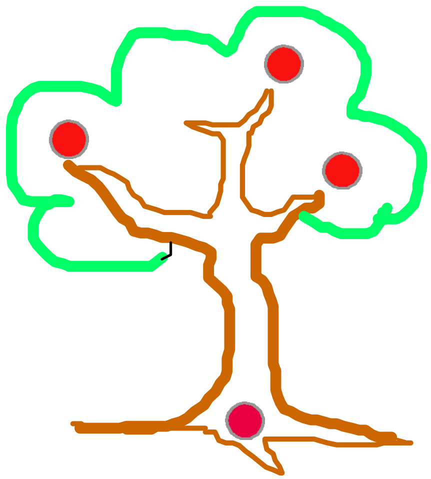
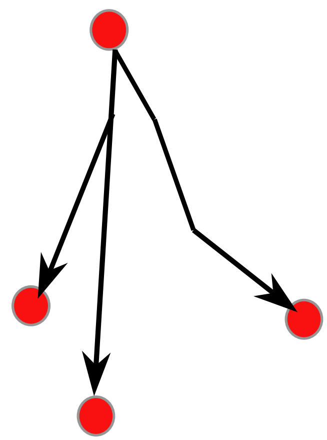
QoSMIC: a Quality Of service Sensitive Multicast Internet protoCol



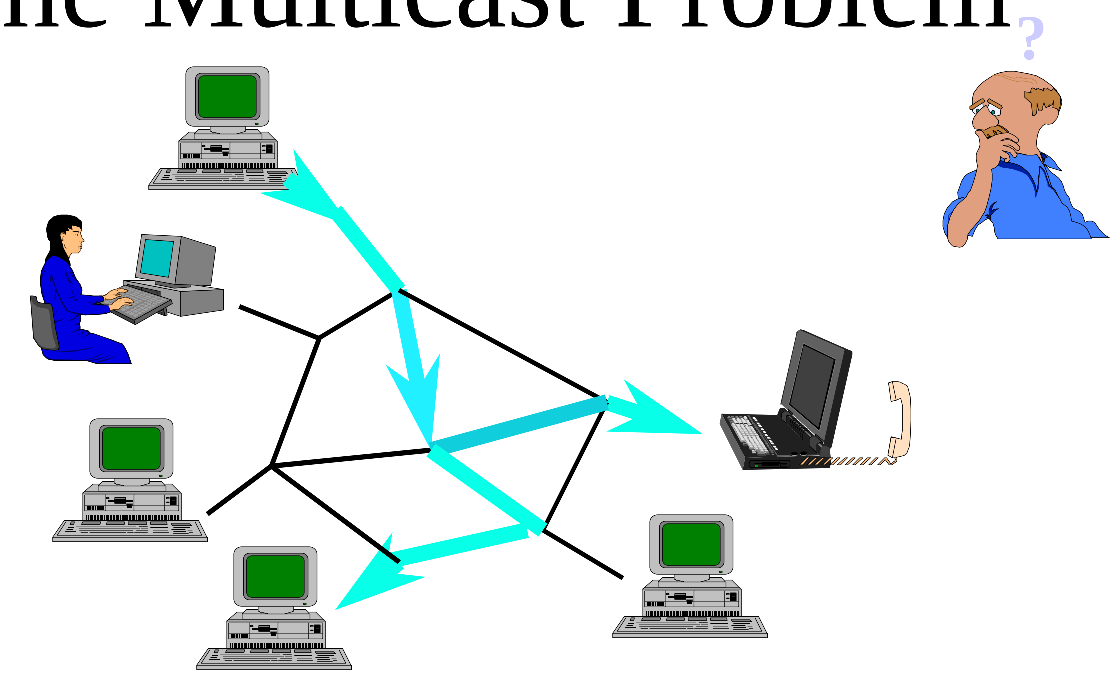


Michalis Faloutsos (U. Toronto/U.C. Riverside)

Anindo Banerjea (U. Toronto)

