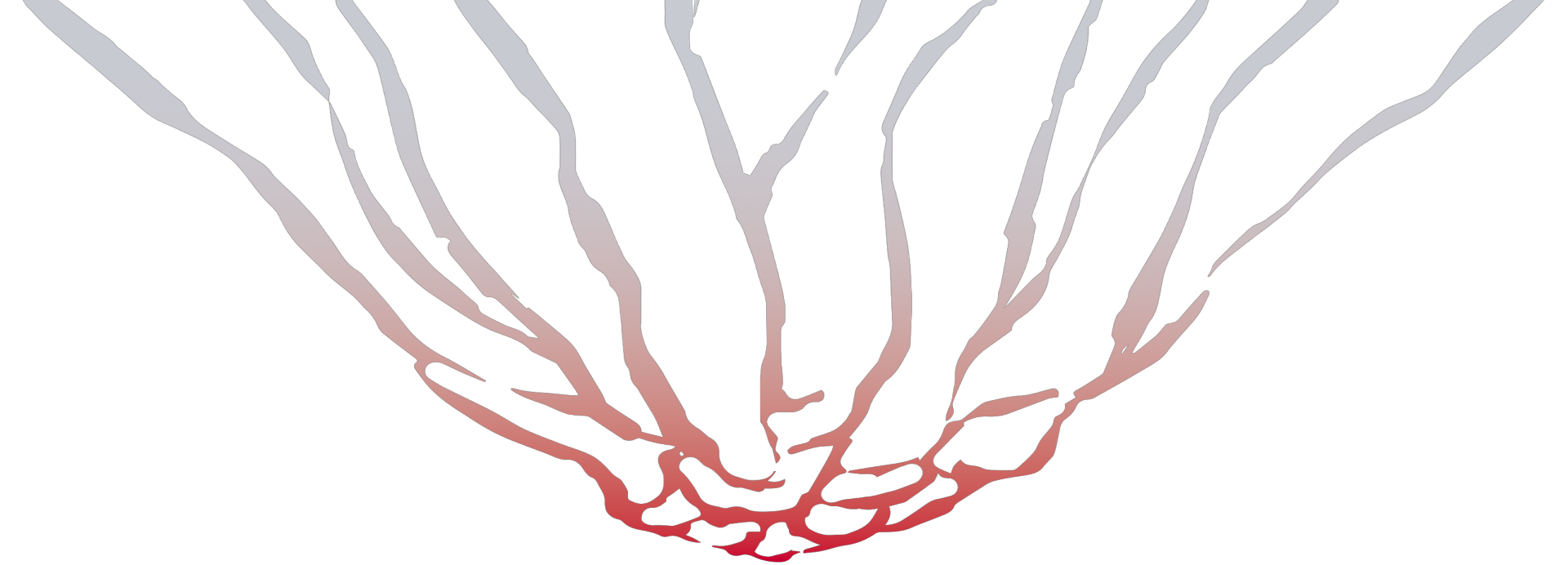
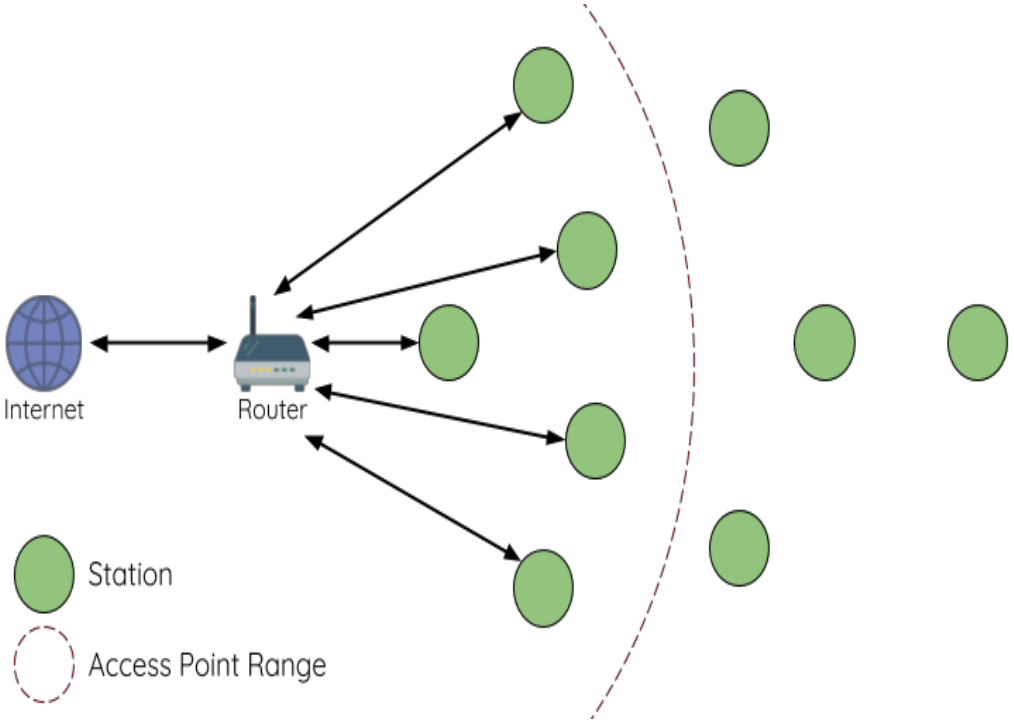


ESPRESSIF

TRAINING

Wi-Fi Mesh

Traditional WiFi Architecture



- Limitations
  - Limited Coverage, AP capacity (number of connections)

