G 364: Mobile and Wireless Networking

CLASS 6, Mon. Jan 26 2004

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

Proactive Ad Hoc Routing

- Each node maintains one or more routing table
- Changes in the network topology are dealt with by propagating updates
- A consistent network view is maintained
- Existing protocols differ in the number of routing table maintained and in updates propagation methods

Proactive Protocols: Drawbacks

- Updates overhead, especially in presence of high mobility
- Overhead for enforcing loop freedom
- Large routing tables
- Low *scalability*
  - Is it really necessary to maintain a consistent view of the network topology?

Reactive Ad Hoc Routing

- A route to a destination is sought for only when needed (on-demand routing)
- Route discovery process
  - A probe is sent (flooded) to discover a path to the destination
  - Upon receiving the probe the destination sends the probe back to the source
  - The probe “accumulates” the route

Reactive Protocols: Drawbacks

- The discovery phase introduces long delays
- Route discovery and maintenance is very sensitive to node mobility
- Route caching is memory greedy
- The size of the header of a data packet can become cumbersome (no scalability)
- Is the dependency on the network topology avoidable?

Location-Enabled Ad Hoc Routing

- Nodes are equipped with positioning system devices (e.g., Global Positioning System receivers) that make them aware of their position
- This enables "directional" routing
- Possible solutions differ on how the location information of the destination nodes is achieved

Strengths

- No need to update big routing tables, no need to piggyback routes to the packet
- No need to know the nodes on the way to the destination: they can be moving while the packet travels

Drawbacks

- Needs extra hardware
- Depends on the extra hardware limitation (and resource requirements)
- Scalability is an issue

DREAM

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

Disseminating Location Information: Problems

- Need to periodically update the location of a moving node.
  - Efficient broadcast of location information
  - Determining how far each location packet should travel
  - Determining how often a location packet should be sent

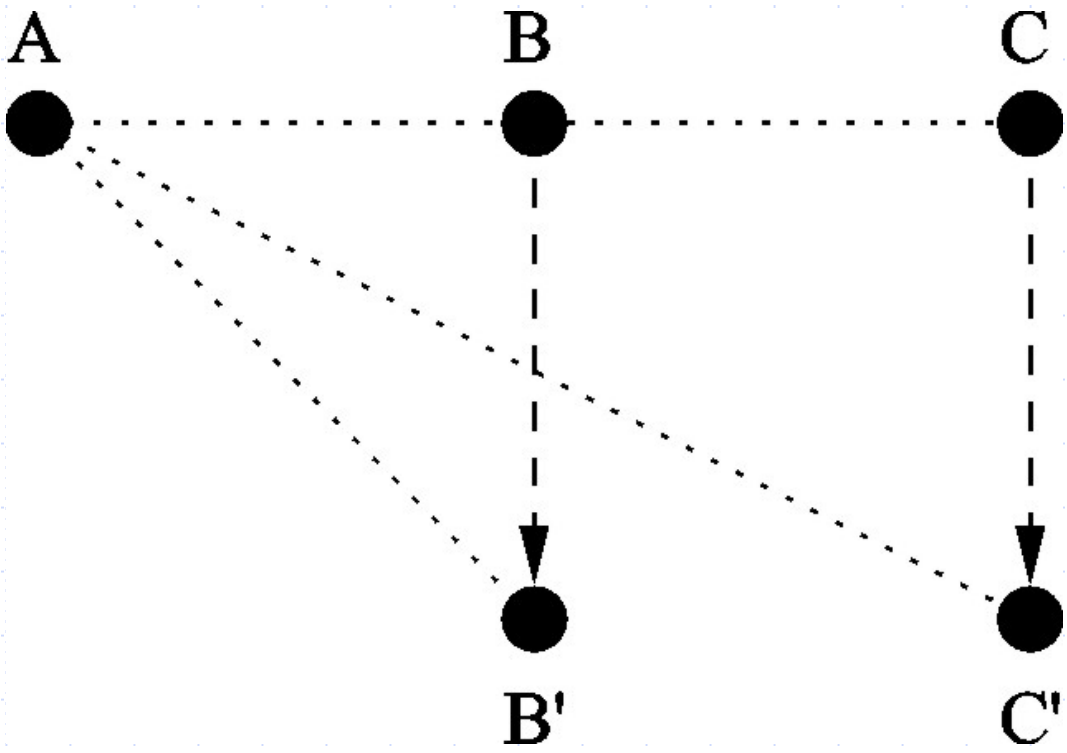
Disseminating Location Information: Solutions

