MOBILE AD-HOC NETWORK

R.C.Jaffer Sheriff
2010212010
M.E., EST, CEG, Anna University
AGENDA

- INTRODUCTION
- MOBILITY SUPPORT
- NEED FOR AD-HOC NETWORKS
- MANET
- ROUTING (DIFFERENT B/W WIRED AND WIRELESS)
- OBSERVATIONS WHILE ROUTING
- TWO TYPES OF ROUTING
- OVERVIEW OF AD-HOC ROUTING PROTOCOLS
AGENDA (contd.,)
INTRODUCTION

MOBILITY SUPPORT

- MOBILE IP - HOME AGENT, TUNNELS, DEFAULT ROUTERS
- DHCP - SERVERS, BROADCAST CAPABILITIES OF NETWORK
- CELLULAR NETWORKS - BASESTATION, INFRASTRUCTURE N/W
WHAT IS AD-HOC?
WHY AD-HOC?

- INSTANT INFRASTRUCTURE
- DISASTER RELIEF
- REMOTE AREAS
- EFFECTIVENESS
AD-HOC

Mobile Router

Mobile Devices

Fixed Network

Router

End system

Manet

Mobile IP, DHCP
ROUTING

• WHY ROUTING IS NEEDED?
  ◦ TO FIND PATH B/W SOURCE & DESTINATION

• IN INFRASTRUCTURE BASED?
  ◦ BASE STATION CAN REACH ALL NODES

• IN AD HOC?
  ◦ DESTINATION AND SOURCE ARE OUT OF RANGE
Dynamic topology

\[ \text{time } = t_1 \]

\[ \text{time } = t_2 \]

- Good link
- Weak link
Difference b/w wired and wireless networks

- Asymmetric links
- Redundant links
- Interference
- Dynamic topology
Can't we use well established routing protocols of wired n/ws?
Reasons

- TCP – makes round trip measurement assuming same path in both directions
Reasons

- Dynamic topology - Routing Requires optimum knowledge
  
  i. Connectivity b/w all nodes
  
  ii. Expected traffic flows
  
  iii. Capacities of all links
  
  iv. Delay of each link
  
  v. Computing and battery power

- Not predictable for even wired n/ws
Reasons

- Capacity of a link- ‘0’ to ‘max’
- Upto date snapshot is impossible
- Periodic update- wastage of power and bandwidth
- Interference
Observations

- Traditional routing won't work
- Routing – Connectivity, Interference
- Centralized approach
- At least one router within range of each node
- Limited battery power
- Connection oriented service not possible
- Flooding – hop counter
Routing protocols

- Distance Vector Routing
- Destination Sequence Distance Vector (DSDV)
- Dynamic Source Routing (DSR)
Distance vector routing

- RIP used in wired n/ws
- Periodic exchange of neighborhood tables
- Change propagate slowly
- Solutions to above wont work in Ad-hoc –Dynamic topology.
- May create loops/ unreachable regions.
Destination Sequence Distance Vector (DSDV)

- Sequence numbers
- Damping
## Sample routing table

<table>
<thead>
<tr>
<th>Dest</th>
<th>Nxt hop</th>
<th>Metric</th>
<th>Seq., No.</th>
<th>Install time</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>N1</td>
<td>0</td>
<td>S1-321</td>
<td>T4-001</td>
</tr>
<tr>
<td>N2</td>
<td>N2</td>
<td>1</td>
<td>S2-218</td>
<td>T4-001</td>
</tr>
<tr>
<td>N3</td>
<td>N2</td>
<td>2</td>
<td>S3-043</td>
<td>T4-002</td>
</tr>
<tr>
<td>N4</td>
<td>N4</td>
<td>1</td>
<td>S4-092</td>
<td>T4-001</td>
</tr>
<tr>
<td>N5</td>
<td>N4</td>
<td>2</td>
<td>S5-163</td>
<td>T4-002</td>
</tr>
</tbody>
</table>
DISADVANTAGES