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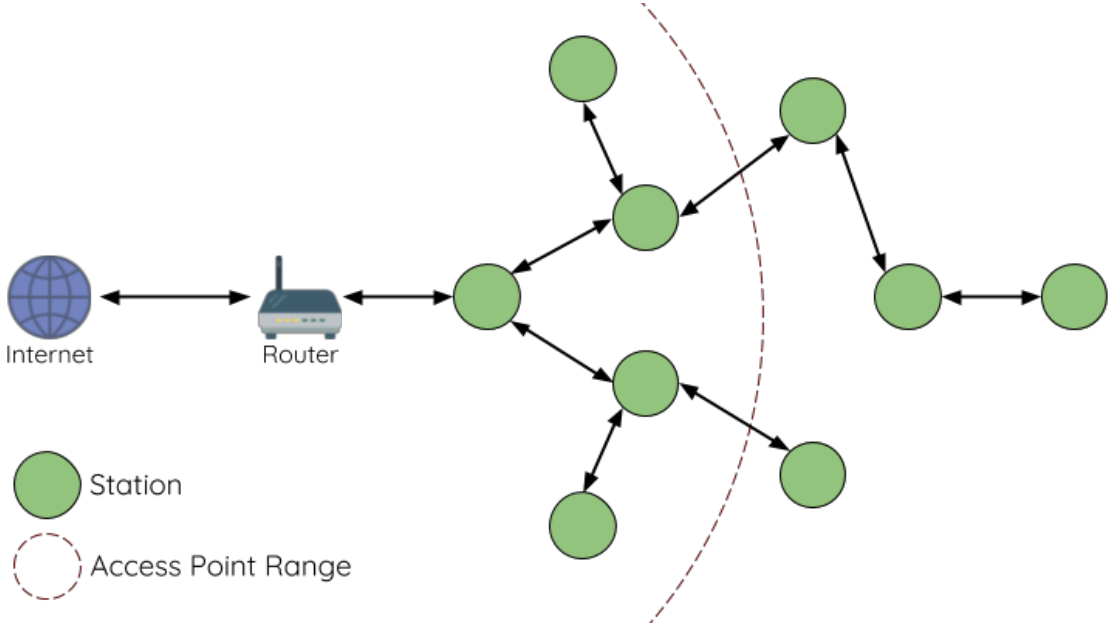
ESP-MESH Network Architecture



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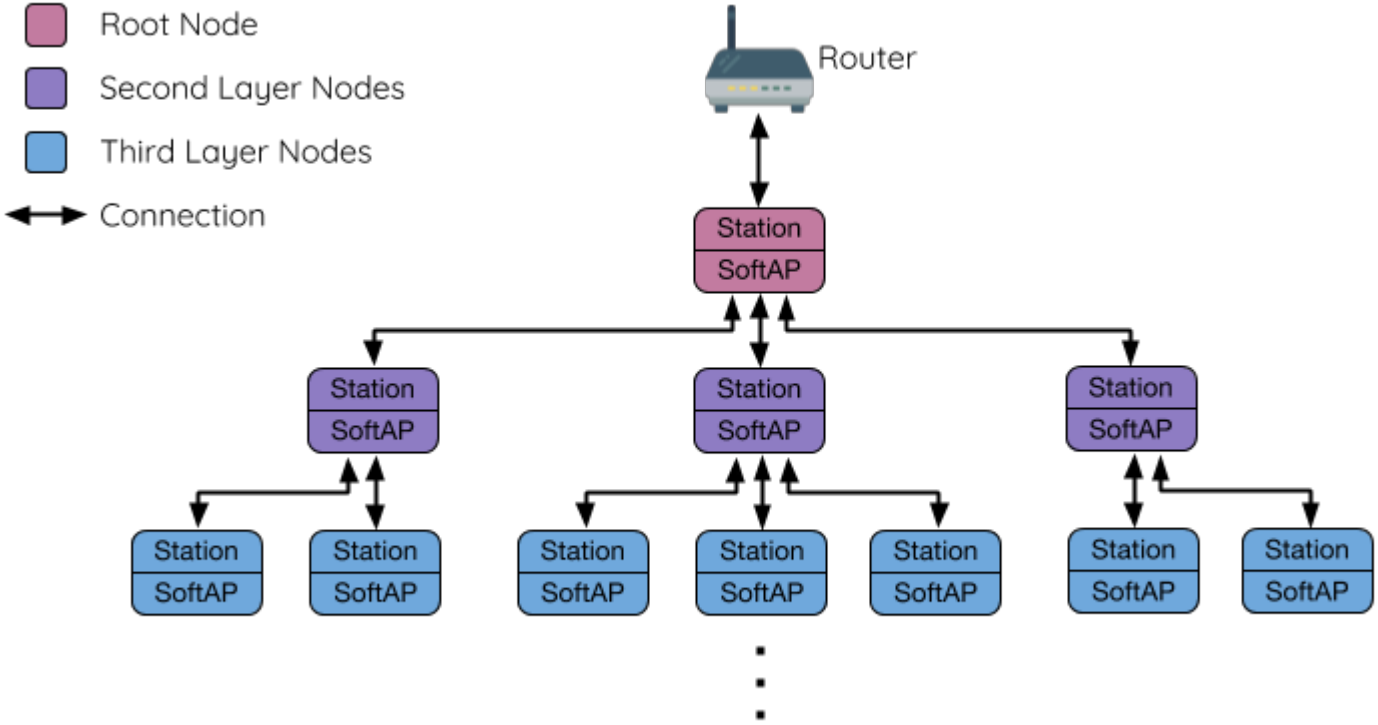
Tree Topology