- Mobility-adaptive, deterministic broadcast
- Distance effect
- Rate of updates is bound to the mobility of the node

Mobility-Adaptive Broadcast

- Deterministic solution that takes into account MAC layer characteristics
- Flooding of location packets proceeds "wave expanding" from the source to the intended destinations
- Deterministic, interference-independent delivery is obtained by using Time-Spread Multiple-Access (TSMA) protocols

The Distance Effect



The Distance Effect

- "Closer nodes look like they are moving faster"
- Need to receive more location updates from closer node
- Each packet is associated with an age that determines how far that packet must travel

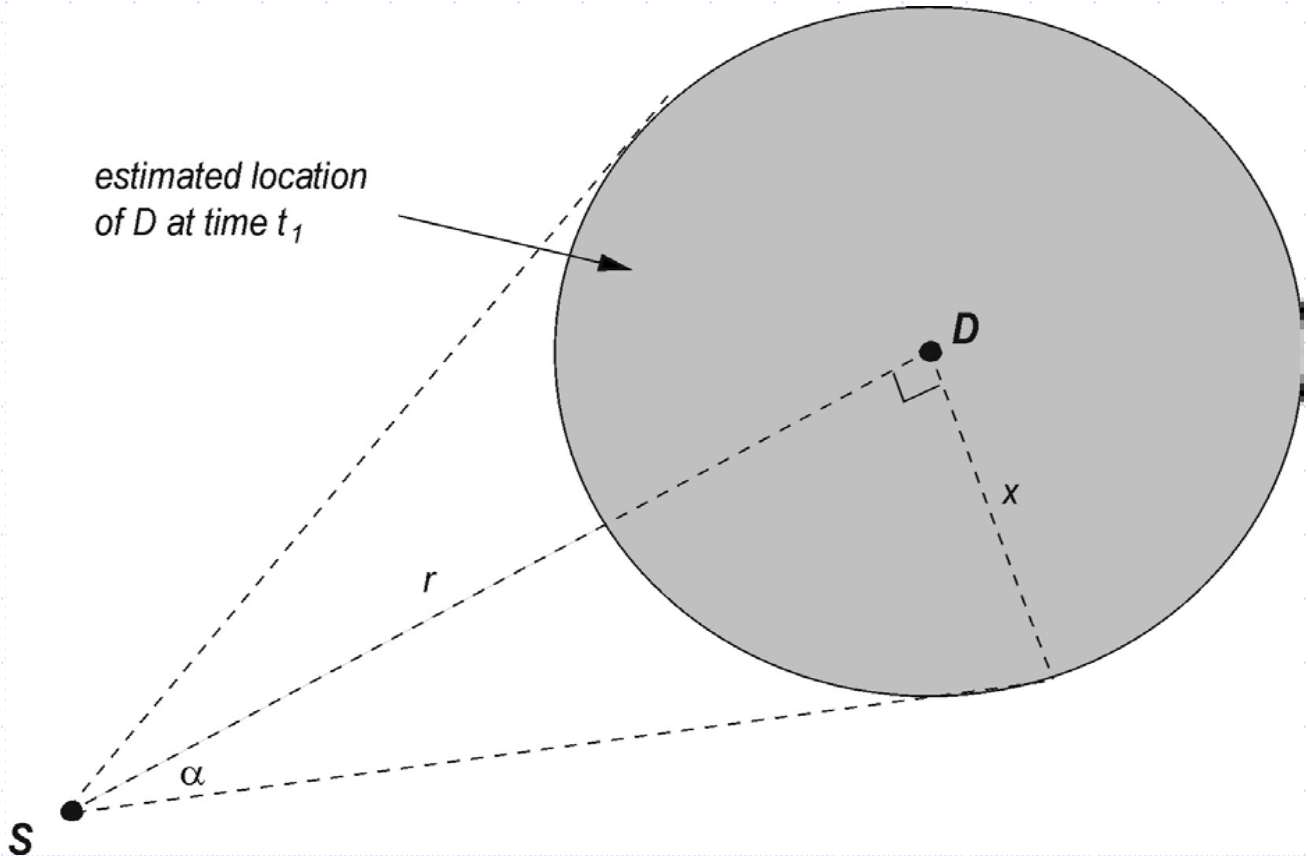
DREAM: Rate of updates

- Triggered by the mobility of the nodes
- The faster the node the more updates it sends
- A plus: slow moving nodes impose little overhead

