Logical Topology Mapping With Content Connectivity Against Multiple Link Failures in Optical Metro Networks

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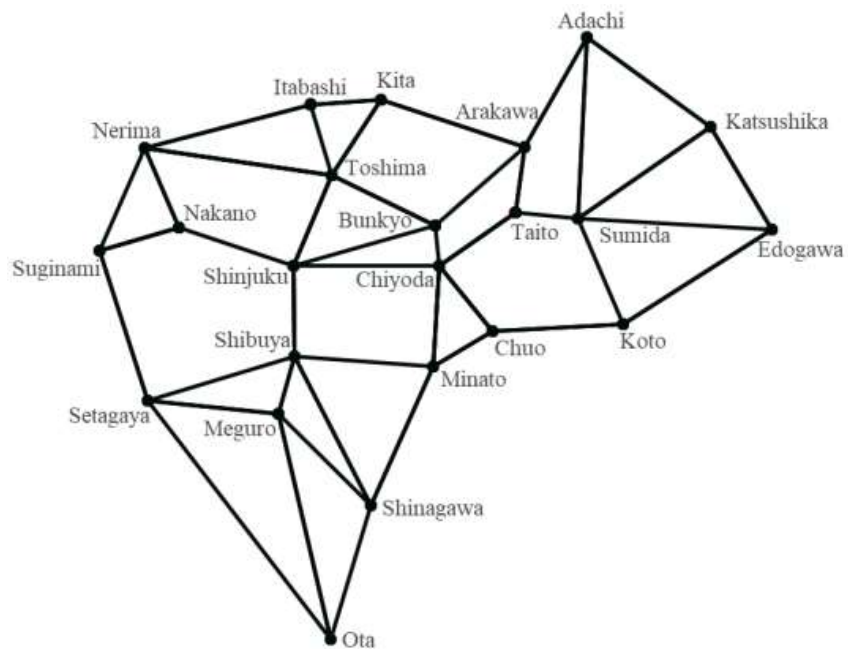
Friday, December 20, 2019
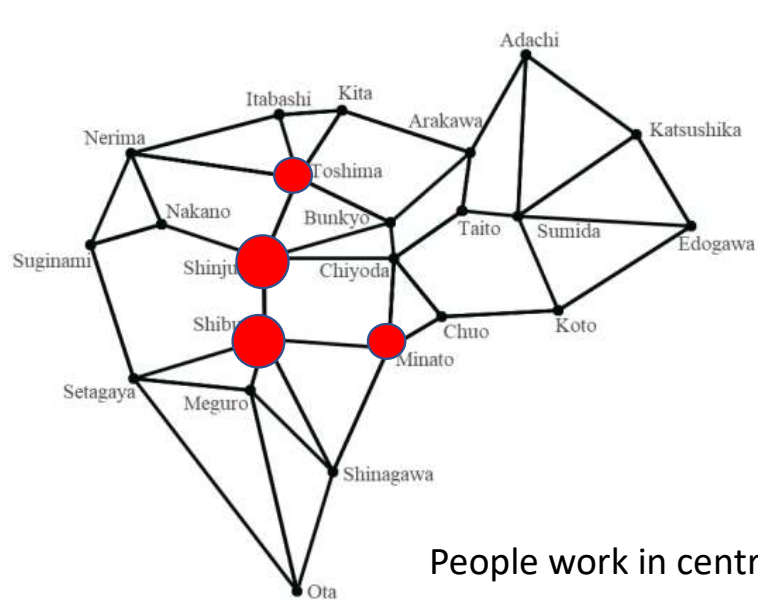
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Outline

