[WiNG 5.1] How-To Guide

[Client Load Balancing and Smart Band Control]

[Month] 2009

Revision [Rev]

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1. Introduction:

1.1 Overview:

Loads are balanced by ignoring association and probe requests. In other words, probe requests and association requests are not responded to, forcing the clients to associate with another radio or AP. This behavior is enabled on a per-wlan basis by means of a configurable item. Enabling it on a per- wlan basis, allows us to make clients on some wlan's non-load balanced, which might be useful in certain scenarios.
Loads are balanced on individual WLAN Profiles and across all AP's that are broadcasting the profile's ESSID. Client probe requests and association requests made to the ESSID are answered by AP's that meet frequency band and load requirements set by the WLAN administrator. Client Load Balancing enables individual ESSID's to distribute clients to increase bandwidth and assist in alleviating band interference. Load and Band Steering Capabilities are configured in the Wireless LAN Profile on the GUI and CLI.

2. Theory of Operation:

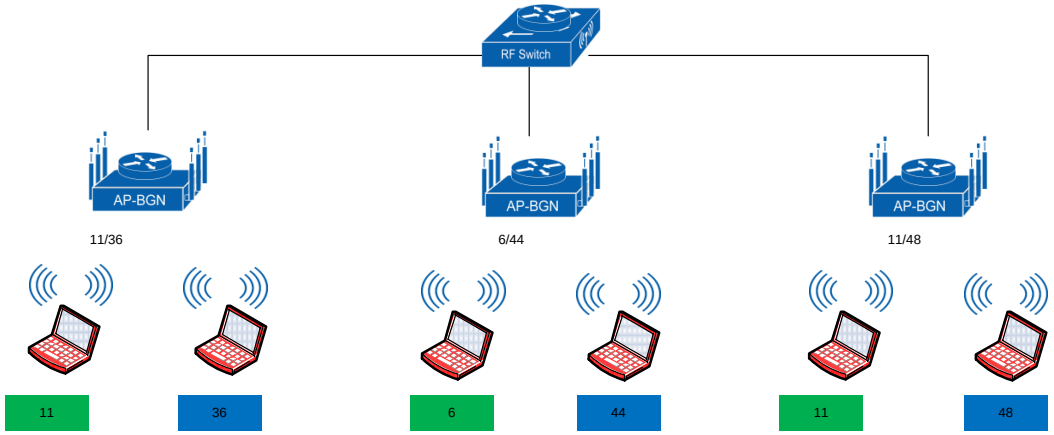
Definitions:

- **Client Load Balancing (CLB) -** Balancing clients across APs based on the relative loading of APs.
- **Smart Band Control (SBC) -** Detect dual band wireless clients and load balance them across the 2.4GHz and 5 GHz bands based on the weights set by the administrator. The common use case is to put more wireless clients on to the 5 GHz band.
- **Loads-** The number of users on an AP and the number of users on a particular frequency band/channel and throughput generated across the WLAN (ESSID) according to configured parameters.

Client Load Balancing balances:

1. **Loads per AP in a neighborhood:**
   Each AP monitors and attempts to equalize its total load with those of the APs in its neighborhood.

Load Balancing per AP

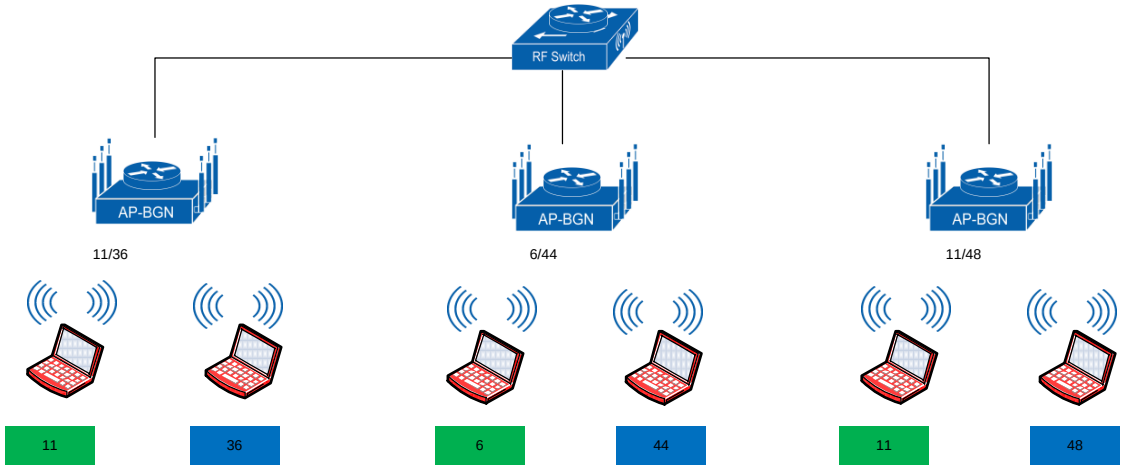


2 Clients on Each AP

2. Loads per channel per band in a neighborhood:

Each AP attempts to evenly distribute its load across the channels of each of the bands in its neighborhood. For example; dual radio AP #1, might be on channel 11 and channel 36. Its neighbors are on channel 1, 11, and channel 44, 48, AP# 1 would attempt to equalize the load on channels 1 and 11 in the 2.4 GHz band, and on channels 36, 44, 48 on the 5 GHz band. AP#1 would do this by rejecting clients if the load on channel 11 is a lot higher than channel 1 or readily accepting clients if the load on channel 1 is higher.

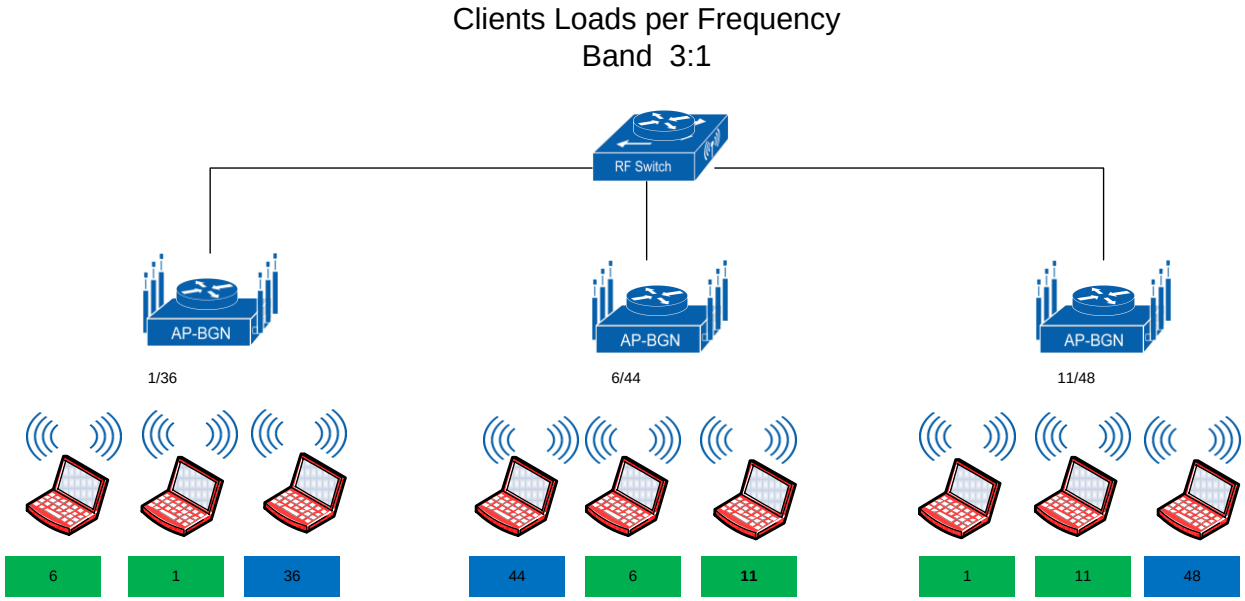
Clients Loads per Channel



2 Clients on Ch11 and 1 Client on Ch6
3 Clients evenly distributed across Ch 36,44,48

3. <u>Loads between bands in a neighborhood:</u>

Each AP attempts to load the 2.4 GHz band and the 5 GHz band in a ratio that is configurable. For example, if the total load in the 2.4ghz band in a wireless neighborhood is 4 times the total load in the 5ghz band and the ratio was specified as 3:1, then AP's would ignore client requests in the 2.4Ghz band until the ratio came down to 3 times.



6 Clients on 2.4 Ghz / 3 Clients on 5 Ghz

2.1 The Client Load Balancing setup pages in the Controller GUI.

There are 3 relevant pages to configure and view Client Load Balancing (CLB)