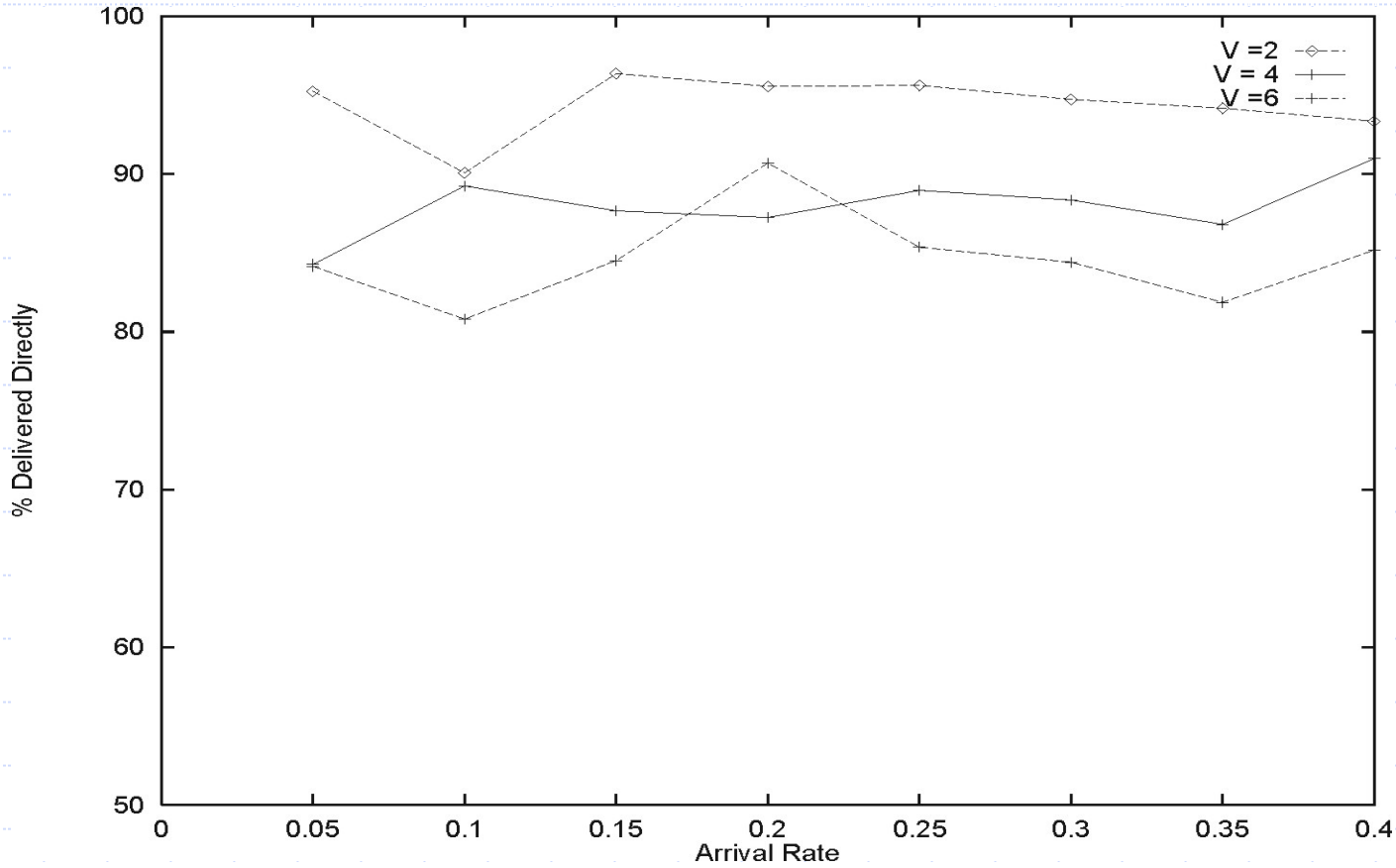
DREAM: Directional Routing

- Source S determines the location of destination D at time t_0 based on its location table
- Based on the current time t_1 and t_0 S determines the area in which D can be found (hence, D's direction)
- S transmits the data packet to all its neighbors in D's direction
- Each neighbor does the same till D is reached

