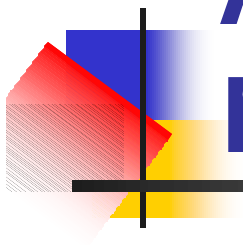
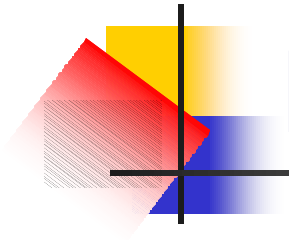


Enabling Conferencing Applications using an Overlay Multicast Architecture

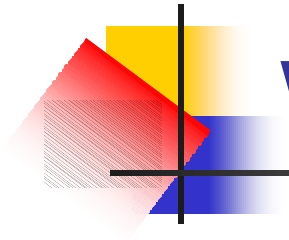
Authors: Yang-hua Chu, Sanjay G. Rao, Srinivasan Seshan and Hui Zang @ CMU



Motivation

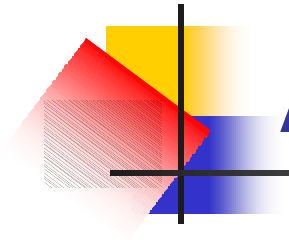
Alternative to active networks

- Goal of active networks: Provide network intelligence to data traveling over network.
- Is network intelligence required ??



Why conferencing as a test case

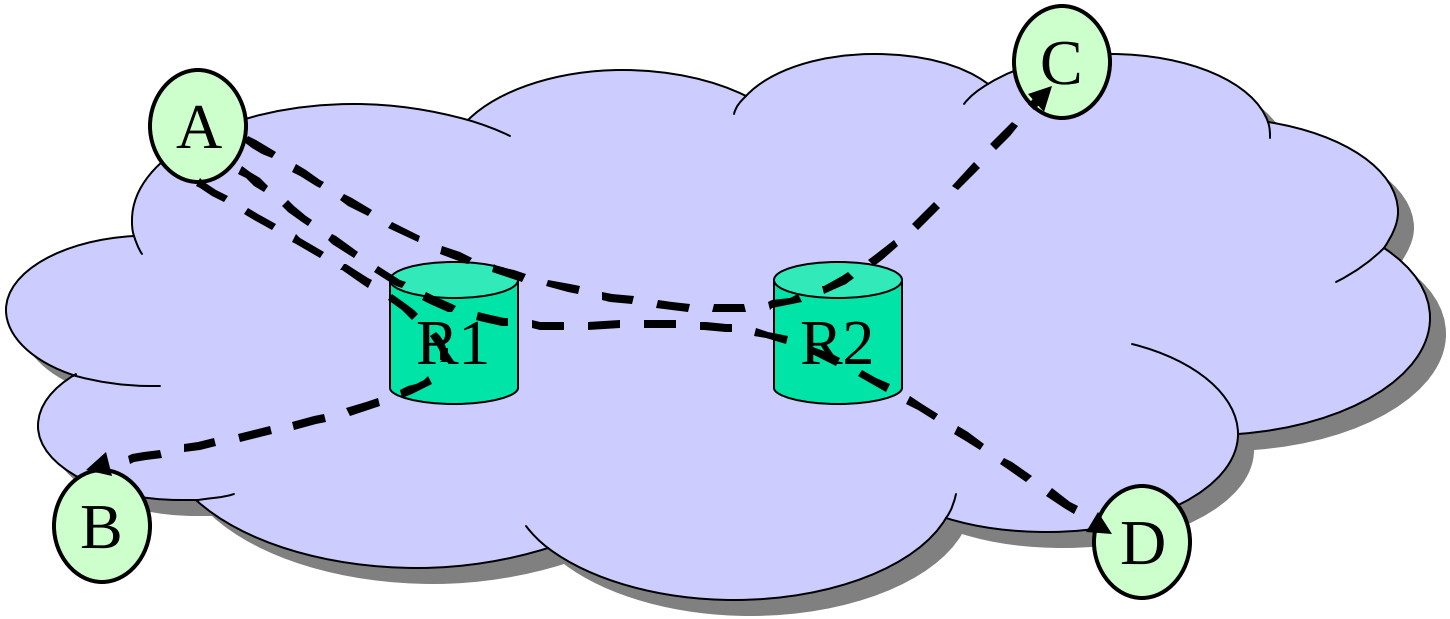
- Time critical
- Bandwidth
- Changing topology



