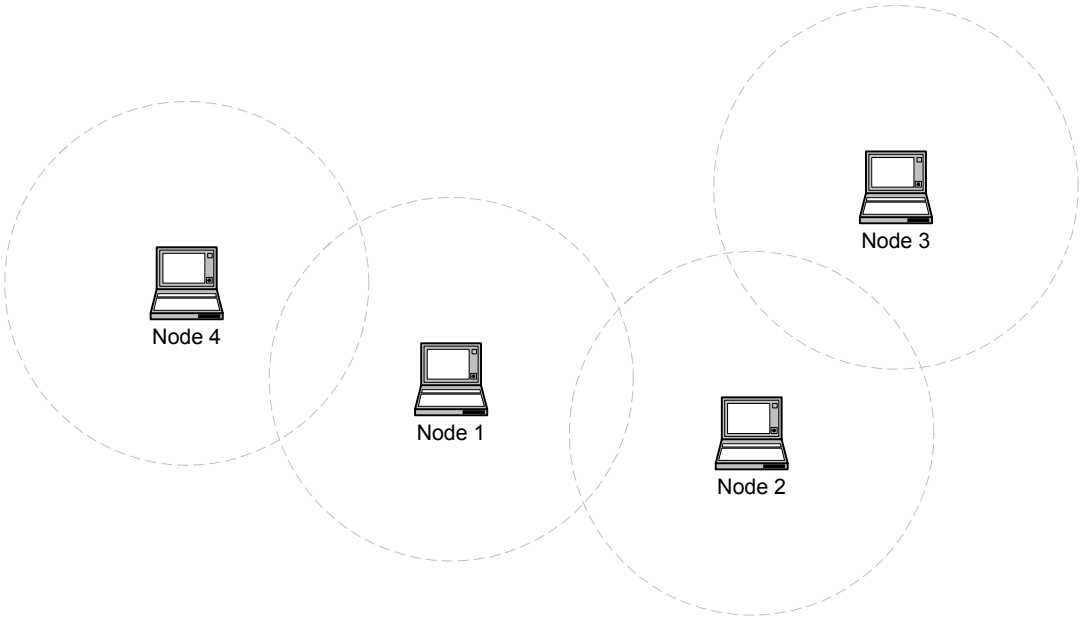
# A Quick Guide to AODV Routing

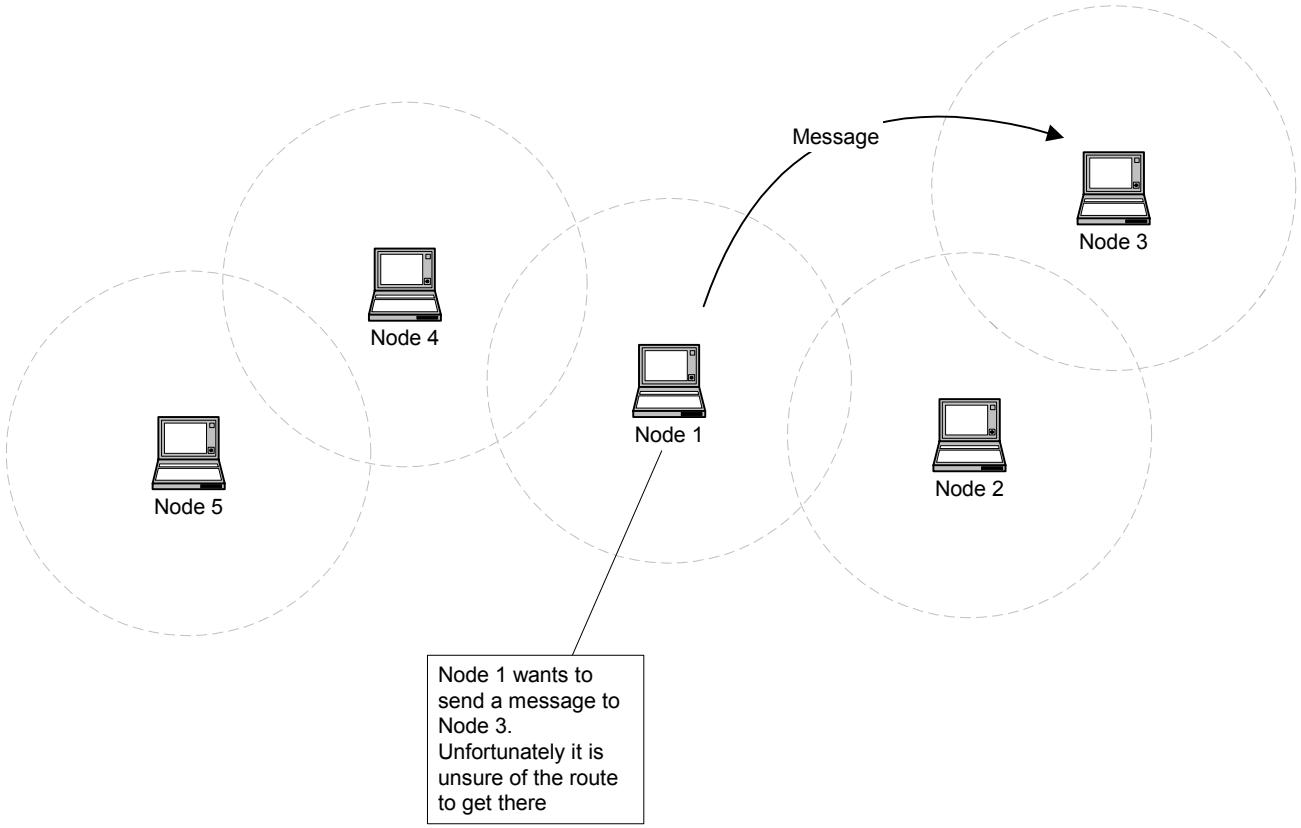



**Luke Klein-Berndt**
Wireless Communications Technologies Group
National Institute of Standards and Technology

NIST
**National Institute of Standards and Technology**
Technology Administration, U.S. Department of Commerce

