



Hierarchical Routing Protocols

Kilinkaridis Theofanis

tkilinka@cc.hut.fi

T-79.5401

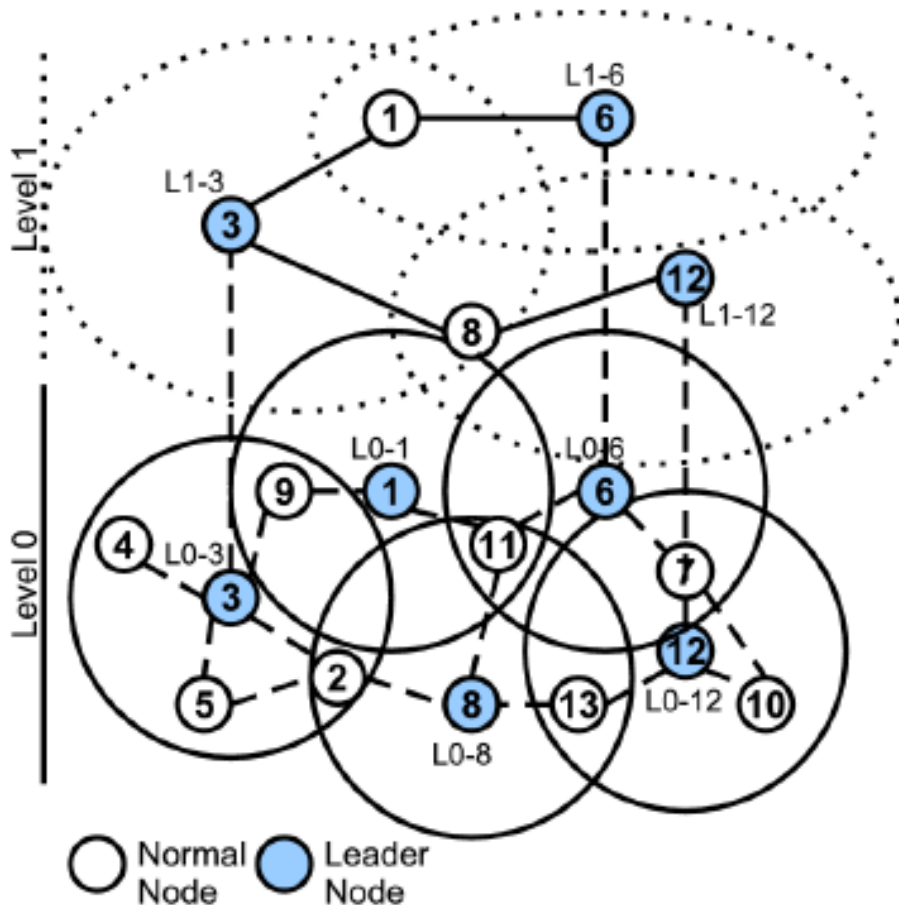
Special Course In Mobility Management



Hierarchical State Routing(HSR)Protocols

- Distributed multi-level hierarchical routing protocol
- Based on multiple level clustering
- Each cluster has its leader
- Clustering is organized in levels
 - Physical: between nodes that have physical wireless one-hop links between them.
 - Logical: based on certain relations

Hierarchical State Routing(HSR)Protocols



- Node 8 is described as L0-8
 - Node ID = 8
 - It leads a cluster at zero level
- Node 3 is described as L1-3
 - Node ID = 3
 - It leads a cluster at first level
- The path between two cluster leaders is called virtual link
- The path between L1-3 L1-12 is:
 - (3 - 2 - 8 - 13 - 12)
- HSR address is <HID - nodeID>
 - HSR Address of node 10 is:
 - <12,12 - 10>.