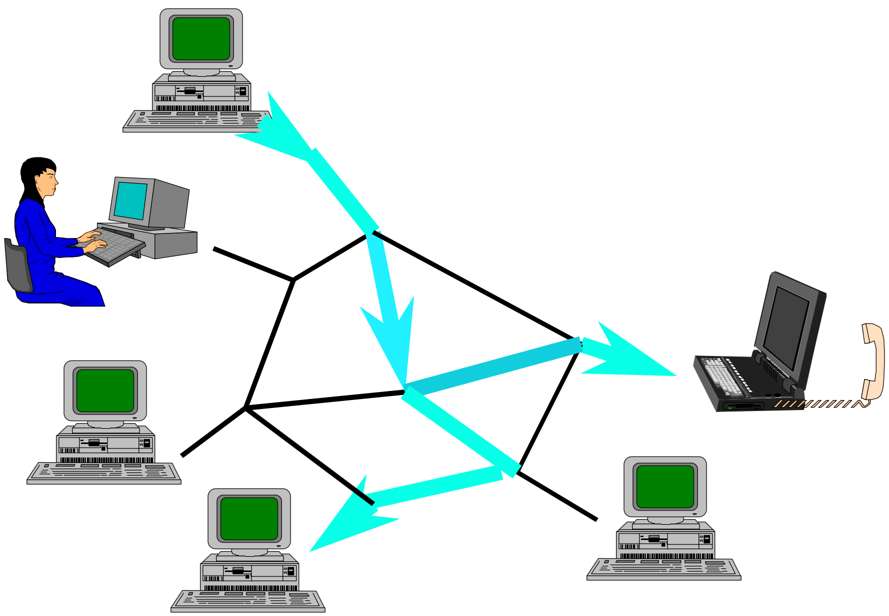
Rajesh Pankaj (QUALCOMM)

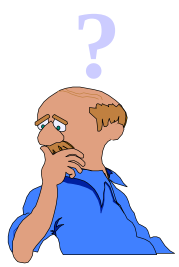
The Multicast Problem



- GIVEN: Network
- GIVEN: User Requests and quality requirements
- FIND: Efficient distribution trees

Quality of Service





- QoS metrics: end-to-end delay, video quality
- Commercial applications need QoS guarantees

Motivation

- Modern applications:
  - Tele-conferencing
  - Tele-education
- Gain resources: 40% bandwidth
- Highly active research area

The Rest of This Talk

- Previous Multicast Protocols
- QoSMIC
- Conclusions

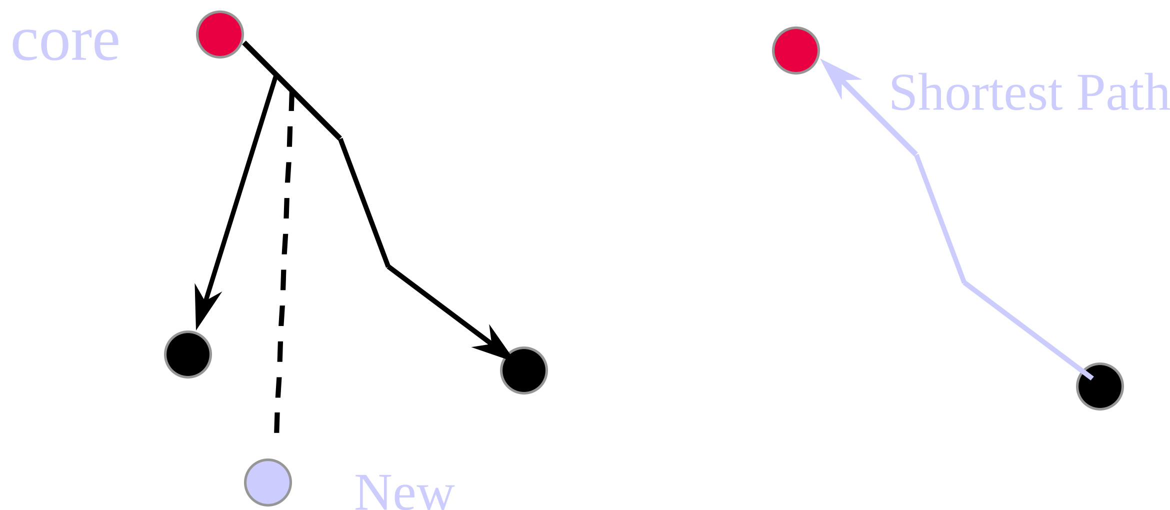
What is the Internet like?

