mesh dynamics

MESHCOMMANDS REFERENCE MANUAL

FOR ATH10K (80211AC)

mesh dynamics

Contents

1. Radio Level Information

Radio level information is available for each radio card present in the unit. The information is available through the following command:

For ath5k chipset
cat /sys/kernel/debug/ieee80211/phyX/ath5k/…

For ath10k chipset
cat /sys/kernel/debug/ieee80211/phyX/ath10k/

1.1 ath5k

1.1.1 beacon

Beacon related all the information will be is shown here.
cat /sys/kernel/debug/ieee80211/phyX/ath5k/beacon
Example output of above command

```
AR5K_BEACON             0x00000019      intval: 25      TIM: 0x0
AR5K_LAST_TSTP          0x59f9bfc7
AR5K_BEACON_CNT         0x00000000

AR5K_TIMER0 (TBTT)      0x00003563      TU: 00003563
AR5K_TIMER1 (DMA)       0x0001ab08      TU: 00003561
AR5K_TIMER2 (SWBA)      0x00e1ab90      TU: 001c3572
AR5K_TIMER3 (ATIM)      0x00003564      TU: 00003564
TSF             0x0000000070d5766a      TU: 001c355d
```

1.1.2 antenna

Antenna related information is provided here.
cat /sys/kernel/debug/ieee80211/phyX/ath5k/antenna
The information is formatted as shown below:

```
antenna mode    0
default antenna 0
tx antenna      0

ANTENNA         RX      TX
[antenna 1]     3640    2034
[antenna 2]     9       0
[antenna 3]     0       0
[antenna 4]     0       0
[invalid]       0       0

AR5K_DEFAULT_ANTENNA    0x00000000
AR5K_STA_ID1_DEFAULT_ANTENNA    0
AR5K_STA_ID1_DESC_ANTENNA       0
AR5K_STA_ID1_RTS_DEF_ANTENNA    0
AR5K_STA_ID1_SELFGEN_DEF_ANT    0

AR5K_PHY_AGCCTL_OFDM_DIV_DIS    0
AR5K_PHY_RESTART_DIV_GC         4
AR5K_PHY_FAST_ANT_DIV_EN        1
```

```
AR5K_PHY_ANT_SWITCH_TABLE_0     0x061a6981
AR5K_PHY_ANT_SWITCH_TABLE_1     0x05165942
```

1.1.3 bwmode

Band width related information is provided here. It will provide current operating BW information.

```
cat /sys/kernel/debug/ieee80211/phyX/ath5k/bwmode
```

The information is formatted as shown below:

```
5 10 [20] 40
```

1.1.4 frameerrros

frameerros information will be provided here.

```
cat /sys/kernel/debug/ieee80211/phy0/ath5k/frameerrors
```

The information is formatted as shown below:

```
RX
----------------------
CRC     2812    (24%)
PHY     0       (0%)
FIFO    0       (0%)
decrypt 2       (0%)
MIC     0       (0%)
process 0       (0%)
jumbo   3       (0%)
[RX all 11597]
RX-all-bytes    1412050

TX
----------------------
retry   0       (0%)
FIFO    0       (0%)
filter  0       (0%)

      TX-all-bytes    435337
```

1.1.5 misc

BSSID mask, filter flags and current operating mode of interface information will be provided here.

```
cat /sys/kernel/debug/ieee80211/phyX/ath5k/misc
```

The information is formatted as shown below:

```
 bssid-mask: ff:ff:ff:ff:ff:f3
filter-flags: 0x97  UCAST MCAST BCAST BEACON PROBEREQ RADARERR-5211
opmode: AP (3)
```

1.1.6 queue

Available queues and queues being used and other information will be provided here.

```
cat /sys/kernel/debug/ieee80211/phyX/ath5k/queue
```

The information is formatted as shown below:

```
available txbuffers: 198
00: setup
  len: 1 bufs: 1
  stuck: 0
01: setup
  len: 0 bufs: 0
```

```
    stuck: 0
  02: setup
    len: 1 bufs: 1
    stuck: 0
  03: setup
    len: 0 bufs: 0
    stuck: 0
  04: not setup
  05: not setup
  06: not setup
  07: not setup
  08: setup
    len: 0 bufs: 0
    stuck: 0
  09: not setup
```

1.1.7 registers

Some of register information is provided here.

```
cat /sys/kernel/debug/ieee80211/phyX/ath5k/registers
```

The information is formatted as shown below:

```
AR5K_CR                 0x00000004
AR5K_RXDP               0x2e8be180
AR5K_CFG                0x00000100
AR5K_IER                0x00000001
AR5K_BCR                0x00000000
AR5K_RTSD0              0x00000000
AR5K_RTSD1              0x00000000
AR5K_TXCFG              0x00000015
AR5K_RXCFG              0x00000005
AR5K_RXJLA              0x2e8be170
AR5K_MIBC               0x00000000
AR5K_TOPS               0x00000008
AR5K_RXNOFRM            0x00000000
AR5K_TXNOFRM            0x00000000
AR5K_RPGTO              0x00000000
AR5K_RFCNT              0x0000001f
AR5K_MISC               0x00000000
AR5K_QCUDCU_CLKGT       0x00dfd770
AR5K_ISR                0x00000000
AR5K_PISR               0x00100000
AR5K_SISR0              0x00000000
AR5K_SISR1              0x00000000
AR5K_SISR2              0x88000000
AR5K_SISR3              0x03000000
AR5K_SISR4              0x00000300
AR5K_IMR                0x00000000
AR5K_PIMR               0x800914b5
AR5K_SIMR0              0x030f0000
AR5K_SIMR1              0x010f0000
AR5K_SIMR2              0x00070000
AR5K_SIMR3              0x00000000
AR5K_SIMR4              0x00000000
AR5K_DCM_ADDR           0x00000061
AR5K_DCCFG              0x00000000
AR5K_CCFG               0x00000000
AR5K_CPC0               0x00000000
AR5K_CPC1               0x00000000
AR5K_CPC2               0x00000000
AR5K_CPC3               0x00000000
```

```
AR5K_CPCOVF              0x00000000
AR5K_RESET_CTL           0x00000000
AR5K_SLEEP_CTL           0x00000000
AR5K_INTPEND             0x00000000
AR5K_SFR                 0x00000000
AR5K_PCICFG              0x00000014
AR5K_GPIOCR              0x00008000
AR5K_GPIODO              0x00000001
AR5K_SREV                0x000000a5
```

1.1.8 debug

debug lists all the available debug levels and display current debug level, as well as allow to change current debug level.

```
cat /sys/kernel/debug/ieee80211/phyX/ath5k/debug
```

The information is formatted as shown below.

```
DEBUG LEVEL: 0x00000000

     reset   0x00000001 - reset and initialization
      intr   0x00000002 - interrupt handling
      mode   0x00000004 - mode init/setup
      xmit   0x00000008 - basic xmit operation
    beacon   0x00000010 - beacon handling
     calib   0x00000020 - periodic calibration
   txpower   0x00000040 - transmit power setting
       led   0x00000080 - LED management
 dumpbands   0x00000400 - dump bands
       dma   0x00000800 - dma start/stop
       ani   0x00002000 - adaptive noise immunity
      desc   0x00004000 - descriptor chains
       all   0xffffffff - show all debug levels
```

1.2 ath10k

1.2.1 fw_stats

fw_stats information is provided here.

```
cat /sys/kernel/debug/ieee80211/phyX/ath10k/fw_stats
```

The information is formatted as shown below:

```
            ath10k PDEV stats
            =================

         Channel noise floor       -105
            Channel TX power         44
              TX frame count   13739057
              RX frame count   13446628
              RX clear count   28636859
                 Cycle count 2702159744
            PHY error count          0
              RTS bad count          0
             RTS good count          0
              FCS bad count          0
            No beacon count       2417
              MIB int count          0

        ath10k PDEV TX stats
           =================
```

```
            HTT cookies queued          0
             HTT cookies disp.          0
                   MSDU queued      44815
                   MPDU queued      44815
                MSDUs dropped           0
                 Local enqued      44815
                  Local freed      44815
                    HW queued      44815
                 PPDUs reaped      44815
                Num underruns           0
                PPDUs cleaned           0
                 MPDUs requed           0
              Excessive retries          0
                        HW rate          3
            Sched self tiggers           0
    Dropped due to SW retries            0
      Illegal rate phy errors            0
        Pdev continous xretry            0
                    TX timeout           0
                   PDEV resets           0
                  PHY underrun           0
MPDU is more than txop limit             0

        ath10k PDEV RX stats
           =================

         Mid PPDU route change           0
       Tot. number of statuses       46671
        Extra frags on rings 0           0
        Extra frags on rings 1           0
        Extra frags on rings 2           0
        Extra frags on rings 3           0
        MSDUs delivered to HTT       46671
        MPDUs delivered to HTT       46671
     MSDUs delivered to stack        46620
     MPDUs delivered to stack        46620
              Oversized AMSUs            0
                    PHY errors           0
               PHY errors drops          0
 MPDU errors (FCS, MIC, ENC)            51

           ath10k PEER stats (1)
           =================

            Peer MAC address 03:00:00:00:04:f0
                   Peer RSSI 46166
               Peer TX rate 0
               Peer RX rate 6000
```

1.2.2 wmi_services

wmi_services information is provided here.

```
cat /sys/kernel/debug/ieee80211/phyX/ath10k/wmi_services
```

The information is formatted as shown below:

```
0x00 -       BEACON_OFFLOAD - disabled
```

```
0x01 -          SCAN_OFFLOAD - enabled
0x02 -          ROAM_OFFLOAD - enabled
0x03 -      BCN_MISS_OFFLOAD - enabled
0x04 -           STA_PWRSAVE - enabled
0x05 - STA_ADVANCED_PWRSAVE - enabled
0x06 -               AP_UAPSD - enabled
0x07 -                 AP_DFS - disabled
0x08 -                   11AC - enabled
0x09 -               BLOCKACK - enabled
0x0a -                 PHYERR - enabled
0x0b -             BCN_FILTER - enabled
0x0c -                    RTT - disabled
0x0d -               RATECTRL - disabled
0x0e -                    WOW - enabled
0x0f -        RATECTRL CACHE - enabled
0x10 -             IRAM TIDS - enabled
0x11 -         ARPNS_OFFLOAD - disabled
0x12 -                   NLO - disabled
0x13 -           GTK_OFFLOAD - disabled
0x14 -              SCAN_SCH - disabled
0x15 -           CSA_OFFLOAD - disabled
0x16 -               CHATTER - disabled
0x17 -        COEX_FREQAVOID - disabled
0x18 -     PACKET_POWER_SAVE - disabled
0x19 -         FORCE FW HANG - disabled
0x1a -                  GPIO - disabled
0x1b -        MODULATED DTIM - disabled
0x1c -           BASIC UAPSD - disabled
0x1d -             VAR UAPSD - disabled
0x1e -        STA KEEP ALIVE - disabled
0x1f -               TX ENCAP - disabled
```

1.3 wireless

Basic information related to all the wireless interfaces are provided in below command

```
cat /proc/net/wireless
Inter-| sta-|   Quality        |   Discarded packets               | Missed |
WE
 face | tus | link level noise |  nwid  crypt   frag  retry   misc | beacon |
22
 wlan0: 0000    0     0     0        0      0      0      0      0        0
 wlan1: 0000   35.  -75.  -256        0      0      0      6      0        0
 wlan2: 0000    0     0     0        0      0      0      0      0        0
 wlan3: 0000    0     0     0        0      0      0      0      0        0
v_wlan0: 0000    0     0     0        0      0      0      0      0        0
  mon3: 0000    0     0     0        0      0      0      0      0        0
```

2 Transient Radio Commands

The transient radio commands in this section have immediate effect on the radio card, but these changes are not persistent across reboots.

