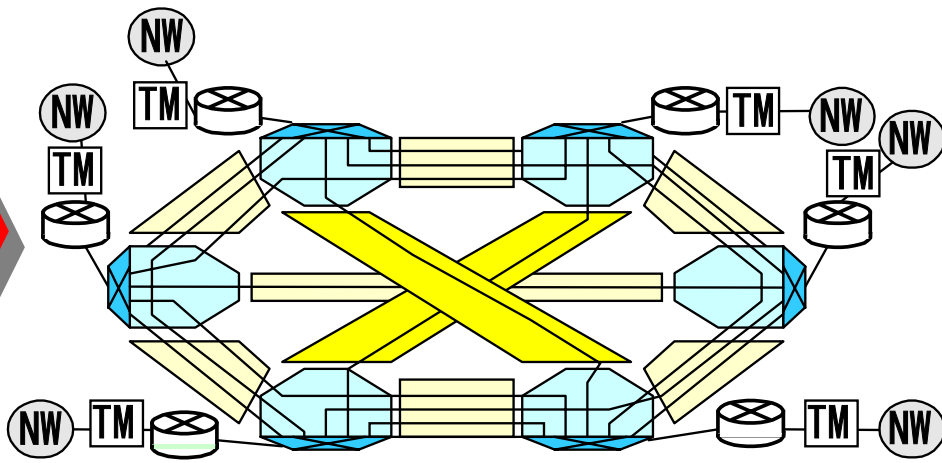
(1) Original path allocation



(2) Traffic refuge from tear-down paths



(3) Optical(LSC) path rearrange



(4) Packet forwarding route optimization

(2) Against address un-matching problem

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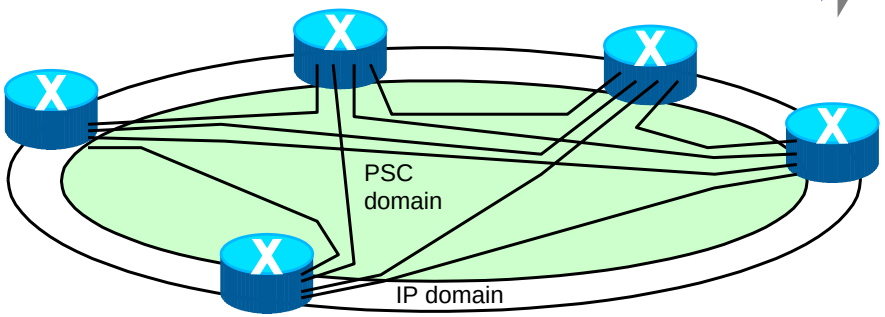
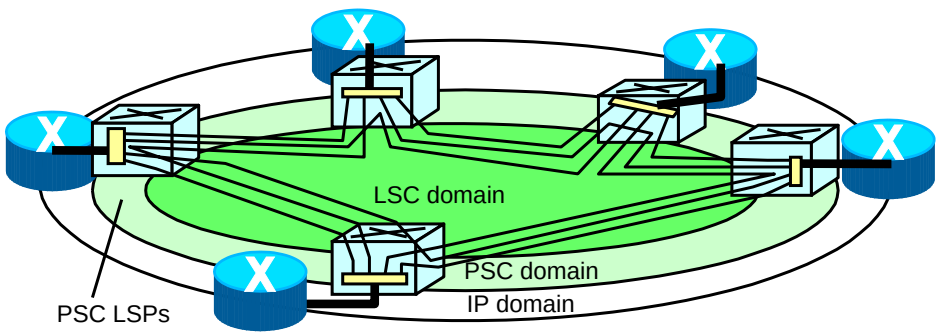
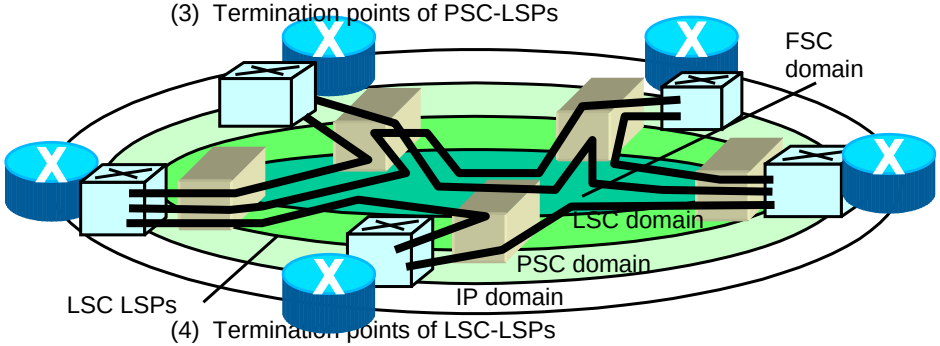
Logical full mesh connection between all IP interfaces by PSC paths