AODV is a method of routing messages between mobile computers. It allows these mobile computers, or nodes, to pass messages through their neighbors to nodes with which they cannot directly communicate. AODV does this by discovering the routes along which messages can be passed. AODV makes sure these routes do not contain loops and tries to find the shortest route possible. AODV is also able to handle changes in routes and can create new routes if there is an error.

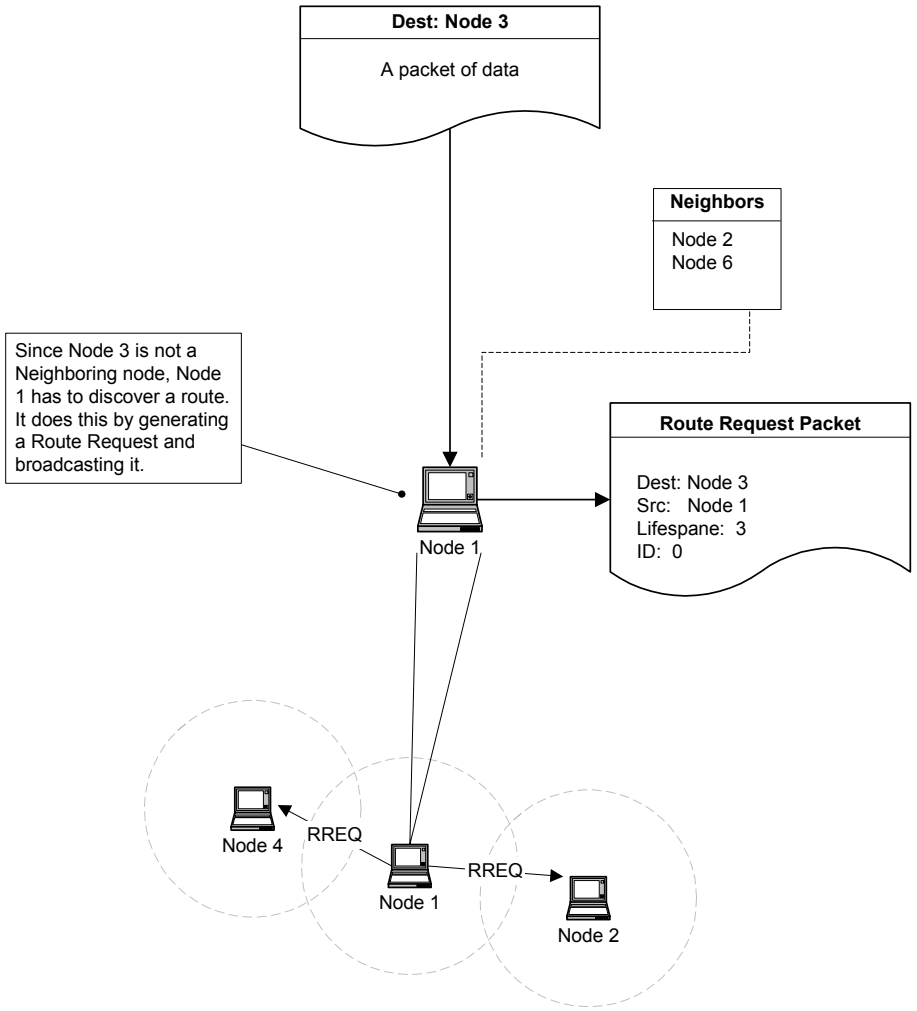
The diagram to the left shows a set up of four nodes on a wireless network. The circles illustrate the range of communication for each node. Because of the limited range, each node can only communicate with the nodes next to it.



