Hybrid Wireless Mesh Protocol+

Bartłomiej Rodek

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Introduction

- Bartłomiej Rodek
- **Inter Projekt S.A.**
  - wireless networking equipement distributor
  - engaged in trainings since 2008 (four MikroTik Certified Trainers)
  - *http://www.interprojekt.com.pl/*
  - *http://szkolenia.interprojekt.pl/*
- **IDEA4PRO Sp. z o.o.**
  - consulting and integration services
  - training services
  - *info@idea4pro.com*

Outline

What's a mesh network?

It's a network topology where all nodes/routers are connected to each other (full mesh) or, more usuall, almost each other (partial mesh). The main features of mesh topology are high scalability, adaptivity and reliability.

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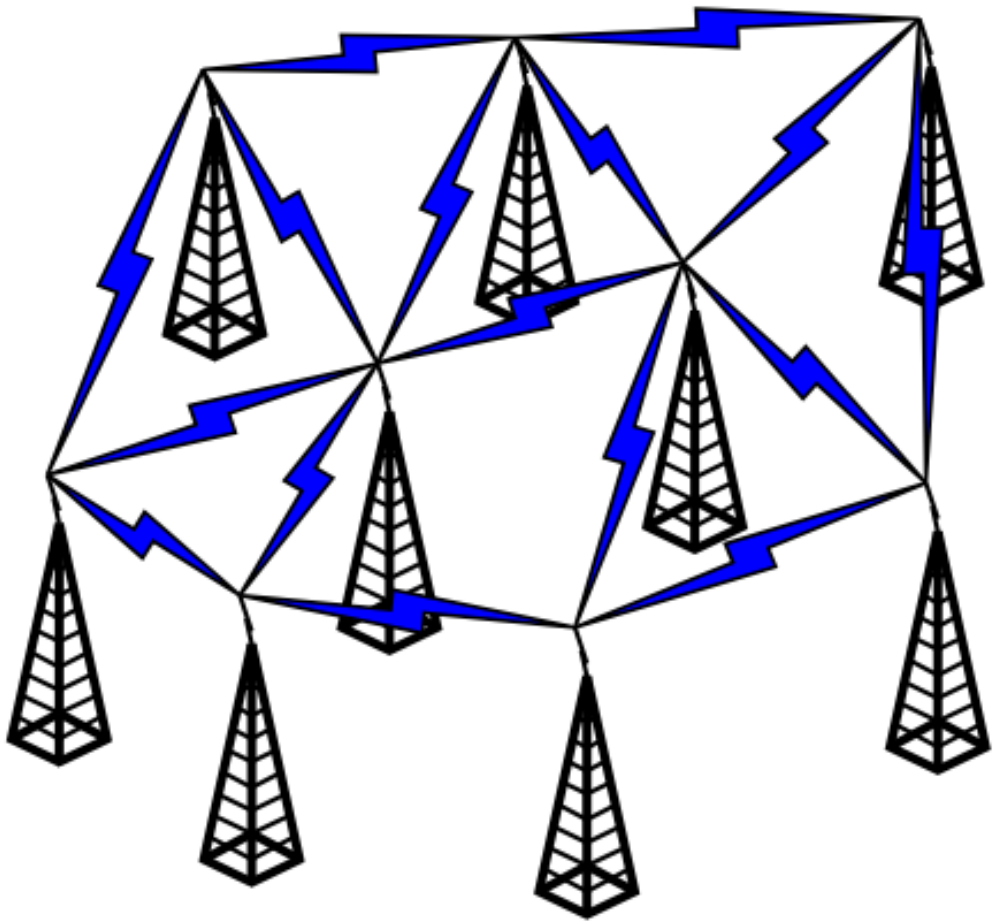
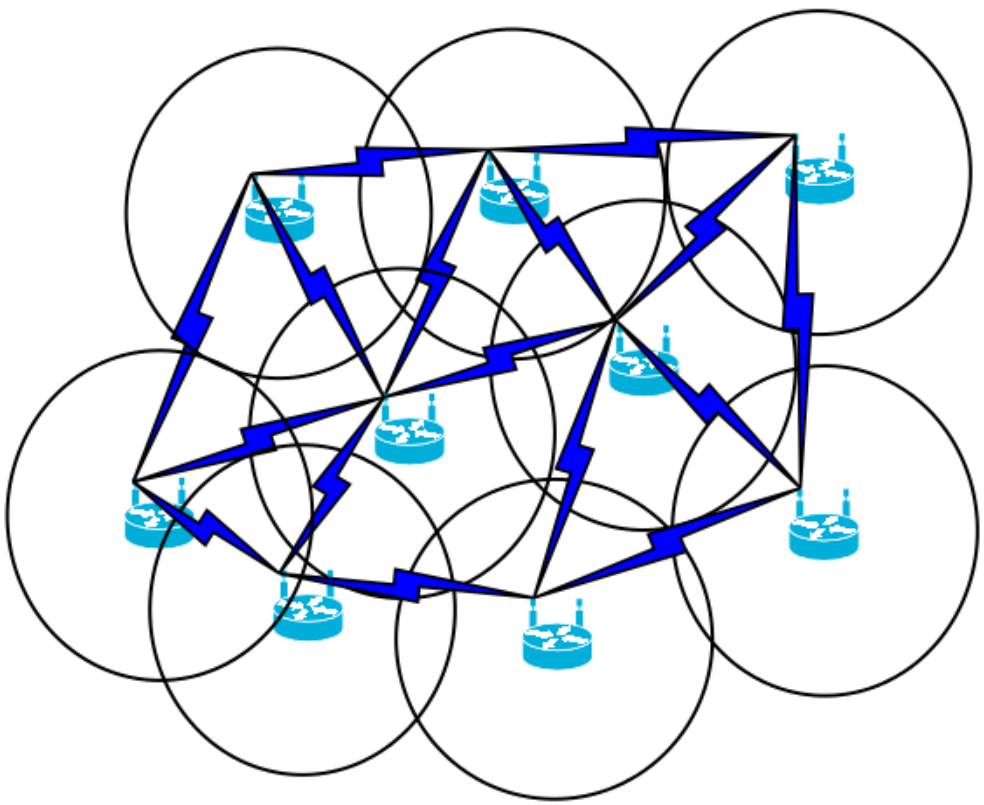
- Wireless networks are usually bridged
- Performance

Mesh topology



Mesh topology - Dual-band



The most common type of configuration: 2.4GHz access points for client connectivity and 5GHz for mesh interconnection.

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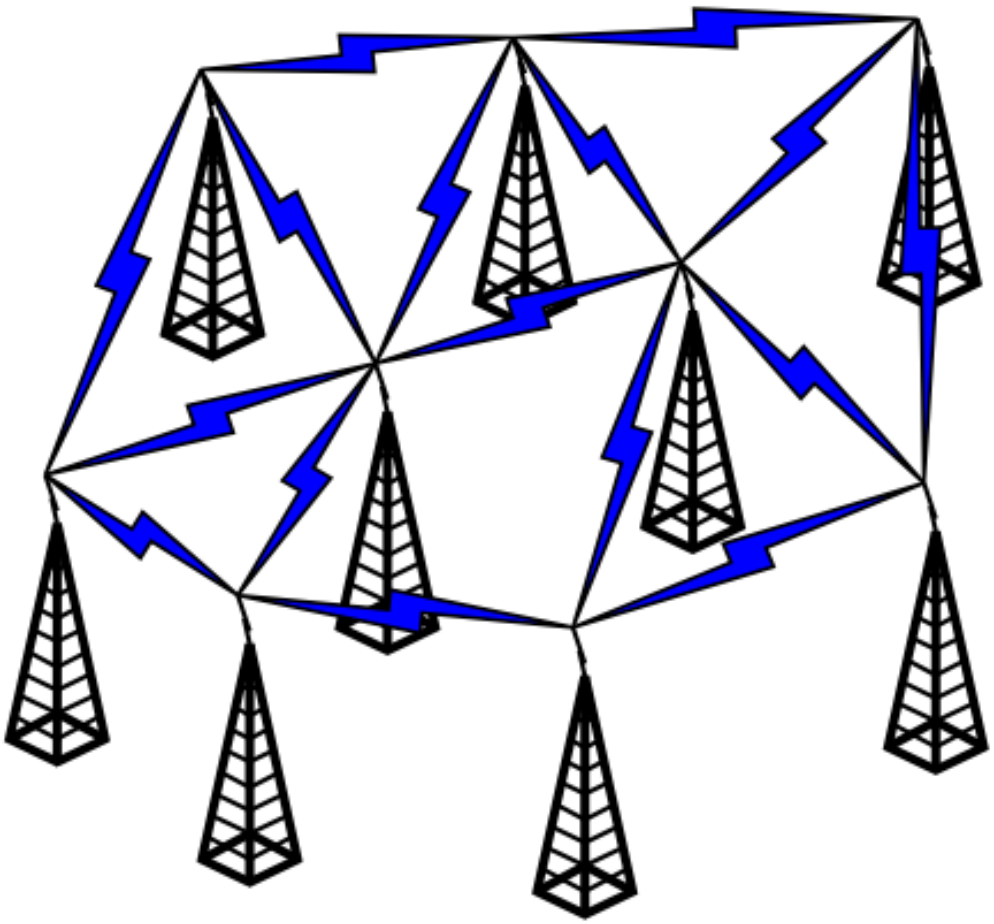
(R)STP Solution

The soultion can be *(Rapid) Spaning Tree Protocol*:

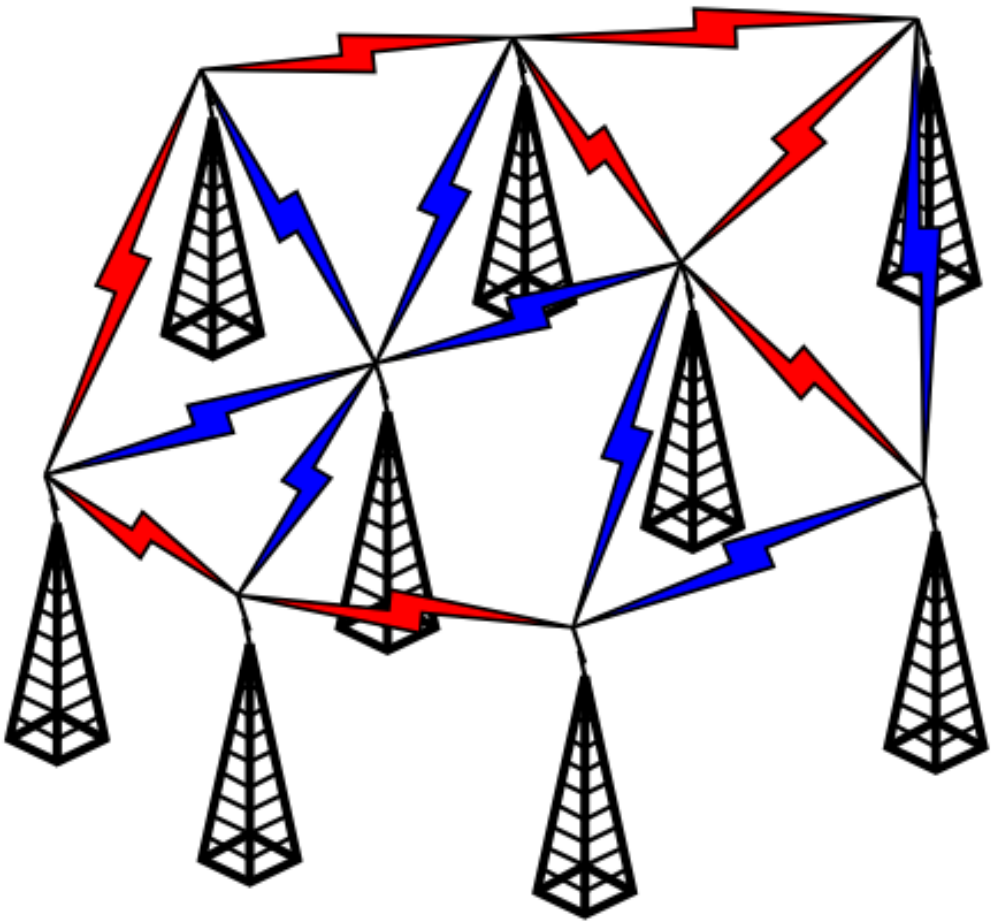
STP[1] or its newer, faster version RSTP[2] is a OSI layer 2 protocol that ensures the loop free topology in bridged networks. RSTP allows to build networks with redundant links without danger of bridge loops, but... let see how it works:

[1] ANSI/IEEE 802.1d-1998 standard
[2] ANSI/IEEE 802.1w-2004 standard

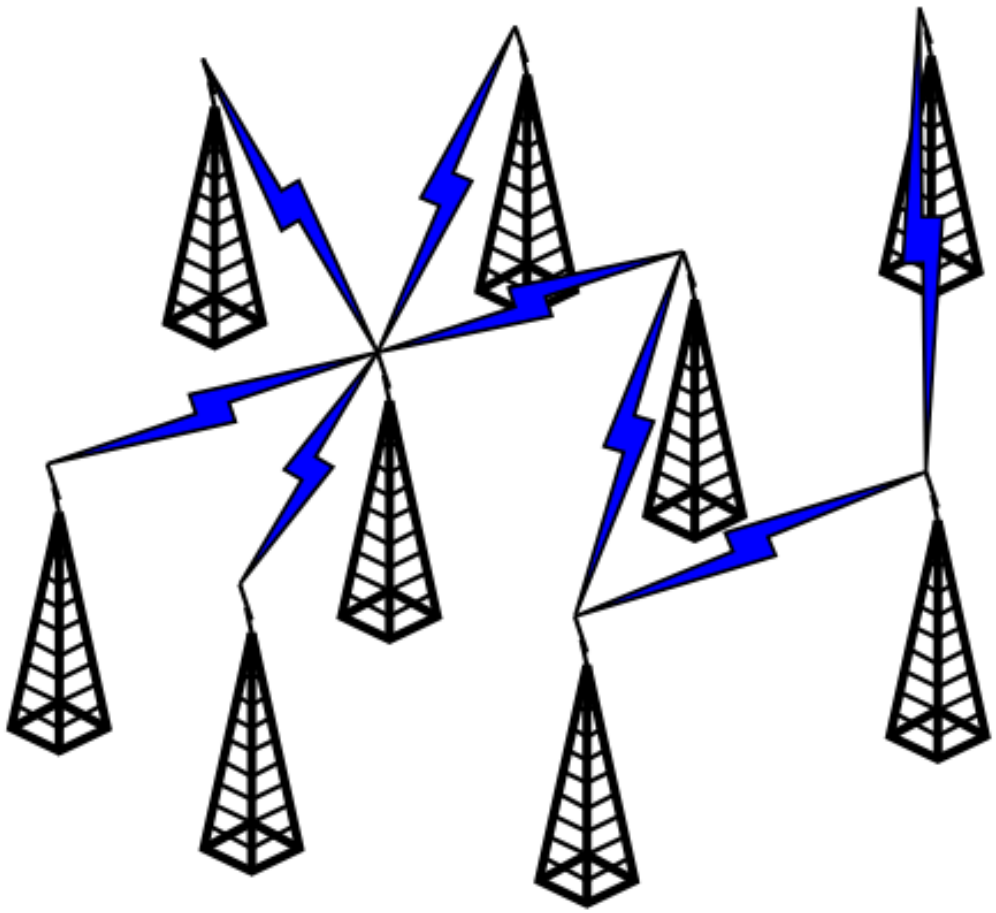
Before RSTP



RSTP select some links (based on path cost)...



And disable it



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- Loop free topology
- Redundant links can be used in case of failure
- More or less optimal topology
- Redundant links are unusable in normal operation

Hybrid Wireless Mesh Protocol+

HWMP+ is a layer two routing protocol based on HWMP[1] but, because of MikrotTik modifications it's incompatible with the standard one. It's designed for wireless mesh networks but works as well in wired Ethernet networks.

Main advantages:

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Main advantages:

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- Optimized route selection based on path cost
- On wireless link the cost is automaticaly calculated based on actual link bandwidth
- On demand route selection or tree based topology

[1] IEEE 802.11s draft

HWMP+ Modes

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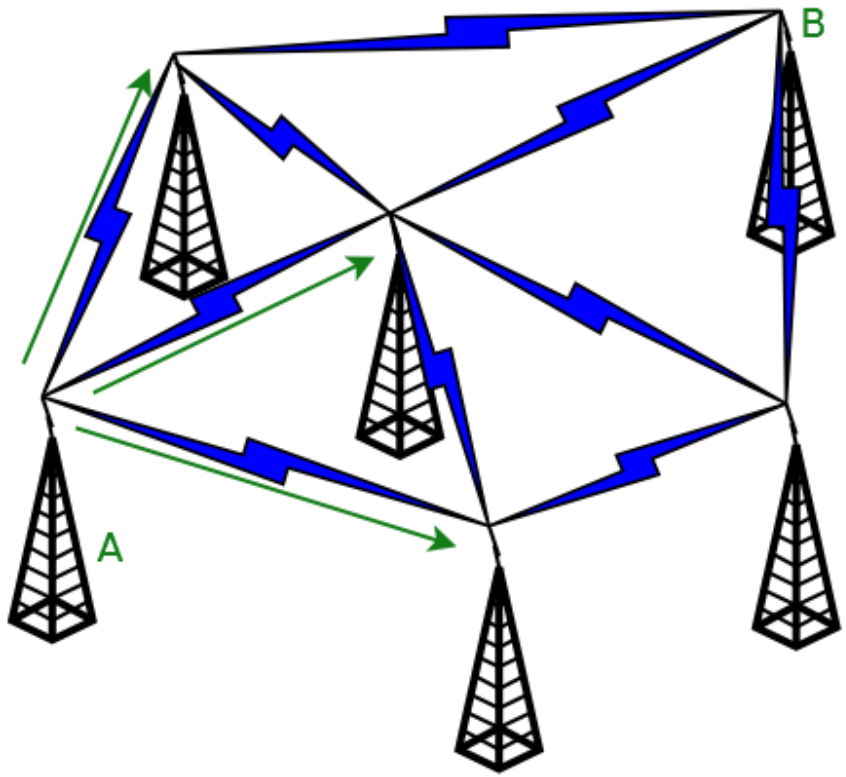
- **Reactive mode**
  Which is more suitable for networks where most of the traffic does not leave the mesh network
- **Proactive mode**
  We should use it in case when most of the traffic goes outside the mesh via few exit points. In this mode we have to define portals. The portals are routers connected to the other networks outside the mesh