Architectural Alternatives

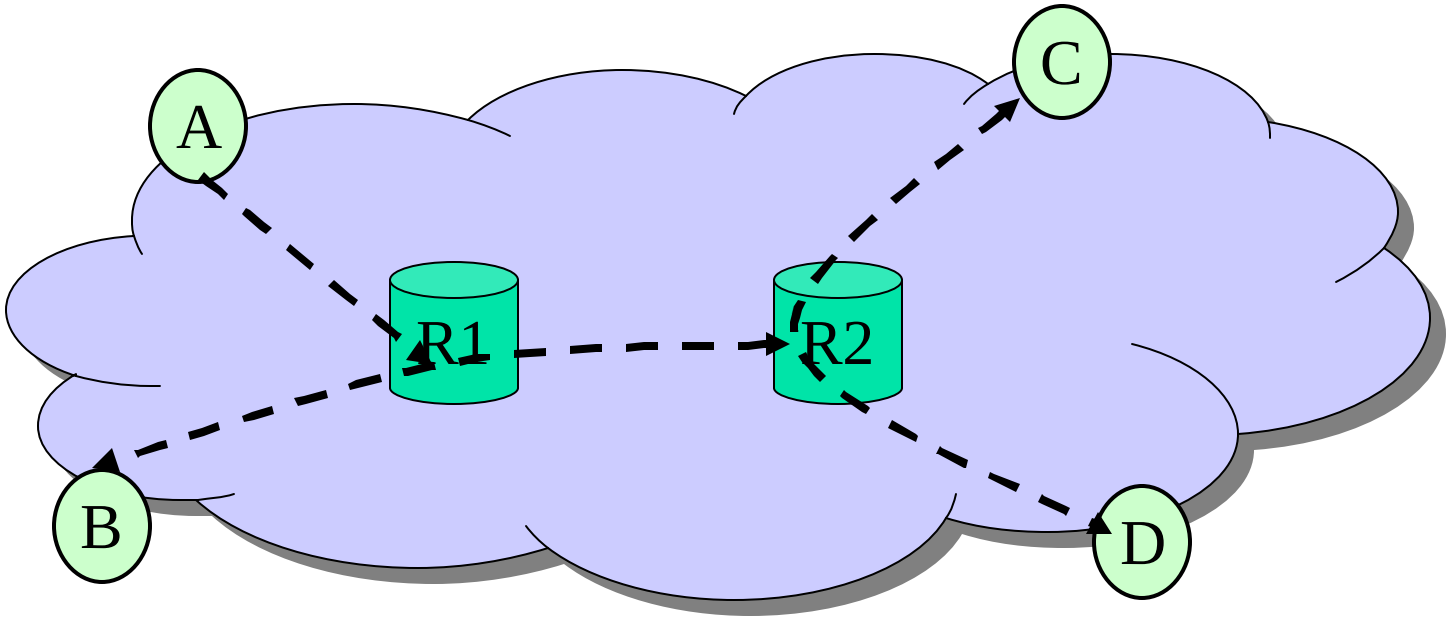
- Multiple unicasts
- IP Multicast
- Active Networks based Multicast
- End System Multicast

