G 364: Mobile and Wireless Networking

CLASS 7, Wed. Jan 28 2004

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M-W, 11:40am-1:20pm, 109 Rob

DREAM

- Distance routing effect algorithm for mobility [Basagni+, 1998]
- A proactive, effective way to spread location information
- Directional routing

DREAM, Strengths

- First of its kind: after us, the deluge!
- Robustness: multiple routes to the destination
- Energy efficient management of control information

DREAM, Weaknesses

- It is not really loop-free
- It is flooding, although only directional
- The “ack” mechanism could be cumbersome
- It is not that scalable

Location-Aided Routing (LAR)

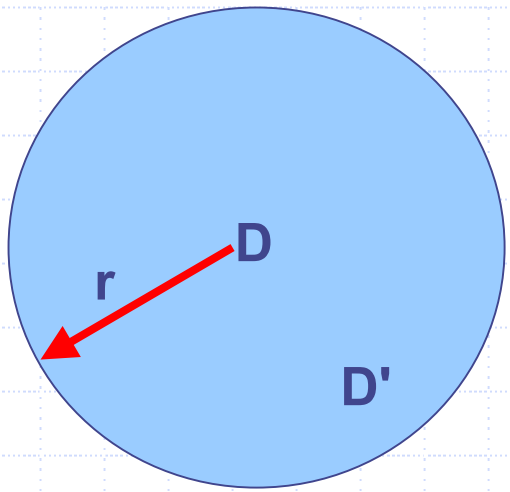
- Exploits location information to limit scope of RREQ flood
- *Expected Zone*: region that is expected to hold the current location of the destination
  - Expected region determined based on potentially old location information, and knowledge of the destination's speed
- RREQs limited to a *Request Zone* that contains the Expected Zone and location of the sender node

