

# *Ad hoc network simulation for disaster management*

COURSE: CSC 579  
PROJECT PRESENTATION

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# Introduction

- There are two main types of networks:
  - Infrastructure network - the mobile nodes are fixed to base stations and as they move around they get into different base station ranges.
  - Infrastructure less (ad hoc network) - the mobile devices dynamically create their network as they move, the nodes act as routers and they are not controlled by base stations.
- Ad hoc wireless network is divided into three branches;
  - Wireless mesh network (WMN)
  - Mobile ad-hoc network (MANET) and
  - Wireless sensor network.



# Introduction cont.

- Wireless ad-hoc network(WANET) is known as a wireless mesh network based on its topology. MANET is a type of WANET which is able to be routed.
- This behavior allows MANET to move independently in any direction and to be able to change the links many times.
- It is self configured without requiring infrastructure based on its capability of delivering connection wirelessly.



# Problem statement

- **Alternative communication** network during emergency/disaster when the existing infrastructure is ruined/damaged .
- The infrastructure less network is important because it provides a **means for communication** especially when there is a disaster like fire or air-borne disease outbreak.
- It helps provide services like search and rescue and recovery from disasters. This can be useful particularly in **rural** areas and in informal settlements.



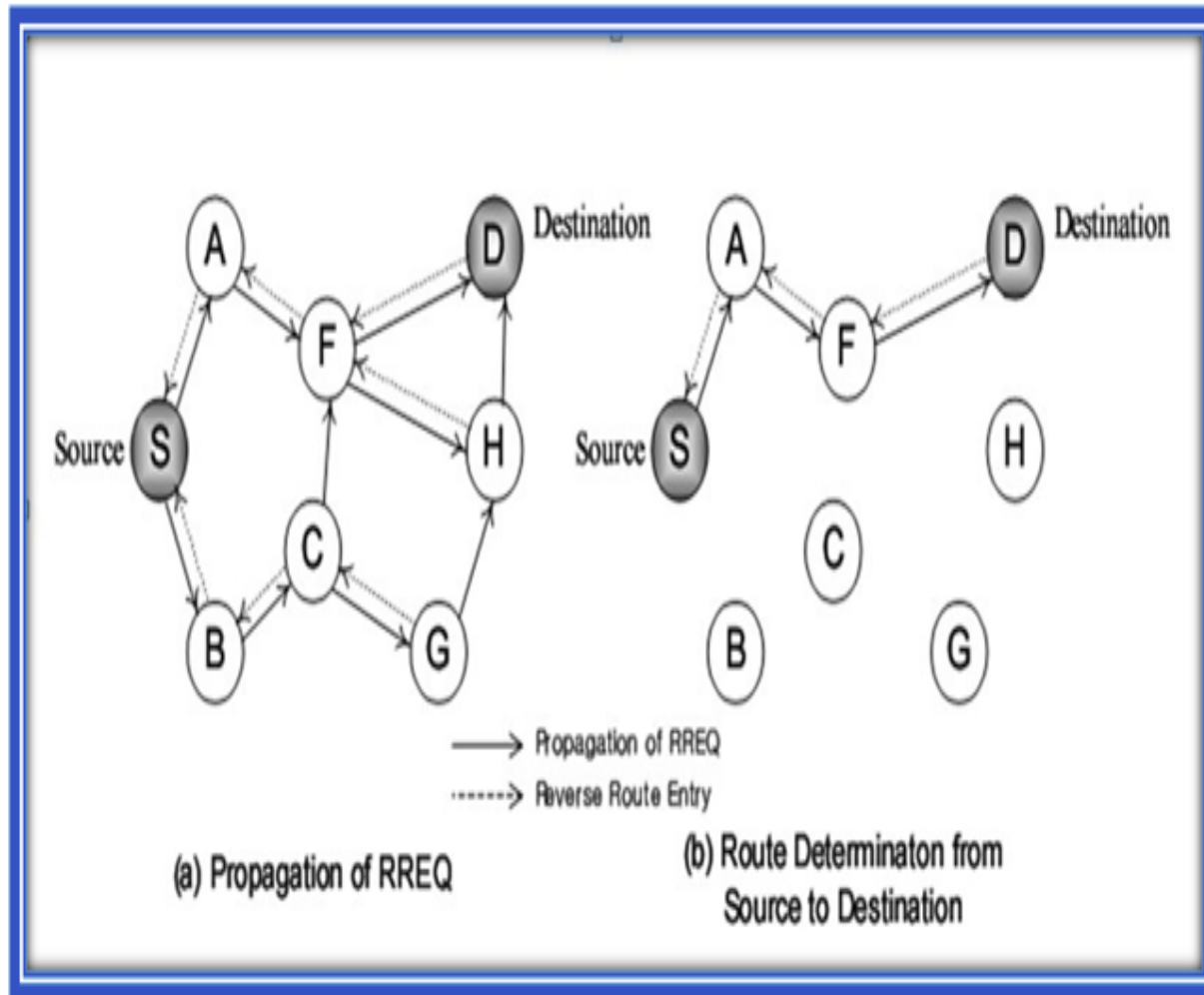
# Communication mechanisms

The communication between nodes can be done in two different ways:

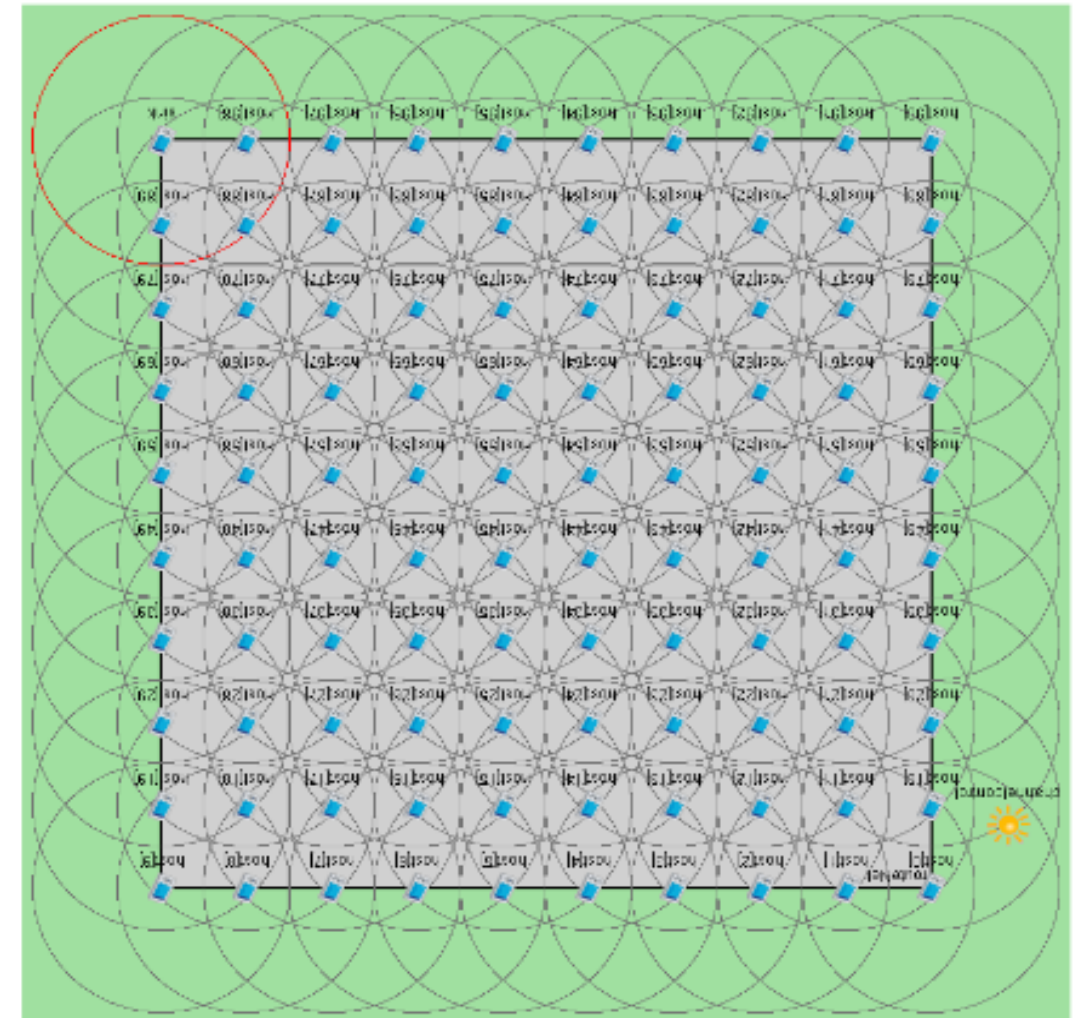
- **Direct communication** - Nodes start by their neighbors until its message is spread into the whole network.
- **Cluster based MANET** has the advantage of dynamic resource allocation and time saving due to the use of CBRP( Cluster Based Routing Protocol) and Dynamic Source Routing (DSR) protocol.



