G 364: Mobile and Wireless Networking
CLASS 6, Mon. Jan 26 2004
Stefano Basagni
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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

estimated location of D at time \( t_1 \)
DREAM: Experiments, 1

% Delivered Directly

Arrival Rate

V = 2
V = 4
V = 6
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