

Design and Evaluation of a Peer-to-Peer MANET Cross-layer Approach: OnehopMANET

Mohammad Al mojamed

Supervisor: Dr. Mario Kolberg

Mobile Ad hoc NETWORK

MANET

- Collection of autonomous mobile nodes, which communicate wirelessly with each other without any need to existing network infrastructure.
- does not rely on any centralised control.
- each participated node is an end system and a router.

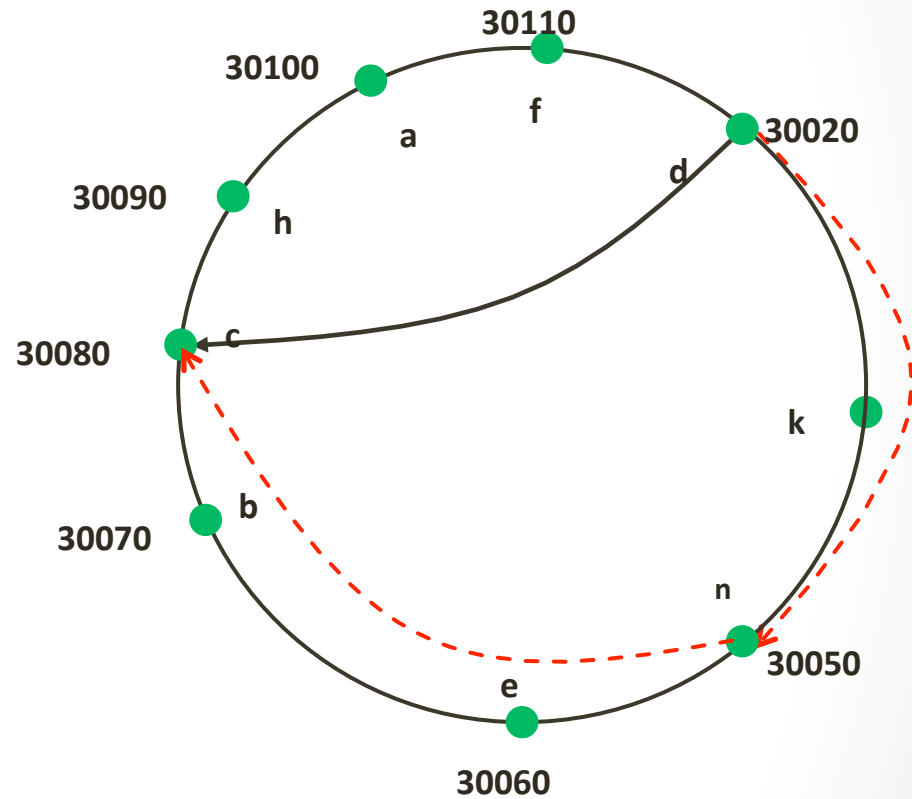
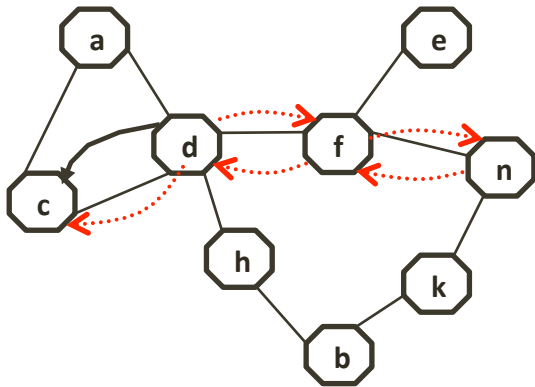
P2P

- Allows peers to access any type of distributed resources and services without a need to a centralised server.
- self-organising, adaptable, scalable, and do not depend on a central component.
- The overlay is responsible for storing and locating services.