# Nodes communication



Nodes comm. starting with neighbors



Cluster based MANET nodes

# MANET cluster routing

- MANET cluster routing works in the following way. The nodes in a given space are divided into zones/cluster and each zone is assigned a cluster head (CH).
- The routes are then established using proactive routing and for nodes that are far away, they use reactive routing.
- It thus uses hybrid routing method. Different clustering methods, we will focus on mobility based clustering approach



# AODV Functionality

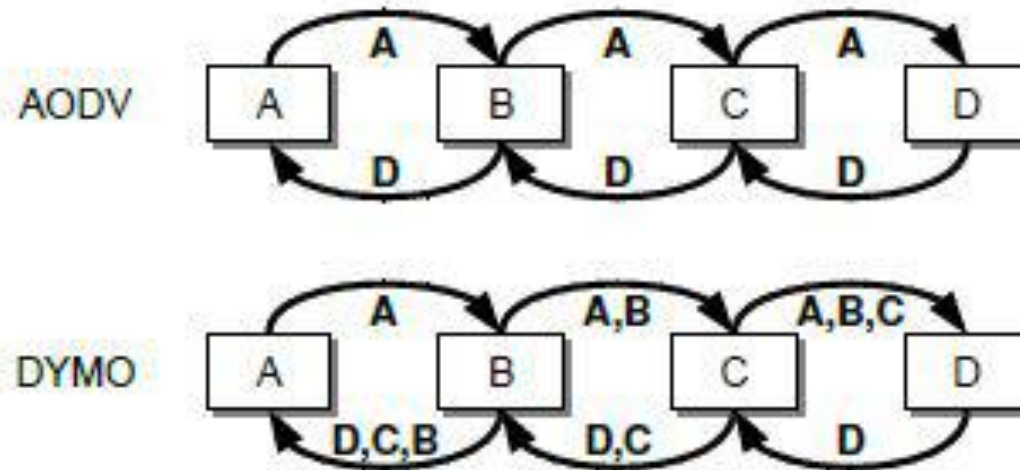
- It is a reactive protocol where routing table is made only when needed.
- It consists of destination address, Next-Hop address, Destination Sequence Number and Lifetime.
- The route might be used within its lifetime otherwise it expires.
- There are two conditions for a node to communicate to others
  - If the route is still alive, the packet is forwarded to next-hop
  - If the route is expired, initiate the route discovery.





# DYMO and AODV

- After the route request is satisfied. In DYMO, the node additionally knows a route to node C. That is, it is able to get information about all intermediate nodes besides the destination node and the next hop node.
- Unlike in AODV, where after the route request is done, for example node D knows only the routes to C and A.



