

Overlay Multicast Protocols

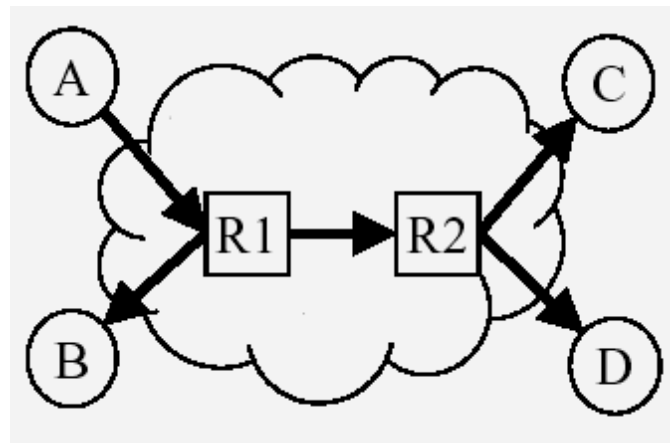
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Agenda

- Introduction
- Overlay Multicasting
- Mesh-first Protocols
- Tree-first Protocols
- Implicit Protocols
- Protocol Comparison
- Challenges
- Conclusion
- Comments

Introduction

- **Multicasting:** sending data to a group of interested receivers
- **IP Multicast:** rely on network layer to replicate and deliver data packets to receivers



A sends to B, C and D

Introduction cont.

- **Advantage:** efficient data distribution
- **Difficulties:**
 - Limited router support
 - Per-group/source state in routers
 - Reliability difficulties
 - Congestion-control difficulties
 - Undefined pricing model
- **Alternative:** application layer multicast, to control and maintain an efficient overlay for data transmission

Overlay Multicasting

- **Performance:**

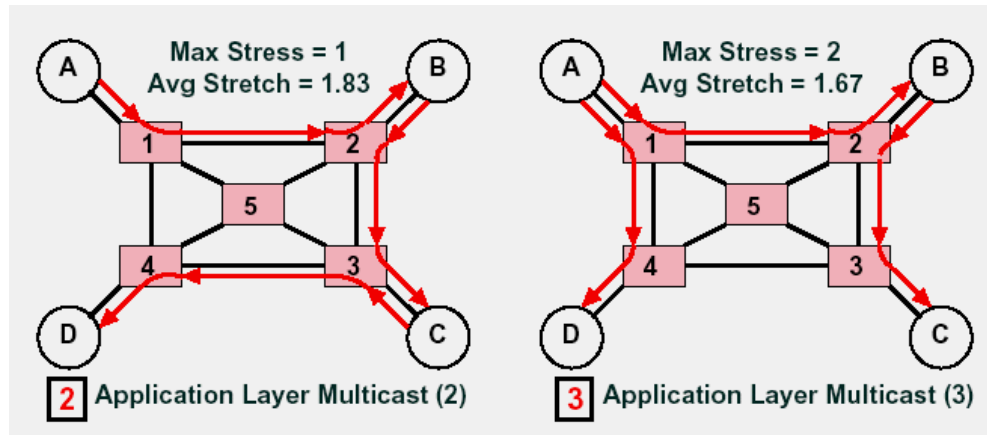
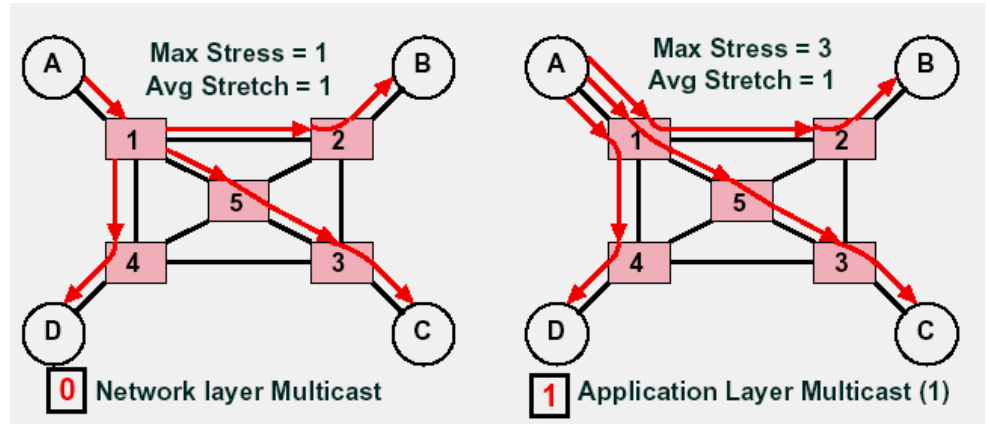
- Stress
- Strain
- Overhead