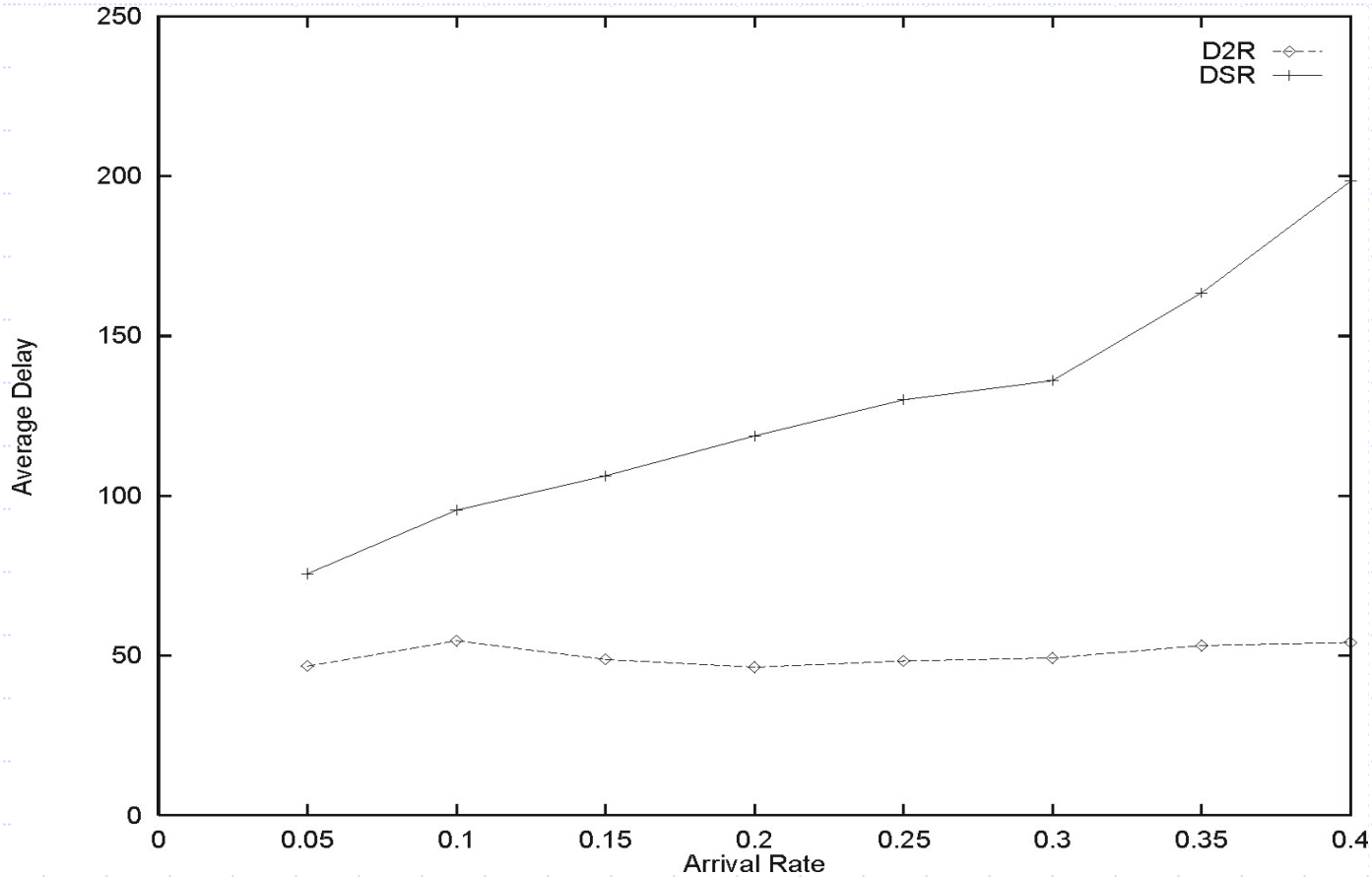
DREAM: Routing a Data Packet



DREAM: Experiments, 1



DREAM: Experiments, 2



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

Assignments

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

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