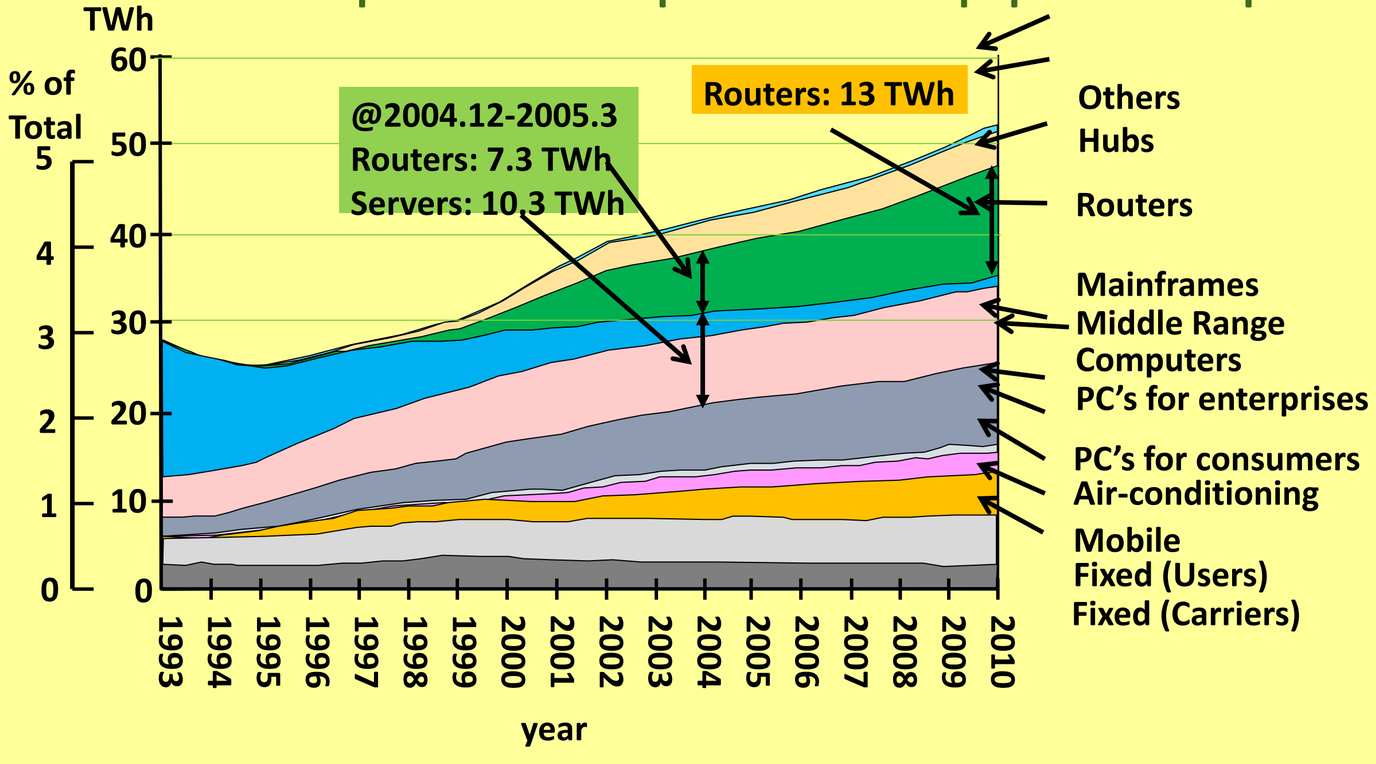
MiDORi Network

MiDORi: Multi-(layer, path, and resources) Dynamically Optimized Routing

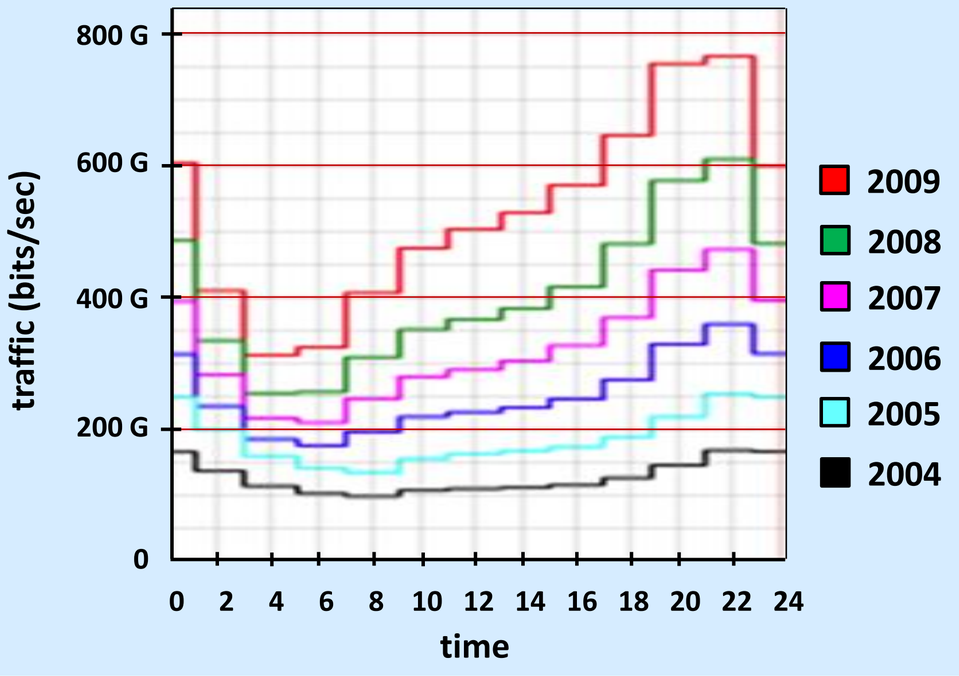
Research Background

- Increase in power consumption of routers. (7.3TWh:2005 → 13TWh:2010)
- Operation in maximum capacity under sharp traffic fluctuation.

