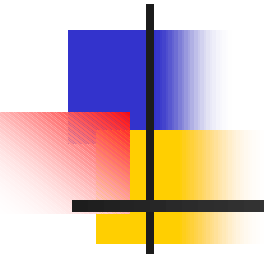


# End System Multicast: Implementation & Simulation



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School of Computing



# Project Target

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- End system multicast protocol design
- Prototype implementation
- System Simulation using NS-2



# Road Map

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- Background & Motivation
- End System Multicast Protocol Design
- Prototype Implementation
- NS-2 Simulation
- Conclusion
- Reference

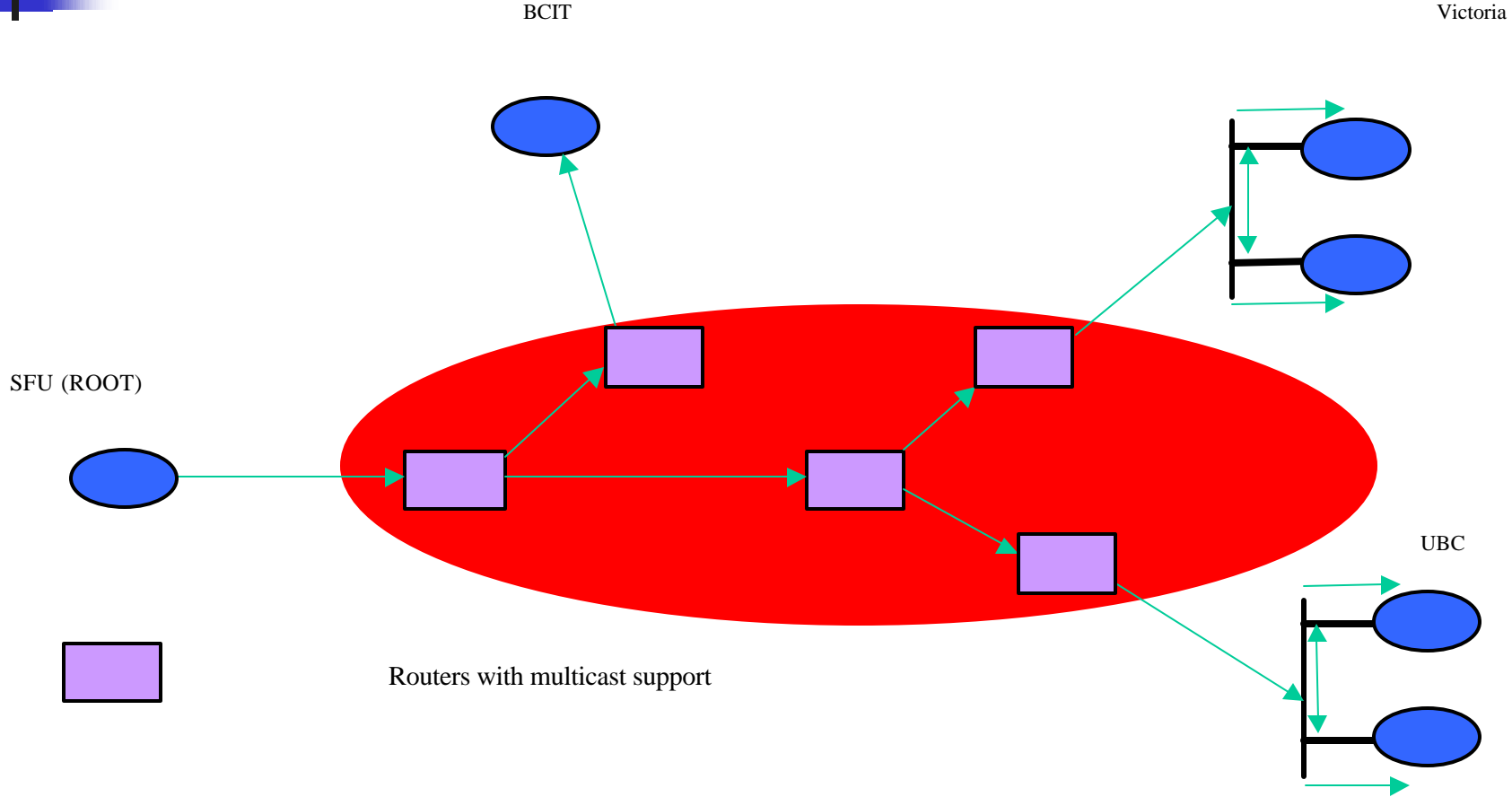


# What is IP Multicast?

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- Enables one copy of the same data send to multiple computers simultaneously
- Group address is used

# Why use Multicast?



**Significant bandwidth savings !**



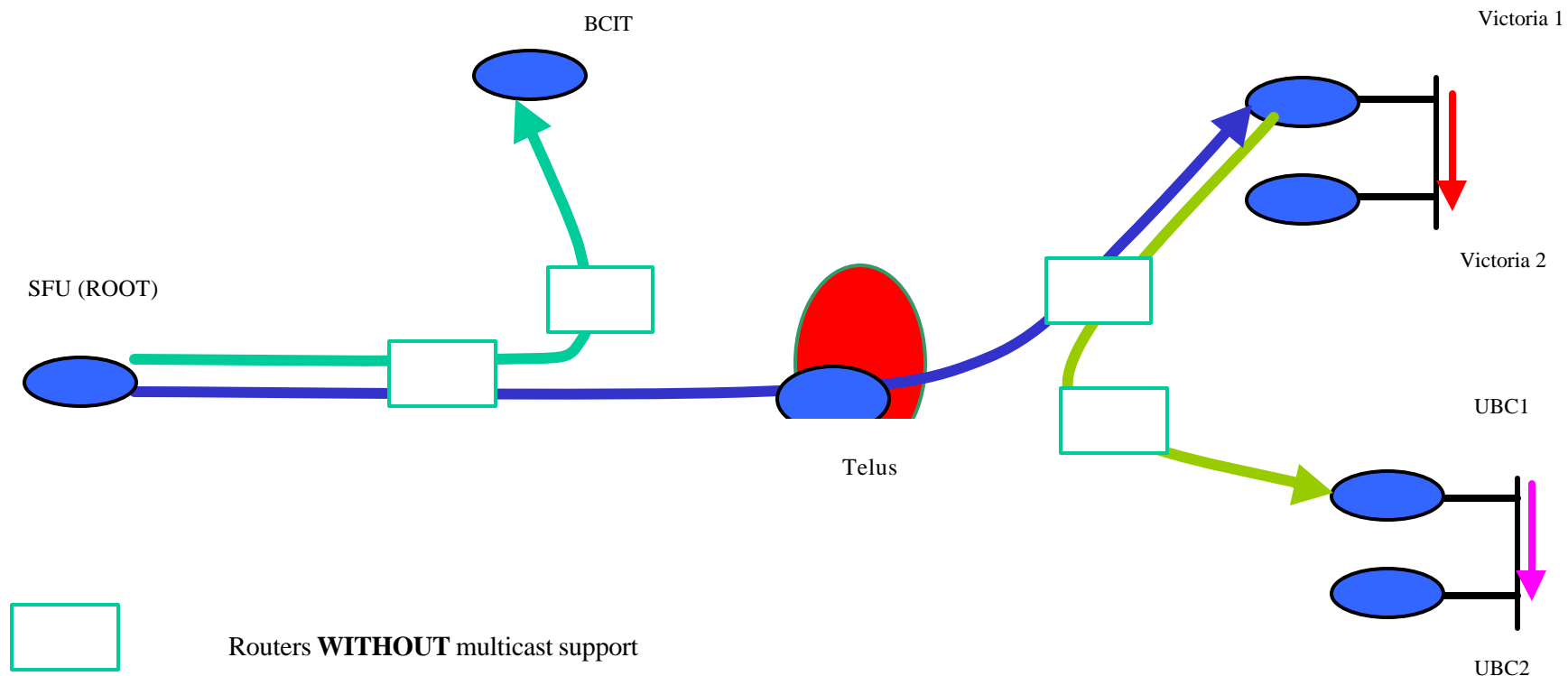
# Disadvantage?