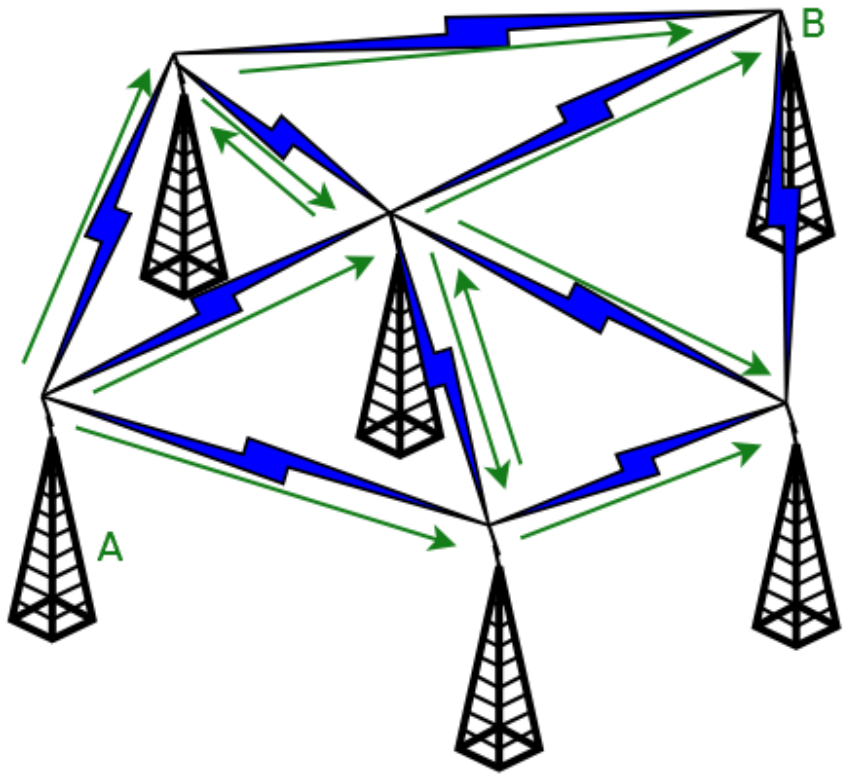
HWMP+ reactive mode

Let's assume bridge A wants to send a frame to bridge B
First it sends **PREQ** message out of its all of its interfaces:



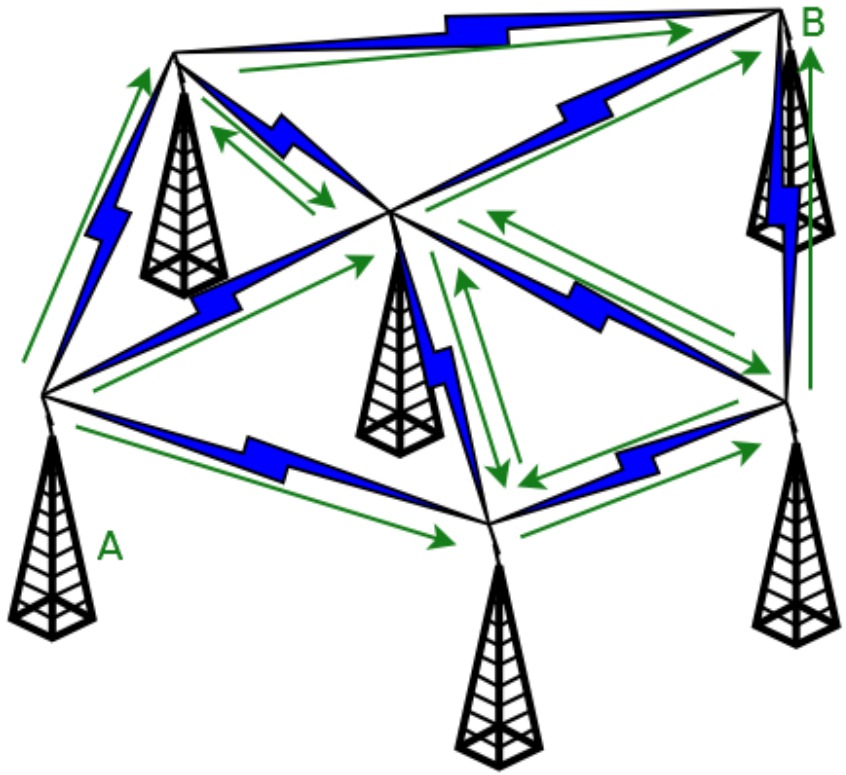
HWMP+ reactive mode

Which is flooded by all of the mesh devices:



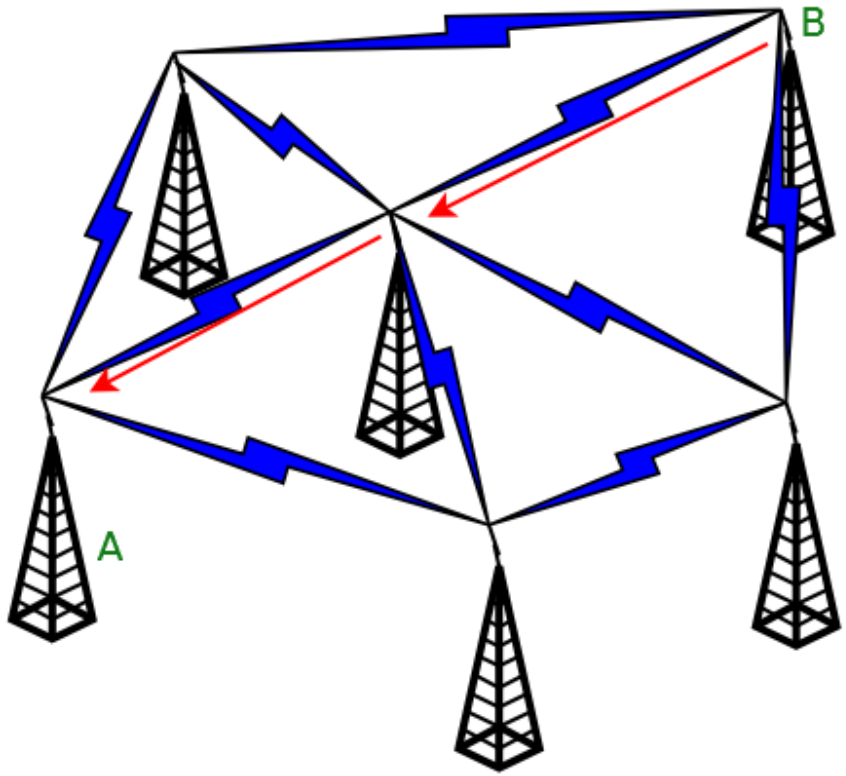
HWMP+ reactive mode

And finally it reaches the B device:



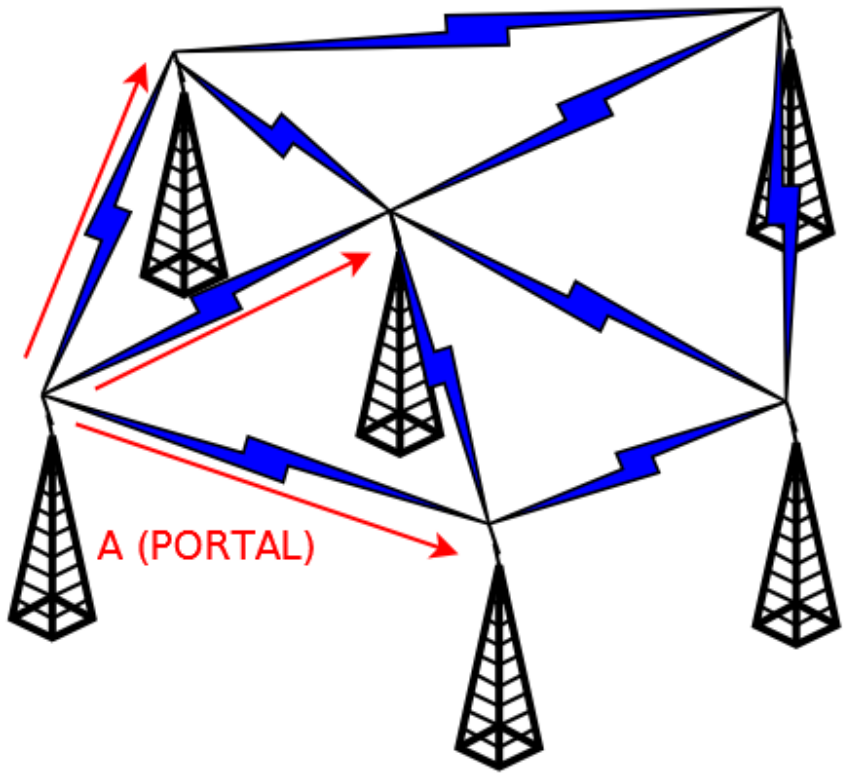
HWMP+ reactive mode

Now the B choses the route with lowest path cost and sends the **PREP** message to A.



