Routing Protocols For Wireless Ad Hoc Networks

- Classification Of Protocols
- A Focus On The Table Driven Protocols

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Outline:

1 – Requirements of routing protocols For wireless ad hoc networks.

2 – Classification of routing protocols for wireless ad hoc networks.

3 – Table-Driven Protocols : Three main approaches?!

4 – Destination Sequenced Distance Vector Routing Protocol: DSDV.

1 - Requirements of routing protocols For wireless ad hoc networks : (1/2)

1 – Fully distributed.

A Centralized routing scheme => High Control overhead.

2 – Adaptive to dynamically changing network topology.

Mobility => dynamic topology.

3 – Less number of nodes involved in connection setup.

Minimum Connection setup time is a must.

4 – Local State Maintenance.

Globe state maintenance => state propagation overhead.

1 - Requirements of routing protocols For wireless ad hoc networks : (2/2)

5 – Loop free and stale routes free.

Up to date routing information and recourse-wise routing are necessities.

6 – Converge to optimal routes for the topologically stable networks.

Optimal routing is always a goal.

7 – It must consider the limited resource of the nodes and the transmission medium.

The standard problem of the wireless ad hoc networks.

2 – Classification of routing protocols for wireless ad hoc networks: (1/4)

- **Ad hoc routing protocols are classified based on four criteria:**

1 – Based on the routing information update mechanism.

2 – Based on the use of temporal information for routing.

3 – Based on the routing topology.

4 . Based on the utilization of a specific resource.

(Viz. Power aware routing and geographical information assisted routing)

2 – Classification of routing protocols for wireless ad hoc networks: (2/4)

1 – Based on the routing information update mechanism:

a – **Table driven routing protocols**:

- Periodic exchange of routing information.

=> "high routing overhead" ***(-ve)***

- Each node maintains its own routing table.

=> "Fast to find routes" ***(+ve)***

b – **On-demand routing protocols**:

- No periodic exchange of routing information.

=> "routing overhead grows according to actual needs" ***(+ve)***

- route is found when only required.

=> "route setup takes more time" ***(-ve)***

c – **Hybrid:** e.g. a (at a defined local zone) + b (among zones)

2 – Classification of routing protocols for wireless ad hoc networks: (3/4)

2 – Based on the use of temporal information for routing:

a – **Using available information at the time of making the routing decisions:**

- Information about the current availability of links with shortest path algorithm are used.

  => "Optimal routes". ***(+ve)***

- The highly probable link breaks during sessions.

  => "Route reconfiguration". ***(-ve)***

b – **Using predictions of the future state of the links:**

- The future status of the links are predicted.

  => "More avoidance to link breaks". ***(+ve)***

  => "More computations" ***(-ve)***

NOTE: *performance studies show less routing overhead when using the predictions of the route links.*

2 – Classification of routing protocols for wireless ad hoc networks: (4/4)

3 – Based on the routing topology:

a – Flat topology routing protocols:

- Routing and data packets are transmitted across any number of nodes in the network.

=> "More suitable for small number of nodes"

(limited scalability)

b – Hierarchical topology routing protocols:

- As the number of nodes increases, clustering of nodes is applied to form hierarchies.

=> More coordination among nodes in the same cluster

=>Traffic inside/among clusters is better scheduled

=> "More resources consuming efficiency".

(better scalability)

3 – Table-Driven Protocols : Three main approaches?! (1/4)

1 – Bellman- Ford /Optimum Routing Approach (ORA):

Destination sequenced routing protocol (DSDV), and Wireless Routing Protocol (WRP).

2 – Clustered Multi-hop Routing:

Cluster *(Hierarchical)* Routing Protocol (DSCR), and Clustered Gateway Switch Routing Protocol (CGSR).

3 – Least Overhead Routing Approach (LORA):

Source Tree Adaptive Routing Protocol (STAR).

3 – Table-Driven Protocols : Three main approaches?! (2/4)

1 – Bellman- Ford /Optimum Routing Approach (ORA):

- Each node maintains a table that contains the shortest distance and the first node on the shortest path to every other node in the network.

- Nodes incorporate periodic table updates with increasing sequence numbers to avoid loops.

- Examples:

DSDV : - A typical example.

- For link break recovery => *Waits for update initiated by the destination nodes.* *(-ve)*

WRP : - For link break recovery => *Uses information about the routes of its neighbors to the destination node*

=> *faster convergence.* *(+ve)*

3 – Table-Driven Protocols : Three main approaches?! (3/4)

2 – Clustered Multi-hop Routing:

- Nodes are organized into clusters and a cluster head is elected.

- The nodes in each cluster can listen to a different spreading than the ones used by other clusters.

- A Token based scheme is used to organized the usage of the spreading code inside each cluster.

Better code scheduling and token scheduling => better performance ***(+ve)***

A typical example: Gateway Switch Routing Protocol (CGSR).

3 – Table-Driven Protocols : Three main approaches?! (4/4)

3 – Least Overhead Routing Approach (LORA):

- Routing information updates are exchanged among nodes only to reflect an altering change.