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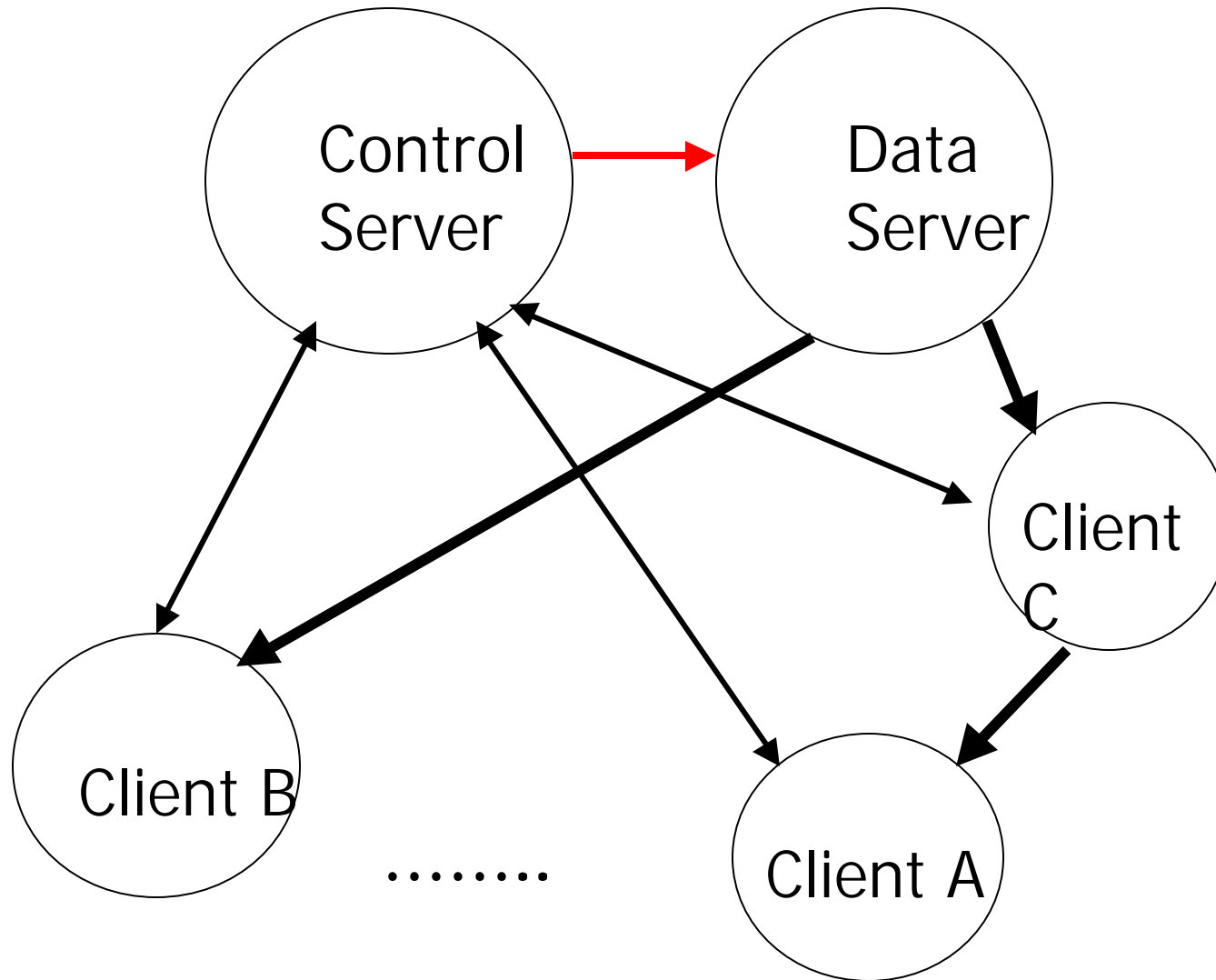
- Need commercial routers supporting multicast protocol
- Prevent multicast service fully applying in internet application

# What can we do?

- Try to explore an alternative architecture!
- Building a system on top of the unicast services with multicast functionalities!

