

# **AD-HOC ROUTING PROTOCOL COMPARISON IN UAV COMMUNICATION SCENARIO**

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## Ad-hoc routing

**Ad-hoc network** is a collection of mobile nodes forming an instant network without a fixed topology. In such a network each node acts as both router and host simultaneously and can join or move out in the network freely. In Ad-hoc routing, nodes take decision of routing among all nodes connected in a mobile ad-hoc network.



# PROACTIVE ROUTING PROTOCOLS

In this type of routing protocol, each node in a network maintains one or more routing tables that are updated regularly. Each node sends a broadcast message to the entire network if there is any change in the network topology. In this project we are implementing these proactive protocols.

**OLSR Protocol** - OLSR is a proactive link state routing protocol, which uses *hello* and *topology control* (TC) messages to discover and then disseminate link state information throughout the mobile ad hoc network. Individual nodes use this topology information to compute next hop destinations for all nodes in the network using shortest hop forwarding paths.

**DSDV Protocol** - In DSDV, each node maintains a routing table with one route entry for each destination in which the shortest path is recorded. It uses a destination sequence number to avoid routing loops. Prior to the establishment of communication between the source and receiver node, the routing protocol should be mentioned to find the route between them. Data Transmission is established between nodes using UDP agent and CBR traffic.



# REACTIVE ROUTING PROTOCOLS

Reactive protocols are also known as on-demand driven reactive protocols. These protocols do not start route discovery by themselves, until it has been made a request to, when a source node asks for finding a route. we are implementing Aodv and Dsr protocol.

**AODV Protocol-** AODV is a routing protocol for ad hoc mobile networks with large numbers of mobile nodes. The protocol's algorithm creates routes between nodes only when the routes are requested by the source nodes, giving the network the flexibility to allow nodes to enter and leave the network at will. Route remain active only as long as data packets are traveling along the paths from the source to the destination. When the source stops sending packets, the path will time out and close.



DSR Protocol- The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. DSR has been implemented by numerous groups, and deployed on several testbeds.

#### HYBRID PROTOCOL :

HWMP - Being a kind of hybrid routing protocol, HWMP includes reactive routing protocol and proactive routing protocol. The tree-based proactive routing protocol is adopted in backbone network, and the RadioMetric AODV (RM-AODV) is adopted in variable network topology, which is evolved from AODV. AODV is an IP-based routing protocol and works in network layer, which uses the number of hops as metric. RM-AODV is MAC address-based routing protocol and works in physical layer, which uses Radio-Aware routing metric to choose path.



# UAV COMMUNICATION SCENARIO

In our scenario we have one Ground control station and a flock of 3 UAVs flying. Initially we have positioned all the UAVs and the Ground control station at the origin using the grid position allocator in the grid topology using 3 grid width, 5m gap for x axis and 10m for y axis for all the nodes, then we provided motion to the flock of the UAVs by providing the velocity containing components in all three directions and maintaining leader follower approach where 2 nodes are following one leader among the uavs we have provided same velocity for all the nodes so that the relative position of all the nodes are maintained .



# UAV COMMUNICATION SCENARIO

- We are broadcasting node's position and velocity to all other nodes in udp packets form using set fill method implemented in ns3.
- Initially ,the velocity assigned to flock of uavs is (2,2,1).
- We are updating followers velocity on a regular time interval to maintain initial topology of the network.
- We are running our simulation upto 10 seconds, initially we are sending 2 packets per second.
- We are comparing the simulation results for all the five protocols - AODV, DSDV,DSR,OLSR,HWMP.



# NS-3 IMPLEMENTATION CODE

We have implemented our simulation using ns3, here is the google drive link containing codes, animations, output and all related materials :

<https://drive.google.com/drive/folders/1ES6im-EFYujhLYgWycXTXJ85puoUXQO?usp=sharing>

This link contains code for aodv implementation for our scenario , very few and relevant changes were done for implementing other protocols.





# PDR COMPARISON

When velocity=(2,2,2) m/s.

PROTOCOL	PDR
AODV	81.25 %
OLSR	80.00%
DSDV	80.6%
DSR	77.8%
HWMP	81.25%



# THROUGHPUT COMPARISON

When velocity=(2,2,2) m/s

PROTOCOL	THROUGHPUT
AODV	1664 bytes/second
OLSR	1536 bytes/second
DSDV	1600 bytes/second
DSR	1536 bytes/second
HWMP	1664 bytes/second



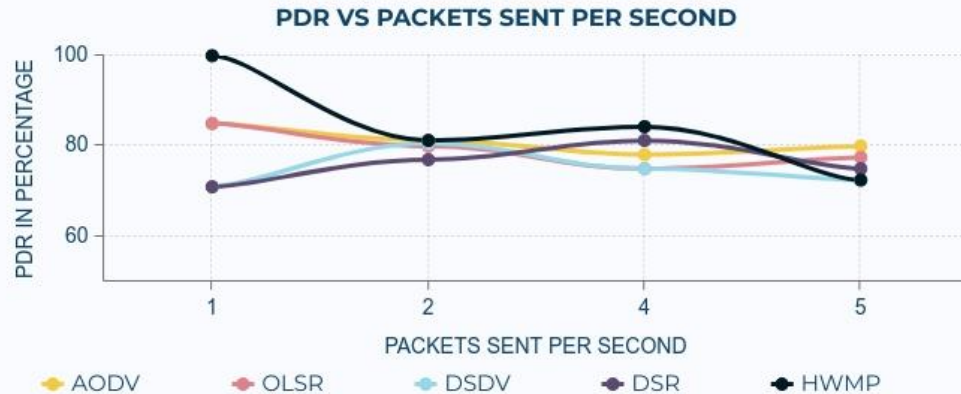
# DELAY COMPARISON

When velocity=(2,2,2) m/s

PROTOCOL	DELAY
AODV	0.00334s
OLSR	0.00315s
DSDV	0.00673s
DSR	0.0151s
HWMP	0.251s

# VARYING PACKETS PER SECOND

## PDR IN PERCENTAGE





# CONCLUSION AND FUTURE PROSPECTS

First we have kept velocity of the flock very low and found that the performance of the network is very good , PDR is almost 100% , increasing velocity leads to decreased PDR , increasing delay and reduced throughput. We also varied power level of data signal , increasing power leads to good PDR , increasing the number of nodes also helps network in giving good performance. We have also done protocol wise comparison.

We have also worked on gazebo-ros integration with ns-3 for simulating more complex Uav communication scenario, read some papers about the implementation for the same and lead in the same direction.



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# REFERENCES

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