- EVEN FOR LIGHT LOAD ROUTING TABLES ARE UPDATED REGULARLY
- MAINTAINS ROUTE WHICH ARE NOT NECESSARY NOW
DYNAMIC SOURCE ROUTING

Two functions:
- Route discovery
- Route maintenance

Eliminates all periodic updates
Routing - Unique ID & Dest. Addr.
DSR: Route Discovery

Sending from C to O
DSR: Route Discovery

Broadcast

[O,C,4711]
DSR: Route Discovery
DSR: Route Discovery

[O,C/B/A,4711]

[O,C/B/D,4711]

(alternatively: [O,C/E/D,4711])
DSR: Route Discovery

[O,C/B/D/F,4711]

[O,C/G/I/K,4711]

[O,C/E/H/J,4711]
DSR: Route Discovery

[O,C/E/H/J/L,4711]
(alternatively: [O,C/G/I/K/L,4711])
DSR: Route Discovery

[O,C/E/H/J/L/N,4711]
DSR: Route Discovery

Path: M, K, I, G
Dynamic Source Routing

- **Maintaining paths**
  - after sending a packet
    - wait for a layer 2 acknowledgement (if applicable)
    - listen into the medium to detect if other stations forward the packet (if possible)
    - request an explicit acknowledgement
  - if a station encounters problems it can inform the sender of a packet or look-up a new path locally
DSR- Optimization

- Counter- avoid too many broadcast
- Cache path fragments
- Update cache from packet headers
- Overhearing transmission from other nodes.
Metrics- Cost of transmission

- No. of hops
- Bandwidth
- Reliability
- Error rate
Interference-based routing

Routing based on assumptions about interference between signals

Neighbors (i.e. within radio range)
Example:

\[ C_1 = \text{COST}(S1,N3,N4,R1) = 16 \]
\[ C_2 = \text{COST}(S1,N3,N2,R1) = 15 \]
\[ C_3 = \text{COST}(S1,N1,N2,R1) = 12 \]
Example:

\[
\begin{align*}
C_4 &= \text{COST}(S2,N5,N6,R2) = 16 \\
C_5 &= \text{COST}(S2,N7,N8,N9,R2)= 15
\end{align*}
\]
Interference-based routing

- With both tx. taking place simultaneously there would have been an interference
- Least-Interference based routing avoided interference
- But – Local decision-just lower
- All tx. info- to avoid interference

Cost = αh + βi + γr + δe + ....
OVERVIEW OF ADHOC PROTOCOLS

- Flat ad-hoc protocols
- Hierarchical ad-hoc routing
- Geographic-position-assisted ad-hoc routing
FLAT AD-HOC ROUTING PROTOCOLS

- Without head
- Without Diff. routing b/w inside/outside
- All nodes play equal role
- Types – Proactive, Reactive
PROACTIVE

- Setup tables regardless of traffic flow
- DSDV, Link state algorithm
- Fisheye state routing
- Fuzzy sighted link state
  - Update depend on hop distance
- Topology broadcast based on reverse path forwarding
- Optimized link state routing
Advantages

- Gives QoS guarantees
- Routing reflect topology with precise
- Propagation char. are known before tx.

Disadvantages

- Overheads in lightly loaded n/w
- Update independent of traffic flow
- Unnecessary traffic & draining of battery
REACTIVE

- Setup paths only if needed
- Dynamic source routing
- Ad-hoc on demand distance vector

Advantages
- Scalability
- Long battery power

Disadvantages
- Initial search latency
- Quality of path is unknown
HIERARCHICAL PROTOCOLS

- Setup clusters
- Traffic in/out through cluster head
- Diff. protocol inside/outside of cluster
- Clusterhead – Gateway Switch

Routing
- Hierarchical state routing
- Zone routing protocol
Geographic-position-assisted ad-hoc routing

- Geographic position information is used for addressing instead of logical numbers
- GeoCast
- Greedy parameter stateless routing
Thank you