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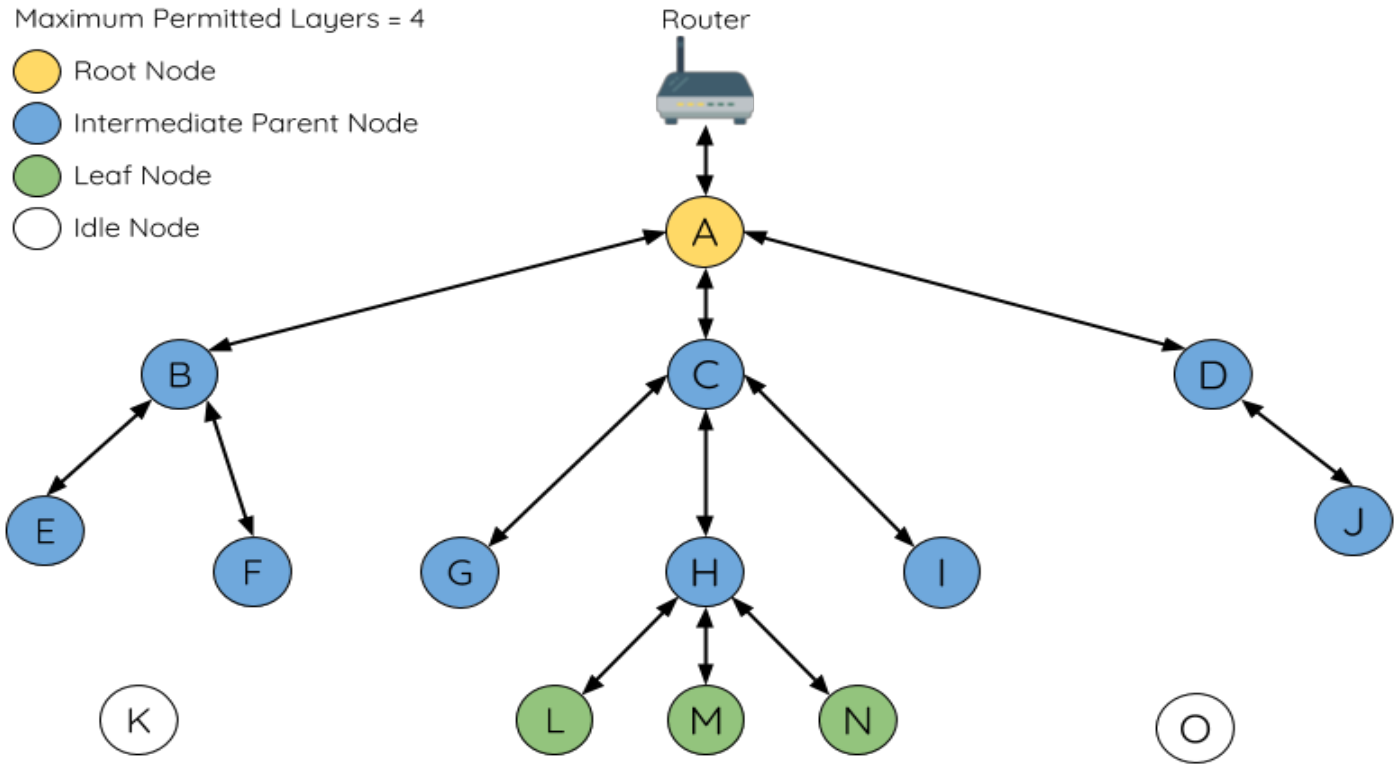
ESP-MESH Node Types



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Beacon Frames

- Mesh uses Vendor IE in beacons to communicate the following metadata
  - Node Type (Root, Intermediate Parent, Leaf, Idle
  - Current layer of Node
  - Max number of layers permitted in network
  - Current number of children nodes
  - Max number of downstream connections to accept

