

# A Review of Current Routing Protocols for Ad Hoc Mobile Wireless Networks

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# Outline

Introduction

Classification of the Ad Hoc Protocols

- Table driven
- Source-initiated

Description of the Routing Protocols

Key features

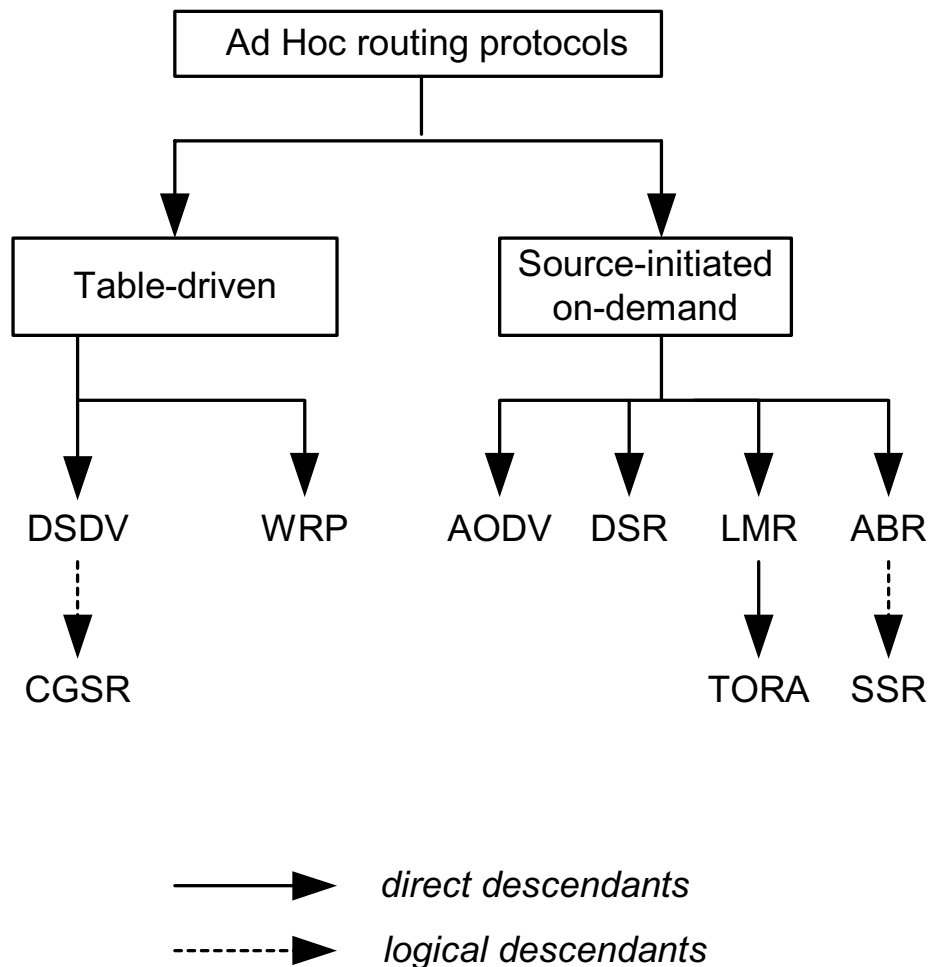
Comparison

Discussion

# Introduction

- Article describe several routing schemes and provide a classification of these schemes. Highlight features, differences and characteristics
- Table-driven routing protocols attempt to maintain consistent, up-to-date routing information from each node to every other node in network
- Source-initiated on-demand routing creates routes only when desired by source node

# Classification of the Ad Hoc routing protocols



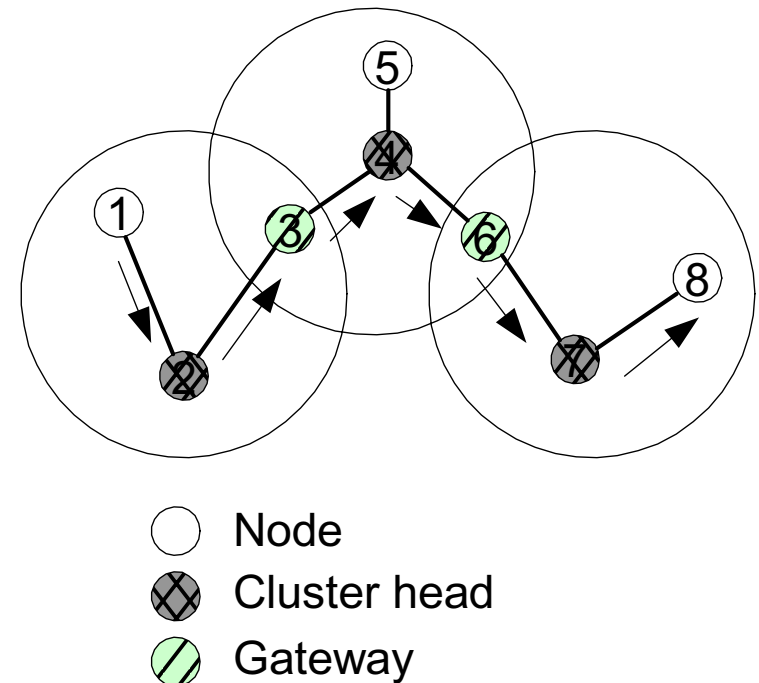
- DSDV (Destination-Sequenced Distance-Vector)
- CGSR (Clusterhead Gateway Switch Routing)
- WRP (Wireless Routing Protocol)
- AODV (Ad Hoc On-Demand Distance Vector)
- DSR (Dynamic Source Routing)
- TORA (Temporally Ordered Routing Algorithm)
- LMR (Lightweight Mobile Routing)
- ABR (Associativity-Based Routing)
- SSR (Signal Stability Routing)