- Network Connectivity and Content Connectivity: Numerical Results

- Network Connectivity and Content Connectivity Probability
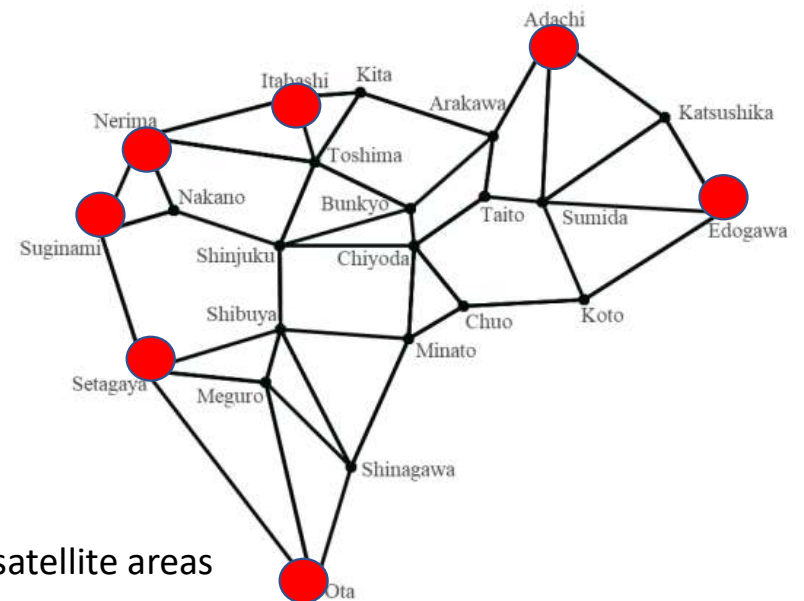
- Impact of Datacenter Placement

Physical Network

- Tokyo 23-node network
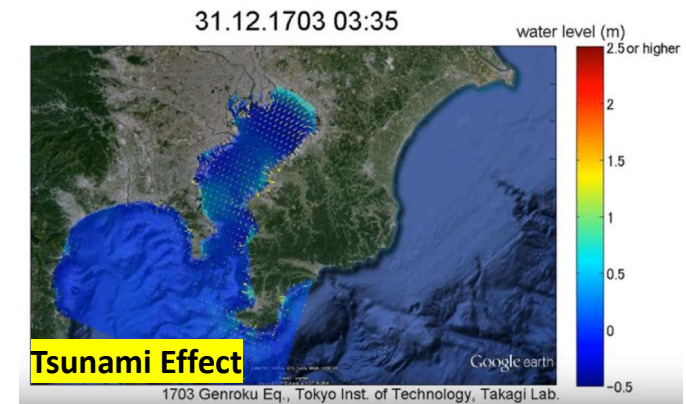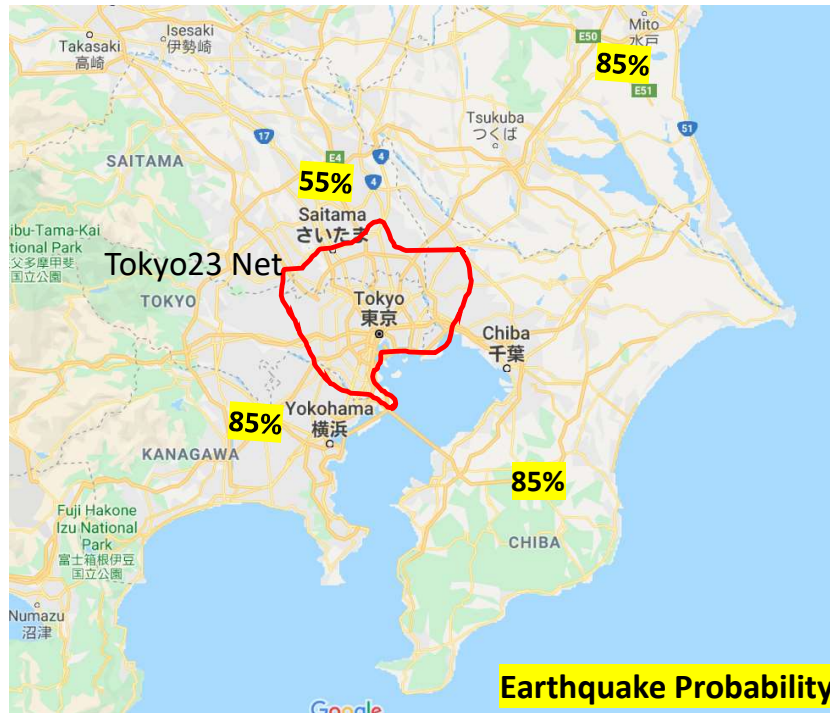- Different population in day and at night