1. WLAN Client Load Balancing Configuration:

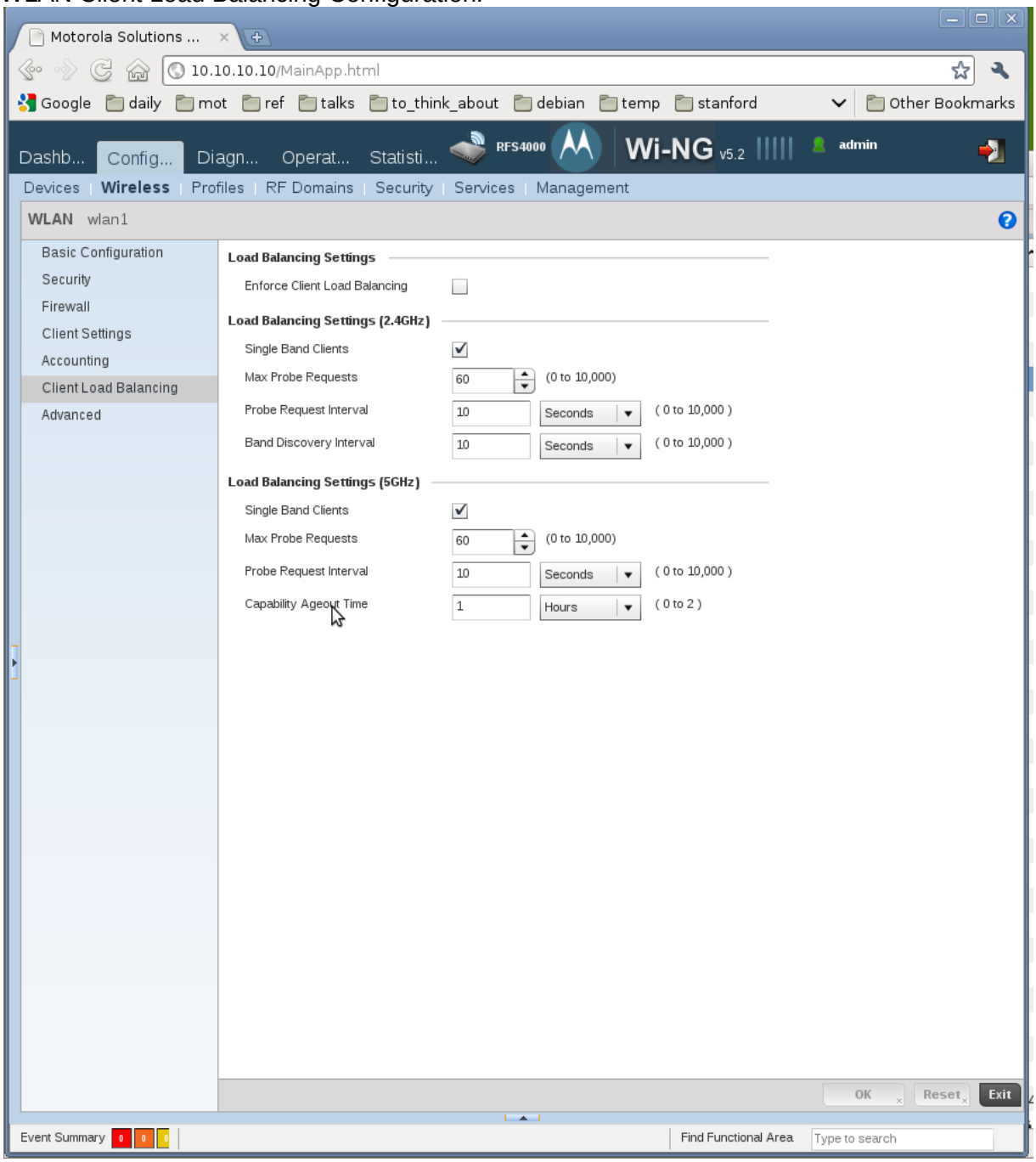


Figure 1

- This page contains all the parameters that are set on a per-WLAN basis:

2. AP Client Load Balancing Configuration

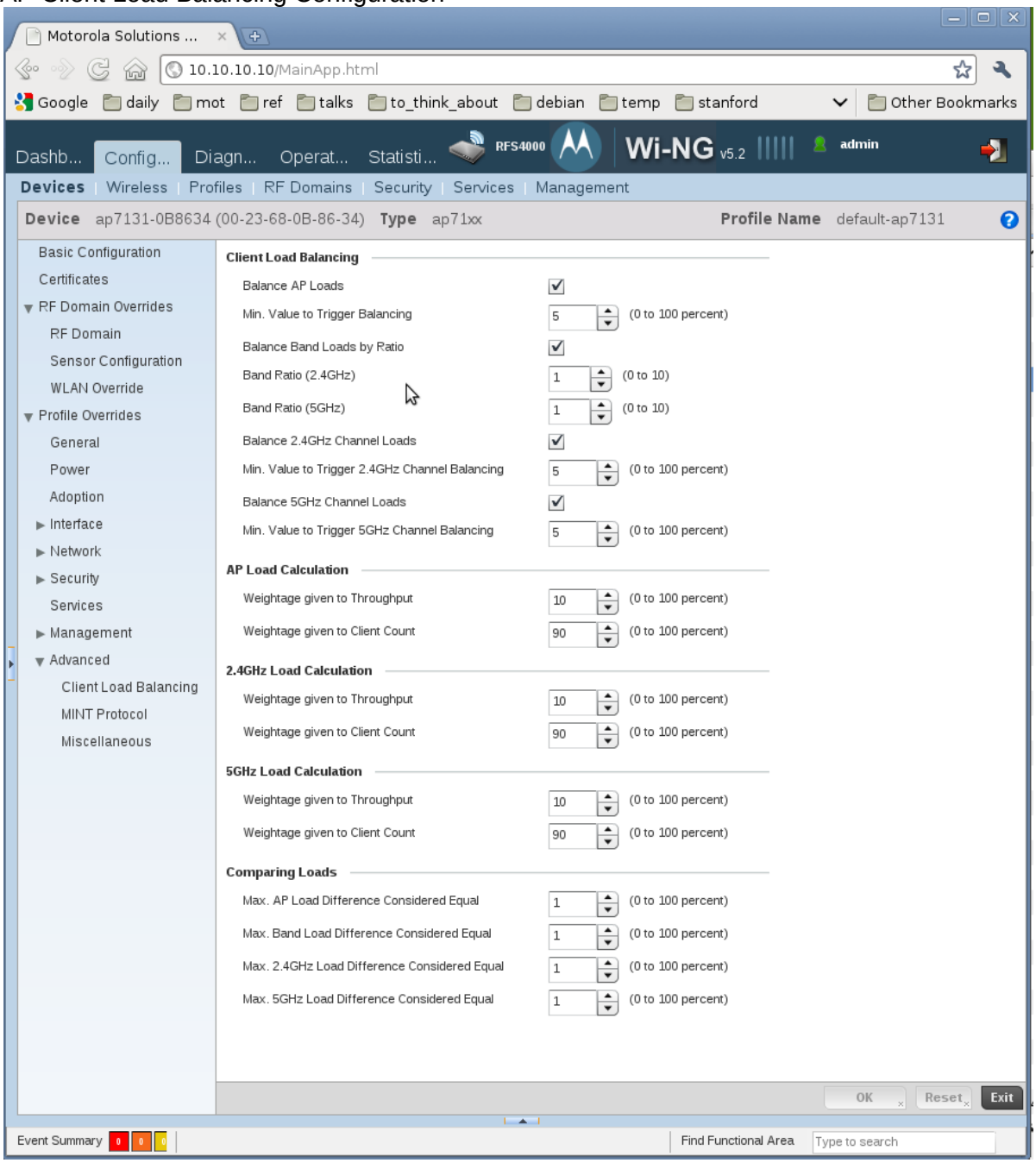
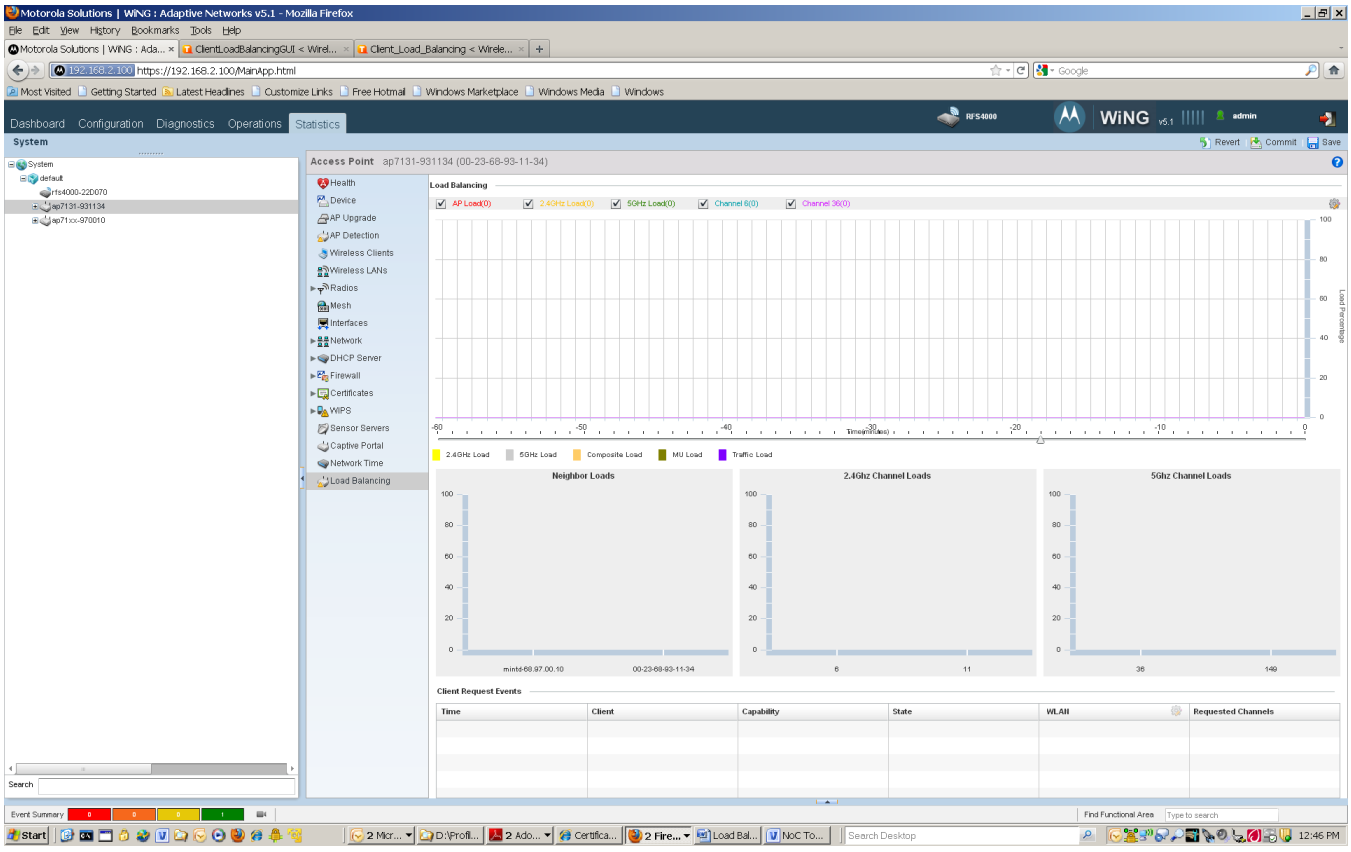


Figure 2

- This page contains the entire CLB configuration that is not WLAN-specific.

3. Client Load Balancing Stats
    - This page is the main thrust of this discussion and will be discussed in the sections to follow.



