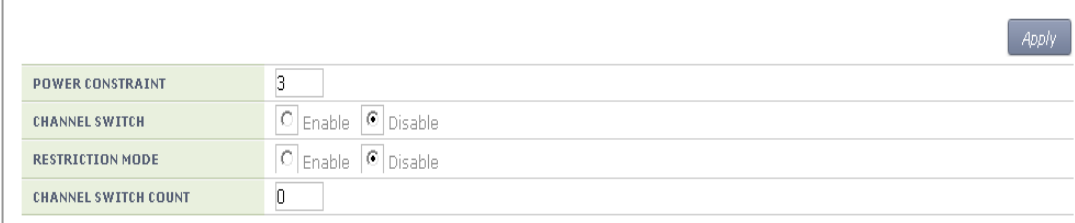


Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> → <802.11h> menu in the sub-menus.



POWER CONSTRAINT	3
CHANNEL SWITCH	☐ Enable ☒ Disable
RESTRICTION MODE	☐ Enable ☒ Disable
CHANNEL SWITCH COUNT	0

Figure 128. Configuring 802.11h

- POWER CONSTRAINT: Power constraint value (0-100)
- CHANNEL SWITCH: Enables channel switch announcement.
- RESTRICTION MODE: Configures transmission restriction.
- CHANNEL SWITCH COUNT: Enter a waiting time until channel switching announcement. Target Beacon Transmission Times (TBTT)

6.4 Country Code

You can use a country code to restrict the number of channels that can be used in an AP and the maximum transmission power of each channel.

Configuration using CLI

To configure the country code function, go to country mode first by executing the following command.

```
APC# configure terminal
APC/configure# country
APC/configure/country#
```

[Global Country Code Configuration]

If you configure a global country code, the country code can be specified to all the connected APs at the same time. The command is shown below.

- set-global [COUNTRY_CODE] [VALUE]

Parameter	Description
COUNTRY_CODE	Country code to configure
VALUE	Environment configuration (both/outdoor/indoor/none)

To check the configuration information, use the ‘show country global-config’ command.

[AP Country Code Configuration]

To configure a country code, execute the command as follows:

- set-ap [AP_ID] [COUNTRY_CODE] [VALUE]

Parameter	Description
AP_ID	AP ID (range: 1-500)
COUNTRY_CODE	Country code to configure
VALUE	Environment configuration (both/outdoor/indoor/none)

To check the configuration information, use the ‘show country ap-config [AP_ID]’ command.

[Editing Country Code]

You can add or delete an operation channel per country and change maximum transmission power per channel.

The command used to add or delete a channel per country is shown below.

- `add-channel [COUNTRY_CODE] [CHANNEL_NUMBER] [MAX_TX_POWER]`: Adds a channel.
- `del-channel [COUNTRY_CODE] [CHANNEL_NUMBER]`: Deletes a channel.

Parameter	Description
COUNTRY_CODE	Country code to configure
CHANNEL_NUMBER	Channel to configure.
MAX_TX_POWER	Maximum transmission power per channel.

The command used to change maximum transmission power value of a channel for a specific country code is shown below.

- `max-tx-power [COUNTRY_CODE] [CHANNEL_NUMBER] [MAX_TX_POWER]`

Parameter	Description
COUNTRY_CODE	Country code to configure
CHANNEL_NUMBER	Channel to configure.
MAX_TX_POWER	Maximum transmission power per channel.

To check the configuration information, use the ‘show country information [COUNTRY_CODE]’ command.

Parameter	Description
COUNTRY_CODE	Country code to configure

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <Country> menu in the sub-menus.

Configured Country Code

DEFAULT COUNTRY	Republic of Korea(KR)
DEFAULT ENVIRONMENT	Both
CONFIGURED COUNTRY #1	None
CONFIGURED ENVIRONMENT #1	Both
CONFIGURED COUNTRY #2	None
CONFIGURED ENVIRONMENT #2	Both
CONFIGURED COUNTRY #3	None
CONFIGURED ENVIRONMENT #3	Both

Edit Country Code

COUNTRY	Republic of Korea(KR)
MAX TX POWER LEVEL(5GHZ)	☒ 36 21 ☒ 40 21 ☒ 44 21 ☒ 48 21 ☐ 52 0 ☐ 56 0 ☐ 60 0 ☐ 64 0 ☐ 100 0 ☐ 104 0 ☐ 108 0 ☐ 112 0 ☐ 116 0 ☐ 120 0 ☐ 124 0 ☐ 128 0 ☒ 149 23 ☒ 153 23 ☒ 157 23 ☒ 161 23
MAX TX POWER LEVEL(2.4GHZ)	☒ 1 20 ☐ 2 0 ☐ 3 0 ☐ 4 0 ☒ 5 20 ☐ 6 0 ☐ 7 0 ☐ 8 0 ☒ 9 20 ☐ 10 0 ☐ 11 0 ☐ 12 0 ☒ 13 20

Figure 129. Country code window (1)

[Global Country Code Configuration]

- 1) Select a country in the DEFAULT COUNTRY drop-down list of Configured Country Code item. (Only an authenticated country code is supported.)
- 2) Select an environment in the DEFAULT ENVIRONMENT drop-down list.
 - Both: The terminal operation environment includes all the environments.
 - Outdoor: The terminal operation environment is outdoor.
 - Indoor: The terminal operation environment is indoor.
 - Non-country: A terminal is operating under non-country entity.
- 3) Click the <Apply> button to apply.

[Editing Country Code]

In the Edit Country Code item, you can add or delete an operation channel per country or change maximum transmission power per channel.

- 1) Select a country in the COUNTRY drop-down list of Edit Country Code item. (Only an authenticated country code is supported.)
- 2) Select a channel to add in the MAX TX POWER LEVEL (5 GHZ/2.4 GHZ) and enter maximum transmission power level (0-30).
- 3) In the MAX TX POWER LEVEL (5 GHZ/2.4 GHZ), unselect a channel to delete.
- 4) Click the <Apply> button to apply.

[AP Country Code Configuration]

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Access Points> → <General> menu in the sub-menus.

Back Apply	
AP PROFILE NAME	ap_1
AP NAME	AP_f4d9fb24d2c0
AP GROUP NAME	group2
AP MODE	Local AP
MAC ADDRESS	f4:d9:fb:24:d2:c0
MAP LOCATION	campus/INFO Bld / 4rd Floor
LOCATION	
COUNTRY	Republic of Korea(KR)
ENVIRONMENT	Both
IP ADDRESS	18.1.1.2
IP ADDRESS POLICY	☐ DHCP ☒ AP Priority (AP Followed) ☐ Static IP
IP ADDRESS	0 . 0 . 0 . 0
NETMASK	0 . 0 . 0 . 0
GATEWAY	0 . 0 . 0 . 0
ADMIN STATUS	☒ Up ☐ Down
PRIMARY CONTROLLER NAME	APC_007e37001fd0 (18.1.1.1)
SECONDARY CONTROLLER NAME	
TERTIARY CONTROLLER NAME	

Figure 130. Country code window (2)

After selecting COUNTRY and ENVIRONMENT, click the <Apply> button.

CHAPTER 7. WLAN Additional Services

In this chapter, how to configure WLAN additional services such as wireless terminal management, spectrum analysis, Call Admission Control (CAC) and Radio Resource Management (RRM), etc. is described.

7.1 Managing Wireless Terminal

7.1.1 Information Retrieval Functions

Configuration using CLI

Using the following command, you can retrieve the information of a wireless terminal being serviced by the APC.

- **show station summary:** When you enter this command, the summary information of all the wireless terminals connected to the APC is retrieved.
- **show station summary ap [AP_ID]:** The information of wireless terminals of each AP is retrieved.
- **show station summary bssid [BSSID_ID]:** The information of wireless terminals of each BSSID is retrieved.
- **show station summary wlan [WLAN_ID]:** The information of wireless terminals of each WLAN is retrieved.
- **show station detail [MAC_ADDRESS]:** The detail information of a wireless terminal that has a specific MAC address is retrieved.
- **show station stats ap-80211-stats [MAC_ADDRESS]:** The WI-FI statistics information of a wireless terminal is retrieved.
- **show station association history [MAC_ADDRESS]:** The connection history of a wireless terminal is retrieved.
- **show station stats debug all:** The debug statistics information of a wireless terminal is retrieved.
- **show station stats management_frame all:** The debug statistics information of a wireless terminal is retrieved.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Stations> menu in the sub-menus. The brief information of each station is displayed in the window.

To check the detail information of a specific station, click the MAC information of the specific station in the Stations window list.

										Show Filter List Export
MAC	USER NAME	IP ADDRESS	AP NAME	SSID	AP MAP LOC.	AUTH.	CYPHER	PROTOCOL	CHANNEL	
00:21:6a:17:62:cc	ilbum.park	10.85.126.6	AP15	uready	null / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36	
d8:31:cf:33:33:9c		0.0.0.0	AP80	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	44	
00:16:ea:a0:45:d4	essong	10.85.134.6	AP15	uready	null / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36	
78:59:5e:4c:dd:81		0.0.0.0	AP30	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	44	
b8:d9:ce:01:1a:4b	nwtest13	10.65.183.41	AP32	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48	
fc:c7:34:cc:1b:09		0.0.0.0	AP45	setup	null / IT_1floor	OPEN		802.11n(5GHz)	40	
d8:57:ef:cd:6b:fe	youngil.yu	10.65.181.93	AP27	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	44	
78:47:1d:c2:32:6d	sang.h.bae	10.65.140.53	AP43	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	44	
b0:d0:9c:80:69:36	yoondy	10.65.148.64	AP3	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	40	
d8:57:ef:c0:40:20	sksksk.lee	0.0.0.0	AP36	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48	
b0:d0:9c:8f:e7:05	nwtest53	10.65.181.129	AP32	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48	
5c:0a:5b:21:66:3e		10.65.7.51	AP63	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	48	
94:63:d1:aa:75:ab	ajou	10.65.160.216	AP15	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36	
cc:05:1b:63:1a:48	nwtest49	10.65.169.221	AP33	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48	
00:26:66:4b:ba:a6		10.65.6.116	AP64	setup	Digital City/IT Building / IT_1floor	OPEN		802.11n(5GHz)	40	
d0:17:6a:7f:53:50	jwjeong	10.65.189.168	AP59	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	48	
6c:83:36:9e:c0:80	jeongheon.kim	10.65.179.18	AP1	ureadymobile	Digital City/IT Building / IT_1floor	WPA2	CCMP	802.11n(5GHz)	36	

Figure 131. Information viewing window

7.1.2 Connection History related Configuration

You can configure maximum value for the connection history of a wireless terminal that will be managed in the APC.

- station number-of-assoc-tracking [COUNT]

Parameter	Description
COUNT	Maximum number of association tracking

7.2 Handover Management

The handover releases a connection with an existing AP and connects to a new AP. It provides seamless wireless LAN connection to a wireless terminal. The APC provides both 802.11 standard handover and Samsung's unique AirMove (Network Controlled Handover) handover.

7.2.1 Connection History Information

Use the 'show station association history [MAC_ADDRESS]' command to check the handover history information of a specific wireless terminal connected to the APC.

7.2.2 AirMove Configuration

Unlike the 802.11 standard handover where a wireless terminal performs the handover function by itself, the AirMove handover is performed by the collaboration between wireless terminals compatible with the APC. Therefore, the packet loss or handover time is optimized. Some Samsung smartphones such as Galaxy S2 or S3, etc. provide the AirMove function.

Configuration using CLI

To configure the AirMove related function, execute the following command to go to the handover configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# handover
```

[Handover Option Configuration]

- handover [OPTION] [OPTION_DETAIL]

AirMove Configuration Item	Description
operation mode	Operation mode configuration - OPTION: opmode - OPTION_DETAIL: Each mode (VoIP/STA)
buffered-forwarding mode	Configures whether to use the buffered forwarding function. - OPTION: fwd-buffering - OPTION_DETAIL: Enable/Disable
decision delta	Configures the threshold of RSSI difference between a serving AP and a target AP. - OPTION: decision-delta - OPTION_DETAIL: Threshold (dBm)
scan time on channel	Configures scanning time of a wireless terminal per channel. - option: scan-time-channel - OPTION_DETAIL: Time (ms)

AirMove Configuration Item	Description
scan interleaving time	Configures the scanning interval of a wireless terminal. - OPTION: scan-time-interleave - OPTION_DETAIL: Time (ms)
Service time in scanning period	Configures a period when an wireless terminal transmits/receives an actual data traffic after scanning. - OPTION: scan-time-service - OPTION_DETAIL: Time (ms)
scan report level	Configures the threshold of a scan report that will be transmitted from an AP to the APC. - OPTION: scan-report-level - OPTION_DETAIL: scan report level (dBm)
Numbers of handover scan attempts per channel	Configures the scanning times of a wireless terminal per channel. - OPTION: number-of-proreq - OPTION_DETAIL: Number of times
Number of channels for which scan is attempted	Configures the number of channels a wireless terminal will scan at a time. - OPTION: number-of-channel - OPTION_DETAIL: Number of channels
scan trigger level	RSSI intensity at which a wireless terminal starts channel scanning - OPTION -trigger-level - OPTION_DETAIL: RSSI (dBm)
station decision delta	Configures the threshold of RSSI difference, measured in a wireless terminal, between a serving AP and a target AP. If the threshold is exceeded, a wireless terminal performs its handover. - OPTION: station-decision-delta - OPTION_DETAIL: Threshold (dBm)

An example of using the command for each configuration item is as follows:

```
WEC8500/configure# handover opmode APP
WEC8500/configure# handover buffered-forwarding enable
WEC8500/configure# handover decision-delta 10
WEC8500/configure# handover scan-time-channel 10
WEC8500/configure# handover scan-time-interleave 1000
WEC8500/configure# handover scan-time-service 200
WEC8500/configure# handover scan-report-level -90
WEC8500/configure# handover number-of-proreq 3
WEC8500/configure# handover number-of-channel 4
WEC8500/configure# handover scan-trigger-level -65
WEC8500/configure# handover station-decision-delta 10
```

To check the configuration information, use the 'show handover configuration' command.

[AirMove Enable/Disable Configuration]

The AirMove is enabled by default, so use the following command to disable it.

- no handover mode NCHO

To check the configuration information, use the ‘show handover configuration’ command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Mobility Management> → <Handover> menu in the sub-menus.

Network Controlled Handover	
OPERATION MODE	STA ▼
BUFFERED FORWARDING	☒ Enable ☐ Disable
SCAN TRIGGER LEVEL (DBM)	-70
SCAN REPORT LEVEL (DBM)	-120
SCANNING TIME FOR ONE CHANNEL (MS)	5
SERVICE TIME DURING SCANNING (MS)	100
SCANNING INTERVAL TIME (MS)	1000
NUMBER OF PROBE REQUESTS	2
NUMBER OF SCANNING CHANNELS	4
VALUE OF HANDOVER DECISION DELTA	5
VALUE OF STATION ROAM DELTA	15

Figure 132. Handover window

You can enable or disable the intra handover function by selecting Enable/Disable in the INTER APC HAND-OVER item. After configuring a value, click the <Apply> button to apply.

7.2.3 Inter APC Handover Configuration

The Inter APC handover is a technology that supports handover among several APC systems. Depending on network configuration, the Inter APC L3 handover and Inter APC L2 handover services are provided.

By using the clustering service, you can configure several APC systems into a single group.

Configures whether to use the Inter APC handover.

The default value of Inter APC handover is not configured.

- handover inter-apc enable

To check the configuration information, use the ‘show handover configuration’ command.

7.3 Call Admission Control (CAC) Configuration

The CAC function is provided to protect existing calls from the calls incoming to a wireless LAN. The APC does not allow an additional call when maximum allowed number of calls per radio is reached.

7.3.1 SIP ALG Configuration

To make Call Admission Control (CAC) working, the Session Initiation Protocol (SIP) Application Layer Gateway (ALG) function must be enabled. The SIP ALG analyzes a SIP packet and forwards VoIP communication status to the CAC.

Configuration using CLI

The SIP ALG related commands are as follows:

- sipalg enable: Configures whether to enable the SIP ALG function.
- sipalg sip-error-resp-enable(SIP ERROR RESPONSE): Configures how to reject a received call when maximum allowed number of calls is exceeded.
 - Disable (default): No response for a received call connection request message. The received message is not forwarded to the called side.
 - Enable: Rejects by transmitting 503 Service Unavailable SIP response for a received call connection request message. The received message is not forwarded to a called side.
- sipalg sip-detect-long-call-enable (SIP DETECT LONG DURATION CALL): Configures whether to delete an internal resource by detecting abnormal remaining calls. The values configured in the below two timers are used to judge an abnormal remaining call.
 - SIP No Answer Timeout (SIP Long Call Setuptimer): Maximum allowed time of the status before call connection (range: 300-3600, default: 600)
 - SIP Connect Timeout (SIP Long Call EstblshTimer): Maximum allowed time for a connected call (range: 3600-86400, default: 7200)
- sipalg sip-long-call-timeout (SIP NO ANSWER TIMEOUT, SIP CONNECT TIMEOUT): Configures a time required to judge an abnormal remaining call and enter SIP No Answer Timeout and SIP Connect Timeout in order.

To enable SIP ALG, execute the command as follows:

- 1) Go to configure mode of CLI.

```
APC# configure terminal
```

2) Enable the SIP ALG.

```
APC/configure# sipalg enable
```

3) To check the configuration information, use the 'show sipalg configuration' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <General> menu in the sub-menus.

AP Management

IP ADDRESS: 18 . 1 . 1 . 1

INTERFACE: vlan1.18

Repeater Service

INTERFACE GROUP: -----

SERVICE: ☒ Enable ☐ Disable

SIP ALG

SIP ALG (VOIP AWARE): ☐ Enable ☒ Disable

SIP ERROR RESPONSE: ☐ Enable ☒ Disable

SIP DIRECT LONG DURATION CALL: ☒ Enable ☐ Disable

SIP NO ANSWER TIMEOUT (SEC): 600

SIP CONNECT TIMEOUT (SEC): 7200

Backup APC List

INDEX	APC NAME	IP ADDRESS
1	APC_007e37001fd0	18.1.1.1
2	APC_f4d9fb236c01	18 . 1 . 1 . 2
3	APC_f4d9fb236e01	18 . 1 . 1 . 3

Figure 133. SIP ALG configuration window

After configuring SIP ALG that is a voice CAC related configuration in the SIP ALG, click the <Apply> button.

7.3.2 Voice CAC Configuration

To protect existing calls, the voice CAC function configures maximum allowed number of calls and rejects any call request when the maximum number is exceeded. You can configure the number of marginal voice calls for handover.

Configuration using CLI

For voice CAC configuration, execute the command as follows:

- 1) Go to configure → voice CAC mode of a wireless section of CLI.

```
APC# configure terminal
APC/configure# [80211a/80211bg] cac voice
APC/configure/80211a/cac/voice#
```

- 2) Enable or disable the voice CAC function.
 - acm [MODE]

Parameter	Description
MODE	Enables or disables the voice CAC function - enable: Enable - disable: Disable

- 3) Configure maximum allowed number of voice calls.
 - max-calls [VALUE]

Parameter	Description
VALUE	Maximum allowed number of voice calls.

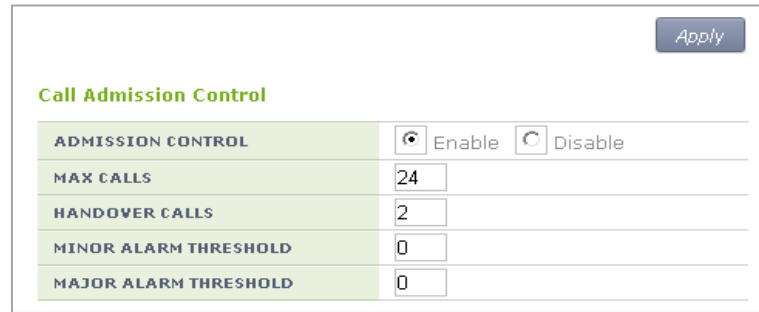
- 4) Configure the number of marginal voice calls considering the handover.
 - reserved-ho-calls [VALUE]

Parameter	Description
VALUE	Number of marginal voice calls considering the handover

- 5) To check the configured voice CAC information, use the ‘show [80211a | 80211bg] cac voice configuration’ command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> or <802.11b/g/n> → <Admission Control> menu in the sub-menus.



Call Admission Control	
ADMISSION CONTROL	☒ Enable ☐ Disable
MAX CALLS	24
HANDOVER CALLS	2
MINOR ALARM THRESHOLD	0
MAJOR ALARM THRESHOLD	0

Figure 134. Admission control configuration of 802.11a/n

After configuring the below item in the Call Admission Control, click the <Apply> button.

- **ADMISSION CONTROL:** Configures the CAC function.
- **MAX CALLS:** Maximum number of allowed calls (range: 2-30)
- **HANDOVER CALLS:** Number of marginal calls considering handover (range: 0-10)
The number of allowed calls is MAX CALLS-HANDOVER CALLS.
- **MINOR ALARM THRESHOLD:** Configures a threshold that generates a Minor alarm (range: 0-15)
Enter '0' to prevent the alarm.
- **MAJOR ALARM THRESHOLD:** Configures a threshold that generates a Major alarm (range: 0-30)
Enter '0' to prevent the alarm.

7.3.3 Video CAC Configuration

To protect existing video calls, the video CAC function configures the maximum allowed number of video calls and rejects any call request when the maximum number is exceeded. You can configure the number of marginal calls for handover.

Configuration using CLI

For video CAC configuration, execute the command as follows:

- 1) Go to configure → video CAC mode of a wireless section of CLI.

```
APC# configure terminal
APC/configure# [80211a/80211bg] cac video
APC/configure/80211a/cac/video#
```

- 2) Enable or disable the video CAC function.

- acm [MODE]

Parameter	Description
Mode	Enables or disables the CAC function - enable: Enable - disable: Disable

- 3) Select a video CAC method.

- method [method]

Parameter	Description
method	Select a video CAC method (static/chan_util) - static: Based on video calls - chan_util: Based on channel usage

- 4) Configure the maximum allowed number of calls.

- max-calls [VALUE]

Parameter	Description
VALUE	Maximum allowed number of video calls

- 5) Configure the number of marginal calls with consideration for handover.

- reserved-ho-calls [VALUE]

Parameter	Description
VALUE	Number of marginal calls with consideration for handover

6) Configure the maximum allowed usage of channels.

- max-chan-util [VALUE]

Parameter	Description
VALUE	Maximum allowed usage of channels

7) Configure the usage of marginal channels with consideration for handover.

- reserved-ho-chan-util [VALUE]

Parameter	Description
VALUE	Usage of marginal channels with consideration for handover

8) You can view the video CAC information you configured by executing the 'show [802.11a | 802.11bg] cac video configuration' command.

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio>→ <802.11a/n> or <802.11b/g/n> → <Admission Control> in the submenus.

Video Call Admission Control	
ADMISSION CONTROL	☐ Enable ☒ Disable
METHOD	☒ Static ☐ Channel Utilization
MAX CALLS	6
HANDOVER CALLS	0
MAX CHANNEL UTILIZATION (%)	10
HANDOVER CHANNEL UTILIZATION (%)	0

Figure 135. 802.11a/n Admission Control Configuration Window

After configuring the items below in the Call Admission Control, click the <Apply> button.

- ADMISSION CONTROL: Configure the video CAC function
- METHOD: Select a video CAC method (static/chan_util)
- MAX CALLS: Maximum allowed number of calls (range: 2-30)
- HANDOVER CALLS: Number of marginal calls with consideration for handover (range: 0-8)
The maximum allowed number of calls becomes MAX CALLS-HANDOVER CALLS.
- MAX CHANNEL UTILIZATION (%): Maximum allowed usage of channels (range: 5-85)
- HANDOVER CHANNEL UTILIZATION (%): Usage of marginal channels with consideration for handover (range: 0-25)

7.4 Radio Resource Management (RRM)

RRM performs automatic setup function for AP's channel and Tx Power. RRM is functionally divided into Dynamic Channel Selection (DCS), Dynamic Power control (DPC), and Coverage Hole Detection and Control (CHDC). The DCS automatically sets the channels of the APs. The DPC DCS automatically sets the Tx Power of the AP. The CHDC adjusts the Tx Power when Coverage Hole occurs.

7.4.1 RRM Configuration

This section describes the settings for using the RRM function and the cluster configuration.

Configuration using CLI

To configure each function, execute the command as follows:

- 1) Go to configure → rrm configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# rrm
```

- 2) Enable RRM. The 'no' parameter is used to disable RRM. DCS, DPC and CHDC, which are functions of RRM, can run only if the RRM is enabled.

```
WEC8500/configure/rrm# enable
```

- 3) In the cluster environment, set the same RF Group Name to all the connected APCs. A name must consist of up to 15 characters.

```
WEC8500/configure/rrm# rf-group-name [Name]
```

- 4) Configure priorities between the neighbor list of each Wlan. Go to the wireless section the configuration of which you want to change and then enter neighbor-list setup mode. You can select between rssi and handover, and the default value is rssi.

```
WEC8500/configure/rrm# 80211a
WEC8500/configure/rrm/80211a# neighbor-list
WEC8500/configure/rrm/80211a/neighbor-list# wlan-neighbor-priority
rssi/handover
```

- 5) To check the configured information, use the 'show rrm config-summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n/ac> or <802.11b/g/n> → <RRM> menu in the sub-menus. Enable or disable the RRM service at the top of the menu. The RRM can be set in either 802.11a/n/ac screen or 802.11b/g/n screens. Configure priorities between the neighbor list of each Wlan at the bottom of the menu.

Radio Resource Management

SERVICE ¹ ☒ Enable ☐ Disable

RF GROUP NAME

Neighbor List Management

WLAN NEIGHBOR PRIORITY ☐ RSSI ☒ Handover

Figure 136. RRM configuration window

7.4.2 DPC Configuration

This section describes the setting options of the DPC function which automatically sets the Tx Power of the AP.

Configuration using CLI

- 1) Go to configure → rrm configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# rrm
```

- 2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

- 3) Set the DPC function. Enter the dpc setting mode and set it to 'enable'. Use the 'no' parameter to disable the mode. The function operates only when the RRM is set to Enable.

```
WEC8500/configure/rrm/80211a# dpc
WEC8500/configure/rrm/80211a/dpc# enable
```

- 4) Execute the following command to change the Received Signal Strength Indication (RSSI) threshold for neighbor AP. The default value is -70 (dBm).

```
WEC8500/configure/rrm/80211a/dpc# rssi-threshold [value]
```

- 5) If you need to change the RSSI threshold for the station, execute the following command. The default value is -70 (dBm). This parameter is used only in the DCS-DPC joint algorithm.

```
WEC8500/configure/rrm/80211a/dpc# rssi-threshold-for-stn [value]
```

- 6) Execute the following command to change the execution interval. The default value is 600 (seconds).

```
WEC8500/configure/rrm/80211a/dpc# periodic-interval [value]
```

- 7) Execute the following command to change the Tx Power range which is automatically set by DPC. The default minimum is 16 for 80211a and 12 for 80211b. The default maximum is 20 for both 80211a and 80211b.

```
WEC8500/configure/rrm/80211a/dpc# txPower min [value] max [value]
```

- 8) Check the settings using the 'show rrm config-summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n/ac> or <802.11b/g/n> → <RRM> menu in the sub-menus.

Enable or disable the DPC in the SERVICE field in Dynamic TX Power Control.

Dynamic TX Power Control	
SERVICE ²	☒ Enable ☐ Disable
RSSI THRESHOLD(DBM)	-70
INTERVAL(SEC.)	600
TX POWER MINIMUM	5
TX POWER MAXIMUM	20

Figure 137. DPC settings

7.4.3 DCS Configuration

This section describes the setting options of the DCS function which automatically sets the channel of the AP.

Configuration using CLI

- 1) Go to configure → rrm configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# rrm
```

- 2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

- 3) Set the DCS function. Enter the dcs setting mode and set it to 'enable'. Use the 'no' parameter to disable the mode. The function operates only when the RRM is set to Enable.

```
WEC8500/configure/rrm/80211a# dcs
WEC8500/configure/rrm/80211a/dcs# enable
```

- 4) Configure whether to apply the DCS-DPC joint algorithm. If the 'no' parameter is selected, the configuration is cleared.

```
WEC8500/configure/rrm/80211a/dcs# joint-algo-enable
```

- 5) Execute the following command to change the execution interval. The default value is 120 (seconds).

```
WEC8500/configure/rrm/80211a/dcs# periodic-interval [value]
```

- 6) Execute the following command to change the Channel Utilization threshold. The default value is 80 (%).

```
WEC8500/configure/rrm/80211a/dcs# channel-utilization-threshold [value]
```

- 7) Execute the following command to change the My Utilization threshold. The default is 10 (%) for 802.11a and 40 (%) for 802.11b.

```
WEC8500/configure/rrm/80211a/dcs# my-utilization-threshold [value]
```

- 8) Execute the following command to set the anchor time. The default value is start time 4, end time 5. If both start time and end time are set to the same time, Anchor Run function is disabled.

```
WEC8500/configure/rrm/80211a/dcs# anchor-time start [value] end [value]
```

- 9) Execute the following command to change the channels that is automatically set by the DCS. Use the 'no' parameter to disable the mode.

```
WEC8500/configure/rrm/80211a/dcs# channel [value]
```

- 10) Execute the following command to use the Delayed Channel Change function. To disable the configuration, enter the 'no' parameter. The default is Disable. The Delayed Channel Change function delays channel change instead of changing it immediately when a channel becomes busy due to channel utilization. If the anchor time is not configured, the default value is used at 4 o'clock.

```
WEC8500/configure/rrm/80211a/dcs# delayed-channel-change
```

- 11) To use the Aware Option function, execute the following command. To disable the configuration, enter the 'no' parameter. The Aware Option does not change a channel if there is a specific condition. Therefore, three functions are provided based on whether there is a voice, the association of a station, or traffic in a station. The default is that only the Voice Aware function is enabled. The Station Aware function specifies the number of stations at the same time.

```
WEC8500/configure/rrm/80211a/dcs# aware-option voice
WEC8500/configure/rrm/80211a/dcs# aware-option station [station count]
WEC8500/configure/rrm/80211a/dcs# aware-option traffic
```

- 12) Check the settings using the 'show rrm config-summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n/ac> or <802.11b/g/n> → <RRM> menu in the sub-menus. Enable or disable the DCS in the SERVICE field in Dynamic Channel Selection.

Dynamic Channel Selection	
SERVICE ³	☒ Enable ☐ Disable
INTERVAL(SEC.)	120
CHANNEL UTILIZATION THRESHOLD(%)	80 My Utilization Threshold(%) 10
INTERFERENCE LEVEL THRESHOLD(%)	80
DELAYED CHANNEL CHANGE ⁴	☐ Enable ☒ Disable
AWARE OPTION	☒ Voice ☐ Traffic ☐ Station Association Count 1
ANCHOR TIME START	4 O'clock
ANCHOR TIME END	5 O'clock
CHANNELS	☒ 36 ☒ 40 ☒ 44 ☒ 48 ☒ 149 ☒ 153 ☒ 157 ☒ 161

Figure 138. DCS settings

7.4.4 CHDC Configuration

This section describes the setting options of the CHDC function which adjusts the Tx Power when Coverage Hole occurs.

Configuration using CLI

- 1) Go to configure → rrm configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# rrm
```

- 2) Go to the wireless section where you want to change the settings.

```
WEC8500/configure/rrm# 80211a
```

- 3) Set the CHDC function. Enter the chdc setting mode and enable it Use the 'no' parameter to disable the mode. The function operates only when the RRM is enabled.

```
WEC8500/configure/rrm/80211a# chdc
WEC8500/configure/rrm/80211a/chdc# enable
```

- 4) To use the pre-alarm function, operator can collect the statistics from an AP. After entering into the chdc configuration mode, complete configuration (statsCollectEnable). To disable the configuration, enter the 'no' parameter. All the functions for pre-alarm are available only when both RRM and CHDC are enabled.

```
WEC8500/configure/rrm/80211a/chdc# statsCollectEnable
Success: DBI set for DPC 11A Stats collect Enable : 1
```

- 5) If a coverage hole is estimated from the statistics for the pre-alarm function, a warning can be transmitted. After entering into the chdc configuration mode, complete configuration (statsWarningEnable). To disable the configuration, enter the 'no' parameter.

```
WEC8500/configure/rrm/80211a/chdc# statsWarningEnable
Success: DBI set for DPC 11A Stats Warning Enable : 1
```

- 6) If a coverage hole is estimated from the statistics for the pre-alarm function, CHDC can be executed. After entering into the chdc configuration mode, complete configuration (statsActionEnable). To disable the configuration, enter the 'no' parameter.

```
WEC8500/configure/rrm/80211a/chdc# statsActionEnable
Success: DBI set for DPC 11A Stats Action Enable : 1
```

- 7) Configure the minimum value of statistics Failed Client Count for the pre-alarm function. It can be 1~75.

```
WEC8500/configure/rrm/80211a/chdc# min-failed-client-count 70
CHDC 802.11a : Set Minimum Failed Client Count Success
```

- 8) Configure the percentage of statistics Failed Client Count for the pre-alarm function. It can be 10~35.

```
WEC8500/configure/rrm/80211a/chdc# percent-failed-client-count 20
Success: CHDC 802.11a : Set Percentage of Failed Client Count Success
```

- 9) Configure the threshold of RSSI that will be added to the statistics Failed Client Count for the pre-alarm function. Configure it for Voice Frame and Data Frame. It can be -90~-20 (dB).

```
WEC8500/configure/rrm/80211a/chdc# rssi-threshold data -75
Success: CHDC 802.11a : Set RSSI THRESHOLD(-75) Successful

WEC8500/configure/rrm/80211a/chdc# rssi-threshold voice -75
Success: CHDC 802.11a : Set RSSI THRESHOLD(-75) Successful
```

- 10) Configure a value that requests an interval to an AP to collect statistics for the pre-alarm function. The default is 120 seconds and it can be 30~3600 seconds.

```
WEC8500/configure/rrm/80211a/chdc# statsCollectInterval 60
This Value: 60 is already set
```

- 11) Configure the minimum value of the idle time-out count of statistics for the pre-alarm function. This parameter can have a value ranging from 0 to 1,000.

```
WEC8500/configure/rrm/80211a/chdc# min-idle-timeout-count 10
CHDC : Set Minimum IdleTimeOutCnt Success
```

- 12) To check the configured information, execute the 'show rrm config-summary' command. In the 'Coverage Hole Detection and Control', operator can check the current status of all the configured values.