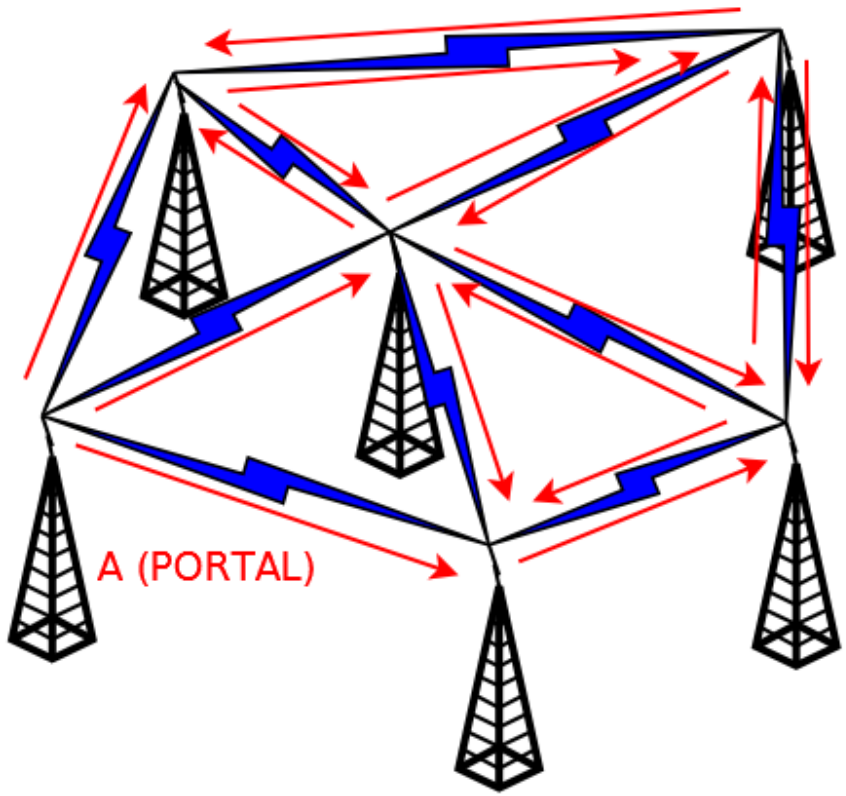
HWMP+ proactive mode

All *portal* nodes start to originate **RANN** messages



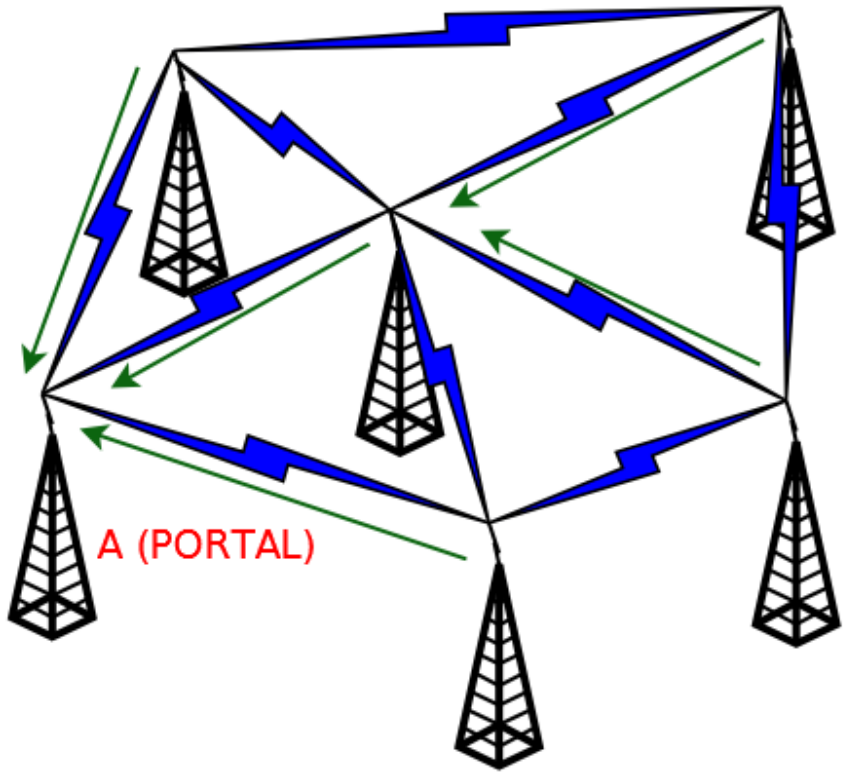
HWMP+ proactive mode

Which are flooded throught the network



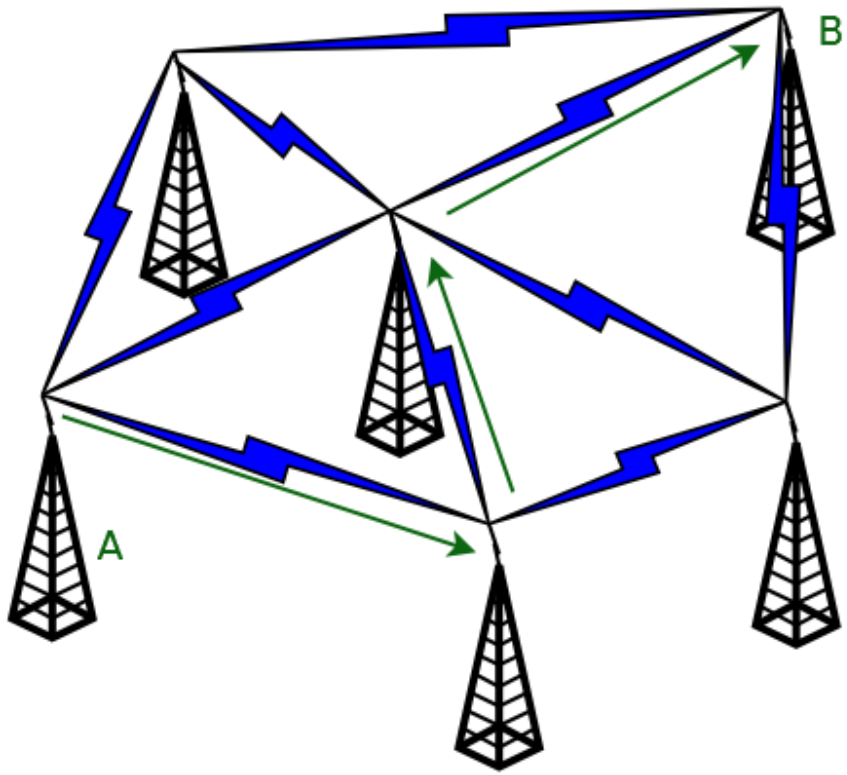
HWMP+ proactive mode - PREG message

Nodes register to the best (nearest) *portal* with **PREG** message



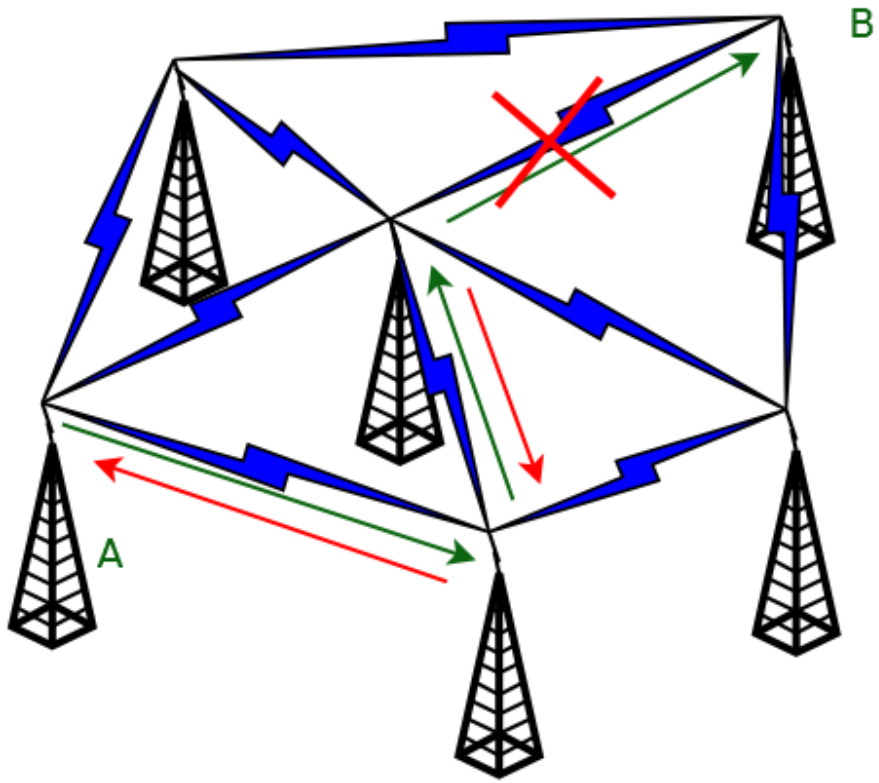
HWMP+ topology change detection

Let's assume that the registered path form A to B is like below

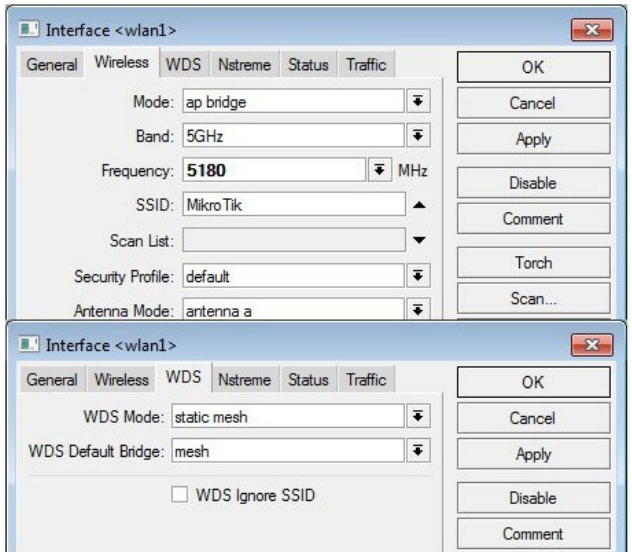


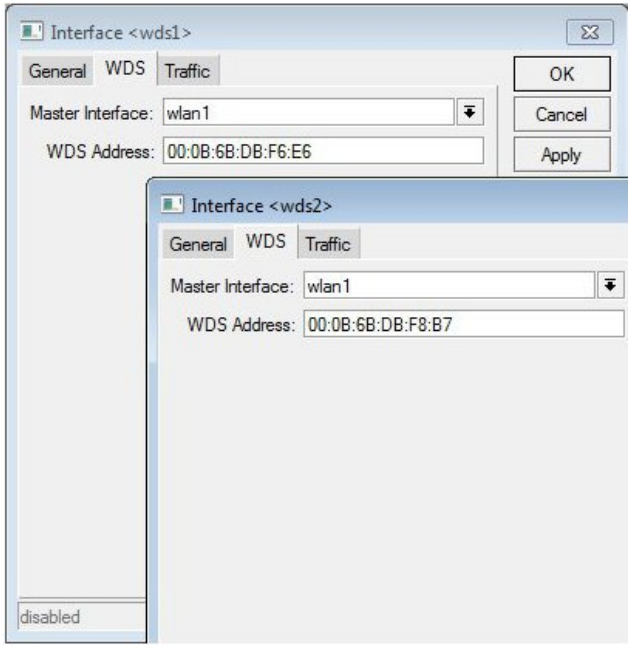
HWMP+ topology change detection