- Packet switching
- Best-effort approach
  - route selection without considering QoS
- Distributed environment

Desirable Protocol Properties

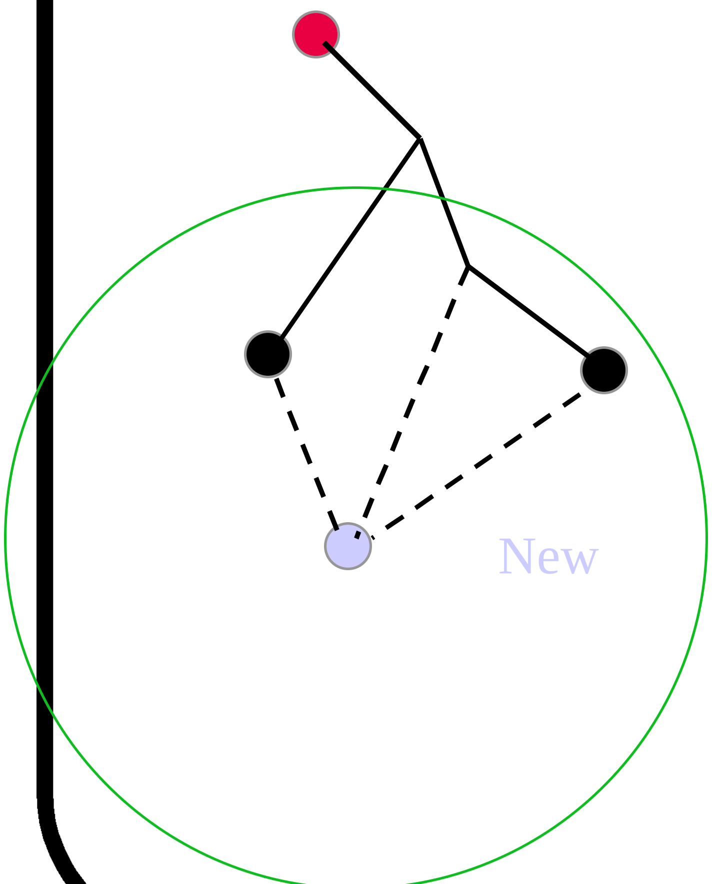
- **Support QoS**
  - Alternate paths
  - Dynamic routing information
- Scalable
- Create efficient trees
- Adaptive - Flexible