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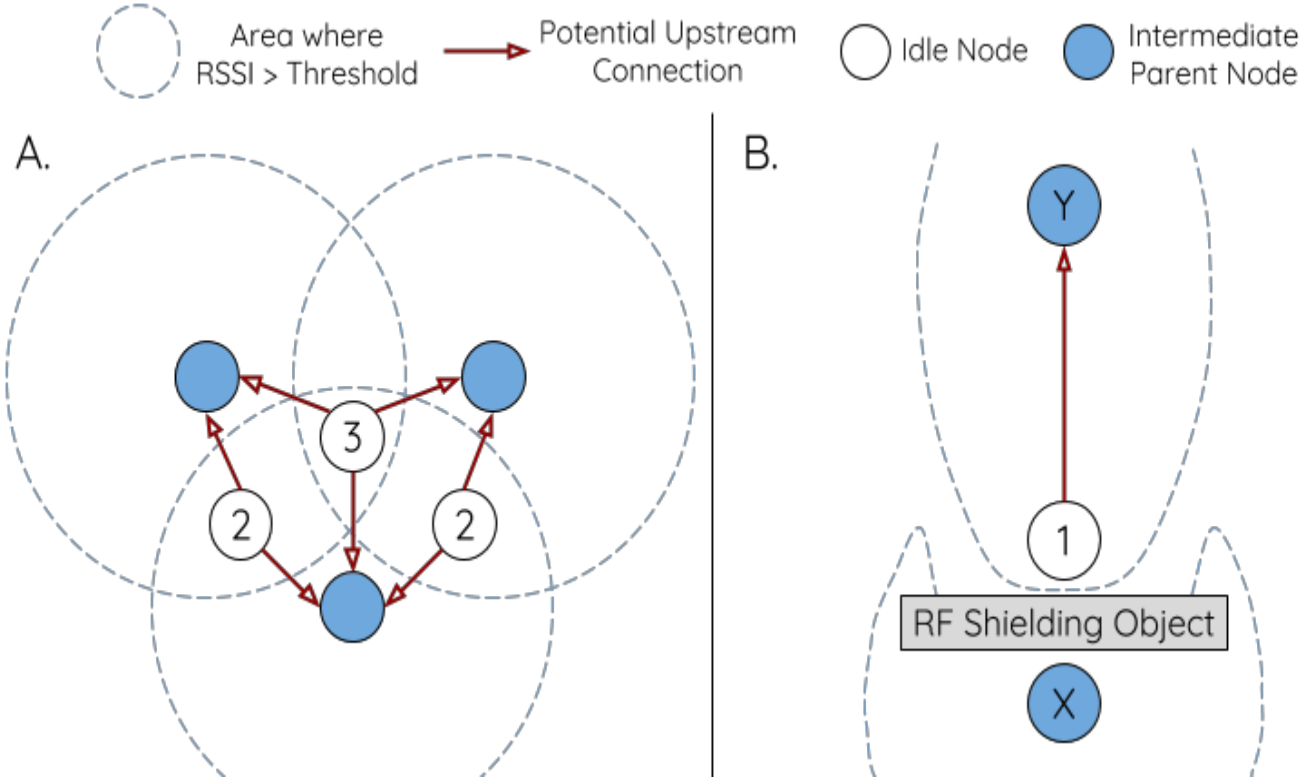
RSSI Thresholding



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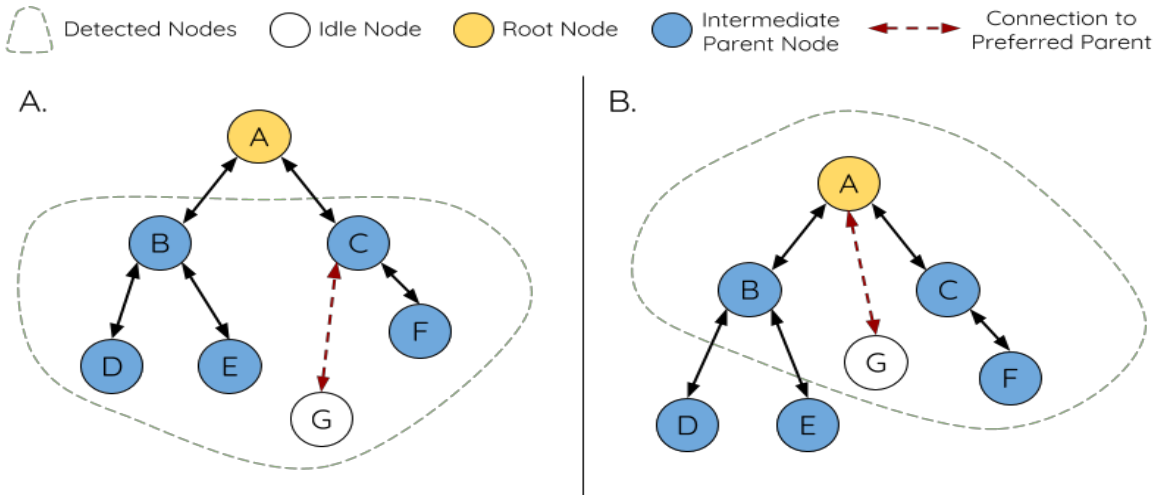
Choosing a Parent Node

- Selection criteria
  - Which layer the parent candidate is situated on.
  - The number of downstream connections (children nodes) the parent node candidate currently has



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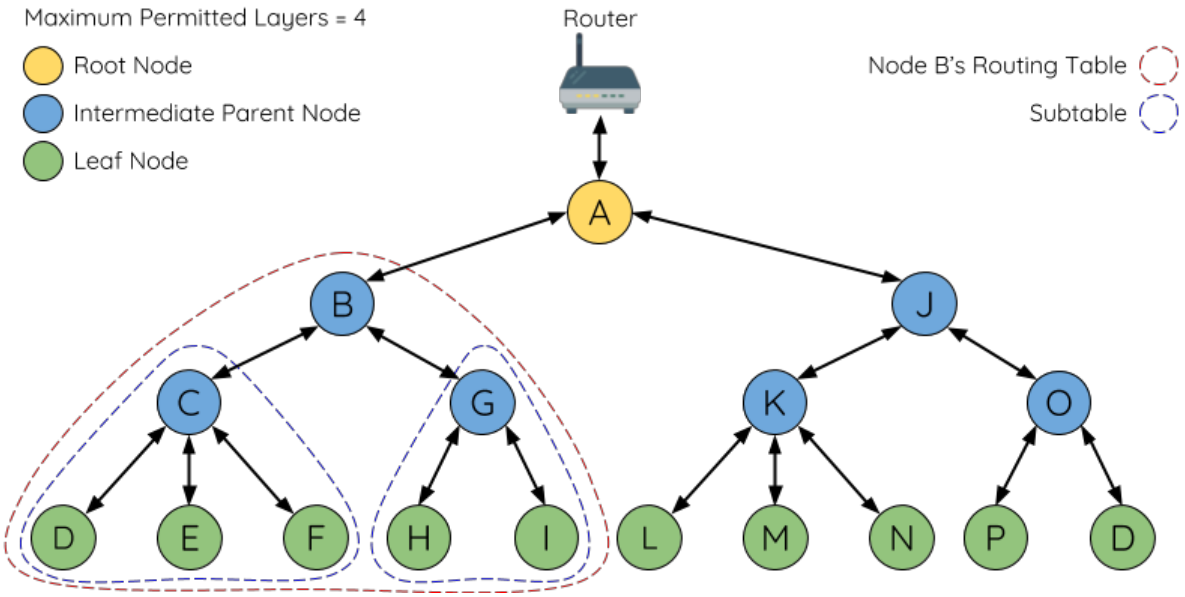
Routing Tables