```
WEC8500/configure/rrm/80211a/chdc# show rrm config-summary

RRM Status ..... Enabled
Rf Group Name ... Group

                        80211a/n      80211b/g/n
Dynamic Power Control -----
DPC Enable              .. Enabled    Enabled
Periodic Interval       .. follow DCS follow DCS
RSSI Threshold for Neighbor AP .. -70    -70
RSSI Threshold for Station .. -70    -70
TX Power Min. - Max.    .. 17 - 20    14 - 20
Minimum Number of AP    .. 2        2
Elapsed Time After Last Run .. 36     7
Dynamic Channel Selection -----
DCS Enable              .. Enabled    Enabled
DCS-DPC Joint Algorithm Enable .. Enabled    Enabled
Periodic Interval       .. 60        60
Anchor Time Start       .. 0         0
Anchor Time Stop        .. 23        23
Interference Level Threshold .. 80     80
Channel Utilization Threshold .. 99     99
My Utilization Threshold .. 10       40
Delayed Channel Change   .. Enabled    Enabled
Aware-Option: Voice Call .. Enabled    Enabled
Aware-Option: Traffic    .. Enabled    Enabled
Aware-Option: Station Assoc. .. Enabled    Enabled
Station Count for Station Aware .. 1      1
Elapsed Time After Last Run .. 36     7
Coverage Hole Detection and Control -----
CHDC Enable             .. Enabled    Enabled
Statistics Collect Enable .. Enabled    Enabled
Statistics Warning Enable .. Enabled    Enabled
```


Statistics Action Enable	.. Enabled	Enabled
RSSI Voice Threshold	.. -75	-75
RSSI Data Threshold	.. 80	-30
Minimum Failed Client Count	.. 1	1
Percentage Min. Failed Count	.. 25	25
Minimum Idle time-out Count	.. 10	10
Statistics Collect Interval	.. 120	60
Neighbor List Management	-----	-----
WLAN Neighbor Priority	.. Handover	Handover

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n/ac> or <802.11b/g/n> → <RRM> menu in the sub-menus.

In the Coverage Hole Detection Control window, operator can enable or disable the CHDC and configure the values using the same functions as the CLI.

Coverage Hole Detection Control	
SERVICE ⁵	☒ Enable ☐ Disable
STATISTICS COLLECTION	☒ Enable ☐ Disable
NOTIFY TRAP WARNING MESSAGE	☒ Enable ☐ Disable
STATISTICS ACTIVATE POWER CONTROL	☒ Enable ☐ Disable
PERCENTAGE OF FAILED CLIENT COUNT	25
MINIMUM RSSI THRESHOLD FOR VOICE TRAFFIC(DBM)	-75
MINIMUM RSSI THRESHOLD FOR DATA TRAFFIC(DBM)	-80
MINIMUM FAILED CLIENT COUNT	1
TIME INTERVAL	120
MINIMUM IDLE TIME-OUT COUNT	10

Figure 139. CHDC settings

7.4.5 Sleeping Cell Detection

This is a function that allows the APC to detect the statuses of APs that are not performing basic functions and transmit an alarm/warning.

Configuration using CLI

- 1) Enable/Disable: Configure whether the silent alarm detection function will be performed. (Enable: function performing, Disable: function not performing)

```
WEC8500/configure/rrm# sleep-cell-detect
WEC8500/configure/rrm/sleep-cell-detect# enable
```

- 2) APC Threshold: Minimum number of connected users throughout the whole APC for sleeping cell detection.

If the total number of STA associations is equal to or smaller than the APC threshold, the day is judged as a holiday and consequently the sleeping cell detection is not performed.

```
WEC8500/configure/rrm/sleep-cell-detect# apc-threshold
```

- 3) AP Threshold: Minimum number of users connected to an AP for sleeping cell detection. If the number of STA associations of an AP is equal to or smaller than the AP threshold, a silent alarm occurs.

```
WEC8500/configure/rrm/sleep-cell-detect# ap-threshold
```

- 4) PERIOD_1ST: Start and end times of sleeping cell detection for Specific Period 1. (For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/sleep-cell-detect# period_1st
```

- 5) PERIOD_2ND: Start and end times of sleeping cell detection start for Specific Period 2. (For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/sleep-cell-detect# period_2nd
```

- 6) PERIOD_ALL: Start and end times of sleeping cell detection for periods other than Specific Periods 1 and 2.

```
WEC8500/configure/rrm/sleep-cell-detect# period_all
```

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <Advanced> → <Sleeping Cell Detection> in the submenus.

Radio > Advanced > Sleeping Cell Detection	
SERVICE	☒ Enable ☐ Disable
APC THRESHOLD ¹	1
AP THRESHOLD ²	10
Period (1st)	
RANGE (UNIT:15MIN) ³	1
START HOUR	8 O'clock
END HOUR	21 O'clock
Period (2nd)	
RANGE (UNIT:15MIN) ³	2
START HOUR	0 O'clock
END HOUR	4 O'clock
Period (ALL)	
RANGE (UNIT:15MIN)	2

7.4.6 Energy Saving

- The purpose is to reduce the power consumption of the APC by turning off the RF radios of APs without any connected STA at a specific time when the number of STAs connected to the APC drops drastically.
- The APs of the APC are divided into the active group in which APs are always in operation and the standby group in which the RF radios of APs are turned off. When the standby group (energy saving group) is defined, the APC recognizes the remaining APs as the active group. You can define up to 10 groups.

Configuration using CLI

- 1) Enable/Disable: Configure whether the energy saving function will be performed. (Enable: function performing, Disable: function not performing)

```
WEC8500/configure/rrm# energy-saving-group 1
WEC8500/configure/rrm/energy-saving-group 1# enable
```

- 2) APC Threshold: Maximum number of connected users throughout the whole APC for energy saving detection.
If the total number of STA associations is equal to or smaller than the APC threshold, the day is judged as a holiday and the energy saving function is performed according to the times set for weekends.

```
WEC8500/configure/rrm/energy-saving-group 1# apc-threshold
```

- 3) WEEKDAY: Start and end times of energy saving for weekdays.
(For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/energy-saving-group 1# weekday
```

- 4) WEEKDEND: Start and end times of energy saving for weekends.
(For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/energy-saving-group 1# weekend
```

- 5) ADD-AP: Add AP members to the energy saving group.

```
WEC8500/configure/rrm/energy-saving-group 1# add-ap
```

6) DEL-AP: Delete AP members from the energy saving group.

```
WEC8500/configure/rrm/energy-saving-group 1# del-ap
```

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <Advanced> → <Energy Saving Groups> → <GROUP NAME> in the submenus.

Samsung Wireless Enterprise Monitor | Configuration | Administration | Help User [samsung] | Logout

Controller > Radio > Advanced > Energy Saving Groups > Edit

GROUP NAME: save1

SERVICE: ☒ Enable ☐ Disable

APC THRESHOLD ¹: 0

WEEKDAY

START HOUR: 21 O'clock

END HOUR: 8 O'clock

WEEKEND

START HOUR: 0 O'clock

END HOUR: 0 O'clock

AP COUNT: 5

Current Filter: None

Selected APs

	AP PROFILE NAME	AP NAME	MAC ADDRESS	IP ADDRESS
☐	ap_71	AP_707172737c60	70:71:72:73:7c:60	201.1.1.168
☐	ap_72	AP_707172737c80	70:71:72:73:7c:80	201.1.1.169
☐	ap_73	AP_707172737ca0	70:71:72:73:7c:a0	201.1.1.170
☐	ap_74	AP_707172737cc0	70:71:72:73:7c:c0	201.1.1.171
☐	ap_75	AP_707172737ce0	70:71:72:73:7c:e0	201.1.1.172

7.5 Location Tracking

The APC tracks the location information of several terminals in a wireless LAN network based on the wireless data collected from W-EP wireless LAN APs.

To configure the location tracking function, execute the command as follows:

- 1) Go to configure → locationtrack configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure # locationtrack
WEC8500/configure/locationtrack #
```

- 2) Configure the location tracking function.

```
WEC8500/configure/locationtrack # enable
```

- 3) To check the configured information, execute the ‘show locationtrack config’ command.

```
WEC8500/configure/locationtrack # show locationtrack config
Location tracking enable.....: Enabled
Algorithm type.....: 4
Expiry date of history files: 0
```

- 4) Configure the MAC address of a wireless terminal for which the tracking function will be executed.

- station [MAC_ADDRESS]

- 5) To check the location information of a wireless terminal to track, execute the ‘show locationtrack station’ command.

```
WEC8500/configure/locationtrack # show locationtrack station
No.  stationId station_MAC_Addr  ap_MAC_Addr      (staX,staY)
lastTime(+)
-----
-----
1          1 f4:d9:fb:34:20:60 f4:d9:fb:34:20:60 (2432,1947)
0(1374022070)
```

7.6 Spectrum Analysis

A non-802.11 device such as microwave oven, bluetooth, or Closed Circuit Television (CCTV), etc. deteriorates data transmitting/receiving performance because it causes interference in a wireless LAN environment. As a function that measures surrounding interference, the spectrum analysis analyzes wireless or Radio Frequency (RF) signals to resolve interference problem instantly.

7.6.1 Retrieving Spectrum Analysis Data

The spectrum analysis function of APC provides the following data.

- Sample report: Wireless capture data converted into Fast Fourier Transform (FFT)
- Duty cycle report: Channel utilization rate
- Interference report: Interference signal information

The FFT report provides the information of an AP and maximum 13 available channels and also maximum/minimum values of Received Signal Strength Indicator (RSSI) for each channel. The duty cycle report provides AP information and affected channel information. In addition, it provides duty cycle transmission data that indirectly provides channel utilization rate.

The interference report provides AP information, affected channel, or configuration information of an interferer and also interference information (RSSI or maximum/minimum frequency of an interference signal) in real-time.

Configuration using CLI

By using the following command, you can check each data.

- `show spectrum-analysis report [DATA] ap [AP_ID]`

Parameter	Description
DATA	Spectrum analysis data type (sample/duty_cycle/interference)
AP_ID	AP ID (range: 1-500)

An example of command execution and its execution result are as follows:

- FFT report

```
APC# show spectrum-analysis report sample ap 1

FFT (Fast Fourier Transform) Reporting Enabled
AP ID 1 Description:
  MAC Address..... 00:11:22:33:44:55
  Name..... AP_ 01122334455
  IP Address..... 100.100.100.220
  Mode..... General
```

```

Operational Status..... Up
Map Location.....
Channel Information:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7 8
9 10 11 12 13

Channel ID..... 1
-----
Num  Maximum RSSI  Average RSSI
---  -
1    -120          -120
2    -120          -120
3    -120          -120
4    -120          -120
5    -120          -120
6    -120          -120
7    -120          -120
8    -120          -120
9    -120          -120
10   -120          -120
11   -120          -120
12   -120          -120
13   -120          -120
14   -120          -120
15   -120          -120
16   -120          -120
17   -120          -120
18   -120          -120
19   -120          -120
20   -120          -120
21   -120          -120
22   -120          -120
23   -120          -120
24   -120          -120
25   -120          -120
26   -120          -120
27   -120          -120
28   -120          -120
29   -120          -120
30   -120          -120
Press any key to continue (q : quit | enter : next line) :

```

- Duty cycle report

```

APC# show spectrum-analysis report duty_cycle ap 1

Duty Cycle Reporting Enabled
AP ID 1 Description:
  MAC Address..... 00:11:22:33:44:55
  Name..... AP_ 01122334455

```



```

IP Address..... 100.100.100.220
Mode..... General
Operational Status..... Up
Map Location.....
Affected Channels:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7 8 9
10 11 12 13
Real Time Duty Cycle Report:
Current Time : 2012-06-29 00:40:13
-----
Channel: 1..... D: 100 %
Channel: 2..... D: 100 %
Channel: 3..... D: 100 %
Channel: 4..... D: 100 %
Channel: 5..... D: 30 %
Channel: 6..... D: 100 %
Channel: 7..... D: 100 %
Channel: 8..... D: 100 %
Channel: 9..... D: 100 %
Channel: 10..... D: 50 %
Channel: 11..... D: 97 %
Channel: 12..... D: 70 %
Channel: 13..... D: 100 %
-----

```

- Interference report

```

APC# show spectrum-analysis report interference ap 1
Interference Reporting Enabled
AP ID 1 Description:
  MAC Address.....
00:11:22:33:44:55
  Name..... AP_
01122334455
  IP Address.....
100.100.100.220
  Mode..... General
  Operational Status..... Up
  Map Location.....
Affected Channels:
  Channel Interval..... 2000 ms
  Channel..... 1 2 3 4 5 6 7
8 9 10 11 12 13
Affected Interferers:
  BlueTooth..... Enabled
  Microwave Oven..... Enabled
  802.11bgn Continuous Transmitter..... Enabled
  802.11bgn DECT-like Phone..... Enabled

```

```

802.11bgn Video Camera..... Enabled
ZigBee..... Enabled
802.11an Continuous Transmitter..... Enabled
802.11an DECT-like Phone..... Enabled
802.11an Video Camera..... Enabled

Real Time Interference Report:
  Number of Interferers..... 1
Num Evoke   Time Interferer Type   RSSI Minimum Frequency Maximum
Frequency
-----
1    2012-06-29 08:52:47 802.11bgn Video Camera -80 2401 2401

```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Interference Device> menu in the sub-menus. You can retrieve the interference report.

AP PROFILE NAME								Show Filter
AP PROFILE NAME	AP NAME	NO	EVOKE TIME	INTERFERER TYPE	RSSI	MIN FREQUENCY	MAX FREQUENCY	
ap_1	NA	1	2013-01-07 14:37:42	bluetooth	-71	2452	2452	

Figure 140. Spectrum Analysis Data

7.6.2 Spectrum Analysis Configuration

You can configure the spectrum analysis function and also a spectrum analysis channel that will be applied to each spectrum report. The channel information is as follows:

Radio	Channel
2.4 GHz	All, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
5 GHz Low	All, 36, 40, 44, 48, 52, 56, 60, 64
5 GHz Mid	All, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140
5 GHz High	All, 149, 153, 157, 161, 165

To configure the spectrum analysis related function, you must go to the configuration mode of an AP for which the spectrum analysis function will be configured by executing the command as follows:

```

APC# configure terminal
APC/configure# spectrum-analysis ap 1
APC/configure/spectrum-analysis/ap 1#

```

[Enable/Disable Spectrum]

The command that enables or disables the spectrum analysis function is shown below.

- service [MODE]

Parameter	Description
MODE	Enables or disables spectrum analysis - enable: Enable (default) - disable: Disable

[Spectrum Analysis Report Configuration]

The command used to enable or disable each spectrum analysis data item is shown below.

- configuration-request [DATA] [MODE]

Parameter	Description
DATA	Type of a report to configure (sample/duty-cycle/interference) - sample: FFT report (default: disabled) - duty-cycle: Duty cycle report (default: disabled) - interference: Interference report (default: enable)
MODE	Enables or disables each report function. - enable: Enable - disable: Disable

[Channel Report Interval Configuration]

The command is shown below.

- channel-interval [INTERVAL]

Parameter	Description
INTERVAL	Channel report interval (range: 1000-60000 ms, default: 1000)

[Changing Channel]

By using the following command, you can change a channel for which the spectrum analysis will be executed.

(The default is 'All' channels.)

- dot11b: 2.4 GHz wireless bandwidth
- dot11aLow: 5 GHz low wireless bandwidth
- dot11aMid: 5 GHz mid wireless bandwidth
- dot11aHigh: 5 GHz high wireless bandwidth

7.6.3 Interference Type Configuration

The interference type of 2.4 GHz or 5 GHz that can be detected by the W-EP wireless LAN is shown below.

Wireless bandwidth	Interference type
2.4 GHz	continuous_transmitter, cordless_phone, video_camera
5 GHz	bluetooth, continuous_transmitter, cordless_phone, microwave_oven, video_camera, zigbee

To configure an interference type, execute the command as follows:

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Configure an interference type. The default value of all the interference types is 'enabled'.
 - interferer 80211b zigbee: 2.4 GHz configuration
 - interferer 80211a cordless_phone: 5 GHz configuration

7.7 Controlling Usage per User

A wireless terminal can control traffic usage per user by receiving a QoS profile that specifies traffic usage (bandwidth) from the RADIUS server at the authentication stage. You can configure upward and downward usage per wireless terminal.

Configuration using CLI

The procedure of configuring a usage to a profile is as follows:

- 1) Go to configure mode of CLI.

```
APC# configure terminal
```

- 2) Create a QoS profile.

```
APC/configure# qos [PROFILE_NAME]
APC/configure/qos samsung#
```

Parameter	Description
PROFILE_NAME	Name of a QoS profile to create

- 3) Configure the downward usage in kbps.
 - bw-contract-downstream [VALUE]

Parameter	Description
VALUE	Downward usage

- 4) Configure the upward usage in kbps.
 - bw-contract-upstream [VALUE]

Parameter	Description
VALUE	Upward usage

- 5) To check the configured profile information, use the 'show qos profile' command.

Configuration using Web UI

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<QoS>** menu in the sub-menus. To create a QoS profile to apply to a terminal, click the **<Add>** button in the initial window.

The QoS addition window consists of the following QoS parameters. By entering each QoS parameter, you can configure the QoS profile of a specific terminal or configure the usage control function for each user.

ID		1
PROFILE NAME		
DESCRIPTION		
MAX. DOT1P TAG		6
PER-USER UPSTREAM BANDWIDTH CONTRACT (KBPS)		0
PER-USER DOWNSTREAM BANDWIDTH CONTRACT (KBPS)		0
VOICE	802.1P TAG	6
	DSCP TAG	46
VIDEO	802.1P TAG	4
	DSCP TAG	26
BEST EFFORT	802.1P TAG	0
	DSCP TAG	0
BACKGROUND	802.1P TAG	1
	DSCP TAG	8

Figure 141. Controlling Usage per User

- ID: ID (range: 1-16)
- PROFILE NAME: Profile name
- DESCRIPTION: Profile description
- MAX. DOT1P TAG: Maximum allowed 802.1p tag (range: 0-7)
- PER-USER UPSTREAM BANDWIDTH CONTRACT: Maximum upward usage (range: 0-450000)
- PER-USER DOWNSTREAM BANDWIDTH CONTRACT: Maximum downward usage (range: 0-450000)
- VOICE/VIDEO/BEST EFFORT/BACKGROUND: Enter 802.1P TAG (range: 0-7) and DSCP TAG (range: 0-64) for each item.

7.8 Remote Packet Capture

APC can capture a packet exchanged between the wireless terminals on a remote PC in real-time by using the remote packet capture protocol.

To configure the remote packet capture function, you must go to the pcap mode by executing the command as follows:

```
APC# configure terminal
APC/configure# pcap
```

Configuring the MAC address of a wireless terminal

Configure the MAC address of a wireless terminal whose packets will be captured.

```
APC/configure/pcap# config-filter
APC/configure/pcap/config-filter# station-mac [MAC_ADDRESS]
APC/configure/pcap/config-filter# enable-station-mac [INDEX]
```

Parameter	Description
MAC_ADDRESS	MAC address (11:22:33:44:55:66 format)
INDEX	Index number of MAC address (range: 1-10)

Configuring AP MAC address

Configure the MAC address of an AP whose packets will be captured.

```
APC/configure/pcap# config-filter
APC/configure/pcap/config-filter# ap-mac [MAC_ADDRESS]
APC/configure/pcap/config-filter# enable-ap-mac [INDEX]
```

Parameter	Description
MAC_ADDRESS	MAC address (11:22:33:44:55:66 format)
INDEX	Index number of MAC address (range: 1-10)

Configuring Filtering Mode

Capture target can be specified by configuring the filtering mode

```
APC/configure/pcap# filtering-mode [FILTERING MODE]
```

Parameter	Description
FILTERING MODE	Filtering mode - station-only: Use only the configured station MAC information. - ap-only: Use only the configured AP MAC information.

Starting Service

You must start the remote packet capture service to connect to a device using a program that supports the remote packet capture protocol on a remote PC.

The related commands are given below.

```
APC/configure/pcap# start-service
```

Retrieving Configuration Information

Use the 'show pcap current-config' command to retrieve the remote packet capture configuration information.

```
APC# show pcap current-config detail

- Current status : Idle
- Filtering mode : station-only

- Configured AP's MAC Information
  No.      MAC Addr.      Filtering      Matched Count
  Inbound Rate      Outbound Rate
  =====
  1  F4:D9:FB:23:66:00  -----> ON      0
  0.0      0.0
      ID      Prf.      AP Name      IPv4 Addr
  -----
      2      ap_2      AP_f4d9fb236600      10.10.10.20

- Configured Station's MAC Information
  No.      MAC Addr.      Filtering      Matched Count
  Inbound Rate      Outbound Rate
  =====
  1  78:47:1D:C5:4C:85  OFF <-----      0
  0.0      0.0
      AP      WN      SSID      IPv4 Addr
  -----
      2      2      Ajay_2_2_4G      20.20.20.30
  2  FC:A1:3E:47:59:E7  OFF <-----      0
  0.0      0.0
      AP      WN      SSID      IPv4 Addr
  -----
      2      2      Ajay_2_2_4G      20.20.20.25

WEC8500#
```


7.9 Clustering

The clustering function comprehensively manages several APC systems in a single wireless LAN when several APC systems are used to manage a wireless LAN that cannot be managed by a single APC. The inter-APC handover function is provided by using clustering. In other words, it can provide the handover function between wireless LANs managed by different APC systems.

However, if a model is different, it is not interoperated through clustering.

Configuration using CLI

[Cluster Setting]

To use the clustering function, you must configure each APC according to the following procedure. Maximum 12 WEC8500 can be grouped in a cluster. Maximum 2 WEC8050 can be grouped in a cluster.

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Set the interval and the number of retries to transmit the Keep-alive messages between APCs in the cluster.
 - cluster keep-alive-interval [INTERVAL]
 - cluster keep-alive-retry-count [RETRY_COUNT]

Parameter	Description
INTERVAL	Interval to transmit the Keep-alive message (Unit: s, range: 1-30, default: 10)
RETRY_COUNT	Maximum number of the transmission retries when there is no response to the Keep-alive message (range: 3-20, default: 3)

- 3) Enable the cluster
 - cluster enable: Enable
 - no cluster enable: Disable
- 4) To check the configuration information, use the 'show cluster config' command.

```
WEC8500# show cluster config
=====
                CLUSTER CONFIGURATION INFORMATION
=====
KEEP-ALIVE-INTERVAL      : 10
KEEP-ALIVE-RETRY-COUNT   : 3
```

```

ENABLE                : YES
OWN-APC-INDEX         : 1
=====

```

[Adding APC to APC List]

To add an APC to the cluster, the APC must be added to the APC list first. APC information is automatically added to the APC list.

- 1) Go to apc-list configure mode of CLI.

```

WEC8500# configure terminal
WEC8500/configure# apc apc-list
WEC8500/configure/apc/apc-list#

```

- 2) Add the APC to the APC list.
 - add-apc [APC_NAME] [MAC_ADDRESS]

Parameter	Description
APC_NAME	APC name to be added to the APC list
MAC_ADDRESS	MAC address of the APC to be added to the APC list (system mac address output parameter value of the 'show system info' command in the APC)

[Adding APC to cluster]

After adding APC to the APC list, the APC must be added to a cluster.

- 1) Go to configure mode of CLI.

```

WEC8500# configure terminal
WEC8500/configure#

```

- 2) Add the APC to a cluster.
 - cluster add-apc [INDEX] [APC_NAME] [IPV4_ADDRESS] [DB_REFRESH_INTERVAL]

Parameter	Description
INDEX	Index in cluster (range: 1-12)
APC_NAME	APC name (maximum 18 characters)
IPV4_ADDRESS	IPv4 address
DB_REFRESH_INTERVAL	Database update interval (Unit: s, range: 60-5000, default: 120)

[Deleting APC from cluster]

Delete the APC added in cluster. To delete an APC from a cluster, you must delete the APC from the cluster configuration of all the APCs in the cluster.

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Delete an APC from the cluster. To delete all the APC systems in a cluster, enter the 'cluster del-apc-all' command.
 - cluster del-apc [INDEX]
 - cluster del-apc-all

Parameter	Description
INDEX	Index in cluster (range: 1-12)

[Retrieving APC information added in cluster]

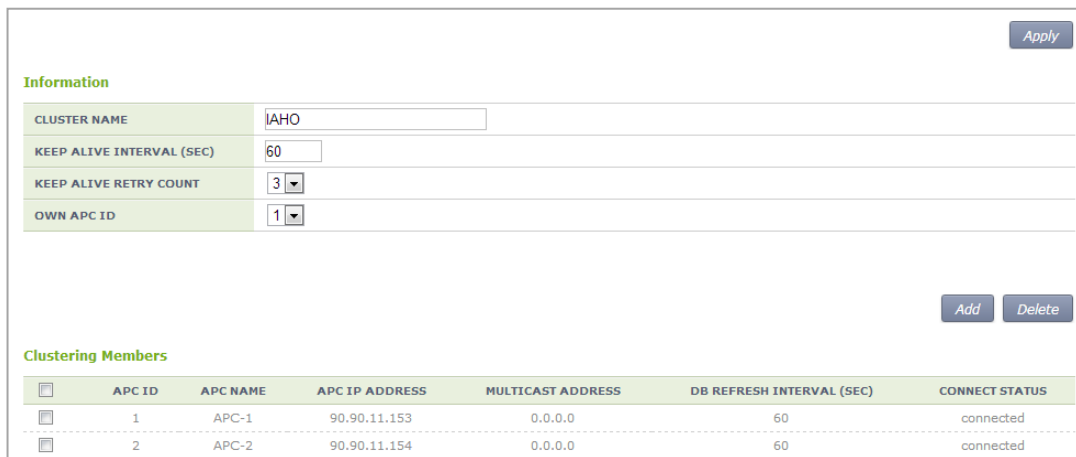
You can check the added APC information using the 'show cluster list-apc' command.

```
WEC8500# show cluster list-apc
=====
INDEX  APC-NAME      IPv4-ADDRESS  DB-REF-INT  CONNECT-STATUS
=====
1      APC-1         192.168.87.146 120         CONNECTED[1]
2      APC-2         192.168.87.217 120         CONNECTED[1]
=====
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Mobility Management> → <Clustering> menu in the sub-menus.

The Clustering window is shown below.



Information

CLUSTER NAME	IAHO
KEEP ALIVE INTERVAL (SEC)	60
KEEP ALIVE RETRY COUNT	3
OWN APC ID	1

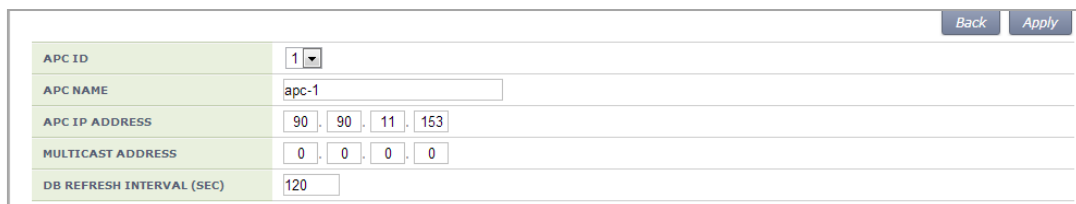
Clustering Members

APC ID	APC NAME	APC IP ADDRESS	MULTICAST ADDRESS	DB REFRESH INTERVAL (SEC)	CONNECT STATUS
1	APC-1	90.90.11.153	0.0.0.0	60	connected
2	APC-2	90.90.11.154	0.0.0.0	60	connected

Figure 142. Clustering window

Configure a clustering configuration value in the <Information> item and then click the <Apply> button to apply. The Clustering Members item shows all the clustering members. Click the <Add> or <Delete> button to add or delete a clustering member.

The clustering addition window is shown below.



APC ID 1

APC NAME apc-1

APC IP ADDRESS 90.90.11.153

MULTICAST ADDRESS 0.0.0.0

DB REFRESH INTERVAL (SEC) 120

Figure 143. Clustering addition window

7.10 Limiting the Number of Connected Users

The W-EP wireless LAN system limits the number of wireless terminals connected to each AP. The limitation is per radio (2.4/5 GHz bandwidth) or WLAN for each AP.

7.10.1 Limiting Connections per Radio

Configuration using CLI

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Configure connection limitation.
 - [RADIO] max-associated-stations [MAX_STATION] global: Configures connection limitation per wireless bandwidth. When you enter the 'global' parameter at the end, connection limitation is applied to all the APs.
 - [RADIO] max-associated-stations [MAX_STATION] [TARGET] [AP_ID]: Configures connection limitation to a specific AP.

Parameter	Description
RADIO	Wireless area to configure [80211bg/80211a] - 80211bg: 2.4 GHz area - 80211a: 5 GHz area
MAX-STATION	Maximum number of wireless terminals that can be connected (default: 127)
TARGET	Configuration range - AP: Index of an AP to configure - Global: All APs connected to an APC
AP_ID	AP ID (range: 1-500)

- 3) To check the configuration information, use the 'show 80211bg radio-config global' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> or <802.11b/g/n> → <General> menu in the sub-menus.

General		Data Rates	
BEACON PERIOD (TUS)	100	6 MBPS	Basic
RTS THRESHOLD (BYTES)	2346	9 MBPS	Supported
SHORT RETRY	4	12 MBPS	Basic
LONG RETRY	10	18 MBPS	Supported
FRAGMENTATION THRESHOLD (BYTES)	2346	24 MBPS	Basic
TX MSDU LIFE TIME (TUS)	512	36 MBPS	Supported
RX MSDU LIFE TIME (TUS)	512	48 MBPS	Supported
MAX. CLIENT COUNTS	127	54 MBPS	Supported
CONTROLLED VOICE OPTIMIZATION	☐ Enable ☒ Disable		

Figure 144. Configuring connection limitation per radio

After configuring MAX CLIENT COUNTS, click the <Apply> button.

7.10.2 Connection Limitation per WLAN

Configuration using CLI

To configure connection limitation per WLAN, execute the command as follows:

- 1) Go to configure → wlan configuration mode of CLI.

```
APC# configure terminal
APC/configure# wlan 1
APC/configure/wlan 1#
```

- 2) Disable the WLAN.

```
APC/configure/wlan 1# no enable
```

- 3) Configure connection limitation.

```
max-associated-stations [MAX-STATION]
```

Parameter	Description
MAX-STATION	Maximum number of wireless terminals that can be connected (default: 127)

- 4) Enable the WLAN.

```
APC/configure/wlan 1# enable
```

- 5) To check the configured connection limitation, use the ‘show wlan detail’ command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Radio> → <802.11a/n> or <802.11b/g/n> → <General> menu in the sub-menus.

The screenshot displays the Web UI configuration page for WLAN settings. It is divided into two main sections: General and Data Rates. The General section includes fields for Beacon Period (TUS), RTS Threshold (Bytes), Short Retry, Long Retry, Fragmentation Threshold (Bytes), TX MSDU Life Time (TUS), RX MSDU Life Time (TUS), Max. Client Counts, and Controlled Voice Optimization. The Data Rates section includes a table for various data rates (6 MBPS to 54 MBPS) with dropdown menus for their status. Below these sections is a Call Admission Control section with fields for Admission Control, Max Calls, Handover Calls, Minor Alarm Threshold, and Major Alarm Threshold. Each section has an 'Apply' button.

General		Data Rates	
BEACON PERIOD (TUS)	100	6 MBPS	Basic
RTS THRESHOLD (BYTES)	2346	9 MBPS	Supported
SHORT RETRY	4	12 MBPS	Basic
LONG RETRY	10	18 MBPS	Supported
FRAGMENTATION THRESHOLD (BYTES)	2346	24 MBPS	Basic
TX MSDU LIFE TIME (TUS)	512	36 MBPS	Supported
RX MSDU LIFE TIME (TUS)	512	48 MBPS	Supported
MAX. CLIENT COUNTS	127	54 MBPS	Supported
CONTROLLED VOICE OPTIMIZATION	☐ Enable ☒ Disable		

Call Admission Control	
ADMISSION CONTROL	☒ Enable ☐ Disable
MAX CALLS	24
HANDOVER CALLS	2
MINOR ALARM THRESHOLD	0
MAJOR ALARM THRESHOLD	0

Figure 145. Configuring connection limitation per WLAN

After configuring MAXIMUM CONNECTIONS, click the <Apply> button.

7.11 Voice Statistics and Communication Failure Detection

Because APC provides voice statistics and the WLAN-based communication failure detection function, you can easily know communication failure reason.

7.11.1 Voice Statistics Function

It provides the number of successful voice communication and call time.
When the CAC function is enabled, the CAC statistics is also provided.

Configuration using CLI

Use the following command to check voice statistics.

```
APC# show 80211bg voip-stats ap 2
VoIP Stats
Cumulative Number of Calls ..... 4
Cumulative Time of Calls ..... 0:0:23
Number of Active Calls ..... 2
CAC Stats
Calls In Progress ..... 2
Handover Calls In Progress ..... 0
Calls Since AP Joined ..... 4
Handover Calls Since AP Joined ..... 0
Calls Rejected Since AP Joined ..... 0
Handover Calls Rejected Since AP Joined ... 0
Calls On Invite ..... 0
Preferred Calls Received ..... 0
Preferred Calls Accepted ..... 0
```


Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Access Points> → <Radio> → <802.11a/n> or <802.11b/g/n> → AP menu in the sub-menus.

AP PROFILE NAME	ap_1
AP NAME	AP_f4d9fb2369e0
Radio Info (* : Fixed)	
CHANNEL	1
TX POWER (DBM)	3
BASE MAC ADDRESS	f4:d9:fb:23:69:e0
VoIP Statistics	
CUMULATIVE NUMBER OF CALLS	
CUMULATIVE TIME OF CALLS	0 sec
SIP CAC CALL STATISTICS	
VOICE CALLS IN PROGRESS	0
HANDOVER VOICE CALLS IN PROGRESS	0
TOTAL VOICE CALLS	0
TOTAL HANDOVER CALLS	0
REJECTED VOICE CALLS	0
REJECTED HANDOVER CALLS	0
VOICE CALLS ON INVITE	0
PREFERRED CALL STATISTICS	
TOTAL RECEIVED CALLS	0
TOTAL ACCEPTED CALLS	0

Figure 146. Voice statistics

7.11.2 Detecting WLAN-based Communication Failure

You can configure whether to detect WLAN-based communication failure.

Configuration using CLI

- 1) Go to configure mode of CLI.