Current Protocols: BGMP

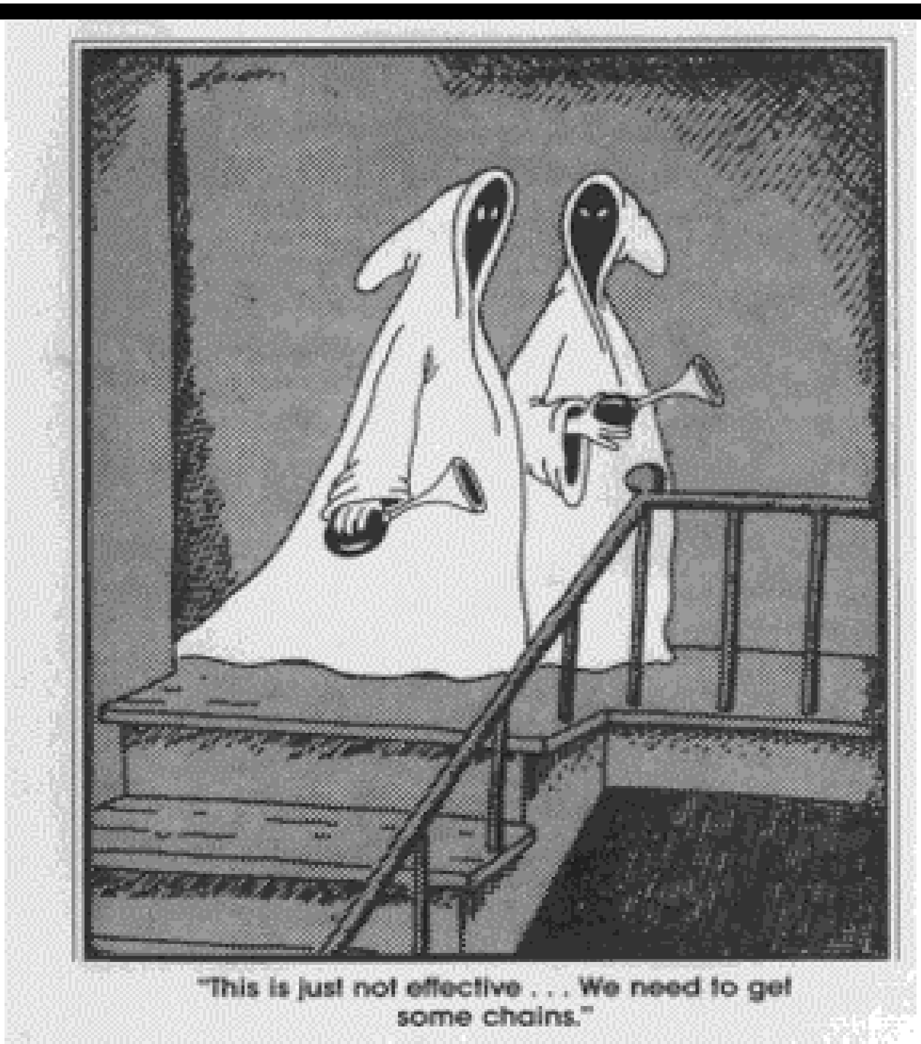


- Border Gateway Multicast Protocol [Thaler 97]
  - **No QoS support**
  - **Reverse** Shortest Paths Routing

Current Protocol: YAM



- Yet Another Multicast protocol [Carlberg97]
- Multiple paths
- Use of **static information**
- **Non scalable**:
  - “flood” of control messages

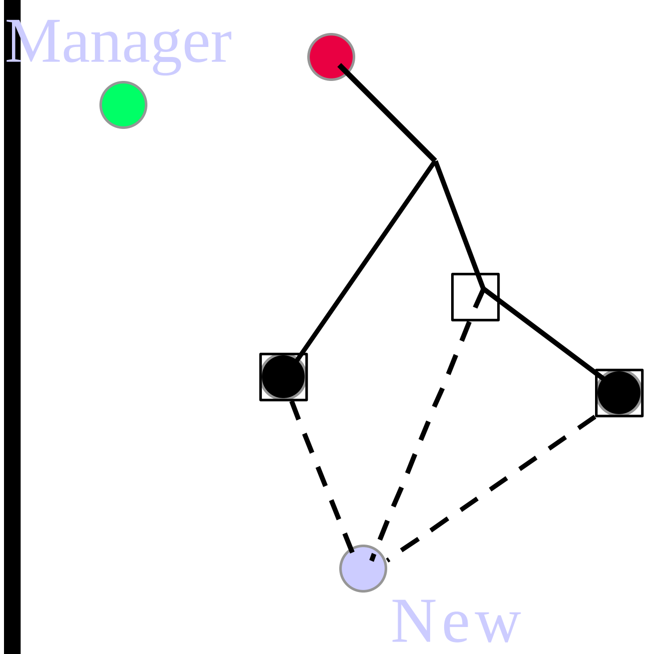


"This is just not effective…We need to get some chains"

Our Protocol: QoSMIC

- QoS Multicast Internet protoCol
- Supports QoS
- Uses dynamic information
- Scalable