2.3 Freq

This command sets the frequency of the radio card. The full command for this information is:

iwconfig wlanX freq <<frequency in MHZ>>M

2.4 Txpower

This command sets the power of the radio card. The full command for this information is:

iwconfig wlanX txpower <<index>> The index is a number between 0 and 63.
Or
iw dev <devname> set txpower <auto|fixed|limit> [<tx power in mBm>]

3 Node Level Information

3.1 Sta-List

This entry provides details of all the connected client devices

and child mesh nodes. The full command for this information is:

cat /proc/net/meshap/access-point/sta-list

The format of the information is show below:

```
------------------------------------------------------------------------------ STATION
ADDR            |IFNAME|VTAG|SIG|RATE|LAST PACKET RX|REFCOUNT|ACL|BUF|COMP| KI|
-------------------------------------------------------------------------------
00:07:ba:a3:7e:33| wlan2|0000|034|0036|00000000060460|00000002|No |No | No |000|
00:1d:e0:ae:df:e5| wlan2|0000|022|0036|00000000009180|00000002|No |No | No |000|
00:0b:85:55:9c:3e| wlan2|0000|003|0001|00000000545690|00000002|No |No | No |000|
```

The description of various fields is given below:

STATION ADDR	The MAC address of the connected device
IFNAME	The radio interface on which the device is
VTAG	The VLAN tag associated with the device
SIG	The average RSSI of the packets received from the
RATE	The transmit rate of the last packet received from
LAST PACKET RX	The milli-seconds since the last received packet
ACL	Set to 'YES' if the device was connected using a
KI	The encryption key index if security is enabled for

Use the sta-list entry to troubleshoot client device connectivity issues. Using the SIG and RATE fields, one can determine the signal and rate of the packets received from the device.

The VTAG field can be used to determine if the client device is being assigned a VLAN tag. The LAST PACKET RX field can be used to determine if any packets are being received from the client.

3.2 Downlink Stat

This entry provides details and statistics for all the downlinks on the node. The full command for this information is:

cat /proc/net/meshap/access-point/downlink-stat

The format of the information is show below:

```
-----------------------------------------------------
IFNAME|MCC|DCC|UBCAST      |TBCAST      |UBCASTR     |
       -----------------------------------------------------
        wlan0|000|000|000000155958|000000128036|000000000000|
         wlan2|000|004|000000165455|000000000000|000000000000
         wlan3|000|000|000000059544|000000000000|000000000000
         ixp1|000|000|000000173245|000000164105|000000000000|
```

The description of various fields is given below:

IFNAME	The interface name of the downlink
MCC	Number of mesh child nodes connected to the
DCC	Number of client devices connected to the downlink
UBCAST	Number of untagged broadcast/multicast packets transmitted by the
TBCAST	Number of tagged broadcast/multicast packets transmitted by the
UBCASTR	Number of untagged broadcast/multicast packets transmitted by the downlink using the MESH IGNORE bit turned on. ***MESH IGNORE bit is used to send broadcast/multicast packets to client devices when a corresponding tagged version of the same packet was broadcast for child mesh nodes. When the MESH IGNORE bit is set, the child mesh nodes shall***

Use the downlink-stat entry to troubleshoot applications that make use of broadcast/multicast packets.

E.g. Spectralink push-to-talk uses multicast packets so that all phones in the network will hear the voice.

The UBCASTR field is relevant if such applications are used over a VLAN.

3.3 Vlan-Stat

This entry provides statistics for all the VLANs

configured on the node. The full command for this

information is:

cat /proc/net/meshap/access-point/vlan-stat

The format of the information is show below:

```
-----------------------------------------------------------------
VTAG|ENCS|ENCB| wlan0| wlan2| wlan3|  ixp1|
-----------------------------------------------------------------
```

The description of various fields is given below:

VTAG	The VLAN tag
ENCS	'Yes' if security is enabled on the settings for
ENCB	'Yes' if security is currently activated for this
wlanX	The count of the number of associated client devices for this VLAN
ixpX	The count of the number of associated client devices for this VLAN

3.4 Adhoc

This entry provides information for disjoint-adhoc

mode operation. The full command for this

information is:

cat /proc/net/meshap/mesh/adhoc

The format of the information is show below:

NODE OPERATING AS FFN STEP SCAN INDEX 0

```
-----------------------------------------------------------
PARENT ADDR      |CHN|SIG|RATE|TRATE|FLAGS      |FNC|R-VAL|
-----------------------------------------------------------
00:12:ce:00:00:6e|060|046|0054|00100|P - - - - -|FFR|08192|
00:12:ce:00:20:da|157|085|0006|00100|- - - - - -|FFR|04096|
00:12:ce:00:00:b2|060|046|0048|00054|- - - - - -|FFN|24576|
00:12:ce:00:00:02|165|033|0006|00054|- - - - - -|FFN|00000|
00:12:ce:00:11:98|149|036|0006|00054|- - - - - -|FFN|24576|
```

The first line of the information provides the current operating mode for the node and also provides the current channel being used for the "STEP SCAN" process.

The description of various fields is given below:

PARENT ADDR	The MAC address of the prospective parent
CHN	Channel
SIG	RSSI
RATE	The transmit rate
TRATE	The parent's RATE to its parent. A root node's
FLAGS	'P': PREFERRED PARENT 'M': MOBILE NODE 'C': CHILD 'D': DISABLED 'L': LIMITED FUNCTIONALITY 'W': DISABLED FOR LFR ARBITRATION 'Q': QUESTIONABLE PARENT
FNC	The node functionality
R-VAL	DHCP random value

3.5 Reboot

This entry displays the status of the last reboot operation.

The full command for this information is: ***cat /proc/net/meshap/reboot***

The format of the information is show below:

```
Code: 5 Flag: 1
Process:
Mem Used: 0 MB
Temp: 30
Voltage: 23
PC REG: FFFFFFFF
CALLER REG: FFFFFFFF
STACK DUMP: 0
```

The table below lists the various Code values and their meaning.

CODE	DESCRIPTION
1	One of the downlink radio cards was not detected
2	Out of primary packet buffers for a long time (improbable)
3	Out of radio hardware packets for a long time (improbable)
4	Out of radio hardware descriptors for a long time
5	Rebooted via software
6	Firmware crashed
128	Heartbeat thread was stalled
129	Root node ixp0 ETHERNET link was down and rebooted to become
130	Relay node ixp0 ETHERNET link was up and rebooted to become
131	FIPS 140-2 POST failure for AES (improbable)
132	FIPS 140-2 POST failure for HMAC-SHA1 (improbable)
133	Routing tables corrupted (improbable)
134	FIPS 140-2 RNG repeated (improbable)
135	General watchdog wake-up (improbable)

The STACK DUMP is present only when the Code value is 6.

3.6 Coord

This entry displays the status of the current GPS coordinates for the node. The full command for this information is: ***cat***

/proc/brdinfo/coord

3.7 Speed

This entry displays the speed in km/h
The full command for this information is: ***cat /proc/brdinfo/speed***

3.8 Temp

This entry displays the current temperature of the node.
The full command for this information is: ***cat /proc/brdinfo/temp***

3.9 Voltage

This entry displays the input voltage of the node.
The full command for this information is: ***cat /proc/brdinfo/voltage***

3.10 Firmware version

This entry displays the current firmware version of the node.
The full command for this information is: ***cat /proc/net/mesh/mesh/version***

3.11 Kap

This entry provides information about all the known

neighboring nodes. The full command for this information is:

cat /proc/net/meshap/mesh/kap

3.11.1 Information format for Stationary nodes

```
------------------------------------------------------------------------------- PARENT
ADDR             |CHN|SIG|RATE|TRATE|NEXTSAMPLE|DISC    |FLAGS    |SAMCNT|MAXSAM|
-------------------------------------------------------------------------------
00:12:ce:00:00:6e|060|036|0054|00100|0000012850|0000000|- - - - -|000000|000000|
00:12:ce:00:20:da|157|032|0036|00100|0000056520|0000000|- - - - -|000000|000000|
00:12:ce:00:00:14|052|014|0024|00054|0000000000|0000000|- M - - -|000020|000050|
```

The command lists the known neighboring nodes in the order of

their preference. The description of various fields is given

below:

PARENT ADDR	The MAC address of the prospective parent
CHN	Channel
SIG	RSSI
RATE	The transmit rate
TRATE	The parent's RATE to its parent. A root node's
NEXTSAMPLE	The number of milli-seconds left until the parent is scheduled for link sampling
DISC	The number of times the node has been disconnected from the
FLAGS	'P': PREFERRED PARENT 'M': MOBILE NODE 'C': CHILD 'D': DISABLED 'L': LIMITED FUNCTIONALITY 'W': DISABLED FOR LFR ARBITRATION 'Q': QUESTIONABLE PARENT (MESH-INIT or Rebooted)

The criteria used by stationary nodes in choosing the "Best" parents is as follows:

- Lower of RATE and TRATE values are used for calculating score
- The DISC value is used to decrease the score.
- For two parent's with the same score
  - If one of them is the current parent, it gets preference
  - If one of them is mobile, then the stationary node gets preference
  - The one with the higher tree bit rate gets preference
  - If tree bit rates are the same, then the higher direct bit rate gets preference
  - If the direct bit rates are the same, then the higher SIG value gets preference
  - If the SIG values are the same the lower hop count gets preference.
- Child mesh nodes (direct and in-direct) cannot be considered as a parent
- "Disabled" and "Questionable" are not considered until their status changes.

3.11.2 Information format for mobile nodes

```
------------------------------------------------------- PARENT
   ADDR            |CHN|SIG|RATE|TRATE|LAST SEEN |PATCNT |
 ------------------------------------------------------
 00:12:ce:00:00:6e|060|047|0054|00100|0000000650|0000012|
 00:12:ce:00:20:da|157|086|0054|00100|0000000650|0000000|
 00:12:ce:00:00:b2|060|048|0054|00054|0000000650|0000000|
 00:12:ce:00:00:02|165|038|0054|00054|0000000650|0000000|
 00:12:ce:00:11:98|149|037|0054|00054|0000000650|0000000|
 00:12:ce:00:22:d8|052|015|0048|00018|0000005270|0000000|
 00:12:ce:00:25:ea|052|013|0006|00100|0000012200|0000000|
```

The command lists the known neighboring nodes in the order of their preference.

The description of various fields is given below:

PARENT ADDR	The MAC address of the prospective parent
CHN	Channel
SIG	RSSI
RATE	The transmit rate
TRATE	The parent's RATE to its parent. A root node's
LAST SEEN	The number of milli-seconds since the parent's
PATCNT	The number of consecutive times the parent was the 'best parent' in

4 Mobile Node Configuration Options

4.1 Sliding Scan Window and "winning" Parent Nodes

Sliding Scan Window: To make switching decisions, the scanner radio of a mobile node measures the beacons received from the downlink or AP radios of potential parent nodes.

Mobile nodes maintain a **sliding window** of scan results. The default size of the **sliding window** is 12 *scan intervals*. An individual *scan interval* lasts for 250ms (by default). This provides the mobile node with a sliding history of the last 3 seconds (12 scans x 250ms/scan = 3 seconds).

During the *scan interval*, equal time is spent on the each channel in the Scan

Channel List of the mobile node's scanner radio. For example, if there are 5 channels in the Scan Channel List, then the scanner radio will listen on each channel for 50ms.

