

Wireless Internet Routing

Optimized Link State Routing
(OLSR)

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- [Jacquet00ietf, Jacquet99Inria]
- RFC 3626 <http://www.ietf.org/rfc/rfc3626.txt>
- Proactive / link state algorithm for wireless ad hoc and mesh networks

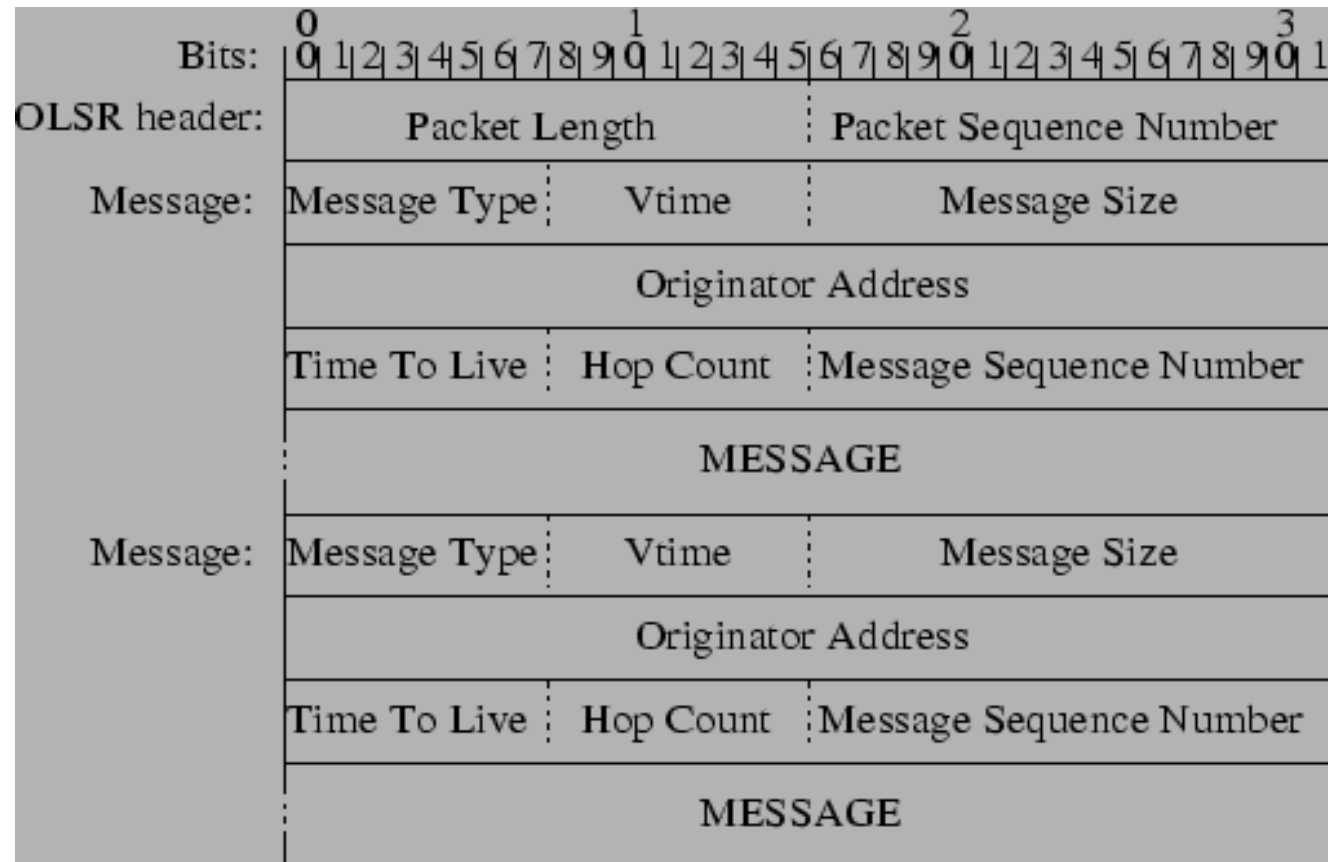
OLSR Overview

- ❑ Neighbor discovery
- ❑ MPR flooding mechanism
- ❑ Topology diffusion mechanism
- ❑ Attached networks diffusion

Neighbor Discovery

- Periodic exchange of HELLO messages
 - Link sensing
 - List neighbors
 - Neighbors "Quality"
 - MPR selection
- To maintain link, neighbor, 2-hop neighbor, MPR

