Management of overlay network performance: End-to-end network measurement strategy and quick failure recovery

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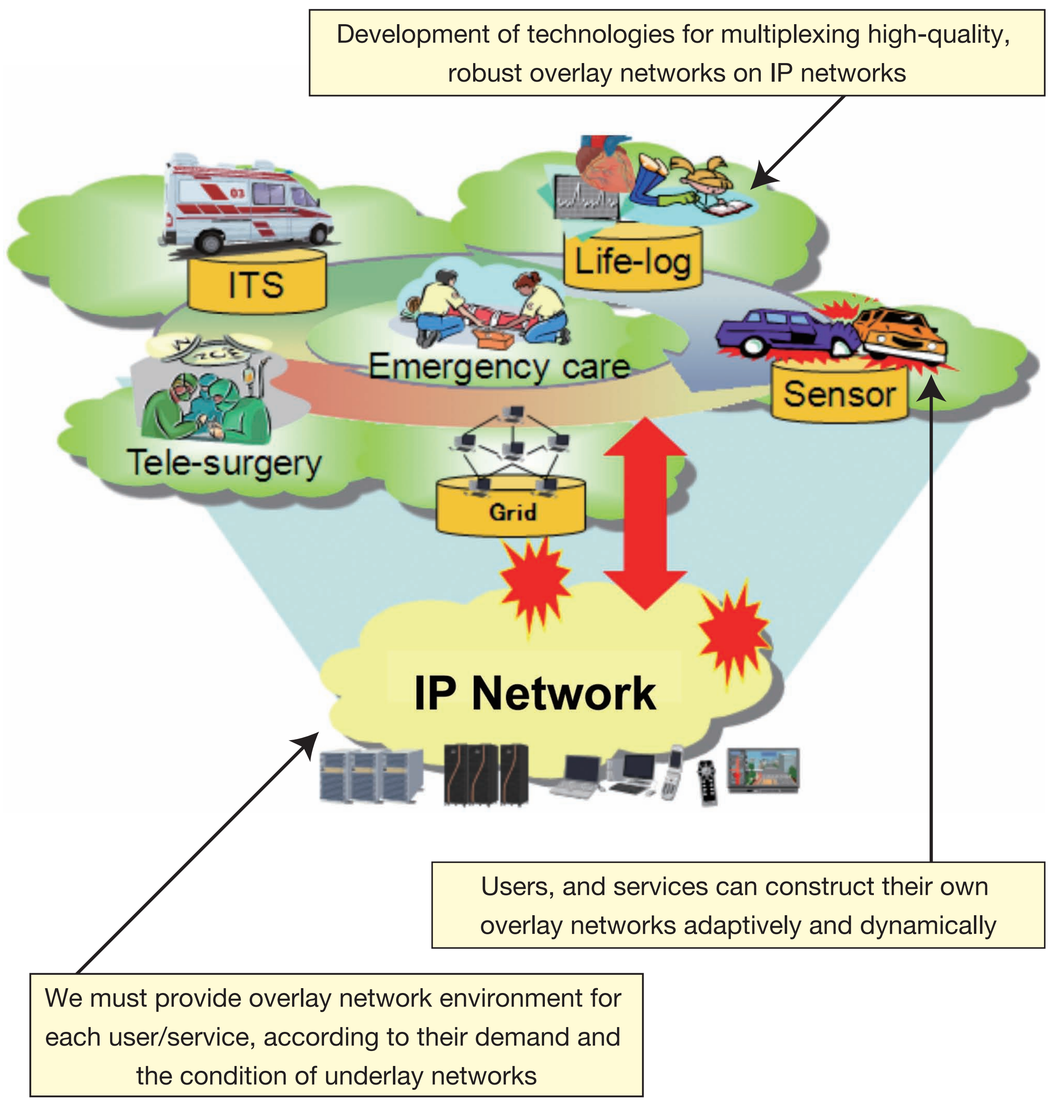
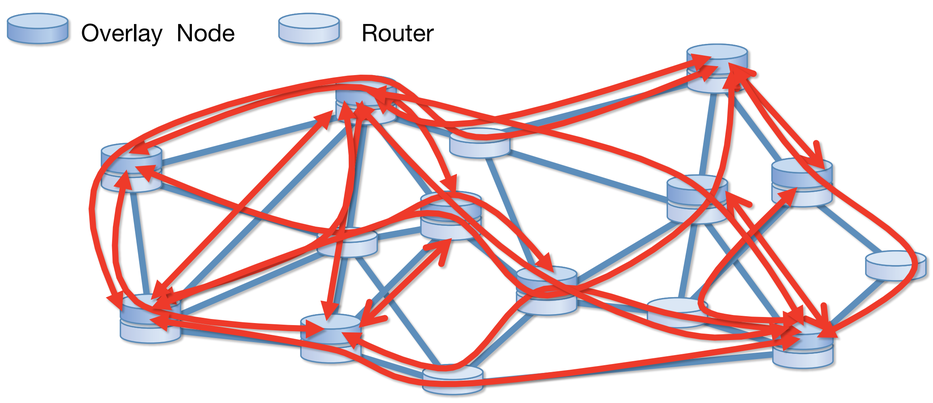
Overlay Networks