LAR: Expected Zone

D = last known location of node D, at time t0

D' = location of node D at current time t1, unknown to node S

r = (t1 - t0) * estimate of D's speed

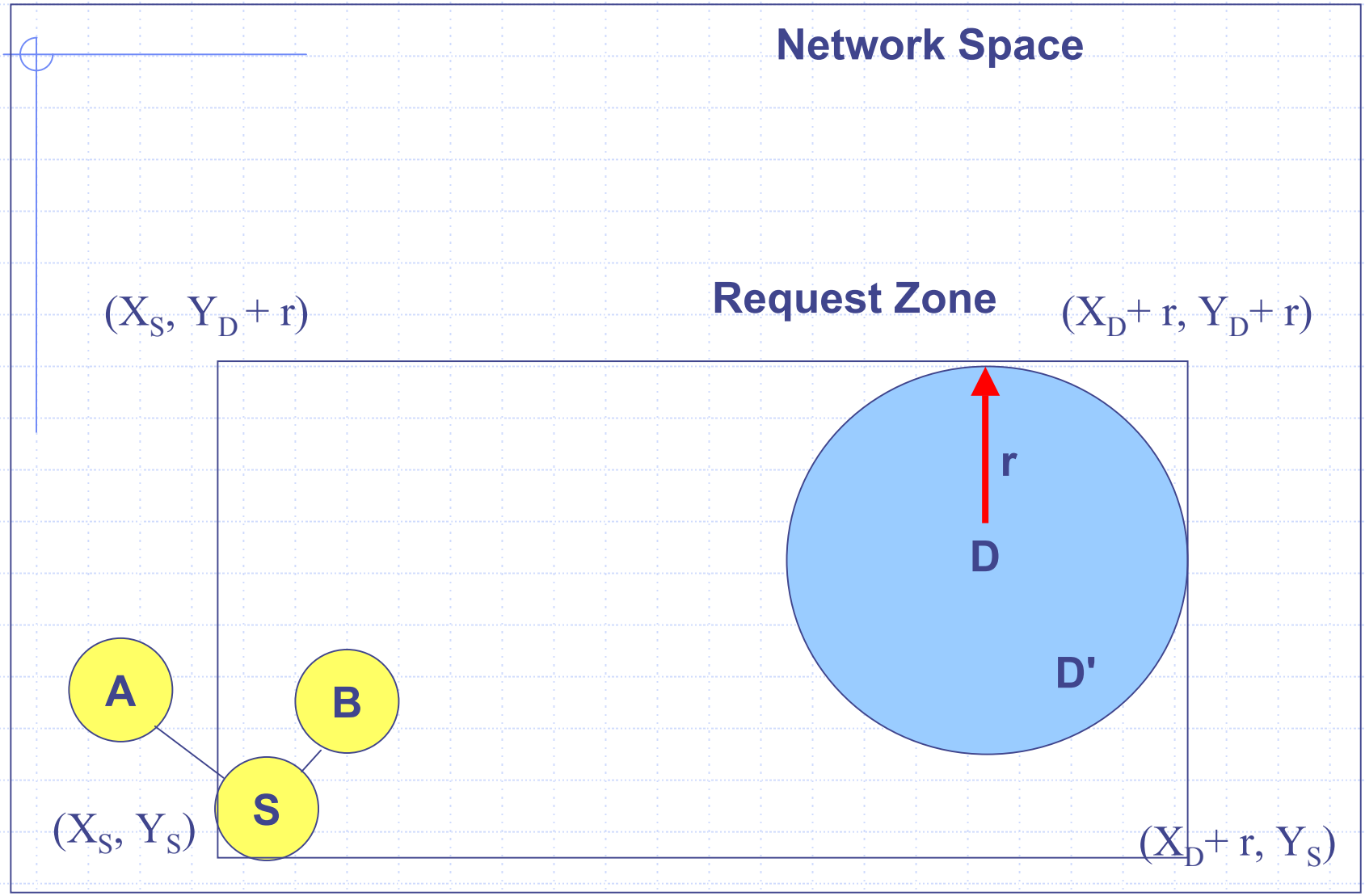


Expected Zone

LAR

- The request zone is the smallest rectangle that includes the current location of the source and the expected zone
- Only nodes within the request zone forward route requests
  - Node A does not forward RREQ, but node B does
- Request zone explicitly specified in the RREQ
- Each node must know its physical location to determine whether it is within the request zone

LAR: Request Zone



LAR, Possible Failures

- If route discovery using the smaller request zone fails to find a route, the sender initiates another route discovery (after a timeout) using a larger request zone
  - The larger request zone may be the entire network
- Rest of route discovery protocol similar to DSR

LAR, the Routing

- The basic proposal assumes that, *initially*, location information for node X becomes known to Y only during a route discovery
- This location information is used for a future route discovery

Variations

- Location information can also be piggybacked on any message from Y to X
- Y may also proactively distribute its location information

LAR, Pros and Cons

- Advantages
  - Reduces the scope of RREQ flood
  - Reduces overhead of route discovery
- Disadvantages
  - Nodes need to know their physical locations
  - Does not take into account possible existence of obstructions for radio transmissions