Hierarchical State Routing(HSR)Protocols



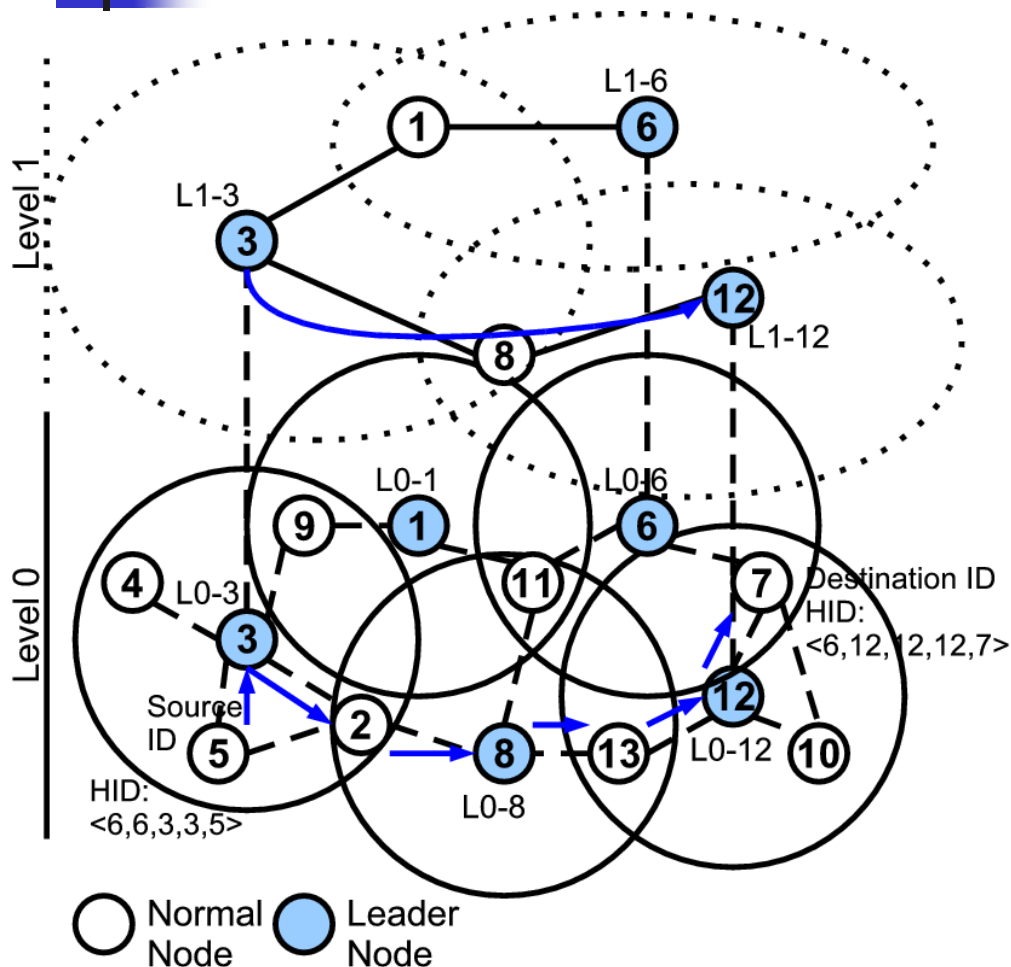
- Every node maintains information about its peers' topology and the status of links to them.
 - this information is broadcast to all the members of the cluster periodically
- Cluster leaders exchange similar information with their peers
 - each cluster leader broadcast the information to the lower level informing all the nodes about the hierarchical topology of the network.



Hierarchical State Routing(HSR)Protocols

- Every node's hierarchical address is stored in an HSR table and indicates its location in the hierarchy
 - HSR table is updated by the routing update packets
 - Route establishment
 - forward the packet to the highest node in the hierarchy of the source
 - sent to the highest node in the hierarchy of the destination
 - forward from this node to the destination node.
- Advantage:
 - using hierarchy information → reduces the routing table size
- Disadvantage:
 - the process of exchanging information concerned all the levels of the hierarchy as well as the process of leader election in every cluster makes it quite problematic for ad hoc networks

Hierarchical State Routing(HSR)Protocols



- Route establishment:
 - Go to highest node in the hierarchy
 - Establish connections on virtual links
 - Send data through channel