Multiple unicast



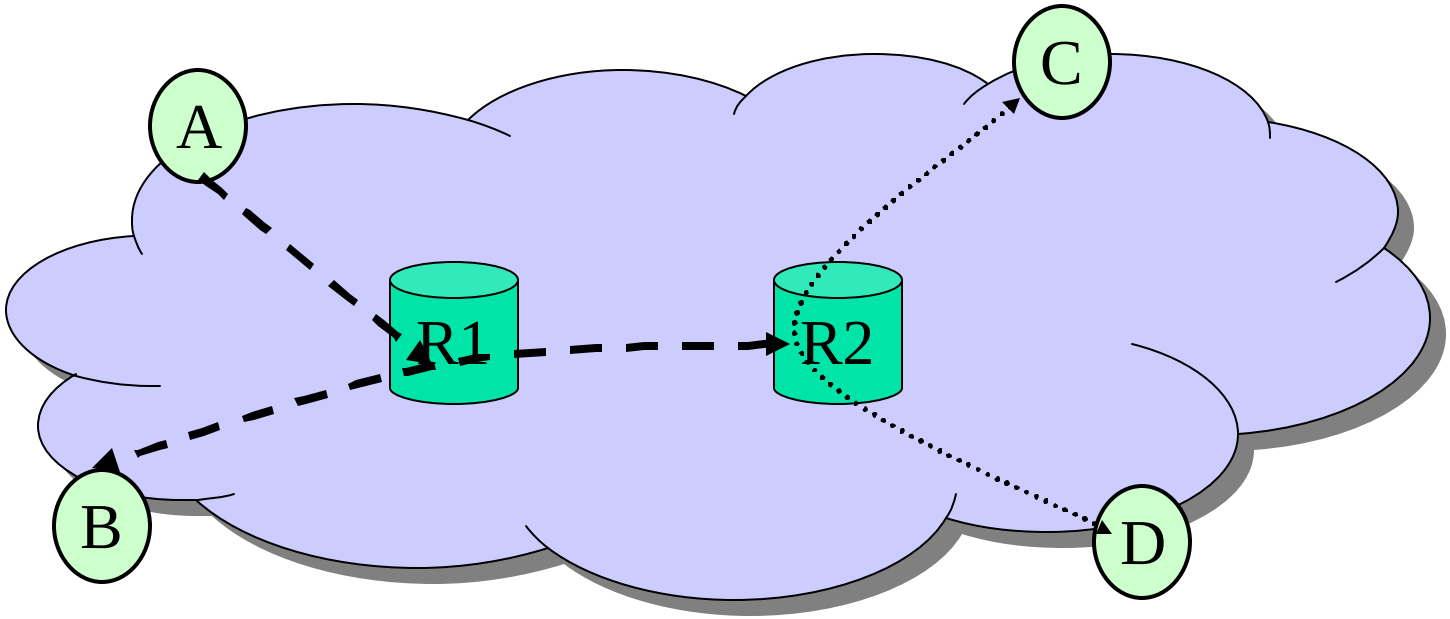
The dumb choice

IP Multicast



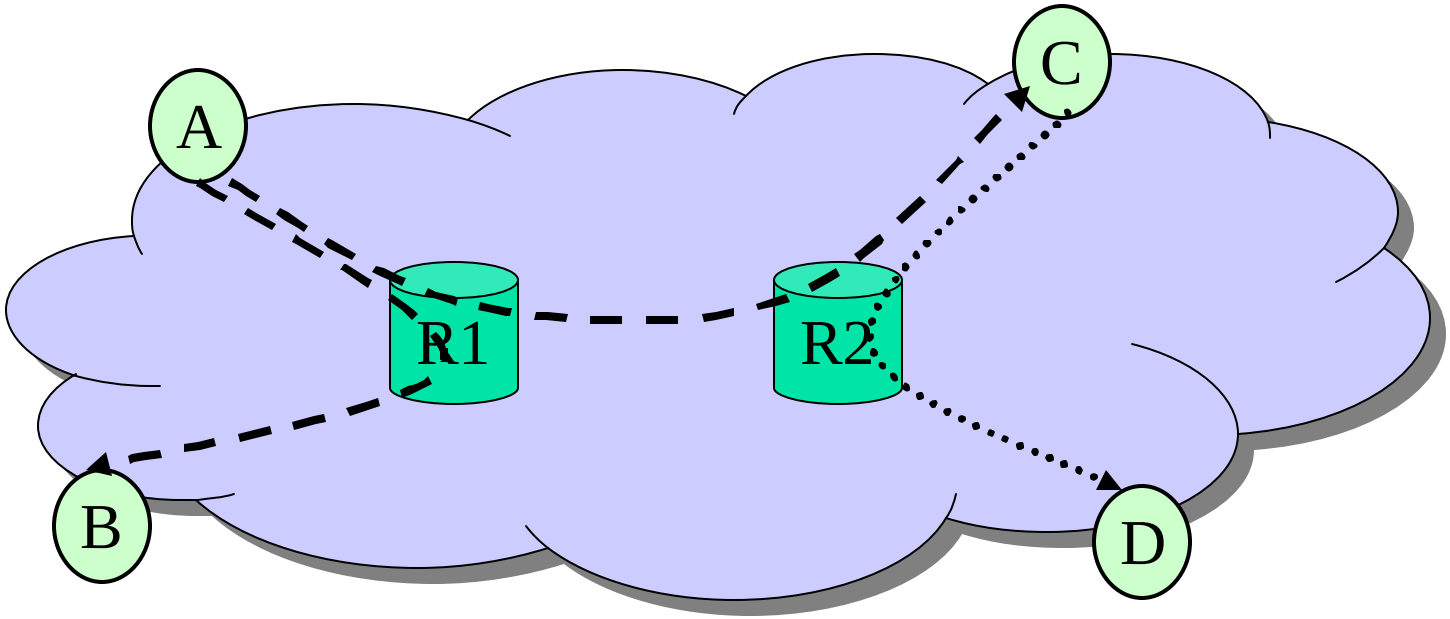
Specific intelligence in router

Active Networks based Multicast



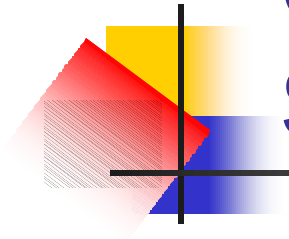
Really intelligent router

End System Multicast



The dumb network
Smart end points

Conferencing Requirements v.s. End System Multicast Features



Conferencing

- Lasts for longer periods compared to other network apps
- Small group sizes

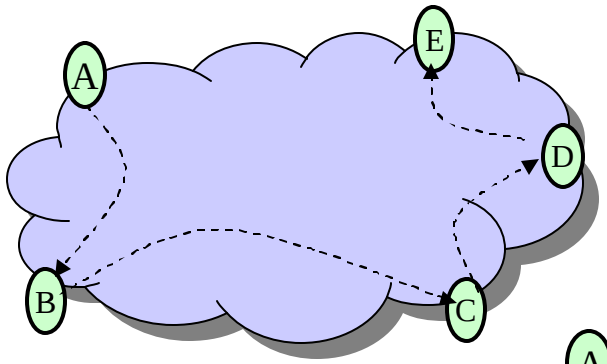
End system multicast features

- Overlays get better with time
- Allows end systems to interact among themselves