```
APC# configure terminal
APC/configure#
```

- 2) Enable or disable communication failure detection.

- [no] call-fail-detect [WLAN_ID]

Parameter	Description
WLAN_ID	WLAN ID (range: 1-240)

- 3) To check the configured connection limitation information, use the 'show voip config [WLAN_ID]' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. Select a WLAN ID to change in the WLANs screen and go to the <Advanced> tab.

The screenshot shows the Web UI configuration page for a WLAN profile named 'wlan1'. The page is divided into several sections with configuration options:

- PROFILE NAME:** wlan1
- ACL RULE:** A dropdown menu showing '-----'.
- STATIC ADDRESS DISALLOWED:** Radio buttons for 'Enable' and 'Disable' (selected).
- DHCP OVERRIDE:** Radio buttons for 'Enable' and 'Disable' (selected).
- DHCP SERVER:** Four input fields showing '0', '0', '0', and '0'.
- WMM:** Radio buttons for 'Enable' (selected) and 'Disable'.
- DTIM:** An input field showing '1'.
- STATION IDLE TIMEOUT (SEC):** An input field showing '300'.
- VOIP FAILURE DETECT:** Radio buttons for 'Enable' and 'Disable' (selected).

Buttons for 'Back', 'Apply', and 'Apply' are visible at the top right, middle right, and bottom right of the form respectively.

Figure 147. Detecting WLAN-based communication failure

After configuring the VOIP FAILURE DETECT item, click the <Apply> button.

7.12 Voice Signal and Media Monitoring

For voice call fault analysis, the APC provides VoIP wireless terminal, call information, event and RTP media voice quality statistics.

7.12.1 Checking Voice Related Wireless Information

Configuration using CLI

Execute the following command to check voice related fault analysis statistics.

- 1) Check the connection status of a voice wireless terminal.

```
WEC8500# show voice station summary
MAC Address      IP Address      Tel-no      AP  BSS      WLAN
Proto  Server IP      Reg      Call
-----
50:01:BB:FD:96:E1 10.10.10.5      9922        3  F4:D9:FB:24:C8:C2 1
SIP(UDP) 90.90.1.100 Registered Established
78:47:1D:C2:18:11 10.10.10.10      9907        3  F4:D9:FB:24:C8:D1 1
SIP(UDP) 90.90.1.100 Registered Not calling
WEC8500#
```

- 2) Check the connection status of an active call.

```
WEC8500# show voice active-call summary
MAC Address      IP Address      Tel-No      AP  BSS      WLAN
Caller      Callee      Dir Status      Dur(sec) Start Time  MOS
-----
C8:19:F7:70:89:04 10.10.10.65      9961        3  F4:D9:FB:24:C8:C2 1
9907      9961      In  Established 48  05-12 21:16:13 3.95
50:01:BB:FD:96:E1 10.10.10.5      9922        3  F4:D9:FB:24:C8:C2 1
9922      9950      Out Established 336 05-12 21:11:25 3.95
78:47:1D:C2:18:11 10.10.10.10      9907        3  F4:D9:FB:24:C8:D1 1
9907      9961      Out Established 48  05-12 21:16:13 3.77
-----
-----#
```

3) Check the information of a completed call.

```

WEC8500# show voice complete-call summary
CONN      Start Time      Dur   AP      SSID      MAC Address
Tel-no    IPv4 Address  Port  Rat   MOS LQ/CQ/PQ   Pkt Cnt
=====
=====
0 2013/05/11-17:24:23   26    1      uready Caller D4:88:90:1B:3C:E2
10.10.10.194   23143  GOOD 4.01/3.95/3.84      225,664
                        Callee 3C:8B:FE:2E:6F:6A
10.10.10.193   10617  POOR 2.31/2.17/2.90      221,708
-----
1 2013/05/11-17:25:16   10    1      uready Caller 3C:8B:FE:2E:6F:6A
10.10.10.193   10617  FAIR 3.57/3.11/3.63      90,300
                        Callee D4:88:90:1B:3C:E2
10.10.10.194   23143  GOOD 4.06/3.91/3.94      85,140
-----
2 2013/05/11-19:02:10   28    1      uready Caller D4:88:90:1B:3C:E2
10.10.10.194   23143  POOR 3.21/2.92/3.44      244,756
                        Callee 3C:8B:FE:2E:6F:6A
10.10.10.193   10617  POOR 1.97/1.66/2.68      240,800
-----
-----

```

4) Check the voice signal related log.

```

WEC8500/configure# show voice sipmsg-log
Time              MAC Address      Msg Type      Dir
SRC IP            DST IP      AP      BSS              WLAN  Contents
-----
-----
2013-05-12 21:26:45   c8:19:f7:70:89:04  INVITE        SEND
10.10.10.65 90.90.1.100  3      f4:d9:fb:24:c8:c2  1      F:9922, T:995
0, RTP:10.10.10.65:21120
2013-05-12 21:26:44   c8:19:f7:70:89:04  200(REGISTER) RECV
90.90.1.100 10.10.10.65  3      f4:d9:fb:24:c8:c2  1      F:9961, T:996
1, Expire:600
2013-05-12 21:26:44   c8:19:f7:70:89:04  REGISTER      SEND
10.10.10.65 90.90.1.100  3      f4:d9:fb:24:c8:c2  1      F:9961, T:996
1, Expire:600
2013-05-12 21:26:44   c8:19:f7:70:89:04  401(REGISTER) RECV
90.90.1.100 10.10.10.65  3      f4:d9:fb:24:c8:c2  1      F:9961, T:996
1, Expire:0
2013-05-12 21:26:44   c8:19:f7:70:89:04  REGISTER      SEND
10.10.10.65 90.90.1.100  3      f4:d9:fb:24:c8:c2  1      F:9961, T:996
1, Expire:

```

5) Check a WLAN event related to a voice.

```

WEC8500# show voice event
Event Type          MAC Address      AP    BSS          WLAN
Time               Contents
-----
-----
Deassoc During Call 78:47:1D:C2:18:11 3      F4:D9:FB:24:C8:D1 1
2013-05-12 21:22:04 wlan disconnected in AP(3) BSSID(f4:d9:fb:24:c8:d1)
during call caller(9907) → callee(9950) duration(5)sec
CallStop           C8:19:F7:70:89:04 3      F4:D9:FB:24:C8:C2 1
2013-05-12 21:22:04 caller(9922) → callee(9950) duration(62)sec
CallConnect        78:47:1D:C2:18:11 3      F4:D9:FB:24:C8:D1 1
2013-05-12 21:22:01 caller(9907) → callee(9950)
CallSetup          78:47:1D:C2:18:11 3      F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:59 caller(9907) → callee(9950)
CallStop           78:47:1D:C2:18:11 3      F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:47 caller(9907) → callee(9950) duration(6)sec
CallConnect        78:47:1D:C2:18:11 3      F4:D9:FB:24:C8:D1 1
2013-05-12 21:21:47 caller(9907) → callee(9950)

```

6) Check the voice related statistics.

```

WEC8500# show voice statistics radio

RADIO (5G) Voice Statistis
-----
Type      Total  Success  Failed  Active  UpstreamTime  Downstream
          Calls  Call    Call   Call   MOS Jitter Delay  MOS Jitter Delay
-----
Total      8      6      0      2 0.0      0      0 0.0      0      0
5 Min      0      0      0      0 0.0      0      0 0.0      0      0
15 Min     0      0      0      0 0.0      0      0 0.0      0      0
1 Hour     0      0      0      0 0.0      0      0 0.0      0      0
1 Day      8      6      0      2 0.0      0      0 0.0      0      0

RADIO (2.4G) Voice Statistis
-----
Type      Total  Success  Failed  Active  UpstreamTime  Downstream
          Calls  Call    Call   Call   MOS Jitter Delay  MOS Jitter Delay
-----
Total      3      3      0      0 0.0      0      0 0.0      0      0
5 Min      0      0      0      0 0.0      0      0 0.0      0      0
15 Min     0      0      0      0 0.0      0      0 0.0      0      0
1 Hour     0      0      0      0 0.0      0      0 0.0      0      0
1 Day      3      3      0      0 0.0      0      0 0.0      0      0
WEC8500# show voice statistics wlan 1

```

WLAN (A_toanyone_1) Voice Statistics

Type	Total Calls	Success Call	Failed Call	Active Call	MOS	UpstreamTime			Downstream		
						Jitter	Delay	MOS	Jitter	Delay	
Total	11	9	0	2	0.0	0	0	0.0	0	0	
5 Min	0	0	0	0	0.0	0	0	0.0	0	0	
15 Min	0	0	0	0	0.0	0	0	0.0	0	0	
1 Hour	0	0	0	0	0.0	0	0	0.0	0	0	
1 Day	11	9	0	2	0.0	0	0	0.0	0	0	

WEC8500# show voice statistics device

DEVICE (Model Name:SHV-E210L, OS Ver:4.1.1 Build Ver:E210LKLJLK1)
Voice Statistics

Type	Total Calls	Success Call	Failed Call	Active Call	MOS	UpstreamTime			Downstream		
						Jitter	Delay	MOS	Jitter	Delay	
Total	8	6	0	2	0.0	0	0	0.0	0	0	
5 Min	0	0	0	0	0.0	0	0	0.0	0	0	
15 Min	0	0	0	0	0.0	0	0	0.0	0	0	
1 Hour	0	0	0	0	0.0	0	0	0.0	0	0	
1 Day	8	6	0	2	0.0	0	0	0.0	0	0	

WEC8500#

Configuration using Web UI

- 1) Check the connection status of a voice wireless terminal.

In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <VoIP Stations> <Active Calls> <Complete Calls> menu in the sub-menus.

VoIP Calls > VoIP Stations

Current Filter : None

Change

Export

Total Entry : 2

MAC ADDRESS	USER NAME	IP ADDRESS	TEL NUMBER	CALL PROTOCOL	CALL STATUS	REG. STATUS	CALL SERVER	SSID	RADIO	AP NAME	BSSID
c8:19:f7:70:89:04		10.10.2.12		UDP	Idle	Not registered	0.0.0.0	voice2	5G	AP_f4d9fb24c8e0	f4:d9:fb:24:c8:e3
50:01:bb:fd:96:e1		10.10.10.11		UDP	Idle	Not registered	0.0.0.0	voice2	5G	AP_f4d9fb24c8e0	f4:d9:fb:24:c8:e3

Foot Notes :

1. Only station that register the VoIP server is displayed

Figure 148. VoIP Stations Retrieval Screen

- 2) Check the connection status of an active call.
In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Active Calls> menu in the sub-menus.

VoIP Calls > Active Calls

Current Filter : None Change

Export

Total Entry : 1

MAC ADDRESS	USER NAME	IP ADDRESS	CALLER	CALLEE	AP NAME	START TIME	DIRECTION	MOS(UP) ¹	MOS(DOWN) ¹
c8:19:f7:70:89:04		10.10.2.12	9922	9961	AP_f4d9fb24c8e0	13:43:36	Inbound	2.17	4.2

1

Figure 149. Active Call Retrieval Screen

- 3) Check the information of a completed call.
In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Complete Calls> menu in the sub-menus.

VoIP Calls > Completed Calls

Search Condition

MAC ADDRESS USER NAME TEL NUMBER

START TIME END TIME

Apply Cancel

Export

Total Entry : 4

MAC ADDRESS	USER NAME	IP ADDRESS	CALLER	CALLEE	AP NAME	START TIME	END TIME	MOS(UP)	MOS(DOWN)
c8:19:f7:70:89:04		30.30.30.11	9961	9950	AP_f4d9fb243341	09-06 23:47:01	09-06 23:47:16	2.87	0
28:cc:01:53:4c:b7		30.30.30.10	9955	9950	AP_f4d9fb243341	09-06 23:47:58	09-06 23:48:15	1.84	0
c8:19:f7:70:89:04		30.30.30.11	9961	9955	AP_f4d9fb243341	09-06 23:51:48	09-06 23:51:52	4.18	4.18
28:cc:01:53:4c:b7		30.30.30.10	9961	9955	AP_f4d9fb243341	09-06 23:51:48	09-06 23:51:52	4.18	4.18

1

Figure 150. Complete Calls Retrieval Screen

7.12.2 Checking Voice Related Quality Information

Configuration using CLI

Execute the following command to check the voice related quality analysis (Voice Quality Monitoring) information.

- 1) Operator can check the voice quality analysis information of a wireless terminal that has an active call.

```
WEC8500# show voice vqm current-stats brief
=====
[CONN-740 Start Time=2013/7/19.14:47:27, Duration=47 sec(s)
  Call-ID[f03c77b50564418855587192e12b889d <-> ca371fce-6e10-401a-
  9a4e-dd53678804c6@ugl.scm.com] Session id :0
  SRC [I/F=ge4 Phone-No=9960, IP=20.20.20.30:22458]
  DST [I/F=ge4 Phone-No=9910, IP=20.20.20.25:25407]
  RTP Flow Quality Metrics:
    [Flow-1] DIR=Forward Quality Ratings=Poor [MOS-LQ=3.06, MOS-
    CQ=2.82, MOS-PQ=3.35]
  RTP Flow Quality Metrics:
    [Flow-2] DIR=Reverse Quality Ratings=Good [MOS-LQ=4.04, MOS-
    CQ=3.95, MOS-PQ=3.89]
WEC8500#
```

- 2) Operator can check the voice quality analysis information of a wireless terminal that has a completed call.

```
WEC8500# show voice vqm history-stats brief
=====
[CONN-1 Start Time=2013/7/19.14:47:27, Duration=75 sec(s)
  Station Mac [78:47:1d:c5:4c:85: <-> fc:a1:3e:47:59:e7:] startBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10] endBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10]
  ssid [Ajay_2_2_4G <-> Ajay_2_2_4G] Direction [1 <-> 2] wlanId [2 <-> 2]
  startApId [2 <-> 2] endApId [2 <-> 2]
  Session id :0
  SRC [I/F=ge4 Call-ID=f03c77b50564418855587192e12b889d Phone-No=9960,
  IP=20.20.20.30:22458]
  DST [I/F=ge4 Call-ID=ca371fce-6e10-401a-9a4e-dd53678804c6@ugl.scm.com
  Phone-No=9910, IP=20.20.20.25:25407]
  RTP Flow Quality Metrics:
    [Flow-1] DIR==Forward Quality Ratings=Poor [MOS-LQ=2.21, MOS-CQ=1.33,
    MOS-PQ=2.84]
  RTP Flow Quality Metrics:
    [Flow-2] DIR==Reverse Quality Ratings=Poor [MOS-LQ=2.46, MOS-CQ=1.50,
    MOS-PQ=3.00]

=====
[CONN-2 Start Time=2013/7/19.14:52:36, Duration=30 sec(s)
  Station Mac [fc:a1:3e:47:59:e7: <-> 78:47:1d:c5:4c:85:] startBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10] endBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10]
```



```

ssid [Ajay_2_2_4G↔Ajay_2_2_4G] Direction [1↔2] wlanId [2↔2]
startApId [2↔2] endApId [2↔2]
Session id :1
SRC [I/F=ge4 Call-ID=035be38a40032eb8edb0b94e944d58d4 Phone-No=9910,
IP=20.20.20.25:25407]
DST [I/F=ge4 Call-ID=917a913e-83ae-497f-ad84-bf0ee80edf36@ug1.scm.com
Phone-No=9960, IP=20.20.20.30:22458]
RTP Flow Quality Metrics:
[Flow-1] DIR==Forward Quality Ratings=Fair [MOS-LQ=3.73, MOS-CQ=3.65,
MOS-PQ=3.72]
RTP Flow Quality Metrics:
[Flow-2] DIR==Reverse Quality Ratings=Poor [MOS-LQ=3.30, MOS-CQ=3.06,
MOS-PQ=3.49]

=====
[CONN-3 Start Time=2013/7/19.14:53:12, Duration=24 sec(s)
Station Mac [78:47:1d:c5:4c:85:↔fc:a1:3e:47:59:e7:] startBssid
[f4:d9:fb:23:66:10↔f4:d9:fb:23:66:10] endBssid
[f4:d9:fb:23:66:10↔f4:d9:fb:23:66:10]
ssid [Ajay_2_2_4G↔Ajay_2_2_4G] Direction [1↔2] wlanId [2↔2]
startApId [2↔2] endApId [2↔2]
Session id :2
SRC [I/F=ge4 Call-ID=a47241e5f5d3d6b7f942d0aaeddbd8ef Phone-No=9960,
IP=20.20.20.30:22458]
DST [I/F=ge4 Call-ID=65031276-a4dd-4b1c-a718-4ed3188e44a5@ug1.scm.com
Phone-No=9910, IP=20.20.20.25:25407]
RTP Flow Quality Metrics:
[Flow-1] DIR==Forward Quality Ratings=Poor [MOS-LQ=3.25, MOS-CQ=2.96,
MOS-PQ=3.47]
RTP Flow Quality Metrics:
[Flow-2] DIR==Reverse Quality Ratings=Fair [MOS-LQ=3.65, MOS-CQ=3.57,
MOS-PQ=3.68]

WEC8500#

```

3) Operator can check the call statistics information.

```

WEC8500# show voice vqm summary-stats
=====
VQM Summary Stats for last YEAR:0 MONTH:0 DAY:0 0 HR:26 MN:44 SEC
Calls Active          = 0
Calls Terminated    = 3
Flows Quality Summary (Total/Good/Fair/Poor) = 6/0/2/4
Listening Call Quality (MOS) min/ave/max = 2.21/3.10/3.73
Conversational Call Quality (MOS) min/ave/max = 1.33/2.68/3.65
P.862 Raw Quality (MOS) min/ave/max = 2.84/3.36/3.72
Listening Call Quality (R-factor) min/ave/max = 45/63/77
Conversational Call Quality (R-factor) min/ave/max = 24/53/75
Packet Delay Variation (msec) ave/max = 13/25
Packet Received/Processed/Lost/Discarded = 12980/12909/93/1154
Packet Duplicate/OutOfSeq = 0/135
Packet Error Stats: Ignored/Errors = 71/1
System Error Stats: Resource Unavail/Filter Mismatch/Limit Exceeded =
0/0/0
Voice Quality Alerts: Low R-factor/Excess Loss/Excess Delay/Upload =
1/6/5/0

```

```

Upload Count      = 1141
Upload Ok Count   = 0
Upload Fail Count = 0
Requested Count   = 1141

```

```
WEC8500#
```

4) Operator can check the alarm information that occurs during call.

```

WEC8500# show voice vqm alarms brief
=====
VQM ActiveRfactor/ActivePktLoss/ActivePktDly/ActiveMos = 1/1/1/1
VQM QualityThresh/LossThresh/DelayThresh/MOSThresh = 50/50/195/35
ALARMS REPORTED :
  Src Call Id = f03c77b50564418855587192e12b889d  Dst Call Id =
ca371fce-6e10-401a-9a4e-dd53678804c6@ugl.scm.com  Session = 0
  Direction :Forward Type : [Low-Quality]          [Excessive Burst]
[Excessive delay]
  Direction :Reverse Type : [Excessive Burst]      [Excessive delay]
ALARMS REPORTED :
  Src Call Id = 035be38a40032eb8edb0b94e944d58d4  Dst Call Id =
917a913e-83ae-497f-ad84-bf0ee80edf36@ugl.scm.com  Session = 1
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]      [Excessive delay]
ALARMS REPORTED :
  Src Call Id = a47241e5f5d3d6b7f942d0aaeddbd8ef  Dst Call Id =
65031276-a4dd-4b1c-a718-4ed3188e44a5@ugl.scm.com  Session = 2
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]

```

```
WEC8500#
```

7.13 Multicast Stream Admission Control

The multicast stream admission control is provided to protect the currently running multicast streams from new streams that flow into the wireless LAN. When the maximum allowed usage of streams or channels per radio is reached, the APC does not allow any additional streams.

7.13.1 Configuring Admission Control

The multicast stream admission control function configures the maximum number of streams or the maximum usage of channels to protect the currently running multicast streams. It denies multicast streaming requests once the maximum number of streams or the maximum usage of channels is reached. You can set the number of marginal streams or the usage of channels with consideration for handover.

Configuration using CLI

To set multicast stream admission control, execute the following commands:

- 1) Configuration mode of CLI → enter the multicast stream admission control mode of the desired wireless section.

```
APC# configure terminal
APC/configure# [80211a/80211bg] msac
APC/configure/80211a/msac#
```

- 2) Enable or disable the multicast stream admission control function.
 - acm [MODE]

Parameter	Description
Mode	Whether or not to use the multicast stream admission control (enable/disable) - enable: Enable - disable: Disable

- 3) Configure the maximum allowed number of streams.
 - max-streams [VALUE]

Parameter	Description
VALUE	Maximum allowed number of streams

4) Set the maximum allowed usage of channels.

- max-chan-util [VALUE]

Parameter	Description
VALUE	Maximum allowed usage of channels

5) Configure the number of marginal streams with consideration for handover.

- reserved-ho-streams [VALUE]

Parameter	Description
VALUE	Number of marginal streams with consideration for handover

6) Configure the usage of marginal channels with consideration for handover.

- reserved-ho-chan-util [VALUE]

Parameter	Description
VALUE	Usage of marginal channels with consideration for handover

7) You can view the information you configured by using the ‘show[80211a | 80211bg] msac configuration’ command.

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <802.11a/n> or <802.11b/g/n> → <Admission Control> in the submenus.

Multicast Stream Admission Control

ADMISSION CONTROL	☐ Enable ☒ Disable
METHOD	☒ Static ☐ Channel Utilization
MAX STREAMS	20
HANDOVER STREAMS	0
MAX CHANNEL UTILIZATION (%)	75
HANDOVER CHANNEL UTILIZATION (%)	0

Figure 151. 802.11a/n Admission Control Configuration Window

After configuring the items below in the Multicast Stream Admission Control, click the **<Apply>** button.

- **ADMISSION CONTROL:** Configure the CAC function
- **METHOD:** Select the method of admission control
- **MAX STREAMS:** Maximum allowed number of streams (range: 1-20)
- **HANDOVER STREAMS:** Number of marginal streams with consideration for handover (range: 0-6)
The maximum allowed number of streams becomes MAX STREAMS-HANDOVER STREAMS.
- **MAX CHANNEL UTILIZATION (%):** Maximum allowed usage of channels (range: 5-85)
- **HANDOVER CHANNEL UTILIZATION (%):** Usage of marginal channels with consideration for handover (range: 0-30)

CHAPTER 8. Security

The W-EP wireless LAN system supports the security function, required in a wire/wireless network environment, such as RADIUS server interoperation function, system user management, guest connection service, unauthorized AP/terminal detection and simple blocking function, firewall, access control (ACL), etc.

In this chapter, how to configure various security functions supported in the system is described.

8.1 RADIUS Server Configuration

The W-EP wireless LAN system provides the security and authentication function by interoperating with an external RADIUS server. The WEC8050 also provides the internal RADIUS server function.

8.1.1 External RADIUS Server

The W-EP wireless LAN system provides the security and authentication function by interoperating with an external RADIUS server. Follow the below procedure to interoperate with a RADIUS server.

8.1.1.1 Basic Settings

The basic steps for configuring a RADIUS server are as follows:

Configuration using CLI

- 1) Go to configure → security → radius configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/wlan 1/security# radius 1
WEC8500/configure/security/radius 1#
```

2) Configure the IP address of a RADIUS server.

```
WEC8500/configure/security/radius 1# serverIp [IP_ADDRESS]
```

Parameter	Description
IP_ADDRESS	The IP address of a RADIUS server

3) Configure the key of a RADIUS server.

```
WEC8500/configure/security/radius 1# secret [KEY_TYPE] [KEY_STRING]
```

Parameter	Description
KEY_TYPE	RADIUS server key input format - ASCII: ASCII character string - HEX: Hexadecimal value
KEY_STRING	RADIUS server key

4) Enable the accounting function of a RADIUS server and configure the port number.

```
WEC8500/configure/security/radius 1# acct [PORT_NUMBER]
```

Parameter	Description
PORT_NUMBER	Accounting port number of a RADIUS server (range: 1-65535, default: 1813)

5) Configure the authentication port number of a RADIUS server.

```
WEC8500/configure/security/radius 1# auth [PORT_NUMBER]
```

Parameter	Description
PORT_NUMBER	Accounting port number of a RADIUS server (range: 1-65535, default: 1812)

6) Configure the items related to retransmissions in RADIUS communications. You can use default values without changing configuration.

```
WEC8500/configure/security/radius 1# retransmit-interval  
[RETRY_INTERVAL]  
WEC8500/configure/security/radius 1# retransmit-count [RETRY_COUNT]
```

```
WEC8500/configure/security/radius 1# fo-retransmit-count
[FO_RETRY_COUNT]
```

Parameter	Description
RETRY_INTERVAL	Retransmission interval for a RADIUS message (unit: seconds, range: 1-60, default value: 2)
RETRY_COUNT	Maximum retransmission count of a RADIUS message (range: 1-20, default value: 10)
FO_RETRY_COUNT	Maximum retransmission count of a RADIUS message before a RADIUS server failover is attempted Must smaller than the RETRY_COUNT value (range: 1-10, default value: 3)

- 7) Exit RADIUS server configuration and security configuration mode.

```
WEC8500/configure/security/radius 1# exit
WEC8500/configure/security# exit
```

- 8) To check the configuration information, use the 'show security radius-server summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <AAA> → <RADIUS> menu in the sub-menus.

If you click the <Add> button in the RADIUS initial window, you can add a RADIUS server.

The server addition window is shown below.

INDEX	1
TYPE	Auth/Acct
IP ADDRESS	90 . 90 . 7 . 207
SHARED SECRET FORMAT	☒ ASCII ☐ HEX
SHARED SECRET	
CONFIRM SHARED SECRET	
AUTH PORT NUMBER	1812
ACCT PORT NUMBER	1813
RETRANSMIT INTERVAL (SECONDS)	2
TOTAL RETRANSMIT COUNT	10
RETRANSMIT COUNT FAILOVER	3

Figure 152. RADIUS server configuration

Item	Description
INDEX	ID that distinguishes RADIUS server configurations
TYPE	Selects the type of the RADIUS server - Auth: Performs authentication - Acct: Performs accounting - Auth/Acct: Performs authentication and accounting
IP ADDRESS	IP address of the RADIUS server
SHARED SECRET FORMAT	Key input format for communications with the RADIUS server - ASCII: ASCII strings - HEX: Hexadecimal values
SHARED SECRET	Key for RADIUS server communications
CONFIRM SHARED SECRET	Re-enters the key for RADIUS server communications for confirmation
AUTH PORT NUMBER	Number of the communication port for RADIUS server authentication (range: 1-65,535, default value: 1,812)
ACCT PORT NUMBER	Number of the communication port for RADIUS server accounting (range: 1-65,535, default value: 1,813)
RETRANSMIT INTERVAL	Retransmission interval for a RADIUS message (range: 1-60, default value: 2, unit: seconds)
TOTAL RETRANSMIT COUNT	Maximum retransmission count of a RADIUS message (range: 1-20, default value: 10)
RETRANSMIT COUNT FAILOVER	Maximum retransmission count of a RADIUS message before a RADIUS server failover is attempted (range: 1-10, default value: 3, must be smaller than the TOTAL RETRANSMIT value)

8.1.1.2 Configuring MAC Authentication

The MAC authentication of a RADIUS server is configured as follows:

Configuration using CLI

- 1) Go to configure → security → radius configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/wlan 1/security# radius 1
WEC8500/configure/security/radius 1#
```

- 2) Set the password type that will be used for the MAC authentication of the device.

```
WEC8500/configure/security/radius 1# mac-auth-pw-type [PW_TYPE]
```

Parameter	Description
PW_TYPE	Password type (default value: mac) - mac: MAC address of the device. Note: it must be a string whose type must be the same as that of the MAC string which is used as a user ID when the MAC authentication of the device is performed - shared-secret: Key shared between the APC and RADIUS server

- 3) Set the type of separator of the device's MAC string which is used as a user ID when the MAC authentication of the device is performed.

```
WEC8500/configure/security/radius 1# mac-auth-delimiter [DELIMITER_TYPE]
```

Parameter	Description
DELIMITER_TYPE	Type of the MAC string separator (default: none) - none: no separator (xxxxxxxxxxx) - colon: Uses ':' as a separator (xx:xx:xx:xx:xx:xx) - hyphen: Uses '-' as a separator (xx-xx-xx-xx-xx-xx) - single-hyphen: Uses only one '-' in the middle (xxxxxx-xxxxxx)

- 4) Configure whether to use lowercase characters or uppercase characters for the device's MAC string that will be used as an ID upon the MAC authentication of the device.

```
WEC8500/configure/security/radius 1# mac-auth-case [CASE_TYPE]
```

Parameter	Description
CASE_TYPE	Case type of the device's MAC string (default value: lower) - lower: Uses lowercase - upper: Uses uppercase

- 5) Exit RADIUS server configuration and then security configuration mode.

```
WEC8500/configure/security/radius 1# exit
WEC8500/configure/security# exit
```

- 6) You can view configuration information by using the 'show security radius-server detail <server-id>' command.

8.1.2 Internal RADIUS Server

The W-EP wireless LAN system provides the security and authentication function by interoperating with an internal RADIUS server.

To use the internal RADIUS server, operator can add, delete, or edit a user (WEC8500: maximum 2048 users, WEC8050: maximum 512 users).

Configuration using CLI

To configure a local network user related function, enter into the 'radiuscm' of configure mode by executing the following command.

```
WEC8050# configure terminal
WEC8050/configure# radiuscm
```

Operator can execute various commands for Local Net Users.

[Adding User]

To add a user to the Local Net Users, execute the following command.

- Add-local-userdb {username} {password} [name] [email] [department] [home_phone] [work_phone] [mobile_phone]

Parameter	Description
Username	Login ID of a user - Character varying (1-63) - MANDATORY - Korean is not allowed. - Special characters { , } , (,) , , , ; , + = , - = , : = , = , ! = , > = , > , < = , < , = - , ! - , = * , ! * , = = , # , " , " , " , * , ? , \ , space , & Cannot be used.
Password	User's password - Character varying (1-63) - MANDATORY - Korean is not allowed. - Special characters { , } , (,) , , , ; , + = , - = , : = , = , ! = , > = , > , < = , < , = - , ! - , = * , ! * , = = , # , " , " , " , * , ? , \ , space , & Cannot be used.
Name	Name - Character varying (1-63) - OPTIONAL - Korean is not allowed. - Special characters ' , * , ? , \ , ; cannot be used.
email	email address - Character varying (1-63) - OPTIONAL

Parameter	Description
	- Korean is not allowed. - Special characters ‘, *, ?, \, ; cannot be used.
department	Division information - Character varying (1-63) - OPTIONAL - Korean is not allowed. - Special characters ‘, *, ?, \, ; cannot be used.
Home_phone	Home phone number - Character varying (1-63) - OPTIONAL - Korean is not allowed. - Special characters ‘, *, ?, \, ; cannot be used.
Work_phone	Office phone number - Character varying (1-63) - OPTIONAL - Korean is not allowed. - Special characters ‘, *, ?, \, ; cannot be used.
Mobile_phone	Mobile phone number. - Character varying (1-63) - OPTIONAL - Korean is not allowed. - Special characters ‘, *, ?, \, ; cannot be used.

[Modifying User]

To modify a user from the Local Net Users, execute the following command.

- `modify-local-userdb {username} {password} [name] [email] [department] [home_phone] [work_phone] [mobile_phone]`

[Deleting User]

To delete one user from the Local Net Users, execute the following command.

- `delete-local-userdb {username}`

Parameter	Description
Username	User's ID - Character varying (1-63) - MANDATORY - Korean is not allowed. - Special characters { , } , (,) , , , ; , +=, -=, :=, =, !=, >=, >, <=, <, = - , ! - , =*, !*, ==, #, "", " ", ``, *, ?, \, space, & Cannot be used.

To delete all the users from the Local Net Users, execute the following command.

- Remove-all-local-userdb

[Importing User]

To import the Local Net Users list file, execute the following command.

- Import-local-userdb {filename}

Parameter	Description
Filename	File to import - CSV file format - Filename (1-512)

[Exporting User]

To export the Local Net Users list file, execute the following command.

- Export-local-userdb {filename}

Parameter	Description
Filename	File to export - CSV file format - Filename (1-512)

[Checking User]

To check one local net user, execute the following command.

- Show radiuscm username {username}

To check all the local net users, execute the following command.

- Show radiuscm all-user

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <AAA> → <Local User> menu in the sub-menus.

Add Delete Import Local Net User List Export Local Net User List			
Total Entry : 2			
☐	NO.	USER ID	E-MAIL
☐	1	test111	PPP
☐	2	test22	
1			

To add a user, click the **<Add>** button.

		Back	Apply
USER ID			
PASSWORD	 1		
CONFIRM PASSWORD			
FULL NAME			
DEPARTMENT			
OFFICE PHONE			
CELL PHONE			
HOME PHONE			
E-MAIL			

- 1) Enter an item according to each parameter description, and click the **<Apply>** button.
 - ID: ID of a user to add
 - PASSWORD: User's initial password
 - CONFIRM PASSWORD: Repeat Password
 - FULL NAME: User's name (option)
 - DEPARTMENT: User's department information (option)
 - OFFICE PHONE: Office phone number (option)
 - CELL PHONE: Mobile phone number (option)
 - HOME PHONE: Home phone number (option)
 - E-MAIL: email (option)
- 2) Importing a local net user list
 Operator can import or export the list of local users. The user list is in the CSV format.
 An existing data is deleted if there is new importing.
- 3) Exporting a local net user list
 Operator can export the list of local users in the CSV format file.

8.2 Unauthorized AP/Terminal Detection and Blocking

As the security function, the W-EP wireless LAN device provides the detection service for an unauthorized AP using the Wireless Intrusion Detection System (WIDS)/WIPS function. This function detects any AP that is illegally installed without an administrator's approval and also any wireless terminals connected to the AP. If an authorized wireless terminal is connected to an unauthorized AP, some information may be exposed or the wireless LAN may be attacked in some ways. Therefore, it is important to manage the risk.

8.2.1 Enabling Detection Function

The procedure of enabling the unauthorized AP and terminal detection function is shown below.

Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable the detection function.

