

# An Introduction to 802.11s and its' current implementation in Linux kernel

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# A brief 802.11s introduction

- Link to the tutorial slide prepared in IEEE 802 plenary meeting at Singapore.
- You can download here:
  - <http://www.ieee802.org/Tutorials.shtml>
  - <https://mentor.ieee.org/802.11/dcn/11/11-11-0380-00-000s-mesh-tutorial.ppt>

# open80211s

- Cozybit Inc is the one created the first implementation of the IEEE 802.11s draft.
- The mesh stack has been integrated in the Linux kernel wireless subsystem in the 2.6.26 release.
  - Hardware Independent with softmac
- More infos:
  - <http://o11s.org/>

# Current open80211s Status

- Features:
  - Mesh Discovery:
    - Passive Scan (Beacon)
  - Mesh Peering:
    - MPM
    - AMPE – Userspace AuthSAE
  - Path Selection (HWMP):
    - Reactive Path Selection
      - Non Forwarding Node
    - Proactive Path Selection
      - Proactive RANN

# Current open80211s Status

Wireshark 1.7.0-SVN-39449 (SVN Rev 39449 from /trunk)

Filter: Expression... Clear Apply Save

Time	TxRate	RSSI	Source	Destination	Protocol	Length	Info
1	0.000000	6.0 Mbps	-76	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=1, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
2	1.023555	6.0 Mbps	-76	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=2, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
3	2.047347	6.0 Mbps	-67	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=3, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
4	3.071054	6.0 Mbps	-61	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=4, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
5	4.095806	6.0 Mbps	-62	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=5, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
6	5.119179	6.0 Mbps	-62	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=6, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
7	6.142863	6.0 Mbps	-63	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=7, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
8	7.167307	6.0 Mbps	-62	0a:0b:6b:b2:03:5d	Broadcast	802.11	157 Beacon frame, SN=8, FN=0, Flags=.....C, BI=1000, SSID=Broadcast, MESHID=open80211s
9	7.168680	6.0 Mbps	-63	0a:0b:6b:7d:e3:b9	0a:0b:6b:b2:0	802.11	153 Action, SN=1, FN=0, Flags=.....C, MESHID=open80211s
10	7.168683	6.0 Mbps	-61	0a:0b:6b:7d:e3:b9	0a:0b:6b:7d:e	802.11	46 Acknowledgement, Flags=.....C
11	7.259359	6.0 Mbps	-58	0a:0b:6b:7d:e3:b9	0a:0b:6b:b2:0	802.11	153 Action, SN=2, FN=0, Flags=.....C, MESHID=open80211s
12	7.259363	6.0 Mbps	-61	0a:0b:6b:7d:e3:b9	0a:0b:6b:7d:e	802.11	46 Acknowledgement, Flags=.....C
13	7.399555	6.0 Mbps	-53	0a:0b:6b:7d:e3:b9	0a:0b:6b:b2:0	802.11	153 Action, SN=3, FN=0, Flags=.....C, MESHID=open80211s
14	7.399557	6.0 Mbps	-61	0a:0b:6b:7d:e3:b9	0a:0b:6b:7d:e	802.11	46 Acknowledgement, Flags=.....C

IEEE 802.11 wireless LAN management frame

- Fixed parameters (12 bytes)
  - Timestamp: 0x00000076c67c84cd
  - Beacon interval: 1.024000 [Seconds]
- Capabilities Information: 0x0000
- Tagged parameters (85 bytes)
  - Tag: SSID parameter set: Broadcast
  - Tag: Supported Rates 6, 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
  - Tag: HT Capabilities (802.11n D1.10)
  - Tag: HT Information (802.11n D1.10)
  - Tag: Mesh ID: open80211s**
    - Tag Number: Mesh ID (114)
    - Tag length: 10
    - Mesh ID: open80211s
  - Tag: Mesh Configuration

```

0050 2d 1a 4e 10 1b ff ff 00 00 00 00 00 00 00 00 00 00  --N.....
0060 00 01 00 00 00 00 00 00 00 00 00 00 3d 16 95 04  .....=...
0070 00 00 00 00 00 ff ff 00 00 00 00 00 00 00 00 00 00  .....
0080 00 00 00 00 72 0a 6f 70 65 6e 38 30 32 31 31 73  ....r.op en80211s
0090 71 07 00 00 00 00 00 00 09 4a d4 b7 13          q.....J...
  
```

Tag (wlan\_mgt.tag), 12 bytes | Packets: 117 Displayed: 117 Marked: 0 Load time: 0:00.231 | Profile: Default

# Current open80211s Status

- Not Yet Implemented:
  - Power Save
  - Mixed Mode Peering
  - Proxy Update
  - Radio Resource Management
    - MBCA
    - MCCA
  - Proactive Path Selection
    - Proactive PREQ

# o11s Nodes Setup in WBMv5

- Connect to the “o11s-net-x”. It is actually running the mesh and AP interface in single radio.

```
# iw wlan0-1 mpath dump
```

DEST ADDR	NEXT HOP	IFACE	SN	METRIC	QLEN	EXPTIME	DTIM		
DRET	FLAGS								
72:72:cf:21:ee:29	72:72:cf:21:ee:29	wlan0-1	0	8193	0	2200430080	0	0	0x10
02:12:cf:c9:3f:c5	02:12:cf:c9:3f:c5	wlan0-1	33	152	0	2200430080	100	0	0x4
00:12:cf:a4:de:e3	00:12:cf:a4:de:e3	wlan0-1	0	8193	0	2200430080	0	0	0x10
72:72:cf:28:23:47	72:72:cf:28:23:47	wlan0-1	0	342	0	2200430080	0	0	0x10