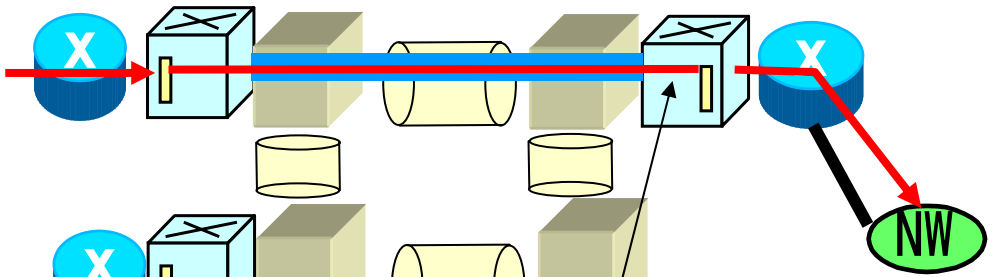
(2) Logical adgacent nodes in IP domain



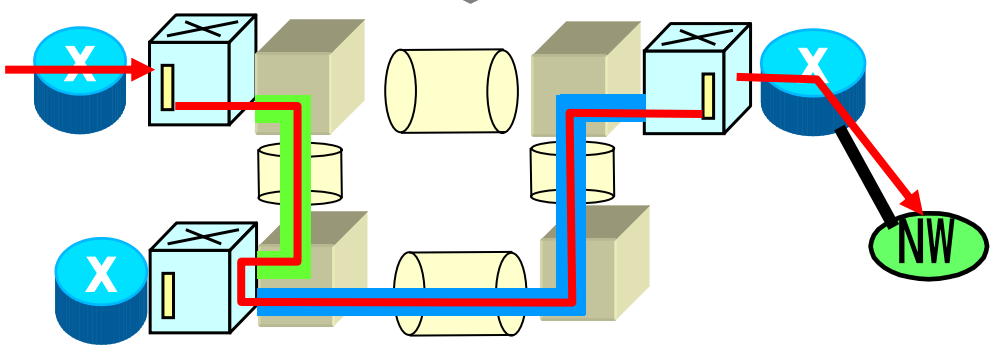
(3) Termination points of PSC-LSPs



(4) Termination points of LSC-LSPs



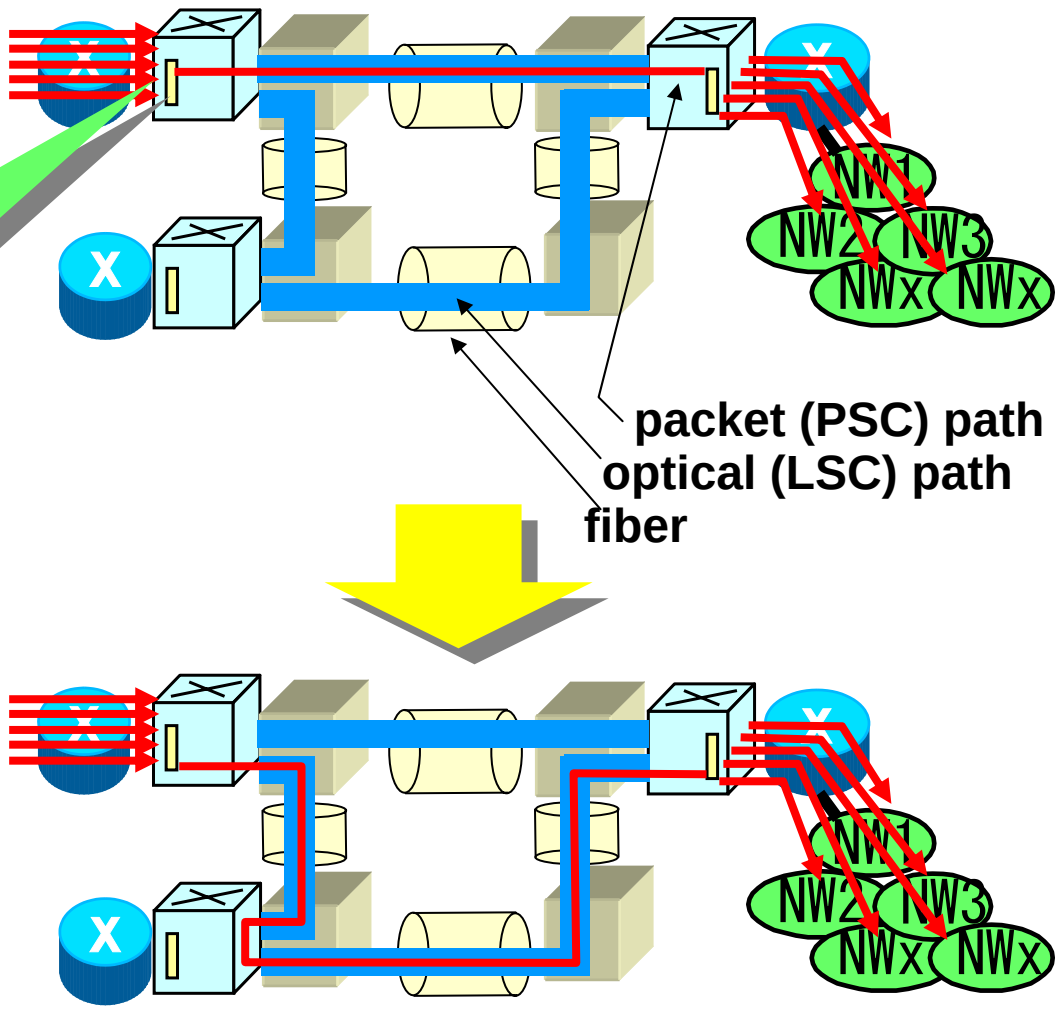
packet (PSC) path
optical (LSC) path
fiber