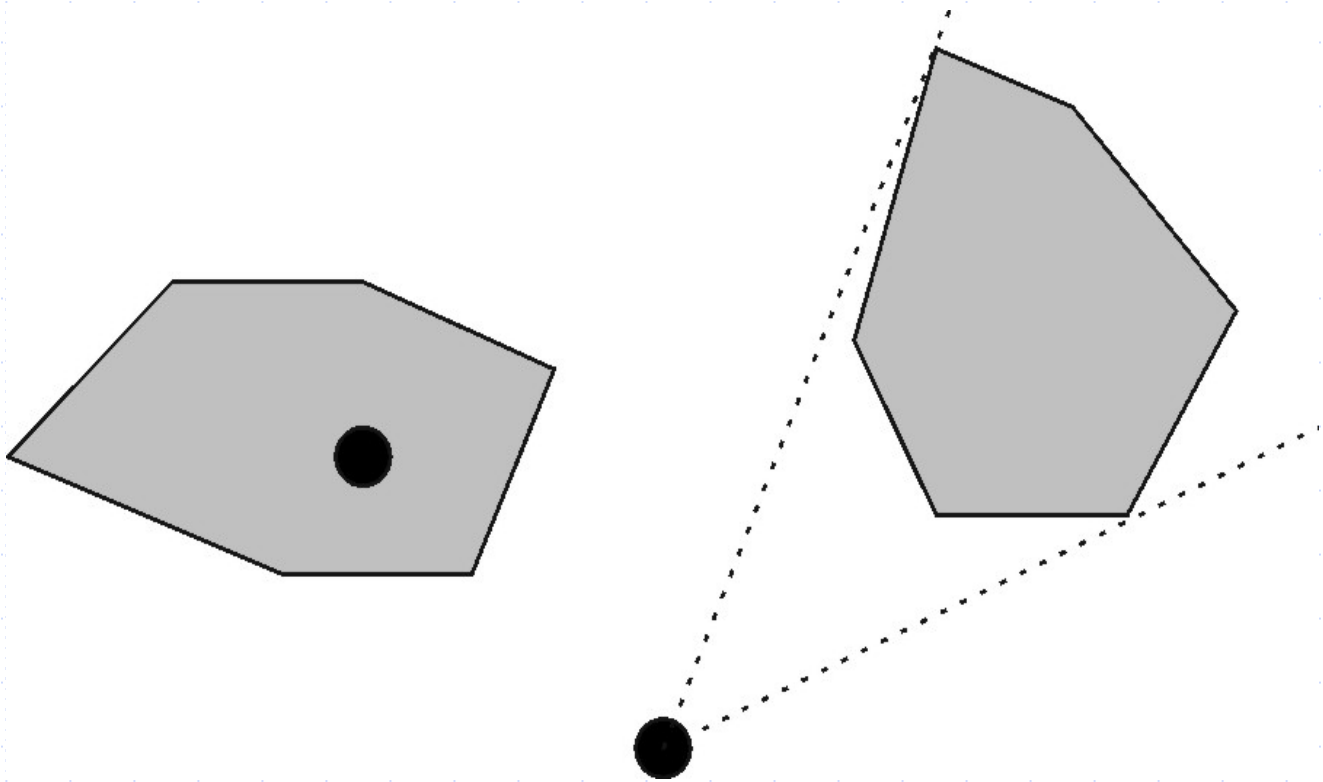
Other Location-Enabled Protocols

- Geographic messaging
  - Sending packets to a targeted geographical area
- Source multipoint communications
  - Routing, multicast and broadcast "dynamic source" style
- Route availability
  - Finding more suitable routes

Geographic Messaging

- Messages from source S have to reach nodes in a given geographic area A
- Based on its current position S determines the direction of A
- Messages are sent in that direction
- Propagation of packets is naturally stopped when they reach A boundaries