Forecast of the power consumption for ICT equipment in Japan



Hourly traffic fluctuation of broadband subscribers



※Source: Ministry of Internal Affairs and Communications (MIC) Japan

Overview of MiDORi Network

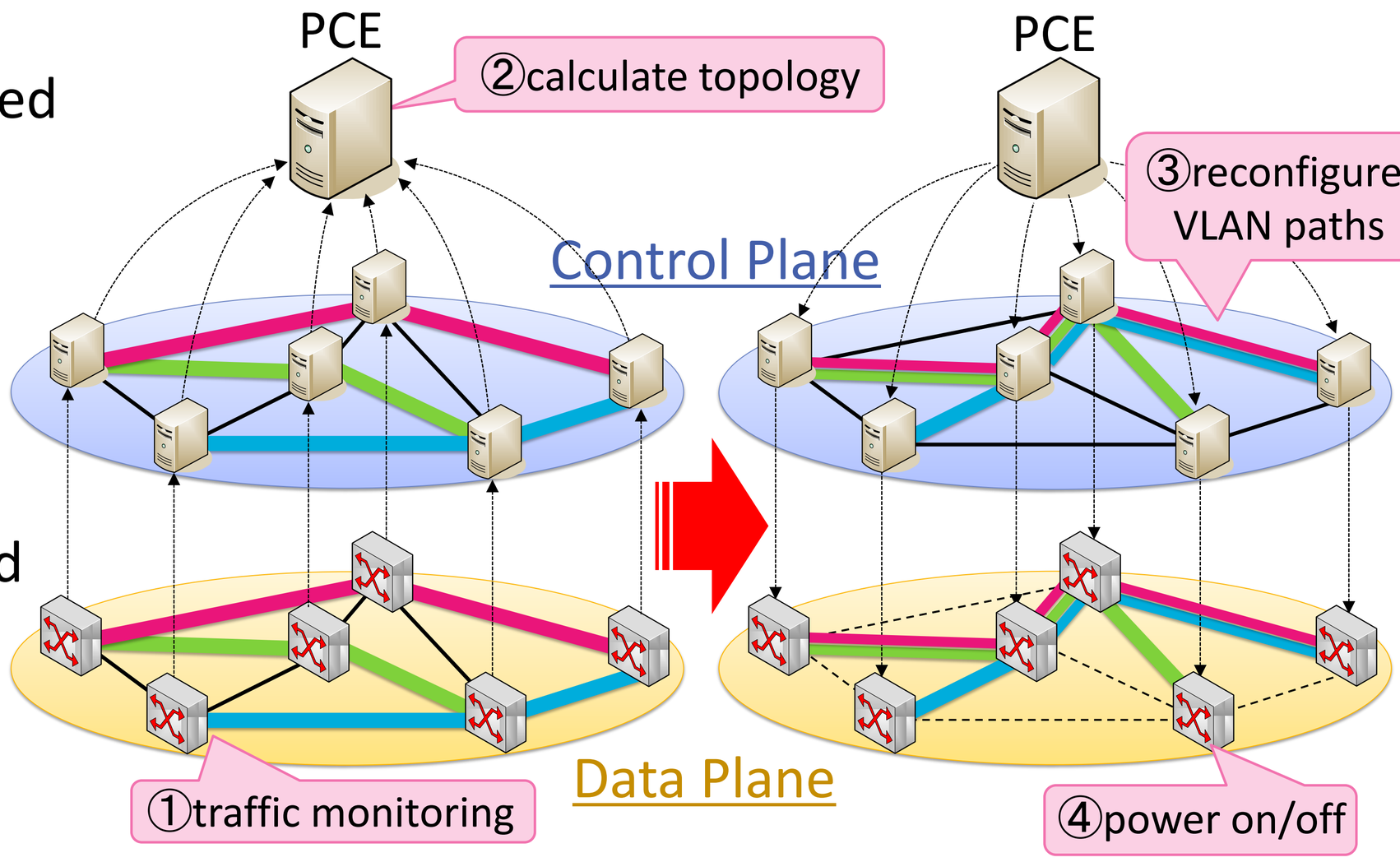
- Reduce the power consumption of the network by powering off router/switch interfaces depending on the amount of traffic.
- The quality of user service is assured by Traffic Engineering(TE).

MiDORi PCE