Winning Parent Nodes:

- After each scan, a "snapshot" will be taken of the prior 12 scans.
- Within this snapshot, there will be a list of "winners" for the 12 scans (for example, parent "A" wins 6 times, parent "B" wins 4 times, and parent "C" wins 2 times ...6 + 4 + 2 = 12). A "winner" is defined by the parameters in section 4.2. A parent with a missed beacon will lose for the interval.
- The parent node that has the most number of wins in the snapshot will be the ***overall winner*** of the snapshot.
- If a particular parent is the ***overall winner*** of four consecutive snapshots, this will become the new actual parent.

4.2 Default Prefernece and Selection Criteria

Mobile Node's Default Preference: By default, mobile nodes prefer *stationary* nodes as parents over *mobile* nodes. If the mobile node sees both stationary and mobile nodes as potential parents, it will associate to stationary nodes even if the signal strength is considerably lower than those of nearby mobile nodes. A mesh command provides the flexibility to modify this behavior. This is covered in the next section.

Mobile Node's Best Parent Selection Criteria: The criteria used for selecting the winning parent for each scan is based on the following criteria (in order of priority):

- Strongest signal is preferred.
- Two parents with signal strengths within a DAMPING FACTOR of each other are considered to have the same ***signal value***. The default value of the DAMPING FACTOR is 6dB. (for example, if the signal from parent "A" is –60dB and the signal from parent "B" is –66dB, they have the same ***signal value***).
- If two parents have the same signal value, and one of them is the current parent, then the current parent remains preferred.
- If two potential parents have equal signal values, the potential parent with the higher *connectivity* is preferred.
- If the connectivity values are the same, the parent with the lower hop count is preferred.
- Child mesh nodes (direct and indirect) cannot be considered as parents. This prevents loops from being formed within the mesh.
- "Disabled" and "Questionable" nodes (see section 3.10.1 under "FLAGS") are not considered until their status changes.
- Parents with a LAST SEEN time (see section 3.10.2) that is outside of the current scan window are not considered. .

MobParams

The following mesh command is used to modify the parent-selection process:

alconfset mobparams patcnt[*4****] patmax[****12****] sigdamp[****6****] [****static_thres=****0****]***
*[****scanint=****250****] [****prefstatic=****1 (0/1)****] [****downscan=****2****] [****adv_root_mobile=****1****]*

The first three parameters are mandatory:

1. patcnt: The number of consecutive times a parent node has to be the ***overall winner*** of the sliding-window snapshot (see section 4.1) in order to become the *actual* parent. The default **patcnt** value is 4, and valid values are >=1.

2. patmax: The length of the sliding window. The default value is 12, and valid values are >=2.

3. sigdamp: The signal damping factor when a mobile node is measuring the relative beacons of two parents. Signal strengths of two parent nodes that are within the damping factor are considered to have equal ***signal values*** (for example, if the signal damping factor is 6dB, and the signal from parent "A" is -60dB and the signal from parent "B" is -66dB, they have the same ***signal value***). The default value is 6, and valid values are >=0.

The next five parameters are optional:

4. static_thresh: A signal strength in dB *above* the noise floor (for example, if a signal is -86dB, and the noise floor is -96dB, the **static_thresh** is 10dB). For **static_thresh** values > 0, a static (non-mobile) node is preferred as a parent over a mobile node as long as its signal is greater than [noise floor + static_thresh]. The default value is 0, and valid values are >=0.

- Scenario 1: Static Parent Node Signal = -80dB, Mobile Parent Node Signal =-50dB, noise floor = -96dB, static_thresh = 0: The Static Parent Node is preferred even though the Mobile Parent Node has a better signal strength.
- Scenario 2: Static Parent Node Signal = -80dB, Mobile Parent Node Signal =-50dB, noise floor = -96dB, static_thresh = 20dB: The Mobile Parent Node is preferred since the Parent Node Signal is less than [noise floor + static_thresh = -76dB].

5. scanint: The duration in milliseconds a scanner radio spends listening on the channels in its
Scan Channel List. Each channel gets the same amount of scan time (for example, if the **scanint**
= 250ms, and there are 5 channels in the Scan Channel List, then each channel gets 50ms of scan time). The default value is 250ms, and valid values are >=1.

Configuring the **scanint** such that each channel gets less than 50ms of scan time is not recommended. This will reduce the dwell time on a channel, and therefore, increase the probability of a beacon miss.

It is important to remember that increasing the number of channels in the Scan Channel List of a mobile node's scanner radio will decrease the scan time for each channel. In this case, two things can be done to counter this effect: the **scanint** can be increased, or, the beacon interval of the parent nodes' downlinks/APs can be decreased. To decrease the beacon interval of the parent nodes' downlink/AP radios, the **alconfset beacint wlan<<0/1/2/3>> << integer >>** command can be used.

6. prefstatic: The mobile node will prefer *static* parent nodes over *mobile* parent nodes. The default value is 1 (a value of "1" means that the mobile node prefers a *static* parent node over a *mobile* parent node), and valid values are 0 or 1. ***If the value is 1, then static and mobile nodes are evaluated by the criteria described by the **static_thresh** setting.

[Note: regardless of the Prefstatic setting, the static_thres setting >0 takes precedence. If the value is greater than 0 then the prefstatic setting is ignored. Consider the following four cases:

- Static_thres =0 and PrefStatic =1. Static parent nodes will *always* be preferred over mobile parent nodes regardless of the signal strength from either.
- Static_thres =0 and PrefStatic =0. Static parent nodes will *not* always be preferred over mobile parent nodes. If mobile parent nodes have a

stronger signal strength, they will be preferred.
- Static_thres =20 and PrefStatic =1. Static nodes will be preferred as long their signal strength is stronger than –96dB+20dB= -76dB. Else, both static parent nodes and mobile parent nodes will be evaluated on the same criteria.

7. downscan: Controls how the mobile node changes channels dynamically on its downlinks:

- 0: No scanning during operation (downlink will continue use channel selected upon boot-up).
- 1: Scan on every parent shift. When the mobile node's uplink makes a change in association to another parent node, its downlink will select another channel on which to transmit (if needed) such that its uplink and downlink are transmitting on different channels.
- 2: Scan on every scan interval. This is the default behavior –which provides the most dynamic reaction to changing interference from external sources.

8. adv_root_mobile: When a mobile node is a *root* node, it will advertise itself as a static node by default. This can effect the *preference of association* for its surrounding nodes (as per the "**prefstatic**" setting). In certain applications, such as convoys, it is often desired that none of the nodes in the mesh advertise themselves as being static. The default setting is 1, where a mobile root *will* advertise itself as being static, and valid values 0/1.

4.2.1 Usage Consideration

A. The order of optional parameters is important. For example, if it is desired that the **static_thres** option be configured, the values for the preceding parameters of **patcnt**, **patmax**, and **sigdamp** must be included in the command. The succeeding parameters of **scanint**, **prefstatic**, **downscan**, **adv_root_mobile** do *not* have to be included. Examples:

- **alconfset mobparams 3 12 3** Å Change patcnt to 3 overall wins, change damping factor to
  3 db. Optional settings are unchanged.
- **alconfset mobparams 4 12 6 0 500 0** Å scan interval changed to 500ms, do not prefer static nodes, remaining optional settings are unchanged.
- **alconfset mobparams 4 12 6 20 250 1** Å prefer static nodes, but only ones that are 20dB
  above the noise floor, else, no node preference. Remaining optional settings are unchanged.
- **alconfset mobparams 4 12 6 0 250 1 0 1** Å prefer static nodes, no scanning on the downlink(s) during operation, advertise mobile-root node as "static".

B. A node whose last beacon heard was outside of the sliding scan window [scan_interval x patmax] is not considered as a possible parent by the mobile node. To see the current sliding window, use the command: ***cat/proc/net/meshap/mesh/mobwin.***

C. If the sliding scan window is set (by default) at 250ms and there are 5 channels being scanned (5 channels in the scan list) then each channel is scanned for 50 ms. If the beacon is at
100 ms then the probability of hearing the beacon is 50% (note that it is not necessary for a beacon from a particular parent to be heard on every scan interval, but the beacon must be heard
a sufficient number of times in the sliding scan window). To increase the probability, consider:

- Reducing all prospective parent downlink beacon intervals by using

alconfset beacint wlan
<<0/1/2/3>> << integer >>

- Reducing the number of channels being scanned. The number of channels being scanned is controlled by populating, or depopulating the Scan Channel List of the mobile node's scanner radio. These channels correlate to the channels being provided by the downlinks of the parent nodes in the mesh.
- Increasing the **patmax** (number of scans in the sliding window).
- Increasing the **scanint** ("scan interval" -the amount of time spent scanning the channels in the Scan Channel List of mobile node's scanner radio).

These options are also helpful for noisy/dynamic RF environments, where the probability of detecting beacons is reduced due to external RF interference.

D. To see when last beacon from a specific parent was received, execute the following command:
cat/proc/net/meshap/mesh/kap. This will show the time (in 'ms') since the last beacon as heard, and also, the number of consecutive wins the node has in the sliding scan window.

E. When mobile nodes display preference to static nodes over mobile nodes, change static node preferences (**pref_static**), or adjust the **static_thresh** setting.

F. All "**alconfset mobparams**" settings will be set back to default after rebooting the node. Typing in the following command after each "**alconfset mobparams**" command is entered can avert this: ***alconfset save*** For example: Type "**alconfset mobparams 4 12 5 0 250 1 0 1**", click "**Enter**" Type "**alconfset save**", click "**Enter**"

4.1 Mobwin

This entry displays the current status of the Sliding Scan Window

for mobile nodes. The full command for this information is:

cat /proc/net/meshap/mesh/mobwin

The format of the information is show below:

```
---------------------------------------- PARENT
ADDR             |CHN|SIG|ITEM ID |CNT|
----------------------------------------
00:12:ce:00:00:6e|060|046|C2AA3FC0|012|
00:12:ce:00:00:6e|060|046|C29091E0|012|
00:12:ce:00:00:6e|060|046|C2909200|012|
00:12:ce:00:00:6e|060|046|C2909220|012|
00:12:ce:00:00:6e|060|046|C2909240|012|
00:12:ce:00:00:6e|060|046|C2909260|012|
00:12:ce:00:00:6e|060|046|C29092A0|012|
00:12:ce:00:00:6e|060|046|C29092E0|012|
00:12:ce:00:00:6e|060|046|C2909300|012|
00:12:ce:00:00:6e|060|046|C2AA3B20|012|
00:12:ce:00:00:6e|060|046|C2AA3F20|012|
00:12:ce:00:00:6e|060|046|C2AA3F80|012|
```

The evaluation results of each scan in the current window are listed in the output.

PARENT ADDR	The MAC address of the best parent for the scan
CHN	Channel

SIG	RSSI
CNT	The number of consecutive times the parent was the 'best parent' in the current scan window.

5 Miscellaneous Commands

5.1 Perf

This command sets the preferred parent for the node without changing its settings. Since the settings are not changed, the preferred parent will not be maintained after a node is rebooted.

The full command is: ***meshd pref <<enable>> <<mac_address>>***

Where

enable: Set to1 to enable the feature and 0 to diable the feature.
mac_address: Set ot the desired preferred parent's downlink mac address

For disabling the feature the mac_address value needs to match the one provided when enabling. **The command takes a minimum of 3 heartbeat intervals to take effect.**

5.1 Kick

This command disassociates a client device or a mesh node and forces the node to execute all procedures when a client device or a mesh node disconnects.

The full command is: ***meshd kick <<mac_address>>***

5.2 fwupdate

This command is used to determine whether a unit's firmware can be upgraded via the NMS. The full command is: ***cat /proc/mtd | grep fwupdate*** If the node's firmware can be upgraded from the NMS, the output of this command will be something like:

mtd7: 00140000 00020000 "fwupdate"

5.3 gpsd

This command is used to determine whether the GPS feature on the node has been activated. The full command is: ***pidof gpsd.*** If the GPS feature is not active, the output will be a blank line.