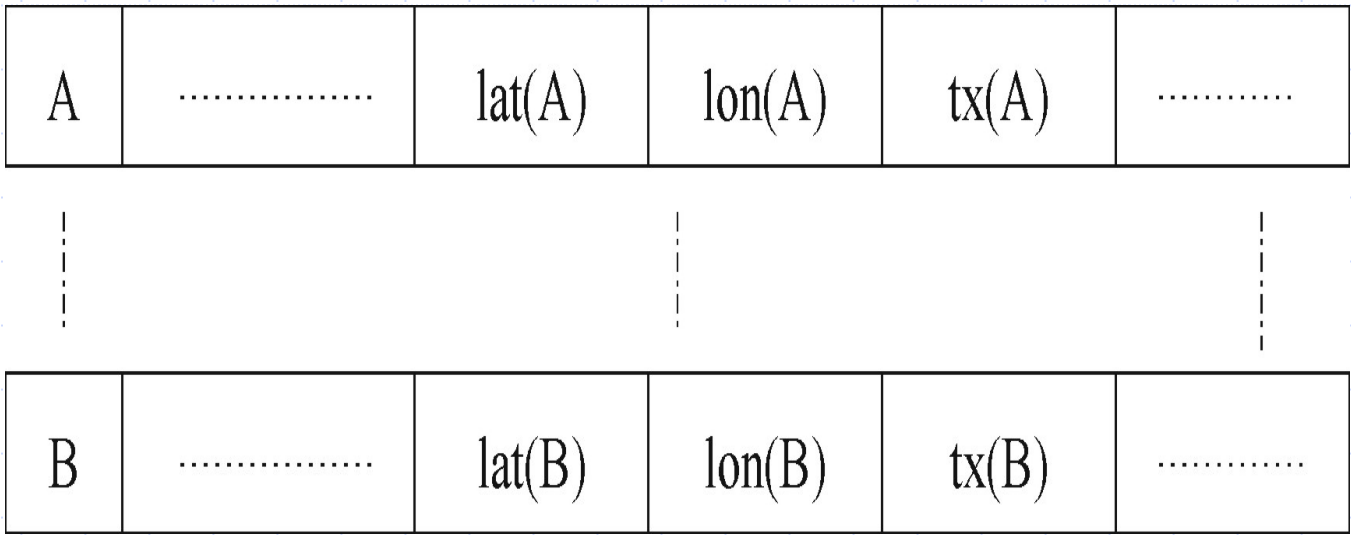
Geographic Messaging



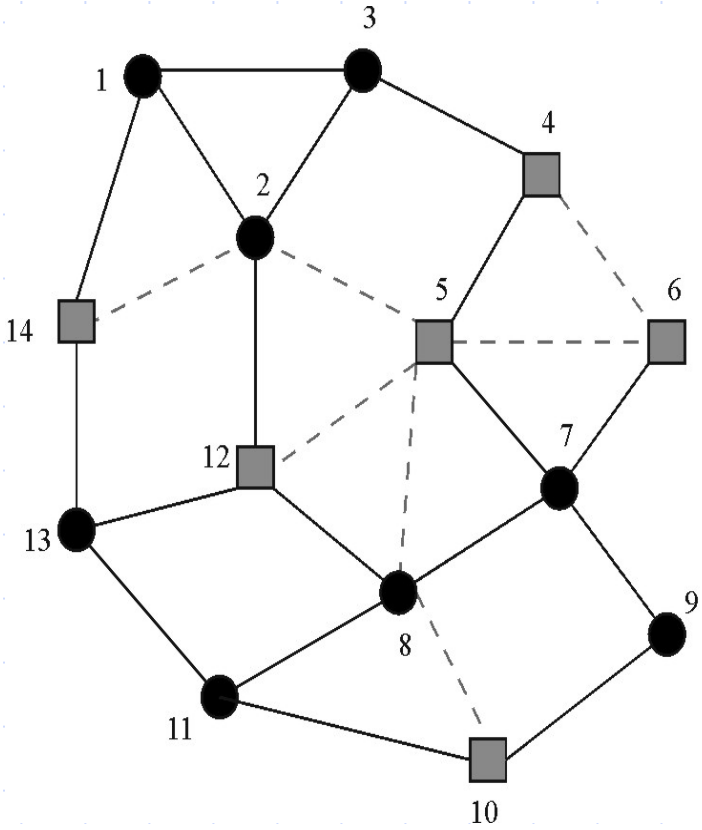
Source Multipoint Communication

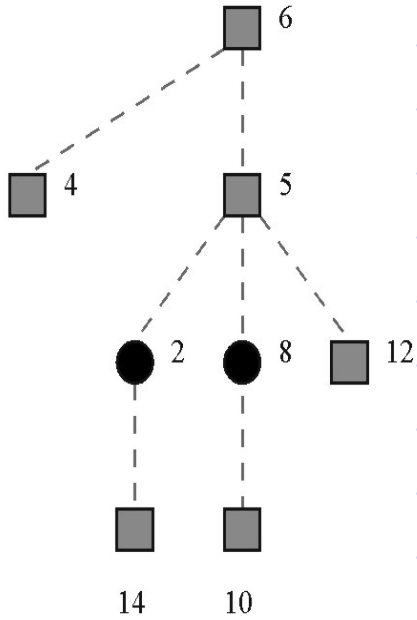
- Location packets carry a node transmission range (plus something else, maybe)
- Based on its location table, source S construct (maintain) a snapshot of the network topology graph (NTG)
- On the NTG routes (simple routes or trees) are computed (locally!)
- Routes are (efficiently) piggybacked to the packets