Physical Network

People work in central city but live in satellite areas
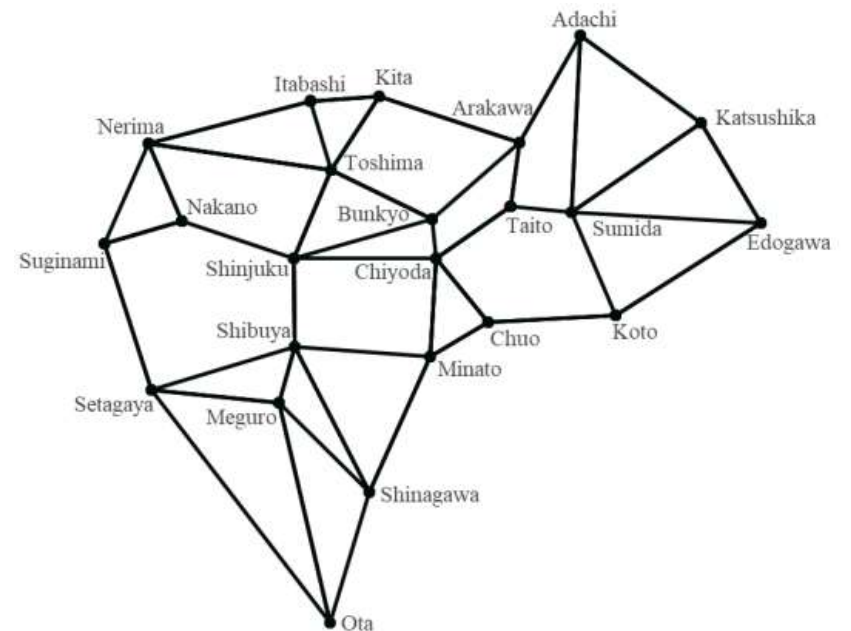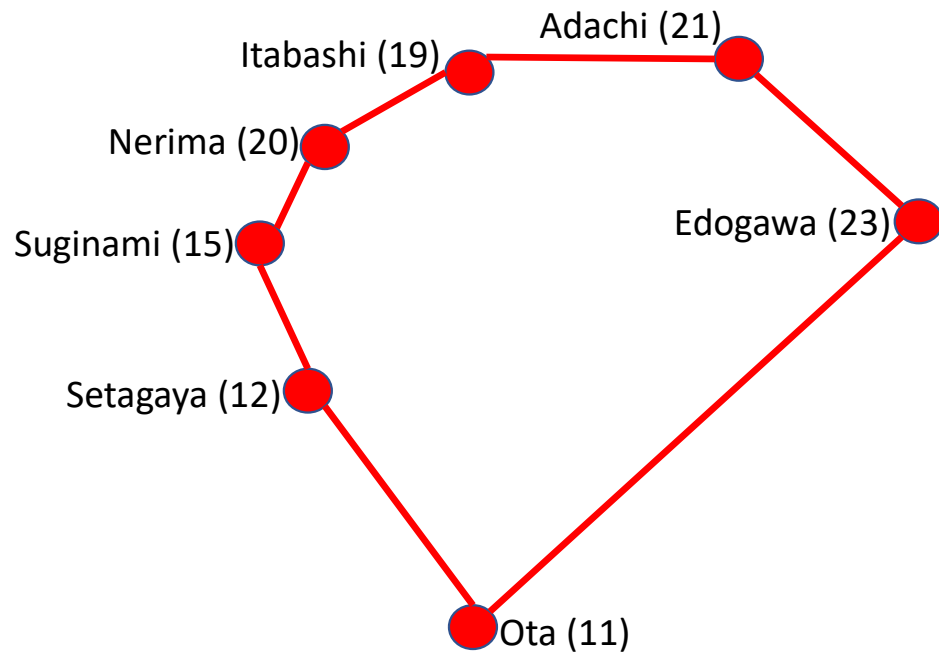
Population distribution in day

Population distribution at night

Tokyo Metropolitan Area Risk Probability

85%

55%

Tokyo23 Net

85%

85%

Earthquake Probability

The Sagami Trough in RED

31.12.1703 03:35

water level (m)

Tsunami Effect

1703 Genroku Eq., Tokyo Inst. of Technology, Takagi Lab.
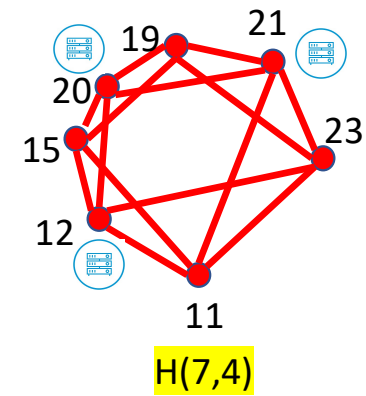
Datacenters should be placed far away from Tokyo Bay and in low earthquake probability region