OLSR Generic Packet Format



Hello Packet Format

0										1										2										3	
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
Reserved										Htime										Willigness											
Link Code					Reserved					Link Message Size																					
Neighbor Interface Address																															
Neighbor Interface Address																															
..																															
Link Code					Reserved					Link Message Size																					
Neighbor Interface Address																															
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Bits:	0	1	2	3	4	5	6	7
	Neigh Type					Link Type		

Link code: contains "link type" and "neighbor type"

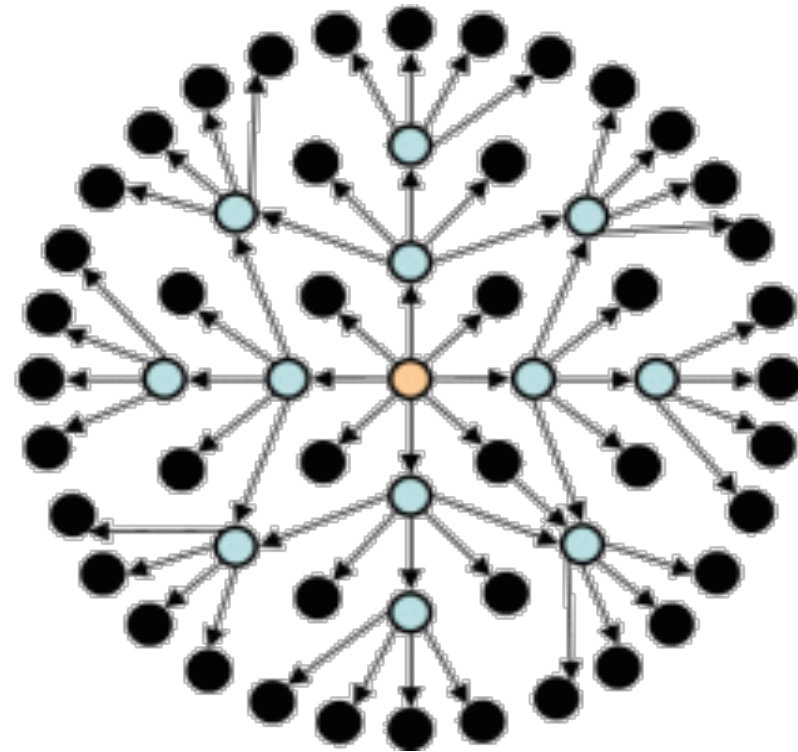
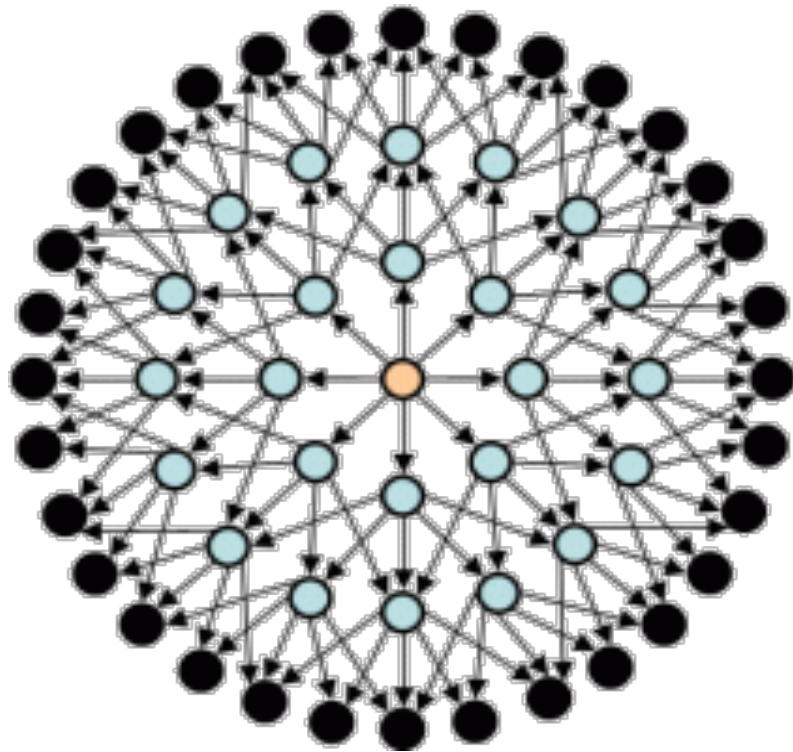
Htime: Hello emission interval