Understanding the CLB Statistics GUI

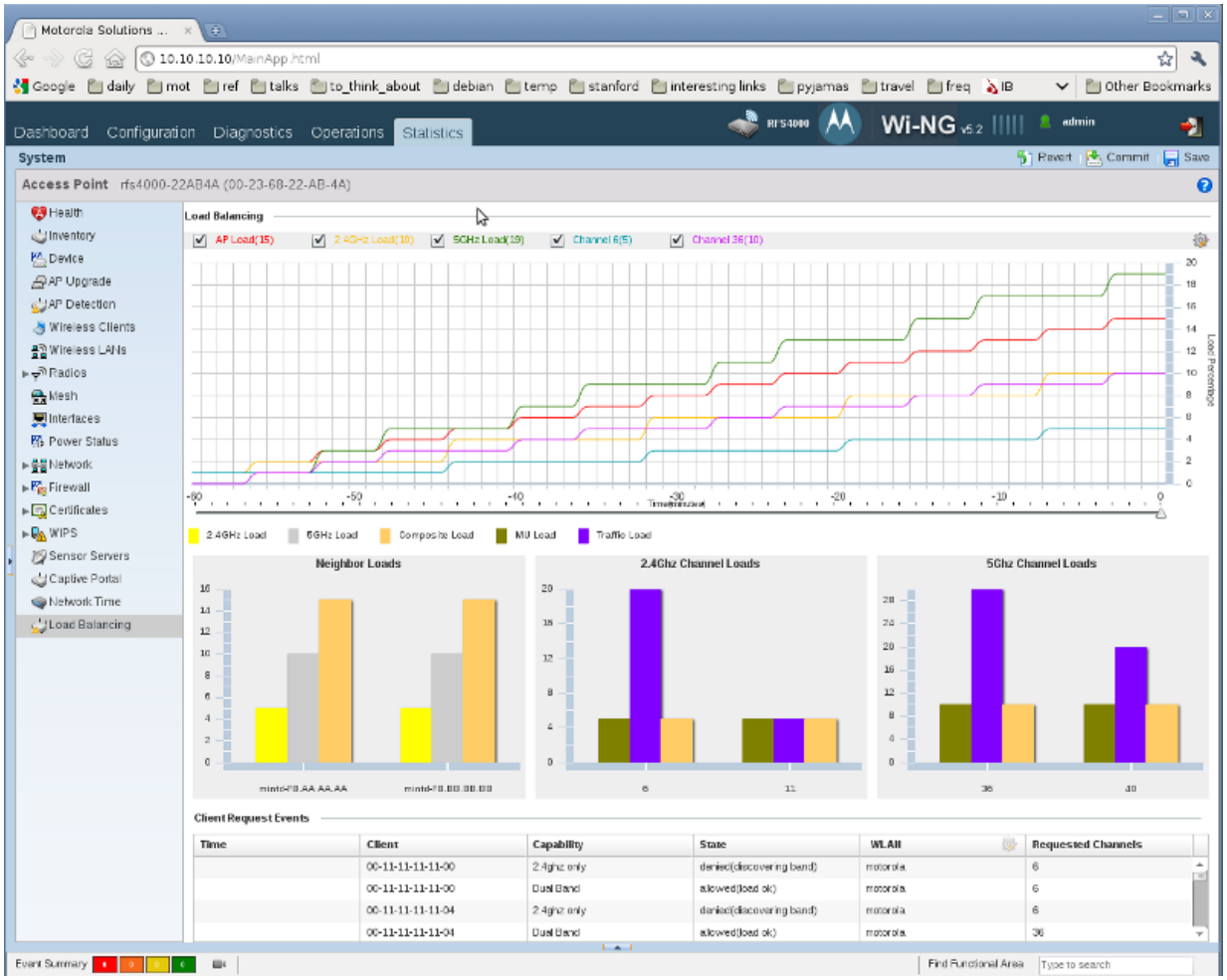


Figure 3

2.1.1 The Individual Parts

- **Note**: In the descriptions below the "load" is always a weighted sum of the throughput and MU count, as specified in configuration, unless it is specifically called "client count load" or "traffic load".
- **Note**: All the bar graphs are updated every minute, but only if the slider is at the '0' or "current value" position. The load balancing graph is always updated every minute, regardless of the position of the slider.
- **Tip:** Performing a mouse-over on any graph will give you the instantaneous value of that graph.

1. Load Balancing Graph: This line graph displays 5 values as measured by the AP over the past 60 minutes:
    1. AP Load: The loading on the AP itself as a percentage.
    2. 2.4 Ghz Load: The load on the 2.4 GHz band in the neighborhood as a percentage.

3. 5. GHz Load: The load on the 5 GHz band in the neighborhood as a percentage.
4. 2.4 Ghz Channel Load: The load on the 2.4 GHz channel that the AP has a radio on. This may include the load contributed to that channel by other neighbors.
5. 5 GHz Channel Load: The load on the 5 GHz channel that the AP has a radio on. This may include the load contributed to that channel by other neighbors.

2. Neighbor Loads Graph: This bar graph displays the instantaneous values of the neighbor loads at the time pointed to by the slider. It shows the following values for each neighbor:
    1. 2.4GHz load: The load contributed to the 2.4 GHz band by that neighbor.
    2. 5GHz load: The load contributed to the 5 GHz band by that neighbor.
    3. Composite load: The loading on that neighbor.
    4. A mouse-over one any of the bars will give you the specific value and the channel information.
3. 2.4 GHz Channel Loads: This bar graph displays the instantaneous values of the channel loads at the time pointed to by the slider. It shows the following values for each channel in the neighborhood:
    1. Client Load: The client count load on that channel.
    2. Traffic Load: The traffic load on that channel.
    3. Composite Load: The load on that channel.
4. 5GHz Channel Loads: This bar graph displays the instantaneous values of the channel loads at the time pointed to by the slider. It shows the following values for each channel in the neighborhood:
    1. Client Load: The client count load on that channel.
    2. Traffic Load: The traffic load on that channel.
    3. Composite Load: The load on that channel.

5. Client Request Events: This is a table of events in time that gives us the following information:
    1. Mac address of the client.
    2. The time when a client attempted to associated.
    3. The result of that request - allowed or denied.
    4. The reason for the result. Clients are usually denied because their band capabilities are being discovered, or the load on that channel/band/AP is too high. Clients are allowed when the loads are within bounds, or when they are deemed desperate.
    5. The WLAN where the client made the request.
    6. The channel on which the client made the request.
    7. The capability of the client.

6. The Slider: This is the main control on the page. The bar graphs and the event table will display values corresponding to the time specified by the slider's location.

7. The "Load Balancing Configuration gear": This is located on the top right corner of the Load Balancing Graph and expands to what is shown below:

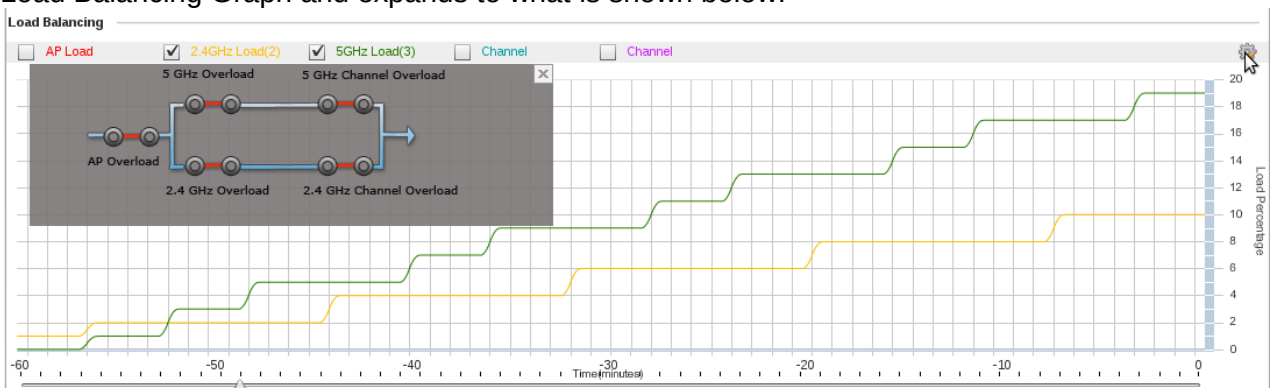


Figure 4

- The AP Overload switch goes "open circuit" (or blocking requests) if the AP load is greater than the average load in the neighborhood. In this case, both radios on this AP will refuse further associations until the AP load is comparable to the average load.
- The AP Overload Switch goes "closed circuited" (or allowing requests), when the AP load is comparable to the average load. In this case, we proceed to the next comparison.
- The current band ratio is compared to the configured band ratio. If the 5 GHz band load is deemed too high compared with the 2.4 GHz band load, the "5Ghz Overload" switch goes "open circuit"(blocking requests). This means that all further requests on the 5 GHz radio will be denied, until the ratio becomes comparable. The "2.4GHz Overload" switch goes "closed circuit" (allowing requests), so the ratio can adjust to become closer to the configured ratio.
- The "5GHz Channel Overload" switch goes "open circuit" (blocking requests) when the channel load on this AP's 5Ghz channel is greater than the average 5Ghz channel load in the neighborhood.
- The same applies to the "2.4GHz Channel Overload" switch.
- Keep in mind that the instantaneous state of all these switches will correspond to the time pointed to by the slider.

3. How to Configure Load Balancing

3.1 Pre-Requisites:

1. Windows 2008 server Enterprise or Existing LAN infrastructure for client data transactions
2. Network should be up and running

3.1.1 Requirements:

The following requirements must be met prior to attempting this configuration:

- 2 or more AP7131N 802.11n Access Points installed and configured
- RSF Switch installed and running WiNG 5.1 or greater
- One (or more) wireless workstations are available to operation.
- The reader has read the Motorola RFS Series Wireless LAN Switches - WiNG System Reference Guide.

3.1.1.1 Components Used:

The information in this document is based on the following Motorola hardware and software versions:

- RFS4000
- AP7131N

✔ Registered users may download the latest software and firmware from the Motorola Technical Support Site http://support.symbol.com.