Nodes you can communicate with directly are considered to be Neighbors. A node keeps track of its Neighbors by listening for a HELLO message that each node broadcast at set intervals.

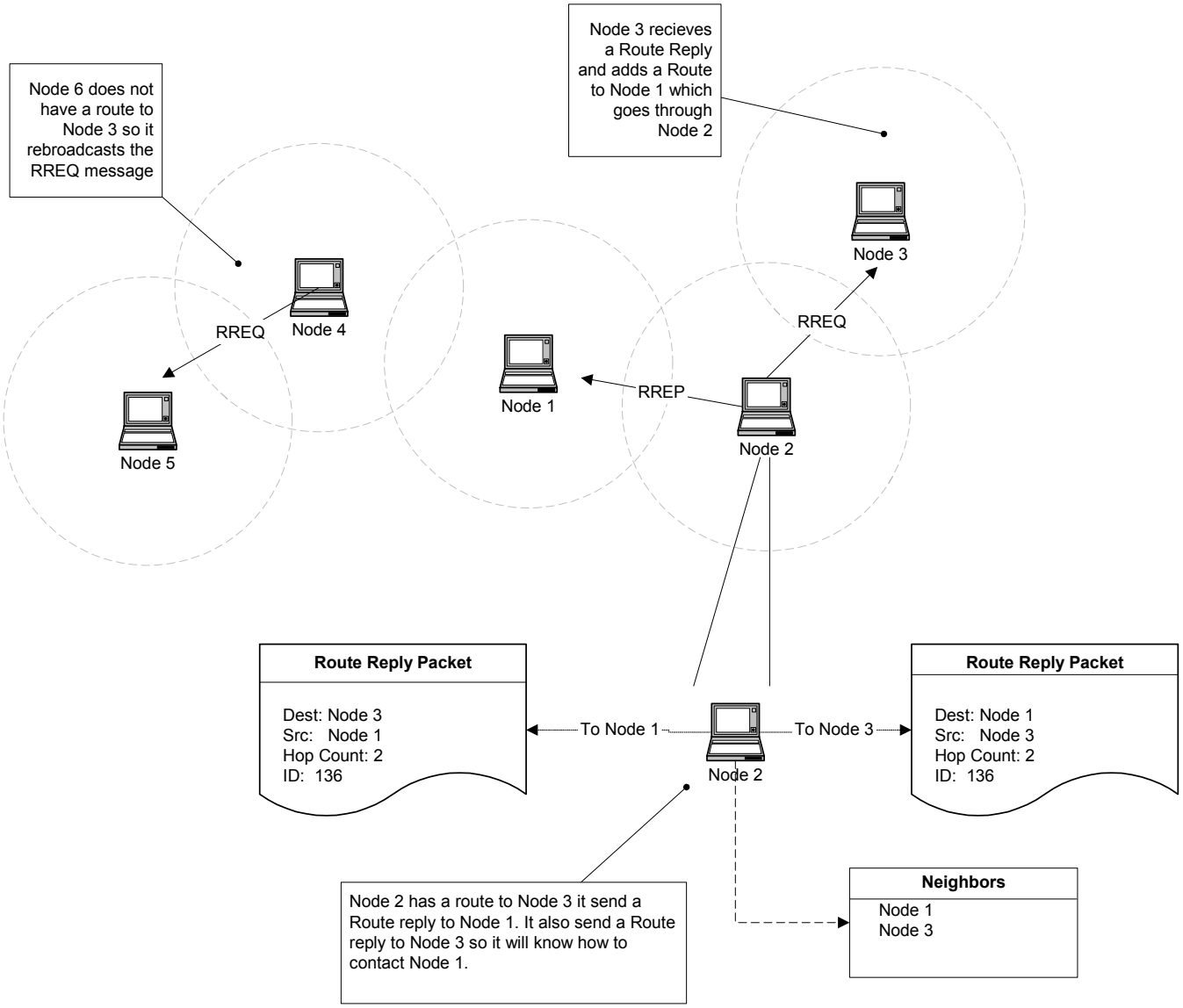
When one node needs to send a message to another node that is not its Neighbor it broadcasts a Route Request (RREQ) message. The RREQ message contains several key bits of information: the source, the destination, the lifespan of the message and a Sequence Number which serves as a unique ID.