Willigness: willingness to carry and forward

Multipoint Relays (MPR) Flooding

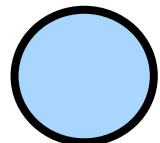
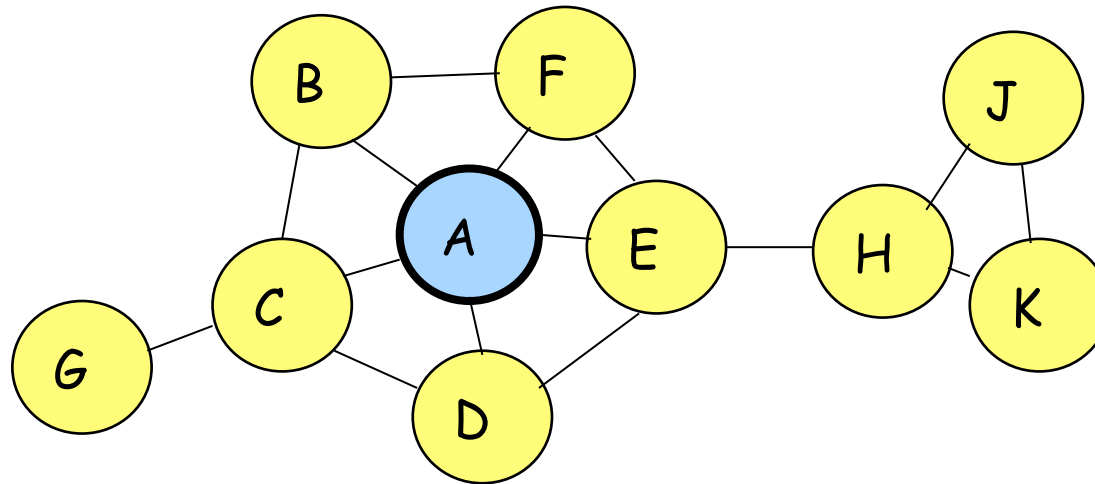
- ❑ The overhead of flooding link state information is reduced by requiring fewer nodes to forward the information
- ❑ A broadcast from node X is only forwarded by its *multipoint relays*
- ❑ Multipoint relays of node X are its neighbors such that each two-hop neighbor of X is a one-hop neighbor of at least one multipoint relay of X
 - Each node transmits its neighbor list in periodic beacons, so that all nodes can know their 2-hop neighbors, in order to choose the multipoint relays

Flooding vs MPR



Optimized Link State Routing (OLSR)

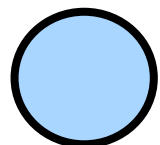
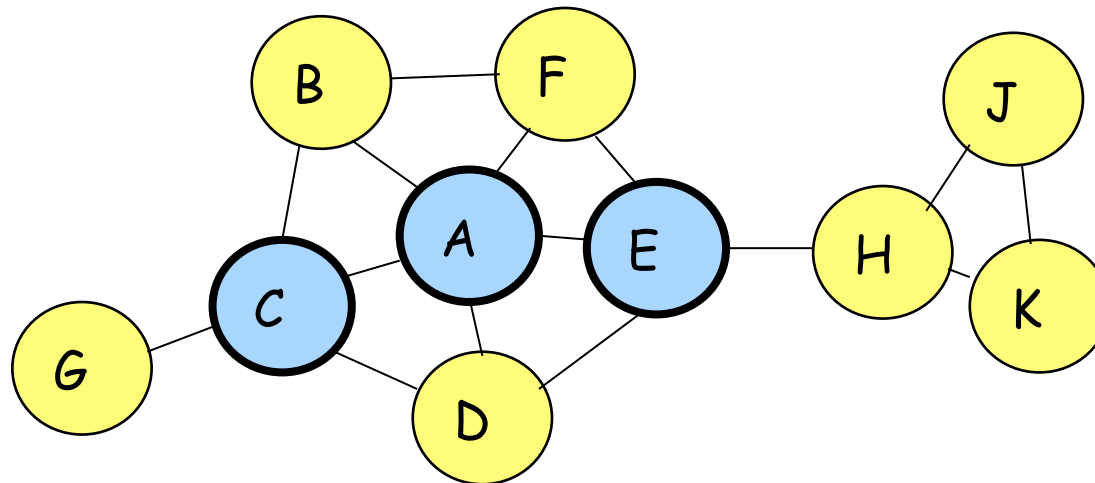
- Nodes C and E are multipoint relays of node A