- Monitor traffic transferred at each router/switch
- Calculation of energy optimal topology

MiDORi GMPLS

- Reconfigure VLAN paths according to the derived topology
- Interface power management protocol



PCE: Path Computation Element
GMPLS: Generalized Multi-Protocol Switching

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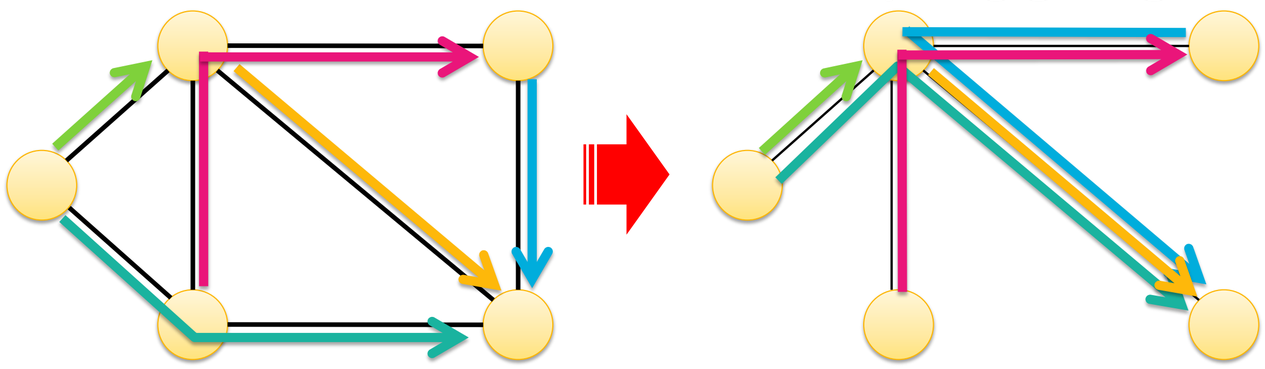
MiDORi Network

Yamanaka Lab.

Energy Optimal Topology

Power off unused links by aggregating traffic into specific links.

