

What is specific in the routing and wavelength assignment problem ?



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What is specific to optical network in routing problems?

- Limitation of device capability and quality degradation
 - Wavelength conversion function (limited number)
 - Wavelength dispersion degradation for transmission, PMD degradation, Signal regeneration (limited distance)
- Quick response
 - For high-speed interactive video stream support < 10msec delay
 - Device Switching speed for Burst Switching < 10 us (1/1000)

What is specific to optical network in routing problems? (contd)

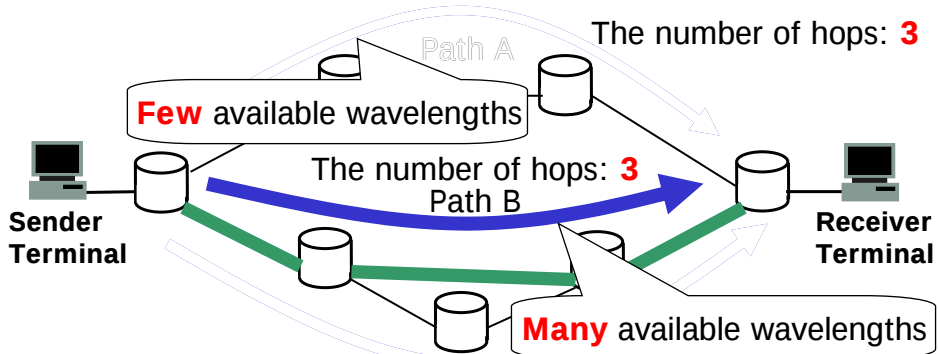
- Congestion
 - Buffer congestion
 - Available Wavelengths
- Account for Both Quality and Reliability
- Network Visibility
 - Difficult to monitor and get information

Distributed Minimum Hop Tree

Apply Dijkstra's algorithm on the basis of cost C

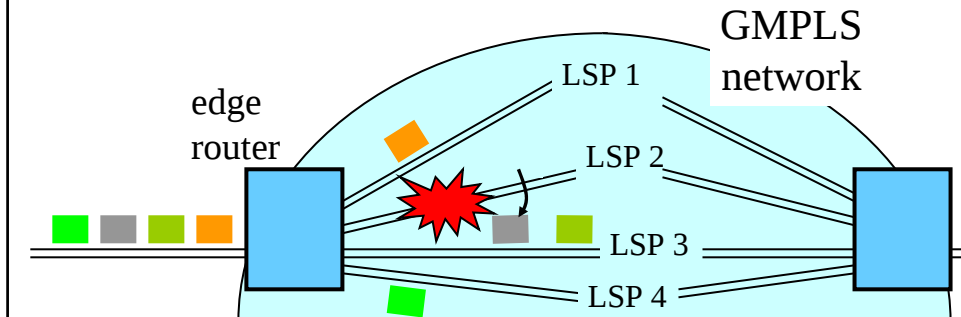
$$C = \text{Hop cost } C_h + \text{Wavelength cost } C_w + \text{Link length cost } C_l$$

$[C_h \quad C_w \quad C_l]$



Dynamic Routing using alternate paths

- Flow allocation to LSPs with fault tolerance
 - Allocating flows based on a reliable metric
- Flexible recovery using only Working LSPs
 - Rerouting to vacancy in LSP



Flow Allocation to LSPs

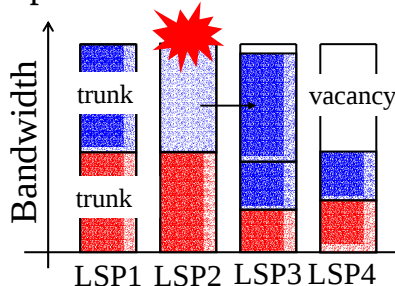
- Load distribution maximizing “Recovery Bandwidth(R)”

$$R = \sum_{i \in G} r(i) \quad r(i) : \text{recoverable bandwidth given LSP\#}i \text{ failure}$$

