

## Lecture 23

CS625: Advanced Computer Networks  
Fall 2003

Thursday, 09 October 2003

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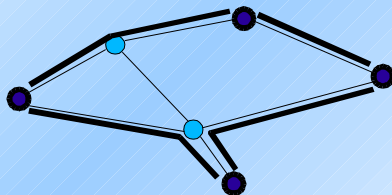
<http://www.cse.iitk.ac.in/users/braman/courses/cs625-fall2003/outline.html>

## Topic for Today

- Overlay Networks
- *Scribe for today?*

## Overlay Network

- Overlay: a network on top of another network
  - IP itself is an overlay network
  - The term generally means a network on top of IP



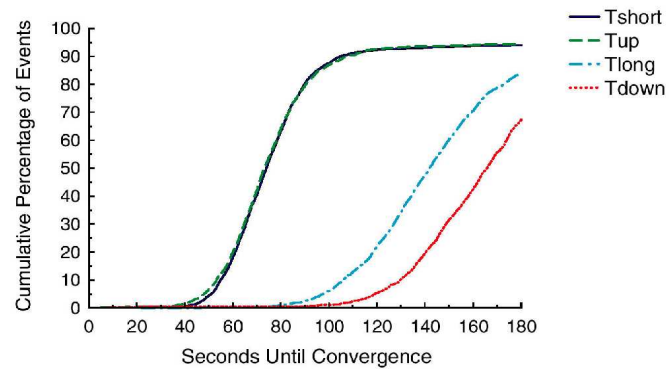
TCP
Overlay
IP

## Purpose of Overlay

- Add a functionality to IP
- Examples:
  - Multicast
  - Resilience or fault tolerance
    - Resilient Overlay Network (RON) [ABK01]
  - Resilient service composition [Raman02]

## Motivation to Provide Resilience

- IP (BGP) takes a long time to recover
  - Up to several minutes! [Labovitz et.al. 2000]



## Motivation (continued)

- BGP hides topological details
- Policy routing takes priority over any metric
- Not good for fault tolerance or congestion-free routing
- BGP availability:
  - 10% of routes are available only 95% of the time
- Multi-homing *not* a solution
- Early ARPANET: unscalable

## RON Model

- Designated RON nodes for an overlay
- Exchange of performance and reachability
- And, routing based on these
- 2-50 nodes (only) on overlay
- Advantages:
  - Fast recovery from failures
  - Application specific metric
  - Packet classification policies are possible

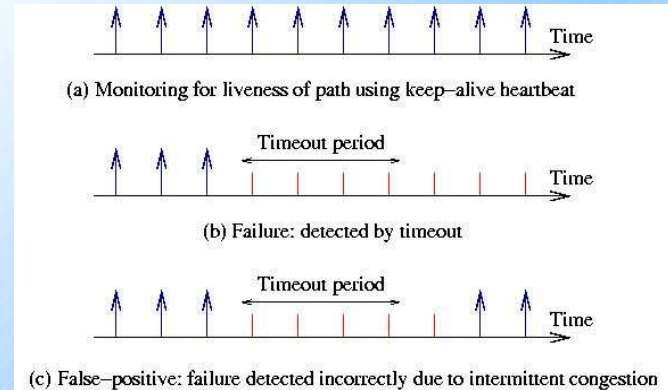
## RON Architecture

- Software modules at RON node
  - RON client
  - Router
  - Forwarder
  - Membership manager
- Full mesh network among members
- Link-state based dissemination

## Possible Usage Models

- A specific application (like video conferencing) constructs and uses RON
- A network administrator constructs an overlay
- Overlay ISP

## Failure Detection



- Overhead versus detection time trade-off
- False positives possible
- Application-specific notion of failure

## Path Metrics

- Latency (EWMA)
- Loss rate
- Bandwidth
  - Relatively unstable
  - But stable over several 10s of minutes within 50% variation
  - TCP throughput:  $\max = \sqrt{1.5} / [RTT \times \sqrt{p}]$ 
    - Difficult to combine
    - Consider only two-hop alternate paths

## Further topics...

- Peer-to-peer networks
- Internet Security
- Reminder:
  - Assignment-2 will be assigned today