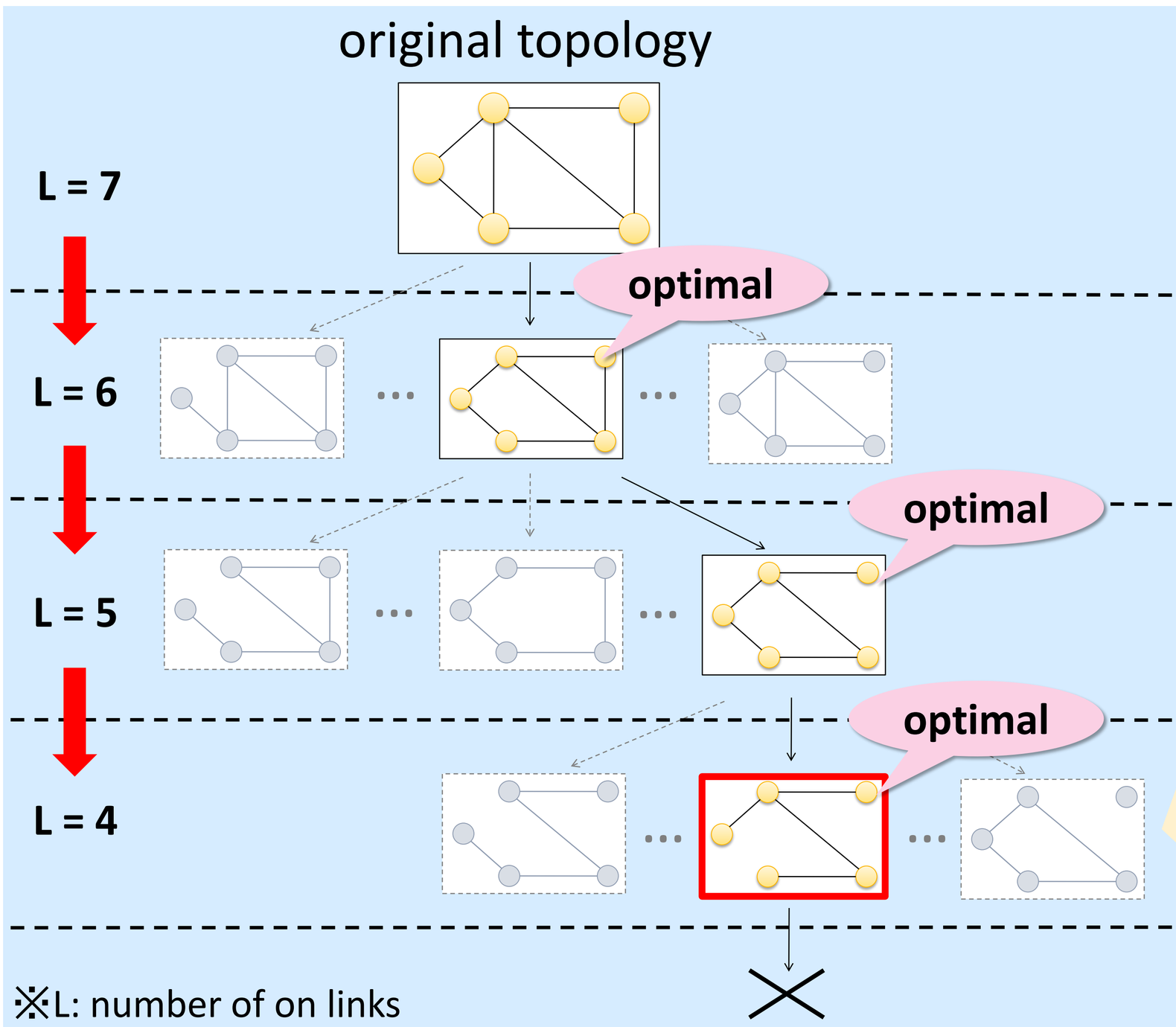


This topology must…
- tolerate all traffic
- consist of minimal links
- satisfy QoS requirements
- be calculated in practical time

Proposed Algorithm

1. Generate different patterns of topologies with one link reduced from the original topology.
2. Choose an optimal topology(*) and iterate the whole process.