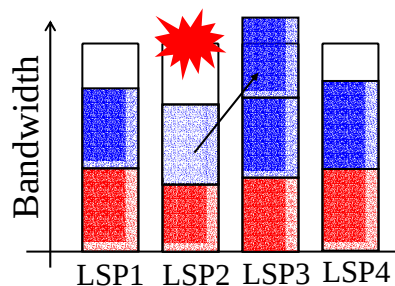
G : LSPs between a pair of edge routers

(Effectiveness)

Proposal allocation

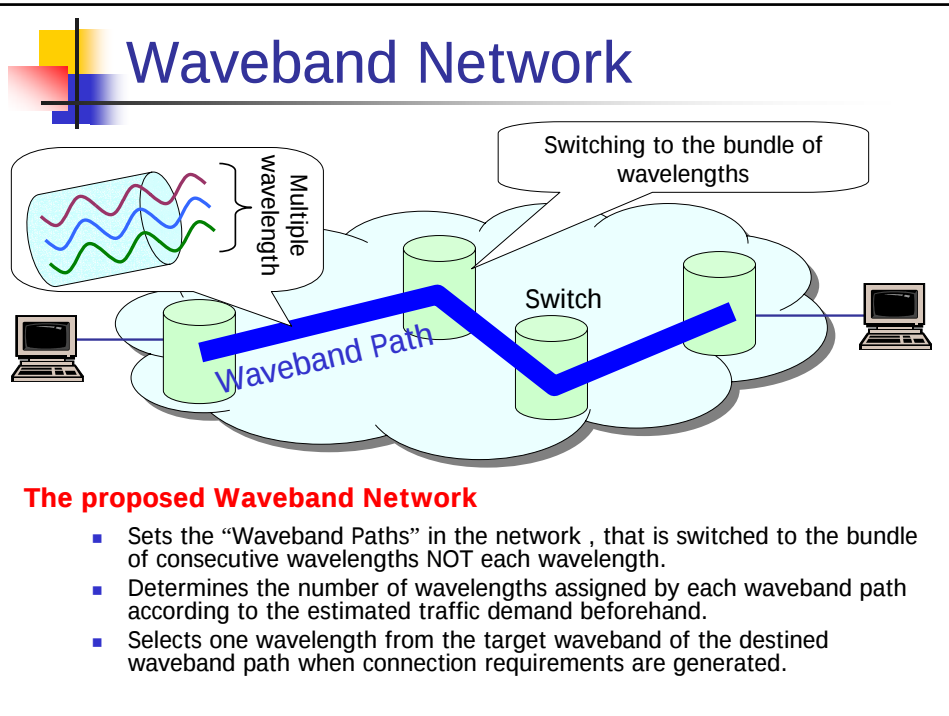
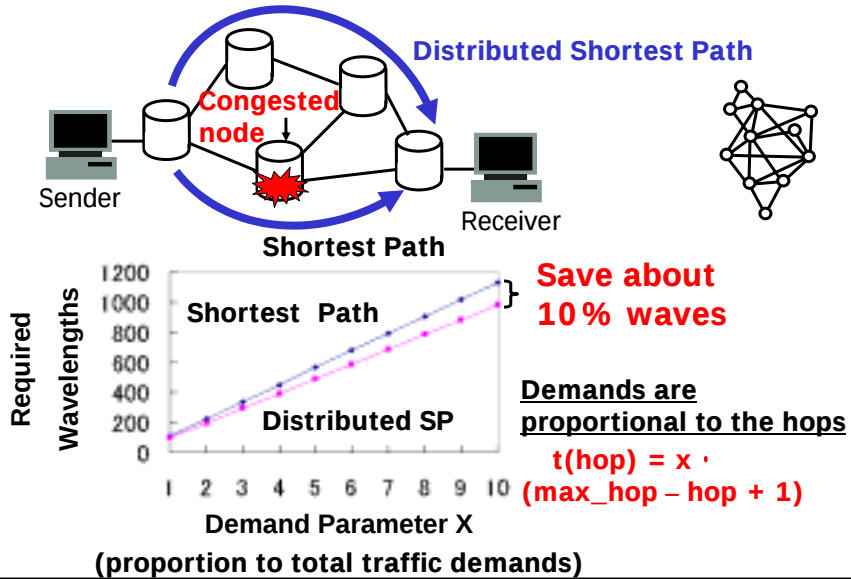