5.4 Meminfo

This command is used to determine the amount of free SDRAM on the unit.
The full command is: ***cat /proc/meminfo***
Typically, the free memory is between 14 and 19 MB. If the node's firmware has been upgraded, and it has not been rebooted, the amount of free memory is less than 10 MB.

5.5 telnetd

This command enables the Telnet daemon on the node.
The full command is: ***cp /bin/otelnetd /bin/telnetd*** Enabling the telnet daemon on the unit exposes the node to security risks, hence, only enable telnet for troubleshooting purposes. After usage, reboot the node to disable telnet access.

6 Alconfset and Alconfget Commands

6.1 Introduction

The alconfset command is used to manually configure mesh related parameters on the node in the absence of NMS controller. The configured parameter will be written to the respective .conf files and for it to take effect the node needs to be rebooted.

6.2 Usage

The usage and supported options for alconfset and alconfget command are available as follows.

alconfset [-v] [-h] -f configfile fieldname [fieldparams]

alconfget [-v] [-h] -f configfile fieldname [fieldparams]

-v: to know the version.

-h: for help

-f: specify config file (Ex: /etc/meshap.conf or /etc/lfrs.conf)

6.3 Supported Parameters

Below are the supported parameters for alconfset and alconfget command which can be used to set and get the values respectively.

Generic fileds:

mesh_id, mesh_imcp_key, name, globdca, swc, aging, regdom, country, medtype, subtype, usetype, channel, essid, rts, frag, beacint, dca, dcalist, antport, txrate, preamble.slot, linkopt, acktime, hidessid, txpower, prefpar, hbint, igmp, adhoc, dhcp, forcedroot, fips, dfs, mobindex, mobmode, gps, logmon, location, acwmin, acwmax, aifsn, backoff, burst, autostart, usevirt, option, save, savefw, failOverEthernet, server_ip_addr, mgmt_gw_addr, mgmt_gw_enable, mgmt_gw_certificates, disable_backhaul_security,

802.11N supported fileds:

ldpc, smps, tx_stbc, rx_stbc, delayed_ba, gfmode.

802.11ac supported fields:

max_mpdu_len, supported_channel_width, rx_ldpc, gi_80, gi_160, vtx_stbc, vrx_stbc, su_beamformer_cap, su_beamformee_cap, beamformee_sts_count, sounding_dimensions, mu_beamformer_cap, mu_beamformee_cap, vht_txop_ps, htc_vht_cap, rx_ant_pattern_consistency, tx_ant_pattern_consistency, vht_oper_bandwidth, seg0_center_freq, seg1_center_freq.

LFRS supported fields:

Priority, failover, server_ip, interface, ip_addr.

6.4 Detail use of Parameters

Generic fields:

mesh_id:

Description: Assign a node to a specific mesh network. An alphanumerical string which helps to connect the nodes into Mesh-network.

Usage alconfset: alconfset -f /etc/meshap.conf mesh_id <<value>>

Usage alconfget: alconfget -f /etc/meshap.conf mesh_id

mesh_imcp_key:

Description: Set the encryption key for imcp packets.

Usage alconfset: alconfset -f /etc/meshap.conf mesh_imcp_key <<self_mac_address>> <<value>>

Usage alconfget: alconfget -f /etc/meshap.conf mesh_imcp_key

name:

Description: Node name parameter is used to set the name of the node.

Usage alconfset: alconfset -f /etc/meshap.conf name <<value>>

Usage alconfget: alconfget -f /etc/meshap.conf name

globdca:

Description: To set the global dca value. It either can be 0 or 1.

Usage alconfset: alconfset -f /etc/meshap.conf globdca <<value=0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf globdca

sac:

Description: stay awake count for the mesh node.

Usage alconfset: alconfset -f /etc/meshap.conf sac <<value (non-zero positive)>>

Usage alconfget: alconfget -f /etc/meshap.conf sac

aging:

Description: Bridge aging timeout value. This is the inactivity time for stations to disconnect from AP.

Usage alconfset: alconfset -f /etc/meshap.conf aging <<value (non-zero possitive)>>

Usage alconfget: alconfget -f /etc/meshap.conf aging

regdom:

Description: To set the regulatory domain code

Usage alconfset: alconfset -f /etc/meshap.conf regdom <<0=NONE, 1=FCC, 2=ETSI, 3=CUSTOM>>

Usage alconfget: alconfget -f /etc/meshap.conf regdom

country:

Description: To set the country code. Set as needed to indicate country in which device is operating. This can limit available channels and transmit power.

Usage alconfset: alconfset -f /etc/meshap.conf country <<value (non-zero positive)>>

Usage alconfget: alconfget -f /etc/meshap.conf country

medtype:

Description: To set the medium type of a particular interface to either ethernet or wireless.

Usage alconfset: alconfset -f /etc/meshap.conf medtype <<if-name>> <<value 0=ethernet,1=802.11>>

Usage alconfget: alconfget -f /etc/meshap.conf medtype <<if-name>>

subtype:

Description: To set the subtype for a particular interface. It can be any supported wireless protocol.

Usage alconfset: alconfset -f /etc/meshap.conf subtype <<if-name>> <<value,a,b,g,bg,psq,psh,psf,n_2_4G,n_5G,ac,bgn,an,anac

Usage alconfget: alconfget -f /etc/meshap.conf subtype <<if-name>>

usetype:

Description: To set the particular interface to act as downlink(wm), uplink(ds), Passive-Monitoring(pmon) or Active-monitoring(amon).

Usage alconfset: alconfset -f /etc/meshap.conf usetype <<if-name>> <<value ds,wm,pmon,amon>>

Usage alconfget: alconfget -f /etc/meshap.conf usetype <<if-name>>

channel:

Description: To set the channel value on which interface has to work.

Usage alconfset: alconfset -f /etc/meshap.conf channel <<if-name>> <<channel>>

Usage alconfget: alconfget -f /etc/meshap.conf channel <<if-name>>

essid:

Description: The Extended Service Set Identification (ESSID) is used to set the name for interface which will be visible to all other nodes in same network.

Usage alconfset: alconfset -f /etc/meshap.conf essid <<if-name>> <<essid>>

Usage alconfget: alconfget -f /etc/meshap.conf essid <<if-name>>

rts:

Description: To set the packet size at which packet transmission is governed by the RTS/CTS transaction.

Usage alconfset: alconfset -f /etc/meshap.conf rts <<if-name>> <<rts>>

Usage alconfget: alconfget -f /etc/meshap.conf rts <<if-name>>

frag:

Description: To set the Fragmentation Threshold to a maximum length of the frame, beyond which payload must be broken up (fragmented) into two or more frames.

Usage alconfset: alconfset -f /etc/meshap.conf frag <<if-name>> <<frag>>

Usage alconfget: alconfget -f /etc/meshap.conf frag <<if-name>>

beacint:

Description: To set the beacon interval .

Usage alconfset: alconfset -f /etc/meshap.conf beacint <<if-name>> <<interval>>

Usage alconfget: alconfget -f /etc/meshap.conf beacint <<if-name>>

Dca:

Description: To set the Dynamic Channel Assignment(dca) value per interface(Can be either 1 or 0). If dca is not present than globdca value will be used for that particular interface.

Usage alconfset: alconfset -f /etc/meshap.conf dca <<if-name>> <<0-1>>

Usage alconfget: alconfget -f /etc/meshap.conf dca <<if-name>>

Dcalist:

Description: dcalist is nothing but the channel list on which configured interface(mostly AP) has to operate on.

Usage alconfset: alconfset -f /etc/meshap.conf dcalist <<if-name>> <<count>> <<channels>>

Usage alconfget: alconfget -f /etc/meshap.conf dcalist <<if-name>>

Antport:

Description: To set the antenna port for interface.

Usage alconfset: alconfset -f /etc/meshap.conf antport <<if-name>> <<1-14>> [1 for RX on all, 0 otherwise]

Usage alconfget: alconfget -f /etc/meshap.conf antport <<if-name>>

Txrate:

Description: To set the maximum transmission rate through which packet will be sent out.

Usage alconfset: alconfset -f /etc/meshap.conf txrate <<if-name>> <<mbps/0=auto>>

Usage alconfget: alconfget -f /etc/meshap.conf txrate <<if-name>>

Preamble:

Description: preamble allows the receiver to acquire the wireless signal and synchronize itself with the transmitter. It can be either set to short(1) or long(0).

Usage alconfset: alconfset -f /etc/meshap.conf preamble <<if-name>> <<long or short>>

Usage alconfget: alconfget -f /etc/meshap.conf preamble <<if-name>>

slot:

Description:

Usage alconfset: alconfset -f /etc/meshap.conf slot <<if-name>> <<long or short>>

Usage alconfget: alconfget -f /etc/meshap.conf slot <<if-name>>

linkopt:

Description:

Usage alconfset: alconfset -f /etc/meshap.conf linkopt <<if-name>> <<all/backhaul/client>>

Usage alconfget: alconfget -f /etc/meshap.conf linkopt <<if-name>>

acktime:

Description: To set the acknowledgement time in micro second.

Usage alconfset: alconfset -f /etc/meshap.conf acktime <<if-name>> <<µs>>

Usage alconfget: alconfget -f /etc/meshap.conf acktime <<if-name>>

hidessid:

Description: Set to 1 to disable broadcasting device SSID to the network.

Usage alconfset: alconfset -f /etc/meshap.conf hidessid <<if-name>> <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf hidessid <<if-name>>

txpower:

Description: To set the transmission power of an AP.

Usage alconfset: alconfset -f /etc/meshap.conf txpower <<if-name>> <<0 to 100>>

Usage alconfget: alconfget -f /etc/meshap.conf txpower <<if-name>>

Prefpar:

Description: To set the preferred parent by selecting the MAC address of the parent you want to connect with.

Usage alconfset: alconfset -f /etc/meshap.conf prefpar <<MAC-ID>>

Usage alconfget: alconfget -f /etc/meshap.conf prefpar

Hbint:

Description: Heartbeat Interval is set in order to wake up the lock at scheduled intervals. By default it is set to 15.

Usage alconfset: alconfset -f /etc/meshap.conf hbint <<value (non-zero possitive)>>

Usage alconfget: alconfget -f /etc/meshap.conf hbint

Igmp:

Description: When enabled(set to 1), IGMP Snooping monitors IGMP communications among devices and optimizes wireless multicast traffic.

Usage alconfset: alconfset -f /etc/meshap.conf igmp <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf igmp

***Adhoc:**

Description: to enable the adhoc mode

Usage alconfset: alconfset -f /etc/meshap.conf adhoc <<adhoc_mode=0/1>> <<begin_in_infra=0/1>> <<sectored_usage=0/1>>

Usage alconfget: alconfget -f /etc/meshap.conf adhoc

dhcp:

Description: Dynamic host control protocol(DHCP) can be enabled by 1 and disable by 0. While enabling follow below alconfset usage for other command options.

Usage alconfset: alconfset -f /etc/meshap.conf dhcp <EN> [<MODE> <NET> <MASK> <GW> <DNS> <LT>]

EN = 1 for enabling, 0 for disabling

MODE = random or fixed

NET = Network in dotted decimal form

MASK = Subnet mask in dotted decimal form

GW = Gateway IP in dotted decimal form

DNS = DNS IP in dotted decimal form

LT = Lease time in seconds

Usage alconfget: alconfget -f /etc/meshap.conf dhcp

Forcedroot:

Description: used to make root node forcefully. Enbaled by setting it to 1 and disable by 0.