(3) Against the time to re-configure the nodes

Aggregation of the packets that has the same destination address into packet paths(PSC paths)

Traffic aggregation



4:Implementation

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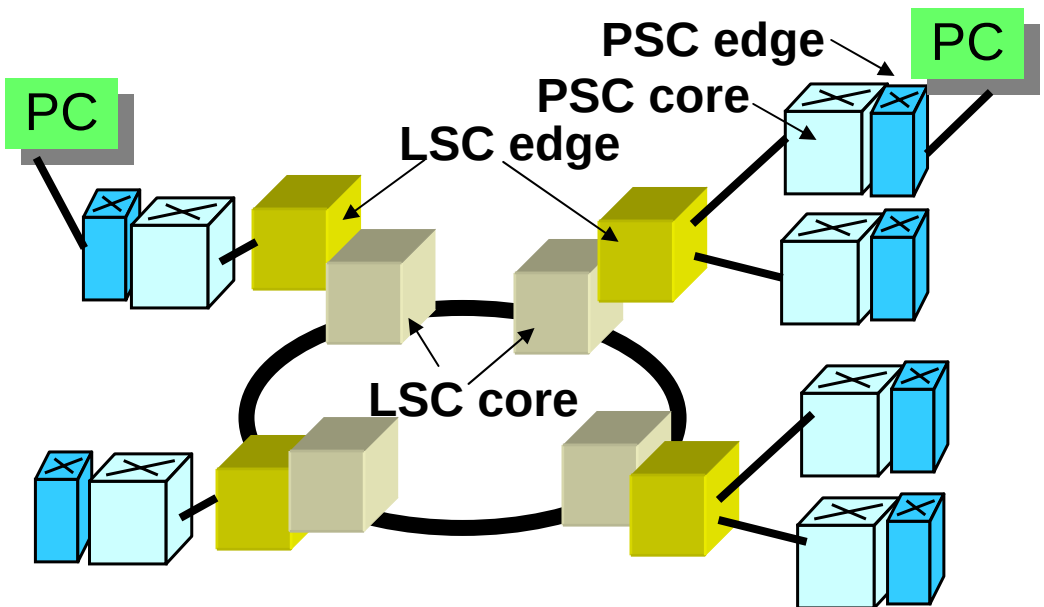
GMPLS PSC node

Platform	AT-PC Computer
OS	Open Source OS
CPU	2.4GHz for Server PC
PSC-Edge-node	6
Interfaces	Gigabit Ethernet
Num.of Ifs	Ex side1/In side1
PSC-Core-node	6
Interfaces	Gigabit Ethernet
Num.of Ifs	6

GMPLS LSC node

Node type	Optical ADM
Number of wavelengths	32
Channel spacing	50GHz
O/E,E/O converter	622M~10GHz
LSC-Edge-node	4
Num.of Ifs	Ex side 2 In side 2
LSC-Core-node	4
Num.of Ifs	Add/drop 2 core in/out1/1



5:Experiment

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GMPLS PSC node

Traffic refuge from tear-down optical (LSC) path < 0.6sec
(4 new packet (PSC) paths allocation,
NHLFE data change on 2 nodes and
4 old packet path tear down.

Optical path rearrange < 8 sec
(4 old paths tear down & 4new paths allocation)

Traffic re-assignment on new optical path allocation <0.6sec
(4 new packet (PSC) paths allocation,
NHLFE data change on 2 nodes and
4 old packet path tear down)

Ping check with 0.1sec interval 0 packet loss

Previous study: 10sec.
(We used telnet command and reconfigure IP router settings for 4 IP destination.

If the number of destination IP ddress are increased, (ex. 100,000) required time is not increased)

6:Conclusion

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(1) We described Traffic driven dynamic optical path rearrange system

(2) We proposed solutions for information data miss-matching problems.
I.e ①Packet loss from tear down optical paths
②IP network address miss-matching when optical paths are rearranged.
③Time to reconfiguring of packet forwarding route tables.
The solution using a shin layer (GMPLS PSC) to conceal optical layer topology transition from IP layer.

(3) We implemented GMPLS PSC and LSC system, and we evaluated the basic functions to resolve the problems.