If link fails, the **PERR** message is propagated to all upstream nodes



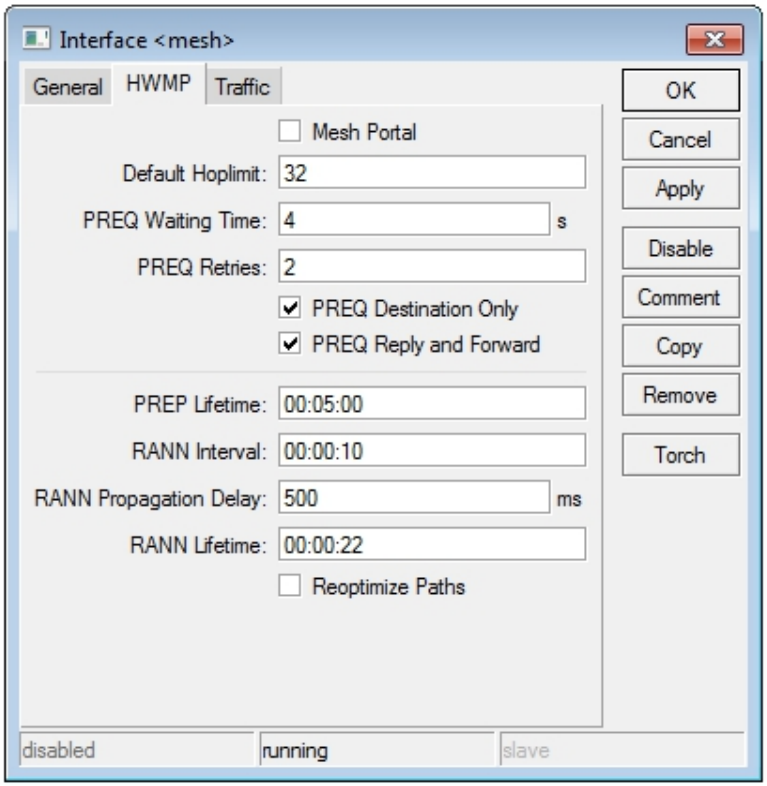
WLAN and WDS configuration





WDS mode should be set to *static mesh* or *dynamic mesh* instead of static/dynamic WDS

Mesh interface parameters



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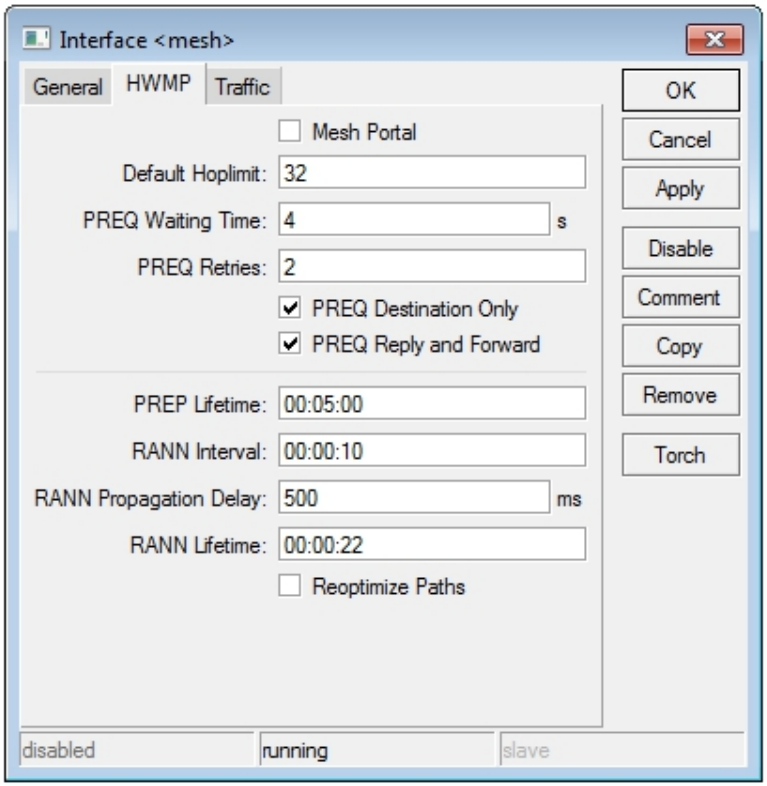

- **Mesh portal** - whether the interface is a portal in the mesh network, if it's set to *yes* protocol use tree based topology

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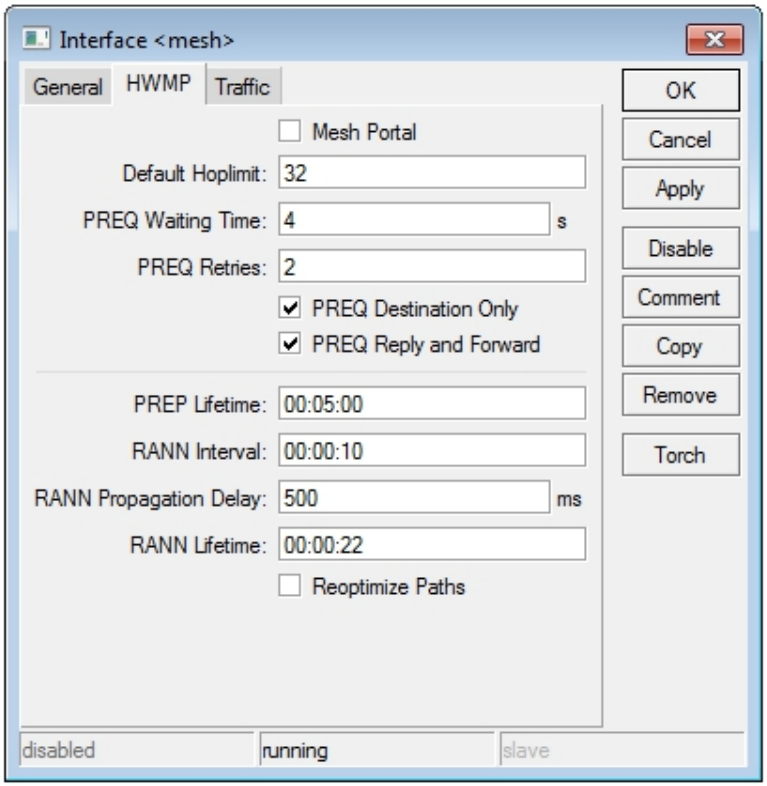

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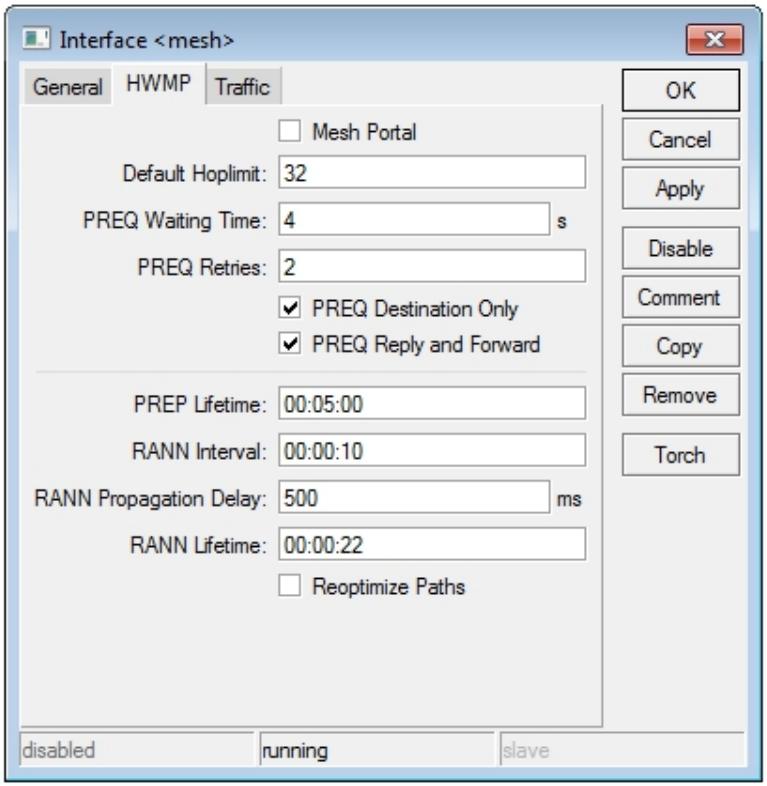