3.1.1.2 Configurable Items

- Client load balancing enable/disable on a per-wlan basis.
- Allow single-band clients.
- Persistence threshold in probe requests per minute.
- Weightage given to client count and throughput in calculating load.
- Ratio in which the bands are to be loaded.
- Min threshold for total-ap-loading, total-band-loading, and total-channel- loading for each hand

3.2 Enable Client Load Balancing

3.2.1 Command Line Interface:

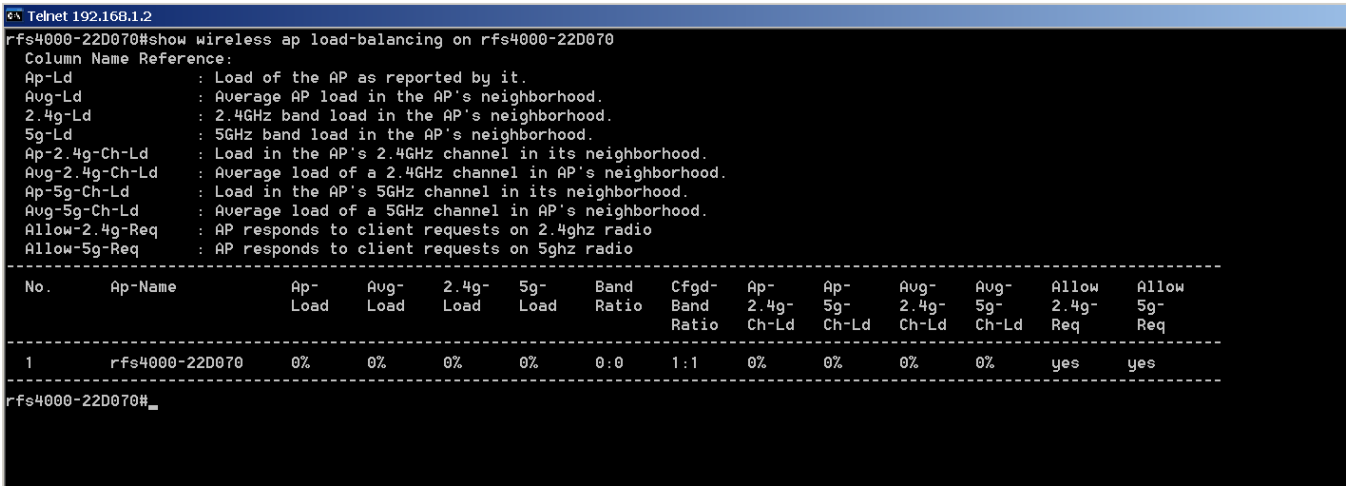
In the CLI issue the "client-load-balancing" command <Enter>
- Enables client load balancing on **this wlan "RFS4000"**

```
login as: admin
admin@192.168.2.100's password:
rfs4000-22D070>en
rfs4000-22D070#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
rfs4000-22D070(config)#wlan MD-RSF4000
rfs4000-22D070(config-wlan-MD-RSF4000)#client-load-balancing
rfs4000-22D070(config-wlan-MD-RSF4000)#commit write
```

!

3.2.1.1 Showing the state:

1) **rfs4000-22D070# show wireless ap load-balancing**
- Show the load-balancing state and stats
- Example output:



3.2.3 GUI

1) On your browser https://controllerip
   a. Enter User name
   b. Enter Password

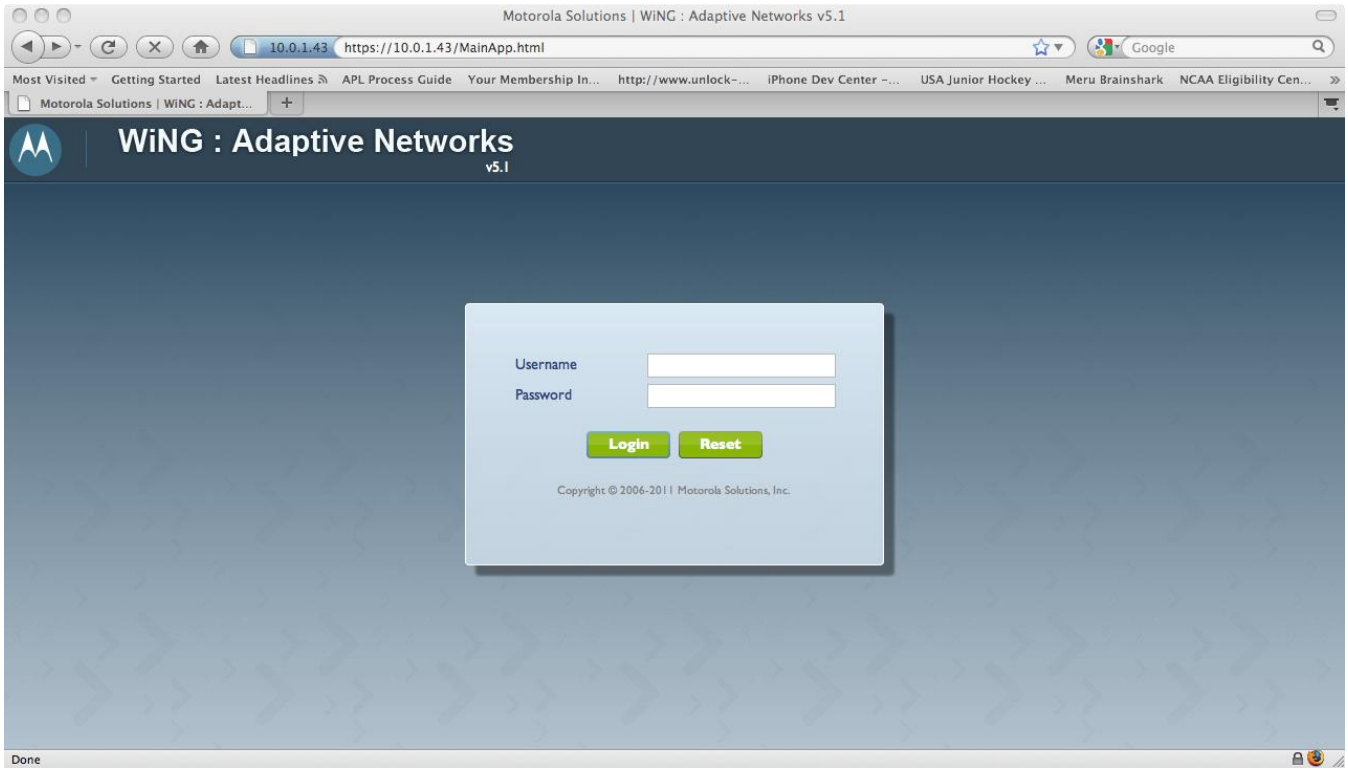


Figure 5

2) Go to:

a. Configuration
b. Wireless
c. Select the WLAN for Load Balancing
d. Select “Edit” at the bottom right hand corner

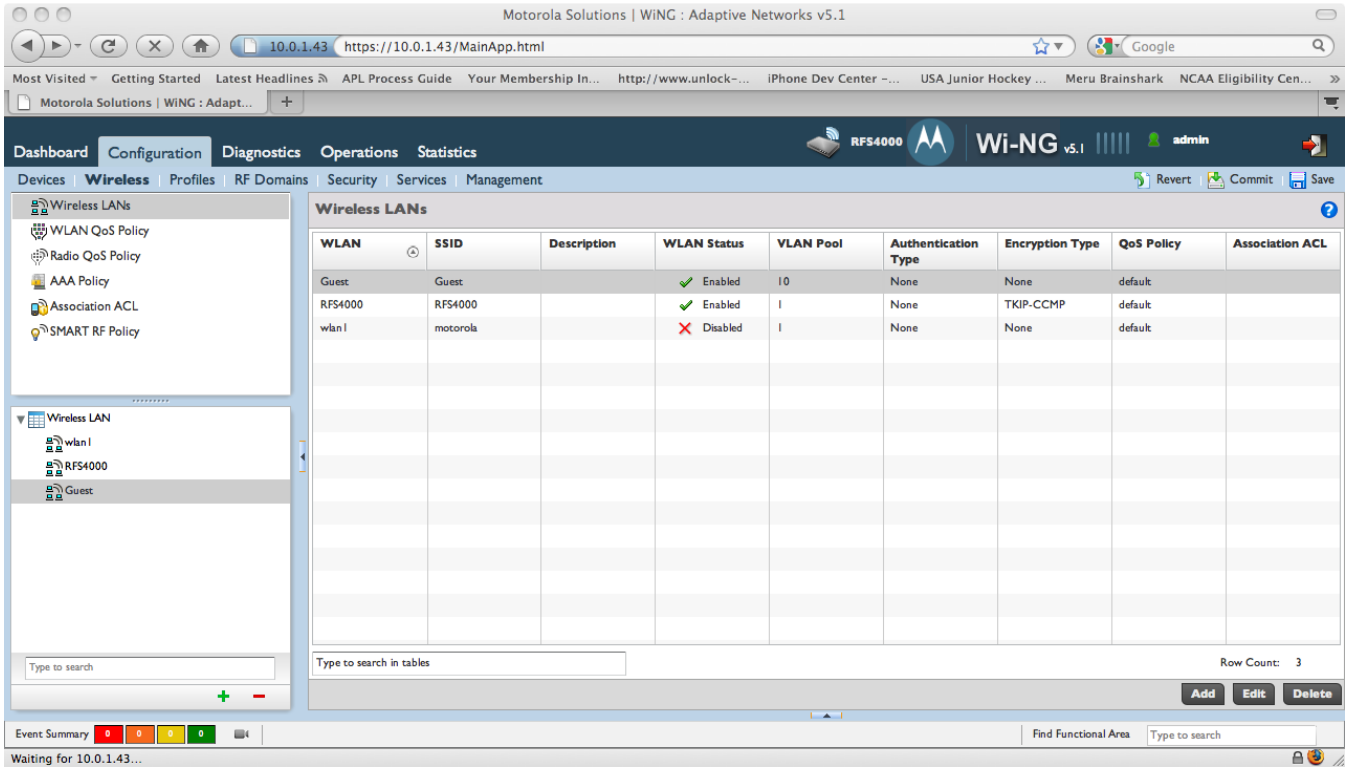


Figure 6

3) On the Wireless LAN Screen

a. Select "Client Load Balancing"
b. in the "Load Balancing Settings" window; click "Enable Client Load Balancing"
c. Click "OK" on the bottom right side
d. Click "Commit" "Save" at the top right

You must click "Commit" and "Save" as this rights the change to the running-config and saves to startup-config/memory