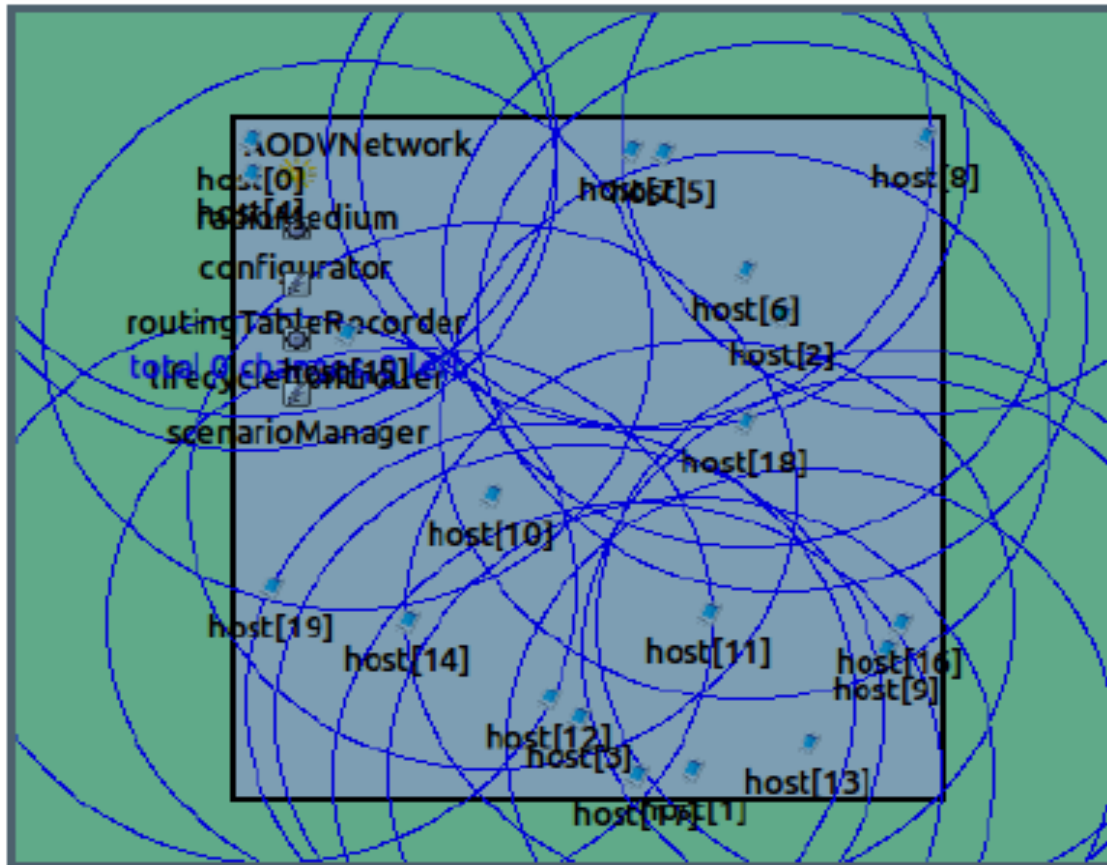
DYMO is preferred over AODV because of better route realization ability.