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Logical Topology

7 most populated nodes at night

Logical Topologies

H(7,2)

H(7,3)

H(7,4)
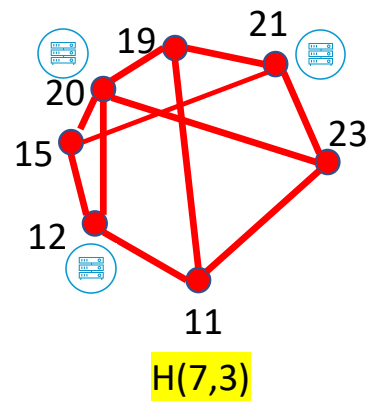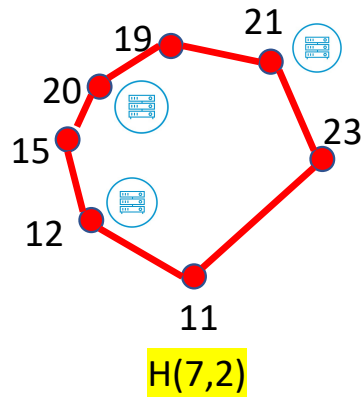
Data Center

Numerical Results

Network Connectivity and Content Connectivity Cost
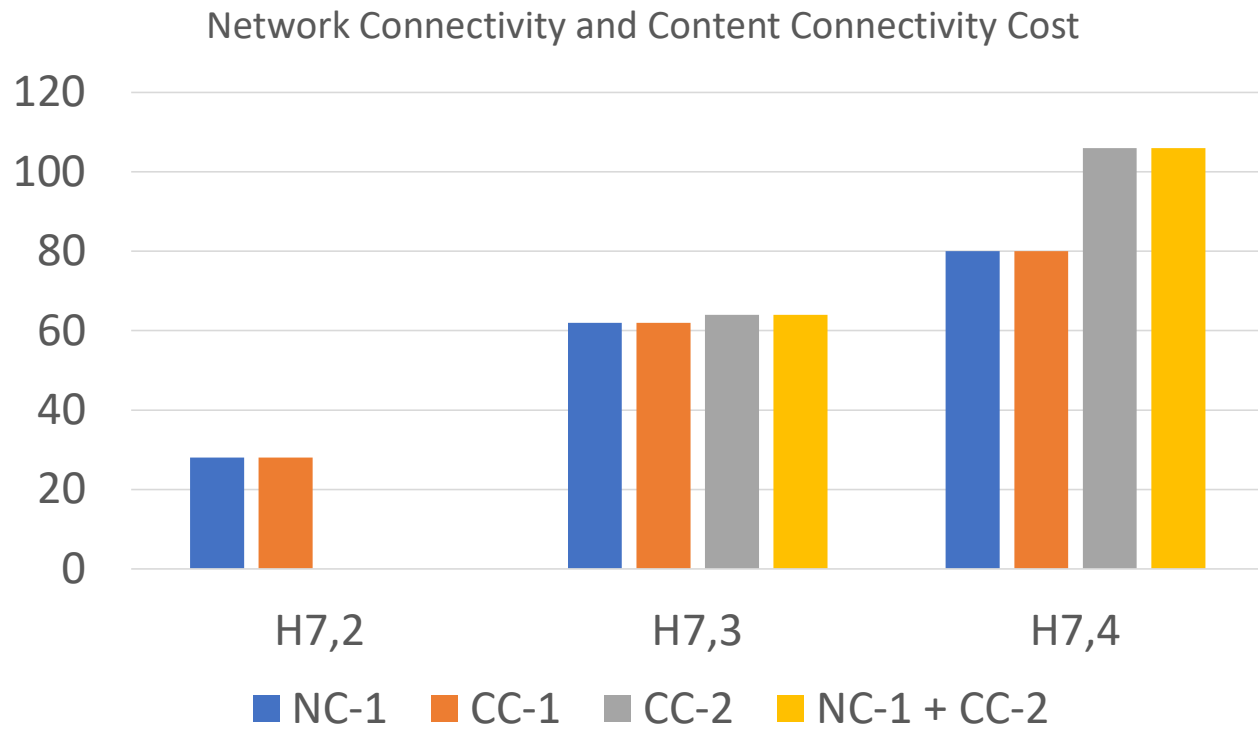
Numerical Results