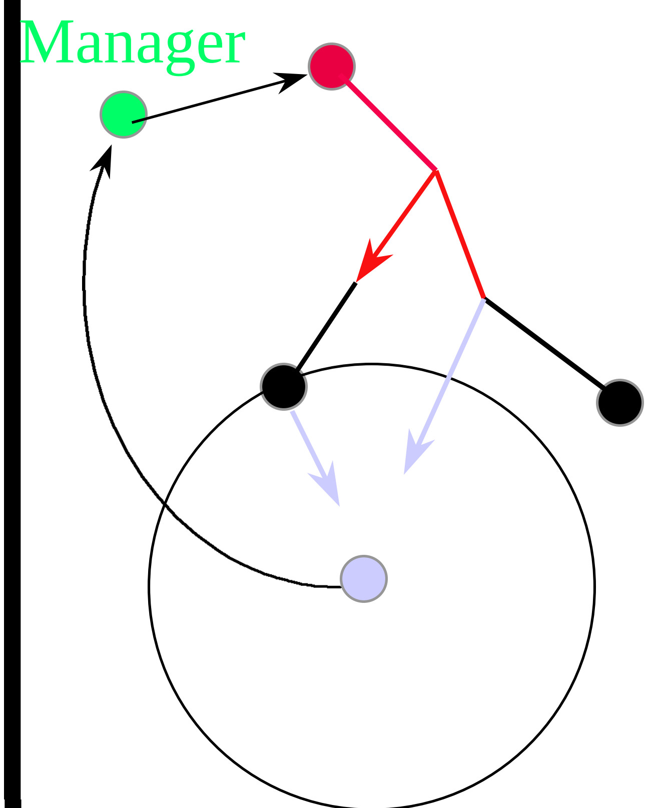
QoSMIC: The Overview



- Manager Router

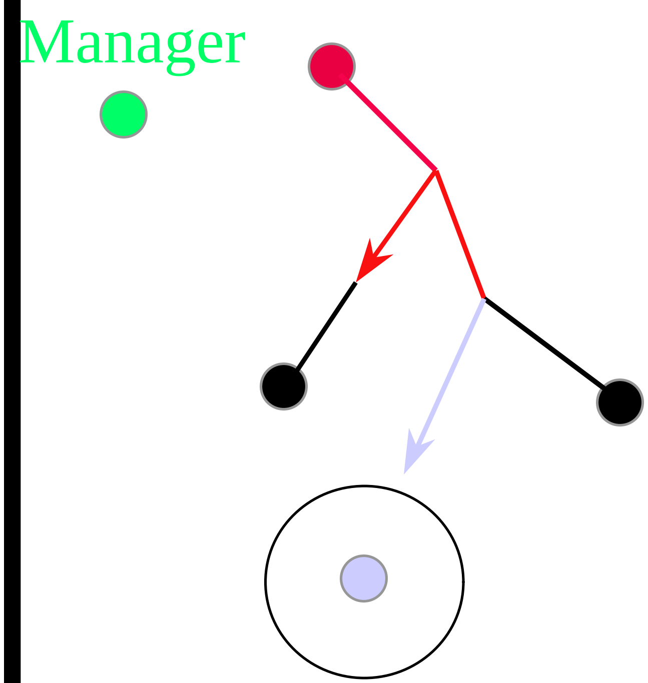
1. **Search:** for Candidates
2. **Bid:** Candidates “Bid”
3. **Select:** New chooses path
   - using dynamic QoS info.

QoSMIC: Search and Bid



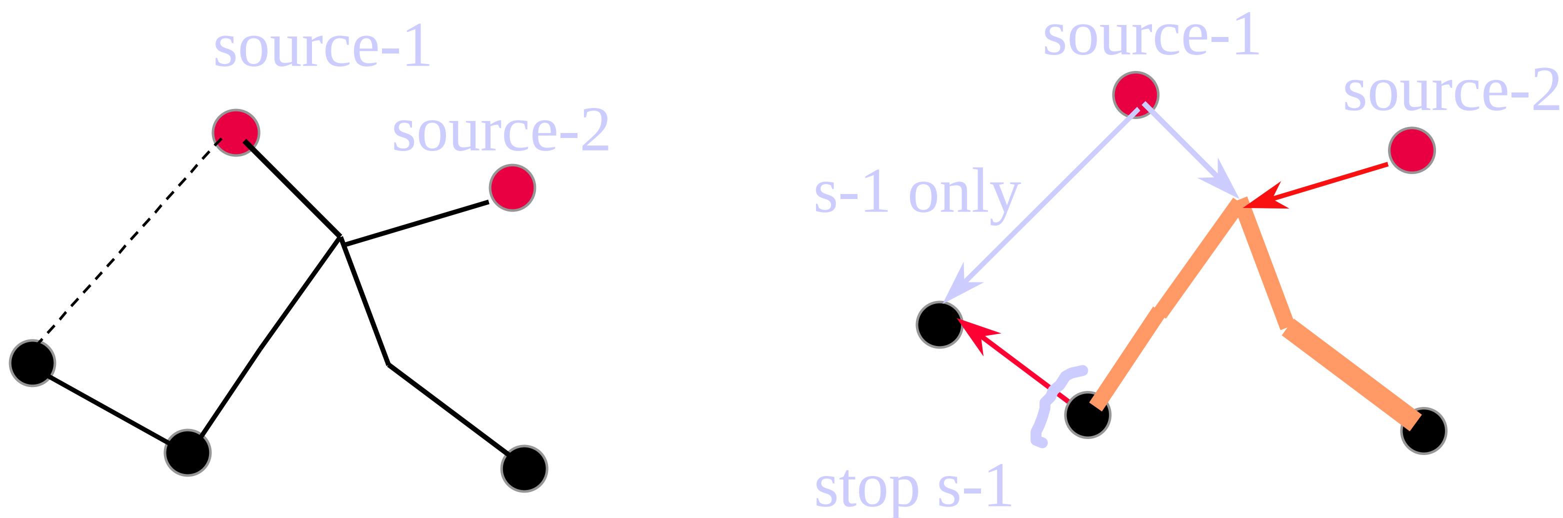
- I. Local Search (costly)
- II. Multicast Tree Search
- Bid messages collect
  dynamic information