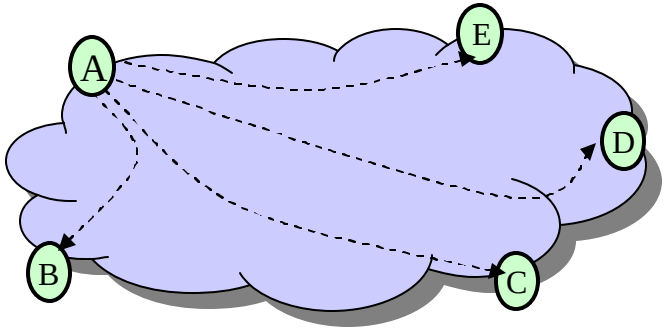
But what about performance ??

Ideal end system overlay network

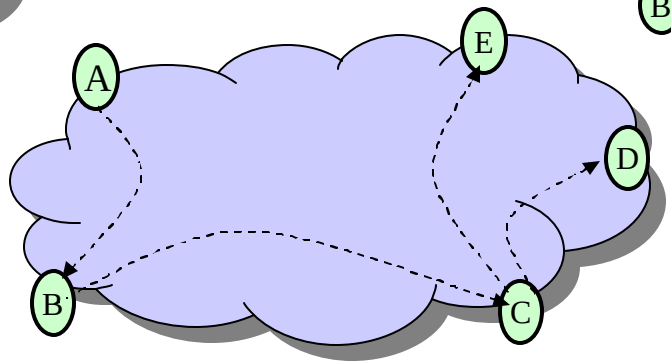
- Small latency
- Optimal bandwidth usage



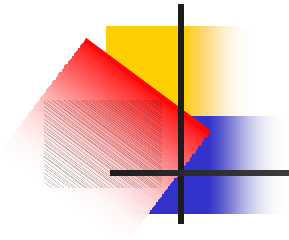
Least Bandwidth



Least Latency

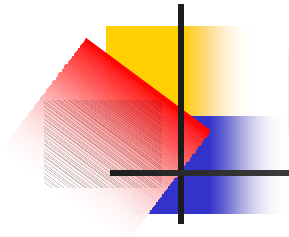


Efficient overlay



Issues Addressed

- Adapt to changes in group membership
- Adapt to changes in network conditions (and get knowledge of network)

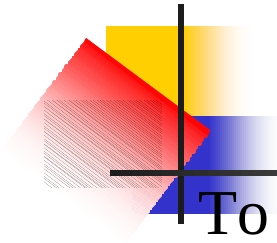


Narada: End System Multicast

1. Create a mesh

   (Might have cycles.)

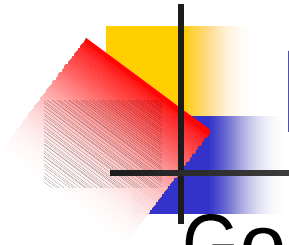
2. Optimize mesh to get good spanning tree at each node
   - Each node sends its routing table periodically
   - Nodes perform measurements



Heuristics

To make decision about a link (add/drop from tree)

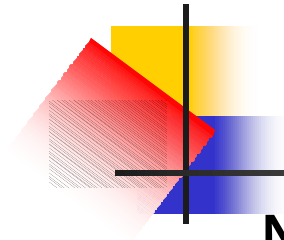
1. Path bandwidths assigned to levels
2. At same level, lower latency link is used
3. To avoid oscillation among different links
    1. Base decisions on smoothed out readings (rather than just one)
    2. Go to lower level immediately but raise bandwidth level only if significantly different from current estimate.
4. Over estimate cost of dropping link



