

Dynamic mesh network implemented in micropython on top of ESP-NOW protocol

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- Self-organizing
 - mesh will form a **tree** topology for better space range
 - need a **root node** to form a tree
- **Relaying** of message - combination of routing and flooding
 - send packets unicast hop by hop (routing)
 - if dst MAC address is not known, broadcast packet to mesh (flooding)
- **StandAlone** vs. **Connected** to external network mode
- **Root** election
 - decide on the strongest RSSI of nodes (F() function)
 - (set root manually in StandAlone)

- ESP-NOW is a connectionless Wi-Fi communication protocol
- Application data is encapsulated in a vendor-specific action frame and then transmitted from one Wi-Fi device to another without connection

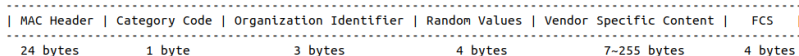


Figure: Vendor specific action frame

- ESP-NOW protocol
 - management and control commands use ESP-NOW
 - WI-FI is used to transfer tree topology and application data
- Self-healing
 - after disconnection of node re-organize tree
 - after adding new node to mesh, add him to the tree

There are three main functions:

- Connecting to mesh - add new node to mesh network
- Forming a tree - topology of tree in structured format (i.e. JSON)
- Mesh Functioning - message relaying and self-healing

- MAC address, $F(RSSI * \text{neighbors})$, access point RSSI

$$N2 \mid F(RSSI * neigh) + f(\text{access point RSSI})$$
$$N3 \mid F(RSSI * neigh) + f(\text{access point RSSI})$$
$$N4 | F(RSSI * neigh) + f(\text{access point RSSI})$$

...

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$$N_{11} \mid F(RSSI_{neigh}) + f(\text{access point RSSI})$$


N1

N11

N10

N2

N3

N4

N6

N5

N9

N7

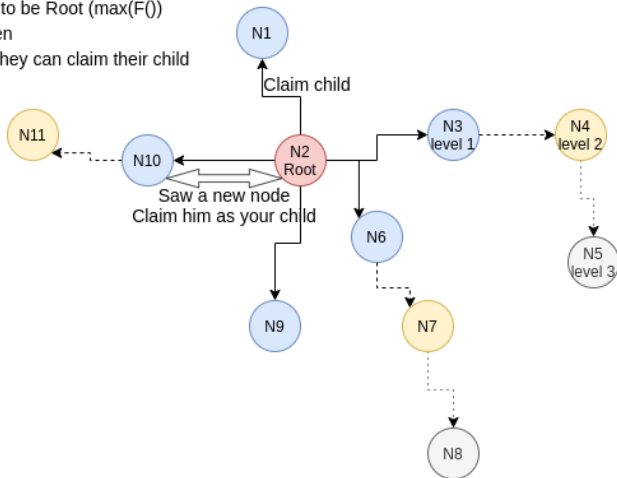
N8

- Root election using $F(\text{RSSI} * \text{neighbors})$ values
- Forming of a tree topology, adding nodes to tree and updating topology

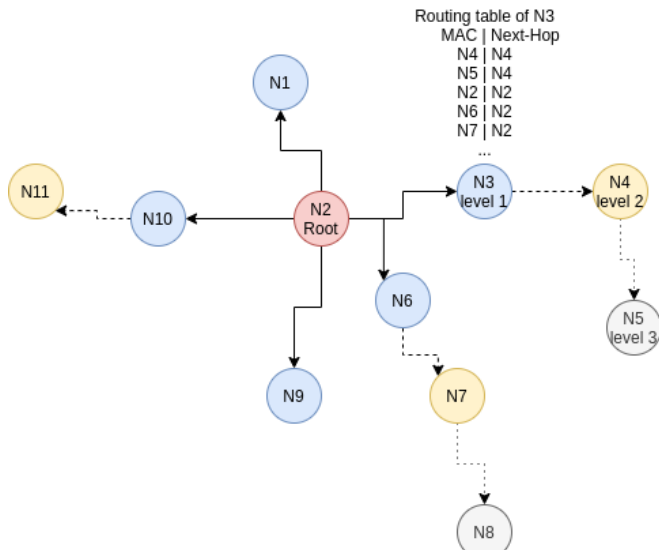
Nodes know best node to be Root ($\max(F())$)

Root node claims children

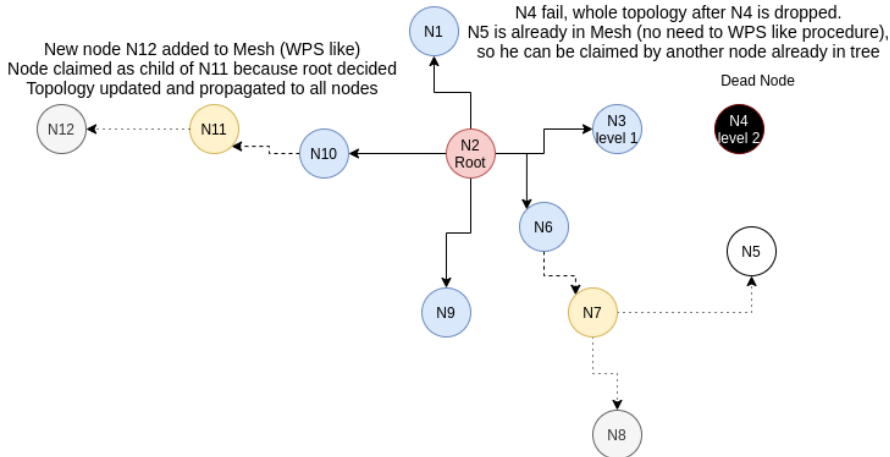
Child nodes ask root if they can claim their child



- Root propagates topology to all nodes
- Nodes form routing table



- Adding a new node to mesh and updating topology
- Removing dead node from mesh and reforming topology



- November/December - write semestral project
- January - present SP in front of comitee
- February/March - implement project, write thesis
- April - testing, revision of implementation
- May - revision and edit diploma thesis text

Thank You For Your Attention !