QoSMIC: Flexible-Adaptable



- In Searching:
  - Local and/or M. Tree Search
- In Routing:
  - Greedy and/or Short. Paths
- In run time according to application needs

QoSMIC: More QoS support



- Multiple sources per group
- Connect directly to the source to improve end-to-end QoS

Simulation Goals

- Compare routing efficiency with BGMP
  - Tree cost = Sum of link-weights
- Compare message complexity with YAM
  - Number of control messages of search phase

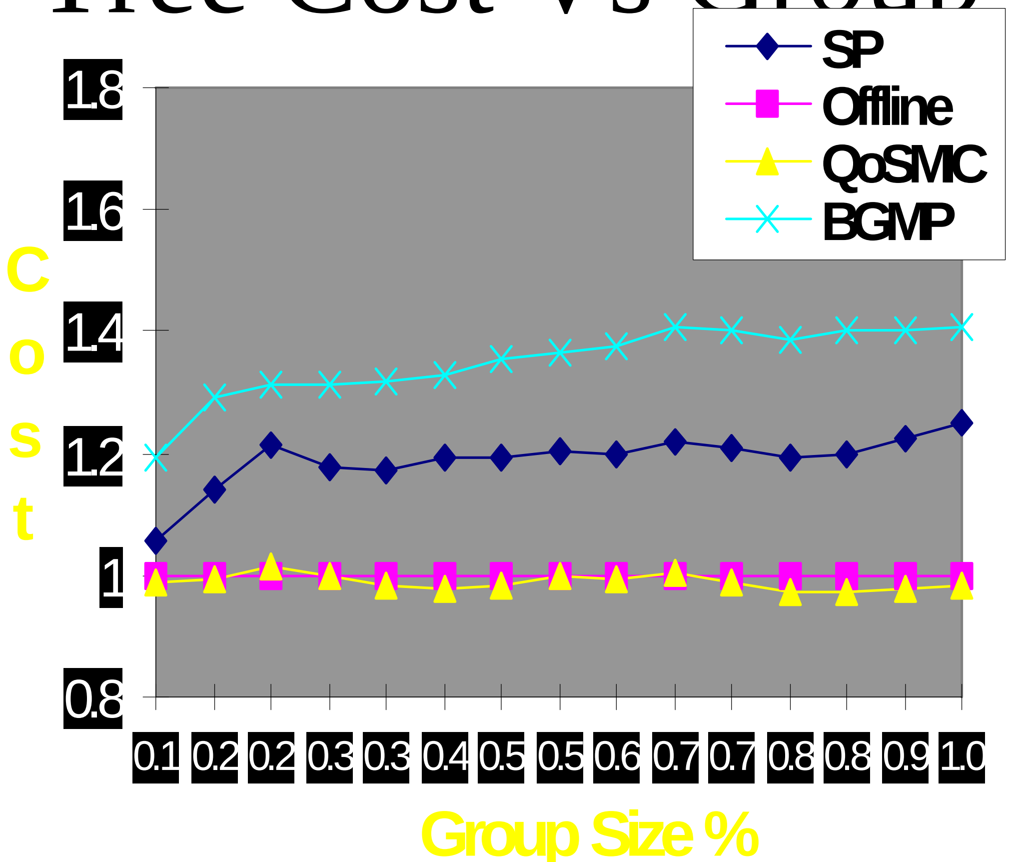
Doing the Simulations

- Build a simulator
- Real Graph: Major Internet routers [Casner93]
- Weighted asymmetric graph
- Simulation Precision:
  – 95%-confidence interval <10% of shown values