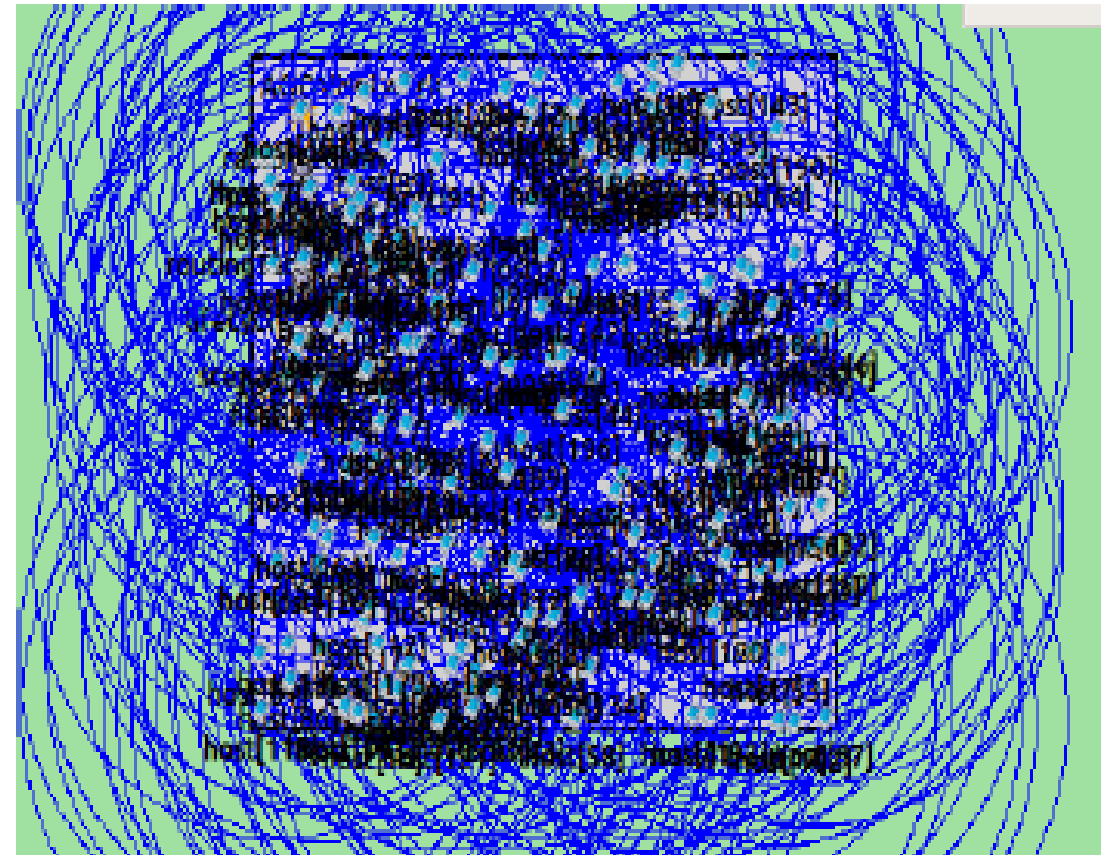
# DYMO Functionality

- DYMO is based on two mechanisms:
  - route discovery &
  - route maintenance
- It performs route discovery in a similar way as AODV. It includes sequence numbers to help keep record of new routes and to prevent routing loops.
- The route maintenance mechanism is for extension of the lifetime of a route that successfully delivers packets and facilitates deletion of routes that have become unavailable/link failure.
- The source of a given packet receives a message to delete the failed route and it can later initiate a fresh route discovery if it has to send packets to the destination again.

# Implementation



20 nodes with AODV



200 nodes with AODV



# AODV Route discovery

Source	Destination	Hop Count	Next host	Time
Host 0	19	7	Host 4	180000
Host 3	17	4	Host 7	13000
Host 7	8	2	Host 2	12000
Host 2	4	2	Host 14	15000
Host 14	11	2	Host 6	16000
Host 6	19	0	Host 19	19000