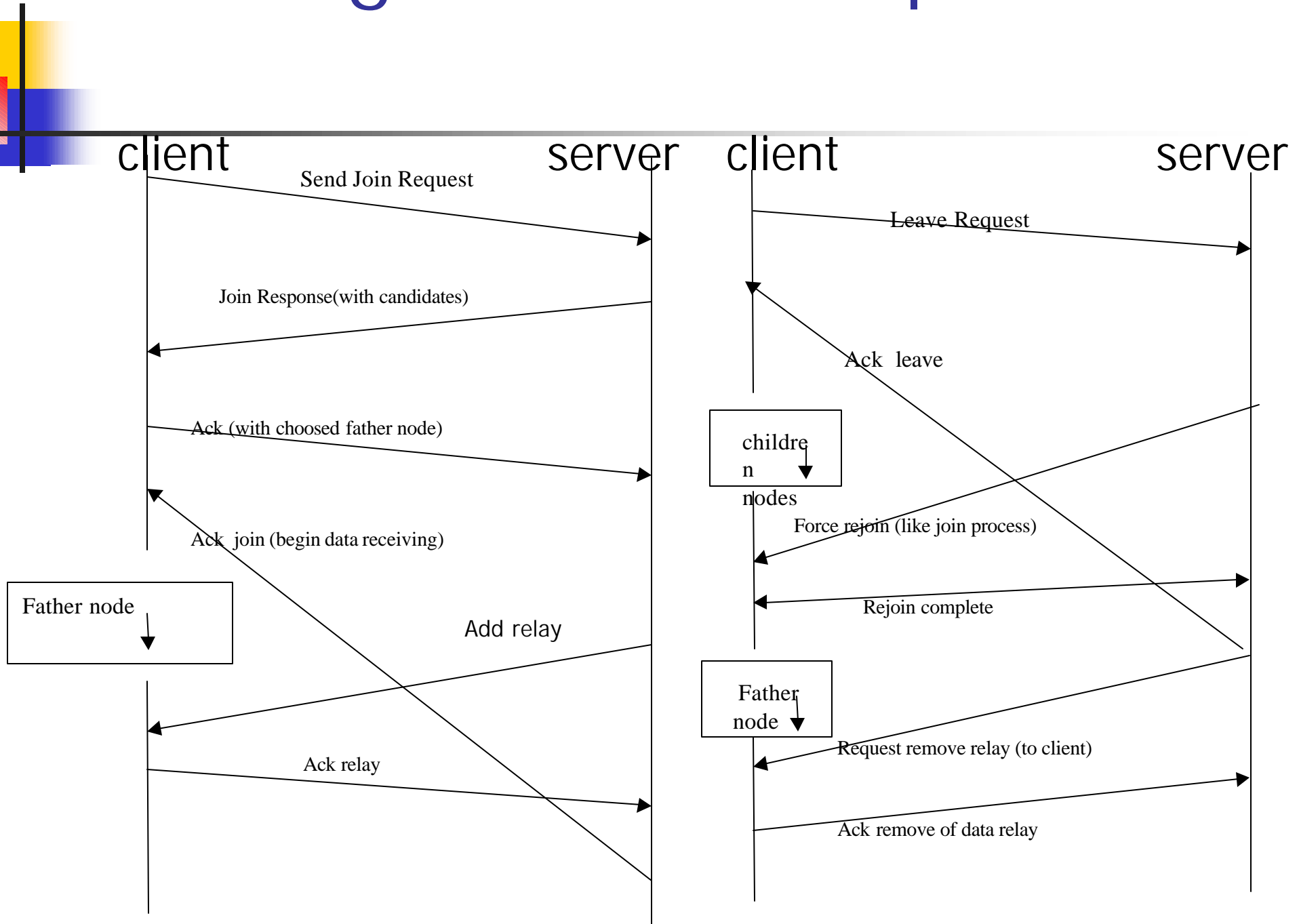


# End System Multicast Design

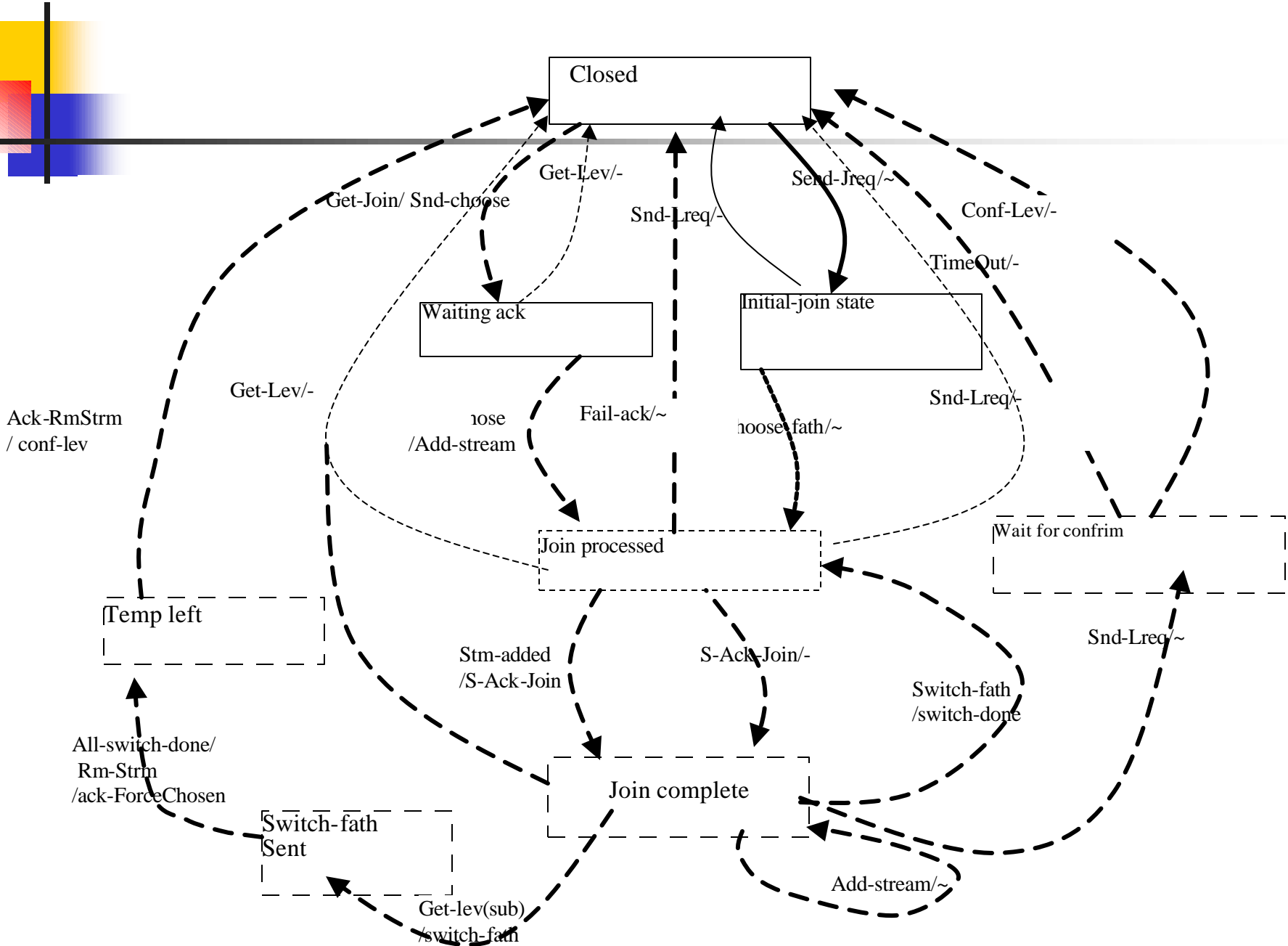




# Leaving and Join Sequence



# Protocol State Machine



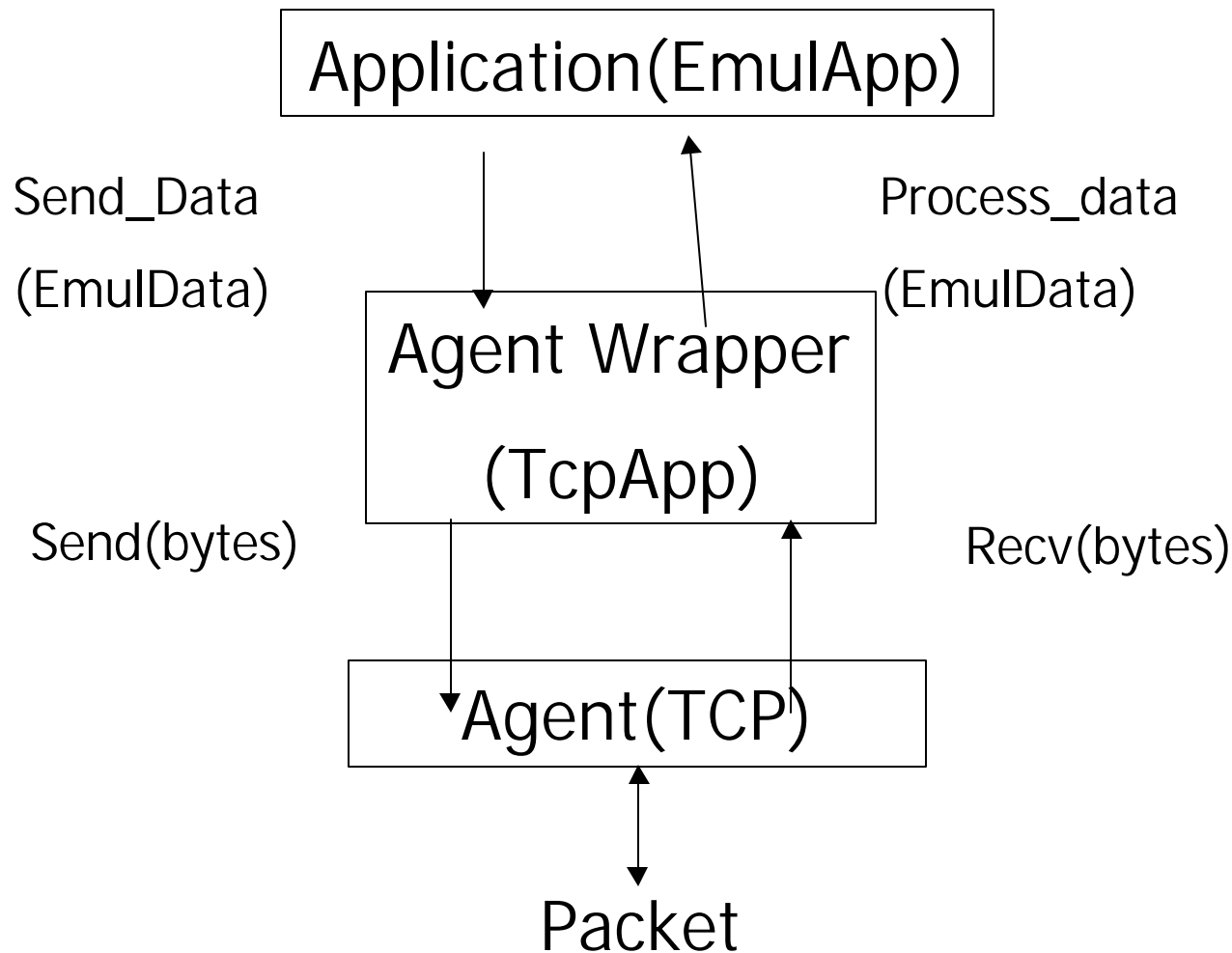


# End System Multicast Implementation & Simulation

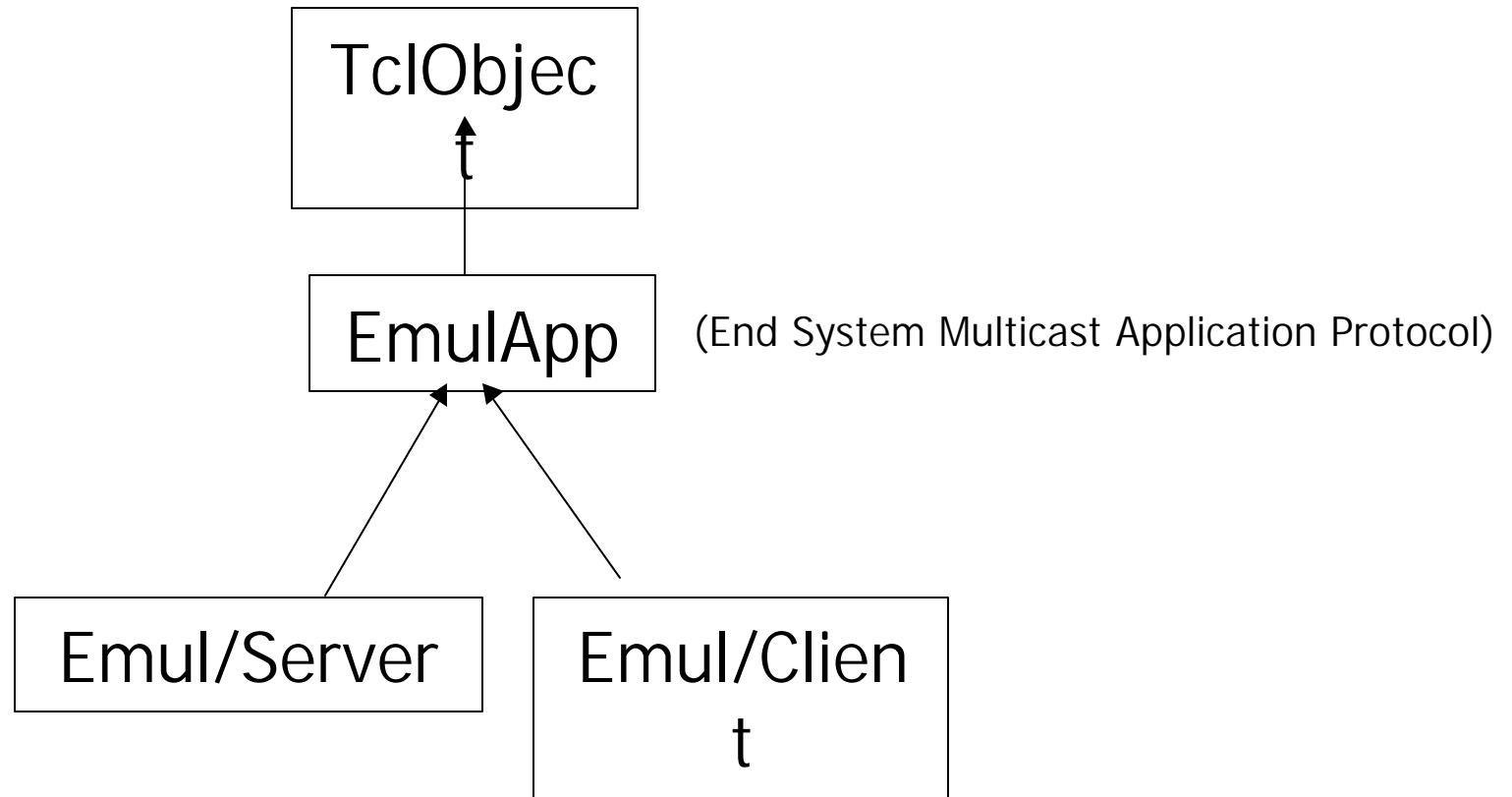
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- Stand alone Implementation