The Simulated Algorithms

- Offline: greedy for reference
- SP: Shortest Paths
- BGMP: Reverse Shortest Paths
- QoSMIC

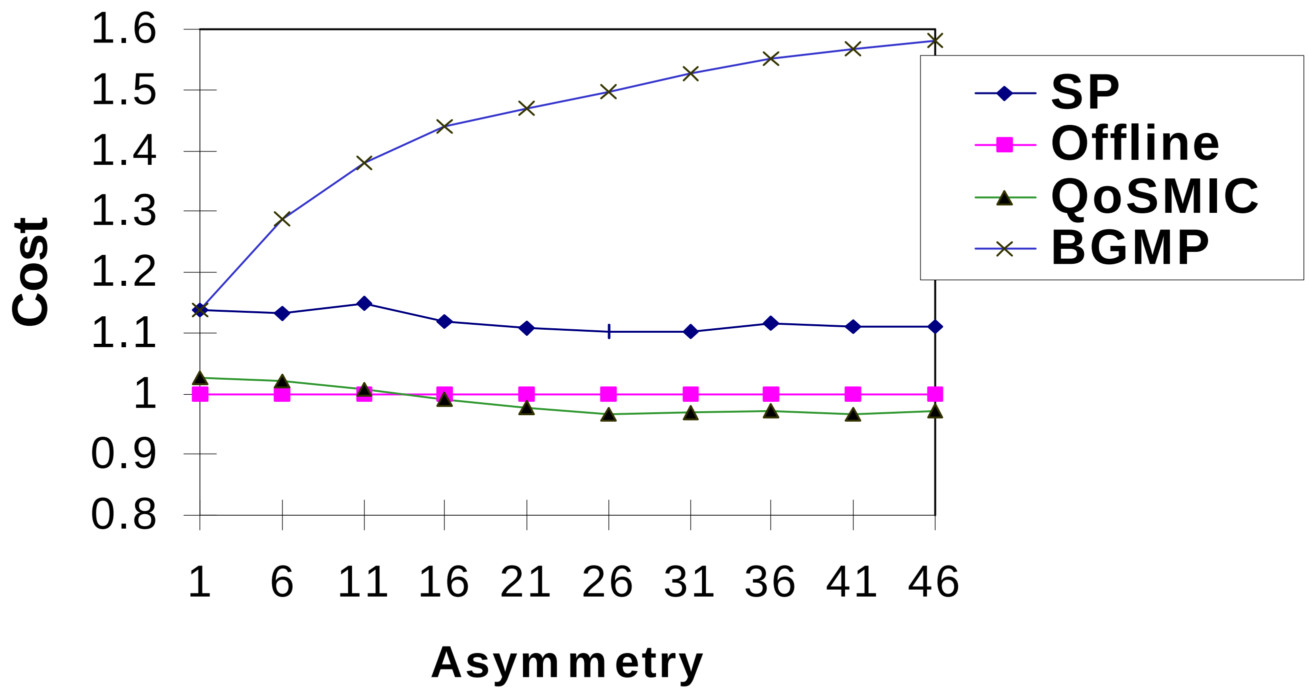
Tree Cost Vs Group Size



Asym = 10

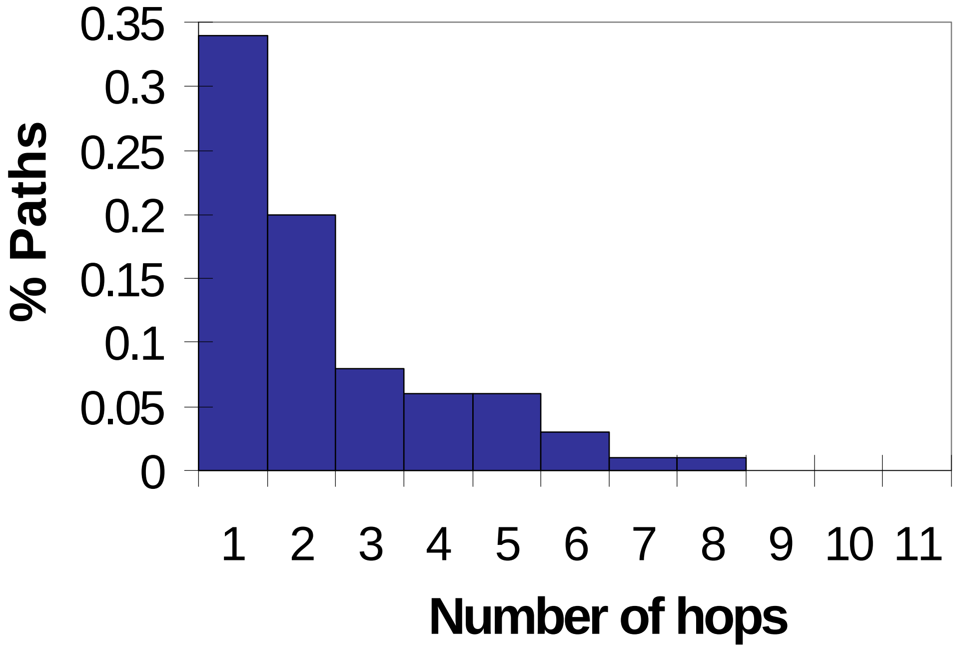
- QoSMIC up to 40% better than BGMP

Tree Cost Vs Asymmetry



- QoSMIC up to 60% better than BGMP

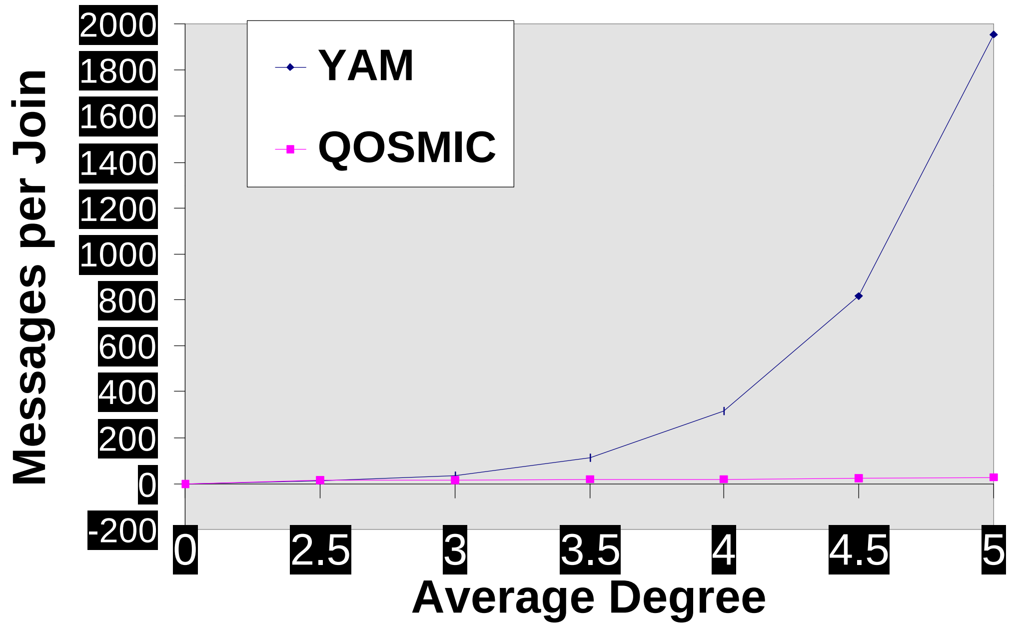
Joining Distance Distribution



Group Density:
1-15 %

- Even small Local Search is good (2 h - 55% joins)
- Large Local Search (8 h) to cover for ALL cases

Search Message Complexity



Over-estimate of both protocols

- YAM has to have large Local Search
- QoSMIC can keep LS small, thus scalable

Summary: QoSMIC Profile

- **Support QoS**
  - Alternate paths
  - Dynamic routing information
- Scalable
- Create efficient trees (40-60%)
- Adaptive - Flexible

The Next Steps

- Detailed Simulations
  - Measuring Internet/applications
- Refining the protocol
- Implementation of QoSMIC
  - Industrial collaboration