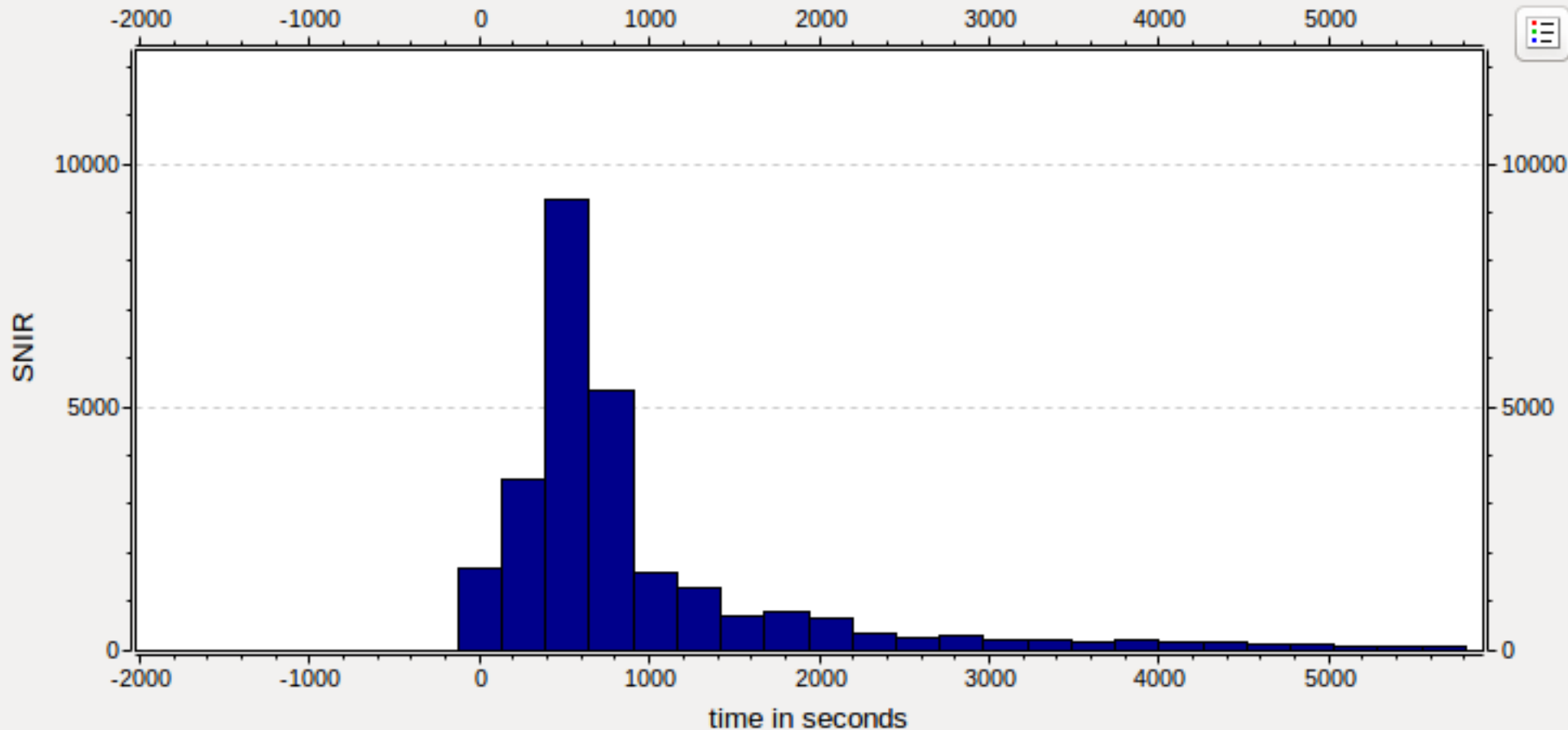
- Unlike AODV, DYMO is able to keep a record of intermediate routes between source and destination.



# Signal to Noise plus Interference Ratio (SNIR)

- Estimation of a node's Signal to Noise plus Interference Ratio (SNIR) in MANET DYMO clustering mechanism.