=> less routing overhead ***(+ve)***

- In case of absence of a route to some destination, a route request is initiated.

=> this is a on-demand routing property ***(hybrid ?)***

- Sub optimal routes. ***(-ve)***

A typical example: Source Tree Adaptive Routing Protocol (STAR).

4 – Destination Sequenced Distance Vector Routing Protocol: DSDV

1 – Key features:

-Each node maintains its own routing table to all the destination in the network.

- A routing table entry =

{Destination ID, Next hop, Distance, Sequence Number}

- Table updates are initiated by destination nodes.

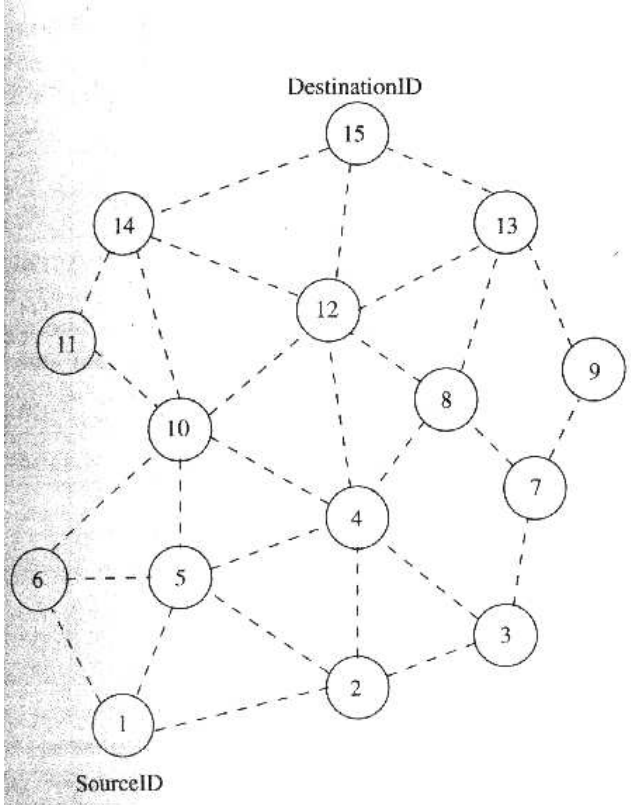
- Types of table updates:

a – Dump updates: *periodically* or to propagate *significant changes*.

b – Incremental updates: to indicate *minimal changes.*

4 – Destination Sequenced Distance Vector Routing Protocol: DSDV

2 – A route establishment example:



(a) Topology graph of the network

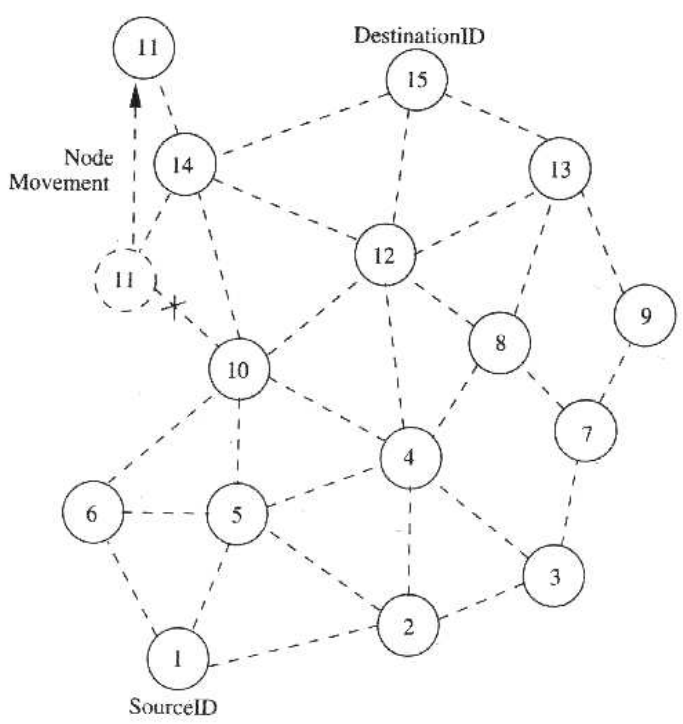
Dest	NextNode	Dist	SeqNo
2	2	1	22
3	2	2	26
4	5	2	32
5	5	1	134
6	6	1	144
7	2	3	162
8	5	3	170
9	2	4	186
10	6	2	142
11	6	3	176
12	5	3	190
13	5	4	198
14	6	3	214
15	5	4	256

(b) Routing table for Node 1

Route establishment in DSDV.

4 – Destination Sequenced Distance Vector Routing Protocol: DSDV

3 – A route maintenance example:



Route maintenance in DSDV.

Routing Table for Node 1

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Summery:

1 – Routing protocols for wireless ad hoc networks have its own unique requirements.

2 – Four criteria are used for classifying routing protocols for wireless ad hoc networks.

3 – Can we divide table driven protocols into groups? *Can this has some benefit?*

4 –DSDV is a typical example of table driven routing protocols.