- If myMAC != destMac and myMAC is in subtable then forward it downstream to corresponding child, else forward it upstream.

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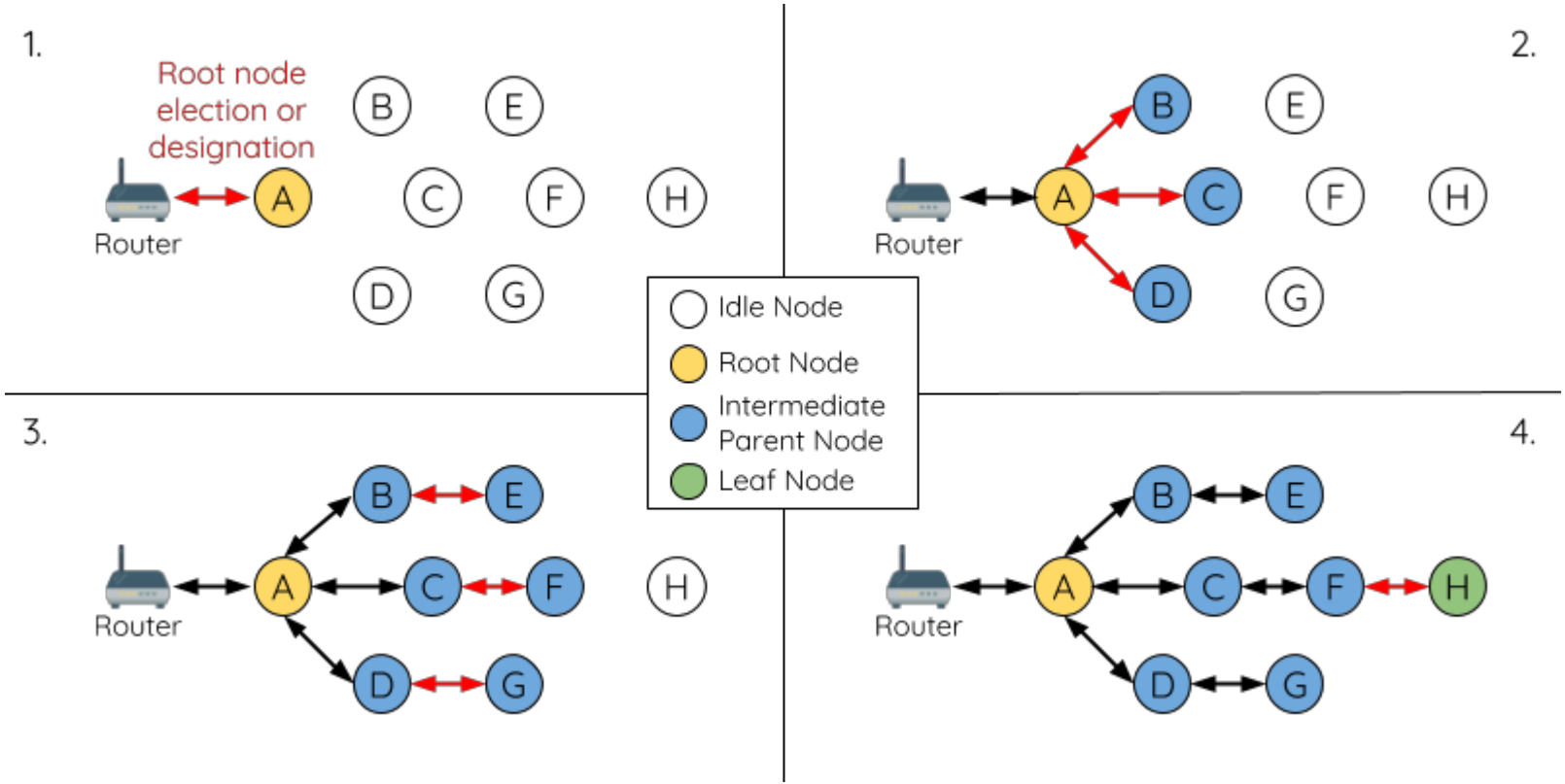
Building a network