Node that has broadcast state information from A

Optimized Link State Routing (OLSR)

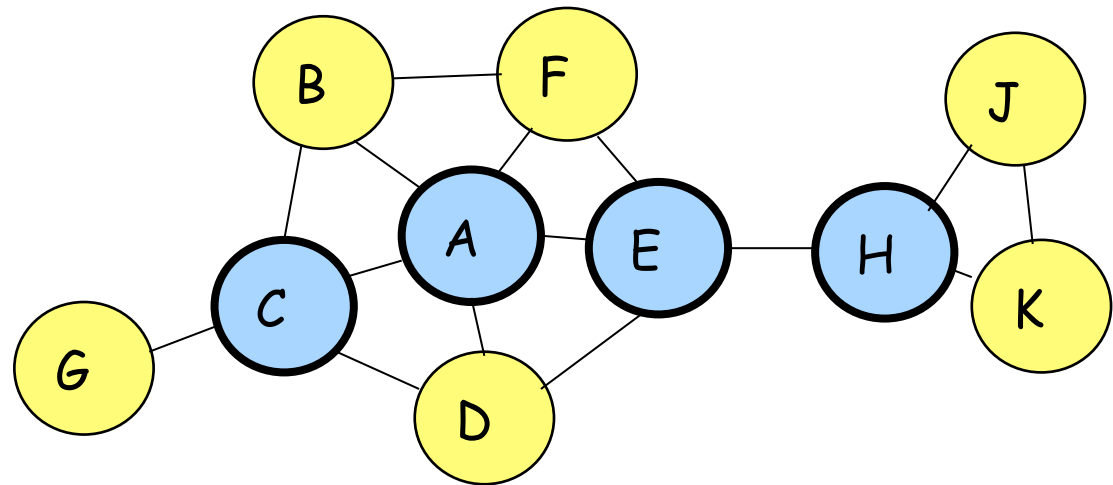
- Nodes C and E forward information received from A



Node that has broadcast state information from A

Optimized Link State Routing (OLSR)

- ❑ Nodes E and K are multipoint relays for node H
- ❑ Node K forwards information received from H
 - E has already forwarded the same information once



 Node that has broadcast state information from A

Topology Diffusion

□ OLSR declares partial topology

- All destinations
- Subset of links
 - Only those which represent MPR selections
- Only subset of nodes declare topology (MPR)

□ How?

- MPR nodes transmit TC (topology control) messages (periodically)
- TC message contains MPR selector set of the source
 - MPR selector set: enumerates nodes that have selected it as an MPR node
- TC can be triggered by link failures

Topology Diffusion

- Forwarding path for TC messages not shared among all nodes
 - Varies depending on the source

Topology Control Packet Format

0										1										2										3	
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
ANSN										Reserved																					
Advertised Neighbor Main Address																															
Advertised Neighbor Main Address																															

ANSN: Advertised Neighbor Sequence Number

Home Network Address (HNA)

- TC disseminate host routes
- HNA disseminate network route advertisements

OLSR Summary

- ❑ OLSR floods information through the multipoint relays
- ❑ The flooded information itself is for links connecting nodes to respective multipoint relays
- ❑ Routes used by OLSR only include multipoint relays as intermediate nodes

Ongoing Work in the MANET WG

□ DYMO

- Draft: <http://tools.ietf.org/html/draft-ietf-manet-dymo-17>

□ NHDP

- Draft: <http://www.ietf.org/internet-drafts/draft-ietf-manet-nhdp-09.txt>

Dynamic On-Demand (DYMO) Routing

- ❑ On-demand
- ❑ Route discovery (RREQ-RREP)
- ❑ Route maintenance
 - To preserve routes in use, DYMO routers extend route lifetimes upon successfully forwarding a packet.
 - RERR: When a data packet is received for forwarding and a route for the destination is not known or the route is broken, then the DYMO router of source of the packet is notified.
- ❑ Sequence numbers to ensure loop freedom
- ❑ Bidirectional links

Neighborhood Discovery Protocol (NHDP)

- ❑ Discover 1-hop and symmetric 2-hop neighbors
- ❑ Local 1-hop broadcast
- ❑ Advertises the presence of a router and its interface addresses.
 - Discovers links from neighboring routers.
 - Performs bi-directionality checks on the discovered links.
 - Advertises discovered links, and whether each is symmetric, to its 1-hop neighbors, and hence discovers symmetric 2-hop neighbors.