Source Multipoint Communication: Location Packets



Dynamic Source Multicast (DSM)

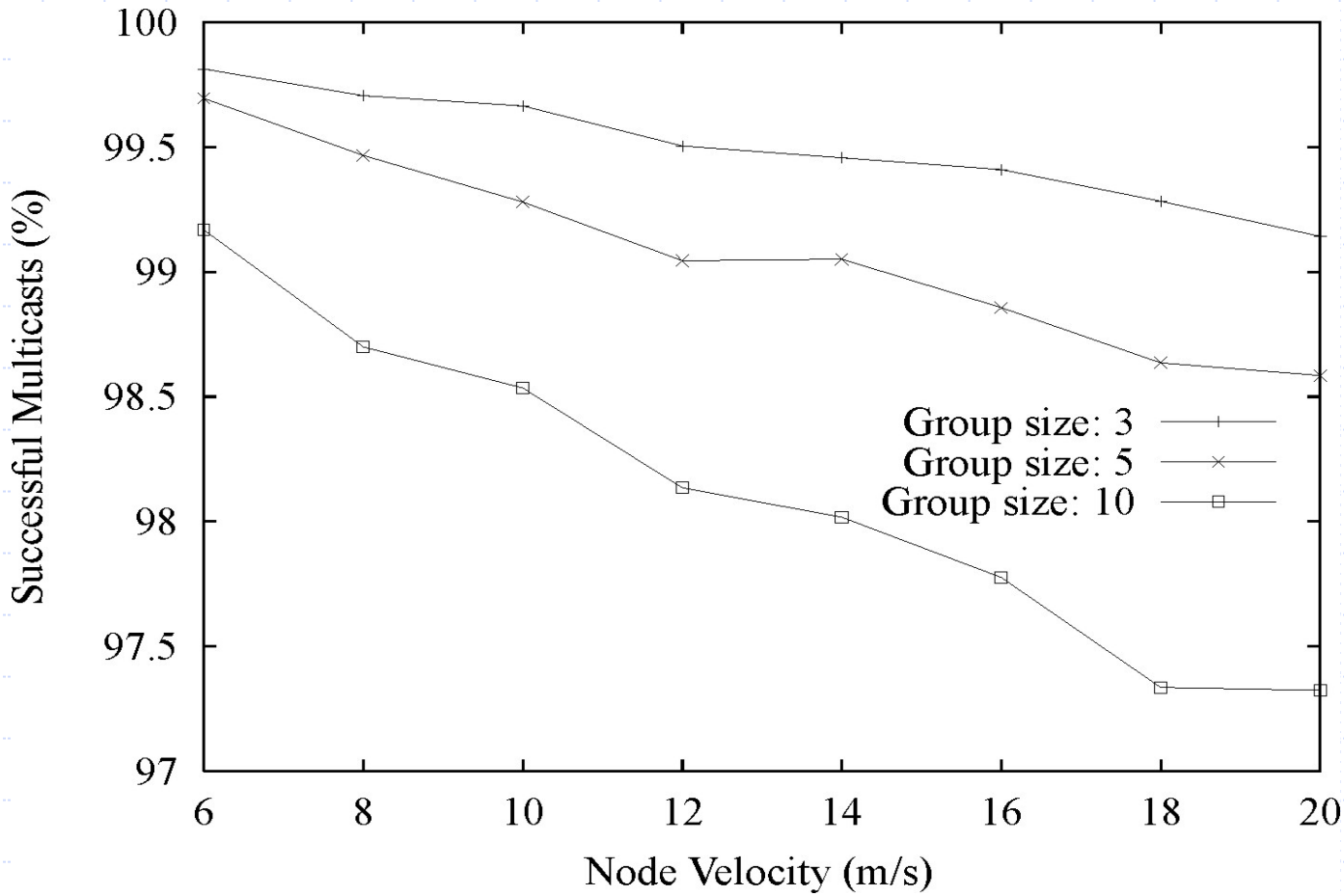