In the example, Node 1 wishes to send a message to Node 3. Node 1's Neighbors are Nodes 2 + 4. Since Node 1 can not directly communicate with Node 3, Node 1 sends out a RREQ. The RREQ is heard by Node 4 and Node 2.



When Node 1's Neighbors receive the RREQ message they have two choices; if they know a route to the destination or if they are the destination they can send a Route Reply (RREP) message back to Node 1, otherwise they will rebroadcast the RREQ to their set of Neighbors. The message keeps getting rebroadcast until its lifespan is up. If Node 1 does not receive a reply in a set amount of time, it will rebroadcast the request except this time the RREQ message will have a longer lifespan and a new ID number. All of the Nodes use the Sequence Number in the RREQ to insure that they do not rebroadcast a RREQ

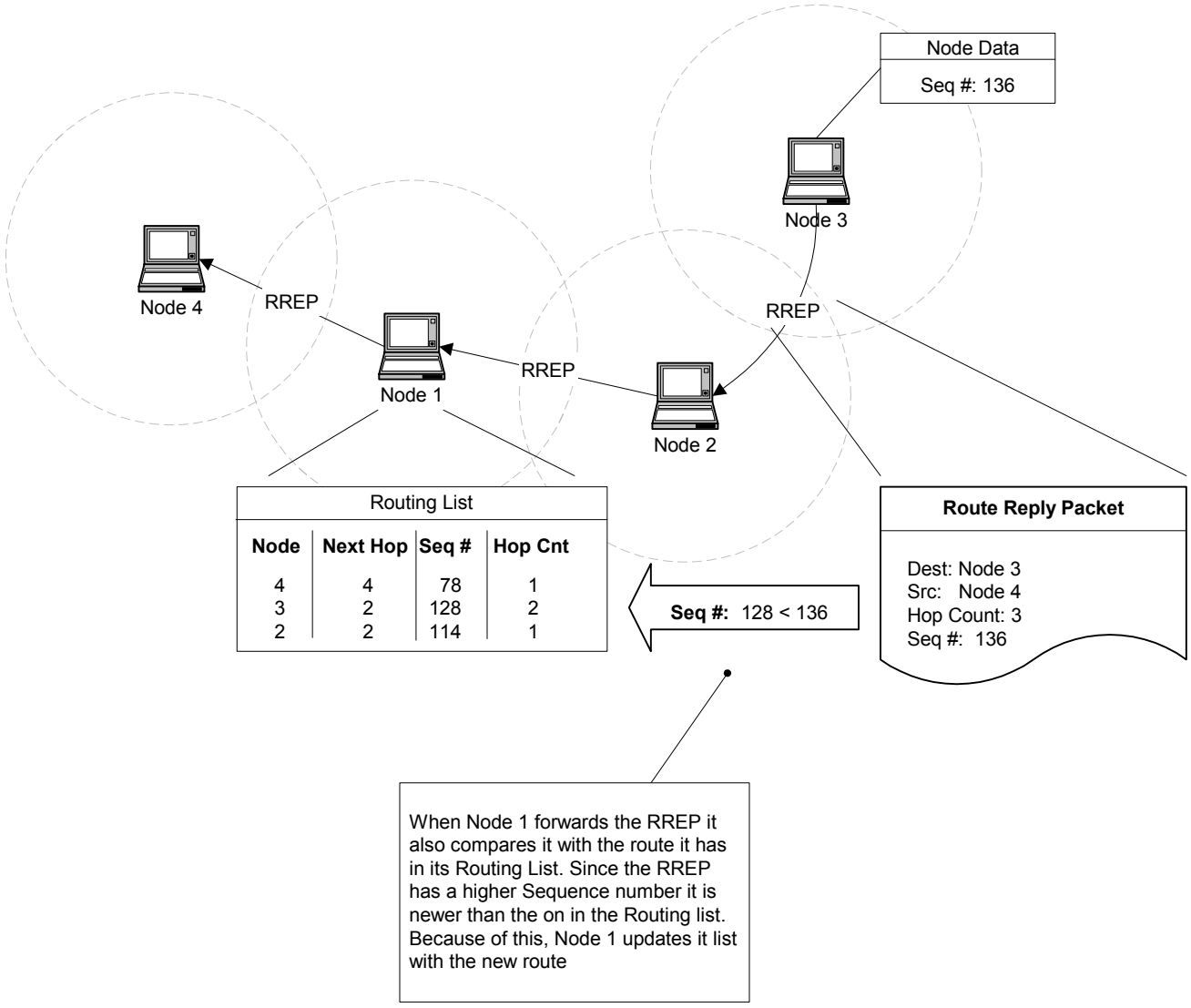
In the example, Node 2 has a route to Node 3 and replies to the RREQ by sending out a RREP. Node 4 on the other hand does not have a route to Node 3 so it rebroadcasts the RREQ.



# Sequence Numbers

Sequence numbers serve as time stamps. They allow nodes to compare how "fresh" their information on other nodes is. Every time a node sends out any type of message it increase its own Sequence number. Each node records the Sequence number of all the other nodes it talks to. A higher Sequence numbers signifies a fresher route. This it is possible for other nodes to figure out which one has more accurate information.

In the example, Node 1 is forwarding a RREP to Node 4. It notices that the route in the RREP has a better Sequence number than the route in it's Routing List. Node 1 then replaces the route it currently has with the route in the Route Reply



# Error Messages

The Route Error Message (RERR) allows AODV to adjust routes when Nodes move around.