# DSDV (Destination-Sequenced Distance-Vector)

- Every node in the network maintains a routing table in which all of the possible destinations within the network and the number of hops to each recorded
- Each entry marked with a sequence number assigned by the destination node
- Routing table updates are periodically transmitted throughout the network in order to maintain table consistency
  - Full dump
    - All available routing information
    - Transmitted infrequently
  - Incremental
    - Only information what has been changed since the last *full dump*

# CGSR (Clusterhead Gateway Switch Routing)

- A clustered multihop mobile wireless network with several heuristic routing schemes
- A cluster head selection algorithm is utilized to elect a node as the cluster head using a distributed algorithm within the cluster
- Disadvantage: Cluster head changes can adversely affect routing protocol performance since nodes are busy in cluster head selection
- A packet sent by a node is first routed to its cluster head and then the packet is routed from the cluster head to gateway to another cluster head and so on until the cluster head of the destination node is reached
- CGSR uses DSDV as the underlying routing scheme. Same overhead as DSDV



# WRP (**W**ireless **R**outing **P**rotocol)

- Each node in the network is responsible for maintaining four tables
  - Distance table
  - Routing table
  - Link-cost table
  - Message retransmission list table
- Mobile inform each other of link changes through the use of update messages
- An update message is sent only between neighboring nodes
- In event of the loss of a link between two nodes, the nodes send update messages their neighbors
- Nodes learn of the existence of their neighbors from the receipt of acknowledgements and other messages
- Routing nodes communicate the distance and second-to-last hop information for each destination in the wireless networks

# AODV (Ad Hoc On-Demand Distance Vector) routing

- AODV is an improvement on DSDV because it typically minimizes the number of required broadcast by creating routes on demand basis
- If valid route doesn't existing, it initiates a path discovery process to locate other path
  - It broadcast route request packet to its neighbors, which then forward request to their neighbors, and so on, until either destination or intermediate node with "fresh enough" route is located
- Each node maintains its own sequence number to ensure all routes are loop-free and contains most recent route information
- If source node moves, it is able to reinitiate route discovery protocol to find a new route to the destination
- Periodic broadcast "hello" messages can be used to maintain local connectivity



# DSR (Dynamic Source Routing)

- Nodes are required to maintain route caches that contain source routes of which mobile is aware
- The protocol performs two basic functions
  - Route discovery
    - If there is already route to destination, use it
    - If not, route request packet is send
    - Each node receiving packet checks whether it knows of route. If not, it adds its own address to route record and forwards packet
  - Route maintenance
    - Route error packets and acknowledgements
- Route reply is generated when route request when the route request reaches either destination itself or intermediate node which contains in its route cache an unexpired route to the destination

# TORA (Temporally Ordered Routing Algorithm)

- Highly adaptive loop-free distributed routing algorithm based on the concept of link reversal
- TORA is localization of control messages to very small set of nodes near the occurrence of a topological changes
- The protocol performs three basic functions
  - Route creation
  - Route maintenance
  - Route erasure
    - Broadcast *clear packets* through network and erase invalid routes
- Potential for oscillations to occur, especially when multiple sets of coordinating nodes are concurrently detecting partitions, erasing routes and building new routes

# ABR (Associativity-Based Routing)

- Protocol is free from loops, deadlocks and packet duplicates
- Each node periodically generates a beacon to signify its existence. When received by neighboring nodes, this beacon causes their associativity tables to be updated and the associativity tick of the current node with respect to the beaconing node is incremented
- The protocol performs three basic functions
  - Route discovery
    - Broadcast query and await-reply
  - Route reconstruction
    - Partial route discovery, invalid route erasure, valid route updates and new updates
  - Route deletion
    - When route is no longer needed, the source node sends route deletion broadcast so that nodes along the route update their routing tables

# SSR (Signal Stability Routing)

- Protocol selects routes based on the signal strength between nodes and a node's location stability
- SSR can be divided into two cooperative protocols
  - Dynamic Routing Protocol
    - Responsible for maintenance of the Signal Stability Table (signal strength of neighboring nodes) and Routing Table
  - Static Routing Protocol
    - Process packets by passing the packet up the stack
- Route-search packets arriving at destination have necessarily chosen the path of strongest signal stability
- When a failed link is detected within the network, intermediate nodes send an error message to the source indicating which channel has failed and initiates another route-search process

# Key features

## Table-driven

- DSDV is inefficient because of periodic update transmissions
- CGSR can be employed several heuristic methods and improve protocol performance
- WRP requires lot of memory and uses "hello" packets

## On-Demand

- AODV packets contains only destination address and support for multicast. Requires symmetric links between nodes
- DSR doesn't make periodic routing advertisements and allows nodes keep in memory multiple routes to the destination. Not for the large networks
- TORA is best suited to the large networks. It's support multicast. TORA needs synchronized clocks
- ABR is compromise between broadcast and point-to-point routing. Long lived paths. Needs beaconing
- SSR paths are stable and long lived. Long delays.

# Comparison

PARAMETER	ON-DEMAND	TABLE-DRIVEN
Availability of routing information	Available when needed	Always available regardless of need
Routing philosophy	Flat	Mostly flat, except for CGRS
Periodic route updates	Not required	Required
Coping with mobility	Use local route discovery as in ABR and SSR	Inform other nodes to achieve a consistent routing table
Signaling traffic generated	Grows with increasing mobility of active routes (as in ABR)	Greater than that of in-demand routing
Quality of service support	Few can support QoS, although most support shortest path	Mainly shortest path as the QoS metric

# Discussion