Usage alconfset: alconfset -f /etc/meshap.conf forcedroot <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf forcedroot

fips:

Description: Federal Information Processing Standard (FIPS) defines security and interoperability requirements . It can be enabled by setting to 1 and disable by 0.

Usage alconfset: alconfset -f /etc/meshap.conf fips <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf fips

dfs:

Description: The concept of DFS is to have the unlicensed device detect the presence of a radar system on the channel they

are using. It can be enabled by setting it to 1 and can be disabled by 0.

Usage alconfset: alconfset -f /etc/meshap.conf dfs <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf dfs

***Mobindex:**

Description:

Usage alconfset: alconfset -f /etc/meshap.conf mobindex <<0-20>>

Usage alconfget: alconfget -f /etc/meshap.conf mobindex

***mobmode:**

Description: To enable mobility power save mode can be set to 1 or else set to 0.

Usage alconfset: alconfset -f /etc/meshap.conf mobmode <<0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf mobmode

gps:

Description: Global Positioning System (GPS) can be enabled by setting it to 1 and disable by 0. While enabling follow the below alconfset usage for other command options.

Usage alconfset: alconfset -f /etc/meshap.conf gps <EN> [<device> <dest_ip> <dest_port> <tx_interval>]

EN = 1 for enabling, 0 for disabling

device = Serial port device e.g. /dev/ttyS0

dest_ip = Push destination IP address

dest_port = Push destination UDP port

tx_interval = Push destination transmit interval

Usage alconfget: alconfget -f /etc/meshap.conf gps

***logmon:**

Description: logging to remote server.

Usage alconfset: alconfset -f /etc/meshap.conf logmon <dest_ip> <dest_port>

dest_ip = Push destination IP address

dest_port = Push destination UDP port

Usage alconfget: alconfget -f /etc/meshap.conf logmon

location:

Description: Location can be enabled by setting it to 1 and disable by 0.

Usage alconfset: alconfset location <<0 or 1>>

Usage alconfget: alconfget location

acwmin:

Description: levels of priority are called as access categories which lies from 0 to 3 and minimum contention window size can be set from below mentioned values. In QoS, if the medium is busy the station will do an exponential backoff between contention window min and contention window max, after which the frame is transmitted.

Usage alconfset: alconfset -f /etc/meshap.conf acwmin <<category [0-3]>> <<value[0,1,3,7,15,31,63,...,1023]>>

Usage alconfget: alconfget -f /etc/meshap.conf acwmin

acwmax:

Description: levels of priority are called as access categories which lies from 0 to 3 and maximum contention window size can be set from below mentioned values. In QoS, if the medium is busy the station will do an exponential backoff between contention window min and contention window max, after which the frame is transmitted.

Usage alconfset: alconfset -f /etc/meshap.conf acwmax <<category [0-3]>> <<value[0,1,3,7,15,31,63,...,1023]>>

Usage alconfget: alconfget -f /etc/meshap.conf acwmax

aifsn:

Description: Arbitration Interframe Spacing Number(AIFSN) values are administrator configurable with proper categories. This is the minimum duration the frame to be transmitted will wait when the medium is free.

Usage alconfset: alconfset -f /etc/meshap.conf aifsn <<category [0-3]>> <<value>>

Usage alconfget: alconfget -f /etc/meshap.conf aifsn

Backoff:

Description: Backoff can be enabled by 1 and disable by 0 with appropriate category.

Usage alconfset: alconfset -f /etc/meshap.conf backoff <<category [0-3]>> <<value = 0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf backoff

Burst:

Description: To set the burst time value with appropriate category.

Usage alconfset: alconfset -f /etc/meshap.conf burst <<category [0-3]>> <<value>>

Usage alconfget: alconfget -f /etc/meshap.conf burst

Autostart:

Description: Autostart is a list of below sub-commands.

<alconfset autostart list> will show you the number of blocks created and the respective task has to be done for each block.

<alconfset autostart create> This will create a new block.

<alconfset autostart add> new command can be added to newly created or already exist block by selecting block number.

<alconfset autostart del> This will delete block with provided block number.

Usage alconfset: alconfset autostart list

alconfset autostart create

alconfset autostart add <<command-block-number>> <<command>>

alconfset autostart del <<command-block-number>>

Usage alconfget: Not implemented.

usevirt:

Description: This is nothing but to create virtual interface from wlan0 if it set to 1.

Note: In meshap.conf file, this can be find as use_virt_if.

Usage alconfset: alconfset -f /etc/meshap.conf usevirt <<value (0 or 1)>>

Usage alconfget: alconfget -f /etc/meshap.conf usevirt

***Option:**

Description:

Usage alconfset: alconfset option list

alconfset option add option-key

alconfset option del option-index

Save:

Description: To save the configurations has been done using alconfset command.

Usage alconfset: alconfset save

Usage alconfget: Not implemented.

savefw:

Description: to save the firmware configurations has been done using alconfset command.

Usage alconfset: alconfset savefw

Usage alconfget: Not implemented.

***FailOverEthernet:**

Description: Enable LFRS mode in the node.

Usage alconfset: alconfset -f /etc/meshap.conf failOverEthernet <<off/enable/enable_with_ping=0/1/2>> <<power_on_default=0/1>> <<scan_freq_secs=0/1>>

Usage alconfget: alconfget -f /etc/meshap.conf failOverEthernet

server_ip_addr:

Description: To set the server ip address.

Usage alconfset: alconfset -f /etc/meshap.conf server_ip_addr <IP_ADDR> eg: alconfset server_ip_addr 10.10.10.10

Usage alconfget: alconfget -f /etc/meshap.conf server_ip_addr

mgmt_gw_addr:

Description: To set the management gateway address. Used for running NMS in a remote site.

Usage alconfset: alconfset -f /etc/meshap.conf mgmt_gw_addr <IP_ADDR> eg: alconfset mgmt_gw_addr <url:port>

Usage alconfget: alconfget -f /etc/meshap.conf mgmt_gw_addr

mgmt_gw_enable:

Description: management gateway can be enabled by setting it to 1 and disable by 0.

Usage alconfset: alconfset -f /etc/meshap.conf mgmt_gw_enable <0/1>

Usage alconfget: alconfget -f /etc/meshap.conf mgmt_gw_enable

mgmt_gw_certificates:

Description: This helps to set the management gateway certificates to speific path with key.

Usage alconfset: alconfset -f /etc/meshap.conf mgmt_gw_certificates <certificate_path>:<key_path> Example: alconfset mgmt_gw_certificates </path/xyz.crt:/path/abc.key>

Usage alconfget: alconfget -f /etc/meshap.conf mgmt_gw_certificates

disable_backhaul_security:

Description: To disable the backhaul security.

Usage alconfset: alconfset -f /etc/meshap.conf disable_backhaul_security

Usage alconfset: alconfset -f /etc/meshap.conf disable_backhaul_security

802.11n Supported fields.

Below are the fields/parameters are supported for 802.11n protocol.

Ldpc:

Description: Low density parity check(LDPC) is iterative error checking code.

It can be set either enable(1) or disable(0).

Usage alconfset: alconfset -f /etc/meshap.conf ldpc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf ldpc <<if-name>>

Smps:

Description: Spatial Multiplexing Power Save (SMPS)mode is a mechanism to conserve power in 802.11n implementation. It can be set either to static, dynamic or disabled.

Usage alconfset: alconfset -f /etc/meshap.conf smps <<if-name>> <<disabled or static or dynamic>>

Usage alconfget: alconfget -f /etc/meshap.conf smps <<if-name>>

tx_stbc:

Description: STA capability of transmitting PPDU using STBC (Space Time Block Coding) . A technique used to send multiple copies of the data streams across a number of antennas and to exploit the various received versions of the data to improve the reliability of data-transfer.

It can be set either to enable or disable.

Usage alconfset: alconfset -f /etc/meshap.conf tx_stbc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf tx_stbc <<if-name>>

rx_stbc:

Description: STA capability of receiving PPDU using STBC (Space Time Block Coding). A technique used to send multiple copies of the data streams across a number of antennas and to exploit the various received versions of the data to improve the reliability of data-transfer.

It can be set either to enable or disable.

Usage alconfset: alconfset -f /etc/meshap.conf rx_stbc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf rx_stbc <<if-name>>

delayed_ba:

Description: indicate STA support of Delayed BlockAck. It can be set either to enable(1) or disabled(0).

Usage alconfset: alconfset -f /etc/meshap.conf delayed_ba <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf delayed_ba <<if-name>>

Intolerant:

Description: It can be set either to enabled(1) or disabled(0).

Usage alconfset: alconfset -f /etc/meshap.conf intolerant <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf intolerant <<if-name>>

lsig_txop:

Description: indicate support for Legacy-Signal (L-SIG) protection mechanism.

Can be set either to enabled(1) or disabled(0).

Usage alconfset: alconfset -f /etc/meshap.conf lsig_txop <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf lsig_txop <<if-name>>

gi_20:

Description: Guard Interval is intended to avoid signal loss from multipath effects which helps to overcome overlapping transmission. Guard interval with 20Mhz can be set to either long, short or auto.

Usage alconfset: alconfset -f /etc/meshap.conf gi_20 <<if-name>> <<long or auto or short>>

Usage alconfget: alconfget -f /etc/meshap.conf gi_20 <<if-name>>

gi_40:

Description: Guard Interval is intended to avoid signal loss from multipath effects which helps to overcome overlapping transmission. Guard interval with 40Mhz can be set to either long, short or auto.

Usage alconfset: alconfset -f /etc/meshap.conf gi_40 <<if-name>> <<long or auto or short>>

Usage alconfget: alconfget -f /etc/meshap.conf gi_40 <<if-name>>

dsss_cck_40:

Description: DSSS check mode in 40 MHz can be set either to allow or deny. Which says, the stream of information to be transmitted has to be divided or not.

Usage alconfset: alconfset -f /etc/meshap.conf dsss_cck_40 <<if-name>> <<allow or deny>>

Usage alconfset: alconfget -f /etc/meshap.conf dsss_cck_40 <<if-name>>

ht_bandwidth:

Description: Hardware threshold bandwidth can be set to 40+, 40- and 20 MHz channel.

Usage alconfset: alconfset -f /etc/meshap.conf ht_bandwidth <<if-name>> <<Bandwidth>>

Usage alconfget: alconfget -f /etc/meshap.conf ht_bandwidth <<if-name>>

max_amsdu_len:

Description: Aggregated Mac Service Data Unit length can be set eiter to 1(7935) and 0(3839).

Usage alconfset: alconfset -f /etc/meshap.conf max_amsdu_len <<if-name>> << 0=>3839 / 1=>7935>>

Usage alconfget: alconfget -f /etc/meshap.conf max_amsdu_len <<if-name>>

ampdu_enable:

Description: Aggregated Mac protocol data unit(AMPDU) can be enabled by setting it to 1 and disabled by 0.

Usage alconfset: alconfset -f /etc/meshap.conf ampdu_enable <<if-name>> <<ampdu_enable integer: 0 or 1>>

Usage alconfget: alconfget -f /etc/meshap.conf ampdu_enable <<if-name>>

max_ampdu_len:

Description: to set the Maximum length of Aggregated Mac protocol data unit(AMPDU).

Usage alconfset: alconfset -f /etc/meshap.conf max_ampdu_len <<if-name>> <<eg: 64KB>>

Usage alconfget: alconfget -f /etc/meshap.conf max_ampdu_len <<if-name>>

Gfmode:

Description: STA is capable of receiving HT Greenfield PPDU if it is set to 1 and vice versa for 0.