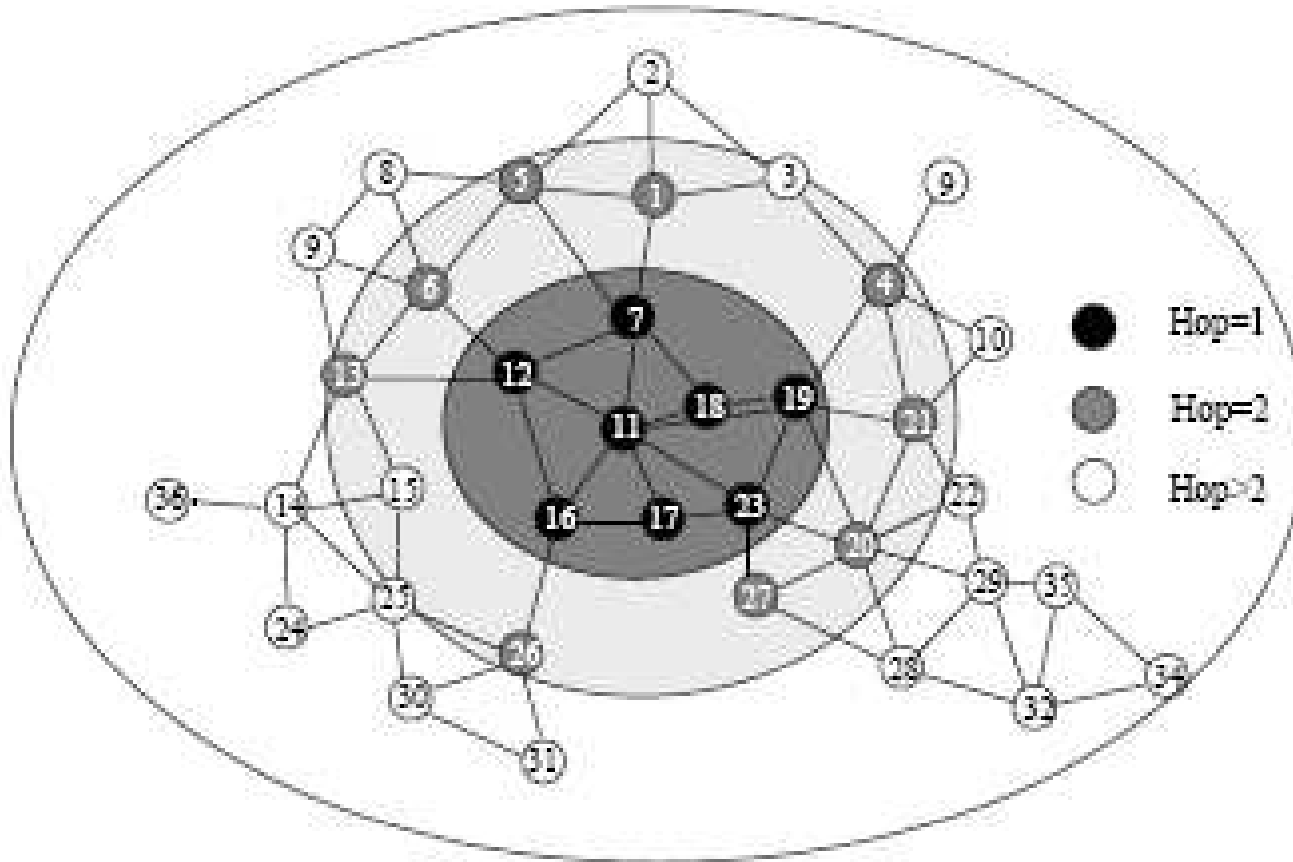


Fisheye State Routing(FSR) protocol

- Uses the fisheye technique to reduce the routing overhead
- Fish eye has the ability to see objects the better when they are nearer to its focal point
- That means that:
 - each node maintains accurate information about near nodes and not so accurate about far-away nodes
- Nodes exchange topology information only with their neighbors

Fisheye State Routing(FSR) protocol

- Basic concept: routing scopes!