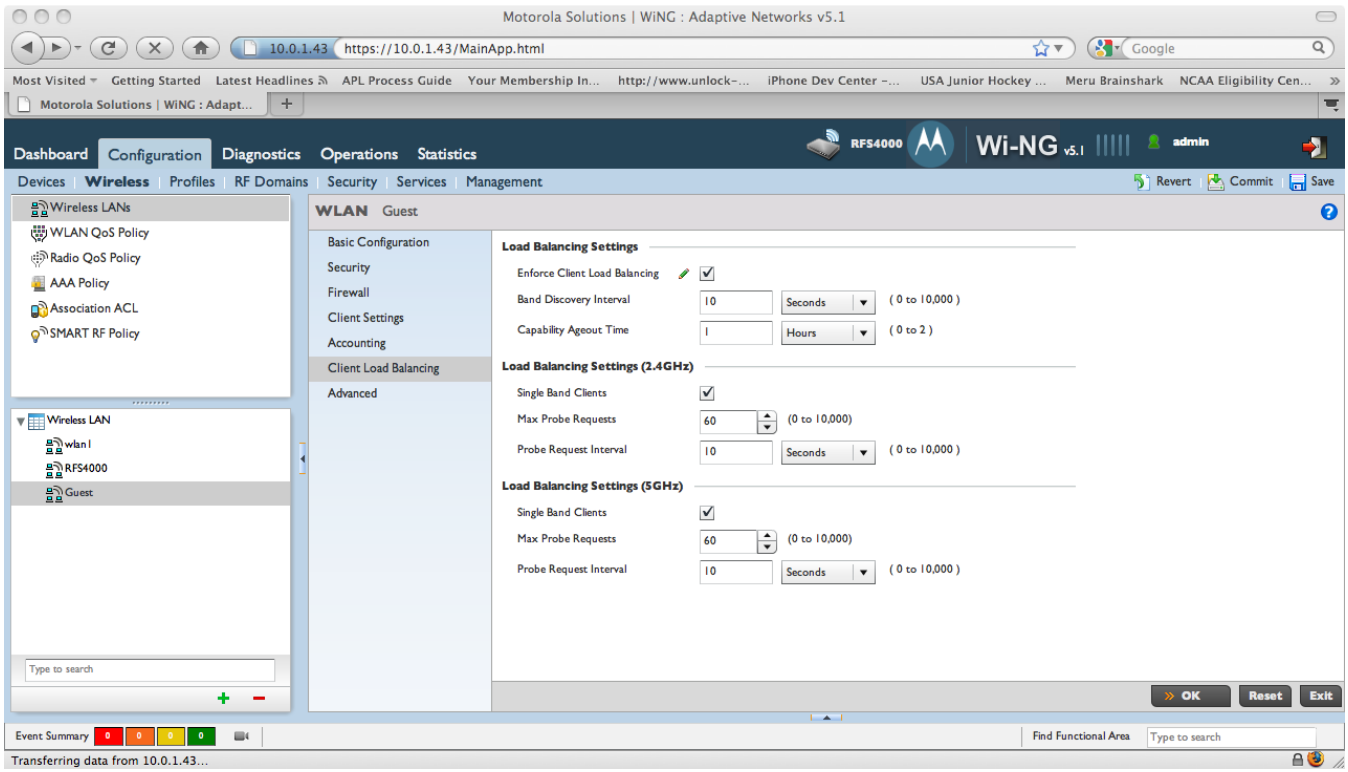


Figure 7

3.3.1 Configuring CLB from the Circuit:

1. Clicking on any switch in the circuit will pop up the relevant configuration items as shown in the diagram below.

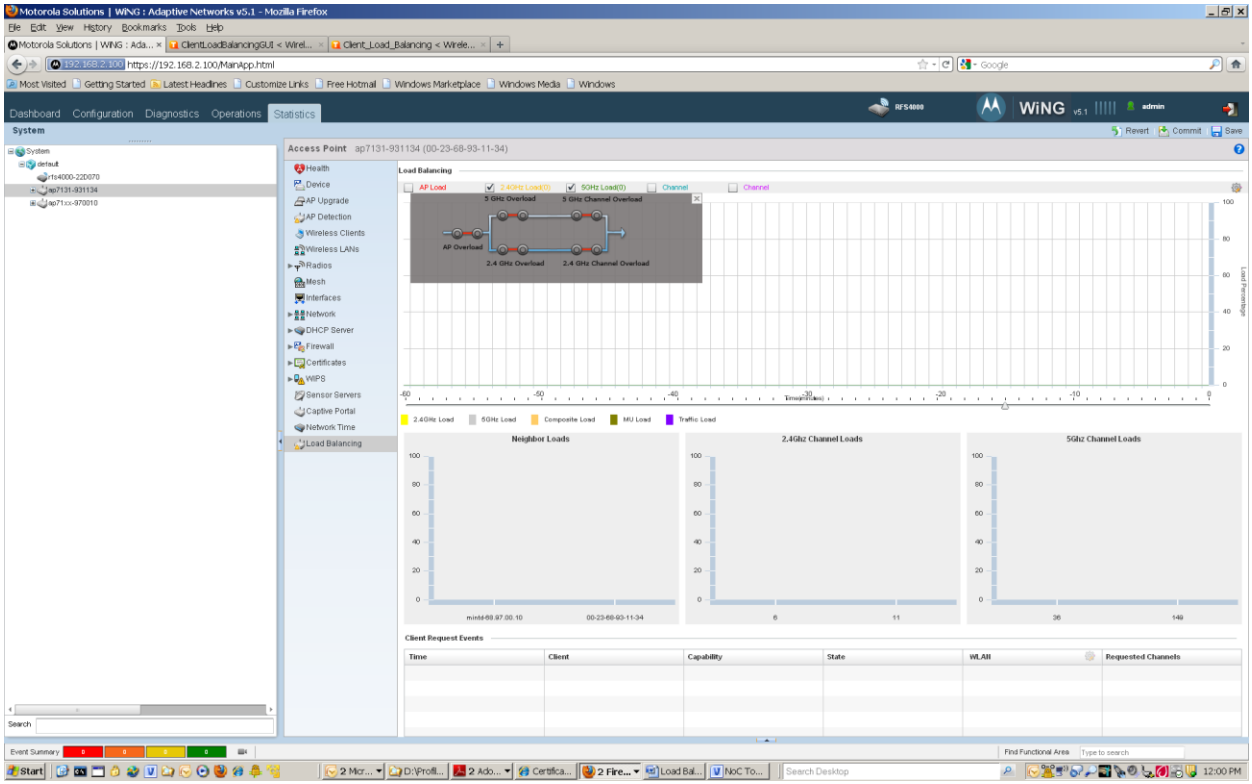


Figure 8

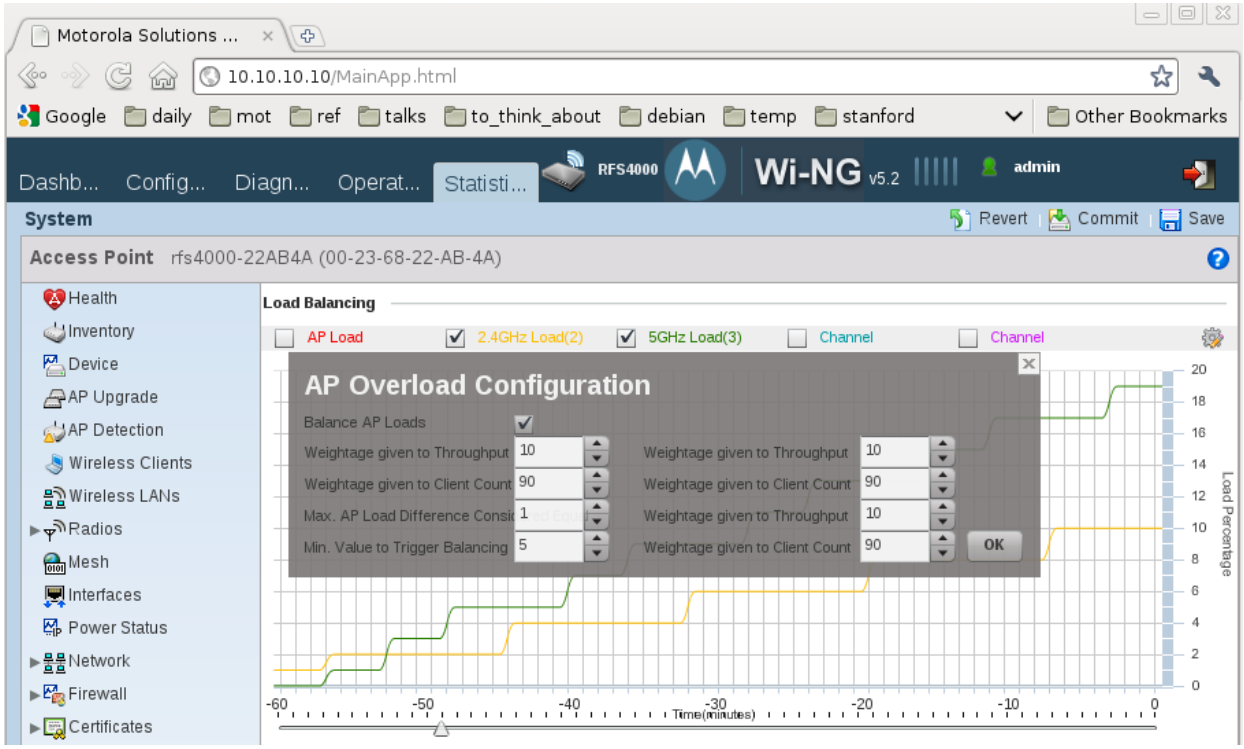


Figure 9

- Notice that these configuration items are a subset of the configuration items that were present in the configuration page.
- WLAN managers can configure directly from this page without having to go back to the WLAN setup page.

3.3.2 Configuring WLAN CLB parameters from the table:

- Selecting any row in the event table and clicking the "gear" icon on the top right corner of the event table pops up the following box.