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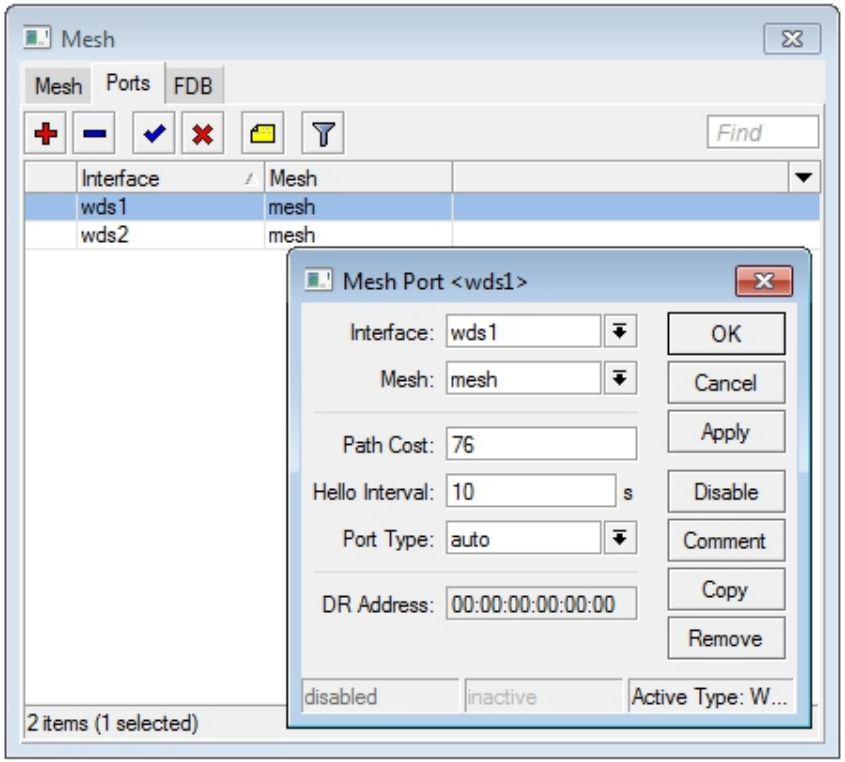
- **Reoptimize Paths** - enables periodical path reoptimization

Mesh port configuration



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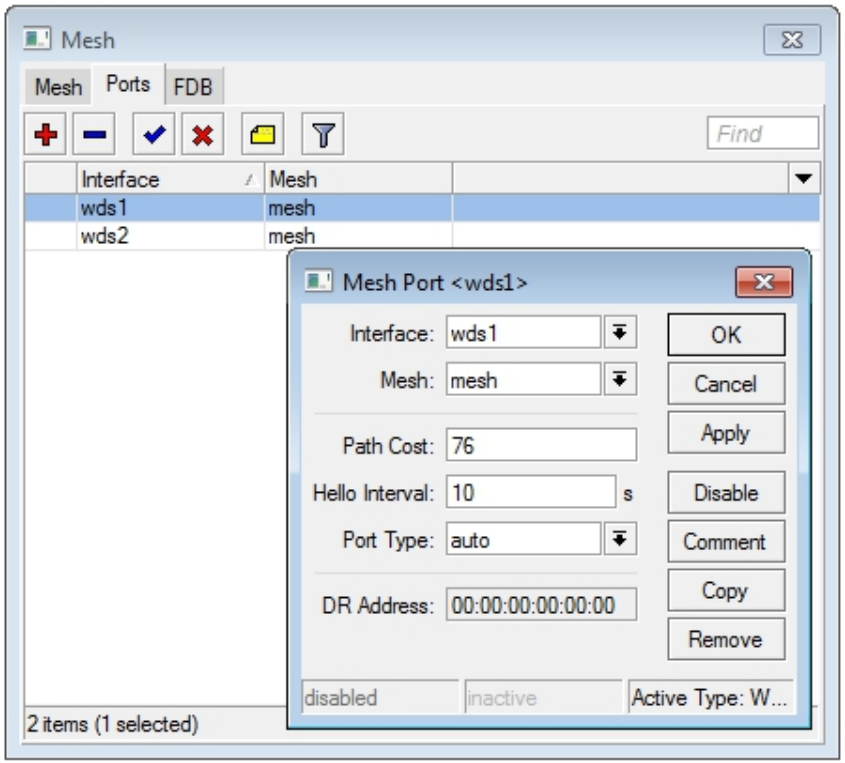

- **Path cost** - cost of the path, for Ethernet default is 10

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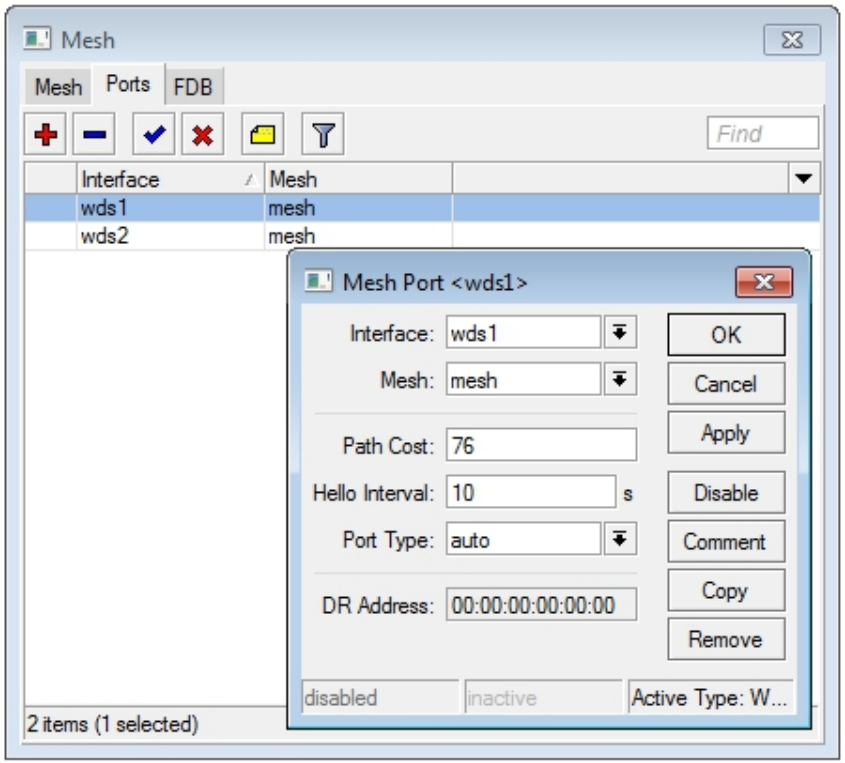

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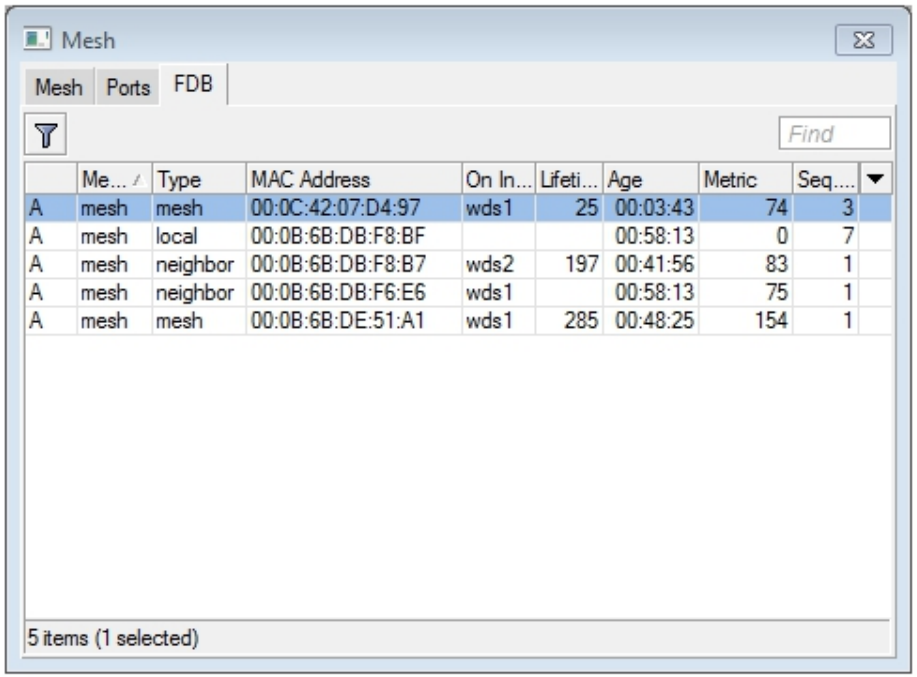
- **Port type** - type of the port. Possible vaule is *auto*, *WDS*, *Wireless* and *Ethernet*

Forwarding Database - device types



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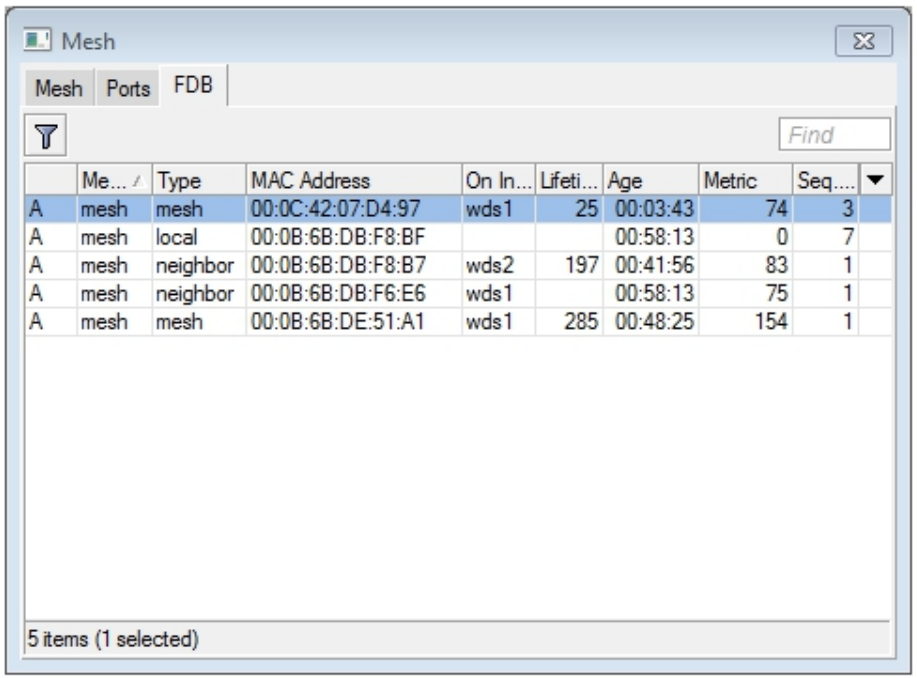