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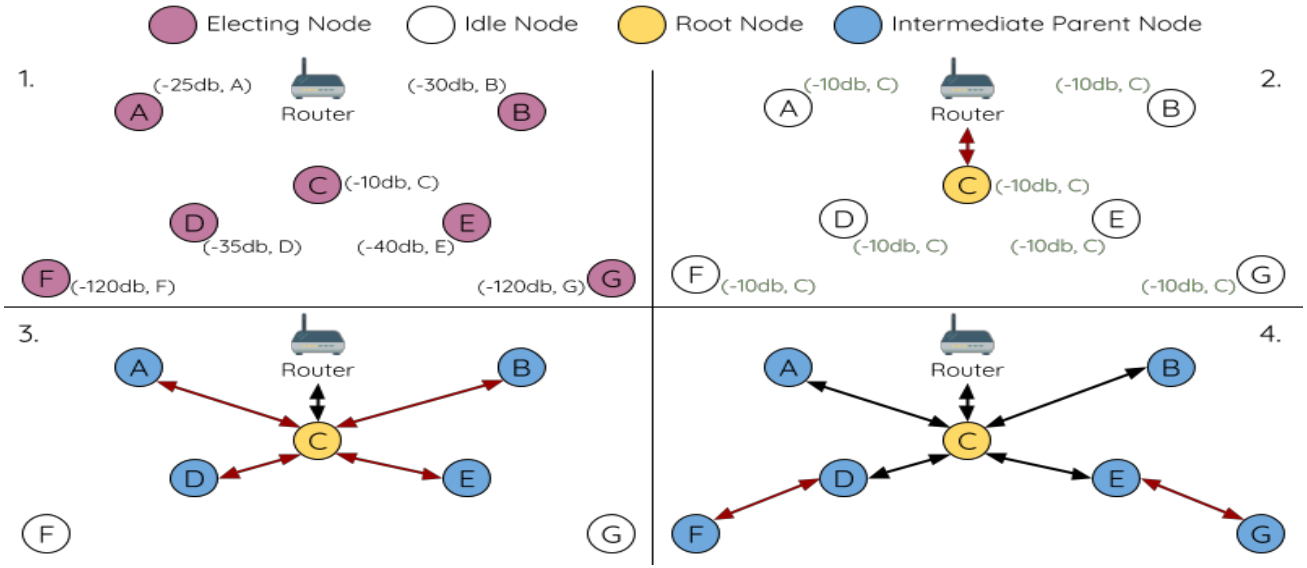
Automatic Root Node Selection



- 10 iteration of beacon transmit and scan by electing nodes
- Each node propagates the Beacon contents corresponding to the node with strongest router RSSI detected until that iteration (votes).
- After all iteration, the node with recv votes > configured threshold wins.

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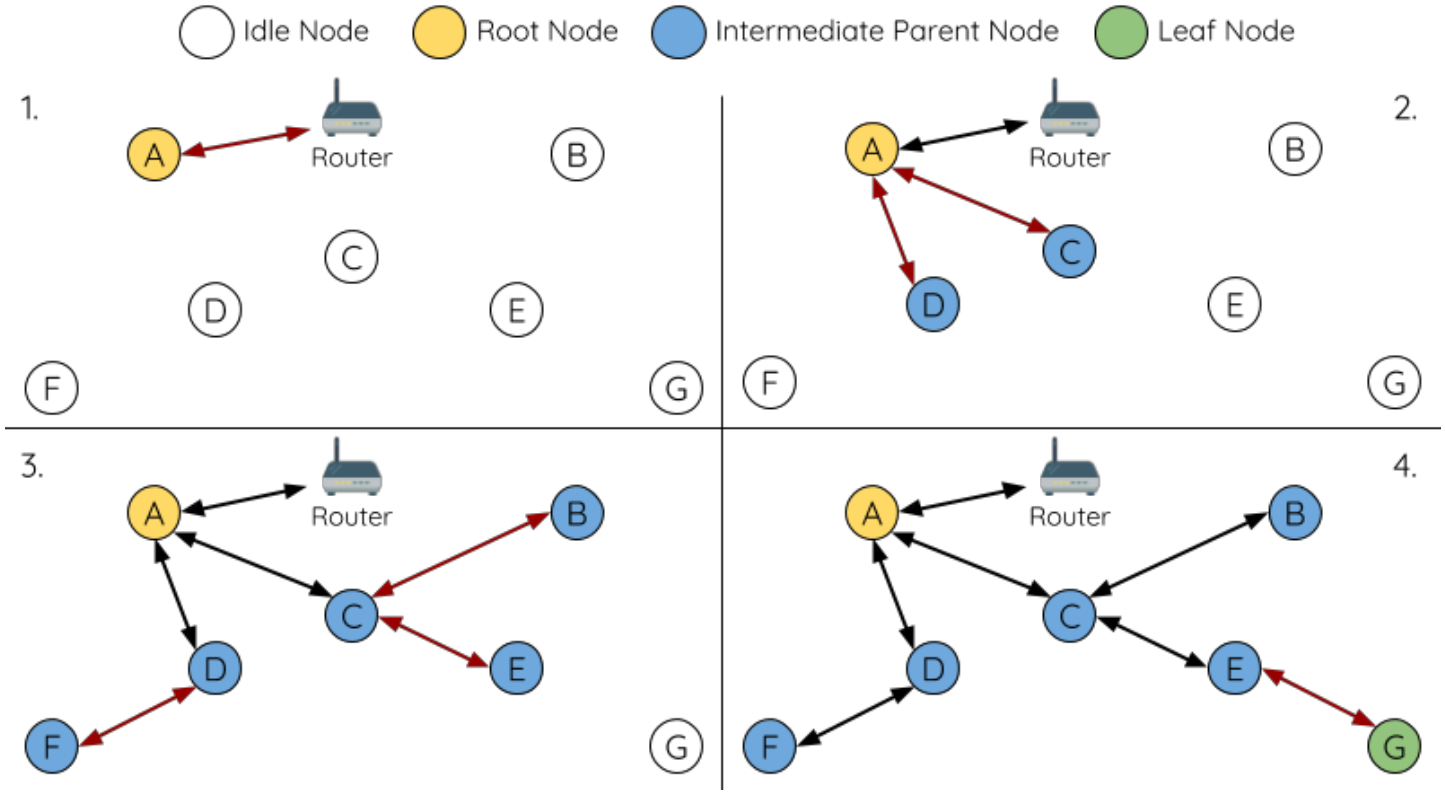
User Designated Root Node Selection