- **Components:**

- Control topology (*mesh*)
- Data topology (*tree*)
- Control messages

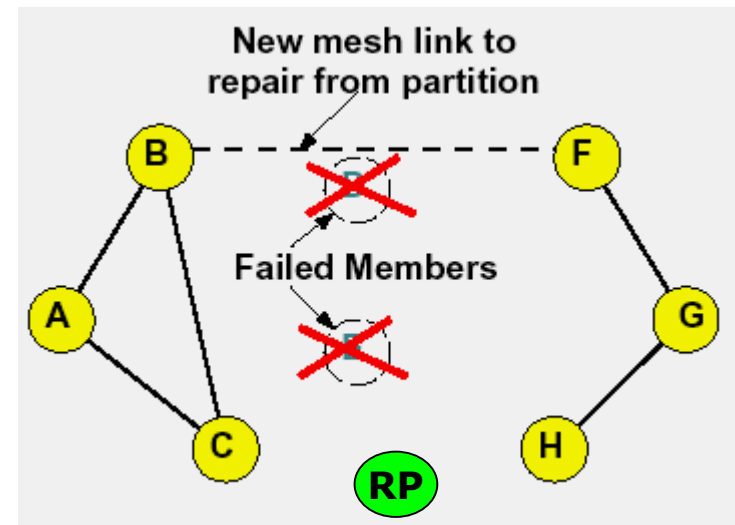
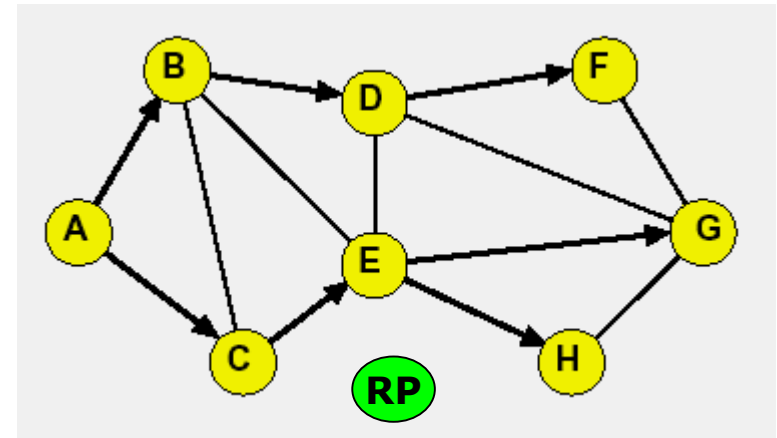
- **Techniques:**

- mesh-first
- tree-first
- implicit



Mesh-first Protocol (NARADA)

- Mesh construction
 - Join:
 - Get group members
 - Select a subset
 - Attempt join then join
 - Send refresh to neighbor
 - Leave/Fail:
 - Detect inactive member
 - Establish new links
- Tree construction:
Run RPF based routing



Tree-first Protocol (HMTP)

■ Tree construction:

■ Join:

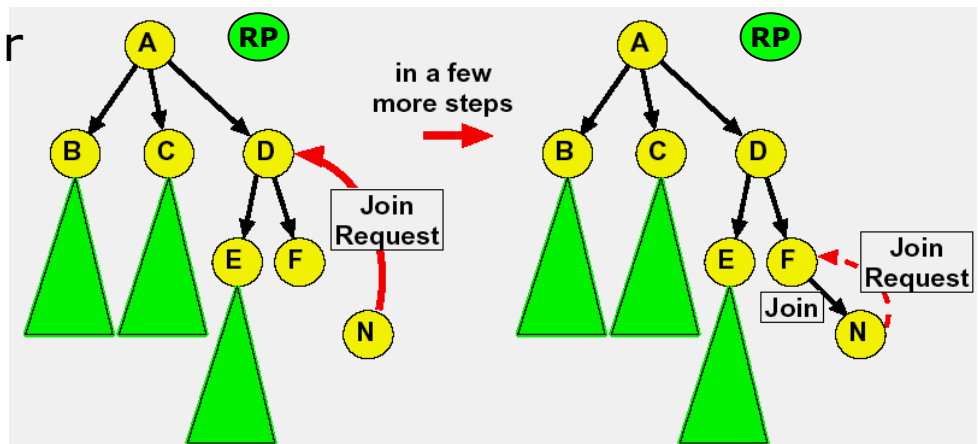
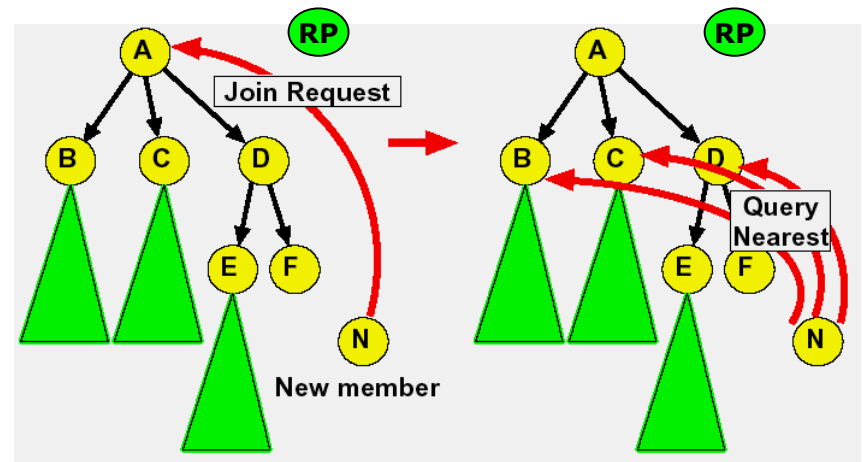
- Get tree root
- Find closest node
- Attempt join then join
- Send refresh to parent