Experimental Evaluation

Goals

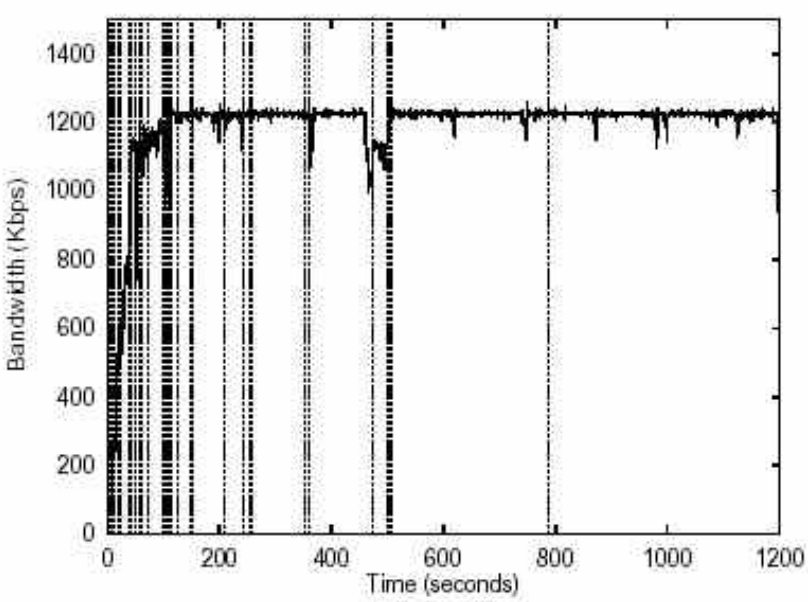
- Is ESM suitable for conferencing
  - Measurement of critical parameters (bandwidth and latency)
- Metrics for constructing overlays
  - Use different metrics see which delivers best values for parameters
- Resource usage
  - Estimate based on propagation delay for all links used
- Overheads of protocol
  - Measurement of control and probe traffic

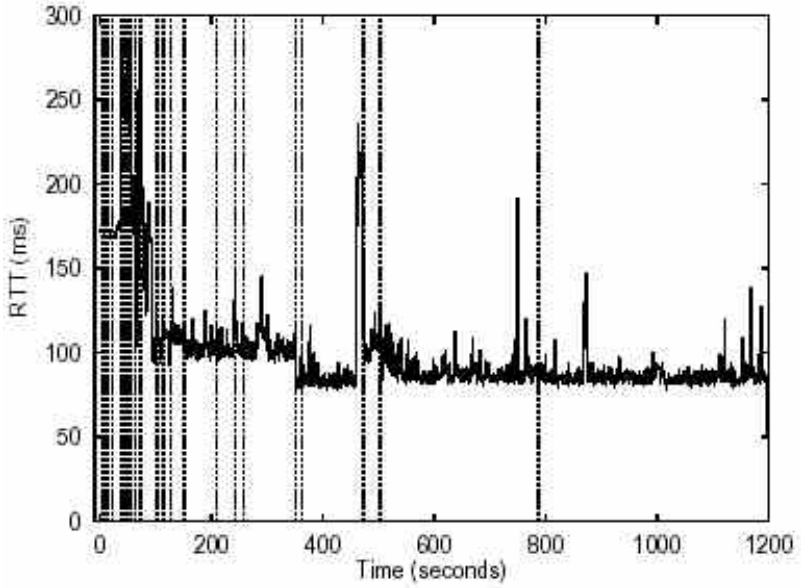


Experimental methodology

- Networking experiments on real test beds are prone to changes in network conditions.
  - Carry out multiple times. Average results
  - Interleave different schemes
  - For different network loads, carryout on different times of the day
  - Consider heterogeneous host set
  - See the big picture