```
WEC8500/configure# wi enable
```

- 3) To check the configured information, use the following command.
 - show wi current-config

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <General> menu in the sub-menus.

Click Apply after selecting Enable or Disable, then operator can configure the Wireless Intrusion service status.



Figure 153. Wireless Intrusion General Configuration Window

8.2.2 Detection

The W-EP wireless LAN system detects all the packets in a wireless LAN network, classifies unauthorized APs and wireless terminals, and creates related alarms and logs. The detected unauthorized APs are classified as follows according to the configured classification policy.

Classification type	Description
Managed AP	AP that is allowed to be used by an administrator among the detected unauthorized APs - Configures the managed AP classification policy. - An administrator can classify a specific AP as a managed AP among the manually detected unauthorized APs.
Unmanage AP	AP that is not allowed to be used by an administrator among the detected unauthorized APs and AP that can be used maliciously - Configures the unmanaged AP classification policy. - An administrator can classify a specific AP as a unmanaged AP among the manually detected unauthorized APs.

8.2.2.1 Configuring the managed AP classification policy

To configure the managed type authorized AP classification policy, execute the command as follows:

Configuration using CLI

- 1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device#
```

- 2) Configure the managed type authorized AP policy.
 - add-classification-rule- managed [RULE_NAME] enable [PRIORITY] [SSID_TYPE] [SSID]

Parameter	Description
RULE_NAME	Classification policy name
PRIORITY	Priority number
SSID_TYPE	SSID type - managed-ssid: SSID that is used in an authorized AP that is connected to the APC. - user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID_NAME is classified as a friendly type unauthorized AP.)

Parameter	Description
SSID_NAME	SSID that is used when the SSID_TYPE is entered as user-configured-ssid

- 3) To check the configured information, use the ‘show wids device rule managed’ command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <User Defined Rule> menu in the sub-menus. And then, select <Managed> at the upper tab.

- 1) By using Add, Delete, or Change, operator can add, delete, or change user defined rules.

	RULE NAME	STATE	PRIORITY	SSID TYPE	CLASS TYPE
☐	123445234563456345645	Enable	1	Managed	Managed
☐	hh	Enable	2	User Configured	Managed

1

Total Entry : 2

Figure 154. Managed Rule Configuration Window

- 2) In the rule addition screen, operator can add a rule by entering the information and click Apply.

CLASS TYPE: ☒ Managed ☐ Unmanaged

RULE NAME:

PRIORITY:

SERVICE STATE: ☒ Enable ☐ Disable

SSID TYPE: ☒ Managed SSID ☐ User Configured SSID

Figure 155. Managed Addition Window

8.2.2.2 Configuring the unmanaged AP classification policy

To configure the unmanaged type unauthorized AP classification policy, execute the command as follows:

Configuration using CLI

- 1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device#
```

- 2) Configure the unmanaged type unauthorized AP policy.
 - add-classification-rule-unmanaged [RULE_NAME] enable [PRIORITY] [MATCH_TYPE] [MIN_RSSI] [MIN_DURATION] [NO_OF_MIN_ASSOC CLIENTS] [ENCRYPTION] [SSID_TYPE] [SSID]

Parameter	Description
RULE_NAME	Classification policy name
PRIORITY	Rule priority number
MATCH_TYPE	Enter either match-all or match-any. - match-all: Classifies as a unmanaged unauthorized AP when the detection criteria entered thereafter are all satisfied. - match-any: Classifies as a unmanaged unauthorized AP when any one of the detection criteria entered thereafter is satisfied.
MIN_RSSI	Minimum RSSI. When the RSSI value is higher than this value, it is classified as a unmanaged unauthorized AP.
MIN_DURATION	Minimum lasting time (unit: s). When the signal lasting time is higher than this value, it is classified as a unmanaged unauthorized AP.
NO_OF_MIN_ASSOC CLIENTS	Minimum number of connected terminals When the number of connected terminals is higher than this value, it is classified as a unmanaged unauthorized AP.
ENCRYPTION	Whether to use encryption - 0: Does not use encryption. If encryption is not used, it is classified as a unmanaged unauthorized AP. - 1: Uses encryption. If encryption is used, it is classified as a malicious unauthorized AP.
SSID TYPE	SSID type - managed-ssid: SSID that is used in an authorized AP that is connected to the APC. - user-configured-ssid [SSID]: Entered SSID (An AP that has SSID as SSID_NAME is classified as a friendly type unauthorized AP.)
SSID_NAME	SSID that is used when the SSID_TYPE is entered as user-configured-ssid

- 3) To check the configured information, use the ‘show wids device rule unmanaged’ command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <User Defined Rule> menu in the sub-menus. And then, select <Unmanaged> at the upper tab.

- 1) By using Add, Delete, or Change, operator can add, delete, or change user defined rules.



Figure 156. Unmanaged Rule Configuration Window

- 2) In the rule addition screen, operator can add a rule by entering the information and click Apply.

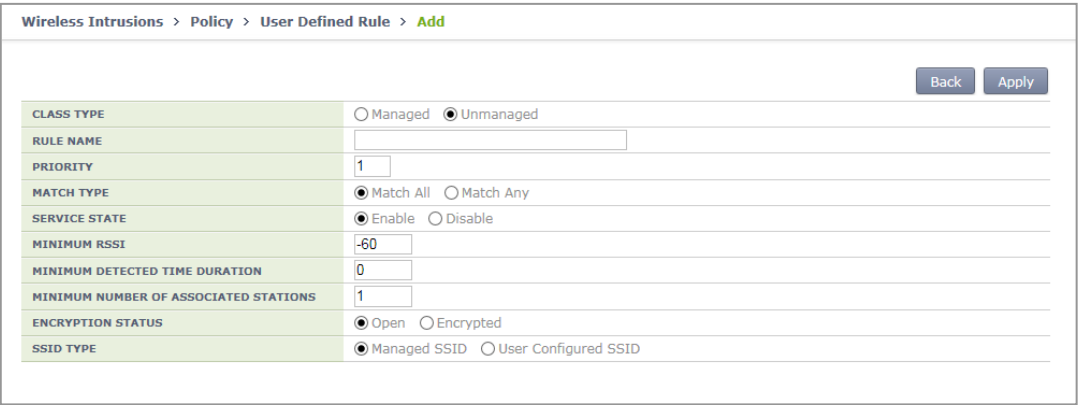


Figure 157. Unmanaged Rule Addition Window

8.2.2.3 Manual configuration (Move)

A user can change the classification of an unauthorized AP that is detected by the WI or that is classified according to the rule configured by a user.

Configuration using CLI

- 1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device#
```

By using the MAC of an unauthorized AP to change, execute the move command.

- move [MAC] [FROM] [TO]

Parameter	Description
MAC	MAC address of a detected AP
FROM	Previous classification of a MAC
TO	Classification to change

- 2) To check the changed configuration, use the following command.
 - show wi device ap list managed
 - show wi device ap list unmanaged

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Wireless Intrusion> → <AP> menu in the sub-menus. And when the AP list is displayed, select one out of the AP list to go to the detail view screen. In the detail view screen, operator can manually change the classification of an AP by using the top down menu of MOVE CLASSIFICATION MANUALLY.

- 1) In the AP list screen, go to the detail view screen by clicking a MAC address.

Wireless Intrusions > AP

Current Filter : None Change

Containment Remove Export

Total Entry : 1432

☐	MAC ADDRESS	SSID	CHANNEL NUMBER	NUMBER OF CLIENTS	CLASS TYPE	STATUS	DETECTING AP
☐	f4:d9:fb:42:7d:00	403_wlan_onoff_test_15	36	2		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:cc:00	ureadymobile	40	2		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:cc:01	setup	40	0		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:23:c4:02	SCME_AP	157	0		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:92:02	ureadymobile	44	0		Removed	f4:d9:fb:34:1f:e0
☐	f4:d9:fb:35:8a:02	WEC8500IG13	153	0		Alert	f4:d9:fb:34:20:20
☐	f4:d9:fb:36:d9:02	wec8500kdh	153	0		Removed	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:69:9a:02	ALEX_5G	161	0		Removed	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:23:be:02	ZCLUSTERED_RRM_5G	161	0	Managed	Managed	f4:d9:fb:34:20:60
☐	f4:d9:fb:23:be:02	ZCLUSTER_TEST_16	9	0	Managed	Managed	f4:d9:fb:34:1f:e0

Figure 158. List Window to Manually Change Classification

- 2) In the AP detail screen, change the classification and click Apply, then the configuration is changed.

Wireless Intrusions > AP > Detail

Back Apply

MAC ADDRESS	f4:d9:fb:35:b0:00
CLASS TYPE	
STATUS	Alert
RADIO TYPE	802.11n(5.0GHz)
CHANNEL NUMBER	44
CHANNEL WIDTH	20Mhz
STRONGEST AP RSSI	-86
SNR	0
MOVE CLASS MANUALLY	Managed ▼
REMOVE MANUALLY	☐ On ☒ Off
SSID	ureadymobile
PREAMBLE	Short
SEVERITY	Major
ENCRYPTION STATUS	Enabled
DETECTION REASON	Managed AP on Invalid/Illegal Channel
NUMBER OF STATIONS	0
DETECTING AP	f4:d9:fb:24:d1:c0
FIRST DETECTION TIME	2014-03-19 08:05:32
LAST DETECTION TIME	2014-03-19 08:18:01

Figure 159. Classification Change Window in AP Detail Screen

8.2.2.4 Manual configuration (Remove)

A user can manually change the status of an unauthorized AP to 'Removed', that is detected by the WIDS or that is classified according to the rule configured by a user.

Configuration using CLI

- 1) Go to configure → wi → device configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configuration# wi
WEC8500/configuration/wi# device
WEC8500/configuration/wi/device#
```

- 2) By using the MAC of an unauthorized AP to change, execute the remove command.
 - remove [MAC]

Parameter	Description
MAC	MAC address of an unauthorized AP

- 3) To check the changed configuration, use the following command.
 - show wi device ap list removed

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Wireless Intrusion> → <AP> menu in the sub-menus. And when the AP list is displayed, check a desired MAC in the list and click the <Remove> button to manually remove an AP. In addition, after going into the detail view screen by selecting one out of the AP list, operator can also remove an AP by changing the REMOVE MANUALLY option to On.

- 1) In the AP list screen, operator can change the status of several APs to 'Removed' by clicking <Remove> button.

	MAC ADDRESS	SSID	CHANNEL NUMBER	NUMBER OF CLIENTS	CLASS TYPE	STATUS	DETECTING AP
☐	f4:d9:fb:42:7d:00	403_wlan_onoff_test_15	36	2		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:cc:00	ureadymobile	40	2		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:cc:01	setup	40	0		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:23:c4:02	SCME_AP	157	0		Alert	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:35:92:02	ureadymobile	44	0		Removed	f4:d9:fb:34:1f:e0
☐	f4:d9:fb:35:8a:02	WEC8500IG13	153	0		Alert	f4:d9:fb:34:20:20
☐	f4:d9:fb:36:d9:02	wec8500khh	153	0		Removed	f4:d9:fb:24:d1:c0
☐	f4:d9:fb:69:9a:02	ALEX_5G	161	0		Removed	f4:d9:fb:34:d1:c0
☐	f4:d9:fb:23:be:02	ZCLUSTERED_RRM_5G	161	0	Managed	Managed	f4:d9:fb:34:20:60
☐	f4:d9:fb:23:be:02	ZCLUSTER_TEST_16	9	0	Managed	Managed	f4:d9:fb:34:1f:e0

Figure 160. List Window to Manually Remove

- 2) If you change the setting of REMOVE MANUALLY to 'On' in the AP detail screen and click Apply, the AP status is changed to 'Removed'.

Wireless Intrusions > AP > Detail

Back Apply

MAC ADDRESS	f4:d9:fb:35:b0:00
CLASS TYPE	
STATUS	Alert
RADIO TYPE	802.11n(5.0GHz)
CHANNEL NUMBER	44
CHANNEL WIDTH	20Mhz
STRONGEST AP RSSI	-86
SNR	0
MOVE CLASS MANUALLY	Managed
REMOVE MANUALLY	☐ On ☒ Off
SSID	ureadymobile
PREAMBLE	Short
SEVERITY	Major
ENCRYPTION STATUS	Enabled
DETECTION REASON	Managed AP on Invalid/Illegal Channel
NUMBER OF STATIONS	0
DETECTING AP	f4:d9:fb:24:d1:c0
FIRST DETECTION TIME	2014-03-19 08:05:32
LAST DETECTION TIME	2014-03-19 08:18:01

Figure 161. Manual Remove Change Window in AP Detail Screen

8.2.2.5 Unauthorized AP detection option

Operator can enable or disable the AP detection option pre-defined in the system.

Configuration using CLI

- 1) Go to configure → wi → device → ap configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# device
WEC8500/configure/wi/device# ap
WEC8500/configure/wi/device/ap#
```

- 2) Using the following command, configure the unauthorized AP detection option.
 - [OPTION] [NOTI_TYPE]

Parameter	Description
OPTION	Unauthorized AP detection option
NOTI_TYPE	Event save option - notify: Notify the state with alarm - detect: Save the state with sys log

The description of OPTION parameter is as follows:

Parameter	Description
ap-blacklist-check	Allocates Rogue ID = 101 by checking a rogue included in the black list.
managed_ssid_invalid_security	Allocates Rogue ID = 102 for an AP that uses a managed SSID and its managed client is in the association status.
fakeap-beacon-on-invalid-channel	Allocates rogue ID = 103 for an AP whose UIC is invalid and that uses a SSID that is not in the ssid white list among the APs that use a managed MAC.
fakeap-beacon-without-ssid	Allocates Rogue ID = 104 for an AP whose UIC is invalid and its SSID is hidden among the APs that use a managed MAC.
fakeap-managed-ssid	Allocates Rogue ID = 105 for an AP whose UIC is invalid and its channel is not in the channel validation list among the APs that use a managed MAC.
illegal-channel	Allocates Rogue ID = 106 if an AP uses a channel that is not in the channel validation list among detected APs.
managedap-invalid-ssid	Allocates Rogue ID = 107 for an AP that uses a SSID that is not in the ssid-whitelist among the APs that use a managed MAC and its UIC is valid.
unknownap-managed-ssid-withauth-client	Allocates Rogue ID = 108 by checking the association status between an unauthorized AP and a managed client.

3) To check the changed configuration, use the following command.

- show wi device ap current-config

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <Static Rule> menu in the sub-menus. And then, operator can change the setting by selecting <AP> at the upper tab and clicking Apply.

In the configuration screen, operator can check Option and click Apply for configuration.

Rule Name	Option 1	Option 2	Option 3
AP BLACKLIST	☒ Detect & Notify	☐ Detect	☐ None
UNMANAGED AP WORKS WITH MANAGED SSID AND ASSOCIATED WITH AUTHORIZED STATION	☒ Detect & Notify	☐ Detect	☐ None
FAKE AP WORKS WITH MANAGED SSID	☒ Detect & Notify	☐ Detect	☐ None
FAKE AP WITH HIDDEN SSID	☒ Detect & Notify	☐ Detect	☐ None
FAKE AP WORKS IN INVALID CHANNEL	☒ Detect & Notify	☐ Detect	☐ None
AP WORKS WITH MANAGED SSID BUT INVALID SECURITY	☒ Detect & Notify	☐ Detect	☐ None
MANAGED AP WITH INVALID SSID	☒ Detect & Notify	☐ Detect	☐ None
AP WORKS IN ILLEGAL CHANNEL	☒ Detect & Notify	☐ Detect	☐ None
ADHOC	☒ Detect & Notify	☐ Detect	☐ None
MANAGED WITHOUT SYSTEM AP WORKS IN SERVING CHANNEL	☒ Detect & Notify	☐ Detect	☐ None

Figure 162. Configuration Window for Unauthorized AP Detection Option

8.2.2.6 Unauthorized client detection option

Operator can enable or disable the client detection option pre-defined in the system.

Configuration using CLI

- 1) Go to configure → wi → device → client configuration mode.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# rogue
WEC8500/configure/wi/device# client
WEC8500/configure/wi/device /client#
```

- 2) Configure the unauthorized client detection option by using the following command.
 - [OPTION] [NOTI_TYPE]

Parameter	Description
OPTION	Rogue Client detect option
NOTI_TYPE	Event save option - notify: Notify the state with alarm - detect: Save the state with sys log

The description of OPTION parameter is as follows:

Parameter	Description
assoc-fail-det	Classifies a client that exceeds the association fail threshold as an unauthorized client.
auth-fail-det	Classifies a client that exceeds the authentication fail threshold as an unauthorized client.
auth-request-det	Classifies a client that exceeds the authentication request threshold as an unauthorized client.
deauth-request-det	Classifies a client that exceeds the de-authentication request threshold as an unauthorized client.
exclusion-list-check	Classifies a MAC that does not exist in the client blacklist as an unauthorized client.
oneXauth-fail-det	Classifies a client that exceeds the 802.1X authentication fail threshold as an unauthorized client.
oui-list-check	Classifies an OUI that does not exist in the OUI list white list as an unauthorized client.
probe-request-det	Classifies a client that exceeds the probe request threshold as an unauthorized client.
webauth-fail-det	Classifies a client that exceeds the WEB authentication fail threshold as an unauthorized client.

- 3) To check the changed configuration, use the following command.
 - show wi device client current-config

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Policy> → <Static Rule> menu in the sub-menus. And then, operator can change the setting by selecting <Station> at the upper tab and clicking Apply.

In the configuration screen, operator can check Option and click Apply for configuration.

Wireless Intrusions > Policy > Static Rule > AP				
		<button>Apply</button>		
AP BLACKLIST	☒ Detect & Notify	☐ Detect	☐ None	
UNMANAGED AP WORKS WITH MANAGED SSID AND ASSOCIATED WITH AUTHORIZED STATION	☒ Detect & Notify	☐ Detect	☐ None	
FAKE AP WORKS WITH MANAGED SSID	☒ Detect & Notify	☐ Detect	☐ None	
FAKE AP WITH HIDDEN SSID	☒ Detect & Notify	☐ Detect	☐ None	
FAKE AP WORKS IN INVALID CHANNEL	☒ Detect & Notify	☐ Detect	☐ None	
AP WORKS WITH MANAGED SSID BUT INVALID SECURITY	☒ Detect & Notify	☐ Detect	☐ None	
MANAGED AP WITH INVALID SSID	☒ Detect & Notify	☐ Detect	☐ None	
AP WORKS IN ILLEGAL CHANNEL	☒ Detect & Notify	☐ Detect	☐ None	
ADHOC	☒ Detect & Notify	☐ Detect	☐ None	
MANAGED WITHOUT SYSTEM AP WORKS IN SERVING CHANNEL	☒ Detect & Notify	☐ Detect	☐ None	

Figure 163. Configuration Window for Unauthorized Station Detection Option

8.2.2.7 Unauthorized Channel Validation Configuration

The unauthorized channel validation function helps an operator detect an AP that uses an unauthorized channel other than configured channels. The configuration procedure is as follows:

Configuration using CLI

- 1) Go to configure → wi → channel-validation configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
WEC8500/configure/wi# channel-validation
```

- 2) Enable the unauthorized channel validation function.

```
WEC8500/configure/wi/channel-validation# enable
```

- 3) Configure an authorized channel.
 - add [CHANNEL]

Parameter	Description
CHANNEL	Authorized channel number (e.g. add 2, 3, 4)

- 4) To check the changed configuration, execute the following command.
- show wi current-config

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Channel Validation> menu in the sub-menus. And then, operator can configure the SERVICE STATE and Valid Channel List in the screen.

Operator can change configuration after changing the SERVICE STATE and Valid Channel List and clicking Apply.

Figure 164. Configuration Window for Channel Validation

8.2.2.8 Configuring and Searching Black/White List

Operator can configure classification to distinguish authorized and unauthorized APs/stations. The administrator configurable lists include <AP black-list, Station black-list, Managed OUI, Managed/Neighbor AP>. The <Managed AP, Managed Station, Managed SSID> are automatically configured and can be used only for search.

Configuration using CLI

- 1) Go to the configure → wids configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wi
```

2) Configure the AP black-list.

- ap-blacklist [MAC]

Parameter	Description
MAC	MAC address that will be used as AP black-list

3) Configure the station black-list.

- client-black-list [MAC]

Parameter	Description
MAC	MAC address that will be used as a black-list of the station

4) Configure the Managed Organizationally Unique Identifier (OUI).

- oui-whitelist [OUI]

Parameter	Description
OUI	First 3 bytes of station MAC address

5) Configure the Managed/Neighbor AP.

- Managed [MAC] [TYPE]

Parameter	Description
MAC	AP MAC address of Managed/Neighbor AP
TYPE	- Managed: Indicates that the address is located internally during configuration - Neighbor: Indicates that the address is located externally during configuration

6) To check the changed configuration, execute the following command.

- show wi lists managed-ap
- show wi lists ap-blacklist
- show wi lists managed-stat
- show wi lists client-blacklist
- show wi lists managed ssid
- show wi lists oui-list
- show wi lists neighbor-ap

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Classification> menu in the sub-menus. And then, operator can configure and search by using the upper tab in the screen.

- 1) In the [AP Blacklist] tab, operator can add an AP blacklist by entering a MAC and click Add. Operator can also delete it by using Delete.

Figure 165. AP blacklist Configuration Window

- 2) In the [Managed AP] tab, operator can search for a Managed AP.

Figure 166. Managed AP Window

- 3) In the [Station Blacklist] tab, operator can add a station blacklist by entering a MAC and click Add. Operator can also delete it by using Delete.

Wireless Intrusions > Classification > Station Blacklist

Current Filter : None Change

MAC Address 00 : 00 : 00 : 00 : 00 : 00 Add Delete

Total Entry : 2

MAC ADDRESS
44:44:44:44:44:44
44:44:44:44:44:45

Figure 167. Station blacklist Search/Configuration Window

- 4) In the [Managed Station] tab, operator can search Managed Station.

Wireless Intrusions > Classification > Managed Station

Current Filter : None Change

Total Entry : 114

MAC ADDRESS
a2:a3:a4:a5:a7:1d
a2:a3:a4:a5:a8:37
a2:a3:a4:a5:a9:4e
a2:a3:a4:a5:a7:e1
a2:a3:a4:a5:a8:50
a2:a3:a4:a5:a9:ab
a2:a3:a4:a5:a9:45
a2:a3:a4:a5:a9:30
a2:a3:a4:a5:a7:03
a2:a3:a4:a5:a9:b8
a2:a3:a4:a5:a8:1c
a2:a3:a4:a5:a9:bc
a2:a3:a4:a5:a8:69
a2:a3:a4:a5:a6:75
a2:a3:a4:a5:a6:0c
a2:a3:a4:a5:a6:2c
a2:a3:a4:a5:a7:0a
a2:a3:a4:a5:a8:6a
a2:a3:a4:a5:a7:4d
a2:a3:a4:a5:a8:f1
a2:a3:a4:a5:a6:1c
a2:a3:a4:a5:a8:7b
a2:a3:a4:a5:a7:5b
a2:a3:a4:a5:a9:c6
a2:a3:a4:a5:a7:e0
a2:a3:a4:a5:a6:a9
a2:a3:a4:a5:a7:20
a2:a3:a4:a5:a8:0c
a2:a3:a4:a5:a8:92
a2:a3:a4:a5:a6:a3
a2:a3:a4:a5:a8:64
a2:a3:a4:a5:a8:d6
a2:a3:a4:a5:a7:e8
a2:a3:a4:a5:a7:0e
a2:a3:a4:a5:a6:d8
a2:a3:a4:a5:a9:94
a2:a3:a4:a5:a6:d9
a2:a3:a4:a5:a9:81
a2:a3:a4:a5:a8:20
a2:a3:a4:a5:a6:f2
a2:a3:a4:a5:a6:82
a2:a3:a4:a5:a9:d3
a2:a3:a4:a5:a9:d8
a2:a3:a4:a5:a9:86
a2:a3:a4:a5:a9:5c
a2:a3:a4:a5:a9:40
a2:a3:a4:a5:a6:06
a2:a3:a4:a5:a8:85
a2:a3:a4:a5:a8:a5
a2:a3:a4:a5:a6:36
a2:a3:a4:a5:a8:fb
a2:a3:a4:a5:a8:01
a2:a3:a4:a5:a9:2f
a2:a3:a4:a5:a6:03
a2:a3:a4:a5:a6:d5
a2:a3:a4:a5:a8:8b
a2:a3:a4:a5:a7:07
a2:a3:a4:a5:a6:70
a2:a3:a4:a5:a8:0e
a2:a3:a4:a5:a9:a9

Figure 168. Managed Station Search Window

- 5) In the [Managed OUI] tab, operator can add a Managed OUI by entering an OUI and click Add. Operator can also delete it by using Delete.

Wireless Intrusions > Classification > **Managed OUI**

Current Filter : None Change

OUI : : Add Delete Total Entry : 6052

OUI		
☐		
☐	33:33:01	☐
☐	33:33:02	☐
☐	33:33:03	☐
☐	33:33:04	☐
☐	a0:11:01	☐
☐	a0:11:02	☐
☐	a0:11:03	☐
☐	a0:11:04	☐
☐	a0:11:05	☐
☐	a0:11:06	☐
☐	a0:11:07	☐
☐	a0:11:08	☐
☐	a0:11:09	☐
☐	a0:11:10	☐
☐	a0:11:11	☐
☐	a0:11:12	☐
☐	a0:11:13	☐
☐	a0:11:14	☐
☐	a0:11:15	☐
☐	a0:11:16	☐
☐	a0:11:17	☐
☐	a0:11:18	☐
☐	a0:11:19	☐
☐	a0:11:20	☐
☐	a0:11:21	☐
☐	a0:11:22	☐
☐	a0:11:23	☐
☐	a0:11:24	☐
☐	a0:11:25	☐
☐	a0:11:26	☐
☐	a0:11:27	☐
☐	a0:11:28	☐
☐	a0:11:29	☐
☐	a0:11:30	☐
☐	a0:11:31	☐
☐	a0:11:32	☐
☐	a0:11:33	☐
☐	a0:11:34	☐
☐	a0:11:35	☐
☐	a0:11:36	☐
☐	a0:11:37	☐
☐	a0:11:38	☐
☐	a0:11:39	☐
☐	a0:11:40	☐
☐	a0:11:41	☐
☐	a0:11:42	☐
☐	a0:11:43	☐
☐	a0:11:44	☐
☐	a0:11:45	☐
☐	a0:11:46	☐
☐	a0:11:47	☐
☐	a0:11:48	☐
☐	a0:11:49	☐
☐	a0:11:50	☐
☐	a0:11:51	☐
☐	a0:11:52	☐
☐	a0:11:53	☐
☐	a0:11:54	☐
☐	a0:11:55	☐
☐	a0:11:56	☐

1 2 3 4 5 > ... [101]

- 6) In the [Managed SSID] tab, you can check the SSID that the WLAN is using.

Wireless Intrusions > Classification > **Managed SSID**

Current Filter : None Change

Total Entry : 255

SSID		
ZCLUSTERED_RRM_5G	ZCLUSTERED_RRM_2G	ZRRM_TEST1
ZCLUSTERED_RRM_3	ZCLUSTER_TEST_5	ZCLUSTER_1234567890
ZCLUSTER_7777	ZCLUSTER_8888	ZCLUSTER_9999
ZCLUSTER_10	ZCLUSTER_11	ZCLUSTER_12
ZCLUSTER_13	ZCLUSTER_14	ZCLUSTER_15
ZCLUSTER_TEST_16	ZRRM_17	ZRRM_18
ZRRM_19	ZRRM_20	ZRRM_21
ZRRM_22	ZRRM_23	ZRRM_24
ZRRM_25	ZRRM_26	ZRRM_27
ZRRM_28	ZRRM_29	ZRRM_30
ZRRM_31	ZRRM_32	ZRRM_33
ZRRM_34	ZRRM_35	ZRRM_36
ZRRM_37	ZRRM_38	ZRRM_39
ZRRM_40	ZRRM_41	ZRRM_42
ZRRM_43	ZRRM_44	ZRRM_45
ZRRM_46	ZRRM_47	ZRRM_48
ZRRM_49	ZRRM_50	ZRRM_51
ZRRM_52	ZRRM_53	ZRRM_54
ZRRM_55	ZRRM_56	ZRRM_57
ZRRM_58	ZRRM_59	ZRRM_60

1 2 3 4 5

Figure 169. Managed SSID Window

- 7) If you click Add in the [Managed/Neighbor AP] tab, operator can go to the Managed/Neighbor AP list addition screen and can add a Managed/Neighbor AP list.
Operator can also delete it by using Delete.
- [Managed/Neighbor AP] tab main screen

	MAC ADDRESS	STATE
☒	f4:d9:fb:24:d2:02	Managed
☐	f4:d9:fb:37:a9:02	Neighbor
☐	f4:d9:fb:37:a1:02	Managed
☐	f4:d9:fb:35:e6:03	Neighbor
☐	f4:d9:fb:36:c5:04	Neighbor
☐	f4:d9:fb:23:be:04	Managed
☐	22:22:22:22:22:22	Managed
☐	22:22:22:22:22:23	Managed

Total Entry : 8

Figure 170. Managed/Neighbor AP Search/Configuration Window

- Managed/Neighbor AP list addition screen

MAC ADDRESS	STATE
00 : 00 : 00 : 00 : 00 : 00	Neighbor

Figure 171. Managed/Neighbor AP List Addition Window

8.2.2.9 Station Allow Limit

The WIDS counts the number of frames and number of authentication failures to distinguish a station that generates too many management frames in a network or that is continuously failed for authentication. A threshold value is defined for the count and a station is recognized as an unauthorized station if the count exceeds the threshold.

Configuration using CLI

- 1) Go to the configure → wi → device → client configuration mode.

```
WEC8500# configure terminal
WEC8500/configuration# wi
WEC8500/configuration/wi# device
WEC8500/configuration/wi/device# client
WEC8500/configuration/wi/device/client#
```


- 2) Configure a threshold.
- allowed-limit [OPTION] [COUNT]

Parameter	Description
OPTION	- 80211-auth-req: Authentication requests threshold per second - 80211-probe-req: Probe requests threshold per second - 80211-deauth-req: De-authentication requests threshold per second - 80211-assoc-fail: Association failures threshold per second - 80211-auth-fail: Authentication failures threshold per second - 8021x-auth-fail: 802.1x authentication failures threshold per WIDS interval - web-auth-fail: Web authentication failures threshold that occurs continuously
COUNT	Threshold value of [OPTION] ranging from 3 to 20

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Wireless Intrusion> → <Station Allow Limit> menu in the sub-menus. And then, enter a threshold value and click Apply to configure the value in the screen.

Wireless Intrusions > Station Allow Limit	
EXCESSIVE 802.11 AUTH REQUESTS THRESHOLD	3
EXCESSIVE 802.11 DEAUTH REQUESTS THRESHOLD	5
EXCESSIVE 802.11 PROBE REQUESTS THRESHOLD	5
EXCESSIVE 802.11 ASSOCIATION FAILURES THRESHOLD	5
EXCESSIVE 802.11 AUTH FAILURES THRESHOLD	5
EXCESSIVE 802.1X AUTH FAILURES THRESHOLD	3
EXCESSIVE WEB AUTH FAILURES THRESHOLD	5

Foot Notes :

1. Set the threshold of management packet per sec. It's for the detect flood attack

Figure 172. Station Allowed Limit Configuration Window

8.3 Captive Portal

The W-EP wireless LAN system provides the Guest Access function. A guest user can receive a limited service after connected to a specific WLAN (SSID) and going through authentication.

8.3.1 WLAN Security Configuration

Configuration using CLI

To configure WLAN security for guest connection control, execute the command as follows:

- 1) Go to configure → wlan configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

- 2) Disable the WLAN.

```
WEC8500/configure/wlan 1# no enable
```

- 3) Configure the WEB policy (default: disabled).

```
WEC8500/configure/wlan 1/security/layer3# web-policy
```

- 4) Enable the WEB authentication (default: disabled)

```
WEC8500/configure/wlan 1/security/layer3# web-policy authentication
```

- 5) Configure a guest flag (default: disabled).

```
WEC8500/configure/wlan 1# guest-flag
```

- 6) Enable the WLAN.

```
WEC8500/configure/wlan 1# enable
```

- 7) To check the configured environment, use the 'show wlan security summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. In the WLANs screen, select WLAN ID and enable the <GUEST SERVICE> option.

MAX. ALLOWED STATIONS	127
GUEST SERVICE	☒ Enable ☐ Disable
ADMIN STATUS	☒ Enable ☐ Disable

Figure 173. WLAN Guest Configuration Window

Go to the <L3> of <Security> tab. Enable <WEB POLICY> and select Web Authentication.

PROFILE NAME	wlan4
WEB POLICY	☒ Enable ☐ Disable
	☒ Web Authentication
	☐ Web PassThrough
	☐ Conditional Web Redirection

Figure 174. WLAN Web Policy Configuration Window

8.3.2 Guest Connection Configuration

Configuration using CLI

By executing the 'security captive-portal' command, operator can configure various Captive Portal related options.

First of all, enter into the configuration mode to execute the command.