■ Leave/Fail:

- Detect inactive member
- Child finds new parent

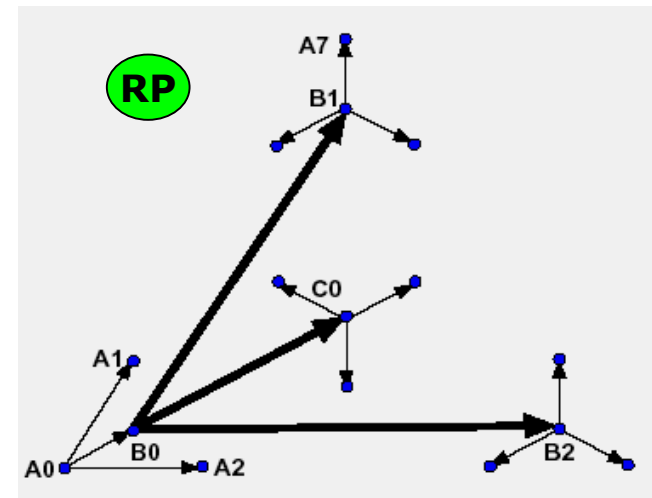
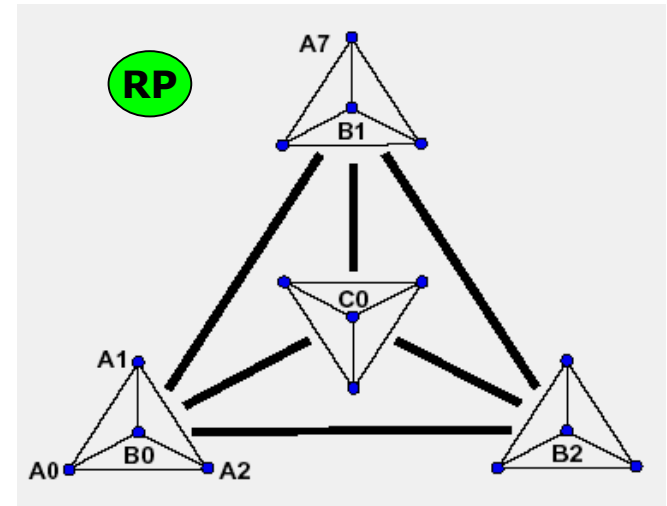
■ Mesh construction:

Periodically discover and cash information about some other members



Implicit Protocol (NICE)

- Organization:
 - Members in layers
 - Member clusters
 - Center cluster leader
 - Cluster leaders in L_i join layer L_{i+1}
- Control:
 - Join closest cluster layer by layer
 - Members of a cluster exchange refreshments
- Data:
 - Source sends to cluster
 - Leader send to other layer leaders



Protocol Comparison

Scheme	Tree Type	Path Length	Tree Degree	Control Overhead
NARADA (mesh-first)	Source	Unbound	Unbound	$O(N)$
HTMP (tree-first)	Shared	Unbound	$O(K)$	$O(K)$
NICE (implicit)	Source	$O(\log N)$	$O(\log N)$	Constant

Group	Mean Stress mean / max	Mean Stretch mean / max	Control Overhead mean / max
32	1.85 / 8.0	1.08 / 1.61	0.84 / 2.34
64	1.73 / 8.0	1.14 / 1.67	0.77 / 2.70
96	1.86 / 9.0	1.04 / 4.63	0.73 / 2.65

Conclusions and Challenges

- Conclusions:
 - Overlay Multicast is readily deployable
 - Acceptable performance
- Challenges:
 - Addressing and advertisement
 - Path quality measurement
 - Tree refinement
 - Failure recovery
 - Reliable overlay multicast

References

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- **Host Multicast: A Framework for Delivering Multicast to End Users.** B. Zhang, S. Jamin and L. Zhang. In IEEE INFOCOM'02.