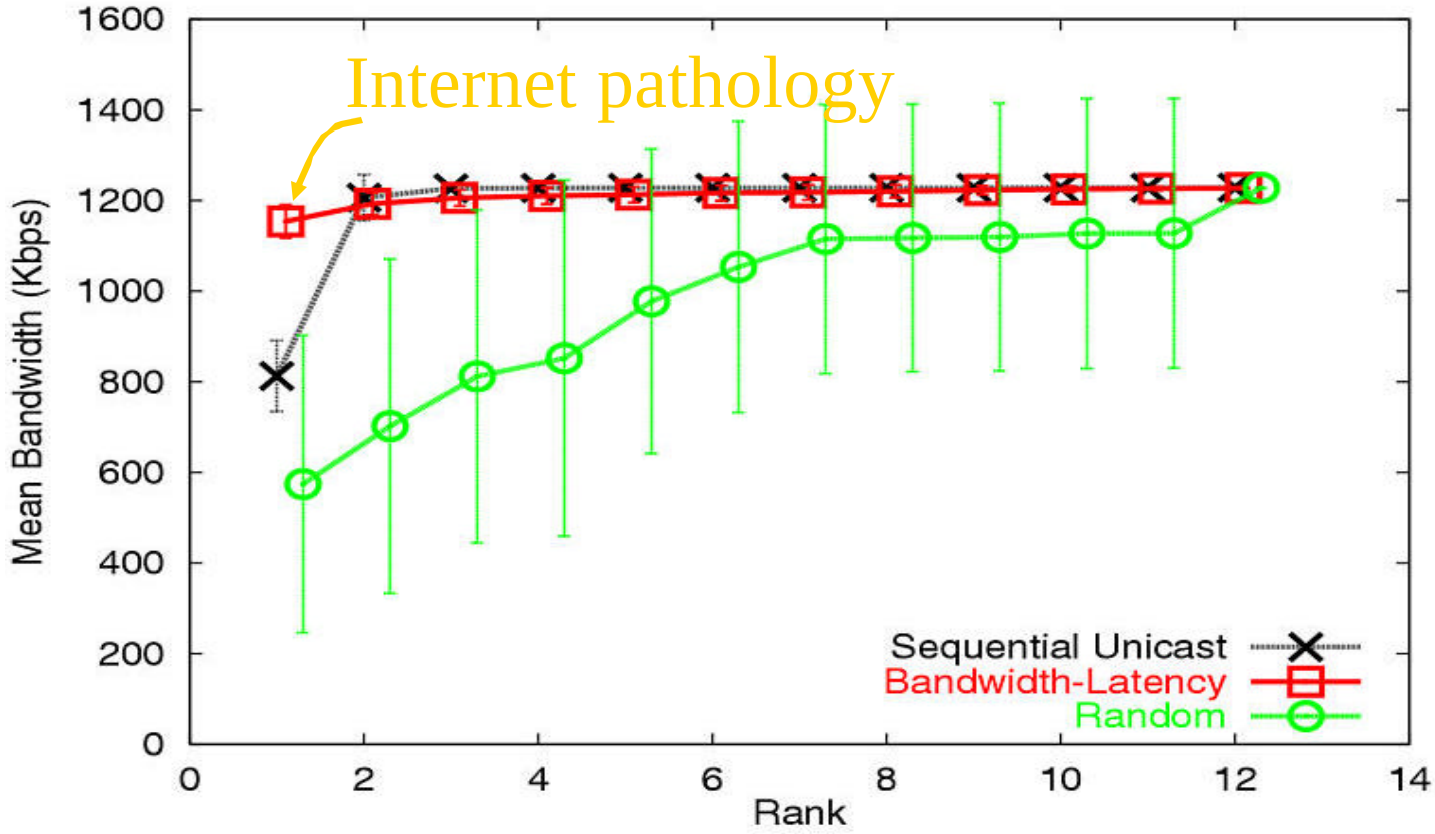
Parameters





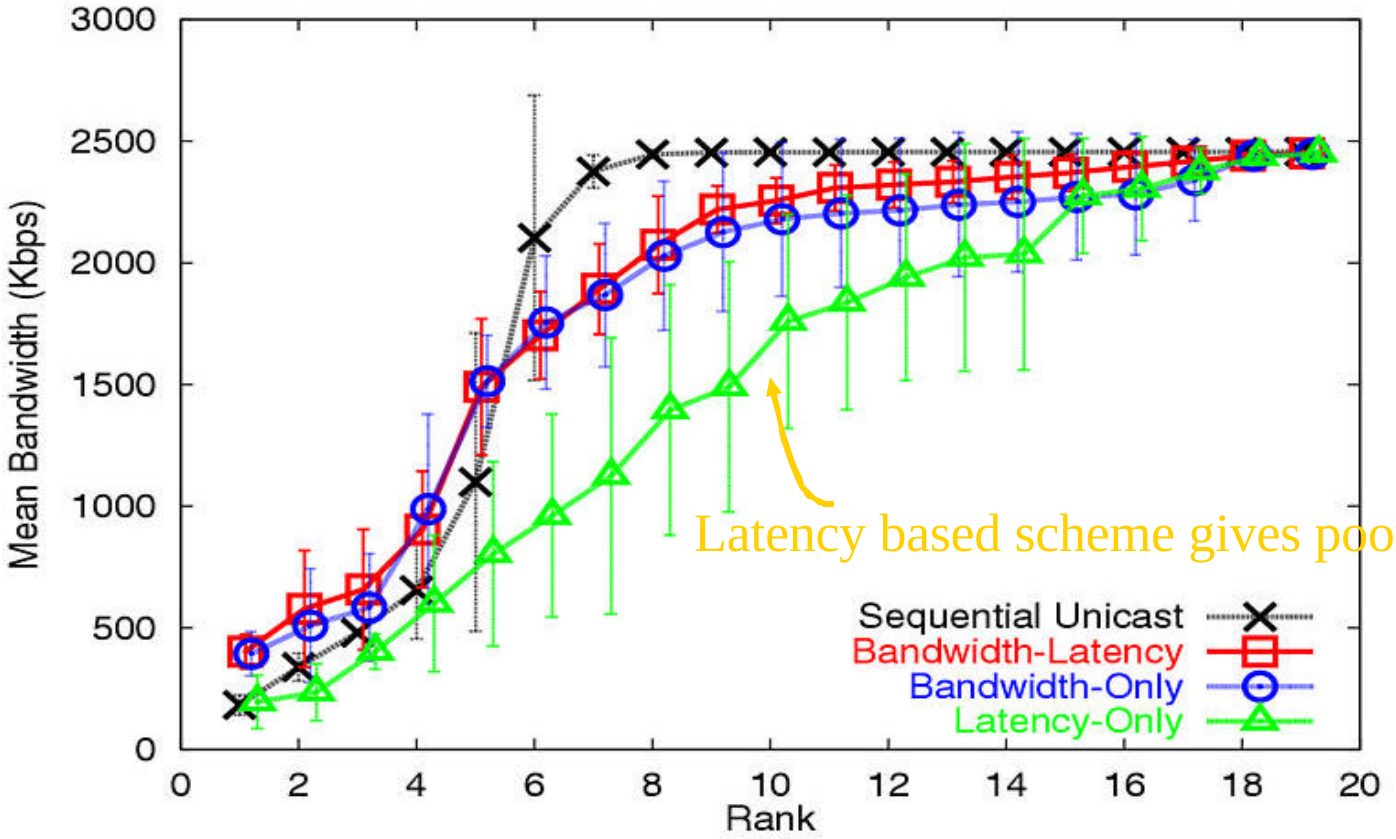
- Different metrics : Sequential unicast, Bandwidth latency, latency only, bandwidth only, propagation delay only
- Different stream sizes 1.2 Mbps, 2.4 Mbps
- Different host sets: Primary and Extended