Usage alconfset: alconfset -f /etc/meshap.conf gfmode <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf gfmode <<if-name>>

802.11ac Supported fields:

max_mpdu_len:

Description: MAC frames in 802.11ac may have one of three lengths: 3,895 bytes, 7,991 bytes, or 11,454 bytes.

Usage alconfset: alconfset -f /etc/meshap.conf max_mpdu_len <<if-name>> <<max_mpdu_len integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf max_mpdu_len <<if-name>>

supported_channel_width:

Description: Supported channel width can be set to either 0, 1 or 2.

Usage alconfset: alconfset -f /etc/meshap.conf supported_channel_width <<if-name>> <<supported_channel_width integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf supported_channel_width <<if-name>>

rx_ldpc:

Description: Transmitter can receive LDPC-encoded frames if it is enabled and vice versa.

Usage alconfset: alconfset -f /etc/meshap.conf rx_ldpc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf rx_ldpc <<if-name>>

gi_80:

Description: Transmitter can receive frames transmitted using guard interval with 80MHz. It can be set to Auto, long or short.

Usage alconfset: alconfset -f /etc/meshap.conf gi_80 <<if-name>> <<long or auto or short>>

Usage alconfget: alconfget -f /etc/meshap.conf gi_80 <<if-name>>

gi_160:

Description: Transmitter can receive frames transmitted using guard interval with 160MHz. It can be set to Auto, long or short.

Usage alconfset: alconfset -f /etc/meshap.conf gi_160 <<if-name>> <<long or auto or short>>

Usage alconfget: alconfget -f /etc/meshap.conf gi_160 <<if-name>>

vtx_stbc:

Description: STA capability of transmitting PPDU using STBC (Space Time Block Coding) for interfaces with 802.11ac support. It can be set either to enable or disable

Usage alconfset: alconfset -f /etc/meshap.conf vtx_stbc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf vtx_stbc <<if-name>>

vrx_stbc:

Description: STA capability of receiving PPDU using STBC (Space Time Block Coding) for interfaces with 802.11ac support. It can be set either to enable or disable

Usage alconfset: alconfset -f /etc/meshap.conf vrx_stbc <<if-name>> <<enabled or disabled>>

Usage alconfget: alconfget -f /etc/meshap.conf vrx_stbc <<if-name>>

su_beamformer_cap:

Description: Single-User (SU) Beamformer is set to yes(1), when transmitter is capable of operating as a single-user beamformer. It can be set either to 1 or 0.

Usage alconfset: alconfset -f /etc/meshap.conf su_beamformer_cap <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf su_beamformer_cap <<if-name>>

su_beamformee_cap:

Description: Single-User (SU) Beamformee is set to yes(1), when transmitter is capable of operating as a single-user beamformee. It can be set either to 1 or 0.

Usage alconfset: alconfset -f /etc/meshap.conf su_beamformee_cap <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf su_beamformee_cap <<if-name>>

*beamformee_sts_count:

Description:

Usage alconfset: alconfset -f /etc/meshap.conf beamformee_sts_count <<if-name>> <<beamformee_sts_count integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf beamformee_sts_count <<if-name>>

***sounding_dimensions:**

Description:

Usage alconfset: alconfset -f /etc/meshap.conf sounding_dimensions <<if-name>> <<sounding_dimensions integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf sounding_dimensions <<if-name>>

mu_beamformer_cap:

Description: Multi-user(MU) beamformer is set to yes(1), when transmitter is capable of operating as a multi-user beamformer.

Usage alconfset: alconfset -f /etc/meshap.conf mu_beamformer_cap <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf mu_beamformer_cap <<if-name>>

mu_beamformee_cap:

Description: Multi-user(MU) beamformee is set to yes(1), when transmitter is capable of operating as a multi-user beamformee.

Usage alconfset: alconfset -f /etc/meshap.conf mu_beamformee_cap <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf mu_beamformee_cap <<if-name>>

vht_txop_ps:

Description: An AP can set this bit to 1 to enable power save operations during a VHT transmission burst, or 0 to disable them. Stations associating with a network will set this bit to 1 to indicate the capability is enabled or 0 if it is disabled.

Usage alconfset: alconfset -f /etc/meshap.conf vht_txop_ps <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf vht_txop_ps <<if-name>>

htc_vht_cap:

Description: This value is set to yes (1) to indicate that the transmitter is capable of receiving the VHT-variant HT Control field.

Usage alconfset: alconfset -f /etc/meshap.conf htc_vht_cap <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf htc_vht_cap <<if-name>>

rx_ant_pattern_consistency:

Description: Set to yes(1), if rx antenna doesn't change and set to No(0), if rx antenna change during the lifetime of current association.

Usage alconfset: alconfset -f /etc/meshap.conf rx_ant_pattern_consistency <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf rx_ant_pattern_consistency <<if-name>>

tx_ant_pattern_consistency:

Description: Set to yes(1), if tx antenna doesn't change and set to No(0), if tx antenna change during the lifetime of current association.

Usage alconfset: alconfset -f /etc/meshap.conf tx_ant_pattern_consistency <<if-name>> <<yes or no>>

Usage alconfget: alconfget -f /etc/meshap.conf tx_ant_pattern_consistency <<if-name>>

vht_oper_bandwidth:

Description: For either 20 MHz or 40 MHz operation, the Channel Width field is set to 0. 80 MHz operation sets this value to 1. Because it is necessary to distinguish the 160 MHz channel width (a value of 2) from the 80+80 MHz channel structure (a value of 3), they receive separate values.

Usage alconfset: alconfset -f /etc/meshap.conf vht_oper_bandwidth <<if-name>> <<supported_channel_width integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf vht_oper_bandwidth <<if-name>>

seg0_center_freq:

Description: This fields are used only with 80 and 160 MHz operation, to transmit the center channel frequency of the BSS

Usage alconfset: alconfset -f /etc/meshap.conf seg0_center_freq <<if-name>> <<supported_channel_width integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf seg0_center_freq <<if-name>>

seg1_center_freq:

Description: This field is used only with 80+80 MHz operation, and is used to transmit the center channel frequency of the second segment.

Usage alconfset: alconfset -f /etc/meshap.conf seg1_center_freq <<if-name>> <<supported_channel_width integer value>>

Usage alconfget: alconfget -f /etc/meshap.conf seg1_center_freq <<if-name>>

LFRS Commands:

priority:

Usage alconfset: alconfset -f /etc/lfrs.conf priority <value>

Usage alconfget: alconfget -f /etc/lfrs.conf priority

failover:

Usage alconfset: alconfset -f /etc/lfrs.conf failover <value> <<accepted Values 0,1,2>>

Usage alconfget: alconfget -f /etc/lfrs.conf failover

interface:

Usage alconfset: alconfset -f /etc/lfrs.conf interface <name>

Usage alconfget: alconfget -f /etc/lfrs.conf interface

Server_ip:

Usage alconfset: alconfset -f /etc/lfrs.conf server_ip <ip_address>

Usage alconfget: alconfget -f /etc/lfrs.conf server_ip

Ip_addr:

Usage alconfset: alconfset -f /etc/lfrs.conf ip_addr <ip_address>

Usage alconfget: alconfget -f /etc/lfrs.conf ip_addr

7 Debug Commands for Mesh

7.1 Using log information

Mesh code can print important log messages of events and this can be displayed by doing the following

- dmesg
- cat /overlay/md_syslog.txt

The format of the mesh logs are given below

```
[   76.510000] MESH_AP:    INFO:        message-text          <line#>
```

```
          Timestamp          module name     ErrorType    "
<message>       : func-name:    func line"
```

Example

```
[220250.070000] MESHAP: INFO: Number of parent bening added = 4:
_add_parents_list_to_heartbeat: 98
```

7.1.1 Displaying Current log levels

```
root@OpenWrt:/# cat /proc/net/meshap/mesh/debug_log_level
0x201
```

7.1.2 Setting Current log levels

```
root@OpenWrt:/# echo 0x205 > /proc/net/meshap/mesh/debug_log_level
root@OpenWrt:/# cat /proc/net/meshap/mesh/debug_log_level
0x205
```

7.2 Printing important internal mesh data structures

```
cat /proc/net/meshap/mesh/debug_ds_info

************************************************************
                        v_wlan0
************************************************************
current_essid_length          : 22
current_essid                 : StructuredMesh_v_wlan0
current_phy_mode              : 802_11_A
iw_mode                       : MASTER
use_type                      : AP
```

```
beacon_conf_complete          : 1
channel_count                 : 255
beacon_interval               : 100
rts_threshold                 : 2347
frag_threshold                : 2346
tx_power                      : 63
sec_chan_offset               : 0
scan_state                    : -1
country code                  : 0
fsm_state                     : STOPPED
mesh_state                    : RUNNING
ht_capab_info                 : 0x0
ht_opera                      : 0x0
vht_capab_info                : 0x0
scan_start_time               : 0
scan_completion_time          : 0
beacon_vendor_info_length     : 0
beacon_vendor_info            :
current_bssid                 :
connected                     : 0
a_mpdu_params                 : 0x0
W_Channel-number              : 52
W_Channel-frequency(HZ)       : 5260
W_Channel-state_flags         : 0
W_Channel-max_power           : 23
W_Channel-min_power           : 0
vht_op_info_chwidth           : 0
vht_op_info_chan_center_freq_seg0_idx: 0
vht_op_info_chan_center_freq_seg1_idx: 0
vht_basic_mcs_set             : 0


<repeat the same for each wlan interface>
```

7.3 Printing queue stats for mesh modules

```
cat /proc/net/meshap/mesh/queue_packet_stats

Entry_pool_current_count              : 2048
Core_packet_pool_current_count        : 2048
Tx_packet_pool_current_count          : 2048
dot1p_queue_total_packet_added_count  : 130
dot1p_queue_total_packet_removed_count: 130
dot1p_queue_current_packet_count      : 0
tx_queue_total_packet_added_count     : 527
tx_queue_total_packet_removed_count   : 527
tx_queue_current_packet_count         : 0
imcp_queue_total_packet_added_count   : 130
imcp_queue_total_packet_removed_count : 130
imcp_queue_current_packet_count       : 0
```

```
skb_queue_total_packet_added_count    : 130
skb_queue_total_packet_removed_count  : 130
skb_queue_current_packet_count        : 0
upstack_queue_total_packet_added_count: 13
upstack_queue_total_packet_removed_count: 13
upstack_queue_current_packet_count    : 0
core_packet_type_alloc_heap           : 2048
```

7.4 Printing thread stats for mesh modules

This stats basically checks if all threads are alive and kicking

```
cat /proc/net/meshap/mesh/thread_stats
Ap_thread [1]                          : 251
Tx_thread [1]                          : 659
process_skb_thread                     : 381
imcp_thread                            : 251
upstack_thread                         : 39
Ap_sta_monitor_thread                  : 1
Ap_dot11i_thread                       : 1
Md_watch_thread                        : 26
Mesh_Thread                            : 315
Mesh_hb_thread                         : 29
Uplink_scan_thread                     : 0
Lfr_thread                             : 0
Scan_thread                            : 157
Radar_dca_thread                       : 0
Dot1x_timer_thread                     : 875
dBmTestRx_thread                       : 1
dBmTestTx_thread                       : 1
Sip_cleanup_thread                     : 0
```

7.5 Printing drop stats for mesh modules

```
cat /proc/net/meshap/mesh/tx_rx_drop_pkt_stats

access_point_process_data_pkt                    : 130
access_point_process_pkt                         : 130
rx_up_stack_pkt    : 13
tx_pkt   : 23
tx_imcp_pkt        : 78
mip_xmit_tx        : 19
rx_master_mode_mgmt_probe_req_frame              : 410
rx_infra_mode_mgmt_frame                         : 32790

*****Embeddedstudios and md-mac80211 packet drop stats***
packet_drop[27 ]_count                 : 19
packet_drop[34 ]_count                 : 23
packet_drop[55 ]_count                 : 3
packet_drop[59 ]_count                 : 13
packet_drop[102]_count                 : 28
packet_drop[104]_count                 : 33
packet_drop[115]_count                 : 8
packet_drop[123]_count                 : 316

mac80211 stats:
WM_mgmt_frame_processed_in_meshap_hook           : 94
mgmt_frame_sent_to_userspace                     : 313
unusable_frame_free                              : 14
non_consume_data_frame_drop                      : 113
tx_frame_not_sent_to_monitor_iface               : 441
```

```
free_tx_skb       : 13108
iface_work_skb    : 32705
rx_monitor_drop   : 26408

v_wlan0 stats:
rx_mgmt : 90

wlan3 stats:
rx_mgmt : 7272

wlan2 stats:
rx_mgmt : 226

wlan1 stats:
rx_mgmt : 25518
rx_data : 111

wlan0 stats:
rx_mgmt : 94
```

7.6 Dumping all stats

Use a single command called gather_info which will dump all the above and other relevant stats for developers to analyze and debug issue

Usage:

gather_info

8 Setting Uboot environment variables for IMX

setenv extra coherent_pool=4M maxcpus=4

Please ensure that the above environmental variable is set on IMX board. If this is not set the board will not come up properly.