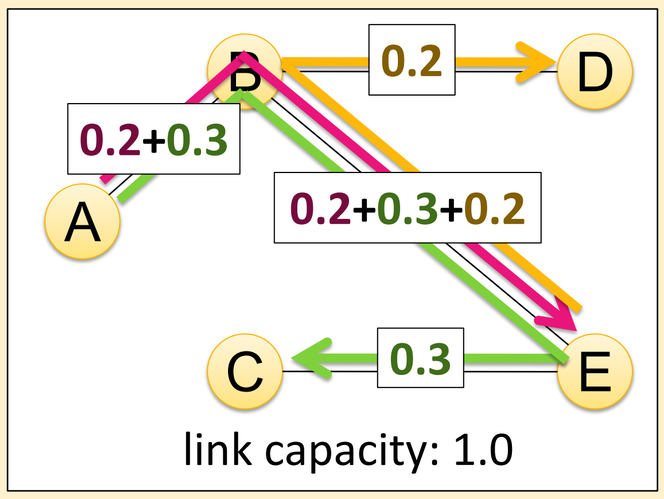
(*) a topology with the minimum value of maximum link utilization



traffic matrix(given)

src	dst	traffic
A	E	0.2
A	C	0.3
E	D	0.2

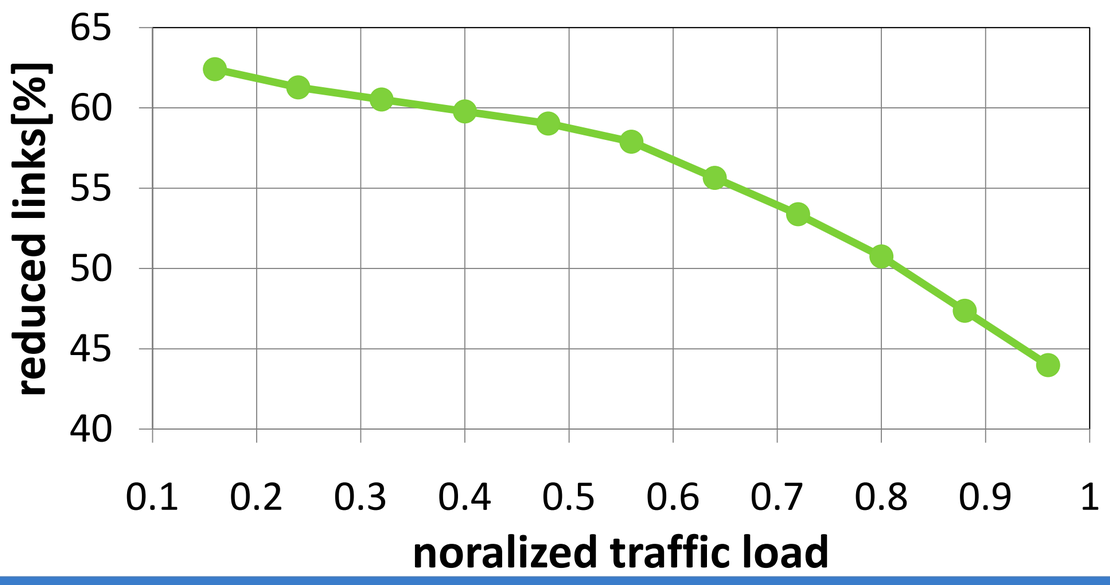
total traffic of each link
(derive shortest path)