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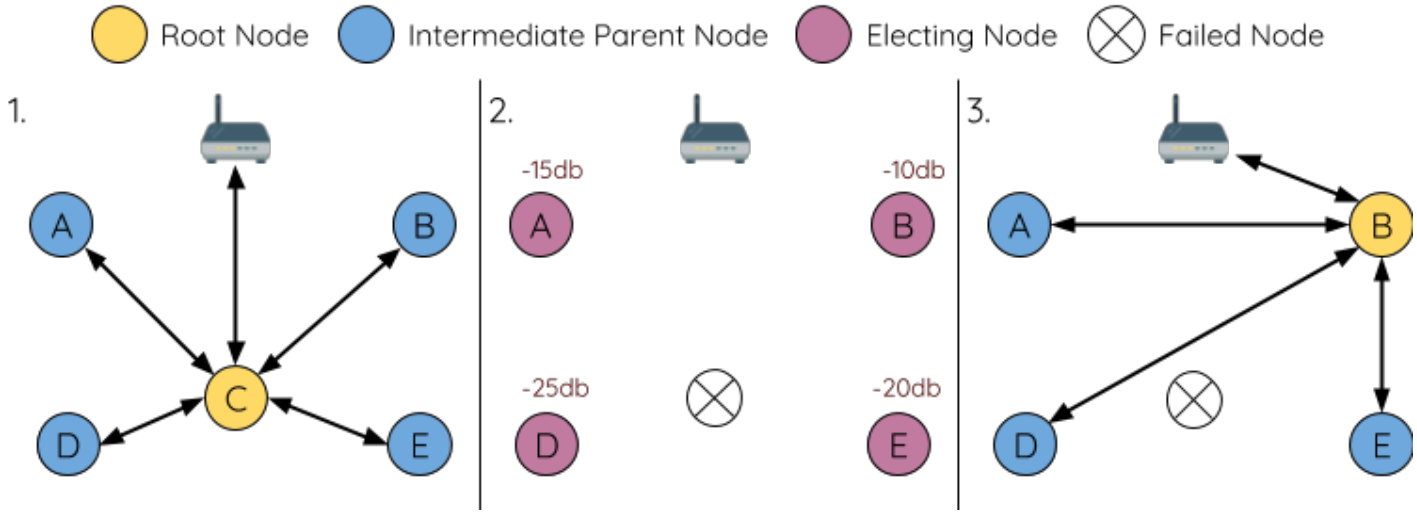
Handling Node Failures

- Root Node Failure
  - A new round of election process by second layer nodes.



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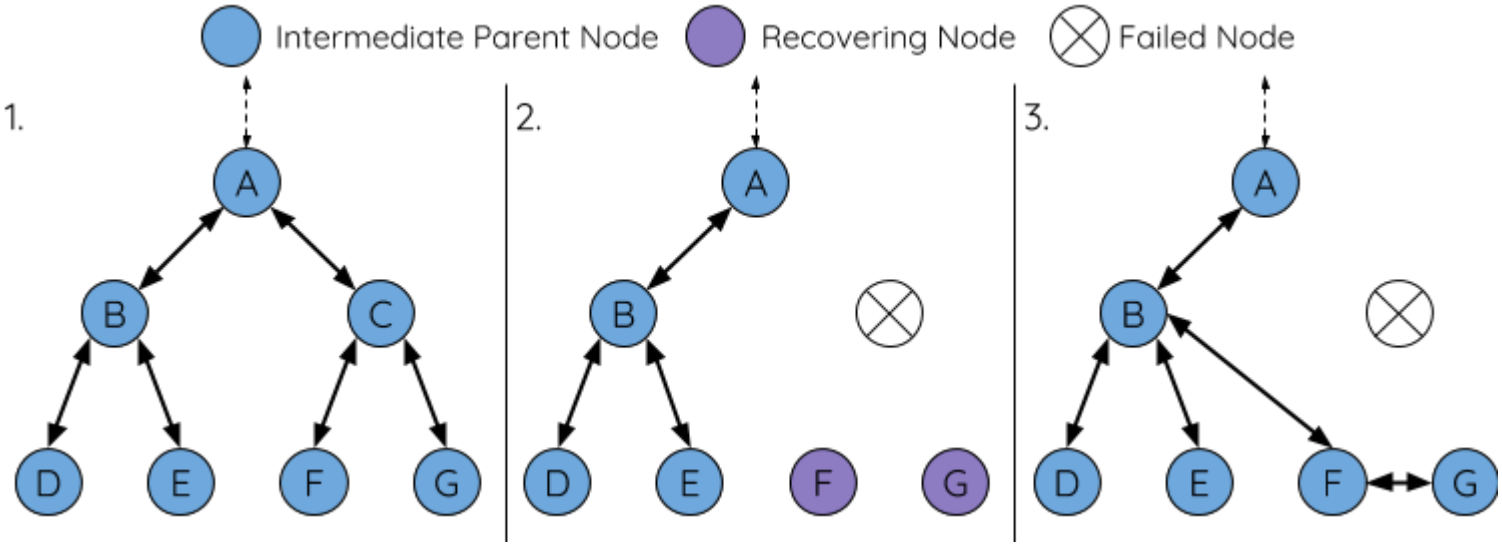
Handling Node Failures

- Intermediate Parent Node failure
  - Each child node will individually select a new preferred parent node.