Similarities

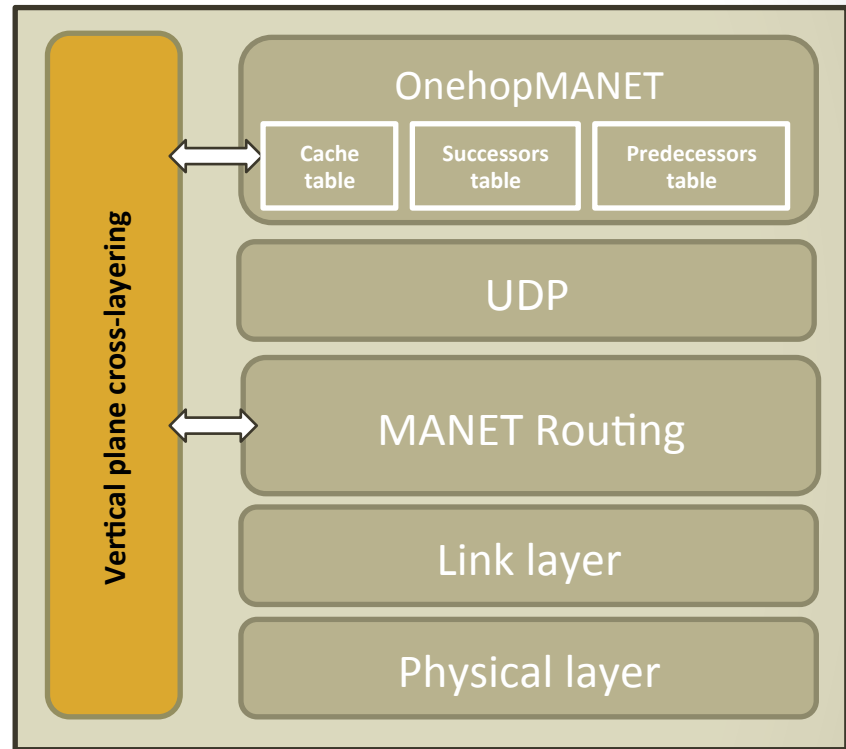
- Self-organisation
- dynamicity
- Decentralisation
- changing topology
- **Common Challenge:** maintain connectivity in dynamic and decentralised network.

Mismatching issue between overlay and underlay



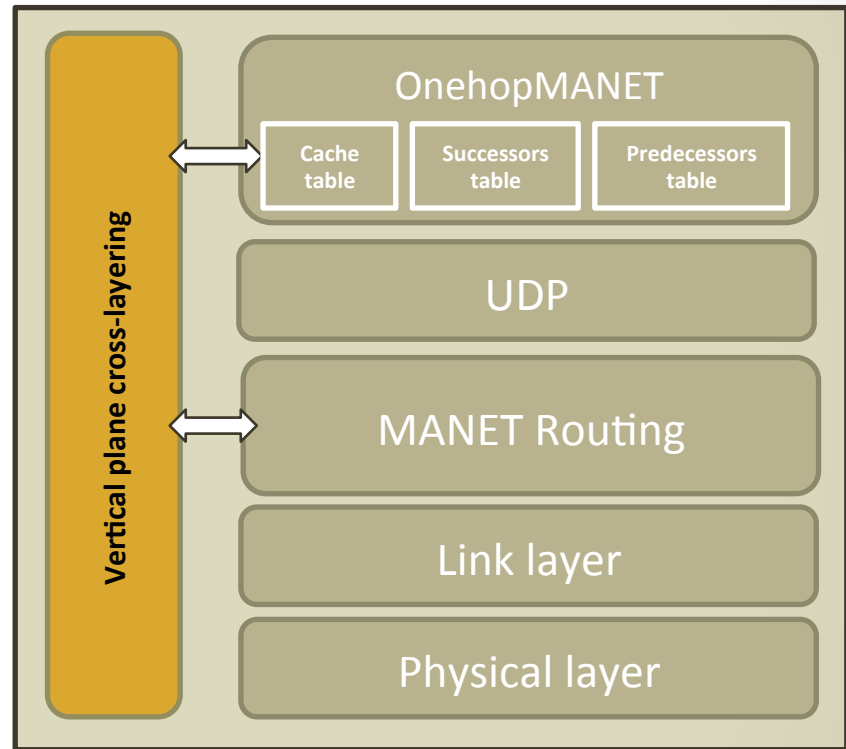
OnehopMANET

- Builds structured P2P overlay similar to Chord and EpiChord.
- Builds circular address space.
- Uses cross-layering to optimize similarities between overlay and underlay.
- Scale down typical P2P traffic.