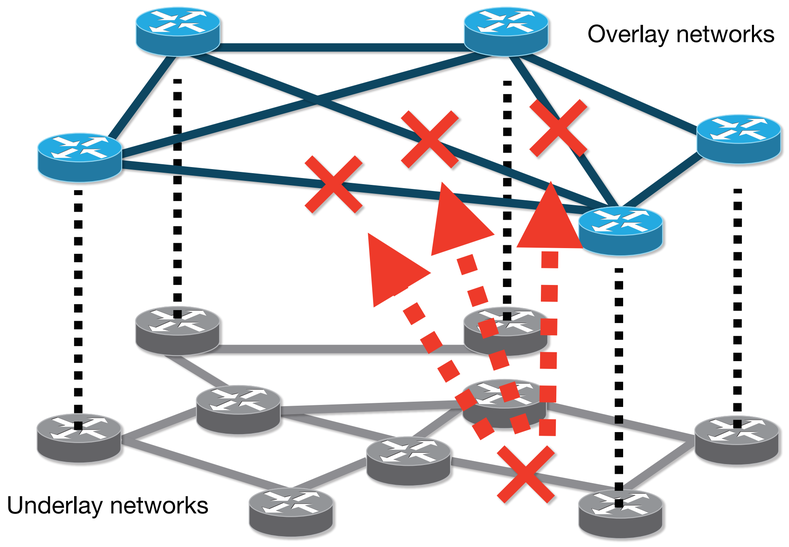


Management of overlay networks

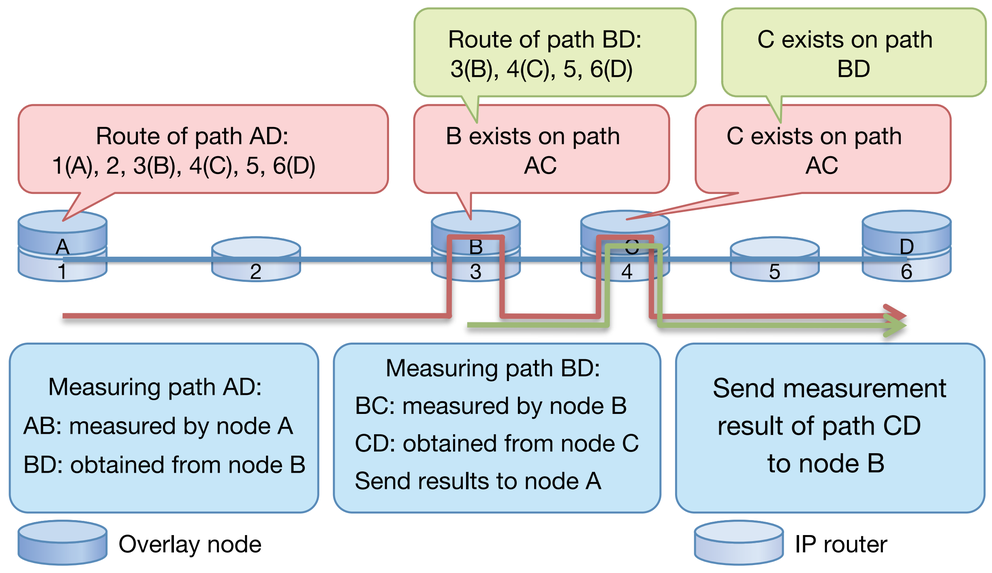
Network measurements: Simple full-mesh measurement has the O (N2) overhead. So, we need simple, lightweight, and scalable measurement method.