```
WEC8500# configure terminal
```

[Adding User]

To add a guest user, execute the command as follows:

- security captive-portal guest add [ID] [PASSWD] [START_TIME] [END_TIME]

Parameter	Description
ID	Login ID of a user
PASSWD	Password
START_TIME	start time (YYYY-MM-DD:HH:MM:SS format)
END_TIME	end time (YYYY-MM-DD:HH:MM:SS format)

[Deleting User]

To add a guest user, execute the command as follows:

- security captive-portal guest delete [ID]

Parameter	Description
ID	User ID

[Auth Type Configuration]

To select the authentication method for a guest service, execute the command as follows:

- security captive-portal auth-type [FLAG]

Parameter	Description
FLAG	Authentication method - local-only: Uses internal authentication. - radius-only: Uses RADIUS server authentication. - local-radius: Uses Radius authentication if the internal authentication is failed. - radius-local: Uses the internal authentication if the RADIUS server authentication is failed.

[RADIUS Server Configuration]

For RADIUS authentication, operator can configure the primary and secondary server by using a profile id.

- security captive-portal radius-primary [PROFILE_ID]
- security captive-portal radius-secondary [PROFILE_ID]

Parameter	Description
PROFILE_ID	Profile ID

[Operation Configuration after Authentication]

To configure the operation after authentication, execute the command as follows:

- security captive-portal web-auth after-auth [FLAG]
- security captive-portal web-auth redirect-url [URL]

Parameter	Description
FLAG	Operation after authentication - redirect: Redirect to a specified URL - request: Redirect to a requested URL
URL	URL specified as the operation after authentication

[Web Authentication Method Configuration]

To configure the web authentication method used for guest authentication, execute the command as follows:

- security captive-portal web-auth web-type [FLAG]
- security captive-portal web-auth external-url [URL]

Parameter	Description
FLAG	Web Authentication Method - internal: Uses the internal authentication page. - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system. - customized: Uses the authentication page created through configuration.
URL	Address of an external authentication server

[Retrieving Captive Portal Configuration]

To retrieve the configured environment, execute the following command.

- show security captive-portal summary
- show security captive-portal guest
- show security captive-portal web-auth

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <CaptivePortal> → <Guest Users> menu in the sub-menus.

Guest Users

USER ID		Generator
PASSWORD		Generator
CONFIRM PASSWORD		
START TIME	2014-03-12 00 : 00 : 00	☐ Immediate
END TIME	2014-03-12 23 : 59 : 59	☐ Unlimited
FULL NAME		
COMPANY		
EMAIL		
PHONE		
MAX SESSION	1	
STATUS	☒ Enable ☐ Disable	
COMMENTS		

Sponsor

SPONSOR	
DEPARTMENT	
EMAIL	
PHONE	
COMMENTS	

Figure 175. Guest User Configuration Window

Operator can check and delete a guest created in the <Guest Users> menu.

	USER ID	START TIME	END TIME
☐	u2	2013-08-13 07:00:00	9999-99-99 99:99:99

Figure 176. Guest User List Window

In the <Guest Users> menu, operator can select Auth Type and also PRIMARY RADIUS and SECONDARY RADIUS server.

GUEST AUTH TYPE	RADIUS
PRIMARY RADIUS SERVER	90.90.40.140 : 1812 / 1813
SECONDARY RADIUS SERVER	90.90.40.140 : 1812 / 1813

Figure 177. Guest Auth Configuration Window

In the <CaptivePortal> → <Web Authentication> menu, operator can select web authentication method. Operator can also configure Redirect as the operation after authentication.

Web Login Page	
WEB AUTHENTICATION TYPE	Internal v
AFTER AUTHENTICATION	☐ Redirect user's original opening web page.
	☒ Redirect URL http://90.90.40.124

Figure 178. Web Auth Configuration Window

8.4 WEB Pass-through

The APC provides the WEB Pass through function that transmits a user packet to the redirect URL configured by an operator.

8.4.1 WLAN Security Configuration

Configuration using CLI

- 1) Go to configure → wlan configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
```

- 2) Disable the WLAN.

```
WEC8500/configure/wlan 1# no enable
```

- 3) Configure the WEB policy (default: disabled).

```
WEC8500/configure/wlan 1/security/layer3# web-policy
```

- 4) Configure the Pass through function (default: disabled).

```
WEC8500/configure/wlan 1/security/layer3# web-policy pass-through
```

- 5) Configure the Overriding Redirect URL function (Default: Disabled)

```
WEC8500/configure/wlan 1/security/layer3# redirect-URL-override enable
WEC8500/configure/wlan 1/security/layer3# redirect-URL-override [URL]
```

Parameter	Description
URL	Web server redirect URL

- 6) Enable the WLAN.

```
WEC8500/configure/wlan 1# enable
```

- 7) To check the configured environment, use the 'show wlan security summary' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANS> menu in the sub-menus. Select a WLAN ID in the WLANS screen and go to the <L3> of <Security> tab. Enable <WEB POLICY> and select Web PassThrough. Enable <OVERRIDING REDIRECT URL> and configure <URL>.

PROFILE NAME	wlan4
WEB POLICY	☒ Enable ☐ Disable
	☐ Web Authentication
	☒ Web PassThrough
	☐ Conditional Web Redirection
PRE-AUTHENTICATION ACL	----- ▾
OVERRIDING REDIRECT URL	☒ Enable ☐ Disable
URL	http://90.90.40.125

Figure 179. Web Pass-through Configuration Window

8.5 NAT and Firewall Configuration

The APC provides the NAT and firewall function to provide stable network to a WLAN user.

8.5.1 Firewall Configuration

Configuration using CLI

[Firewall Configuration]

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure the accelerator function of a firewall.

```
WEC8500/configure# firewall enable
```

[Firewall Configuration using Access List]

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Create an access-list.

```
WEC8500/configure# access-list fw fw4 deny tcp any any eq 23
```

- 3) Configure a firewall to the interface using an access-list.

```
WEC8500/configure# interface vlan1.10
WEC8500/configure/interface vlan1.10# ip access-group fw forward fw4
WEC8500/configure/interface vlan1.10# exit
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <Firewall> → <General> menu in the sub-menus. You can configure whether to use a firewall.



Figure 180. Firewall configuration (1)

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <Firewall> → <Interface> menu in the sub-menus.
You can configure an interface for which a firewall will be applied by clicking the <Add> button of Interface window.

INTERFACE	Select Interface
DIRECTION	☐ Ingress ☐ Egress ☐ Forward
POLICY RULE	if_test1

Figure 181. Firewall configuration (2)

8.5.2 Access List Configuration

Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Create an access-list.

- access-list fw [ACL_NAME] [ACTION] [SRC_ADDRESS (SRC_PORT)] [DST_ADDRESS (DST_PORT)] [PROTOCOL]

Parameter	Description
ACL_NAME	ACL name to configure
ACTION	Action configuration (deny/permit)
SRC_ADDRESS(SRC_PORT)	Source IP address and port
DST_ADDRESS(DST_PORT)	Destination IP address and port
PROTOCOL	Protocol

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <Firewall> → <<Policy> menu in the sub-menus. Click the <Add> button to configure the firewall Policy.

NAME	
PROTOCOL	Any
SOURCE IP	Any
SOURCE PORT	Any
DESTINATION IP	Any
DESTINATION PORT	Any
ICMP TYPE	NotUsed
ACTION	Permit

Figure 182. Access-list configuration

8.5.3 NAT Configuration

Configuration using CLI

[SNAT Configuration using Access List]

To add Source NAT (SNAT) using an access-list, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Create an access-list.

```
WEC8500/configure# access-list fw fw1 deny any 10.10.10.10/32 any
```

- 3) Create a NAT pool.

```
WEC8500/configure# ip nat pool pool1 30.30.30.1 30.30.30.1  
255.255.255.0
```

- 4) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30  
WEC8500/configure/interface vlan1.30# ip nat inside  
WEC8500/configure/interface vlan1.30#exit
```

- 5) Add the NAT rule by using access-list and pool.

```
WEC8500/configure# ip nat outside source list fw1 pool pool1
```

[SNAT Configuration using Static IP]

To add SNAT using a static IP, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30  
WEC8500/configure/interface vlan1.30#ip nat outside  
WEC8500/configure/interface vlan1.30#exit
```

- 3) Configure a NAT rule using a static IP.

```
WEC8500/configure# ip nat outside source static 10.10.10.10 30.30.30.1
```

[DNAT Configuration using Access List]

To add Destination NAT (DNAT) using an access-list, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Create a NAT pool.

```
WEC8500/configure# ip nat pool pool2 10.10.10.10 10.10.10.10  
255.255.255.0
```

- 3) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30  
WEC8500/configure/interface vlan1.30#ip nat outside  
WEC8500/configure/interface vlan1.30#exit
```

- 4) Add the NAT rule by using access-list and pool.

```
WEC8500/configure# ip nat outside destination list fw6 pool pool2
```

[DNAT Configuration using Static IP]

To add DNAT using a static IP, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure a NAT to the interface.

```
WEC8500/configure# interface vlan1.30  
WEC8500/configure/interface vlan1.30#ip nat outside  
WEC8500/configure/interface vlan1.30#exit
```

- 3) Configure a NAT rule using a static IP (A port can be also specified for DNAT).

```
WEC8500/configure# ip nat outside destination static tcp 10.10.10.1
4300 30.30.30.2 23
```

[Checking NAT Configuration]

To check the created NAT, use the following command.

```
WEC8500/configure# show nat
```

Configuration using Web UI

- 1) In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <NAT> → <Pool> menu in the sub-menus. Click the <Add> button and configure the NAT pool.

NAME	pool1			
START IP ADDR	192	168	20	10
END IP ADDR	192	168	20	200
SUBNET MASK	255	255	255	0

Figure 183. NAT configuration (1)

- 2) Click the <Add> button in the Translation Rule window and configure the Translation Rule. Select NAT TYPE as either SNAT or DANT. Select STATIC checkbox to configure Static and configure the values of Original IP Addr: Port and Translated IP Addr: Port.

NAT TYPE	SNAT
NAT DIRECTION	Inside
STATIC	☐
PROTOCOL	Any
ORIGINAL IP ADDR : PORT	0 . 0 . 0 . 0 : 0
TRANSLATED IP ADDR : PORT	0 . 0 . 0 . 0 : 0
FIREWALL POLICY	jf_test1
NAT POOL	pool1

Figure 184. NAT configuration (2)



NOTE

To proceed with NAT configuration, you must create an access list first.

8.6 MAC Filter

The W-EP wireless LAN system provides the MAC filter function. A user may experience connection restriction due to MAC filtering when connecting to a specific WLAN (SSID).

Configuration using CLI

To configure a MAC list for connection control by the MAC filter, execute the command as follows:

- 1) Go to configure → security configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
```

- 2) Creates a MAC filter list.

```
WEC8500/configure/security# mac-filter [ID]
```

Parameter	Description
ID	MAC filter list table ID (range: 1-20)

- 3) Configure the filtering policy.

```
WEC8500/configure/security/mac-filter 1# policy [POLICY]
```

Parameter	Description
POLICY	Table policy of MAC filtering list

- 4) Configure a MAC entry.

```
WEC8500/configure/security/mac-filter 1# mac [MAC_ADDRESS]
```

Parameter	Description
MAC_ADDRESS	MAC address (XX:XX:XX:XX:XX:XX format)

- 5) Specify the MAC filter ID that is configured in the WLAN to which a MAC filter will be applied.

```
WEC8500/configure/wlan 1/security# mac-filter <MAC_FILTER_ID>
```


Parameter	Description
MAC_FILTER_ID	MAC FILTER ID (range: 1-20)

6) You can check the configured information below.

```
show security mac-filter summary
```

```
WEC8500# show security mac-filter detail
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Security> → <MAC Filter> menu in the sub-menus.

You can create a MAC filter table for station access control by clicking the <Add> button.

Security > MAC Filter

AddDelete

☐	INDEX	NAME	POLICY	RADIUS AUTH	INTERVAL	COUNT
☐	1	MAC_Filter_1	Allow	disable	0	0
☐	2	MAC_Filter_2	Deny	enable	0	1
☐	3	MAC_Filter_3	Not Use	disable	0	0
☐	4	MAC_Filter_4	Allow	disable	0	2

Figure 185. MAC configuration

The procedure for MAC entry configuration is given below.

- 1) In the MAC Filter initial window, select an INDEX item to switch to the Edit screen and then click the <Add> button to configure a MAC entry.

Security > MAC Filter > Add

BackApply

MAC

00 : 16 : 32 : 82 : ed : ca

DESCRIPTION

station 1

Figure 186. MAC entry configuration window(1)

- 2) Configure the policy in the Edit configuration screen by selecting the index of MAC filter list.

Security > MAC Filter > Edit	
INDEX	1
NAME	MAC_Filter_1
POLICY ¹	Deny
RADIUS AUTH ²	disable
INTERVAL ³	1
COUNT	0

Figure 187. MAC entry configuration(2)

- 3) Select a WLAN for which the MAC filter will be applied. Check a MAC FILTER ID to apply in the Security > L2 configuration screen.
To apply the configuration, click the <Apply> button.

WLANs > WLANs > Security > L2	
L2 L3 Radius	
PROFILE NAME	wlan2
L2 SECURITY TYPE ¹	None
MAC FILTER	MAC_Filter_1

Figure 188. MAC entry configuration(3)

8.7 Operator Authentication through Interoperation with TACACS+ Server

A W-EP wireless LAN system provides an operator authentication function by interoperating with an external TACACS+ server.

8.7.1 Configuring External TACACS+ Server

A W-EP wireless LAN system provides an operator authentication function by interoperating with an external TACACS+ server and the procedure detailed below is carried out for interoperation with a TACACS+ server.

8.7.1.1 Basic Settings

The default configuration of the TACACS+ server is as follows:

Configuration using CLI

- 1) Go to configure → security → tacacs configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# security
WEC8500/configure/security# tacacs 1
WEC8500/configure/security/tacacs 1#
```

- 2) Configure the IP address of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# server-ip [IP_ADDRESS]
```

Parameter	Description
IP_ADDRESS	IP address of the TACACS+ server

- 3) Set the public key of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# shared-secret [KEY_STRING]
```

Parameter	Description
KEY_STRING	Public key of the TACACS+ server

- 4) Configure the port number of the TACACS+ server.

```
WEC8500/configure/security/tacacs 1# server-port [PORT_NUMBER]
```

Parameter	Description
PORT_NUMBER	Port number of the TACACS+ server (range: 1-65,535, default value: 49)

- 5) Configure the items related to retransmissions in TACACS+ communications.
You can use default values without changing configuration.

```
WEC8500/configure/security/tacacs 1# retransmit-interval
[RETRY_INTERVAL]
WEC8500/configure/security/tacacs 1# retransmit-count [FO_RETRY_COUNT]
```

Parameter	Description
RETRY_INTERVAL	Retransmission interval for a TACACS+ message (unit: seconds, range: 1-5, default value: 3)
FO_RETRY_COUNT	Maximum message retransmission count before a TACACS+ server failover is attempted (range: 0-3, default value: 2)

- 6) If necessary, configure the source IP address of the TACACS+ message.

```
WEC8500/configure/security/tacacs 1# source-ip [IP_ADDRESS]
```

Parameter	Description
IP_ADDRESS	Source IP address of the TACACS+ message Note: it must be one of the IP addresses configured in the W-EP wireless LAN system.

- 7) Configure whether to transfer packets to the TACACS+ server. You can use default values without changing configuration.

```
WEC8500/configure/security/tacacs 1# status [STATUS]
```

Parameter	Description
STATUS	Status indicating whether packets are transferred to the TACACS+ server (default value: enable)

- 8) Exit TACACS+ server configuration and then security configuration mode.

```
WEC8500/configure/security/tacacs 1# exit
WEC8500/configure/security# exit
```

- 9) You can view configuration information by using the ‘show security tacacs server config’ and ‘show security tacacs server detail [SERVER ID]’ commands.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, and then select <Security> → <AAA> → <TACACS+> in the submenus.

If you click the <Add> button in the TACACS+ initial window, you can add a TACACS+ server.

The server addition window is shown below.

Figure 189. TTACACS+ Server Configuration Window

Item	Description
INDEX (PRIORITY)	ID that distinguishes TACACS+ server configurations
IP ADDRESS	IP address of the TACACS+ server
SHARED SECRET	Public key of the TACACS+ server
CONFIRM SHARED SECRET	Re-enters the key for TACACS+ server communications for confirmation
PORT NUMBER	Communication port number of the TACACS+ server (range: 1-65,535, default value: 49)
RETRANSMIT INTERVAL	Retransmission interval for a TACACS+ message (range: 1-5, default value: 2, unit: seconds)
RETRANSMIT COUNT BEFORE FAILOVER	Maximum message retransmission count before a TACACS+ server failover is attempted (range: 0-3, default value: 2)
SOURCE IP ADDRESS	Source IP address of the TACACS+ message - Note: it must be one of the IP addresses configured in the W-EP wireless LAN system.
STATUS	Status indicating whether packets are transferred to the TACACS+ server (default value: enable)

8.7.2 Configuring Authentication Type of Operator Account

The steps for configuring the authentication type of the operator account are as follows:

Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Configure the type of operator account authentication.

```
WEC8500/configure# mgmt-user auth-type [AUTH_TYPE]
```

Parameter	Description
AUTH_TYPE	Authentication type of the operator account (default value: local) - local: Authentication is performed using the database stored inside. - tacacs: Authentication is performed using the TACACS+ server. - local-tacacs: Authentication is performed using the database stored inside first, and, failing that, an authentication request is transmitted to the TACACS+ server. - tacacs-local: An authentication request is transmitted to the TACACS+ server first, and, failing that, authentication is performed using the DB stored inside.

- 3) You can view the configuration information by using the 'show mgmt-users auth-type' command.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, and then select <Security> → <AAA> → <Management User> in the submenus.

Security > AAA > Management User

ORDER USED FOR AUTHENTICATION: TACACS+/Local

Apply

Figure 190. Operator Account Authentication Type Configuration Window

CHAPTER 9. IP Application

In this chapter, the IP application functions available in the APC and each configuration method are described.

9.1 DNS

The DNS is a network service that interprets a domain or host name into an IP address. The APC gets DNS information from a DNS server and provides the DNS relay function that relays the DNS server and a client. If a wireless terminal connected to the APC configures the APC as a DNS server, it can receive the DNS service.

If a DNS server is connected to the APC and a DNS proxy is configured, a station connected to the APC can receive the DNS service by configuring the APC as a DNS server.

9.1.1 DNS Client Configuration

Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure a DNS client.
 - ip dns client enable: Enable
 - no ip dns client enable: Disable
- 3) Configure a DNS server to which DNS will be requested. You can enter maximum 3 DNS server addresses.
 - ip dns name-server [A.B.C.D]: Configures a DNS server.
 - no ip dns name-server [A.B.C.D]: Deletes a configured DNS server.
 - no ip dns name-server all: Deletes all the DNS servers.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <DNS> menu in the sub-menus.

DNS Server				
QUERY	☒ Enable ☐ Disable			
1ST DNS SERVER	3	1	1	1
2ND DNS SERVER	2	2	2	2
3RD DNS SERVER	8	8	8	8
DNS Relay				
SERVICE	☒ Enable ☐ Disable			
CACHING SIZE	10000			

Figure 191. DNS client

You can enable or disable a DNS client using the QUERY of a DNS SERVER item. In the 1ST DNS SERVER, 2ND DNS SERVER, and 3RD DNS SERVER boxes, you can configure 3 name servers.

9.1.2 DNS Proxy Configuration

You can configure the DNS relay function or a cache for relay. The cache is a temporary space where the APC saves the DNS information obtained from a DNS server. You can configure maximum number of entries as 10000-100000. The DNS relay is related to the DNS client configuration. If you disable the DNS client function or delete all the name servers, the DNS relay function is not working.

Configuration using CLI

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure a DNS relay. Configure the cache to a default, i.e. 10000.
 - ip dns relay enable: Enables a relay.
 - no ip dns relay enable: Disables a relay.
- 3) To change cache configuration, enter as follows:
 - ip dns relay enable cache: Configures a DNS relay and configures the cache to a default, i.e. 10000.
 - ip dns relay enable cache 20000: Configures a DNS relay and configures the cache to 20000.
 - ip dns relay enable no-cache: Configures a DNS relay and disables the cache settings.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <DNS> menu in the sub-menus.

DNS Server	
QUERY	☒ Enable ☐ Disable
1ST DNS SERVER	3 1 1 1
2ND DNS SERVER	2 2 2 2
3RD DNS SERVER	8 8 8 8

DNS Relay	
SERVICE	☒ Enable ☐ Disable
CACHING SIZE	10000

Apply

Figure 192. DNS proxy

The DNS Relay item supports DNS Proxy configuration. In the SERVICE, you can enable or disable a DNS proxy and configure the cache size of the DNS proxy in the CACHING SIZE. If the cache size is 0, disable the cache.

9.2 NTP

The Network Time Protocol (NTP) is a protocol used to receive time from a configured server and synchronize the local time.

The APC can operate as a NTP server and a client. If you configure the APC as a NTP client, it receives the Coordinated Universal Time (UTC) information from the configured NTP server and synchronizes the local time. In addition, if you configure the APC as a NTP server, it transmits a local time when it receives a NTP request from a NTP client.

Configuration using CLI

[Configuring NTP Client]

The time server that is referred to when the APC is working as a NTP client can be used based on a domain name and IP address. But, if it is working based on a domain name, there must be a configured DNS server.

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable a NTP client.
 - ntp client enable: Enable
 - no ntp client enable: Disable
- 3) Configure the interval of a NTP client.
 - ntp client interval [INTERVAL]: Configures an interval.
 - no ntp client interval: Disables an interval.

Parameter	Description
INTERVAL	Interval (range: 3-14)

- 4) Configure a server that a NTP client will refer to.

[Configuring based on a domain name]

Enables or disables.

- ntp client server-addr hostname <WORD>: Enable
- no ntp client server-addr hostname <WORD>: Disable

Configure the index of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr hostname <WORD> index [INDEX]: Enable
- no ntp client server-addr hostname <WORD> index [INDEX]: Disable

Parameter	Description
INDEX	Server index (range: 1-5)

Configure the version of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr hostname <WORD> version [1-4]: Enable
- no ntp client server-addr hostname <WORD> version [1-4]: Disable

[Configuring based on IP address]

Enable or disable.

- ntp client server-addr ip <A.B.C.D>: Enable
- no ntp client server-addr ip <A.B.C.D>: Disable

Configure the index of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr ip <A.B.C.D> index [1-5]: Enable
- no ntp client server-addr ip <A.B.C.D> index [1-5]: Disable

Configure the version of a server that a NTP client will refer to. (Use a default value 1 if it is not configured.)

- ntp client server-addr ip <A.B.C.D> version [1-4]
- no ntp client server-addr ip <A.B.C.D> version [1-4]

You can proceed with configurations simultaneously as shown below.

- ntp client server-addr hostname <WORD> index [1-5] version [1-4]
- ntp client server-addr hostname <WORD> version [1-4] index [1-5]
- ntp client server-addr ip <A.B.C.D> index [1-5] version [1-4]
- ntp client server-addr ip <A.B.C.D> version [1-4] index [1-5]
- no ntp client server-addr hostname <WORD> index [1-5] version [1-4]
- no ntp client server-addr hostname <WORD> version [1-4] index [1-5]
- no ntp client server-addr ip <A.B.C.D> index [1-5] version [1-4]
- no ntp client server-addr ip <A.B.C.D> version [1-4] index [1-5]

[NTP Server Configuration]

The NTP server configuration is as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure a NTP server.
 - ntp server enable: Configures a NTP server.
 - no ntp server enable: Disables a NTP server.

[Checking NTP Configuration Status]

To check the status of a NTP client or server, enter the 'show ntp' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <NTP> menu in the sub-menus.

The NTP initial window is shown below.

NTP Client

POLLING: ☐ Enable ☒ Disable

POLLING INTERVAL:

NO	SERVER IP ADDRESS	SERVER DOMIAN NAME	TYPE

NTP Server

SERVICE: ☐ Enable ☒ Disable

Figure 193. NTP client configuration

The Enable/Disable of a NTP server can be performed using a radio box. You can configure polling interval enable/disable of a NTP client and also configure the polling interval during enabling. The range of polling interval is 3-14.

Click the <Add> or <Delete> button to add or delete a NTP proxy server. Click the <Add> button to configure a specific 'Server IP' or 'Server DOMAIN NAME' that will be used by a NTP proxy.

9.3 FTP/sFTP

The FTP is a network service for file transmission. The APC support the client and server function for FTP and sFTP (Secure FTP).

Configuration using CLI

[SFTP Server Configuration]

The secure FTP server configuration is as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the sFTP server.
 - sftp-server enable: Enable
 - no sftp-server enable: Disable
- 3) Enter as follows to change a user's ID and password.
 - sftp-server chguser [ID] [PASSWORD]

Parameter	Description
ID	User ID of a server
PASSWORD	User password of a server

- 4) To check the status of sFTP server, enter the 'show sftp-server' command.

[FTP Server Configuration]

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the sFTP server.
 - ftp-server enable: Enable
 - no ftp-server enable: Disable
- 3) Enter as follows to change a user's ID and password.
 - ftp-server chguser [ID] [PASSWORD]

Parameter	Description
ID	User ID of a server
PASSWORD	User password of a server

- 4) To change the idle timeout, enter the command below. The unit of timeout is minutes and the default value is 15 minutes.
 - `ftp-server idle-timeout [timeout]`
- 5) To check the status of FTP server, enter the 'show ftp-server' command.

[Using as Client]

Using the following commands, you can download or upload a file using a FTP/sFTP client.

- file download
- file upload

A usage example is provided below.

- File download using a sFTP client

```
WEC8500# file download samsung Samsung 90.90.21.108 wec8500 wec8500
sftp
```

- File upload using a sFTP client

```
WEC8500# file upload samsung Samsung 90.90.21.108 wec8500 wec8500 sftp
```

- File download using a FTP client

```
WEC8500# file download samsung Samsung 90.90.21.108 wec8500 wec8500
```

- File upload using a FTP client

```
WEC8500# file upload samsung Samsung 90.90.21.108 wec8500 wec8500
```

Configuration using Web UI

To configure the FTP/SFTP server configuration, in the menu bar of <WEC Main window>, select <Administrator> and then select the <FTP-SFTP> menu in the sub-menus.

FTP	
FTP	☒ Enable ☐ Disable
PORT	21
USER	samsung
PASSWORD	☐ 3
CONFIRM PASSWORD	
IDLE TIMEOUT (MINUTE) 4	17

SFTP	
SFTP	☒ Enable ☐ Disable
PORT 2	22
USER	samsung
PASSWORD	☐ 3
CONFIRM PASSWORD	

Apply

Figure 194. FTP/SFTP server configuration

The FTP and SFTP can be configured using the Enable/Disable radio box.

For FTP, you can configure a port number that will be used for FTP by using 'PORT' and can change the user name and password of a FTP server by entering 'USER', 'PASSWORD', or 'CONFIRM PASSWORD'. Enter an idle timeout value in 'IDLE TIMEOUT'.

Also for SFTP, you can change the user name and password of a SFTP server by entering 'USER', 'PASSWORD', or 'CONFIRM PASSWORD'.

9.4 Telnet/SSH

The telnet or Secure Shell (SSH) is an Internet protocol that helps login to another computer in a network or connects to a virtual remote system. Using telnet or SSH, you can connect to another computer while staying at a current computer.

Because the SSH can access a remote system and transmit an encrypted message by using public key-based encryption method, it provides better security.

Configuration using CLI

[Telnet Server Configuration]

The Telnet server configuration is as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the telnet service. If you configure the telnet service, you can use the APC as a telnet server.
 - telnet-server enable: Enable
 - no telnet-server enable: Disable
- 3) If you configure the telnet service, specify the port number of telnet server.
 - telnet-server port [PORT_NUMBER]

Parameter	Description
PORT_NUMBER	Port number to configure (range: 1-65535)

[SSH Server Configuration]

The SSH server configuration is as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the SSH server.
 - ssh-server enable: Enable
 - no ssh-server enable: Disable
- 3) Specify the port number of SSH server.
 - ssh-server port [PORT_NUMBER]

Parameter	Description
PORT_NUMBER	Port number to configure (range: 1-65535)

[Checking Server Configuration Status]

To check the status of telnet or ssh server, enter the following command. You can retrieve the configured port number as well as server status.

- show ssh-server: Retrieves the status of SSH server
- show telnet-server: Retrieves the status of telnet server

[Using as Client]

By using the APC as a telnet or SSH client, you can connect to a server.

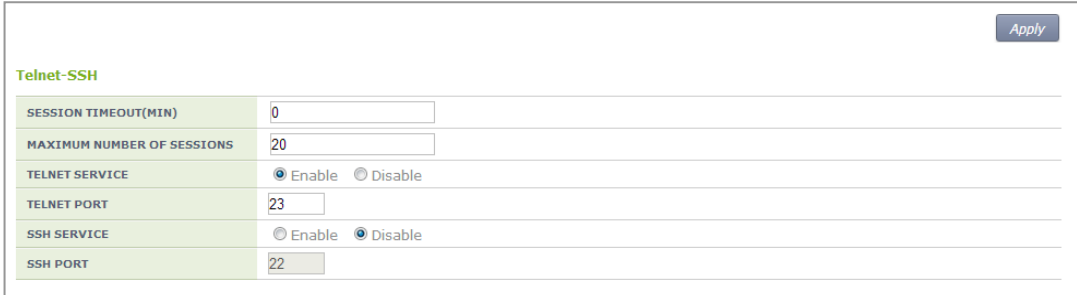
Enter as follows in CLI.

- telnet [IP_ADDRESS] [PORT_NUMBER]
- ssh [IP_ADDRESS] [ID] [PORT_NUMBER]

Parameter	Description
IP_ADDRESS	IP address or domain name of a server to connect
ID	login ID
PORT_NUMBER	Port number (range: 1-65535) If the port number is not entered, its default is shown below. - telnet: 23 - ssh: 22

Configuration using Web UI

To configure the Telnet/SSH server configuration, in the menu bar of <WEC Main window>, select <Administrator> and then select the <Telnet-SSH> menu in the sub-menus.



The screenshot displays the 'Telnet-SSH' configuration page. It includes an 'Apply' button in the top right. The configuration fields are as follows:

Parameter	Value
SESSION TIMEOUT(MIN)	0
MAXIMUM NUMBER OF SESSIONS	20
TELNET SERVICE	☒ Enable ☐ Disable
TELNET PORT	23
SSH SERVICE	☐ Enable ☒ Disable
SSH PORT	22

Figure 195. Telnet/SSH server configuration

You can configure the service by using the Enable/Disable radio box of 'TELNET SERVICE' or 'SSH SERVICE'.

You can configure the port number of service by using 'TELNET PORT' or 'SSH PORT'. By using 'SESSION TIMEOUT', you can configure the session timeout of TELNET or SSH in min. and can also configure maximum number of sessions by using 'MAXIMUM NUMBER OF SESSIONS'.

9.5 Utilities

The APC provides the functions such as ping, traceroute, or tcpdump to check a network and its problems.

[ping]

Used to check network connection status.

- ping [IP_ADDRESS]

[traceroute]

Used to check a route path.

- traceroute [IP_ADDRESS]

[tcpdump]

Used to check the packet of a specific interface.

- tcpdump [INTERFACE_NAME]

CHAPTER 10. System Management

In this chapter, the various functions used by an operator to manage the system and troubleshooting method are described. In addition, the configurations required for system operation such as system configuration management, resource management, alarm management, and package management, etc. and checking methods are described.

10.1 SNMP Configuration

10.1.1 SNMP Community

To use an external management server or to manage the system through a web server after initial system installation, you must configure the SNMP community using CLI. When creating the SNMP community, you can restrict configuration privilege by allocating the access right such as read-only or read-write and can also restrict an IP to connect. You can configure maximum 10 SNMP communities.

Configuration using CLI

To add a SNMP community, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Use the 'snmp community' command to add a SNMP community.
 - snmp community [COMMUNITY_NAME] [ACCESS] [IP_VERSION]
[IP_ADDRESS] [NET MAST]

Parameter	Description
COMMUNITY_NAME	Name of a community to add
ACCESS	Access privilege (rw/ro) - rw: read-write privilege - ro: read-only privilege
IP_VERSION	IP address version type (v4/v6)
IP_ADDRESS, NETMAST	IP address area that can be connected

- 3) To check the created SNMP community, use the 'show snmp community' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <SNMP> → <Community> menu in the sub-menus. When you click the <Add> button in the Community window, the community creation window is displayed. When you enter a configuration value and click the <Apply> button, the configuration is applied.

Figure 196. Adding SNMP community

10.1.2 SNMP Trap

All the alarms of the APC system are basically transmitted to outside through the SNMP trap. Therefore, to receive a system alarm from an external management server, the server address must be registered as a trap target. The trap supports v1/v2.

Configuration using CLI

To add a SNMP trap target, execute the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Add a SNMP trap target.
 - snmp trap [TRAP_VERSION] [COMMUNITY_NAME] [IP_VERSION]
[IP_ADDRESS] [PORT_NUMBER]

Parameter	Description
TRAP_VERSION	Trap version (v1/v2)
COMMUNITY_NAME	Name of a community to be transmitted
IP_VERSION	IP address type (v4/v6)
IP_ADDRESS	IP address to which a trap will be transmitted
PORT_NUMBER	Port number to which a trap will be transmitted (default: 162)

- 3) To check the added trap target, use the 'show snmp trap' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <SNMP> → <Trap Receiver> menu in the sub-menus.
When you click the <Add> button in the Trap Receiver window, the trap creation window is displayed. When you enter a configuration value and click the <Apply> button, the configuration is applied.

BackApply

IPv4 ADDRESS	0000
PORT NUMBER	162
TRAP VERSION	v1
COMMUNITY NAME	

Figure 197. SNMP trap configuration

10.2 System Management

10.2.1 Retrieving System Information

Retrieving with CLI

By using the 'show system info' command, you can check the system configuration information of the APC system such as version information, memory information, disk information, temperature sensor and fan status, etc.

The execution results of the command in WEC8500 are as follows:

```
WEC8500/configure# show system info
-----
Item                               System Info
-----
System Info :
  model type                       WEC8500
  system description               Samsung AP Controller
  board version                   0.1
  cpld version                    0.5
  system mac address              00:7e:37:00:1e:70
  system total memory             16046580 KBytes
  system total disk               13520032 KBytes

Temperature Sensor Status :
  cpu upside sensor               OK
  cpu downside sensor             OK
  board sensor                    OK

Fan Status :
  fan[0]                          OK
  fan[1]                          OK
  fan[2]                          OK
  fan[3]                          OK

Power Supply Status :
  Power Supply[0]                 Equipped
  Status                          OK
  Power Supply[1]                 Not Equipped
  Status                          -
-----
```

The execution results of the command in WEC8050 are as follows:

```
WEC8050# show system info
-----
Item                      System Info
-----
System Info :
model type                WEC8050
system description        Samsung AP Controller
board version             0.0
cpld version              0.1
serial number
system mac address        00:7e:37:00:21:d4
system total memory        4855272 KBytes
system total disk         12191593 KBytes

Temperature Sensor Status :
CPU sensor1               OK
CPU sensor2               OK