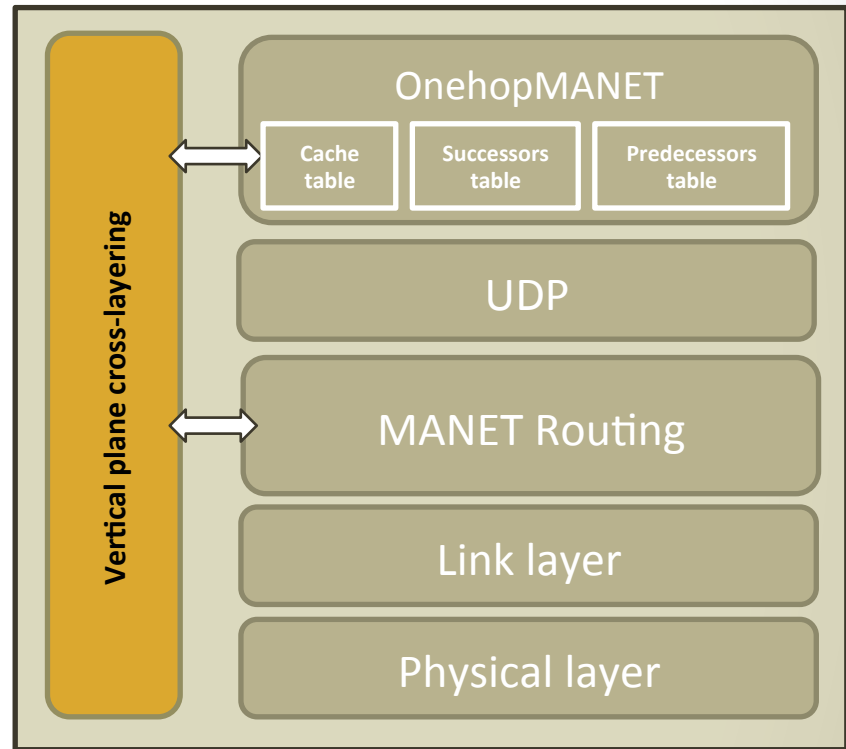
OnehopMANET

- Each peer maintains list of succeeding peers and preceding peers.
- Cache table.
- Cross-layering channel is the main source of routing entries.
- A notification board is used as a channel that manages the information sharing.