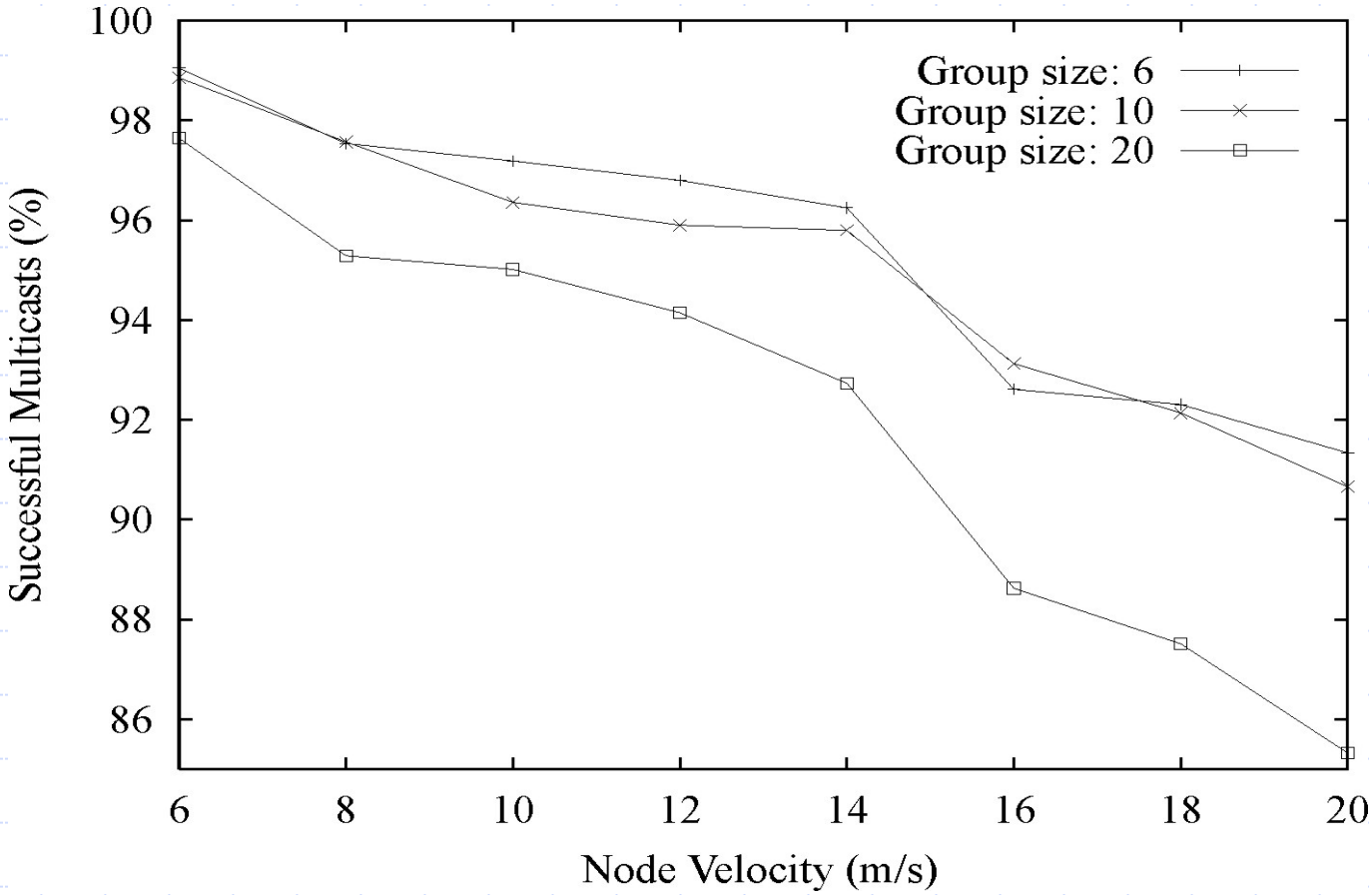
Dynamic Source Multicast and Broadcast: Coding Trees