Fan Status :
fan[0]                    OK
fan[1]                    OK
-----
```

The descriptions of the output parameters are as follows:

[System Info]

Parameter	Description
model type	Product model name
system description	Product type
board version	Hardware version of a board
cpld version	System cpld version
system mac address	System MAC address
system total memory	System total memory capacity
system total disk	System total disk capacity

[Temperature Sensor Status]

Parameter	Description
cpu upside sensor	CPU upside sensor status (OK, NOK)
cpu downside sensor	CPU downside sensor status (OK, NOK)
board sensor	Board sensor status (OK, NOK)

[Fan Status]

For WEC8500:

Parameter	Description
Fan [0]~[3]	Fan operation status (OK, NOK)

For WEC8050:

Parameter	Description
Fan [0]~[1]	Fan operation status (OK, NOK)

[Power Supply Status]

The WEC8500 has dual detachable power module as shown below.

Parameter	Description
Power Supply [0]~[1]	Whether a power module is equipped (Equipped, Not Equipped)
Status	Power module operation status (OK, NOK)

The WEC8050 has only one power module as shown below.

Parameter	Description
Power Supply Status	Power module operation status (OK, NOK)

Retrieving with Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Summary> menu in the sub-menus. It provides a wide range of information, status retrieving event and alarm retrieving function of the WEC8500 system.

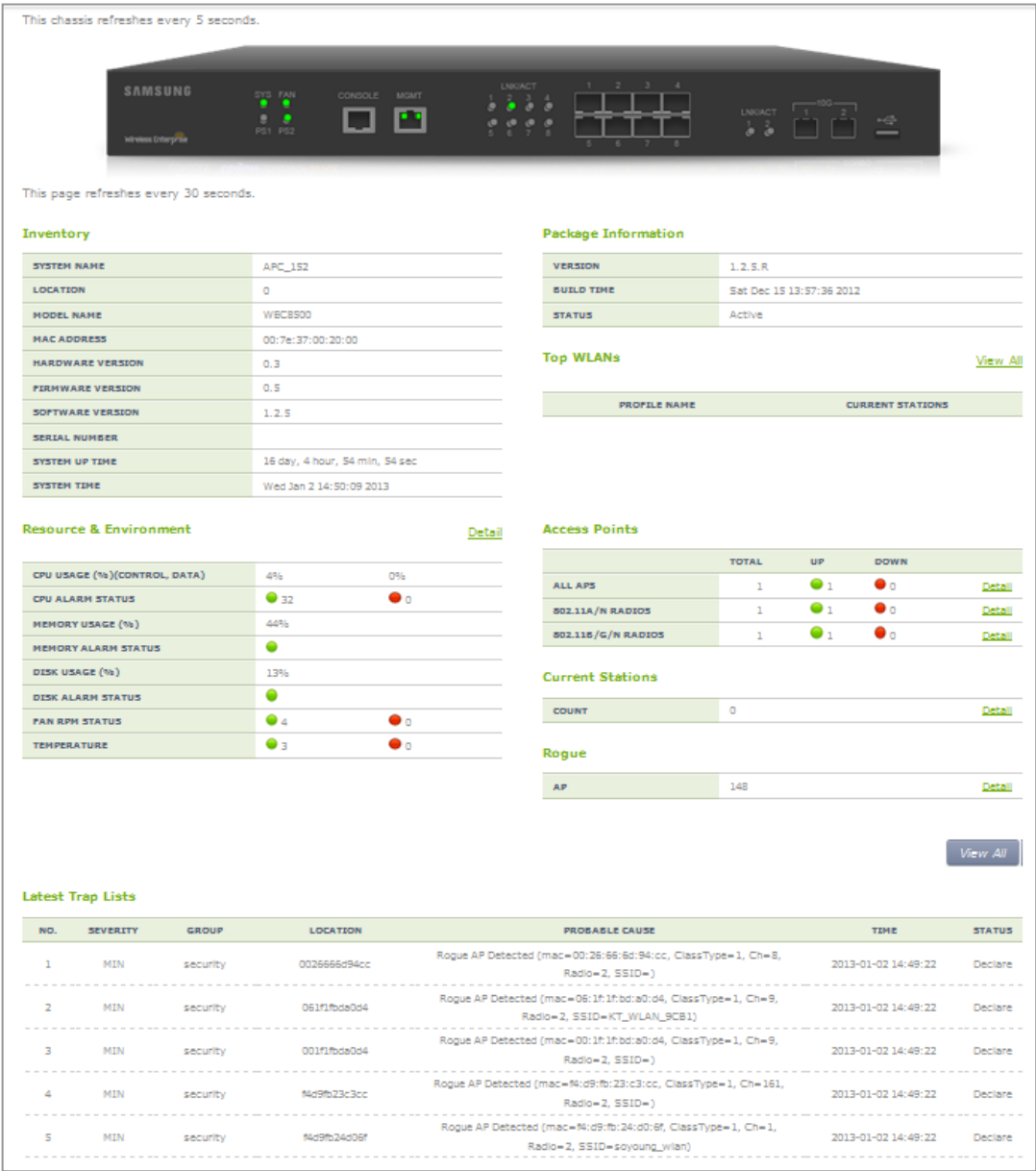


Figure 198. System information

It provides various information, status retrieving event and alarm retrieving function of the WEC8050 system.

Summary

This chassis refreshes every 5 seconds.



This page refreshes every 30 seconds.

Inventory

SYSTEM NAME	SMB_96
LOCATION	where
MODEL NAME	WEC8050
MAC ADDRESS	00:7e:37:00:21:c4
HARDWARE VERSION	0.0
FIRMWARE VERSION	0.1
SOFTWARE VERSION	0.4.4
SERIAL NUMBER	
SYSTEM UP TIME	16 min, 1 sec
SYSTEM TIME	Fri Sep 06 10:27:41 2013

Package Information

VERSION	0.4.4.R
BUILD TIME	Thu Sep 5 15:28:34 2013
STATUS	Active

Top WLANs

[View All](#)

PROFILE NAME	CURRENT STATIONS

Resource & Environment

[Detail](#)

CPU USAGE (%) (CONTROL, DATA)	59%	0%
CPU ALARM STATUS	● 6	● 0
MEMORY USAGE (%)	50%	
MEMORY ALARM STATUS	●	
DISK USAGE (%)	50%	
DISK ALARM STATUS	●	
FAN RPM STATUS	● 2	● 0
TEMPERATURE	● 2	● 0

Access Points

	TOTAL	UP	DOWN	
ALL APs	150	● 0	● 150	Detail
802.11A/N RADIOS	150	● 0	● 150	Detail
802.11B/G/N RADIOS	150	● 0	● 150	Detail

Current Stations

[Detail](#)

COUNT	0
-------	---

Rogue

[View All](#)

AP	0	Detail
STATION	0	Detail
ADHOC	0	Detail

Latest Trap Lists

NO.	SEVERITY	GROUP	LOCATION	PROBABLE CAUSE	TIME	STATUS
1	NOT	pm	APC	Reporting Statistics Failed (Reason=ftp connection failure)	2013-09-06 10:27:20	Notice
2	NOT	wifi	APC	RRM DPC RUN (Dynamic power control done [2.4GHz])	2013-09-06 10:22:53	Notice
3	NOT	wifi	APC	RRM DPC RUN (Dynamic power control done [5GHz])	2013-09-06 10:22:50	Notice
4	NOT	pm	APC	Reporting Statistics Failed (Reason=ftp connection failure)	2013-09-06 10:22:20	Notice
5	NOT	system	APC	Management User Login (ID=samsung, IP=10.254.175.139 (WEC))	2013-09-06 10:22:09	Notice

10.2.2 System Reboot

There is a command that can reboot the system. Rebooting can be reserved and you can cancel or retrieve the reservation.

Configuration using CLI

Use the ‘reboot’ command to reboot the system.

```
WEC8500# reboot
```

Use the ‘reboot in HH:MM:SS’ command to reserve system reboot. Once the reservation is completed, the system is rebooted after a specified time (HH:MM:SS).

```
WEC8500# reboot in 12:00:00

Do you want to save the configuration? (y/n): y

Do you want to restart the system? (y/n): y
Notice: The system WILL reboot in 12:00:00.
WEC8500# show reboot schedule
The reboot has scheduled in 11:58:41.
```

To cancel the reservation, enter the ‘no reboot’ command.

```
WEC8500# no reboot
```

Configuration using Web UI

To configure a reboot related function, in the menu bar of <WEC Main window>, select <Administrator> and then select the <Reboot> menu in the sub-menus.

The Reboot window is shown below.

[APC]

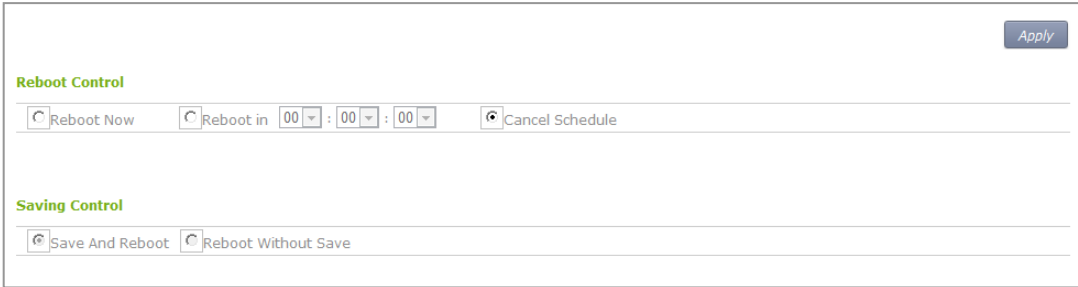


Figure 199. Reboot (APC)

[AP]

Reboot All with Upgrade

Reboot

☐	AP PROFILE NAME	AP NAME	REBOOT CAUSE
☐	ap_1	AP_f4d9fb24d2c0	reboot after package upgrade
☐	ap_2	AP_f4d9fb24cfc0	-

1

Figure 200. Reboot (AP)

10.3 System Resource Management

10.3.1 Retrieving System Status

Retrieving with CLI

By using the 'show system' command, you can check the status of each system resource such as CPU load, memory usage, disk usage, Fan RPM level, or system temperature, etc.

- show system cpu: Retrieves CPU load. If there are several cores, the CPU load of each core is displayed.
- show system memory: Retrieves memory usage.
- show system disk: Retrieves disk usage.
- show system fan: Retrieves system fan speed (RPM level range: 0-3)
- show system temp: Retrieves system temperature (°C).

The result of system status retrieval using each command is as follows:

[CPU Load]

The retrieving CLI execution result of WEC8500 is as follows:

```
WEC8500# show system cpu
Average CPU usage (%)
  control plane : 3.84
  data plane    : 0.00
WEC8500# show system cpu detail
-----
Average CPU usage                                (%)
  control plane                                2.12
  data plane                                  0.00
-----
Detail CPU usage                                (%)
  control plane
    [10.00] [04.23] [00.00] [02.74] [00.00] [00.00] [00.00] [00.00]
  data plane
    [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00]
    [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00] [00.00]
```

The retrieving CLI execution result of WEC8050 is as follows:

```
WEC8050# show system cpu
Average CPU usage (%)
  control plane : 39.43
  data plane    : 0.01
WEC8050# show system cpu detail
-----
Average CPU usage                                (%)
  control plane                                21.97
  data plane                                  0.01
```

```

-----
Detail CPU usage                                     (%)
control plane
  [23.29] [25.71] [16.90]
data plane
  [00.01] [00.00] [00.00]

```

[Memory usage]

```

WEC8500# show system memory
Total      Memory : 7657960 KBytes
Used       Memory : 3341868 KBytes
Available  Memory : 4316092 KBytes
Reserved   Memory : 8900608 Kbytes

```

[Disk usage]

```

WEC8500# show system disk
Total  Disk   : 13520032 KBytes
Used   Disk   : 4338296 KBytes
Free   Disk   : 9181736 KBytes

```

[Fan RPM Level]

The retrieving CLI execution result of WEC8500 is as follows:

```

WEC8500# show system fan
FAN ID   rpm Level(0-3)
-----
FAN[0]    1 level
FAN[1]    1 level
FAN[2]    1 level
FAN[3]    1 level

```

The retrieving CLI execution result of WEC8050 is as follows:

```

WEC8050# show system fan
FAN ID   rpm Level(0-3)
-----
FAN[0]    1 level
FAN[1]    1 level

```

[System Temperature (°C)]

The retrieving CLI execution result of WEC8500 is as follows:

```
WEC8500# show system temp
Sensor Location  Temperature
-----
CPU sensor 1    33
CPU sensor 2    38
Board           29
```

The retrieving CLI execution result of WEC8050 is as follows:

```
WEC8050# show system temp
Sensor Location  Temperature(°C)
-----
CPU sensor 1    45
CPU sensor 2    52
```

Retrieving with Web UI

In the menu bar of <**WEC Main window**>, select <**Monitor**> and then select the <**Summary**> menu in the sub-menus. For more information about detail window, see ‘10.2.1 Retrieving System Information’.

10.3.2 Retrieving and Configuring Threshold

If each resource of the system exceeds its configured threshold, there occurs an alarm. The APC helps an operator check and configure each threshold.

Configuration using CLI

To check each threshold, use the below command.

- show system threshold cpu: CPU load (%)
- show system threshold memory: Memory usage (%)
- show system threshold disk: Disk usage (%)
- show system threshold fan: Fan RPM level
- show system threshold temp: Retrieves system temperature (°C).

To change a threshold related to CPU load or memory usage, enter the command as follows:

- system monitor cpu threshold [THRESHOLD]: Configures the CPU load threshold.
- system monitor memory threshold [THRESHOLD]: Configures the memory usage threshold.

Parameter	Description
THRESHOLD	Threshold to configure (%)

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <SNMP> → <Trap Control> → <Alarm Threshold> menu in the sub-menus.

You can retrieve and configure a threshold at which CPU load, disk usage, temperature alarm, memory usage, or fan alarm occurs. Enter a value for each item, and click the <Apply> button to make the configuration applied.

CPU Load

MONITOR

☒ Enable ☐ Disable

THRESHOLD(%)

90

Memory Usage

MONITOR

☒ Enable ☐ Disable

THRESHOLD(%)

90

Disk Usage

MONITOR

☒ Enable ☐ Disable

THRESHOLD(%)

90

Fan Alarm

MONITOR

☒ Enable ☐ Disable

THRESHOLD(LEVEL)

5

Temperature Alarm

MONITOR

☒ Enable ☐ Disable

THRESHOLD(°C)

88

Apply

Figure 201. Configuring SNMP alarm threshold

10.4 Managing Alarm and Event

The system alarms and events are saved into a system log and transmitted to an external server according to the filtering policy. An alarm is managed in terms of occurrence and release and an event is managed in the report format.

The alarm and event are managed according to group or level. Each group or level is classified into the following item. You can select an item to retrieve.

Alarm, event group

Group	Description
system	Retrieves system alarm or event.
pm	Retrieves performance monitoring alarm or event.
ap	Retrieves AP related alarm or event.
wlan	Retrieves WLAN related alarm or event.
wifi	Retrieves WI-FI related alarm or event.
security	Retrieves security related alarm or event.
network	Retrieves network related alarm or event.
interface	Retrieves interface related alarm or event.
se	Retrieves system engine related alarm or event.
list	Retrieves alarm or event list information.

Alarm level

Level	Description
critical	Retrieves a critical alarm. A critical alarm is a system log that could give a critical effect to a service.
major	Retrieves a major alarm. A major alarm is a system log that could give a major effect to a service.
minor	Retrieves a minor alarm. A minor alarm is a system log that could give a minor effect to a service.

10.4.1 Retrieving Current Alarm

All the system alarms are basically recorded into a system log. The procedure of retrieving current alarms is as follows:

Retrieving with CLI

To retrieve current alarms, execute the command as follows:

```
WEC8500# show alarm list all
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
2 network    2012-12-17 09:56:13 MAJ APC xe1 1301 NET Link dn
AdminStatus[up] OperStatus[down]
3 network    2012-12-17 09:56:13 MAJ APC xe2 1301 NET Link dn
AdminStatus[up] OperStatus[down]
...
```

To selectively retrieve a group or level, execute the command as follows:

```
WEC8500# show alarm list group network
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
```

```
WEC8500# show alarm history level major
1 network    2012-12-17 09:56:13 MAJ APC ge8 1301 NET Link dn
AdminStatus[up] OperStatus[down]
```

Retrieving with Web UI

To retrieve the list of current alarms, in the menu bar of <WEC Main window>, select <Monitor> and then select the <Active Alarm> menu in the sub-menus.

						Clear	List Export
NO.	SEVERITY	GROUP	LOCATION	PROBABLE CAUSE	ALARM TIME		
0	MIN	security	002666d94cc	Rogue AP Detected (mac=00:26:66:d9:4c:cc)	2013-01-02 14:49:22		
1	MIN	security	061f1fbd80d4	Rogue AP Detected (mac=06:1f:1f:bd:80:d4)	2013-01-02 14:49:22		
2	MIN	security	001f1fbd80d4	Rogue AP Detected (mac=00:1f:1f:bd:80:d4)	2013-01-02 14:49:22		
3	MIN	security	f4d9fb23c3cc	Rogue AP Detected (mac=f4:d9:fb:23:c3:cc)	2013-01-02 14:49:22		
4	MIN	security	f4d9fb24d06f	Rogue AP Detected (mac=f4:d9:fb:24:d0:6f)	2013-01-02 14:49:22		
5	MIN	security	f4d9fb23f3e2	Rogue AP Detected (mac=f4:d9:fb:23:f3:e2)	2013-01-02 14:49:22		
6	MIN	security	e80462777443	Rogue AP Detected (mac=e8:04:62:77:74:43)	2013-01-02 14:44:09		
7	MIN	security	f4d9fb23bc02	Rogue AP Detected (mac=f4:d9:fb:23:bc:02)	2013-01-02 14:38:56		
8	MIN	security	000000000000	Rogue AP Detected (mac=00:00:00:00:00:00)	2013-01-02 14:38:56		
9	MIN	security	f4d9fb23f6a2	Rogue AP Detected (mac=f4:d9:fb:23:f6:a2)	2013-01-02 14:38:56		
10	MIN	security	f4d9fb23f4a2	Rogue AP Detected (mac=f4:d9:fb:23:f4:a2)	2013-01-02 14:38:56		
11	MIN	security	f4d9fb2401a2	Rogue AP Detected (mac=f4:d9:fb:24:01:a2)	2013-01-02 14:38:56		
12	MIN	security	e8046277a5d2	Rogue AP Detected (mac=e8:04:62:77:a5:d2)	2013-01-02 14:33:43		
13	MIN	security	e80462768553	Rogue AP Detected (mac=e8:04:62:76:85:53)	2013-01-02 14:28:30		
14	MIN	security	e80462777440	Rogue AP Detected (mac=e8:04:62:77:74:40)	2013-01-02 14:28:30		
15	MIN	security	e80462777442	Rogue AP Detected (mac=e8:04:62:77:74:42)	2013-01-02 14:28:30		
16	MIN	security	e80462777441	Rogue AP Detected (mac=e8:04:62:77:74:41)	2013-01-02 14:28:30		
17	MIN	security	f4d9fb24d010	Rogue AP Detected (mac=f4:d9:fb:24:d0:10)	2013-01-02 14:12:51		
18	MIN	security	dc7144eede7a	Rogue AP Detected (mac=dc:71:44:ee:de:7a)	2013-01-02 14:07:38		
19	MIN	security	a00bba0ff084	Rogue AP Detected (mac=a0:0b:ba:ff:0f:84)	2013-01-02 14:02:25		

Figure 202. Current alarm

10.4.2 Retrieving History

Retrieving with CLI

The APC retrieves the history of alarm and event using the following command.

[Alarm History]

```
WEC8500# show alarm history all
1 ap      2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=1 AP RADIO
CARD TX FAIL Clear radio(1)
2 ap      2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=2 AP RADIO
CARD TX FAIL Clear radio(2)
3 ap      2012-12-20 13:13:25 MAJ AP_f4:d9:fb:24:cf:80 r=1,w=1 BSS
...
```

Because all the alarms are managed per group or level, you can retrieve it selectively using the following command.

```
WEC8500# show alarm history group system
1 system  2012-12-21 17:49:45 MAJ APC core2 CPU Load Alarm Declare
LOAD(100.00)
...
```

```
WEC8500# show alarm history level major
1 system  2012-12-21 17:49:45 MAJ APC core 2 CPU Load Alarm Declare
LOAD(100.00)
...
```

[Event History]

You can retrieve event information using the following command.

```
WEC8500# show event
1 system  2012-08-31 13:59:46 NOT APC MGMT User Login ID=samsung,
IP=192.168.0.91
2 system  2012-08-31 13:48:33 NOT SWM:system Boot Complete -
...
```

An event is managed per group and you can retrieve it selectively using the following command.

```
WEC8500# show event group interface
1 interface 2012-08-31 13:48:32 NOT APC Index[1] Name[ge1] IF Admin No
Shut AdminStatus[up] OperStatus[up]
...
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Summary> menu in the sub-menus. It provides status retrieving event and alarm retrieving function.

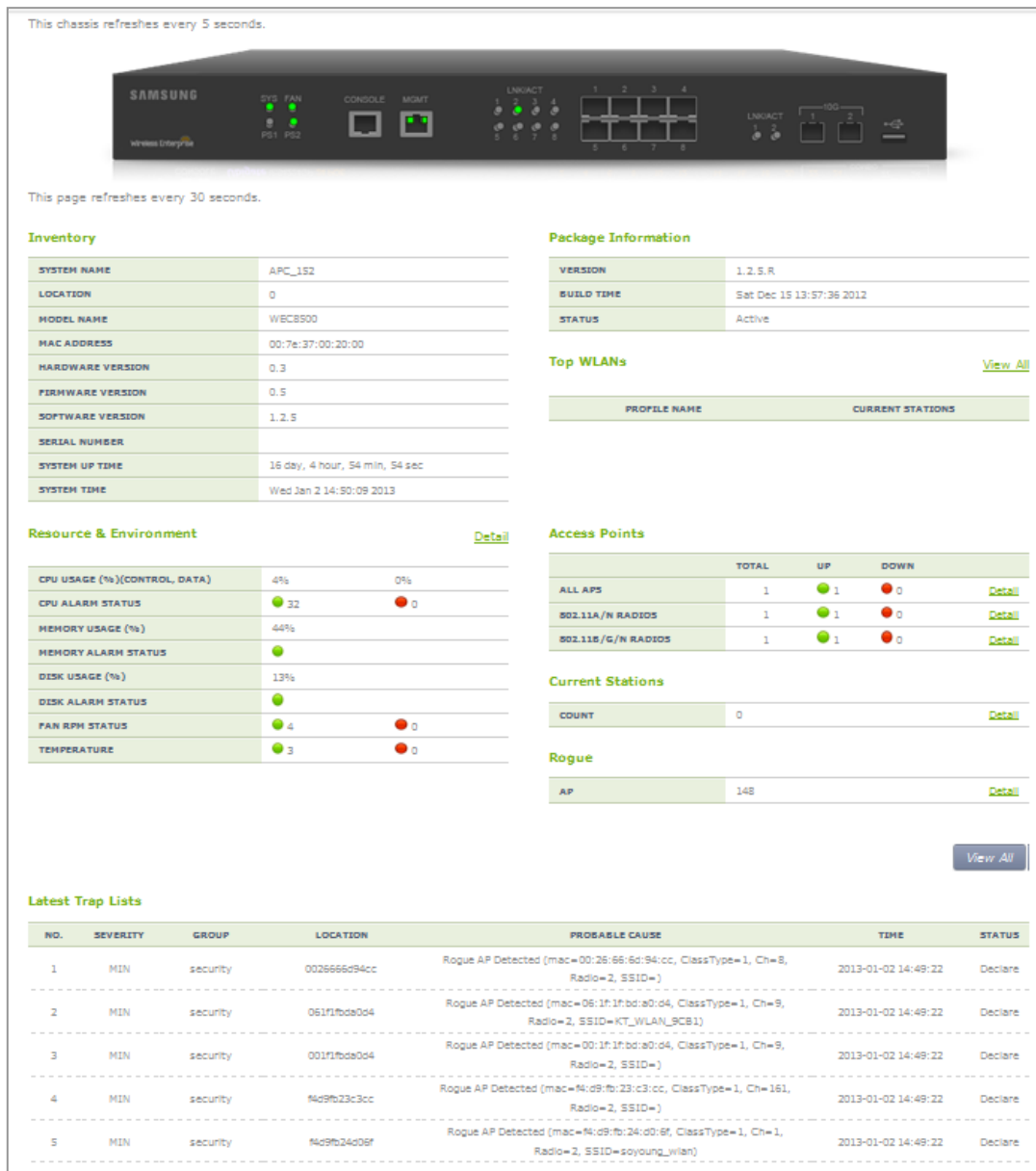


Figure 203. History

10.4.3 External Transmission Configuration

All the alarms and events in the system are transmitted to outside through the SNMP trap and syslog. If the alarm filter information is configured, only filtered alarm is transmitted to an external management server.

10.4.4 Alarm Filter and Level Configuration

An alarm filter can be configured per group or level (severity). The filtered alarms are transmitted to an external server through the SNMP trap and syslog.

Configuration using CLI

The procedure of alarm filter configuration is as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) Configure group information.

```
WEC8500/configure# alarm group system
```

- 3) Configure level information.

```
WEC8500/configure# alarm level major
```

- 4) To check the configured alarm filter information, use the 'show alarm conf' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <SNMP> → <Trap Control> → <Alarm Information> menu in the sub-menus.

You can retrieve the configuration related to alarm filter and alarm level.

Alarm Group
Selected groups will be activated by clicking apply button.

☒ System
 ☒ Pm
 ☒ Ap
 ☒ Wlan
 ☒ wifi
 ☒ Security
 ☒ Network
 ☒ Interface
 ☒ Se
 ☒ All

Alarm Severity
Selected level and higher levels will be activated by clicking apply button.

☐ Critical
 ☐ Major
 ☒ Minor

Alarm Information
Assign severity level to each alarm.

INDEX	ALARM NAME	GROUP	ALARM ID	DESCRIPTION	SEVERITY
1	Software Down	system	856	Software is down	major ▼
2	Cpu Load Alarm	system	863	CPU Load is higher than the Threshold	major ▼
3	Memory Usage Alarm	system	864	Memory Usage is higher than the Threshold	major ▼
4	Disk Usage Alarm	system	865	Disk Usage is higher than the Threshold	major ▼
5	Fan Rpm Alarm	system	866	Fan Usage is higher than the Threshold	major ▼
6	System Temperature Alarm	system	867	System Temperature is higher than the Threshold	critical ▼
7	System Thermal Runaway	system	868	Thermal shutdown	critical ▼
8	DHCP Sever Connect Failure	system	877	Failed to connect to DHCP server	major ▼
9	DNS Server Connect Failure	system	878	Failed to connect to DNS server	major ▼
10	NTP Server Connect Failure	system	879	Failed to connect to NTP server	major ▼
11	Fan Fail alarm	system	931	FAN rpm is lower than fan Standard RPM	critical ▼
12	Temperature Sensor Fail	system	936	Detecting breakdown on TEMP sensor	critical ▼
13	Power Module Fail	system	937	Detecting failure of power module	major ▼
14	Duplicated IP	ap	1001	Duplicate IP addresses detected	critical ▼
15	No Radio	ap	1002	No description	critical ▼
16	License Expired	ap	1009	AP's license has expired	critical ▼

Figure 204. Configuring alarm filter and level

10.5 Managing Traffic Performance

You can manage the traffic performance statistics information and accumulated data for the APC system and the interface of each AP.

10.5.1 Managing History Information

When the traffic performance information management is enabled, the APC system creates history information at every 5 minute. But, if the FTP server information is not configured, the history information is not transmitted to outside although it is created.

Collecting information

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Configure the traffic performance information.

```
WEC8500/configure# stats-report enable
```

- 3) Configure a FTP server to transmit history information.
 - stats-report target ip [IP_ADDRESS] port [PORT_NUMBER] id [ID] password [PASSWORD] path [PATH]

Parameter	Description
IP_ADDRESS	IP address of a target server
PORT_NUMBER	Port number of a target server
ID	User ID of a target server
PASSWORD	User password of a target server
PATH	File storage path of a target server

- 4) To check the information of traffic performance information management, use the 'show stats-report conf' command.
- 5) Configure so that the performance information is uploaded to the FTP server. But, because the default is the 'start' status, this step may be skipped.

```
WEC8500/configure# stats-report upload start
```

Stopping information collection

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) 'Disable' the traffic performance information management.

```
WEC8500/configure# no stats-report enable
```

- 3) To check the configured information, use the 'show stats-report conf' command.

10.5.2 Managing Real-time Information Collection

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) To collect real-time information, execute the following command. At this time, you must specify the name and status of an interface whose information will be collected.
 - stats-report current-stats [INTERFACE_NAME] [STATE]

Parameter	Description
INTERFACE_NAME	Name of an interface to collect or stop collection
STATE	Status of real-time information (start/stop) - start: Starts real-time information collection - stop: Stops or initializes the real-time information collection.

- 3) To check the entered information, use the 'show stats-report conf' command.
- 4) To check the information of a configured interface when the real-time information collection is configured, execute the following command.
 - show stats-report current-stats [INTERFACE_NAME]

If the real-time information collection is suspended or initialized, you cannot check the real-time information of the interface.

```
WEC8500/configure# show stats-report current-stats ge3
Error: This interface was not configured to gather statistics.
```


10.6 Managing License Key

The Samsung Electronics Common License Method (SLM) is applied to Version 1.5 or newer of the APC system.

Therefore, SLM licensing is applied to new websites that are installed using Version 1.5 or later.

However, if Version 1.4 is upgraded to Version 1.5, the existing license key is used without any modification. The existing license which is not SLM must be installed and used also in the case of expanding or reissuing the APC system.

In this document, license keys supported by Version 1.4 or later are referred to as ‘old license keys’ and license keys supported by Version 1.5 or later are referred to as ‘Activation keys’.

These details are summarized in the table below.

Initially installed version	Reinstalling the license	Expanding/reissuing	After an upgrade
APC Version 1.4 or below	Install the old license	Install the old license	Re-use the old license
APC 1.5 or higher	Install the SLM license	Install the SLM license	Re-use the SLM license

If an APC system is shipped out without a license installed, only the following services are offered:

System Model	Number of APs	VQM	Firewall
WEC8050	5 units connected	Not provided	Not provided
WEC8500	2 units connected	Not provided	Not provided

10.6.1 Managing SLM License (Activation) Key

An SLM activation key can have differences in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.

Every system has a unique activation key and activation keys are provided in the form of encrypted files.

To clear an SLM activation key installed in a system, the deactivation command needs to be executed and after the execution of the command, a deactivation key is issued to notify that clearing has been completed successfully.

**Installation**

Only two activation keys can be installed/registered in an APC system.
If two unexpired activation keys co-exist, available services are offered as shown in the following example:

(Example)

- Activation Key 1: AP (100 units), VQM (Disable), Firewall (Disable)
- Activation Key 2: AP (50 units), VQM (Enable), Firewall (Disable)
- result: AP (100 units), VQM (Enable), Firewall (Disable)

**Period of Use**

Each activation key has its own information regarding the start and end times, and if the current time is not within the set period, the activation key expires.

**Application**

An activation key only functions correctly after the system is rebooted after deletion or installation of a key.

Configuration using CLI

To configure an activation key, first execute the following commands and enter license mode:

```
WEC8500# configure terminal
WEC8500/configure# system license
WEC8500/configure/system/license#
```

[Installing Activation Key]

When the system is shipped out, there is no registered license key. Therefore, you must install the license key you received immediately after the first system installation. You can install a license key directly or remotely using CLI.

- **activate-key [Fullpath filename]**
Registers an activation key file. If a license key file exists in a specified folder, use the license key file for registration.
When entering the file name of an activation key, you must enter the file name including its full path.

[Clearing Activation Key]

- **no activate-key [the activation key's license key]**
Clears an activation key registered in the system.
You can view the license key information of an activation key in the 'License' field of the activation key by executing the 'show system license-key' command.
After clearance, you can view information about the deactivation key in the 'License Key' of the key after executing the 'show system license-key' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <License> menu in the sub-menus.

In the figure below, the ‘SLM License Key Status’ shows the installation and application statuses of SLM activation keys.

In the ‘License Control’ section, the operator can select an activation key stored in their PC and install it in the system.

In addition, the operator can also deactivate an installed activation key. The operator can clear an installed activation key by selecting Deactivation in ‘License Control’ and then entering the license key shown in ‘SLM License Key Status’.

License

License Key Status ¹

OFFICIAL KEY	Valid
TEMPORARY KEY	Not valid

Current System Status

NUMBER OF AP	500
VQM	Enable
FIREWALL	Enable

SLM License Key Status

SLM LICENSE KEY 1	Activation(apply)	NWMIS1-3DC52V-WTEBZL-6ESN
SLM LICENSE KEY 2	Deactivation(apply)	NWMIS1-3DC52V-WTEBZL-6ESNBQ-ZCEHYP-NXDWMN-DEHFTG-EMRTGZ-RTAMO7

Apply

License Control

CONTROL TYPE ²	☒ Activation ☐ Deactivation
UPLOAD ACTIVATION KEY FILE	찾아보기...
REBOOT CONTROL ⁴	☐ With Reboot ☒ Without Reboot

Figure 205. SLM License Search and Configuration Window

10.6.2 Managing Old License Key

An old license key can differ in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.

A license key is unique for each system and it consists of encrypted 53 characters.

A license key is distributed in a file or text format.



NOTE

Installation

APC system can install/register only one official license key and one temporary license key. A license key (temporary license Key) with time duration can be installed only 3 times.



NOTE

Use period

An official license key has no restriction on use period.

A temporary license key has a restriction on use period and the period can be 1, 30, or 60-day.



NOTE

Apply

A license key becomes active only after system rebooting after the key is installed or deleted.

Configuration using CLI

To configure a license key related function, go to license mode by executing the following command.

```
WEC8500# configure terminal
WEC8500/configure# system license
WEC8500/configure/system/license#
```

[Installing License Key]

When the system is shipped out, basically there is no registered license key. Therefore, you must install the license key you received right after the first system installation. You can install a license key directly or remotely using CLI.

- `install-key`: Registers a file. If a license key file exists in a specified folder, use the license key file for registration. Once it is installed, the license key file is deleted from the system.
- `install-key [LICENSE_KEY]`: Direct registration
- `install-key [IP_ADDRESS] [PORT_NUMBER] [ID] [PASSWORD] [PATH]`: Remote registration

Parameter	Description
LICENSE_KEY	Issued license key
IP_ADDRESS	IP address
PORT_NUMBER	Port number
ID	login ID
PASSWORD	Password
PATH	Server path

[Deleting License Key]

You can delete a license key directly.