  - To demonstrate the end system multicasting function, video streaming is used as the data source to show that each relay and leaf nodes in the tree structure receiving and play the same video image at the same time
  - Java, C++

# Application Protocol Simulation using TcpApp in NS-2

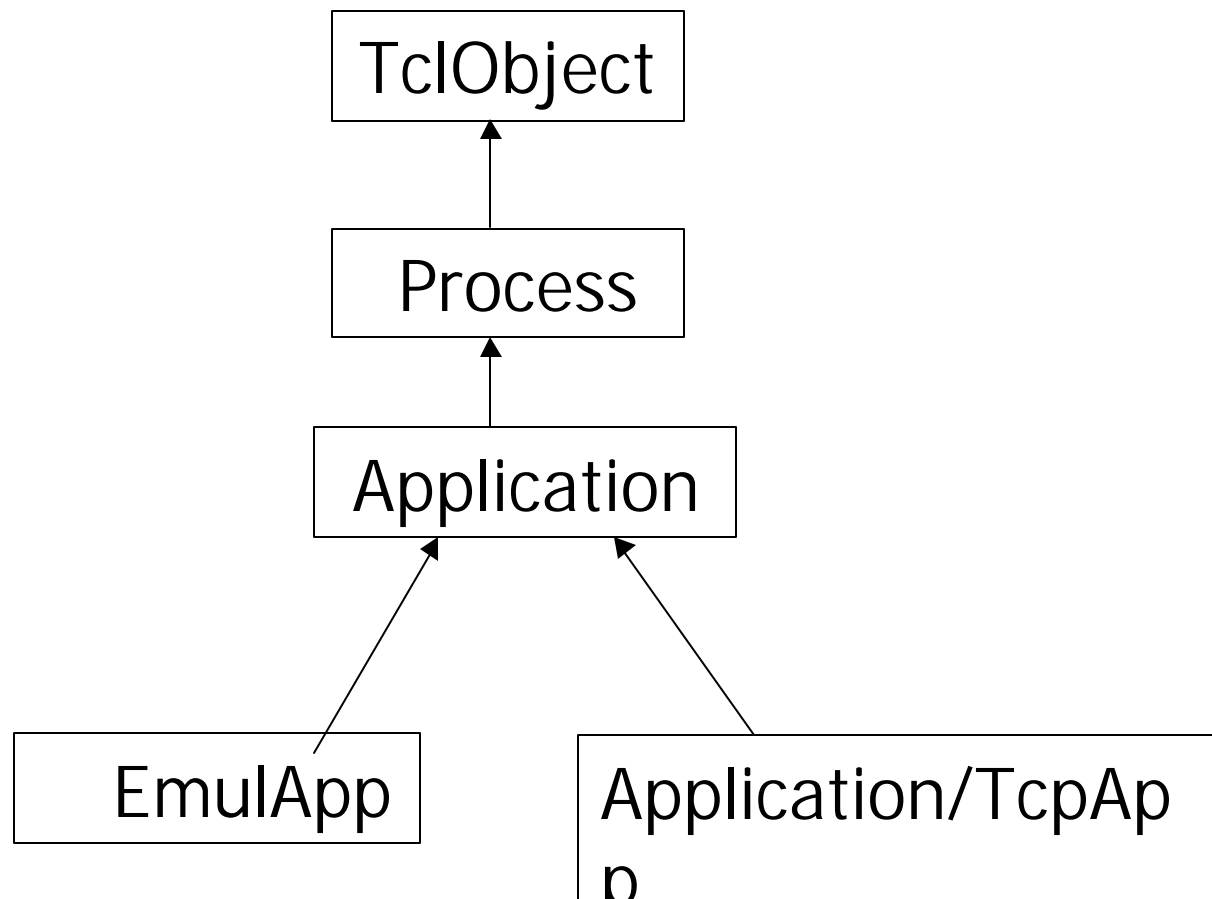


# Class Hierarchy of End System Multicast Application Protocol



# Hierarchy of classes related to EmulApp data handling

- Hierarchy of classes relate to EmulApp data handling



# Joining process simulation in NS-2

**Tcl Object: Emul/Client**

**Tcl Object: Emul/Server**

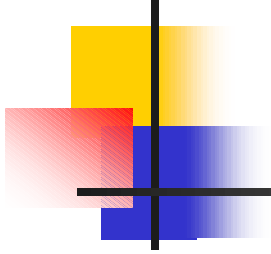
\$client send-Jreq \$server → \$server get-join \$self \$server