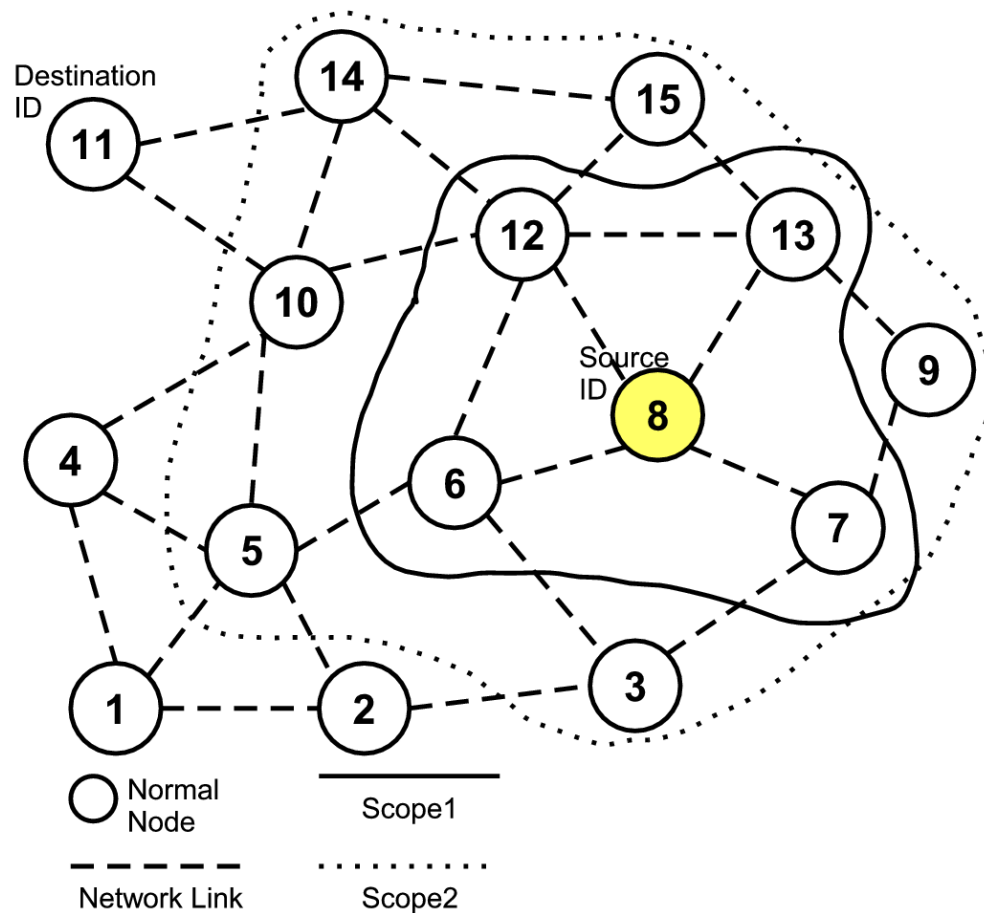




Fisheye State Routing(FSR) protocol

- Another characteristic:
 - different frequency in exchanging link state information.
 - The smaller the scope is the higher the frequency of the exchanges.
 - The exchanges in smaller scopes are more frequent than in larger.
 - That makes the topology information about near nodes more precise than the information about farther nodes
- However, it results in:
 - less knowledge about distant nodes
 - inaccurate and inadequate information for route establishing

Fisheye State Routing(FSR) protocol



- However, as the packet approaches the destination, the route becomes more and more accurate



Fisheye State Routing(FSR) protocol

- Link break:
 - No control messages after a break
- Advantage:
 - FSR reduces significantly the consumed bandwidth as the link state update packets are exchanged only among neighbouring nodes
 - The routing overhead is also reduced due to different frequencies of updates among nodes of different scopes
 - FSR manages to reduce the message size of the topology information due to removal of topology information concerned far-away nodes
- Disadvantage:
 - Very poor performance in small ad hoc networks