- no install-key [LICENSE_KEY]

Parameter	Description
LICENSE_KEY	License key to delete

[Retrieving License Key Information]

To check the license key information, use the 'show system license-key' command.

```

===== Current System Status =====
Number of APs           : 2
VQM                     : Disabled
Firewall                 : Disabled

===== License Information =====
* Old License - Official License Key
  License Key           : YNHSHPWP-5MNMTE04-UJHKDO4U-A2WGSBGX-
OJZ2MJ5R-7Z5DBYMT
  MAC Address           : F4D9FB236C01
  System Model           : Any
  Lifetime               : Permanet
  Number of APs          : 75
  VQM                    : Eanbed
  Firewall               : Eanbed
  Installation Time      : 00

```

[Analyzing License Key]

Before registering a license key to the system, you can check the functions supported by the license key.

- analyze-key [LICENSE-KEY]

Parameter	Description
LICENSE_KEY	License key

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <License> menu in the sub-menus.

From the APC Version 1.5 and later, in respect of old license keys, the web UI does not provide input/deletion functions and shows only whether they are installed properly.

In the figure below, ‘License Key Status’ is the section that shows whether old license keys are installed properly and ‘Current System Status’ shows license information currently applied to the system.

License

License Key Status ¹

OFFICIAL KEY	Valid
TEMPORARY KEY	Not valid

Current System Status

NUMBER OF AP	500
VQM	Enable
FIREWALL	Enable

SLM License Key Status

SLM LICENSE KEY 1	None
SLM LICENSE KEY 2	None

License Control

CONTROL TYPE ²	☒ Activation ☐ Deactivation
UPLOAD ACTIVATION KEY FILE	찾아보기...
REBOOT CONTROL ⁴	☐ With Reboot ☒ Without Reboot

Figure 206. Old License Installation Check Window

10.7 Syslog Configuration

The system log (syslog) configuration is required to transmit an event, alarm, and system log information to a target syslog server. You can configure maximum two target syslog servers in the system and you can configure the IP address and port number independently. In addition, because you can configure a filter level, only filtered log information is transmitted to the syslog server.

Configuration using CLI

To transmit an alarm, event, and system log to the syslog server, executes the command as follows:

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
```

- 2) To transmit an alarm, event, and system log information to the syslog server, specify 'enable' as a parameter.

```
WEC8500/configure# syslog enable
```

- 3) Configure the IP address and UDP port of a target syslog server (The default of the UDP port is '514').

```
WEC8500/configure# syslog add 192.168.0.91  
WEC8500/configure# syslog add 192.168.0.99 udpport 510
```

- 4) Configure a log level to filter.

```
WEC8500/configure# syslog level information
```

- 5) To check the configured syslog information, use the 'show syslog conf' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <Logs> → <SysLog Configuration> menu in the sub-menus.
It provides syslog related configuration and retrieving function.

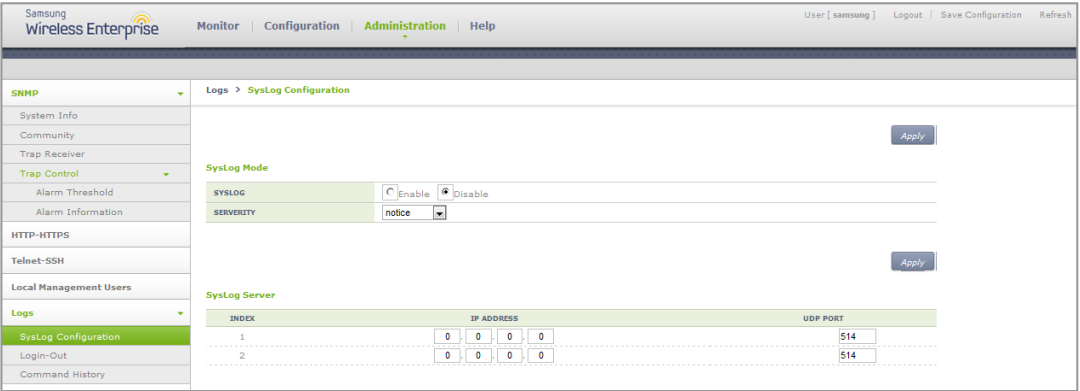


Figure 207. Syslog window

10.8 Upgrade

The APC provides the upgrade function and version checking function that applies a new version of package when it is distributed.

10.8.1 Checking Package Version

You can check the version of a current system by using the following command.

- show version

The following shows the execution results of the command:

```
WEC8500# show version
Samsung package version information
Primary (currently running)
  ver           : 1.4.4.R
  buildTime     : Fri Sep  6 06:08:35 2013
  builder       : apcbuild
  buildDir      : /home2/apcbuild/release/wec8500_1.4.4
Backup
  ver           : 1.4.4.R
  buildTime     : Fri Sep  6 06:08:35 2013
  builder       : apcbuild
  buildDir      : /home2/apcbuild/release/wec8500_1.4.4

Boot rom version information
  ver           : GC15
```

10.8.2 System Upgrade

The APC does system upgrade using CLI and Web UI.

Configuration using CLI

Apply a new package to the system by using the following command.

- 1) Go to configure mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure#
```

- 2) Perform upgrade by using a package.
 - package upgrade [FILE_NAME]

Parameter	Description
FILE_NAME	Package file to upgrade The package must be located in the /user/package directory.

A usage example is provided below. When the upgrade is completed, the system is rebooted to apply the package.

When executing the package upgrade command, the message recommending to save the configuration file is displayed.

If you save the current configuration, operator can use it for any future version downgrade.

If there is a configuration file saved during previous upgrade, the message asking whether you are going to use the file is displayed.

```
WEC8500/configure# package upgrade wec8500_1.4.4.R.bin
Notice: It is recommended that you save the configuration before
upgrade.
    You can reapply the configuration, if you need to downgrade.

    Do you want to save the configuration? (y/n): y

    Previous configuration file is existed. Do you want to use it?
(y/n): y
Package Validation check ... success
Package Upgrade ..... done
Success
```

3) If package upgrade fails, upgrade is cancelled.

Possible causes and the troubleshooting methods are described below.

Possible Cause	Error Message	Troubleshooting
File does not exist	Error: no exist 'wec8500_1.3.11.R.bin' file	Download the package to be upgraded again as the package error has occurred during the package downloading.
Checksum error on the file	Error: Package validation check	
Upgrade terminated due to an internal error	Error: Internal error	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.
Upgrade terminated due to timeout	saving the configuration-failed (time-out)	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.

- 4) After system rebooting, check if the new package is applied to the system.

```
WEC8500# show reboot cause
Reboot Cause: Block: Upgrade/ Code: Package Upgrade

WEC8500# show version
Samsung package version information
Primary (currently running)
  ver           : 0.7.1.R
  buildTime     : Mon Aug 20 11:35:43 2012
  builder       : gampul
  buildDir      : /data/nome/ymkim/apc_0817
Backup
  ver           : 0.7.1.R
  buildTime     : Mon Aug 20 11:35:43 2012
  builder       : gampul
  buildDir      : /data/nome/ymkim/apc_0817

Boot rom version information
  ver           : unknown
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <Package Upgrade> → <APC> menu in the sub-menus.

Package Upgrade > APC Apply

Select Package File

CURRENT VERSION	2.0.0.T
	wec8500_1.5.4.R.bin
PACKAGE NAME	Model: WEC8500 Version: 1.5.4 AddInfo: R BuildTime: Wed Jan 8 13:19:57 2014 Builder: apcbuild Directory: /home2/apcbuild/release/wec8500_1.5.5 PLD Version: R1.01.040; MD5Sum: 0c88d0206d51036b7c499d7a3d319ccd
COMPATIBILITY	Compatible
BACKUP CONFIGURATION ¹	exist ☒ Restore Backup Configuration ☐ Keep Current Configuration

Saving Control ²

☒ Save and Package Upgrade ☐ Package Upgrade Without Save

Package Upgrade Status

STATUS	None
--------	------

Foot Notes :

1. If the backup configuration exists, apply the configuration.
If you select "Restore Backup Configuration", the backup configuration of previous upgrade operations will be restored.
2. It is recommended that you save the configuration before upgrade.
If you select "Save and Package Upgrade", configuration is saved and also backup under the name of the package version.
You can apply the configuration in "Backup Configuration".
3. The system will be reboot after upgrade operations.

Figure 208. Package upgrade (APC)

10.9 Configuration Management

The APC supports the following functions for configuration management.

- Saves the current configuration information.
- Exports/imports the current configuration information (import/export).
- Initializes system

Configuration using CLI

To save the current configuration information in the system, execute the command as follows:

```
WEC8500# save local
```

To transmit the current configuration information in the system to outside, execute the command as follows: When you execute the command, the configuration information is compressed into the entered 'FILENAME' as a file.

```
WEC8500# export [FILENAME]
```

In addition, to apply a file ('FILENAME') from outside to the current system, execute the command as follows:

```
WEC8500# import [FILENAME]
```

To initialize the current configuration information to the factory default, execute the command as follows: If the 'full-erase' parameter is not entered, only the configuration information is initialized.

```
WEC8500# factory-reset (full-erase)
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <DB backup/restore> menu in the sub-menus.

Apply

DB Backup

FILE NAME	
STATUS	

Apply

DB Restore

FILE NAME	Select File Name ▾
STATUS	

Figure 209. DB Backup/Restore

In the DB backup/restore window, enter FILE NAME and click the <Apply> button to create the configuration information as a file or apply an external configuration information file. The STATUS shows the execution results of backup/restore function.

10.10 Debug and Diagnosis

10.10.1 Process

The APC can retrieve the status of an active process in the system and an error associated with each process.

Retrieving the Process Status

```
WEC8500# show processes
```

```
Processes Info.
```

```
Status: D - usually IO, R - Running, S - Sleep
```

```
T - Stop, X - Dead, Z - Zombie
```

```
up - Active, down - Inactive
```

```
dis - Disable
```

id	name	pid	activationTime	status	reStart
--	-----	----	-----	-----	-----
0	swmmon	6222	2012-08-31 14:38:21	up (S)	0
1	evm	1759	2012-08-31 13:47:08	up (S)	0
2	evmlogd	1760	2012-08-31 13:47:08	up (S)	0
3	db	1807	2012-08-31 13:47:14	up (S)	0
4	license	1838	2012-08-31 13:47:34	up (S)	0
5	pcap	1839	2012-08-31 13:47:34	up (S)	0
6	filemgr	1840	2012-08-31 13:47:34	up (S)	0
7	filemib	1841	2012-08-31 13:47:34	up (S)	0
8	cm	1846	2012-08-31 13:47:34	up (S)	0
9	iim	1847	2012-08-31 13:47:34	up (S)	0
10	iimp	1850	2012-08-31 13:47:34	up (S)	0
11	nsm	1902	2012-08-31 13:47:35	up (S)	0
12	mstpd	1903	2012-08-31 13:47:35	up (S)	0
13	pimd	1904	2012-08-31 13:47:35	up (S)	0
14	ripd	1905	2012-08-31 13:47:35	up (S)	0
15	ospfd	1906	2012-08-31 13:47:35	up (S)	0
16	lacpd	1907	2012-08-31 13:47:35	up (S)	0
17	fqm	1909	2012-08-31 13:47:35	up (S)	0
18	imi	1942	2012-08-31 13:47:35	up (S)	0
19	zebosm	2188	2012-08-31 13:47:55	up (S)	0
20	awmb	2226	2012-08-31 13:48:00	up (S)	0
21	apm	2385	2012-08-31 13:48:30	up (S)	0
22	capwap	2386	2012-08-31 13:48:30	up (S)	0
23	hostapd	2387	2012-08-31 13:48:30	up (S)	0
24	eqm	2388	2012-08-31 13:48:30	up (S)	0

Checking process error log

You can check the log of errors that occurred in a current process

```
WEC8500# show processes log
```

id	date	name	pid	signal	backtrace	reason
2509.	2012-12-21 15:59:50	iimp	1800	SIGTERM(15)	traced	signal
2510.	2012-12-21 15:59:50	sipalg	2377	SIGTERM(15)	traced	signal
2511.	2012-12-21 15:59:50	apclt	2375	SIGTERM(15)	traced	signal
2511.	2012-12-21 15:59:50	apccluster	2217	SIGTERM(15)	traced	signal
2512.	2012-12-21 15:59:50	evmlogd	1766	SIGTERM(15)	traced	signal
2513.	2012-12-21 15:59:50	imi	1893	SIGTERM(15)	traced	signal
2514.	2012-12-21 15:59:50	wids	2293	SIGTERM(15)	traced	signal
2515.	2012-12-21 15:59:50	ipwlogd	2416	SIGTERM(15)	traced	signal
2516.	2012-12-21 15:59:50	nfm	2417	SIGTERM(15)	traced	signal
2517.	2012-12-21 15:59:50	httprd	2379	SIGTERM(15)	traced	signal
2518.	2012-12-21 15:59:50	fqm	1882	SIGTERM(15)	traced	signal
2519.	2012-12-21 15:59:50	irfm	2297	SIGTERM(15)	traced	signal
2520.	2012-12-21 15:59:50	filemib	1770	SIGTERM(15)	traced	signal
2520.	2012-12-21 15:59:50	pm	2376	SIGTERM(15)	traced	signal
2521.	2012-12-21 15:59:50	salh	2415	SIGTERM(15)	traced	signal
2522.	2012-12-21 15:59:50	guestService	2294	SIGTERM(15)		

In addition, you can check the detail information corresponding to the 'id' of each error log by using the following command.

```
WEC8500# show processes log id 15
```

id	date	name	pid	signal	backtrace	reason
15.	2012-08-02 18:39:08	eqm	2311	NONE(0)	-	coredump

detail (additional info.)

- core_dump (comm:eqm, signr:11, pid:2311)
- detected unixtime: 1343900344 -> Thu Aug 2 18:39:04 2012

id	date	name	pid	signal	backtrace	reason
15.	2012-08-09 12:37:09	eqm	30103	NONE(0)	-	coredump

detail (additional info.)

- core_dump (comm:eqm, signr:11, pid:30103)

10.10.2 Retrieving Crash Information

When a critical problem occurs in the system platform during operation, the APC saves important system information at that time to provide the crash information that can be used for post mortem analysis. The crash information includes the Crash Detect and Report (CDR) information that has the context about the crash status and the core dump information that has the memory dump about the crash status of a user process.

10.10.2.1 Managing CDR Information

To manage the CDR information, the system provides the following function.

- Retrieving CDR Information
- Exports CDR history information
- Deletes CDR history information

[Retrieving Summarized CDR History Information]

To retrieve the entire history information for all the rebooting including rebooting due to a crash, enter the 'show debug reboot summary' command.

- show debug reboot summary

```
WEC8500# show debug reboot summary
=====
ID      EVENT_NAME      EVENT_DESCRIPTION
REBOOT_TIME
=====
0001 DIE                DIE_VAL[1] - Unhandled kernel unaligned access
03:56:00, Aug 22 2012
0000 PANIC              softlockup: hung tasks
03:51:51, Aug 22 2012
```

[Retrieving Detail CDR History Information]

To check the detail crash information, execute the 'show debug reboot info [id/all]' command. By using this command, you can view the key information including a kernel log that exists before the system is rebooted due to a critical crash. The description of each parameter is shown below.

- show debug reboot info [DATA]

Parameter	Description
DATA	Selects crash information (id/all) - id: A specific CDR ID value to view - all: Retrieve all the CDR histories

If no parameter is entered, the most recent reboot information is retrieved.

```
WEC8500# show debug reboot info

#####

[REBOOT_SUMMARY]=====

ID           : 0001
EVENT NAME   : DIE
EVENT DESC   : DIE_VAL[1] - Unhandled kernel unaligned access
REBOOT TIME  : 03:56:00, Aug 22 2012

[KERNEL_LOG]=====

console [cdr-1] enabled
Creating 1 MTD partitions on "nor0":
0x000000dc0000-0x000000fc0000 : "crash_raw"
CDR connector initialized (ID = {8.1})
...
...
```

[Exporting CDR history information]

The crash information of system can be extracted to text file for post analysis.

By entering the 'show debug reboot export' command, you can send the system crash information created in a text file to outside using the 'transfer' command.

- show debug reboot export

[Deleting CDR history information]

To delete CDR information remaining in a device, execute the following command.

- debug reboot erase [DATA]

Parameter	Description
DATA	If there is no reboot information selection (id/all) option, the most recent system reboot information is deleted. - id: A specific CDR ID value to delete - all: Delete all the CDR histories

10.10.2.2 Retrieving Core Dump Information

Use the 'show debug coredump summary' command to retrieve the status of core dump.

```
WEC8500# show debug coredump summary
```

```
CORE_DUMP      :      enable
DUMP_QUOTA     :      1024 (MB)
CORE_SIZE      :      204800 (KB)
POLL_PERIOD    :      60 (sec)
THRESHOLD      :      80 (%)
```

```
-----
PROCESS        |          SIGNAL          |          TIME          |
CORE_FILE
-----
eqm             Segmentation fault   Wed Aug 22 03:05:16 2012 core-eqm-
11-1345572316-2437.gz
hostapd         Aborted Wed Aug 22 03:06:02 2012 core-hostapd-6-
1345572362-2436.gz
nsm             Bus error Wed Aug 22 03:07:21 2012 core-nsm-10-
1345572441-2013.gz
```

10.11 File Management

The APC provides the file management functions of copying, moving, or retrieving a file and also file download and upload. In addition, it checks the integrity of a package file and provides version retrieving method.

To use a file related command, go to the file mode first. The command is basically used as follows:

- 1) Go to the file mode of CLI.

```
WEC8500# file
WEC8500/file#
```

- 2) Use each command. The following commands are used in the file mode.

Command	Description
cd	Changes the current directory.
copy	Copies a file.
df	Retrieves the brief information of a storage media connected to the system.
download	Downloads a file using FTP protocol.
dump	Shows the content of a file.
ls	Retrieves the list of files or directories in a specified path.
move	Changes the name of a file.
pwd	Shows the current directory.
remove	Deletes a file.
upload	Uploads a file using FTP protocol.
verify	Checks the integrity of a package file and shows the result.
version	Shows the information of a package file.

10.11.1 Retrieving Configuration of Current Directory

The file management command supports both a relative path and an absolute path based on the current (working) directory. The current directory is a path that is a reference of a relative path. For example, if the current directory is 'disk:/', the 'copy test1 test2' is the same as the 'copy disk:/test1 disk:/test2' command.

To retrieve a current directory, enter the 'pwd' command.

```
WEC8500/file# pwd

disk:/
```

To change a directory, use the 'cd [TARGET_DIR]' command.

```
WEC8500/file# cd etc
WEC8500/file# pwd

disk:/etc
```

Parameter	Description
TARGET_DIR	Name of a directory to change

10.11.2 Retrieving Directory List

To retrieve a file or directory in a specific directory, use the 'ls' command. If you enter only 'ls', all the contents in the current directory are displayed.

To check only a specific directory, enter the 'ls [TARGET_DIR]' command.

A usage example is provided below.

```
WEC8500/file# ls
Current working directory: disk:/
directory      4.0K      Jul   5 13:49:49  etc
directory     16K       Jan   1 09:00:39  lost+found
directory      4.0K      Jun   9 15:36:02  opt
directory      4.0K      Jun   9 16:46:59  stats
directory      4.0K      Jun  12 01:11:01  var
WEC8500/file# ls etc
Current working directory: disk:/
directory      4.0K      Jun   9 15:36:02  ap
directory      4.0K      Jun   9 15:36:02  config
directory      4.0K      Jun   9 15:36:02  db
file           168       Jul   5 13:49:49  PKG_INFO_STANDBY
WEC8500/file# ls disk:/etc
Current working directory: disk:/
directory      4.0K      Jun   9 15:36:02  ap
directory      4.0K      Jun   9 15:36:02  config
directory      4.0K      Jun   9 15:36:02  db
file           168       Jul   5 13:49:49  P KG_INFO_STANDBY
WEC8500/file#
```

10.11.3 Revising File

To copy a file, use the ‘copy [SRC_FILENAME] [DES_FILENAME]’ command. The below command copies the ‘test’ file into ‘disk:/test2’.

```
WEC8500/file# copy test disk:/test2
```

To delete a file, use the ‘remove [FILENAME]’ command. If you enter the below command and enter ‘y’, the ‘test2’ file is deleted.

```
WEC8500/file# remove test2
'disk:/test2' Do you really want to remove it ? (y/n)
y
```

To change a filename, use the ‘move [SRC_FILENAME] [DES_FILENAME]’ command. If you enter the below command, the ‘test’ file is changed to ‘test2’.

```
WEC8500/file# move test test2
```

10.11.4 Retrieve File Content

To retrieve the content of a file, use the ‘dump’ command. It can be displayed in the hexa or ascii format.

```
WEC8500/file# dump test2
0000000 7f45 4c46 0202 0100 0000 0000 0000 0000 |.ELF.....|
0000010 0002 0008 0000 0001 0000 0001 2000 4950 |..... .IP |
0000020 0000 0000 0000 0040 0000 0000 0002 9600 |.....@.....|
0000030 808d 0007 0040 0038 0007 0040 001e 001d |.....@.8...@...|
0000040 0000 0006 0000 0005 0000 0000 0000 0040 |.....@.....|
0000050 0000 0001 2000 0040 0000 0001 2000 0040 |.... ..@.... ..@ |
0000060 0000 0000 0000 0188 0000 0000 0000 0188 |.....|
0000070 0000 0000 0000 0008 0000 0003 0000 0004 |.....|
0000080 0000 0000 0002 5b40 0000 0001 2002 5b40 |.....[@.... .[@ |
0000090 0000 0001 2002 5b40 0000 0000 0000 000f |.... .[@.....|
```

10.11.5 File Download and Upload

A file is downloaded or uploaded through FTP protocol.

To download a file, use the 'download' command. An example of downloading the 'test' file from '192.168.1.1' to 'disk:/test' is shown below.

```
WEC8500/file# download guest guest 192.168.1.1 test disk:/test
```

To upload a file, use the 'upload' command.

An example of uploading the 'disk:/uploadtest' file to '192.168.1.1' is shown below.

```
WEC8500/file# upload guest guest 192.168.1.1 disk:/uploadtest
uploadtest
```

10.11.6 Package File

You can use a package file by downloading it from a network or copying it from a USB memory. The APC checks the integrity of a package file and provides the information retrieving function.

Checking the integrity of a package file

Checking if a package file is damaged is called integrity checking. An example of checking integrity using the 'verify' command is shown below.

[Checking APC package file]

```
WEC8500/file# verify package/wec8500_0.3.0.R.bin
Verify: success!!
```

[Checking AP package file]

```
WEC8500/file# verify package/ap/wea302.img
Verify: success!!
```

Retrieving the information of a package file

A package file includes the information such as version information, model information, package build information, etc. To check the content of a package file, use the ‘version’ command.

[Retrieving the information of APC package file]

```
WEC8500/file# version package/wec8500_0.3.0.R.bin
=====
Model       : WEC8500
Version     : 0.3.0.R
Build Date  : Sat Jun 30 15:57:09 2012
Builder     : apcbuild
Build Path  : /home2/apcbuild/release/apc
MD5SUM      : b715450abf1be81616fd7e6391e12cee
```

[Retrieving the information of AP package file]

```
WEC8500/file# version package/ap/wea302.img
=====
Model       : wea302
Version     : 0.1.0.R
Build Date  : Fri Apr 13 18:41:26 KST 2012
Sisze      : 31998080
CRC        : d5aa76ad
```

10.11.7 Retrieving Storage Media

The WEC8500 supports a disk and USB memory as a storage media. And the WEC8050 supports only a disk as a storage media. Both current directory-based relative path and absolute path are all supported during command execution and the path of each device is shown in the below table.

Device	Path	Description
Disk	disk:/	Uses the system disk as a storage media. (basic path)
USB memory	usb [N]:/	Uses a USB memory as a storage media. (‘N’ represents a partition number in a USB memory.)

The check the information of a storage media connected to the APC, use the ‘df’ command.

```
WEC8500/file# df
Device      : disk
Filesystem  : ext4
Total size  : 12.9G Free space: 11.3G

Device      : usb1
Filesystem  : vfat
Total size  : 7.4G Free space: 7.0G
```

Using the results of entering the above command, an operator can check the below information.

- The disk and USB memory are connected.
- Disk free space: 11.3 GB
- USB memory free space: 7 GB

10.11.8 Managing File in Web UI

In the menu bar of <WEC Main window>, select <Administration > and then select the <File Management> → <APC-Local PC> menu in the sub-menus.

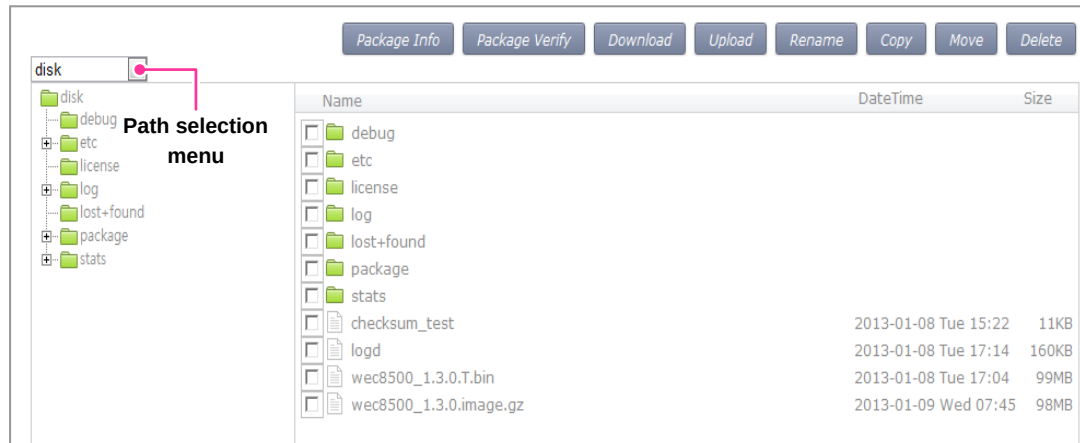


Figure 210. File management window

The File Management window provides the following functions:

Retrieving a file list

Select a desired path in the path selection menu, which is categorized based on the following criteria:

- disk: Select this to retrieve the entire files in the SSD disk of APC.
- APC Package: Select this to retrieve an APC package file.
- AP Package: Select this to retrieve an AP package file.
- Log: Select this to retrieve a log file.
- Stats: Select this to retrieve a statistics file.
- USBN: Select this to retrieve a file in a USB memory connected to the APC.
(The N represents a partition number in a USB memory.)

Copying a file

After selecting the checkbox of a file to copy, click the <Copy> button. Then a popup window is displayed. In the popup window, specify a location where the file will be copied.

Moving a file

After selecting the checkbox of a file to move, click the <Move> button. Then a popup window is displayed. In the popup window, specify a location where the file will be moved.

Deleting a file

After selecting the checkbox of a file to delete, click the **<Delete>** button.

Changing a filename

After selecting the checkbox of a file to change its name, click the **<Rename>** button. Then a popup window is displayed. In the popup window, enter a file name to change.

Downloading a file

After selecting the checkbox of a file to download, click the **<Download>** button.

Uploading a file

When you click the **<Upload>** button, the popup window where you can select a file to upload is displayed. After selecting a file in the upload window, click the **<Upload>** button.

Retrieving a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Info>** button. The package file information is displayed in the popup window.

Checking the integrity of a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Verify>** button. The result of checking the integrity of a package file is displayed in the popup window.



ANNEX A. CLI Command Structure

The structure of CLI command is as follows.

A.1 configure

```

|-- configure
|   |-- spectrum-analysis
|   |   |-- ap
|   |   |   |-- service
|   |   |   |-- channel-request
|   |   |   |   |-- channel-interval
|   |   |   |   |-- channel-control
|   |   |   |   |   |-- dot11b
|   |   |   |   |   |-- dot11aLow
|   |   |   |   |   |-- dot11aMid
|   |   |   |   |   |-- dot11aHigh
|   |   |   |-- configuration-request
|   |   |   |   |-- sample
|   |   |   |   |-- interference
|   |   |   |   |-- duty-cycle
|   |-- interferer
|   |   |-- 80211a
|   |   |   |-- continuous_transmitter
|   |   |   |-- cordless_phone
|   |   |   |-- video_camera
|   |   |-- 80211b
|   |   |   |-- bluetooth
|   |   |   |-- microwave_oven
|   |   |   |-- continuous_transmitter
|   |   |   |-- cordless_phone
|   |   |   |-- video_camera
|   |   |   |-- zigbee
|   |   |-- unknown
|   |-- hostname
|   |-- call-fail-detect

```

```
|  |-- mgmt-user-password
|  |-- mgmt-user
|  |-- telnet-timeout
|  |-- console-timeout
|  |-- system
|      |-- monitor
|      |   |-- cpu
|      |       |-- threshold
|      |       |-- memory
|      |       |-- threshold
|      |-- license
|      |   |-- install-key
|      |   |-- analyze-key
|  |-- qos
|      |-- description
|      |-- max-dot1p
|      |-- ac
|      |-- bw-contract-downstream
|      |-- bw-contract-upstream
|      |-- call-test
|  |-- country
|      |-- set-global
|      |-- set-ap
|      |-- add-channel
|      |-- del-channel
|      |-- max-tx-power
|  |-- handover
|      |-- time
|      |   |-- ho-decision
|      |   |-- command
|      |   |-- scan-suppress
|      |-- mode
|      |-- opmode
|      |-- scan-trigger-level
|      |-- scan-report-level
|      |-- scan-time-channel
|      |-- scan-time-service
|      |-- scan-time-interleave
|      |-- number-of-prereq
|      |-- number-of-channel
|      |-- buffered-forwarding
|      |-- handover-timer
|      |-- command
```

```

|      |      |-- scanmode-clear
|      |      |-- start-buffering
|      |      |-- fwd-buffering
|      |      |-- upload-data
|      |      |-- decision-delta
|      |      |-- station-decision-delta
|      |      |-- nchostats-req
|      |      |-- inter-apc
|      |-- station
|      |      |-- number-of-assoc-tracking
|      |      |-- stats-req
|      |      |-- device_type
|      |      |-- data
|      |      |      |-- collection
|      |      |      |-- assoc-latency-threshold
|      |      |      |-- ho-latency-threshold
|      |      |      |-- assoc-fail-threshold
|      |      |      |-- ho-fail-threshold
|      |-- security
|      |      |-- radius
|      |      |      |-- auth
|      |      |      |-- acct
|      |      |      |-- serverIp
|      |      |      |-- secret
|      |      |      |-- fo-retransmit-count
|      |      |      |-- retransmit-count
|      |      |      |-- retransmit-interval
|      |      |      |-- use-vip
|      |      |-- advanced
|      |      |      |-- eap-retransmit-interval
|      |      |      |-- eap-retransmit-count
|      |      |      |-- eap-key-retransmit-interval
|      |      |      |-- eap-key-retransmit-interval-1st
|      |      |      |-- eap-key-retransmit-count
|      |      |      |-- allow-last-eap-key-timeout
|      |      |      |-- rsn-ie-ptksa-replay-counter
|      |      |      |-- rsn-ie-gtksa-replay-counter
|      |      |      |-- sta-info-free-timer-after-disassoc
|      |      |      |-- log-mic-error
|      |      |      |-- sta-auth-session-limit
|      |      |      |-- eap-failure-quiet-period
|      |      |-- guestaccess
|      |      |      |-- enable

```

```
| | | |-- secure-auth-enable
| | | |-- idle-session-timeout
| | | |-- add-user
| | | |-- del-user
| | | |-- db-access-flag
| | | |-- ext-primary-radius-server
| | | |-- ext-secondary-radius-server
| | | |-- web-server
| | |-- captive-portal
| | | |-- web-auth
| | | | |-- auth-type
| | | | |-- after-auth
| | | | |-- redirect-url
| | | | |-- external-url
| | | | |-- downloaded-url
| | | | |-- title
| | | | |-- content
| | | | |-- message
| | | |-- enable
| | | |-- guest-auth
| | | |-- radius-primary
| | | |-- radius-secondary
| | | |-- web-server
| | | |-- add-user
| | | |-- del-user
| | |-- mac-filter
| | | |-- policy
| | | |-- mac
| | | |-- wlan_id
| | | |-- name
| | |-- ext-wips
| | | |-- enable
| | | |-- interval
| | | |-- primary
| | | |-- secondary
| | | |-- port
| | | |-- user
| | | |-- password
| |-- remote-ap-group
| | |-- add-ap
| | |-- local-auth
| | |-- primary-radius
| | |-- secondary-radius
```

```

|      |-- ap-group
|      |      |-- add-wlan
|      |      |-- add-ap
|      |      |-- profile
|      |      |      |-- echo-interval
|      |      |      |-- discovery-interval
|      |      |      |-- report-interval
|      |      |      |-- statistics-timer
|      |      |      |-- retransmit-interval
|      |      |      |-- max-retransmit
|      |      |      |-- echo-retransmit-interval
|      |      |      |-- max-echo-retransmit
|      |      |      |-- ip-mode
|      |      |      |-- primary-apc
|      |      |      |-- secondary-apc
|      |      |      |-- tertiary-apc
|      |      |      |-- vlan-support
|      |      |      |-- native-vlanId
|      |      |      |-- auto-mode
|      |      |      |-- description
|      |      |      |-- telnet-enable
|      |      |      |-- ssh-enable
|      |      |      |-- led-config
|      |      |      |-- fragment-size
|      |      |      |-- discovery
|      |      |      |-- time-config
|      |      |      |      |-- mode
|      |      |      |      |-- ac-stamp-interval
|      |      |      |      |-- timezone
|      |      |-- airmove
|      |      |      |-- enable
|      |      |      |-- target-ap
|      |      |      |-- scan-trigger-level
|      |      |      |-- scan-time-channel
|      |      |      |-- scan-time-service
|      |      |      |-- scan-time-interleave
|      |      |      |-- number-of-proreq
|      |      |      |-- number-of-channel
|      |      |      |-- decision-delta
|      |-- if-group
|      |      |-- add-if
|      |-- wlan
|      |      |-- band-steering

```

```

| | | -- load-balancing
| | | -- multicast-to-unicast
| | | | -- enable
| | | | -- discard
| | | | -- max-entry
| | | -- enable
| | | -- guest-flag
| | | -- radio
| | | -- ssid
| | | -- security
| | | | -- apply
| | | | -- wpa
| | | | -- psk
| | | | -- wpa2
| | | | -- ieee8021x
| | | | -- keymgmt
| | | | -- wep
| | | | -- okc
| | | | -- dynamicVlan
| | | | -- setDefault
| | | | -- grpRekeyTime
| | | | -- pmkLifeTime
| | | | -- radius-server
| | | | | -- auth-servers
| | | | | -- acct-servers
| | | | -- eapReauthTime
| | | | -- eapolVersion
| | | | -- radiusPrimaryRetryInterval
| | | | -- acct_interim_interval
| | | | -- layer3
| | | | | -- web-policy
| | | | | -- pre-auth-acl
| | | | | -- redirect-URL-override
| | | | -- mac-filter
| | | -- iuts
| | | | -- mode
| | | | -- latency
| | | | -- queue-length
| | | | -- filter-mode
| | | | -- codec-list
| | | -- if-group
| | | -- acl
| | | -- aaa-override