\$client choose-father \$candidates ← \$server ack-join \$self \$father

\$father add-stream \$child

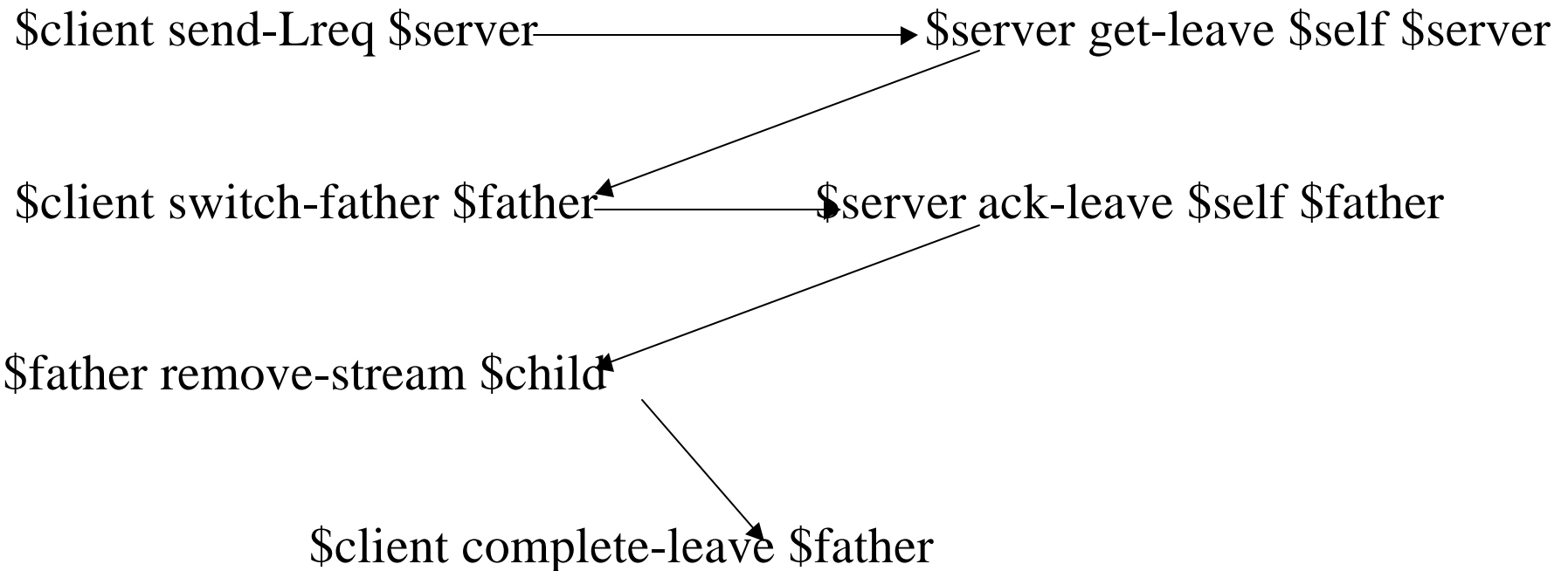
↓  
\$client complete-join \$father

# Leaving Process Simulation in NS-2



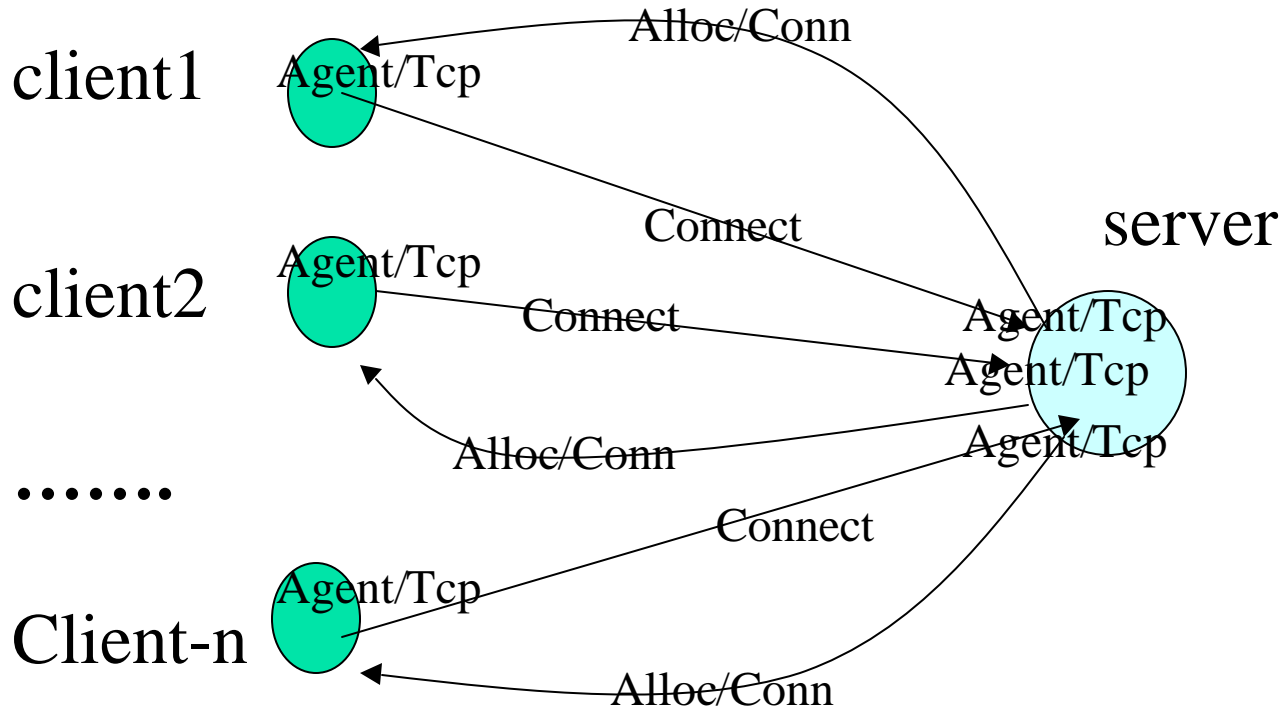
**Tcl Object: Emul/Client**

**Tcl Object: Emul/Server**



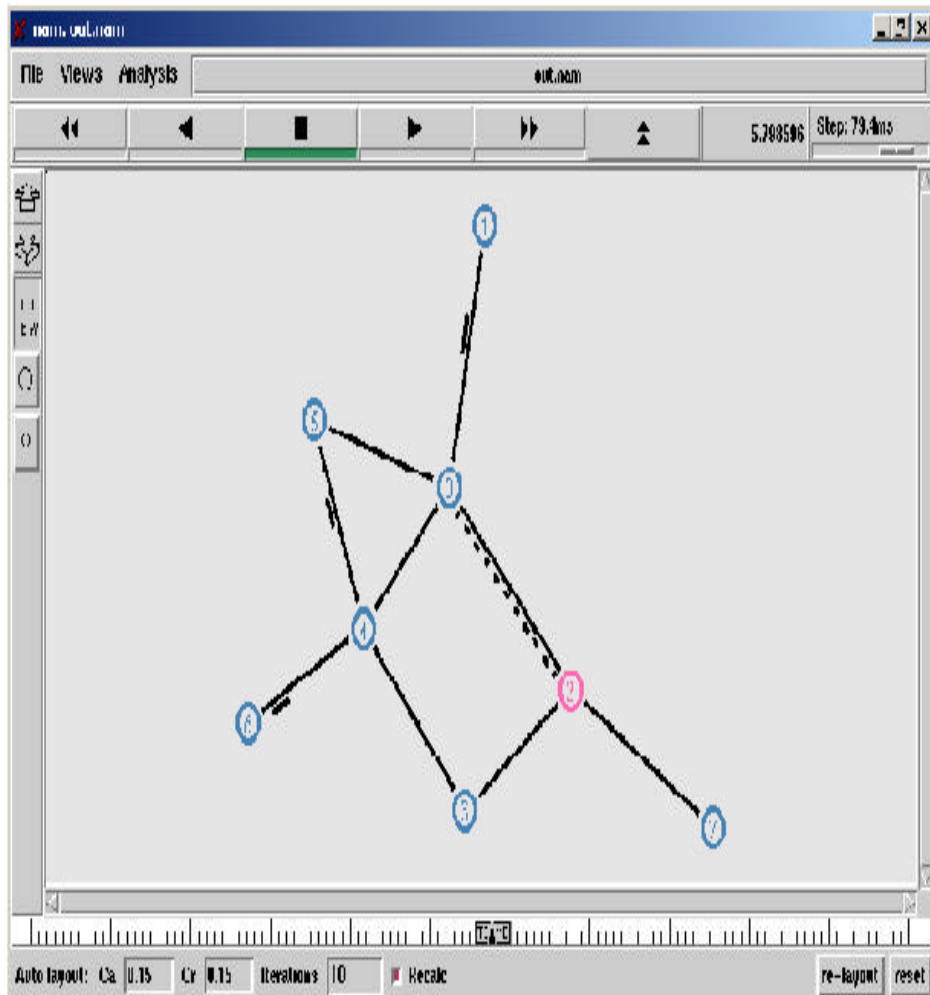


# Connection Allocation Process in NS-2

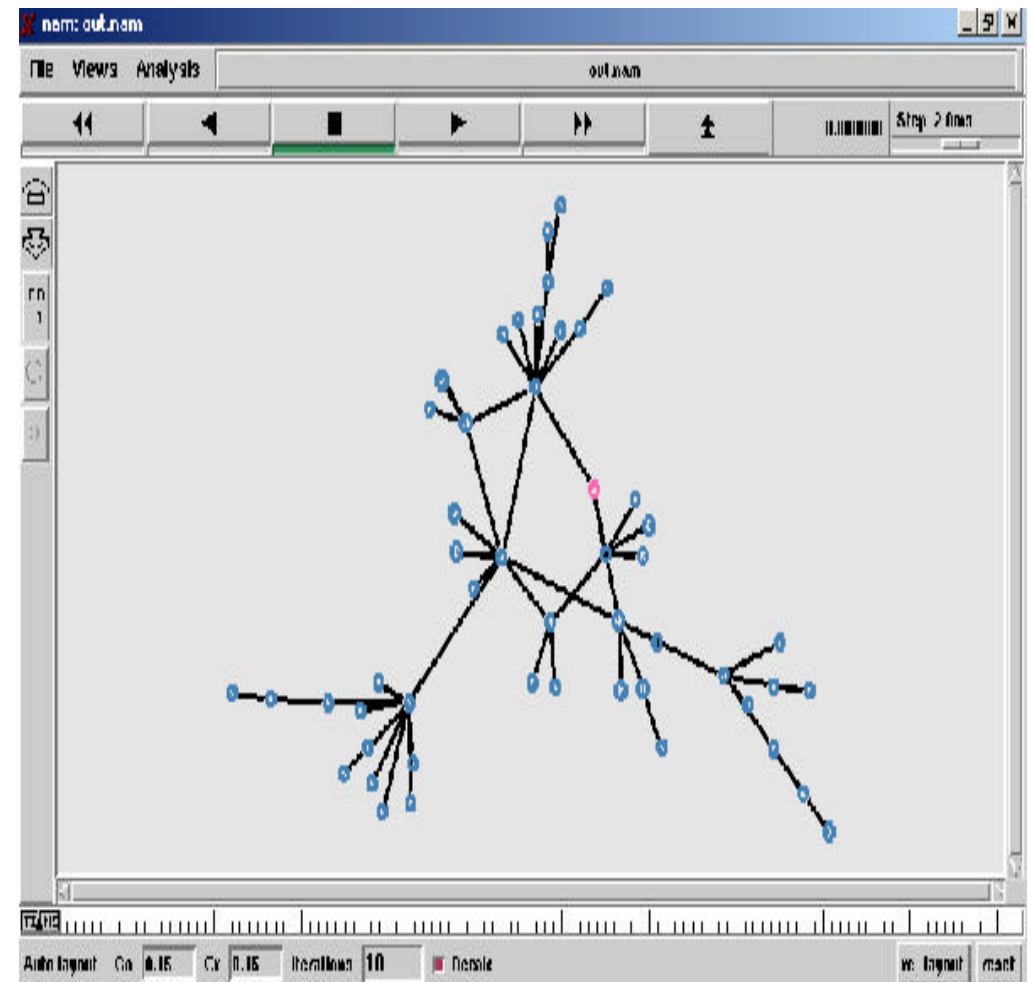


# Simulation Topology in NS-2

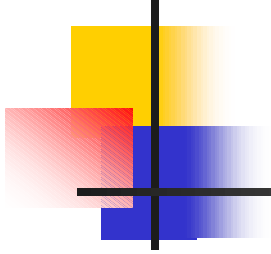
8 nodes



50 nodes



# Delay time for different bandwidth simulation in each link



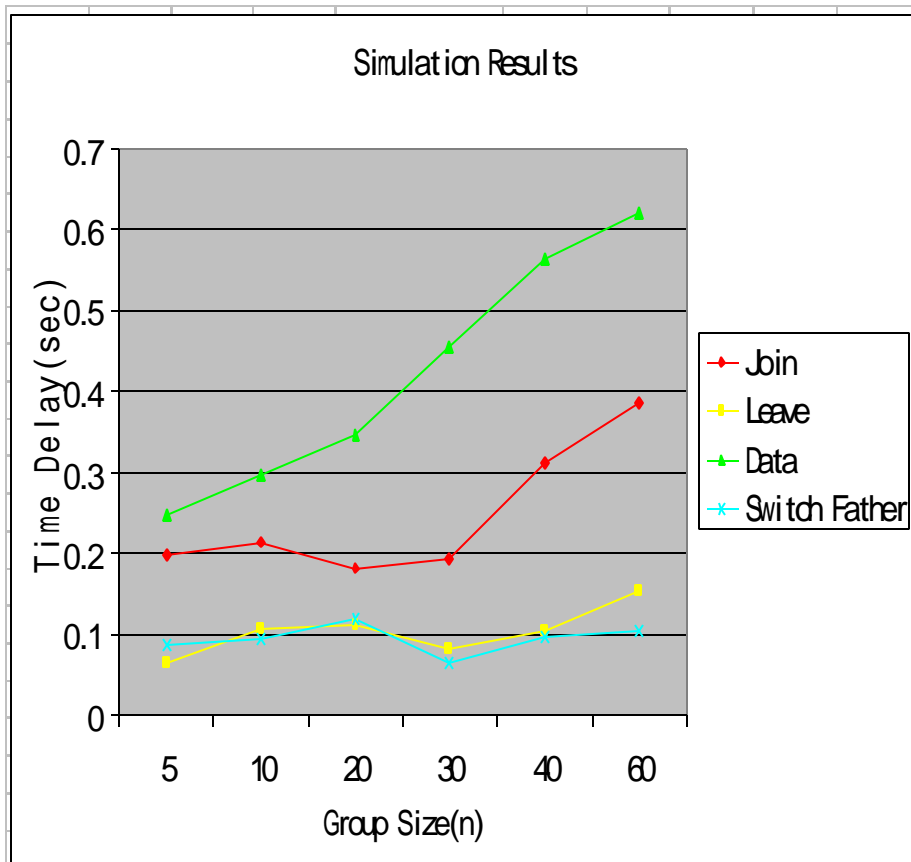
Top(n): topology with n nodes. Time: seconds