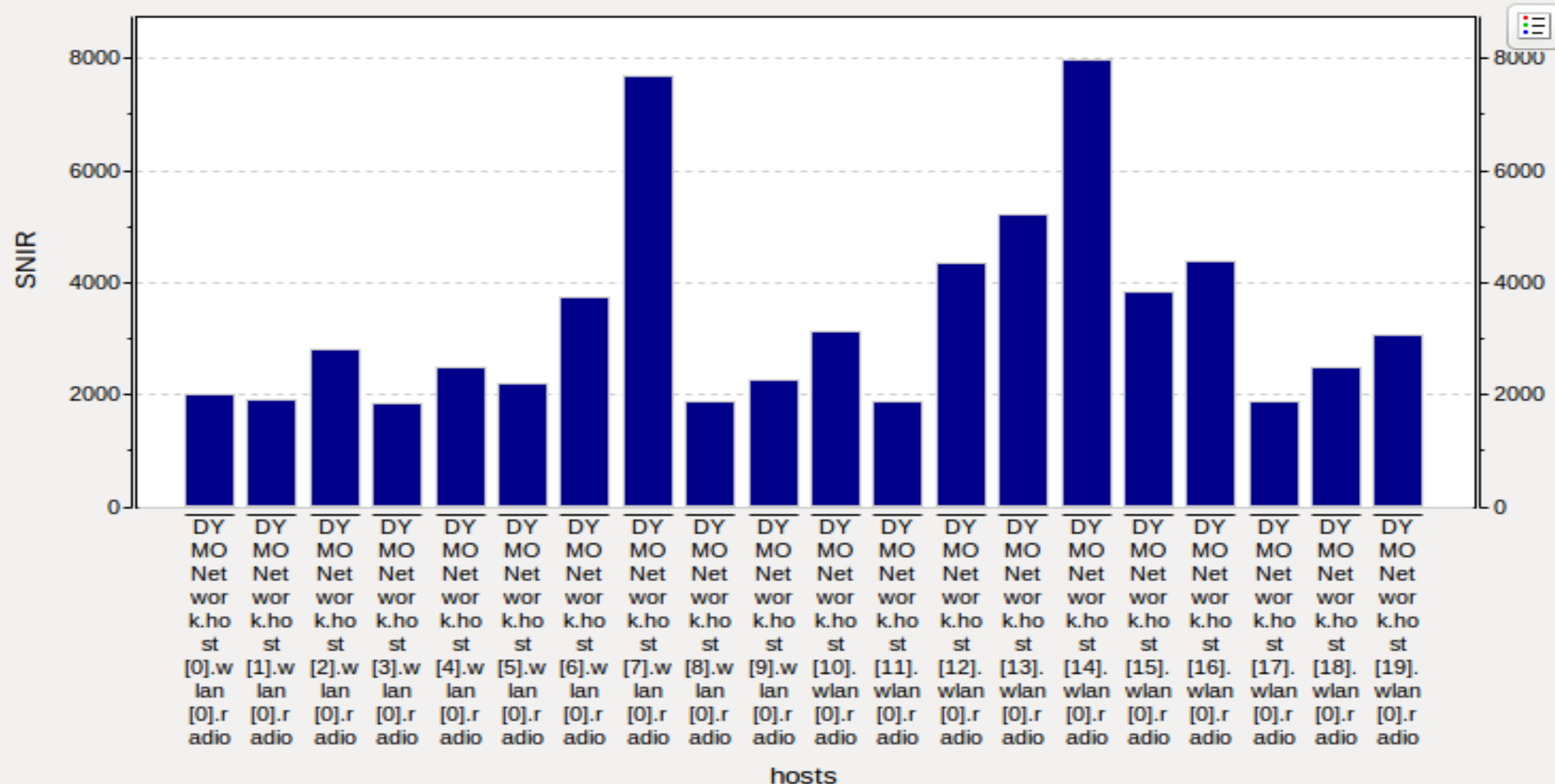
Chart: SNIR:histogram DYMONetwork.host[18].wlan[0].radio



# SNIR FOR 20 hosts

- Mass mobility parameters: Change interval = 180s Change angle = 15deg & speed = 1mps