Primary set with 1.2Mbps (b/w)



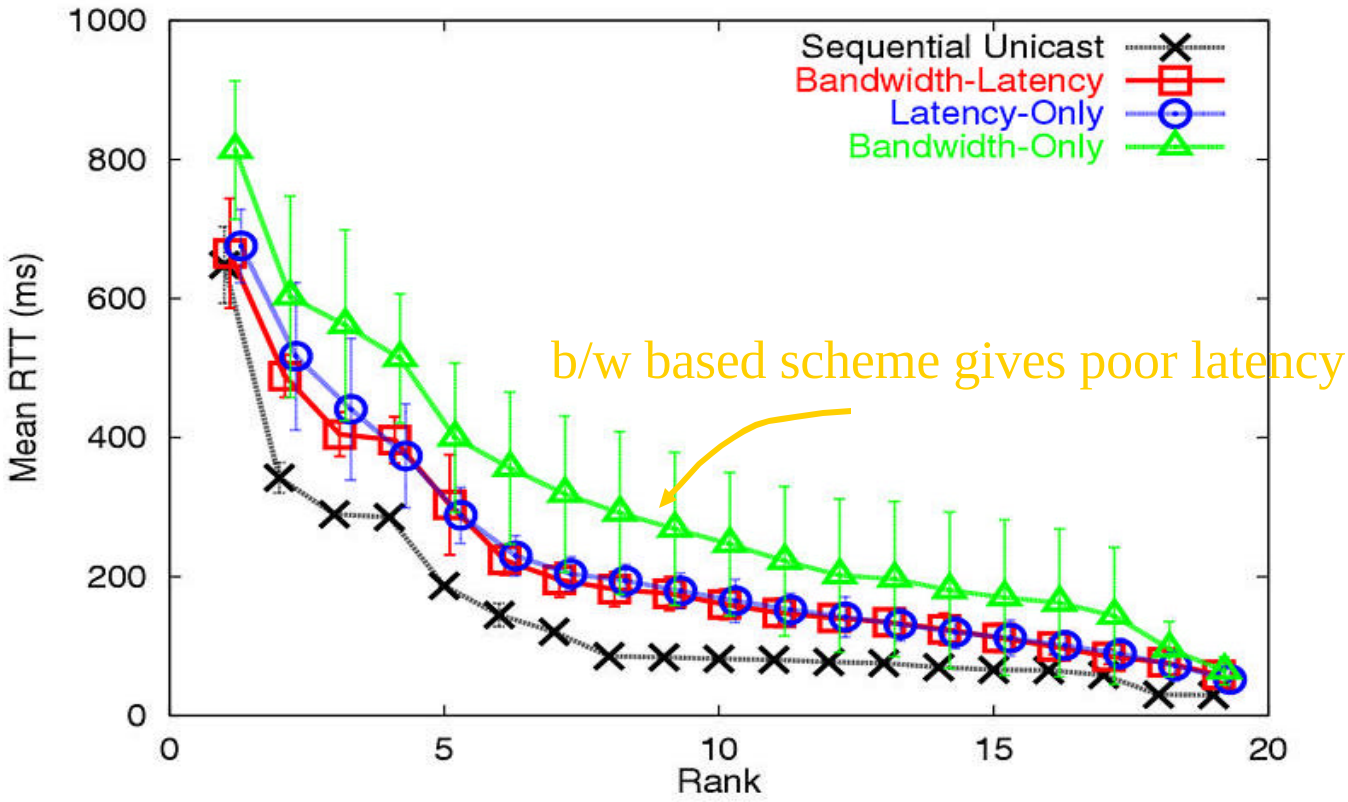
Graph from SIGCOMM presentation

Extended set with 2.4 Mbps (b/w)