9 Procedure for flashing via tftpupgrade

Step1: Generate the target for IMX board(.bin file)

Example:

```
sudo make imx6_md_sysupgrade MAC=04:F0:21:2F:78:94
MD_CONFIG=MD6455-AAIAxx.conf RMAC1=04:F0:21:2F:78:95
RMAC2=04:F0:21:2F:78:96 RMAC3=04:F0:21:2F:78:97
RMAC4=04:F0:21:2F:78:98 BOARD=nor FLASHSIZE=16 VERSION=3.0.1
```

Output will be "**.bin** " file.

Copy this image to the local system(where tftp server runs).

Step2: Configuration for TFTP server

Precondition: PumpKIN should be installed on the local server.

i. Open TFTP Server (**PumpKIN**).

ii. Click on "Options" and select the "**.bin**" image path.

iii. Tick on the check box "server is running".

Step3: Setup the environment

iv. Connect device eth0 cable to the local system(server).

v. On device "**ventana**" console enter below commands.

setenv ipaddr <IP of the device>

setenv serverip <IP of the server>

setenv image_rootfs <image file name>

setenv extra coherent_pool=4M maxcpus=4

setenv

run nand_update

boot

Note: Device IP and server IP should be on same subnet.

Check the ping between device and server before running "run nand_update"

10 Procedure for flashing via Sysupgrade

It is used to upgrade the firmware.
Note: Images with "**.bin**" file extension is used for sys upgrade.
Steps:

1. **Build target for sys upgrade(Build .bin file).**

   IMX:

   sudo make **imx6_md_sysupgrade** MAC=04:F0:21:33:0E:DD MD_CONFIG=MD6455-LLJAxx_NO_ETH1.conf RMAC1=04:F0:21:25:61:01 RMAC2=04:F0:21:25:61:02 RMAC3=04:F0:21:25:61:03 RMAC4=04:F0:21:25:61:04 RMAC5=04:F0:21:25:61:05 VLAN1=04:F0:21:25:61:06 VLAN2=04:F0:21:25:61:07 VLAN3=04:F0:21:25:61:08 BOARD=nor FLASHSIZE=16 VERSION=1.1.11

   CNS:

   sudo make **cns3xxx_md_sysupgrade** MAC=30:14:4A:EA:88:53 MD_CONFIG=MD4455-AAIA_NO_ETH1.conf RMAC1=30:14:4A:AE:11:01 RMAC2=30:14:4A:AE:11:02 RMAC3=30:14:4A:AE:11:03 RMAC4=30:14:4A:AE:11:04 RMAC5=30:14:4A:AE:11:05 VLAN1=30:14:4A:AE:11:06 VLAN2=30:14:4A:AE:11:07 VLAN3=30:14:4A:AE:11:08 BOARD=nor FLASHSIZE=16 VERSION=1.1.11

2. **Copy image(.bin) to "/tmp/" folder of the device.**

   [Scp image to the device "/tmp/" folder]

   To copy from local machine use:
   scp <file name> username@<IP address>:/tmp/
   example:
   scp **imx_md_1.1.11_04_F0_21_33_0E_DD.bin** root@172.17.200.7:/tmp/
   Note: Before doing scp make sure that password is set for the device console.

   ****How to set password in console****
   root@OpenWrt123:/# ***passwd***
   Changing password for root
   New password:
   Bad password: too short

```
Retype password:
Password for root changed by root
```

3. In device console enter the following command.

sysupgrade /tmp/<filename>

```
example:
sysupgrade /tmp/imx_md_1.1.11_04_F0_21_33_0E_DD.bin
```

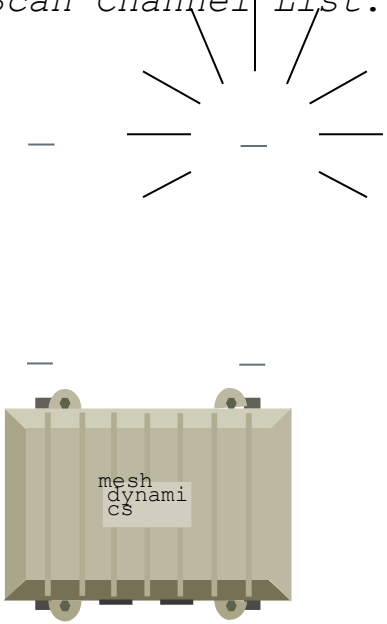
This will initiate sysupgrade and it will preserve all configuration files in /etc/

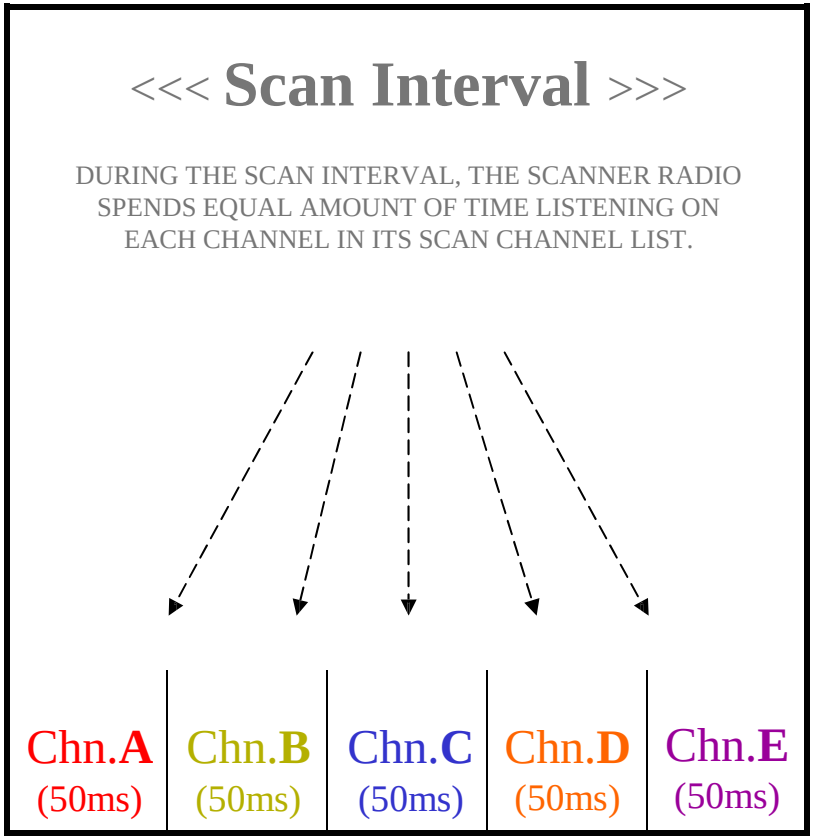
If you do not want to save configuration files over reflash, use "-n" option.

```
sysupgrade -n /tmp/imx_md_1.1.11_04_F0_21_33_0E_DD.bin

Below are the upgrade options for sysupgrade.

Usage: /tmp/sysupgrade [<upgrade-
option>...] <image file or URL>
/tmp/sysupgrade [-q] [-i] <backup-command> <file>
upgrade-option:
    -d <delay>   add a delay before rebooting
    -
f <config>  restore configuration from .tar.gz (file or url)
    -i           interactive mode
    -c           attempt to preserve all changed files in /etc/
    -n           do not save configuration over reflash
     -p
 do not attempt to restore the partition table after flash.
    -T | --
test Verify image and config .tar.gz but do not actually flash
.
    -F | --
forceFlash image even if image checks fail, this is dangerous!
    -q           less verbose
    -v           more verbose
    -h | --help  display this help


backup-command:
    -b | --create-backup <file>
     create .tar.gz of files specified in sysupgrade.conf
    then exit. Does not flash an image. If file is '-',
    i.e. stdout, verbosity is set to 0 (i.e. quiet).
    -r | --restore-backup <file>
    restore a .tar.gz created with sysupgrade -b
    then exit. Does not flash an image. If file is '-',
    the archive is read from stdin.
    -l | --list-backup
    list the files that would be backed up when calling
   sysupgrade -b. Does not create a backup file.
```

The following is a supplement to **section 4.1** of the MeshCommand manual.

A scanner radio constantly repeats scan intervals, listening on each channel in its *Scan Channel List*.