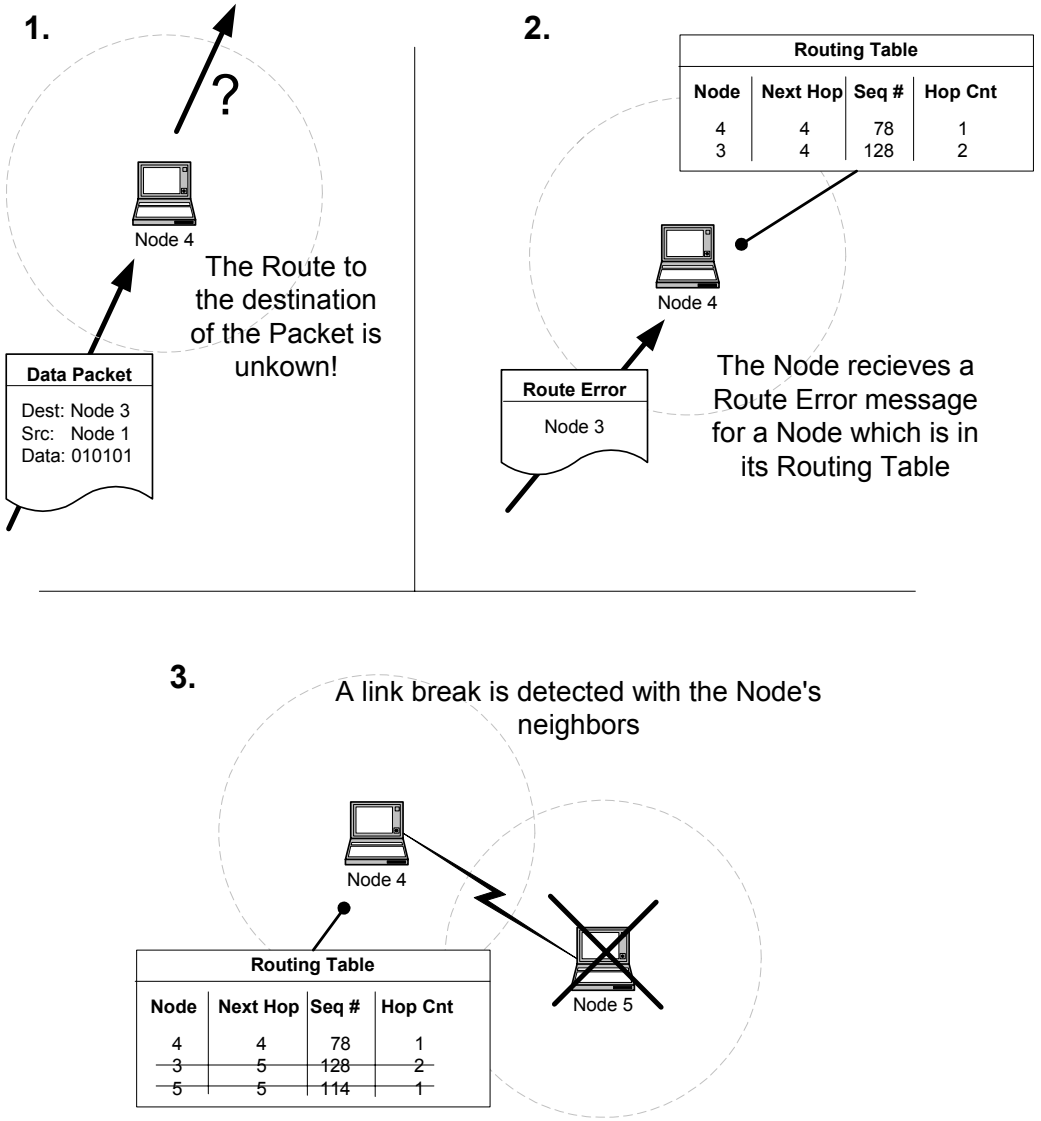
Whenever a Node receives RERR it looks at the Routing Table and removes all the routes that contain the bad Nodes.

The diagrams to the left illustrate the three circumstances under which a Node would broadcast a RERR to its neighbors.

In the first scenario the Node receives a Data packet that it is supposed to forward but it does not have a route to the destination. The real problem is not that the Node does not have a route; the problem is that some other node thinks that the correct Route to the Destination is through that Node.

In the second scenario the Node receives a RERR that cause at least one of its Route to become invalidated. If it happens, the Node would then send out a RERR with all the new Nodes which are now unreachable

In the third scenario the Node detects that it cannot communicate with one of its Neighbors. When this happens it looks at the route table for Route that use the Neighbor for a next hop and marks them as invalid. Then it sends out a RERR with the Neighbor and the invalid routes



## AODV Characteristics:

- Will find routes only as needed
- Use of Sequence numbers to track accuracy of information
- Only keeps track of next hop for a route instead of the entire route
- Use of periodic HELLO messages to track Neighbors

## References:


- IETF Manet Working Group AODV Draft
  http://www.ietf.org/internet-drafts/draft-ietf-manet-aodv-08.txt