- **local** - local device

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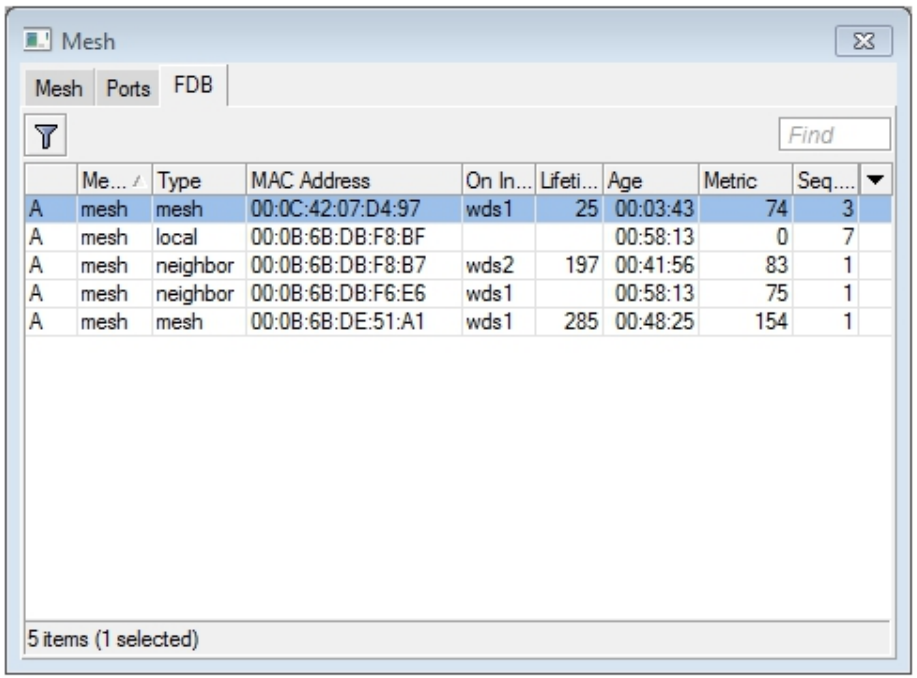

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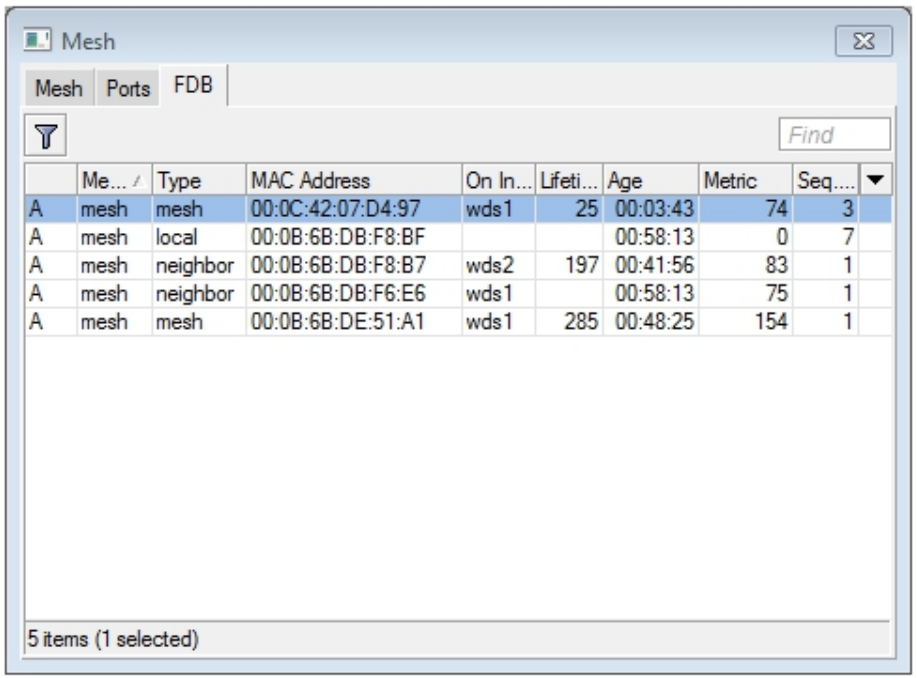

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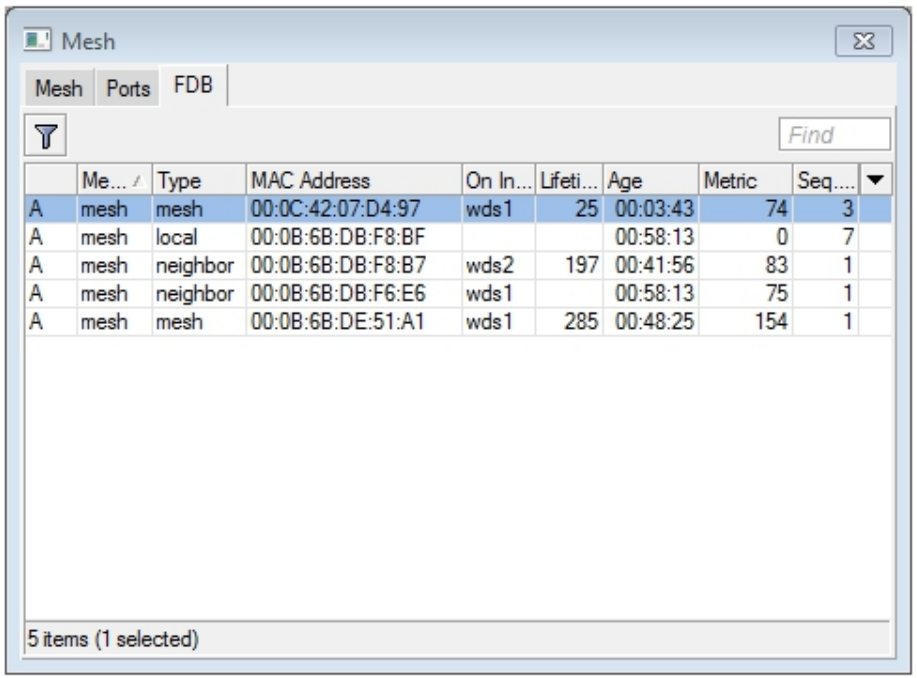

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- **mesh** - device reachable over the mesh network

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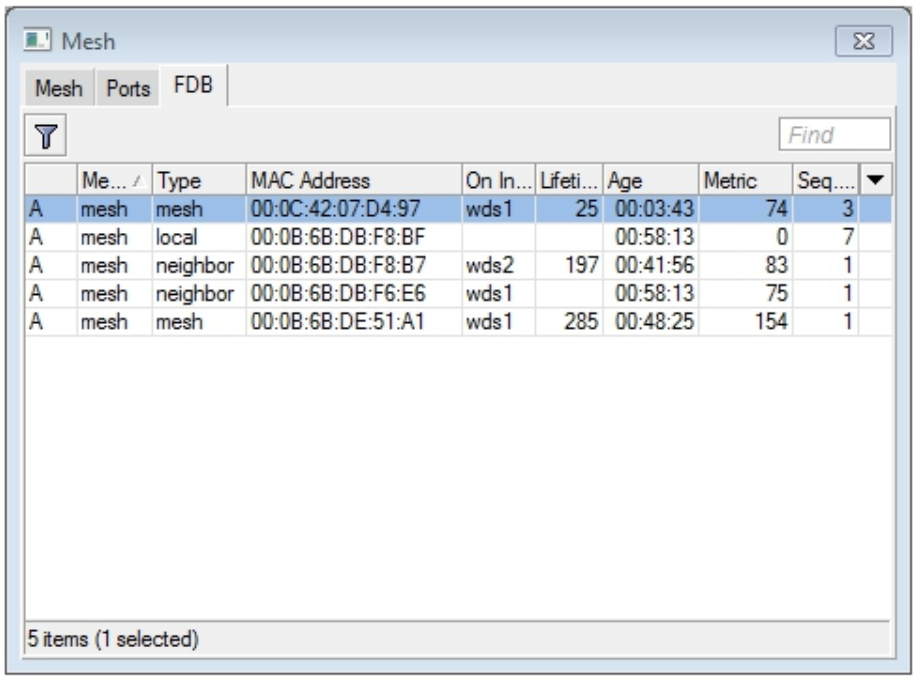

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- **neighbor** - mesh device that is directly connected to this device