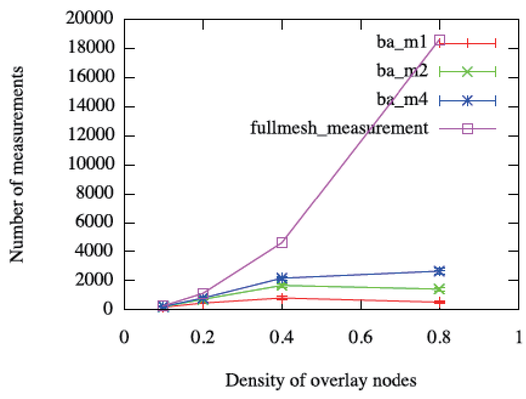
Failure recovery: Since overlay networks share underlay network equipments, a single network failure would bring multiple, simultaneous failures in overlay networks. So, we need failure recovery method from simultaneous failures in overlay networks.



Measurement strategies for overlay networks

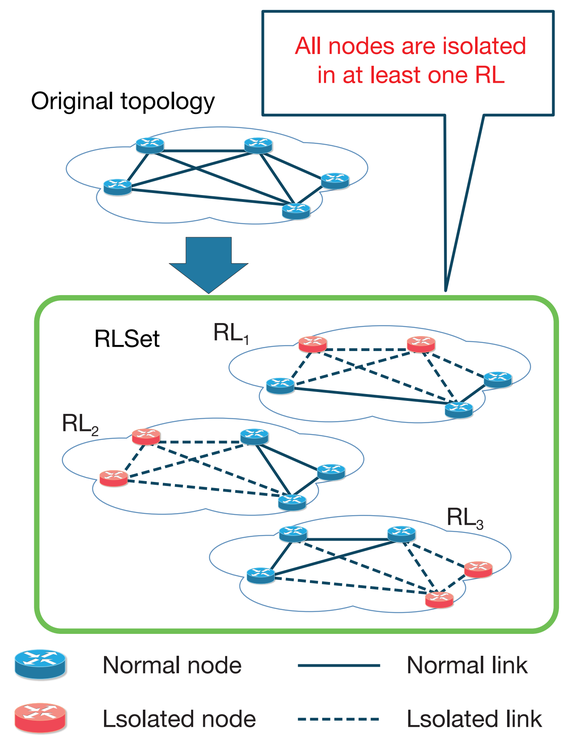


-Each overlay node conduct traceroute commands to other overlay nodes
-Intermediate overlay nodes capture them and record src/dst nodes
-All overlay nodes understand path overlapping status
-Measurement of longer path will be omitted and measurement result is estimated from results of shorter paths
-- Delay: D=d1+d2, bandwidth: B=min(b1, b2)
-- Packet loss ratio: P=1-(1-p1)(1-p2)



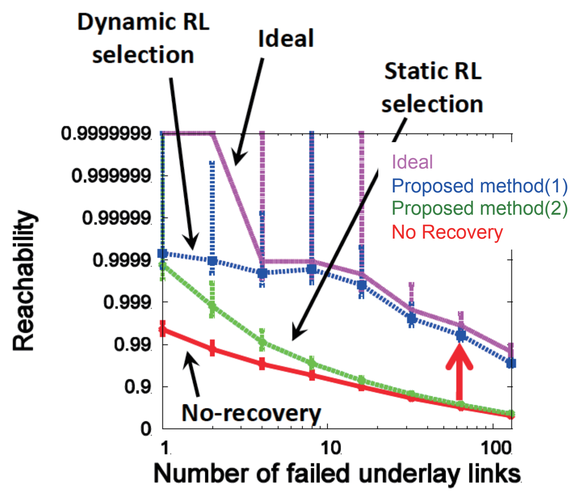
We can decrease the number of required measurement paths to 1/30 – 1/50, regardless of the underlay network topologies and the number of overlay nodes.

Proactive recovery method for overlay networks



-We construct multiple topologies for failure recovery from the original topology
-Each topology has isolated nodes. When a node failure occurs, we utilize the topology which isolates the failed nodes
-Multiple simultaneous node failures can be recovered, when such nodes isolated in one topology

We can improve reachability of the overlay network from 69% to 99%, when 5% links in the underlay network fail simultaneously.



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