Random allocation



Allocation preparing recovery by a trunk

Comparison of Route Design Algorithm



Design Policy of New Wavelength Assignment Method

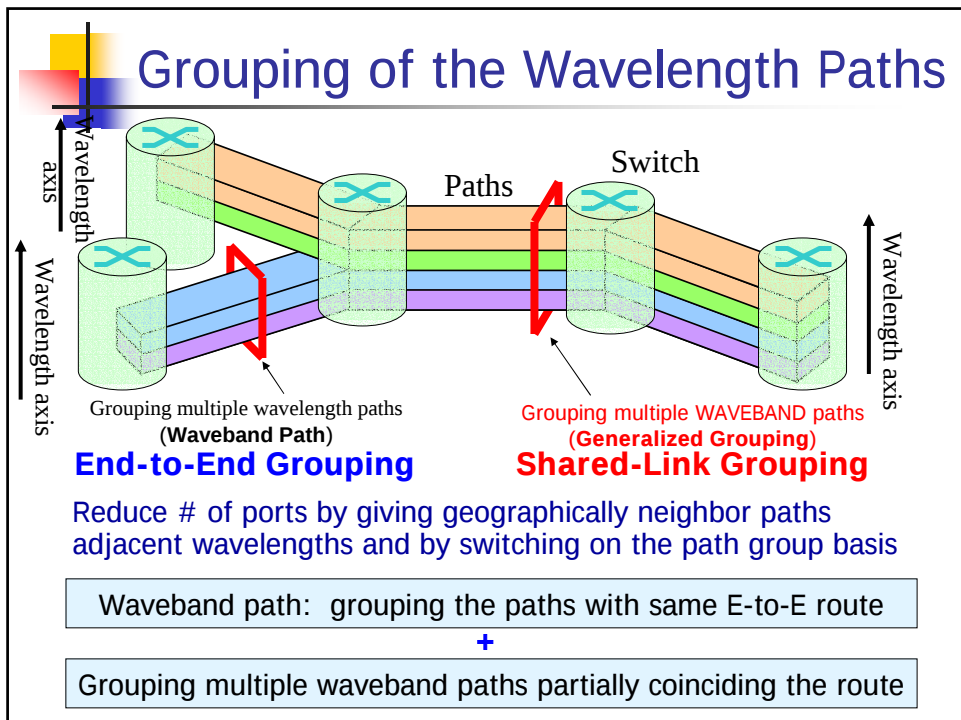
- Conventional Wavelength Assignment Method
 - Minimizes required number of Wavelengths [Objective Function]
 - Regards each wavelength as independent resource.
 - does not consider path aggregation on the wavelength axis.
 - Just satisfies the constraint of wavelength disjoint between paths with partially same route.



- Proposal of new wavelength assignment method

Metrics of objective function (Trade-off relationship)

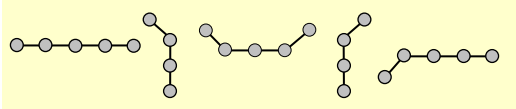
- Reduce the required number of wavelengths.
- Reduce the number of ports by the path grouping.





Outline of the Proposed Algorithm

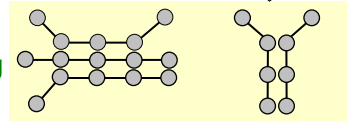
Paths in the network



1. Create the Grouping Candidate Sets

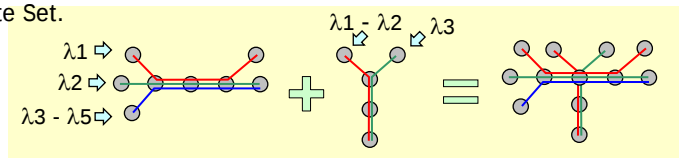
Find the path set whose elements have partially same route.

Clustering



2. Wavelength Assignment to paths in each Candidate Set

Assign consecutive waves to the paths in each Candidate Set.



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