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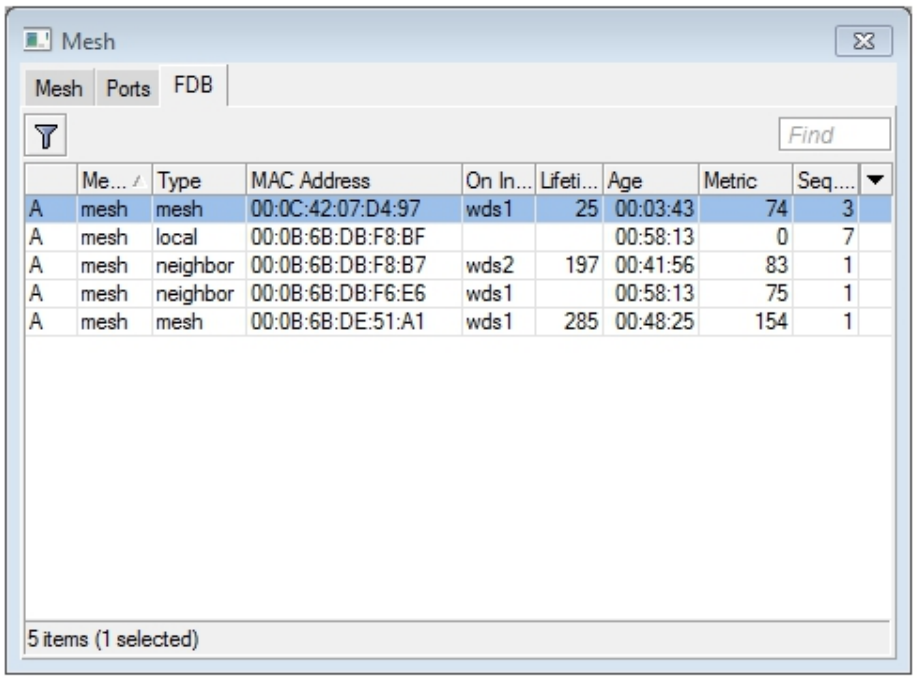

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- **larval** - an unknown device which is reachable over the mesh network

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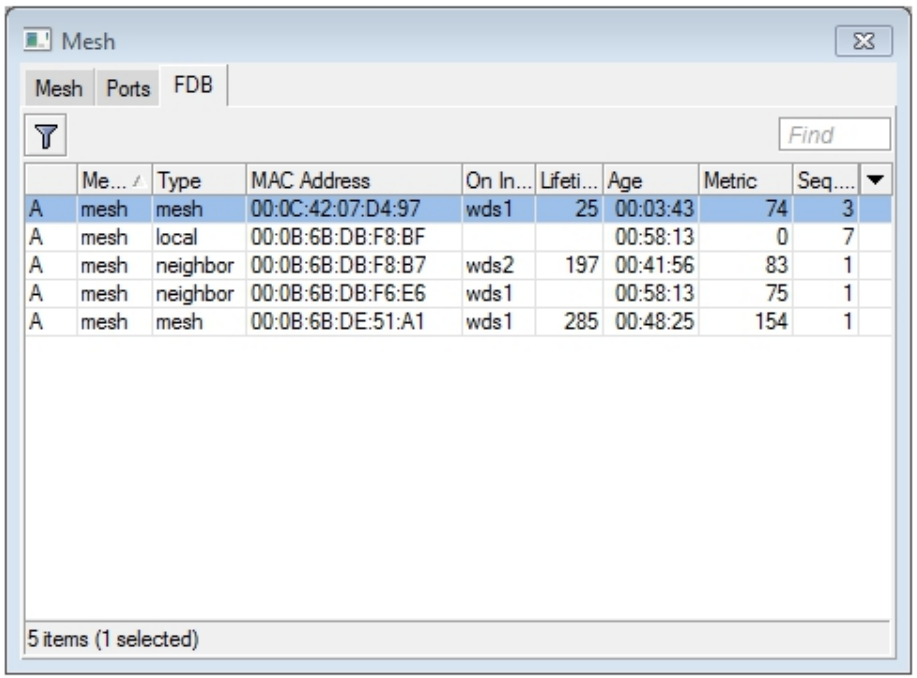

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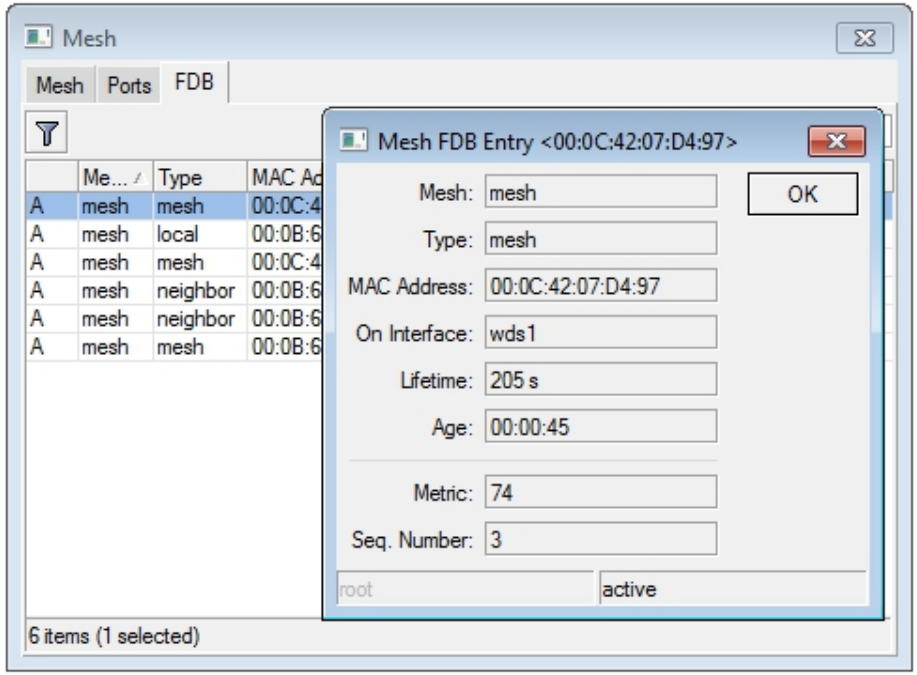
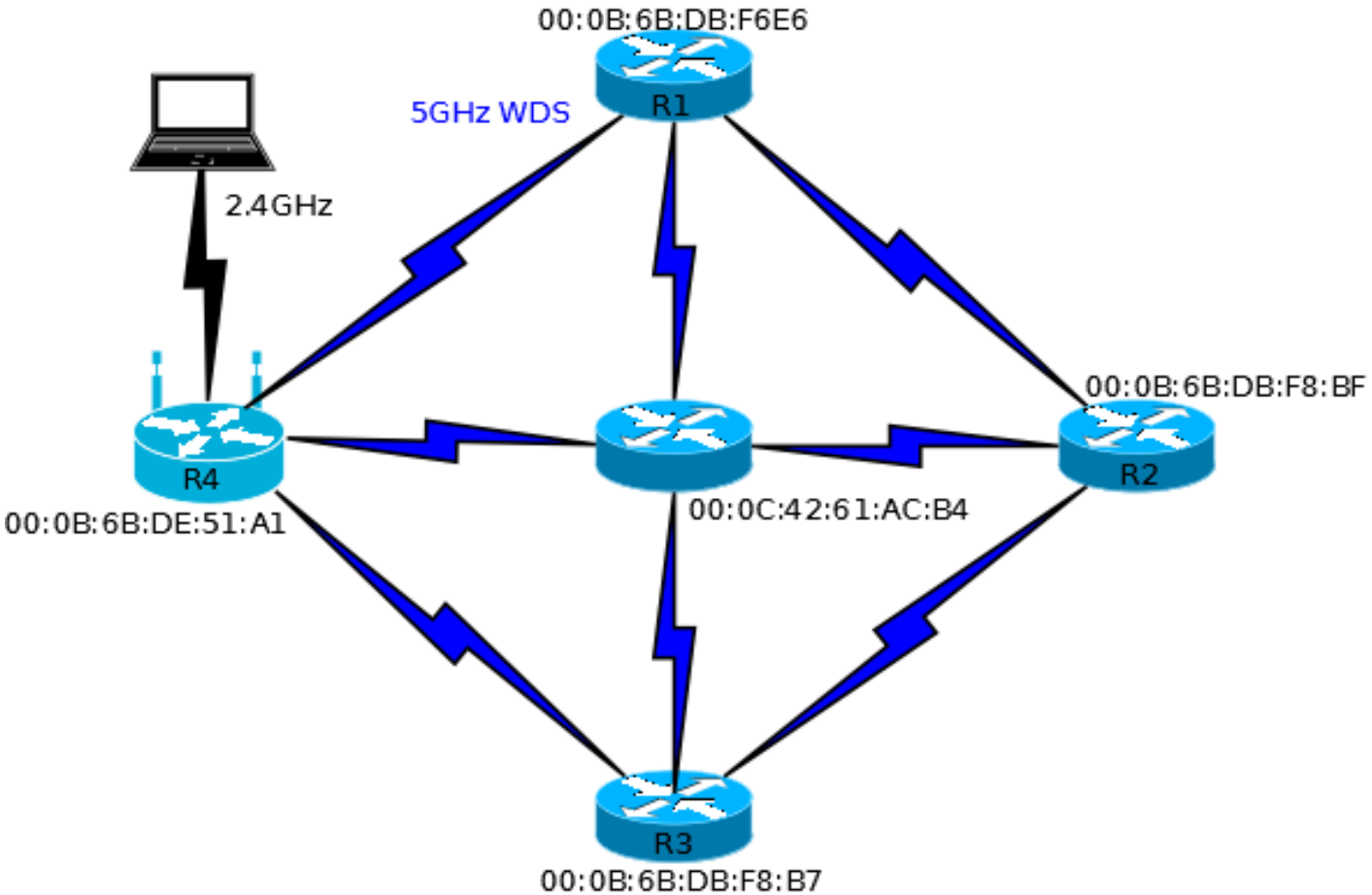
- **unknown** - unknown device

FDB entry details




00:0B:6B:DB:F6E6
R1
5GHz WDS
2.4GHz
00:0B:6B:DB:F8:BF
R2
R4
00:0B:6B:DE:51:A1
00:0C:42:61:AC:B4
R3
00:0B:6B:DB:F8:B7

Any questions?

Thank you.