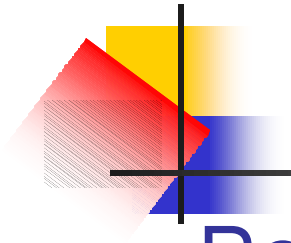


Graph from SIGCOMM presentation

Extended set with 2.4 Mbps (b/w)



Graph from SIGCOMM presentation



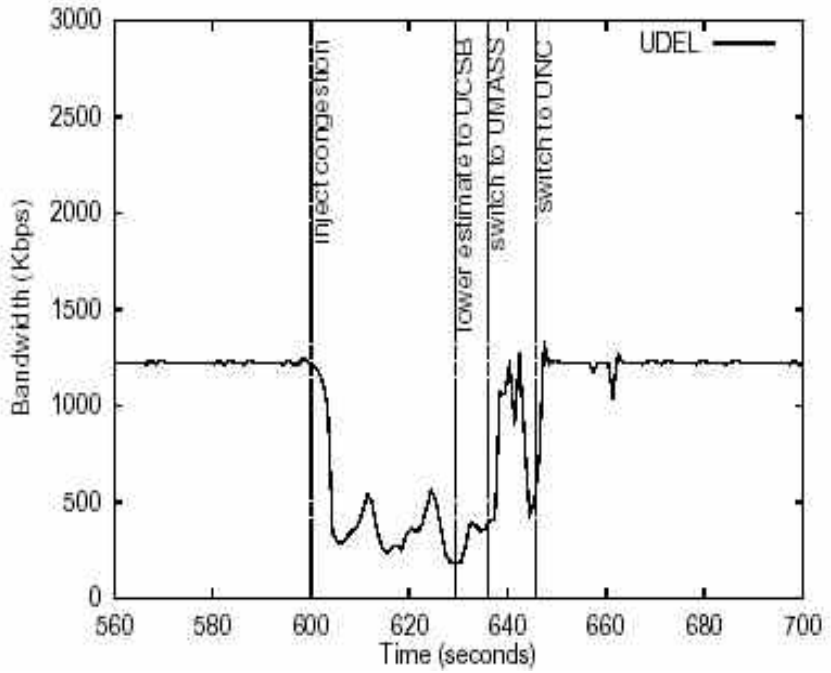
Resource Usage overhead

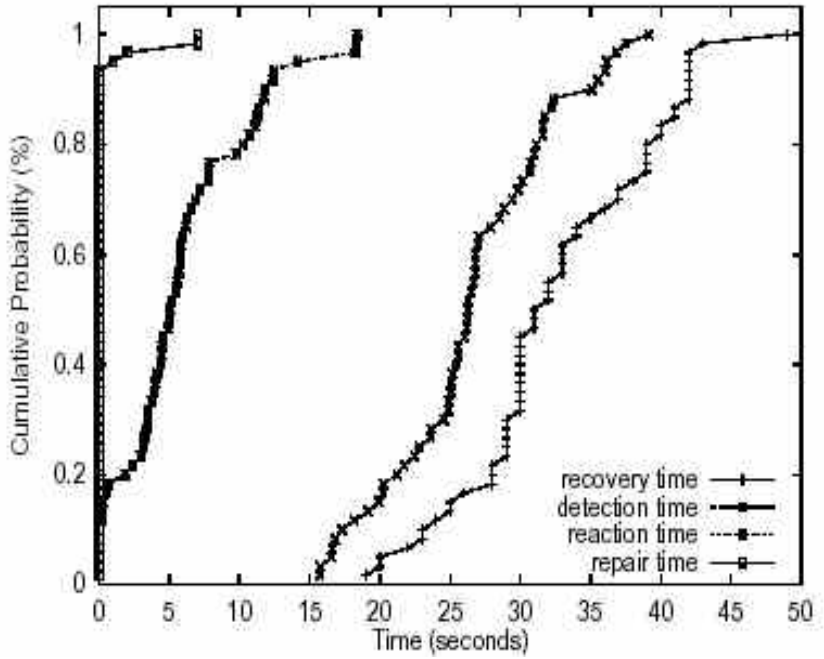
Protocol

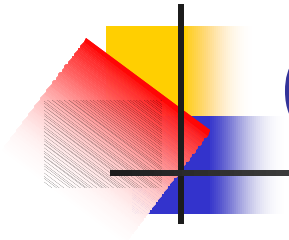
Scheme	Primary 1.2	Extended 2.4
Unicast	2.62	1.83
Random	2.24	1.97
B/w only	1.85	1.51
B/w latency	1.49	1.31

	Primary 1.2	Extended 2.4
Average Overhead	10.79	14.20
B/w probes	92.24	94.30
Other	7.76	5.70

Adaptation to network congestion







Conclusions

- End systems approach to multicast is pretty good.
- Can be easily deployed
- Active networks still easier way to provide multicast functionality and customization for network conditions.