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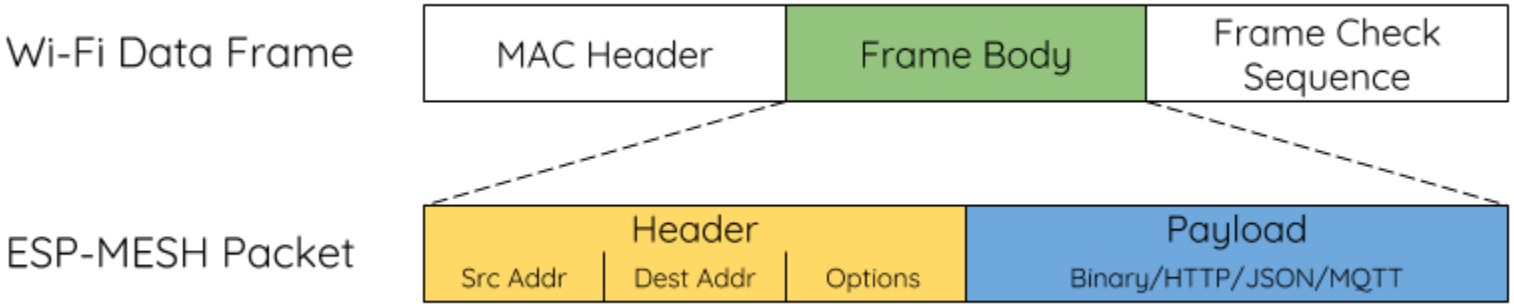
Data Transmission



- Features
  - Multicast/Broadcast
  - Upstream Flow Control (Avoid parent buffer overflow)
  - Bidirectional Data Stream

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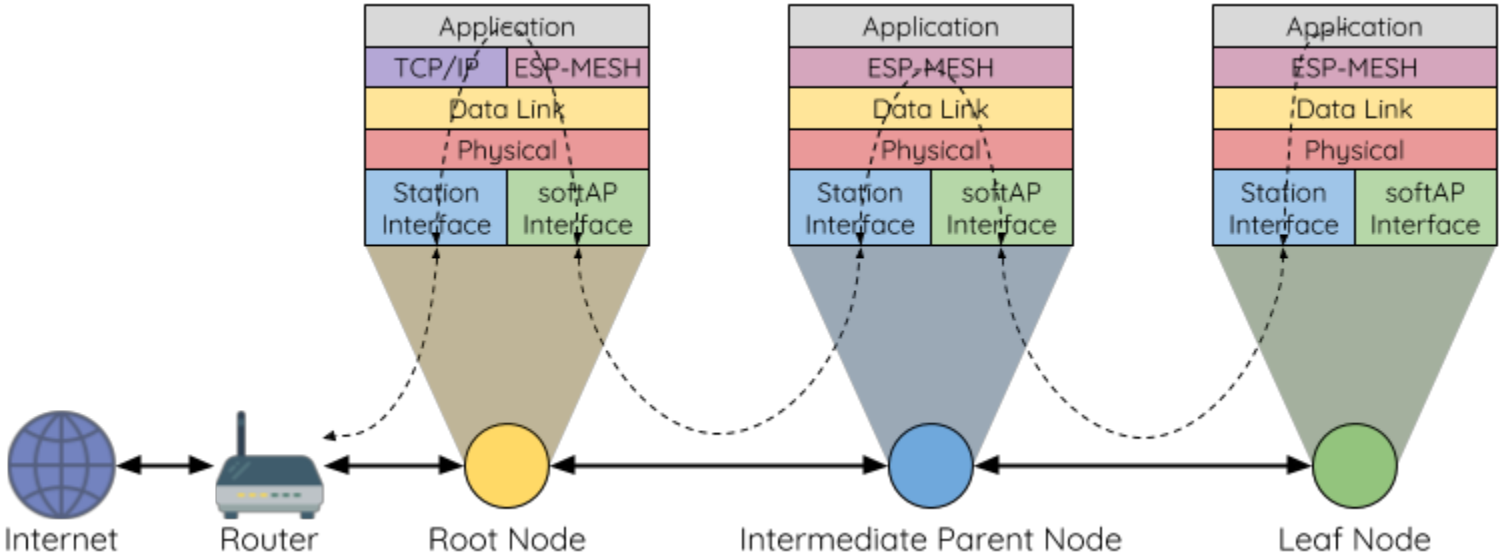
Bidirectional Data Stream



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Performance

- Number of test devices: **100**
- Maximum Downstream Connections to Accept: **6**
- Maximum Permissible Layers: **6**

Function	Description
Networking Building Time	< 60 seconds
Healing time	Root Node Break Down: < 10 seconds Child Node Break Down: < 5 seconds
Per-hop latency	10 to 30 milliseconds

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External Links

- ESP-MDF
  - https://github.com/espressif/esp-mdf
- Examples
  - https://github.com/espressif/esp-idf/tree/master/examples/mesh/internal_communication
  - https://github.com/espressif/esp-idf/tree/master/examples/mesh/manual_networking

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