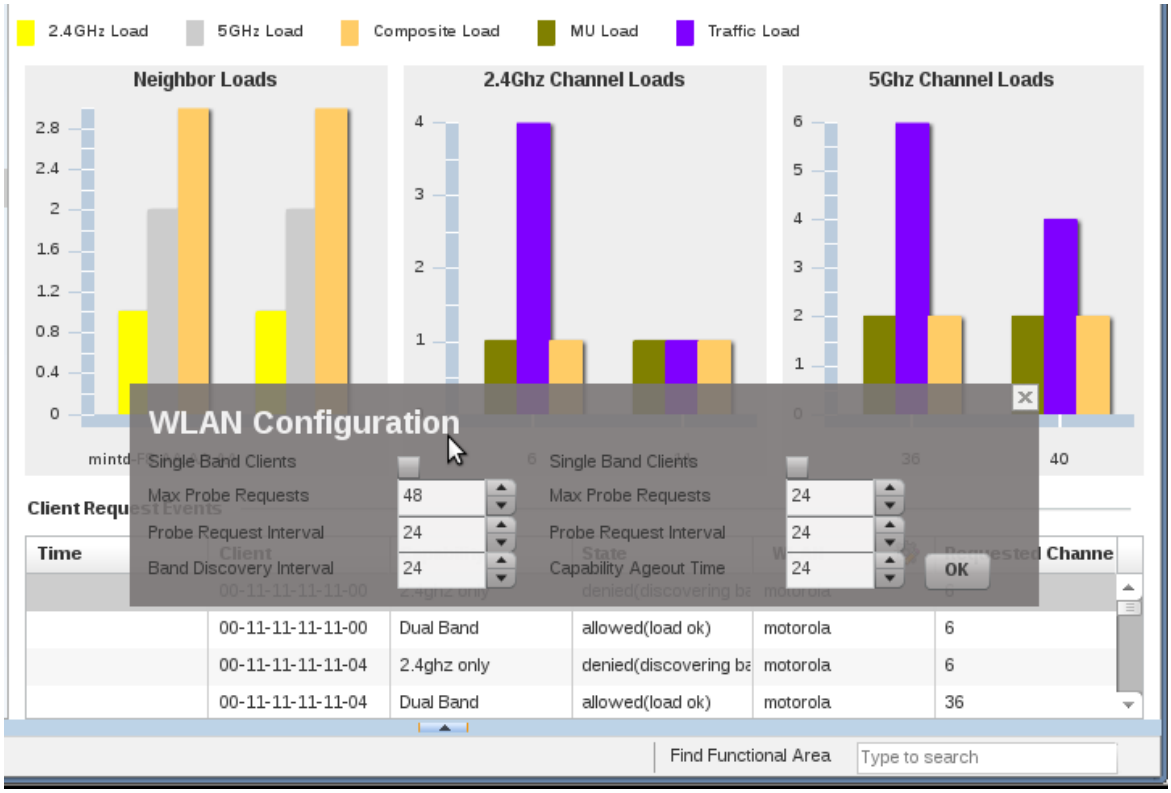


Figure 10

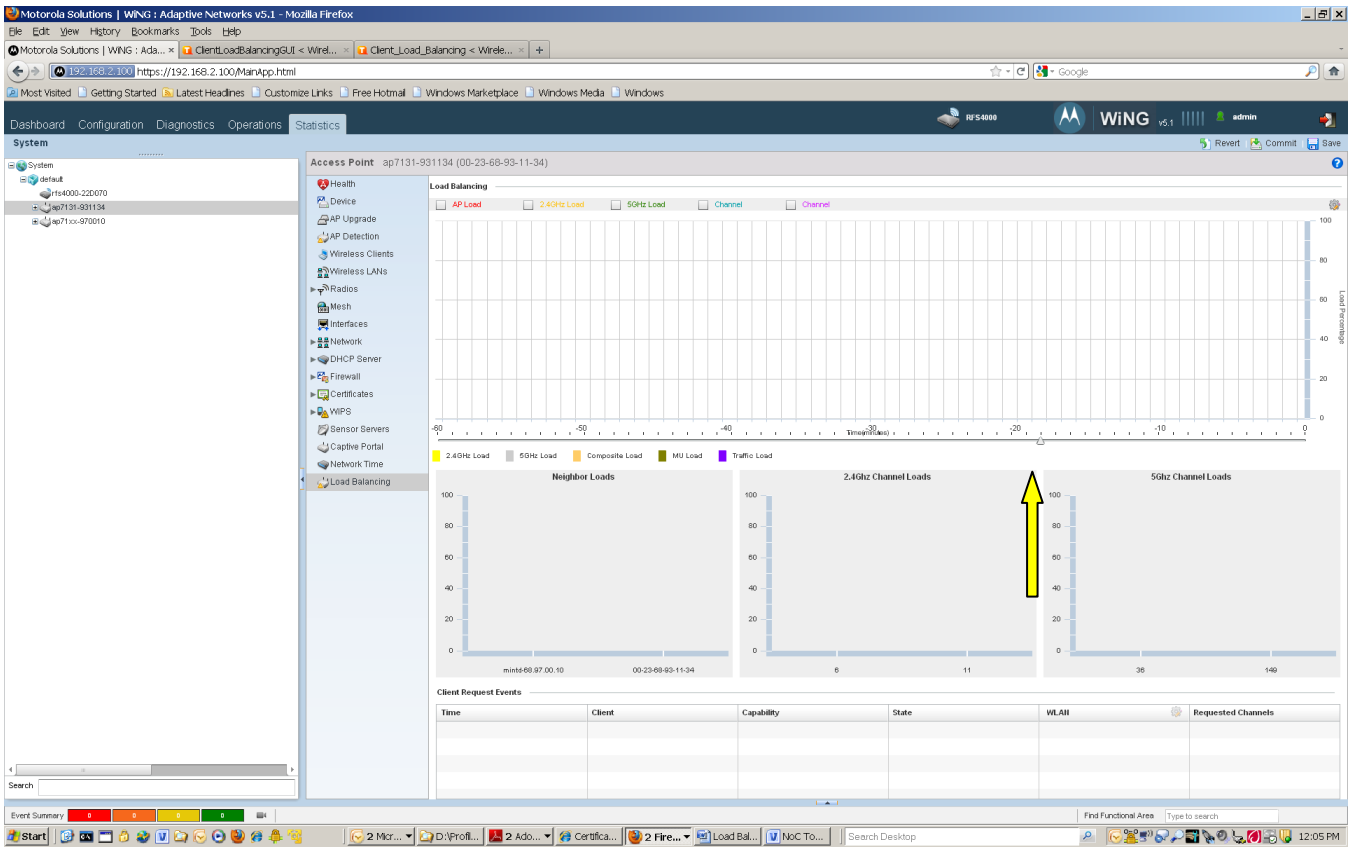
- This is the same configuration items as in the main WLAN Client Load Balancing configuration.

3.3.3 Verifying That CLB Works

The stats-GUI was created specifically to quickly tell whether or not CLB is working. We shall see how below.

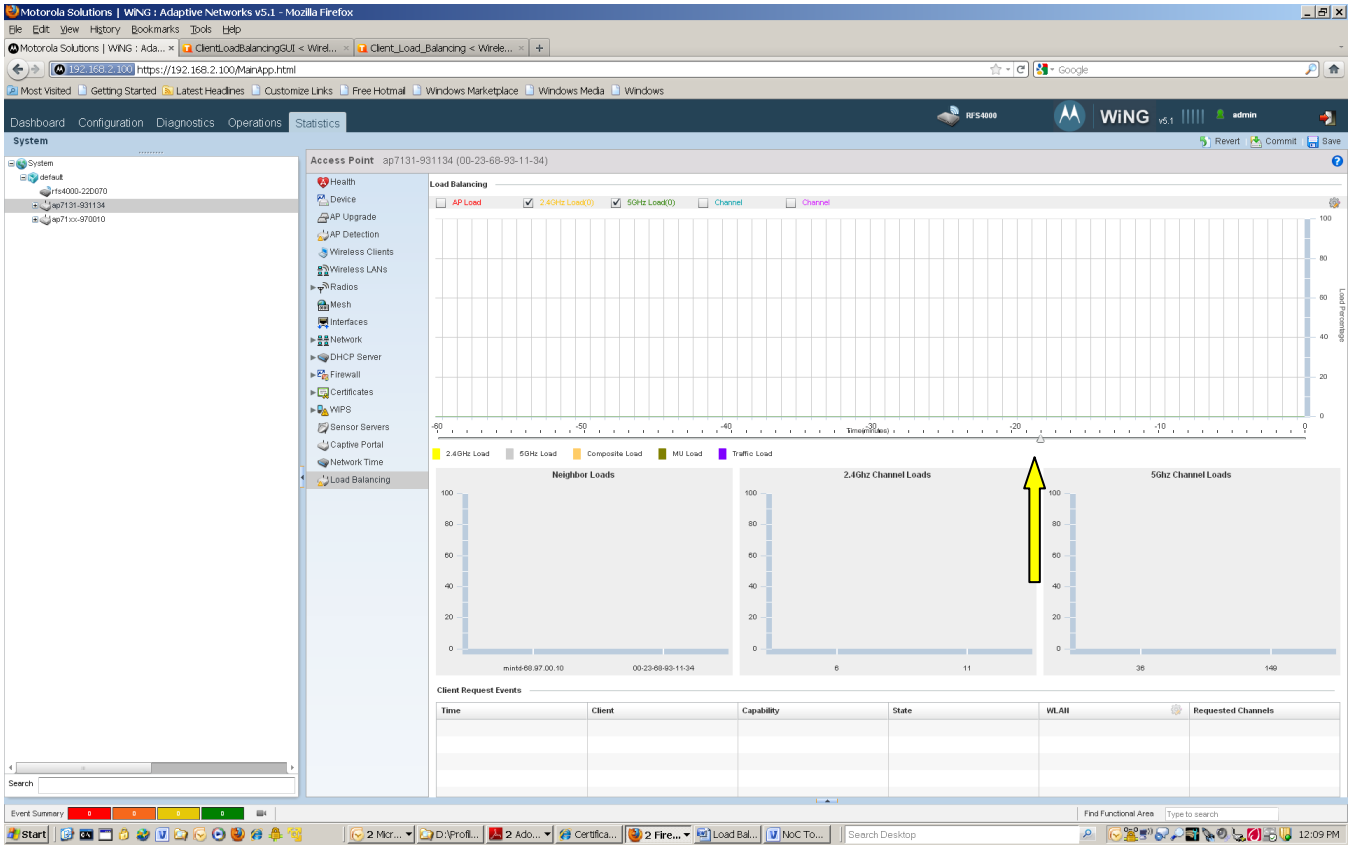
3.3.3.1 To verify that AP Load Balancing works using the GUI:

1. Check the Neighbor load graph, and confirm that the composite load for each neighbor is roughly the same within the margin specified in configuration.
2. Move the slider back in time and confirm that this is true for all recorded time.
3. As you move the slider back in time, each time a neighbor's load goes above the average, check the events table to see if any clients are being associated. They should all be denied. This further proves that the loads are deliberately being balanced by the AP, and that this is not a fluke.



3.3.3.2 To verify that Band Balancing works as designed:

1. Check the relative ratio of the 5 GHz band Load versus the 2.4GHz band load at any point in the Load Balancing Graph over 60 minutes. It should roughly equal the configured band ratio.
2. To confirm that this is deliberately being done, move the slider to multiple points in the past, and see the corresponding events in the table and the state of the circuit switch comparisons. You should see one or the other radio being turned off as a result of overload on the band.



3.3.3.3 To verify that Channel Balancing works as designed:

1. Check the 2.4GHz and 5 GHz Channel Load graphs.
2. The composite load on each channel should be roughly the same within each band.
3. Further, ensure that this was true by moving the slider back in time.
4. Finally, ensure that this was a deliberate outcome by checking the circuit and the events at that each time.

3.4 Configuration Use Case's

1) *Auditorium use case: client load balancing with emphasis based on AP load.*
   In such a scenario we have large number of clients and load should be based on number of clients and not throughput
2) *Classroom Use case: client load balancing with emphasis on throughput and load per channel*.
   In a classroom students could be watching education videos; throughput is a major concern
3) *Mix environment use case: client load balancing with emphasis on using 5ghz band*
   Used for better performance and less RF interference.

3.5 Auditorium Use Case

Scenario:
Exhibition hall; with approx 100-200 Wi-Fi users surfing internet and downloading email and surfing the web. The Wi-Fi users have mixed wireless nics that are capable of using 2.4 GHz and or 2.4 Ghz/5Ghz bands. The 5 GHz band has more none overlapping channels and allows for better bandwidth so we would like to put more clients on that band.