- Most cases:

  ✓ If NC and CC solutions exist, NC cost = CC cost

  ✓ Rare scenarios: NC and CC solutions exist and CC cost < NC cost

- Often: NC is not possible, but CC is possible

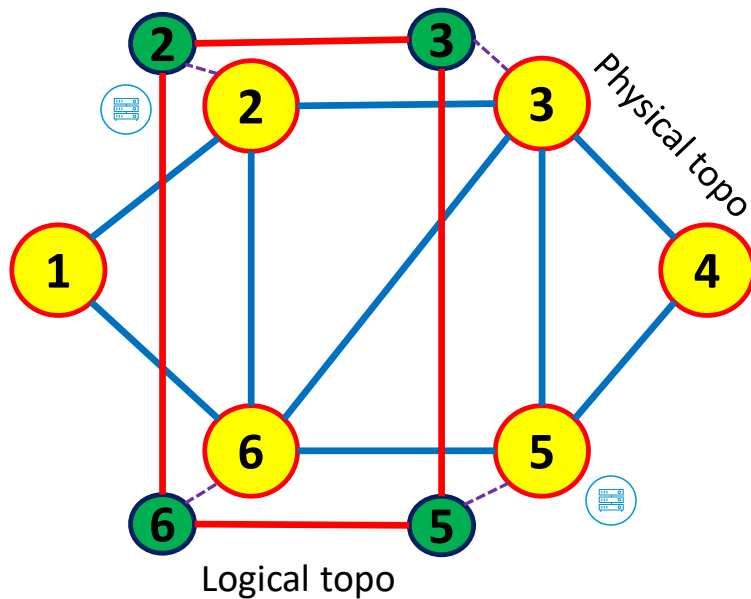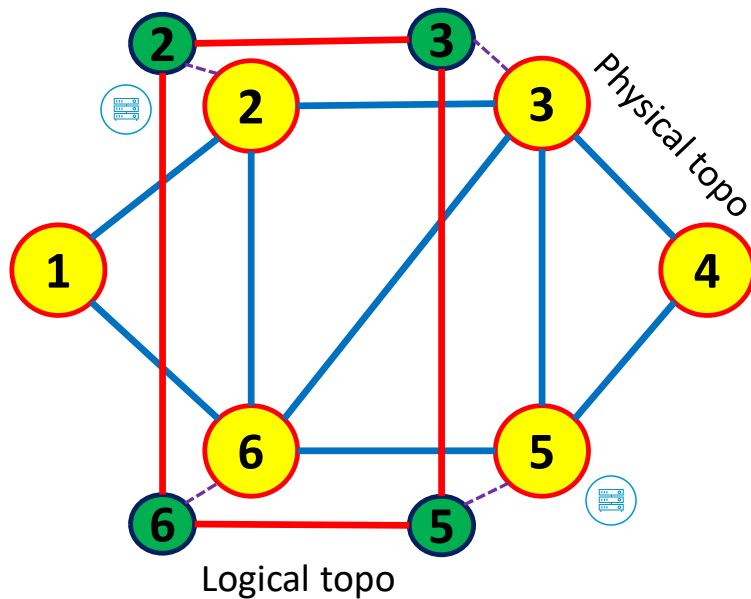# Network and Content Connectivity Probability

✓ Scenario:

Physical topo

Logical topo

- NC probability after 1 failure: 100%
- CC probability after 1 failure: 100%
- NC probability after 2 failures: 83.3%
- CC probability after 2 failures: 94.4%
- Similar calculation for 3 failures, and so on
- Considering risk probability

 Data Center

Network and Content Connectivity Probability

✓ Scenario:

Physical topo

Logical topo

Data Center

- Adding more data centers, higher CC probability

- Adding more DCs, CC probability the same

Further Analysis and Wrap Up

1. Complexity comparison: Table

2. Network and Content Connectivity Comparison:

   ✓ Bar Graph

   ✓ Scenario analysis and generalization

3. Network and Content Connectivity Probability vs. # failures: Line Graph

4. Network and Content Connectivity Probability vs. # DCs: Line Graph

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