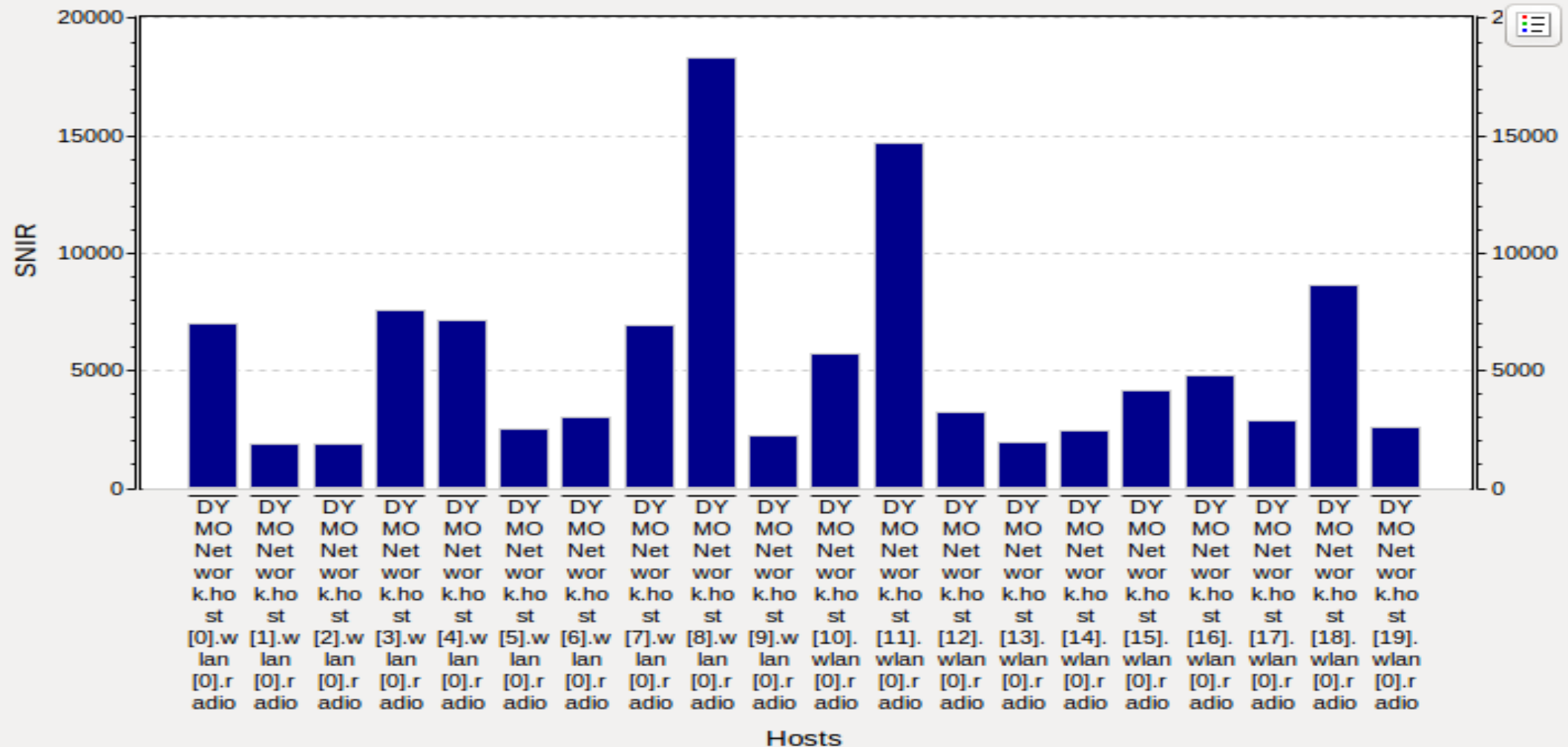
Chart: SNIR:histogram:mean



# SNIR FOR 20 hosts (with doubled change interval)

- Mass mobility parameters: Change interval = 360s Change angle = 15deg & speed = 1mps

Chart: SNIR:histogram:mean





# Areas for further study

- Cluster routing challenges - The nodes are mobile therefore it's hard to maintain cluster heads;
  - For instance what happens when two CHs get into contact (are in close proximity to each other) or when a node leave a given cluster?
- Parameters to consider:
  - Increasing speed
  - Provide more nodes
  - Common parameters for weight estimation include node degree, mobility, distance and battery power.
- Challenge in selecting the appropriate weight parameters for cluster head that minimize overhead and maximize the throughput.





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