1. The below configuration sets the band ratio to be 1:3, for every 1% load on 2.4ghz, there should be 3% load on 5ghz.

2. Configure the following on all APs:

```
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing balance-band-loads
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing band-ratio 2.4ghz 1
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing band-ratio 5ghz 3
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-ap-loads
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-channel-loads
2.4ghz
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-channel-loads 5ghz
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load client-weightage
100
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load throughput-
weightage 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 5ghz-load client-weightage 100
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 5ghz-load throughput-
weightage 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing equality-margin band 0
ap7131-DC7EA6(config-profile-default-ap7131)#com
ap7131-DC7EA6(config-profile-default-ap7131)#
```

GUI Setup in the Default Profile for the AP

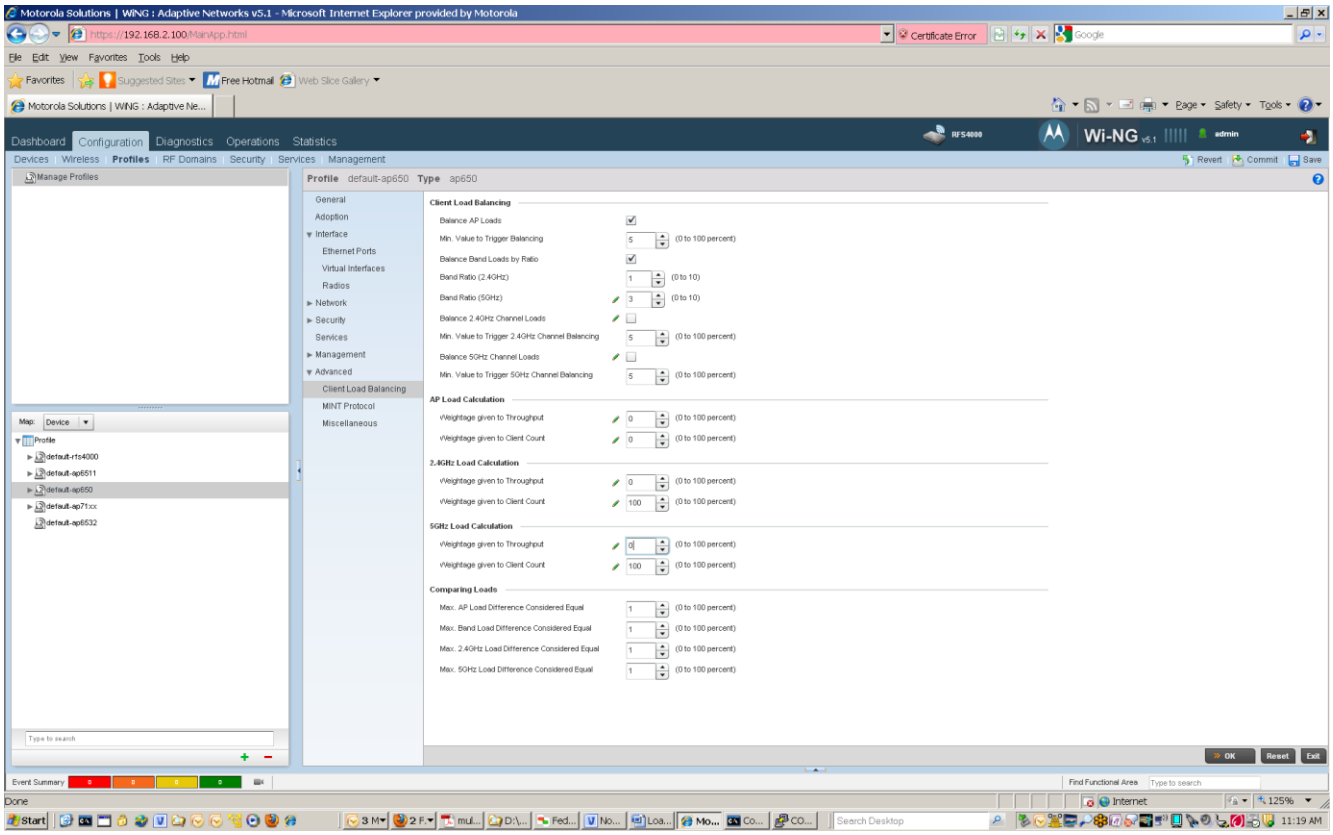


Figure 11

3.6 Classroom Use Case

Scenario:
A school system is in the process of implementing a new IVideo Learning application and the existing laptops have only 2.4 (BG Wireless Cards). We want to balance the loads across all channels to give them the best bandwidth and channel utilization.

The below configuration enables channel load balancing on the 2.4 GHz band.

1. Configure the following on all APs using the default AP profile:

```
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing balance-channel-loads 2.4ghz
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-channel-loads 5ghz
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-band-loads
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-ap-loads
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load client-weightage
100
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load throughput-
weightage 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing equality-margin 2.4ghz 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing hiwater-threshold 2.4ghz-load 0
ap7131-DC7EA6(config-profile-default-ap7131)#com
ap7131-DC7EA6(config-profile-default-ap7131)#exit
```