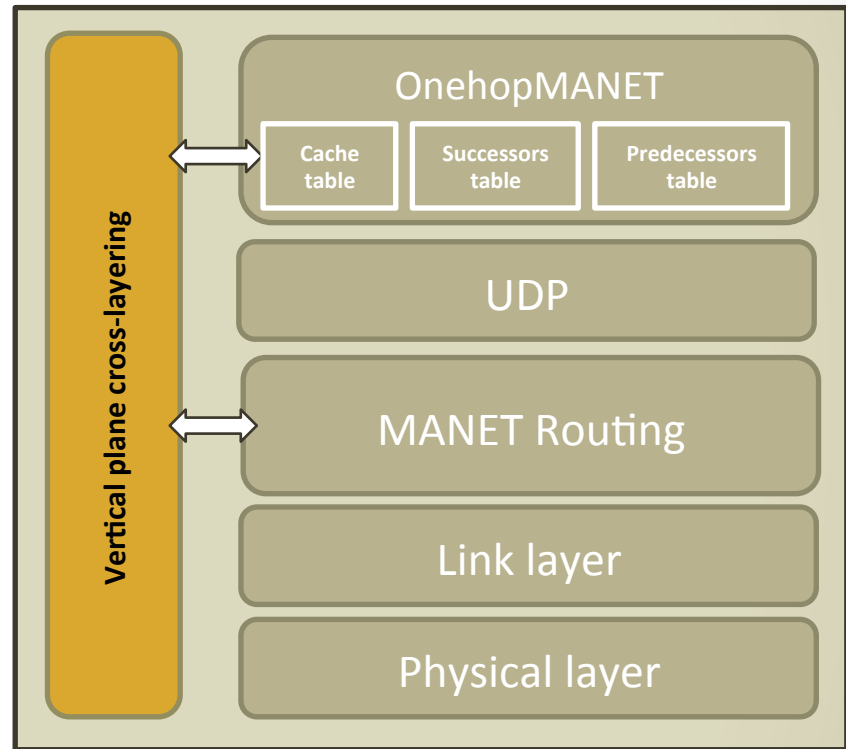
OnehopMANET

- Overlay subscribes with the notification board to get notifications of changes .
- Underlay routing protocol notifies the notification board, whenever changes occur in its routing table.
- Notification board passes the information to the overlay.
- Overlay uses this information to update its view of the network



OnehopMANET

- Using the underlay information significantly reduces the need for overlay maintenance traffic.
- OnehopMANET can also use responses to lookup queries to update its routing tables.
- Sends lookup requests to single destinations.



Simulation

OMNeT++

- OMNETPP: an open-source component-based C++ simulation library and framework, primarily for building network simulators.



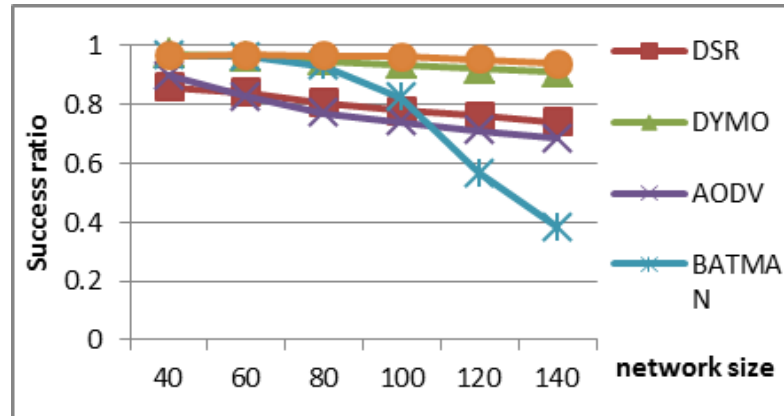
- INET Framework: an open source communication network simulation package for OMNET++ simulation environment. The INET Framework contains models for several wired and wireless networking protocols



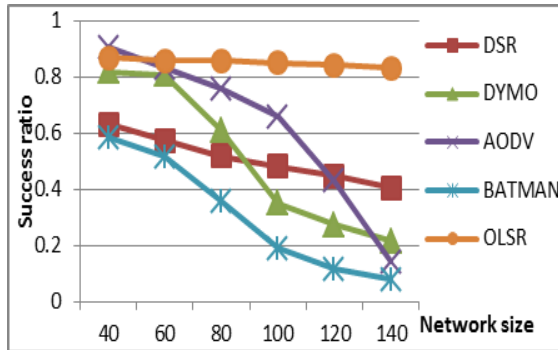
- OverSim: Oversim is an open source P2P network simulators for OMNET++. It supports different structured P2P protocol and unstructured protocols.