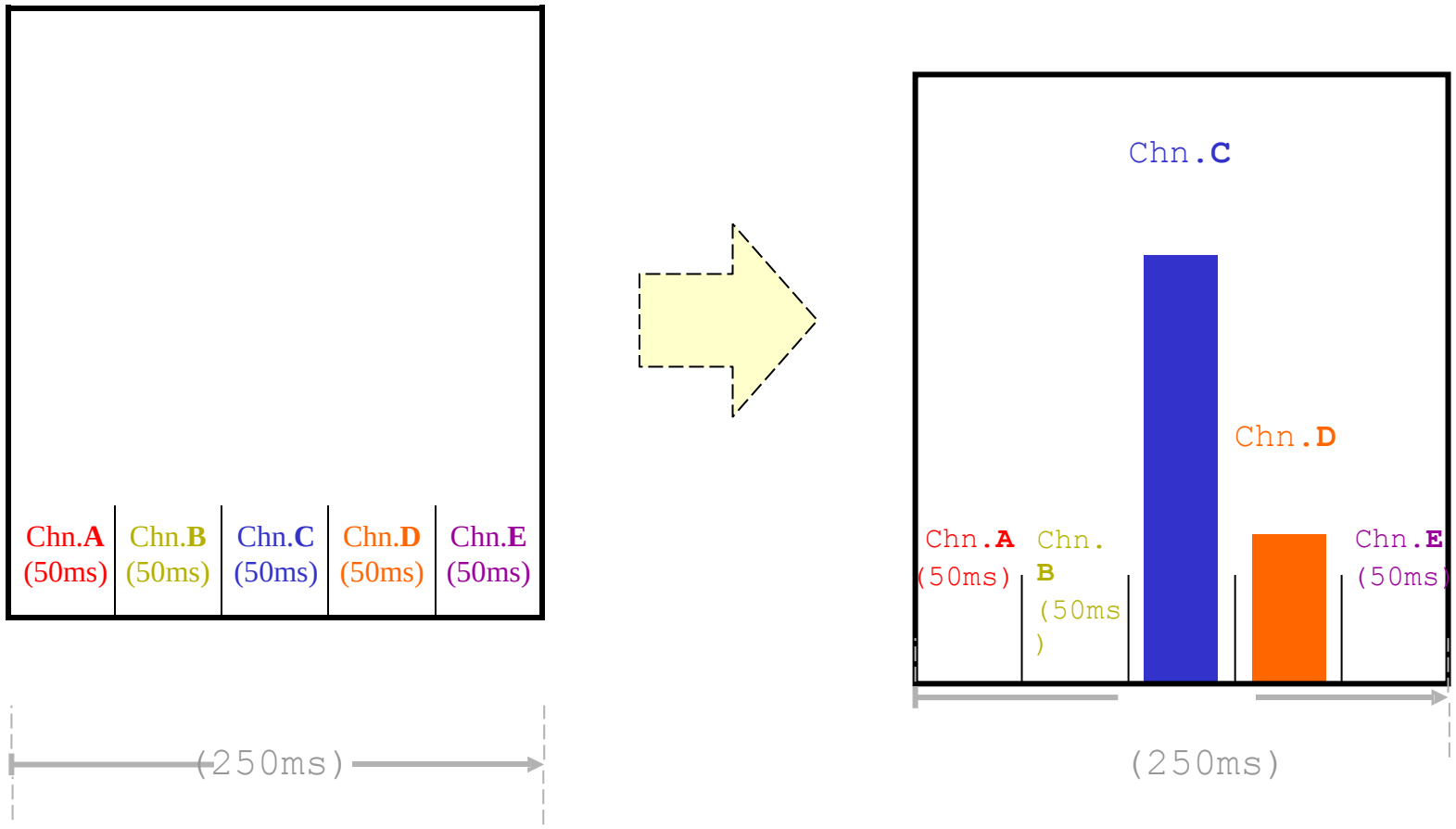




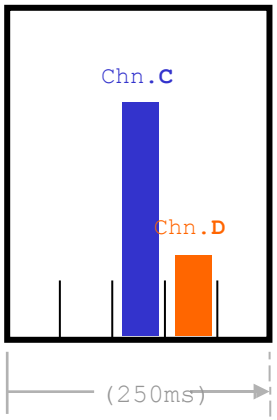
***NOTE THAT TWO QUANTITIES ARE BEING DEFINED HERE:
SCAN INTERVAL = 250ms (default)
DWELL TIME = 50ms (default)

(DWELL TIME = SCAN INTERVAL DIVIDED BY NUMBER OF CHANNELS IN THE SCAN CHANNEL LIST …**5** CHNS. BY DEFAULT)

During the Scan Interval, the scanner radio may hear beacons from the downlinks/APs of parent nodes. In the example below, two beacons are heard, one on channel **C**, and one on channel **D**. Channel C has the highest received signal strength of the two channels, so channel **C** is the "winner" of the scan interval.



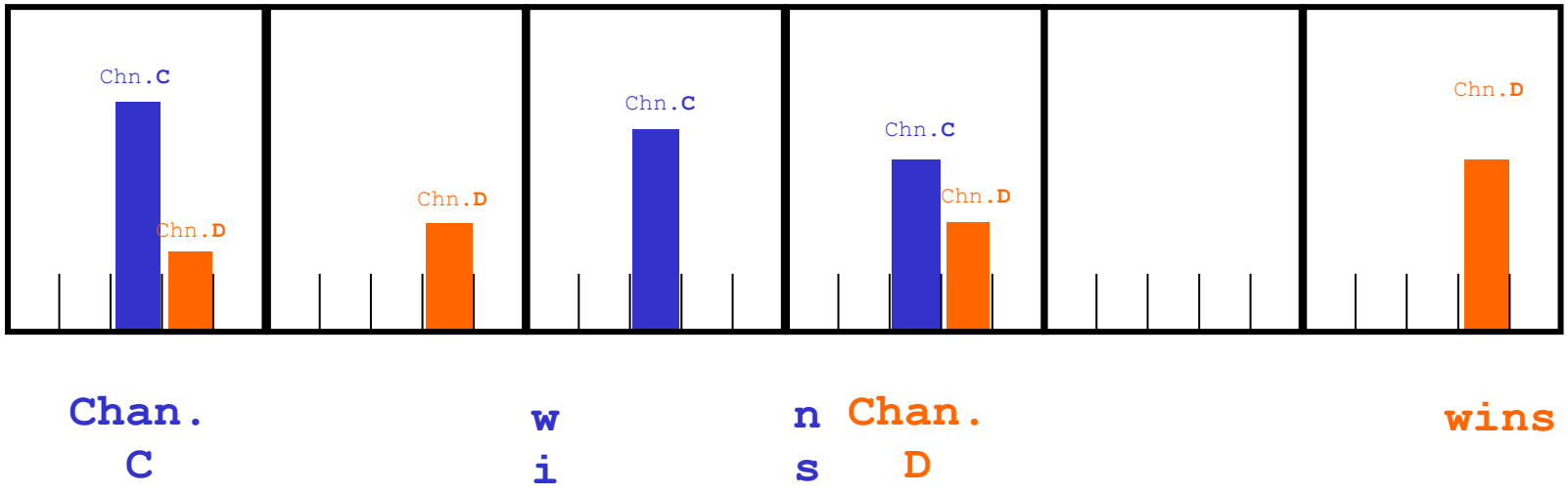
***There are more factors taken into account when a beacon “wins” a scan interval, but for the
purposes of maintaining IP, ***signal strength*** is the only property needed for, and used in the explanation.



Since beacons are sent by the downlinks/APs of the parent nodes every 100ms (by default), there is a fair chance that not all beacons will be heard during a scan interval. The reason for this is because the dwell time for each channel is only 50ms.

In the illustration below, it is seen how some scan intervals miss beacons altogether. These intervals do not have "winners".

Other scan intervals only see *one* beacon -making this beacon the winner by default.



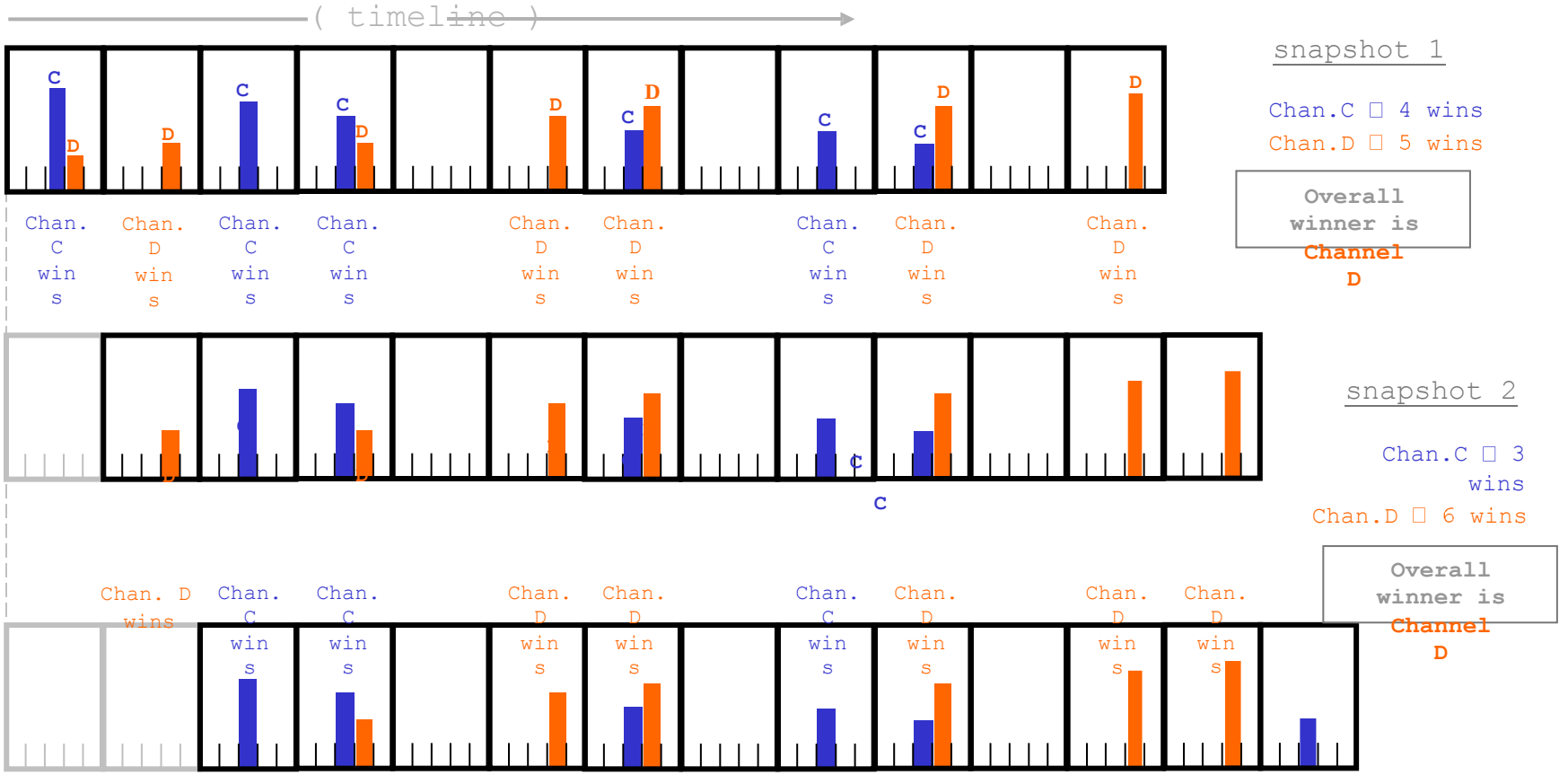
Chan. C wins

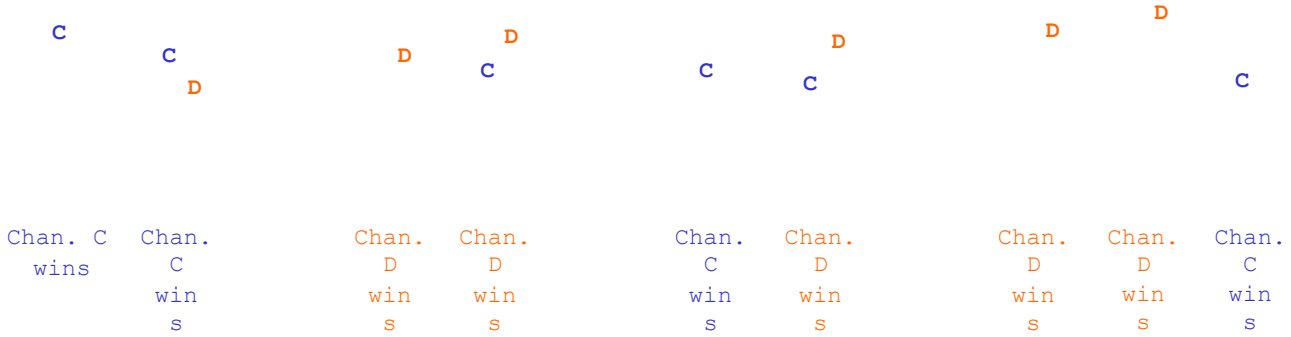
Chan. C wins

Chan. D wins

After each scan interval, a *snapshot* is taken of the past **12** scan intervals. Within these 12 scan intervals will be an **overall winner** of the snapshot as seen below.

With each consecutive snapshot, there will be a new **overall winner**. A sequence of three consecutive snapshots are shown on this page, along with each respective overall winner. In order for a *potential* parent node to become the new *actual* parent node, this potential parent node must be the overall winner for *4 consecutive snapshots*.





snapshot 3

Chan.C □ 4 wins

Chan.D □ 5 wins

Overall winner is **Channel D**