GUI Setup in the Default Profile for the AP

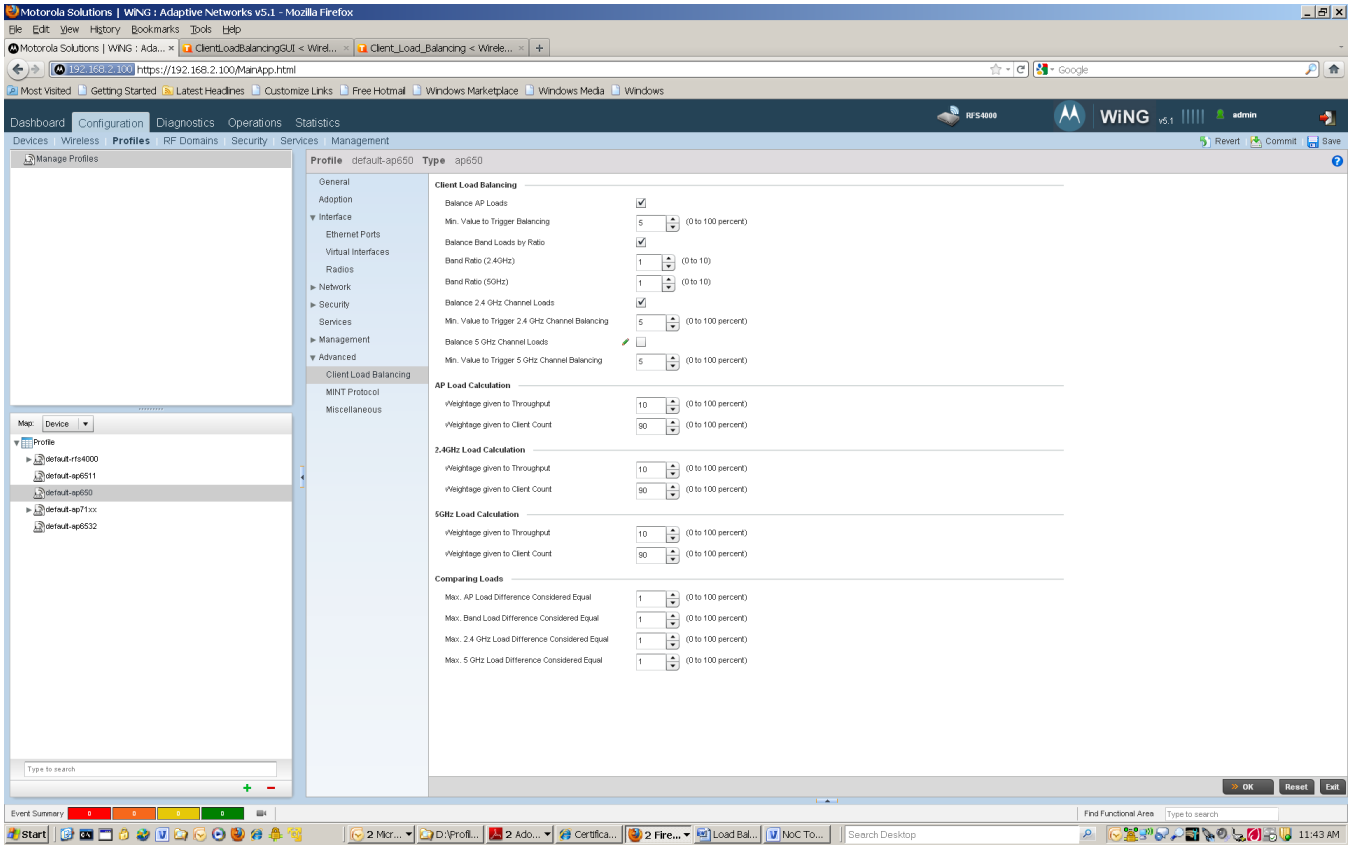


Figure 12

3.7 Noisy 2.4 Ghz Environment Use Case

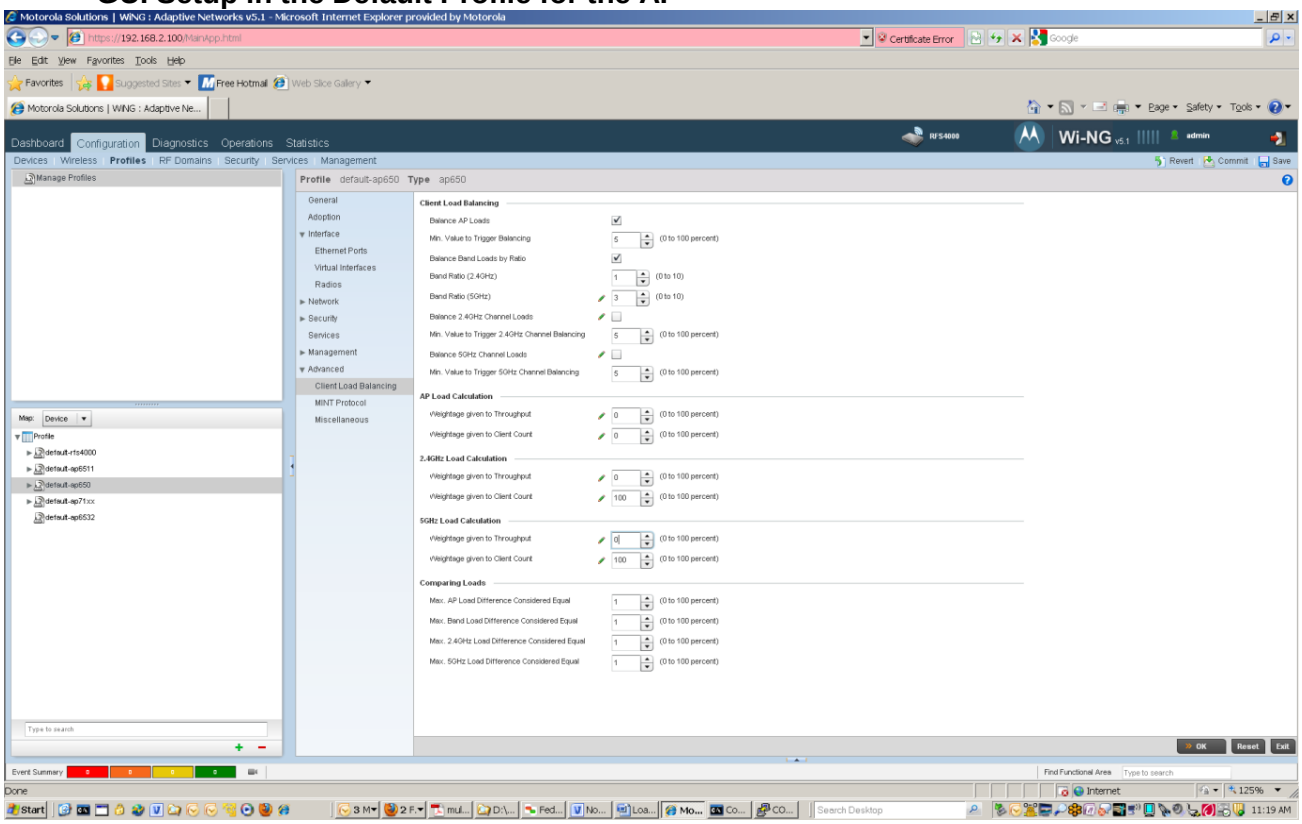
Scenario:
Exhibition hall; with approx 100-200 Wi-Fi users surfing internet and downloading email and surfing the web. The Wi-Fi users have mixed wireless nics that are capable of using 2.4 GHz and or 2.4 Ghz/5Ghz bands. Everyone is using BlueTooth and there are 2.4 Ghz Cameras broadcasting in the area. The 5 GHz band has more none overlapping channels and less interference so we would like to put more clients on that band.

1. The below configuration sets the band ratio to be 1:3, for every 1% load on 2.4ghz, there should be 3% load on 5ghz.
2. Configure the following on all APs:

```
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing balance-band-loads
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing band-ratio 2.4ghz 1
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing band-ratio 5ghz 3
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-ap-loads
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-channel-loads
2.4ghz
ap7131-DC7EA6(config-profile-default-ap7131)#no load-balancing balance-channel-loads 5ghz
```

```
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load client-weightage 100
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 2.4ghz-load throughput-weightage 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 5ghz-load client-weightage 100
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing 5ghz-load throughput-weightage 0
ap7131-DC7EA6(config-profile-default-ap7131)#load-balancing equality-margin band 0
ap7131-DC7EA6(config-profile-default-ap7131)#com
ap7131-DC7EA6(config-profile-default-ap7131)#
```

GUI Setup in the Default Profile for the AP



4. RF Switch Running Configuration:

The following shows the running configuration of the RFS7000 switch used to create this guide:

```
RFS4000# show running-config
!
! Configuration of RFS4000 version 5.1.0.0-074R
!
!
version 2.1
!
!
ip access-list BROADCAST-MULTICAST-CONTROL
 permit tcp any any rule-precedence 10
 permit udp any eq 67 any eq dhcpc rule-precedence 11
 deny udp any range 137 138 any range 137 138 rule-precedence 20
 deny ip any 224.0.0.0/4 rule-precedence 21
 deny ip any host 255.255.255.255 rule-precedence 22
 permit ip any any rule-precedence 100
!
ip access-list dhcp
!
mac access-list PERMIT-ARP-AND-IPv4
 permit any any type ip rule-precedence 10
 permit any any type arp rule-precedence 20
!
firewall-policy default
 no ip dos tcp-sequence-past-window
!
role-policy test
!
igmp-snoop-policy default
 no igmp-snooping
 no querier
 unknown-multicast-fwd
!
!
mint-policy global-default
!
wlan-qos-policy default
 qos trust dscp
 qos trust wmm
!
radio-qos-policy default
!
aaa-policy MD-AAA-Policy
 authentication server 1 onboard controller
!
captive-portal MD-Captive
 server host 192.168.2.100
 server mode centralized
 terms-agreement
 webpage internal agreement main-logo www.motorola.com
 use aaa-policy MD-AAA-Policy
!
wlan MD-RSF4000
 ssid MD-RSF4000
 vlan 1
 bridging-mode local
 encryption-type ccmp
 authentication-type none
 wpa-wpa2 psk 0 george01
 client-load-balancing
!
wlan cp
 description captive porta
 ssid cp
 vlan 1
 bridging-mode tunnel
 encryption-type none
 authentication-type none
 use captive-portal MD-Captive
 captive-portal-enforcement
!
smart-rf-policy MD-Smart-RF
 auto-assign-sensor
```

```
 channel-list 5GHz 36,40,44,48,52,56,136,140,149,153,157,161,165
!
device-categorization inocent\ neighbior
 mark-device neighboring client any
!
wips-policy md-wips
!
auto-provisioning-policy petes\ config
 adopt ap650 1 default-ap650 bld3 any
!
radius-group Engineers
 guest
 policy vlan 1
!
radius-group Lab-Admin
 policy vlan 1
 policy day mo
 policy day tu
 policy day we
 policy day th
 policy day fr
 policy day sa
 policy day su
!
radius-user-pool-policy LAB-Pool
 user pete password 0 12345678 group Lab-Admin
 user mike password 0 hume
!
radius-server-policy MD-TME-Radius-Policy
 use radius-user-pool-policy LAB-Pool
 no ldap-group-verification
!
dhcp-server-policy MDLAB
 dhcp-pool LabPool
  network 192.168.2.0/24
  address range 192.168.2.200 192.168.2.240
  default-router 192.168.2.100
!
!
management-policy default
 no http server
 https server
 ssh
 user admin password 1 196dab753782380ca3e8b5baaea455ceda5b89d8b25490e7d1b287673a35568c role
superuser access all
 user operator password 1 652cf90b270df3c233ef0b2efbf35ff535228c3917c07e8cda2811a943ef5ed1 role
monitor access all
 no snmp-server manager v2
 snmp-server community public ro
 snmp-server user snmpoperator v3 encrypted des auth md5 0 operator
 snmp-server user snmptrap v3 encrypted des auth md5 0 motorola
 snmp-server user snmpmanager v3 encrypted des auth md5 0 motorola
!
profile rfs4000 default-rfs4000
 autoinstall configuration
 autoinstall firmware
 use radius-server-policy MD-TME-Radius-Policy
 crypto isakmp policy default
 crypto ipsec transform-set default esp-aes-256 esp-sha-hmac
 interface radio1
 interface radio2
 interface up1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge2
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge3
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge4
  ip dhcp trust
  qos trust dscp
```

```
  qos trust 802.1p
 interface ge5
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface wwan1
 use firewall-policy default
 logging on
 service pm sys-restart
!
profile ap71xx default-ap71xx
 autoinstall configuration
 autoinstall firmware
 interface radio1
  data-rates gn
  wlan MD-RSF4000 bss 1 primary
  wlan cp bss 2 primary
  preamble-short
 interface radio2
  shutdown
  data-rates an
 interface radio3
 interface ge1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge2
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface vlan1
  ip address dhcp
  ip dhcp client request options all
 interface wwan1
 use firewall-policy default
 use captive-portal server MD-Captive
 logging on
 service pm sys-restart
!
profile ap6532 default-ap6532
 autoinstall configuration
 autoinstall firmware
 interface radio1
 interface radio2
 interface ge1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface vlan1
  ip address dhcp
  ip dhcp client request options all
 use firewall-policy default
 logging on
 service pm sys-restart
!
profile ap650 default-ap650
 autoinstall configuration
 autoinstall firmware
 interface radio1
 interface radio2
 interface ge1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface vlan1
  ip address dhcp
  ip dhcp client request options all
 use firewall-policy default
 logging on
 service pm sys-restart
!
profile ap6511 default-ap6511
 autoinstall configuration
 autoinstall firmware
 interface radio1
 interface up1
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface fe1
```

```
   ip dhcp trust
   qos trust dscp
   qos trust 802.1p
  interface fe2
   ip dhcp trust
   qos trust dscp
   qos trust 802.1p
  interface fe3
   ip dhcp trust
   qos trust dscp
   qos trust 802.1p
  interface fe4
   ip dhcp trust
   qos trust dscp
   qos trust 802.1p
  interface vlan1
   ip address dhcp
   ip address zeroconf secondary
   ip dhcp client request options all
  use firewall-policy default
  logging on
  service pm sys-restart
!
rf-domain bld3
 country-code us
!
rf-domain default
 country-code us
 use smart-rf-policy MD-Smart-RF
 channel-list dynamic
!
rfs4000 00-23-68-22-D0-70
 use profile default-rfs4000
 use rf-domain default
 hostname rfs4000-22D070
 license AP DEFAULT-6AP-LICENSE
 license ADSEC DEFAULT-ADV-SEC-LICENSE
 sensor-server 1 ip 192.168.2.9
 interface vlan1
  ip address 192.168.2.100/24
  ip dhcp client request options all
 use dhcp-server-policy MDLAB
 use captive-portal server MD-Captive
 logging on
 logging console warnings
 logging buffered warnings
!
ap71xx 00-23-68-93-11-34
 use profile default-ap71xx
 use rf-domain default
 hostname ap7131-931134
 sensor-server 1 ip 192.168.2.9
 interface radio1
  shutdown
  wlan MD-RSF4000 bss 1 primary
 use captive-portal server MD-Captive
!
ap71xx 00-23-68-96-FD-34
 use profile default-ap71xx
 use rf-domain default
 hostname ap71xx-0F4000
 interface radio1
  wlan MD-RSF4000 bss 1 primary
!
ap71xx 00-23-68-97-00-10
 use profile default-ap71xx
 use rf-domain default
 hostname ap71xx-970010
 interface radio1
  no shutdown
  channel 11
 interface radio2
  channel 149+
  power 6
  data-rates custom basic-54
  beacon dtim-period 2
  wlan MD-RSF4000 bss 1 primary
 use firewall-policy default
!
!
```

```
end
```

5. Reference Documentation:

Description	Location
Motorola RFS Series Wireless LAN Switches WiNG System Reference Guide	http://support.symbol.com
Motorola RF Switch CLI Reference Guide	http://support.symbol.com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