OnehopMANET over different underlays

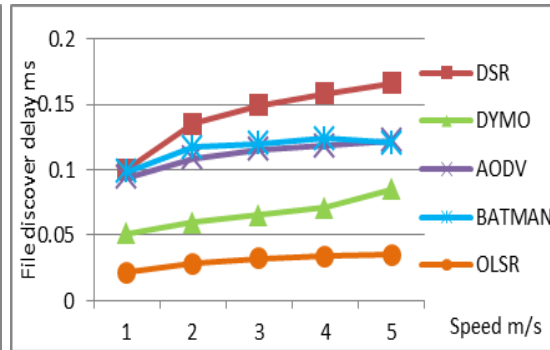
Simulator	OMNET++
MANET Routing Protocols	OLSR, BATMAN, DSR, AODV, DYMO
Topology size	1000 m x 1000 m
Number of nodes	40, 60, 80, 100, 120, 140.
Mobility Type	Random Way Point
Measurement time	1000 seconds
Transition time	60 second
Lookup interval	10, 60 second
Node speed	1,2,3, 4, 5 mps



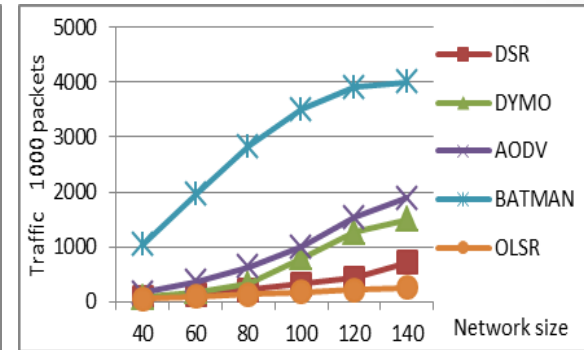
1m/s Speed, 60s Lookup Frequency



5m/s Speed, 10s Lookup Frequency



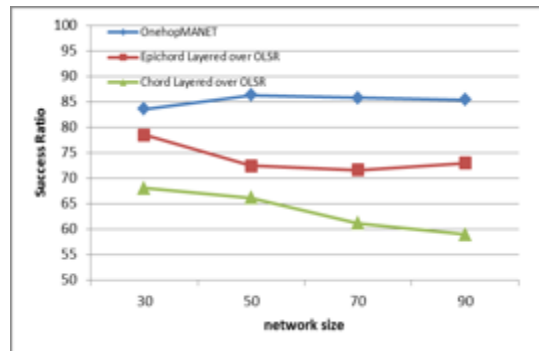
80 nodes, 10s Lookup Frequency



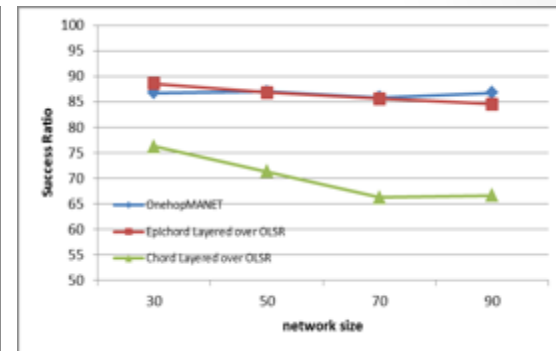
1m/s Speed, 10s Lookup Frequency

OnehopMANET vs. Chord and EpiChord

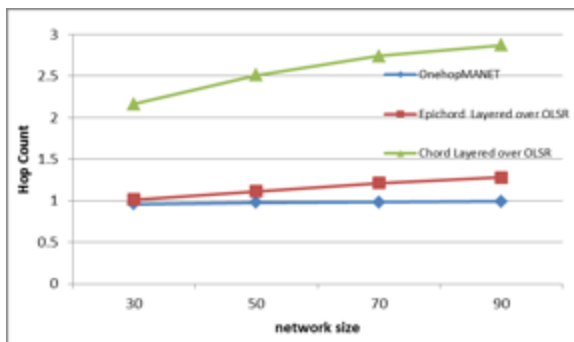
Simulator	OMNET++
MANET Routing Protocols	OLSR
Topology size	1000 m x 1000 m
Number of nodes	30, 50, 70, 90
Mobility Type	RWP
Measurement time	600 seconds
Stabilisation time	120 second
Lookup interval	30,10,5
Node speed	5 m/s
Parallelism	3 for EpiChord only



