Mobile Mesh Wi-Fi Network

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Introduction

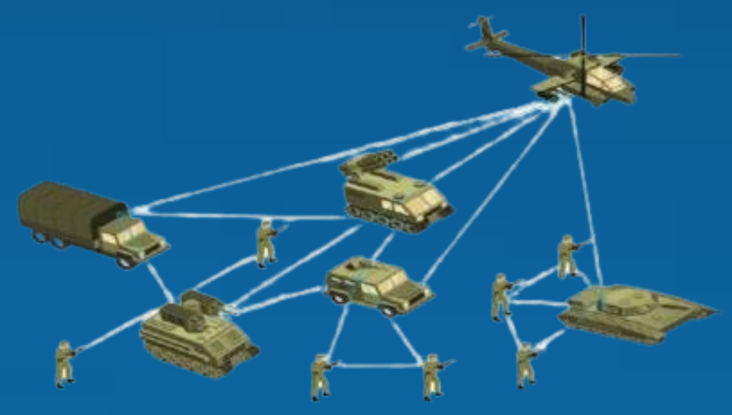
A mobile mesh network is a network topology which devices inside the network connect each other dynamically and non-hierarchically to provide peer-to-peer communication with one another.

On the contrary of Wi-Fi networks that we use in our daily life, mesh network is in the form of ad-hoc which means that the network does not depend a pre-built infrastructure and the whole communication is provided in a decentralized manner.

The main goal of this study is to create a mobile mesh wireless network that operates at both 2.4GHz and 5GHz with minimum of six user support each having a static IP address.

Application Areas

The application area of mobile mesh wi-fi network is primarily military fields. In addition to that such a network would be effective in post-disaster scenarios where internet infrastructure is damaged

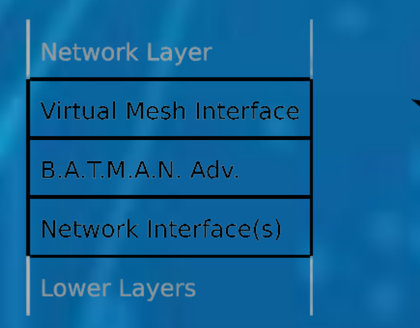


Military application area of mesh network

Design

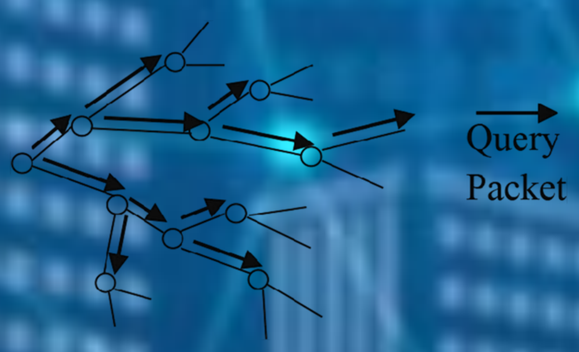
The key part of such a network topology is routing protocol that handles both node discovery and optimal path selection. Since the system is desired to be mobile, a proactive routing protocol, that is optimal paths are determined even before there is no packets to send, is the appropriate choice. To satisfy this needs, B.A.T.M.A.N. IV (Better Approach to Mobile Ad-Hoc Networks) routing protocol is used.

B.A.T.M.A.N. IV is a proactive wireless routing protocol implementation which operates on OSI/ISO layer 2, data link layer. Thus, not only information transmission but also data flow traffic is controlled by B.A.T.M.A.N. IV's virtual bat0 interface.



bat0 virtual interface

Each device that works in B.A.T.M.A.N. interface broadcasts OGM(originator message) packets periodically. OGM packets are query packets which contain essential data such as TTL(Time to Live), TQ(Transmit Quality), Originator Address and Sequence Number that is required for both node discovery and optimal path selection.

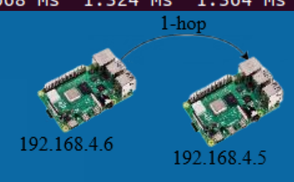


OGM packet flooding

Results

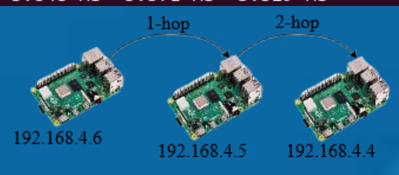
Single Hop

```
pi@RPi-6:~ $ sudo batctl tr 192.168.4.5
traceroute to 192.168.4.5 (e4:5f:01:74:05:2a), 50 hops max, 20 byte packets
 1: e4:5f:01:74:05:2a  1.668 ms  1.324 ms  1.364 ms
```



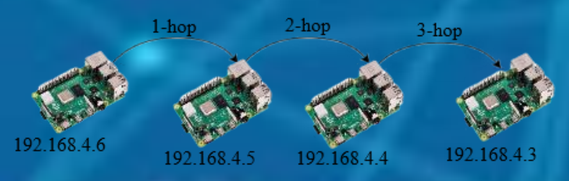
Double Hop

```
pi@RPi-6:~ $ sudo batctl tr 192.168.4.4
traceroute to 192.168.4.4 (e4:5f:01:74:05:5d), 50 hops max, 20 byte packets
 1: e4:5f:01:74:05:2a  1.590 ms  1.525 ms  1.593 ms
 2: e4:5f:01:74:05:5d  3.848 ms  3.571 ms  3.529 ms
```

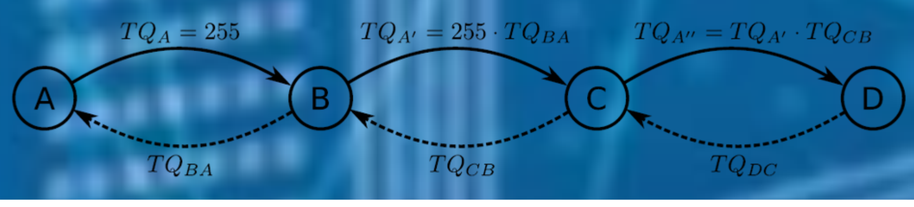


Triple Hop

```
pi@RPi-6:~ $ sudo batctl tr 192.168.4.3
traceroute to 192.168.4.3 (e4:5f:01:74:04:61), 50 hops max, 20 byte packets
 1: e4:5f:01:74:05:2a  1.896 ms  1.488 ms  1.654 ms
 2: e4:5f:01:74:05:5d  3.766 ms  3.480 ms  3.350 ms
 3: e4:5f:01:74:04:61  5.100 ms  4.842 ms  4.922 ms
```



Route Selection



- At each node traversed by the OGM, the global TQ(1 byte value) towards Node A is updated.
- For every node an OGM traverses, a hop penalty is applied, which favors short paths over longer ones.

Node discovery