- Unique method for coding trees locally computed: Prufer sequences
- A multicast tree with $j < n$ nodes requires a Prufer sequence of $j-2$ node identifiers
- No "space overhead" with respect to source routing
- Headers decrease as data packets get closer to the destinations

DSM: Experiments



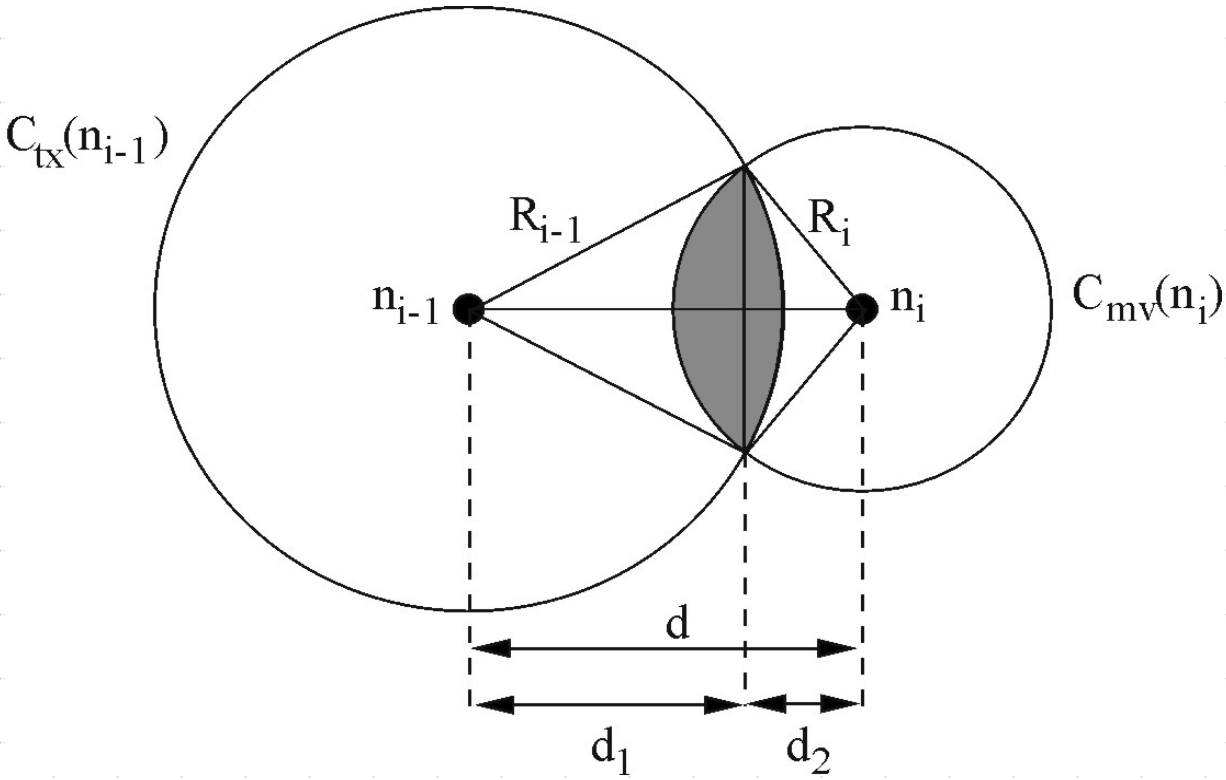
DSM: Experiments



Route Availability

- Based on local computation of the network topology graph
- Given the area of residence of the destination and intermediate nodes, for each route we define the probability of that route to be available for packet
- Multiple routes can be computed and the more convenient chosen

Route Availability



What now: Scalability and Security Issues for DREAM-like Protocols

- Location aware protocol offer potentially less problem for scalability, since only the location of the destination is needed, and not the identity or the location of intermediate nodes
- Efficient dissemination of TEKs (traffic encryption keys) can be implemented via location aware routing and "clustering"

Assignments

- Read the routing handout
- Updated information on the class web page:

  www.ece.neu.edu/courses/eceg364/2004sp