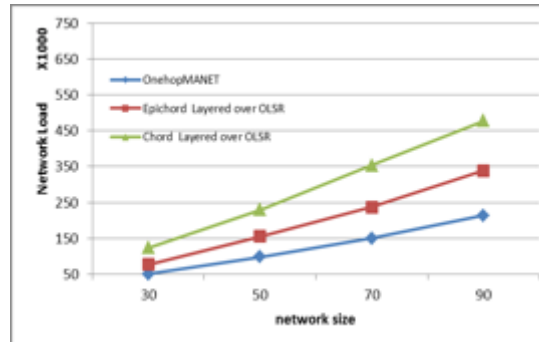
Success ratio with 30 s lookup frequency



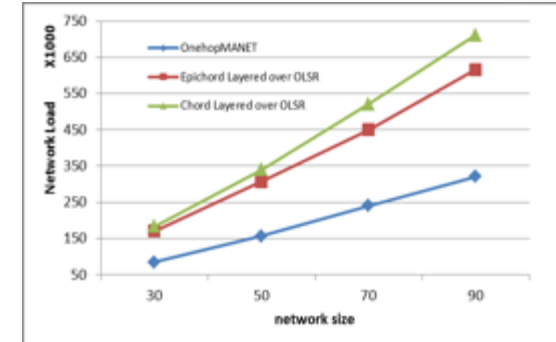
Success ratio with 5 s lookup frequency



Logical path length with lookup frequency 10s



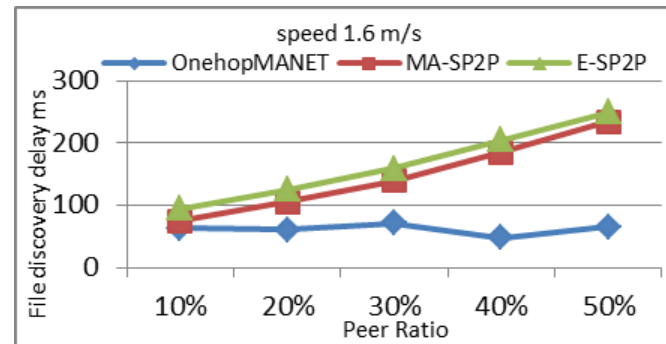
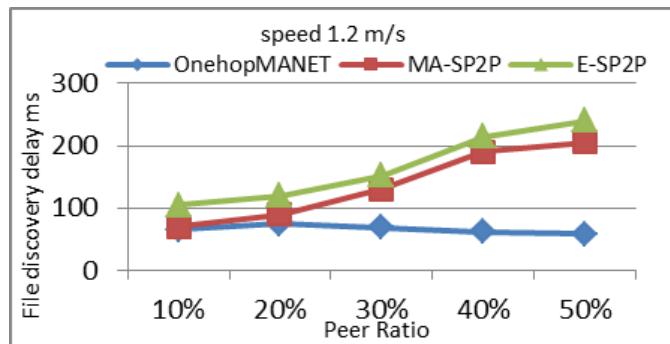
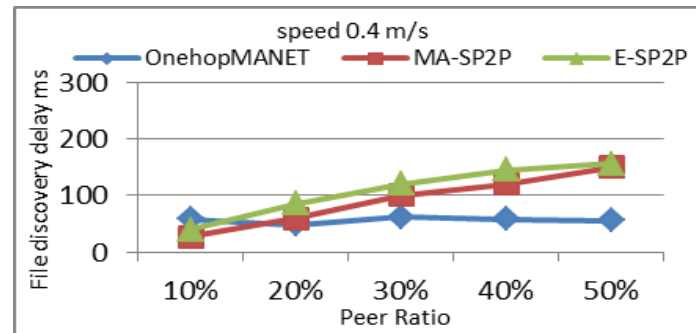
Network Load with 30 s lookup frequency