link	AB	BD	BE	CE
utilization	0.5	0.2	0.7	0.3

maximum link utilization

※utilization = traffic / capacity



It is possible to reduce 62% of links at maximum in a 100 node network

11.7kW of energy can be saved

※In a Cisco GSR 12008 router

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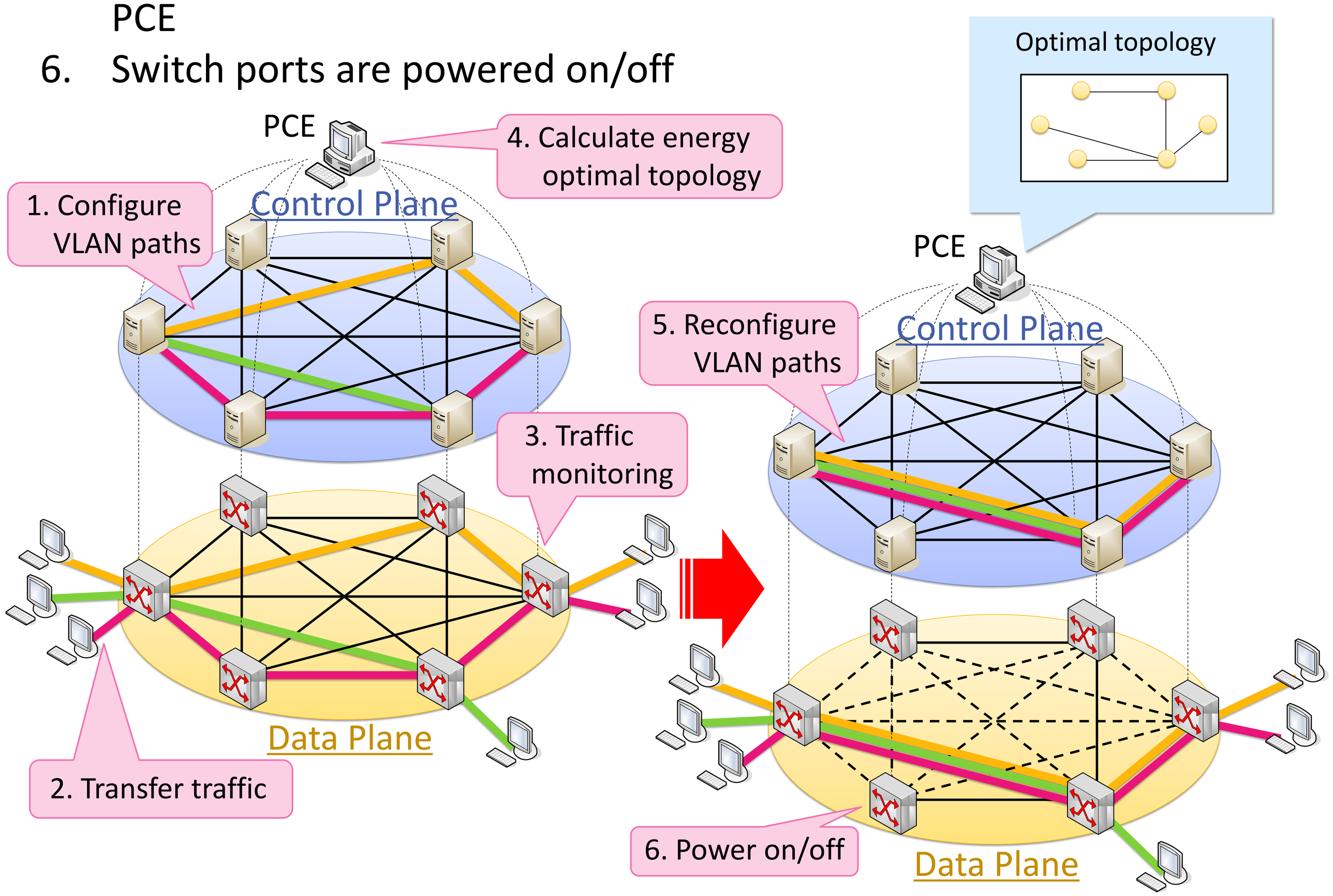
Experimental Outline

- The MiDORi PCE monitors traffic at each MiDORi GMPLS supporting switch and calculates an energy optimal topology applying the proposed algorithm.
- The MiDORi GMLPS reconfigures VLAN paths according to the derived topology and controls the on/offs of the switches.

Demonstration

1. The network is configured by setting VLAN paths
2. IP packets are transferred using these paths
3. The PCE monitors the amount of traffic transferred at each switch
4. The PCE computes an energy optimal topology by applying the proposed algorithm
5. VLAN paths are reconfigured according to the topology derived by the PCE
6. Switch ports are powered on/off