Packet size: 500bytes, burst time: 1 sec., idle time: 0.5sec. Traffic rate: 2Mb/sec

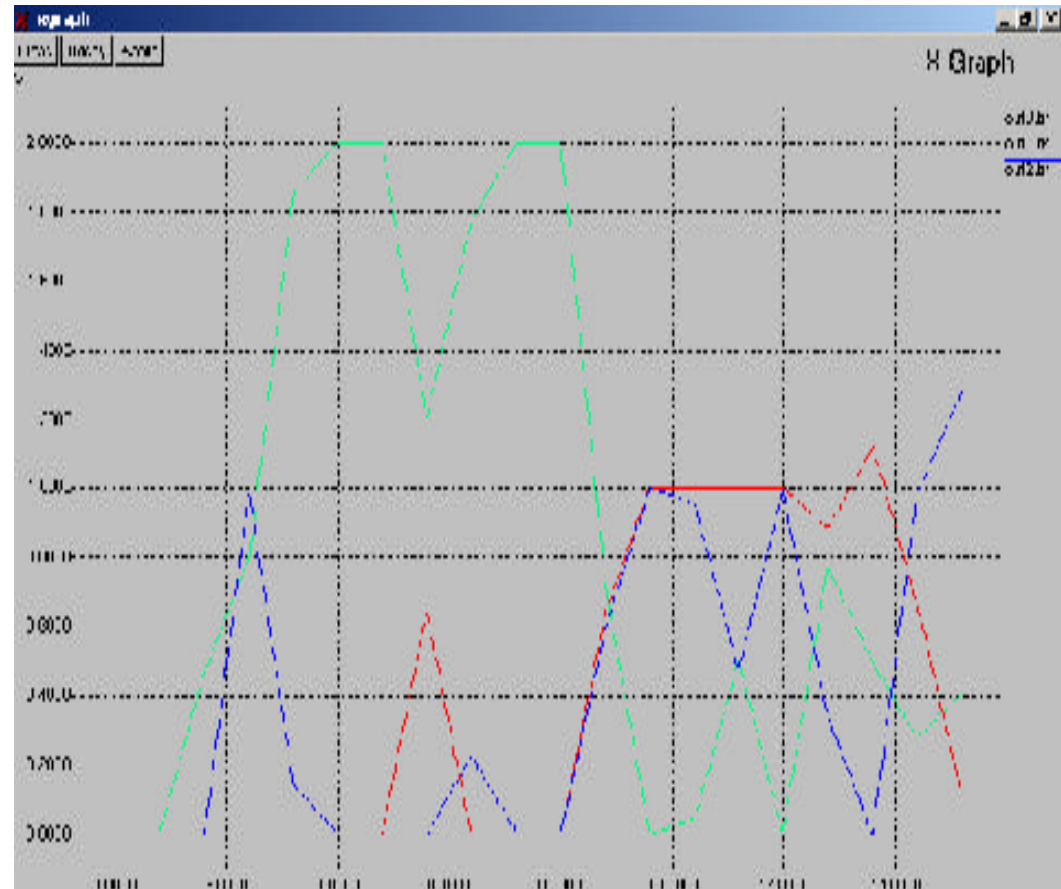
Top	Bandwidth	Delay	Bandwidth	Delay	Bandwidth	Delay	Bandwidth	Delay
Top(2)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(3)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(4)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(5)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(6)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(7)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(8)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(9)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000
Top(10)	1000000	0.000000	1000000	0.000000	1000000	0.000000	1000000	0.000000

# Time Delay and Flow Rate

## Sample Results of Time Delay and Flow Rate



MB/secs



running time (sec)



# Conclusion

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- End system multicast is feasible, especially for sparse, medium size groups
- This Simulation can be contributed to NS-2 as an application protocol
- Further work can extend to distributed control system and dynamic topology



# Reference

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- [6]Backbone (MBONE).” <http://www.cs.columbia.edu/~hgs/internet/mbone-faq.html>

Thank you!

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