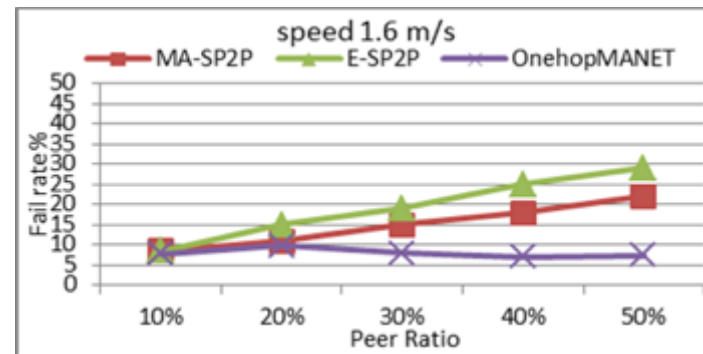
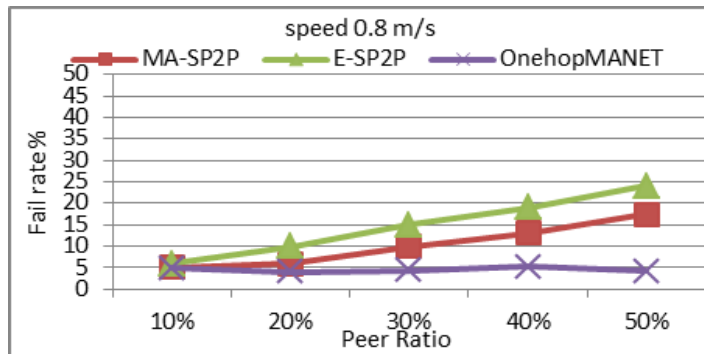
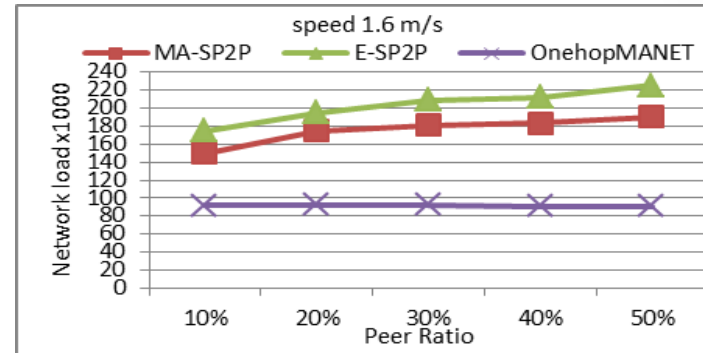
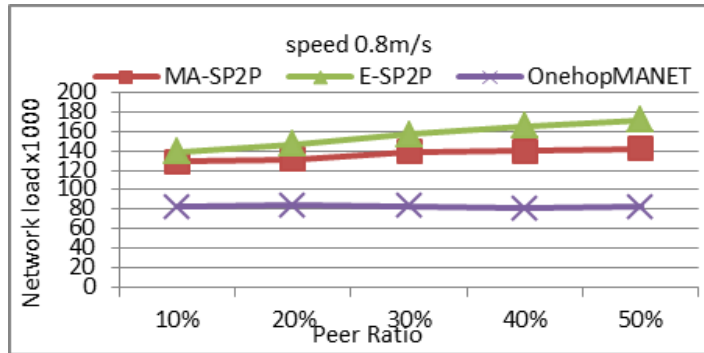
Network Load with 5s lookup frequency

OnehopMANET vs. MA-SP2P and E-SP2P

Simulator	OMNET++
MANET Routing Protocols	OLSR
Topology size	1000 m x 1000 m
Number of nodes	100
Peer ratio	10%, 20%, 30%, 40%, 50%
Mobility Type	RWP
Measurement time	1000 seconds
Network stabilization	60 second
Node speed	0.4m/s, 0.8m/s, 1.2m/ s, 1.6m/s



OnehopMANET vs. MA-SP2P and E-SP2P



Conclusion

- OnehopMANET Optimize MANET underlay to build efficient P2P overlay.
- OnehopMANET uses cross-layering.
- OnehopMANET scale down typical P2P traffic to suit MANET.
- Evaluated over different underlays.
- Compared to Chord and EpiChord and achieved better performance.
- Compared to P2P MANET systems and achieved better performance.