```



```

|      |      |-- mac-type
|      |      |-- tunnel-mode
|      |      |-- qos-class
|      |      |-- ext-wips
|      |      |-- suppress-ssid
|      |      |-- dls-allowed
|      |      |-- local-vlan
|      |      |-- max-associated-stations
|      |      |-- vdm
|      |      |      |-- multicast-info
|      |      |      |-- station-policy
|      |      |      |-- mode
|      |      |      |-- threshold
|      |      |      |-- default-policy
|      |      |      |-- join-gap
|      |      |      |-- session-timeout
|      |      |      |-- multiframing_threshold
|      |      |      |-- limit
|      |      |      |-- retry-limit
|      |      |      |-- schedule-interval
|      |      |      |-- min-mux-packets
|      |      |      |-- mux-skip-limit
|      |      |      |-- station-queue-limit
|      |      |      |-- packet-lifetime
|      |      |      |-- pifs-access
|      |      |      |-- tx-rate
|      |      |      |-- retry-ratio-update-period
|      |      |      |-- stop-threshold
|      |      |      |-- stop-interval
|      |      |      |-- start-rssi
|      |      |      |-- seq-list-size
|      |      |      |-- nack-interval
|      |      |      |-- rx-timeout
|      |      |-- sds
|      |      |      |-- weight
|      |      |-- dhcp-override
|      |      |-- ampdu
|      |      |-- reject-probe-mode
|      |-- ap
|      |      |-- profile
|      |      |      |-- dtls-policy
|      |      |      |-- discovery
|      |      |      |-- mac

```

			-- location
			-- name
			-- echo-interval
			-- discovery-interval
			-- report-interval
			-- statistics-timer
			-- retransmit-interval
			-- max-retransmit
			-- echo-retransmit-interval
			-- max-echo-retransmit
			-- ap-mode
			-- ip-mode
			-- static-ip
			-- sync-group
			-- primary-apc
			-- secondary-apc
			-- tertiary-apc
			-- ap-stats-history-enable
			-- vlan-support
			-- native-vlanId
			-- telnet-enable
			-- ssh-enable
			-- led-config
			-- edge-ap
			-- fragment-size
			-- client-ip
			-- repeater-whitelist
			-- wlan-vlanId
			-- time-config
			-- mode
			-- ac-stamp-interval
			-- timezone
			-- reboot
			-- upgrade-request
			-- tech-support
			-- get-all
			-- get-crash-file
			-- get-coredump
			-- get-log-file
			-- get-system-report
			-- get-if-stats
			-- syslog-config
			-- shutdown

```

|      |      |-- audit
|      |      |      |-- wlan-reprovisioning
|      |      |      |-- bss-status
|      |      |-- airmove
|      |      |      |-- config-priority
|      |      |      |-- scan-trigger-level
|      |      |      |-- scan-time-channel
|      |      |      |-- scan-time-service
|      |      |      |-- scan-time-interleave
|      |      |      |-- number-of-proreq
|      |      |      |-- number-of-channel
|      |      |      |-- decision-delta
|      |-- ap-all
|      |      |-- upgrade
|      |      |      |-- transfer-protocol
|      |      |      |-- start
|      |      |      |-- stop
|      |      |      |-- max-retry
|      |      |      |-- max-download
|      |      |      |-- select-package
|      |      |      |-- target
|      |      |-- reboot
|      |-- apc
|      |      |-- security-auth-type
|      |      |-- R-MAC
|      |      |-- apc-list
|      |      |      |-- add-apc
|      |      |      |-- del-apc
|      |      |      |-- change-name
|      |      |      |-- change-mac
|      |      |-- ap-mgmt-if
|      |      |-- capwap
|      |      |      |-- ctr-src-port
|      |      |      |-- window-size
|      |      |      |-- change-state-pending-timer
|      |      |      |-- data-check-timer
|      |      |      |-- dtls-session-delete
|      |      |      |-- retransmit-interval
|      |      |      |-- wait-dtls-timer
|      |      |      |-- wait-join-timer
|      |      |      |-- discovery-del-timer
|      |      |      |-- max-retransmit
|      |      |      |-- mutal-auth-enable

```

```

| | | |-- discovery-by-multicast
| | | |-- add-multicast-if
| | | |-- discovery-by-broadcast
| | | |-- auto-discovery
| | | |-- auto-discovery-ap-group
| | | |-- add-admin-user
| | | |-- add-user
| | | |-- ecn-support
| | |-- tech-support
| | | |-- mode
| | | |-- max-retry
| | |-- ap-stats-history
| | | |-- mode
| | | |-- period
| | | |-- max-retry
| | | |-- enable
| | |-- ap-if-stats
| | | |-- period
| | |-- ap-time-config
| | | |-- add-ntp
| | | |-- ntp-interval
| | |-- service
| | | |-- wlan-reprovisioning
| | | |-- wlan-reprovisioning-count
| | | |-- wlan-reprovisioning-interval
| |-- redundancy
| | |-- fallback-enable
| | |-- fallback-interval
| | |-- add-apc
| | |-- del-apc
| |-- 80211a
| | |-- max-associated-stations
| | |-- edca-parameters
| | |-- qos
| | | |-- protocol
| | | |-- edca-profile
| | | | |-- cw-min
| | | | |-- cw-max
| | | | |-- aifsn
| | | | |-- txop-limit
| | | | |-- msdu-lifetime
| | | |-- policy
| | | |-- dot1p

```

```

| | | | | |-- enable
| | | | | |-- policy
| | | | |-- dscp
| | | | | |-- enable
| | | | | |-- policy
| | | |-- dot1p-tag
| | | |-- dscp-tag
| | | |-- ap-tags
| | | |-- qap-missing-ack-retry-limit
| | | |-- edca-avg-period
| | | |-- reset-edca-profiles
| | |-- cac
| | | |-- acm
| | | |-- reserved-ho-calls
| | | |-- max-calls
| | | |-- alarming-count
| | |-- rate
| | | |-- basic
| | | |-- supported
| | |-- txPower
| | |-- channel
| | |-- 11n-support
| | | |-- enable
| | | |-- mcs
| | | |-- forty-mhz
| | | |-- guard-interval
| | | |-- rifs
| | | |-- forty-mhz-intolerant
| | | |-- phy-format
| | | |-- tx-stbc
| | | |-- rx-stbc
| | | |-- beamforming
| | | |-- tx-mcs-set
| | | |-- protection
| | | |-- spatial-stream
| | |-- retry-limit
| | | |-- short
| | | |-- long
| | |-- threshold
| | | |-- rts
| | | |-- fragmentation
| | |-- msdu-lifetime
| | | |-- tx

```



```

|      |      |      |      |-- threshold
|      |      |-- antenna
|      |      |-- station-kickout
|      |-- 80211bg
|      |      |-- max-associated-stations
|      |      |-- edca-parameters
|      |      |-- qos
|      |      |      |-- protocol
|      |      |      |-- edca-profile
|      |      |      |      |-- cw-min
|      |      |      |      |-- cw-max
|      |      |      |      |-- aifsn
|      |      |      |      |-- txop-limit
|      |      |      |      |-- msdu-lifetime
|      |      |      |-- policy
|      |      |      |      |-- dot1p
|      |      |      |      |      |-- enable
|      |      |      |      |      |-- policy
|      |      |      |      |-- dscp
|      |      |      |      |      |-- enable
|      |      |      |      |      |-- policy
|      |      |      |-- dot1p-tag
|      |      |      |-- dscp-tag
|      |      |      |-- ap-tags
|      |      |      |-- qap-missing-ack-retry-limit
|      |      |      |-- edca-avg-period
|      |      |      |-- reset-edca-profiles
|      |-- cac
|      |      |-- acm
|      |      |-- reserved-ho-calls
|      |      |-- max-calls
|      |      |-- alarming-count
|      |-- rate
|      |      |-- basic
|      |      |-- supported
|      |-- txPower
|      |-- channel
|      |-- 11n-support
|      |      |-- enable
|      |      |-- mcs
|      |      |-- guard-interval
|      |      |-- rifs
|      |      |-- forty-mhz-intolerant

```

```

| | | -- phy-format
| | | -- tx-stbc
| | | -- rx-stbc
| | | -- beamforming
| | | -- tx-mcs-set
| | | -- protection
| | | -- spatial-stream
| | -- 11g-support
| | | -- enable
| | -- retry-limit
| | | -- short
| | | -- long
| | -- threshold
| | | -- rts
| | | -- fragmentation
| | -- msdu-lifetime
| | | -- tx
| | | -- rx
| | -- beacon
| | | -- period
| | -- cca
| | | -- mode
| | | -- threshold
| | -- sds
| | | -- enable
| | | -- ampdu-control
| | | -- schedule-interval
| | | -- ac
| | | | -- scheduler
| | | | -- wfq-metric
| | | | -- sq-max-length
| | | | -- sq-drop-option
| | | | -- token-unit
| | | | -- fs-direction
| | | | -- sq-retry-limit
| | | | -- long-retry-limit
| | | | -- short-retry-limit
| | | | -- ampdu-tx-time-limit
| | -- enable
| | -- cvo
| | | -- enable
| | | -- local-call-enable
| | | -- edit-profile

```



```

| | | | -- aifsn
| | | | -- cw-min
| | | | -- cw-max
| | | | -- txop-limit
| | | | -- ampdu-limit
| | | -- set-profile
| | -- rate-control
| | | -- voice
| | | | -- max-rate
| | | | -- probe-interval
| | | | -- weight
| | | | -- threshold
| | | -- video
| | | | -- max-rate
| | | | -- probe-interval
| | | | -- weight
| | | | -- threshold
| | -- antenna
| | -- station-kickout
| -- 80211h
| | -- no-possess-time
| | -- channel-switch
| | -- power-constraint
| -- alarm
| | -- level
| | -- group
| | -- logsize
| | -- logcount
| | -- dump
| | -- backupIP
| | -- stdout
| | -- current-terminal
| -- event-filter
| | -- enable
| -- web-service-port
| -- ip
| | -- dhcp
| | | -- pool
| | | | -- network
| | | | -- range
| | | | -- lease
| | | | -- domain-name
| | | | -- dns-server

```

```

| | | | -- default-router
| | | | -- fix-address
| | | | -- ntp-server
| | | | -- user-option
| | | | -- ping-check
| | | | -- capwap-dhcp-option
| | | | -- enable
| | | | -- server-ip
| | | -- dhcp-proxy
| | | | -- timeout
| | | | -- default-dhcp-server
| | | | -- enable
| | | -- dns
| | | | -- client
| | | | -- relay
| | | | -- name-server
| | | -- igmp
| | | | -- limit
| | | | -- snooping
| | | | -- ssm-map
| | | | | -- enable
| | | | | -- static
| | | -- route
| | | -- multicast-routing
| | | -- pim
| | | | -- accept-register
| | | | -- anycast-rp
| | | | -- bsr-candidate
| | | | -- cisco-register-checksum
| | | | -- crp-cisco-prefix
| | | | -- ignore-rp-set-priority
| | | | -- jp-timer
| | | | -- register-rate-limit
| | | | -- register-rp-reachability
| | | | -- register-source
| | | | -- register-suppression
| | | | -- rp-address
| | | | -- rp-register-kat
| | | | -- spt-threshold
| | | | -- rp-candidate
| | | | | -- interval
| | | | | | -- priority
| | | | | | -- group-list

```

```

|   |   |-- nat
|   |-- access-list
|   |-- http
|   |-- https
|   |-- arp
|   |-- firewall
|   |-- wlan-arp-mode
|   |-- package
|   |   |-- upgrade
|   |-- stats-report
|   |   |-- enable
|   |   |-- upload
|   |   |-- target
|   |   |-- current-stats
|   |-- telnet-server
|   |   |-- enable
|   |   |-- port
|   |-- ssh-server
|   |   |-- enable
|   |   |-- port
|   |-- sftp-server
|   |   |-- enable
|   |   |-- chguser
|   |-- ftp-server
|   |   |-- enable
|   |   |-- port
|   |   |-- chguser
|   |-- clock
|   |   |-- set
|   |   |-- timezone
|   |-- ntp
|   |   |-- server
|   |   |   |-- enable
|   |   |-- client
|   |   |   |-- enable
|   |   |   |-- interval
|   |   |   |-- server-addr
|   |   |   |   |-- ip
|   |   |   |   |-- hostname
|   |-- syslog
|   |   |-- enable
|   |   |-- add
|   |   |-- del

```

```

| | | -- level
| | -- bridge
| | | -- protocol
| | | | -- ieee
| | | | -- mstp
| | | | -- rstp
| | | -- ageing-time
| | | -- address
| | | | -- discard
| | | | | -- vlan
| | | | -- forward
| | | | | -- vlan
| | | -- max-age
| | | -- forward-time
| | | -- hello-time
| | | -- instance
| | | -- max-hops
| | | -- spanning-tree
| | | | -- enable
| | | | -- errdisable-timeout
| | | | | -- enable
| | | | | -- interval
| | | | -- portfast
| | | | | -- bpdu-filter
| | | | | -- bpdu-guard
| | | -- rapid-spanning-tree
| | | | -- enable
| | | -- multiple-spanning-tree
| | | | -- enable
| | | -- priority
| | | -- transmit-holdcount
| | -- spanning-tree
| | | -- bridge
| | | | -- instance
| | | | | -- vlan
| | | | -- region
| | | | -- revision
| | -- vlan
| | | -- vlan
| | -- interface
| | | -- switchport
| | | | -- mode
| | | | -- access

```

```

|   |   |   |-- trunk
|   |   |   |-- add
|   |   |   |-- except
|   |   |   |-- remove
|   |   |   |-- all
|   |   |   |-- none
|   |   |   |-- hybrid
|   |   |   |-- allowed
|   |   |   |   |-- add
|   |   |   |   |-- remove
|   |   |   |   |-- all
|   |   |   |   |-- none
|   |   |   |-- vlan
|   |   |-- static-channel-group
|   |   |-- channel-group
|   |   |-- flowcontrol
|   |   |-- storm-control
|   |   |   |-- level
|   |   |-- bridge-group
|   |   |   |-- instance
|   |   |   |   |-- path-cost
|   |   |   |   |-- priority
|   |   |   |-- priority
|   |   |   |-- path-cost
|   |   |-- mirror
|   |   |   |-- interface
|   |   |   |-- direction
|   |   |-- ip
|   |   |   |-- address
|   |   |   |-- igmp
|   |   |   |   |-- ra-option
|   |   |   |   |-- access-group
|   |   |   |   |-- immediate-leave
|   |   |   |   |-- last-member-query-count
|   |   |   |   |-- last-member-query-interval
|   |   |   |   |-- limit
|   |   |   |   |-- except
|   |   |   |-- mroute-proxy
|   |   |   |-- querier-timeout
|   |   |   |-- query-interval
|   |   |   |-- query-max-response-time
|   |   |   |-- robustness-variable
|   |   |   |-- snooping

```

```

| | | | | |-- fast-leave
| | | | | |-- mrouter
| | | | | |-- querier
| | | | | |-- report-suppression
| | | | | |-- static-group
| | | | | |-- interface
| | | | | |-- source
| | | | | | |-- interface
| | | | | |-- version
| | | |-- pim
| | | | |-- sparse-mode
| | | | |-- bsr-border
| | | | |-- dr-priority
| | | | |-- exclude-genid
| | | | |-- hello-holdtime
| | | | |-- hello-interval
| | | | |-- neighbor-filter
| | | | |-- propagation-delay
| | | | |-- unicast-bsm
| | | |-- access-group
| | | |-- nat
| | | |-- proxy-arp
| | | |-- tcp-adjust-mss
| | | |-- rip
| | | | |-- authentication
| | | | | |-- key-chain
| | | | | |-- mode
| | | | | |-- string
| | | | |-- receive
| | | | | |-- version
| | | | |-- receive-packet
| | | | |-- send
| | | | | |-- version
| | | | |-- send-packet
| | | | |-- split-horizon
| | | |-- ospf
| | | | |-- address
| | | | | |-- authentication
| | | | | |-- authentication-key
| | | | | |-- cost
| | | | | |-- database-filter
| | | | | |-- dead-interval
| | | | | |-- hello-interval

```

```

| | | | | | -- message-digest-key
| | | | | | | -- md5
| | | | | | -- mtu-ignore
| | | | | | -- priority
| | | | | | -- retransmit-interval
| | | | | | -- transmit-delay
| | | | | | -- authentication
| | | | | | -- authentication-key
| | | | | | -- cost
| | | | | | -- database-filter
| | | | | | -- dead-interval
| | | | | | -- hello-interval
| | | | | | -- message-digest-key
| | | | | | | -- md5
| | | | | | -- mtu-ignore
| | | | | | -- priority
| | | | | | -- retransmit-interval
| | | | | | -- transmit-delay
| | | | | | -- disable
| | | | | | -- mtu
| | | | | | -- network
| | | | | | -- shutdown
| | | | | | -- traffic-shape
| | | | | | -- service-policy
| | | | | | -- dhcp
| | | | | | | -- server
| | | | | | | -- option-82
| | | | | | -- arp-ageing-timeout
| | | | | | -- speed-duplex
| | | | | | -- mtu
| | | | | | -- spanning-tree
| | | | | | | -- autoedge
| | | | | | | -- edgeport
| | | | | | | -- force-version
| | | | | | | -- guard
| | | | | | | -- hello-time
| | | | | | | -- instance
| | | | | | | -- path-cost
| | | | | | | -- priority
| | | | | | | -- restricted-role
| | | | | | | -- restricted-tcn
| | | | | | -- link-type
| | | | | | -- path-cost

```

```

|   |   |   |-- portfast
|   |   |   |   |-- bpdu-filter
|   |   |   |   |-- bpdu-guard
|   |   |   |-- priority
|   |   |   |-- restricted-role
|   |   |   |-- restricted-tcn
|   |   |   |-- transmit-holdcount
|   |-- vrrp
|   |-- router
|   |   |-- rip
|   |   |   |-- cisco-metric-behavior
|   |   |   |-- default-information
|   |   |   |-- default-metric
|   |   |   |-- distance
|   |   |   |-- distribute-list
|   |   |   |-- maximum-prefix
|   |   |   |-- neighbor
|   |   |   |-- network
|   |   |   |-- offset-list
|   |   |   |-- passive-interface
|   |   |   |-- recv-buffer-size
|   |   |   |-- redistribute
|   |   |   |   |-- metric
|   |   |   |   |-- route-map
|   |   |   |-- route
|   |   |   |-- timers
|   |   |   |   |-- basic
|   |   |   |-- version
|   |   |-- ospf
|   |   |   |-- area
|   |   |   |   |-- authentication
|   |   |   |   |-- default-cost
|   |   |   |   |-- filter-list
|   |   |   |   |-- nssa
|   |   |   |   |   |-- default-information-originate
|   |   |   |   |   |-- metric
|   |   |   |   |   |-- metric-type
|   |   |   |   |   |-- no-redistribution
|   |   |   |   |   |-- no-summary
|   |   |   |   |   |-- translator-role
|   |   |   |   |-- no-redistribution
|   |   |   |   |-- no-summary
|   |   |   |   |-- translator-role

```


© SAMSUNG Electronics Co., Ltd. page 443 of 528

```

| | | | -- passive-interface
| | | | -- redistribute
| | | | | -- metric
| | | | | -- metric-type
| | | | | -- route-map
| | | | | -- tag
| | | | -- router-id
| | | | -- summary-address
| | | | -- timers
| | | | | -- spf
| | | | | | -- exp
| | | -- vrrp
| | | | -- advertisement-interval
| | | | -- circuit-failover
| | | | -- disable
| | | | -- enable
| | | | -- preempt-mode
| | | | -- preempt-delay
| | | | -- priority
| | | | -- virtual-ip
| | -- os-aware
| | | -- os-aware
| | | -- delete
| | | -- update
| | -- ipwatch
| | -- ftp
| | -- stationtracking
| | | -- station
| | | -- on
| | | -- off
| | -- fqm-mode
| | | -- access-list
| | | -- class-map
| | | | -- match
| | | | | -- access-group
| | | | | -- class
| | | | | -- cos
| | | | | -- dst
| | | | | -- ip
| | | | | | -- dscp
| | | | | | -- precedence
| | | | | | -- tos
| | | | | -- protocol

```



```

| | | | -- channel
| | | | -- aware-option
| | | | -- delayed-channel-change
| | | | -- chdc
| | | | -- enable
| | | | -- statsCollectEnable
| | | | -- statsWarningEnable
| | | | -- statsActionEnable
| | | | -- statsCollectInterval
| | | | -- rssi-threshold
| | | | -- min-failed-client-count
| | | | -- percent-failed-client-count
| | | -- 80211b
| | | | -- dpc
| | | | -- enable
| | | | -- periodic-interval
| | | | -- rssi-threshold
| | | | -- txPower
| | | | -- dcs
| | | | -- enable
| | | | -- periodic-interval
| | | | -- anchor-time
| | | | -- interference-level-threshold
| | | | -- channel-utilization-threshold
| | | | -- my-utilization-threshold
| | | | -- channel
| | | | -- aware-option
| | | | -- delayed-channel-change
| | | | -- chdc
| | | | -- enable
| | | | -- statsCollectEnable
| | | | -- statsWarningEnable
| | | | -- statsActionEnable
| | | | -- statsCollectInterval
| | | | -- rssi-threshold
| | | | -- min-failed-client-count
| | | | -- percent-failed-client-count
| | | -- rf-group-name
| | | -- sub-channel-group
| | | | -- enable
| | | | -- disable
| | | | -- group-name
| | | | -- add-ap

```

```

|      |      |      |-- del-ap
|      |      |      |-- add-channel
|      |      |      |-- del-channel
|      |-- cluster
|      |      |-- keep-alive-interval
|      |      |-- keep-alive-retry-count
|      |      |-- enable
|      |      |-- add-apc
|      |      |-- del-apc
|      |      |-- del-apc-all
|      |-- wids
|      |      |-- enable
|      |      |-- ap-blacklist
|      |      |-- client-blacklist
|      |      |-- ssid-whitelist
|      |      |-- oui-whitelist
|      |      |-- friendlylist
|      |      |-- rogue
|      |      |      |-- expiration-timeout
|      |      |      |-- remove
|      |      |      |-- move
|      |      |      |-- modify-state
|      |      |      |-- adhoc-connection-detection
|      |      |      |-- ap
|      |      |      |      |-- ap-blacklist-check
|      |      |      |      |-- managed_ssid_invalid_security
|      |      |      |      |-- illegal-channel-detection
|      |      |      |      |-- unknownap
|      |      |      |      |      |-- managed-ssid-withauth-client-det
|      |      |      |      |      |-- wired-netwrok-detection
|      |      |      |      |-- fakeap
|      |      |      |      |      |-- managed-ssid-detection
|      |      |      |      |      |-- beacon-without-ssid-detection
|      |      |      |      |      |-- beacon-on-invalid-channel-detection
|      |      |      |      |-- managedap
|      |      |      |      |      |-- invalid-ssid-detection
|      |      |      |-- client
|      |      |      |      |-- oui-list-check
|      |      |      |      |-- auth-request-det
|      |      |      |      |-- probe-request-det
|      |      |      |      |-- deauth-request-det
|      |      |      |      |-- assoc-fail-det
|      |      |      |      |-- auth-fail-det

```

```

| | | | -- oneXauth-fail-det
| | | | -- webauth-fail-det
| | | | -- exclusion-list-check
| | | | -- allowed-limit
| | | | -- add-friendly-rule
| | | | -- del-friendly-rule
| | | | -- modify-friendly-rule
| | | | -- add-malicious-rule
| | | | -- del-malicious-rule
| | | | -- modify-malicious-rule
| | | -- channel-validation
| | | -- enable
| | | -- add
| | | -- delete
| | -- monitor-radio
| | | -- scan-interval
| | | -- periodic-interval
| | -- snmp
| | | -- community
| | | -- user
| | | -- trap
| | | -- trap-source-ip
| | -- pcap
| | | -- mode
| | | -- start-service
| | | -- filter
| | | | -- station-mac
| | | | -- enable-station-mac
| | | | -- ap-mac
| | | | -- enable-ap-mac
| | -- wlan-radio-service
| | | -- sta-idle-timeout
| | | -- wmm-mode
| | | -- dtim
| | -- preferred-calls
| | | -- add
| | | -- del
| | -- locationtrack
| | | -- autotrace
| | | -- algorithm
| | | -- enable
| | | -- ap
| | | -- station

```

```

|      |      |-- rogueap
|      |      |-- roquestation
|      |      |-- expiryhistory
|      |-- vcc
|      |      |-- scme-if
|      |      |-- add-user
|      |      |-- handover
|      |      |-- enable
|      |-- voice
|      |      |-- monitor
|      |      |      |-- enable
|      |      |      |-- interval
|      |      |      |-- fieldType
|      |      |      |      |-- ip
|      |      |      |      |-- mac
|      |      |      |      |-- user-name
|      |      |      |      |-- phone-no
|      |      |-- vqm
|      |      |      |-- enable
|      |      |      |-- connection-limit
|      |      |      |-- reporting-mode
|      |      |      |-- periodic-timer
|      |      |      |-- session-idle-timer
|      |      |      |-- rtp-port-range
|      |      |      |-- alarm
|      |      |      |      |-- enable
|      |      |      |      |-- threshold
|      |      |      |-- upload
|      |      |      |      |-- enable
|      |      |      |      |-- server
|      |      |      |      |-- interval
|      |      |      |      |-- mode
|      |      |      |      |-- user-login
|      |      |      |      |-- target-directory
|      |      |      |      |-- file-size
|      |      |      |      |-- immediate-upload
|      |      |      |-- filter
|      |      |      |-- prefix
|      |-- router-id
|      |-- route-map
|      |      |-- match
|      |      |      |-- interface
|      |      |      |-- ip

```

```
|      |      |      |-- metric
|      |      |      |-- route-type
|      |      |      |-- tag
|      |      |-- set
|      |      |      |-- dampening
|      |      |      |-- ip
|      |      |      |-- metric
|      |      |      |-- metric-type
|      |      |      |-- tag
```


A.2 show

```

|-- show
|   |-- band-steering
|   |-- load-balancing
|   |-- air-quality
|   |   |-- count
|   |   |   |-- interferers
|   |   |   |-- worst-interferers
|   |-- spectrum-analysis
|   |   |-- config
|   |   |   |-- ap
|   |   |-- report
|   |   |   |-- duty_cycle
|   |   |   |   |-- ap
|   |   |   |-- sample
|   |   |   |   |-- ap
|   |   |   |-- interference
|   |   |   |   |-- ap
|   |-- mgmt-users
|   |-- command-log
|   |-- cli-idle-timeout
|   |-- cli-sessions
|   |-- country
|   |   |-- global-config
|   |   |-- ap-config
|   |   |-- information
|   |-- voip
|   |   |-- config
|   |   |-- call-info
|   |-- vcc
|   |   |-- connect-status
|   |   |-- msg-counts
|   |-- 80211a
|   |   |-- cac
|   |   |   |-- configuration
|   |   |-- summary
|   |   |-- qos
|   |   |   |-- policy
|   |   |   |-- ac-profile
|   |   |   |-- edca-parameters
|   |   |   |-- radio-configuration
|   |   |-- radio-config
|   |   |-- voip-stats

```

```

|   |   |-- cvo
|   |   |-- profile
|   |   |-- config
|   |   |-- neighbors
|   |   |-- channel-info
|   |   |-- call-count
|   |   |-- heads
|   |-- 80211bg
|   |   |-- cac
|   |   |-- configuration
|   |   |-- summary
|   |   |-- qos
|   |   |-- policy
|   |   |-- ac-profile
|   |   |-- edca-parameters
|   |   |-- radio-configuration
|   |   |-- radio-config
|   |   |-- voip-stats
|   |   |-- cvo
|   |   |-- profile
|   |   |-- config
|   |   |-- neighbors
|   |   |-- channel-info
|   |   |-- call-count
|   |   |-- heads
|   |-- 80211h
|   |   |-- configuration
|   |   |-- prohibit-channels
|   |-- qos
|   |   |-- profile
|   |-- wlan-radio-service
|   |   |-- config
|   |   |-- msg-counts
|   |-- handover
|   |-- airmove
|   |   |-- ap
|   |   |-- group
|   |-- station
|   |   |-- stats
|   |   |-- management_frame
|   |   |-- all
|   |   |-- NCHO
|   |   |-- all

```

```

|      |      |      |-- IAHO
|      |      |      |-- all
|      |      |      |-- debug
|      |      |      |-- all
|      |      |      |-- ap-80211-stats
|      |      |-- association
|      |      |      |-- history
|      |      |-- summary
|      |      |      |-- ap
|      |      |      |-- bssid
|      |      |      |-- wlan
|      |      |-- detail
|      |      |-- data
|      |      |      |-- configuration
|      |      |      |-- wlan
|      |      |      |-- radio
|      |      |      |-- ap
|      |      |      |-- ap-packet-loss
|      |      |      |-- ap-packet-loss-raw
|      |      |      |-- device
|      |      |      |-- worst_wlan
|      |      |      |-- worst_radio
|      |      |      |-- global_stats
|      |-- system
|      |      |-- info
|      |      |-- uptime
|      |      |-- load
|      |      |-- cpu
|      |      |-- memory
|      |      |-- disk
|      |      |-- fan
|      |      |-- temp
|      |      |-- threshold
|      |      |      |-- cpu
|      |      |      |-- memory
|      |      |      |-- disk
|      |      |      |-- fan
|      |      |      |-- temp
|      |      |-- fancontrol
|      |      |-- license-key
|      |-- remote-ap-group
|      |      |-- summary
|      |      |-- user-state

```

```
| | | -- detail
| | -- ap-group
| | | -- summary
| | | -- detail
| | | -- time-config
| | -- ap
| | | -- upgrade
| | | | -- summary
| | | | -- list
| | | -- summary
| | | -- detail
| | | -- wlan-vlan
| | | -- stats-history
| | | -- if-stats
| | | -- join-stats
| | | -- capwap-stats
| | | -- radio-stats
| | | -- tech-support
| | | -- time-config
| | | -- syslog-config
| | -- apc
| | | -- summary
| | | -- list
| | | -- capwap
| | | | -- summary
| | | -- ap-if-stats
| | -- redundancy
| | | -- summary
| | | -- priority-list
| | -- wlan
| | | -- summary
| | | -- detail
| | | -- security
| | | | -- summary
| | | | -- detail
| | -- vap
| | -- if-group
| | -- alarm
| | | -- info
| | | -- conf
| | | -- list
| | | | -- all
| | | | -- level
```

```

|      |      |      |-- group
|      |      |-- history
|      |      |      |-- all
|      |      |      |-- level
|      |      |      |-- group
|      |      |-- backup
|      |-- event
|      |-- running-config
|      |      |-- system
|      |      |-- cli-idle-timeout
|      |      |-- alarm
|      |      |-- network
|      |      |-- snmp
|      |      |-- wifim
|      |      |-- vqm
|      |      |-- voice-vqm
|      |      |-- apc
|      |      |-- capwap
|      |      |-- if-group
|      |      |-- wlan
|      |      |-- wlan-security
|      |-- tech-support
|      |      |-- version
|      |      |-- uptime
|      |      |-- system
|      |      |-- cpu
|      |      |-- load
|      |      |-- memory
|      |      |-- disk
|      |      |-- process
|      |      |-- processlog
|      |      |-- processmemory
|      |      |-- coredump
|      |      |-- crash
|      |      |-- swm-log
|      |      |-- alarm
|      |      |-- debug
|      |      |-- cluster
|      |      |-- redundancy
|      |      |-- cli-idle-timeout
|      |      |-- network
|      |      |-- snmp
|      |      |-- wifim

```

```

|   |   |-- vqm
|   |   |-- apc
|   |   |-- capwap
|   |   |-- if-group
|   |   |-- wlan
|   |   |-- wlan-security
|   |   |-- rrm
|   |   |-- alarmhistory
|   |   |-- event
|   |   |-- wids
|   |-- ip
|   |   |-- dhcp
|   |   |   |-- pool
|   |   |   |-- lease
|   |   |   |-- proxy-lease
|   |   |   |-- statistics
|   |   |   |-- process
|   |   |-- dhcp-proxy
|   |   |-- dns
|   |   |   |-- name-server
|   |   |   |-- relay
|   |   |   |   |-- cache
|   |   |   |   |-- cache-info
|   |   |-- igmp
|   |   |   |-- groups
|   |   |   |-- interface
|   |   |   |-- snooping
|   |   |   |   |-- mroute
|   |   |   |   |-- statistics
|   |   |   |-- ssm-map
|   |   |-- route
|   |   |-- interface
|   |   |-- rip
|   |   |-- protocols
|   |   |-- nat
|   |   |-- access-list
|   |   |-- filter
|   |   |-- pim
|   |   |   |-- sparse-mode
|   |   |   |   |-- bsr-router
|   |   |   |   |-- interface
|   |   |   |   |-- local-members
|   |   |   |-- mroute

```

```

|      |      |      |      |-- neighbor
|      |      |      |      |-- nexthop
|      |      |      |      |-- rp
|      |      |      |      |-- rp-hash
|      |      |-- ospf
|      |      |      |-- border-routers
|      |      |      |-- database
|      |      |      |-- adv-router
|      |      |      |-- asbr-summary
|      |      |      |-- external
|      |      |      |-- max-age
|      |      |      |-- network
|      |      |      |-- nssa-external
|      |      |      |-- opaque-area
|      |      |      |-- opaque-as
|      |      |      |-- opaque-link
|      |      |      |-- router
|      |      |      |-- self-originate
|      |      |      |-- summary
|      |      |-- neighbor
|      |      |-- route
|      |      |-- virtual-links
|      |-- access-list
|      |-- arp
|      |-- wireless-acl-list
|      |-- multi2uni-list
|      |-- interface
|      |-- vlan
|      |-- mirror
|      |-- reboot
|      |-- processes
|      |      |-- status
|      |      |-- log
|      |      |-- memory
|      |-- version
|      |-- syslog
|      |-- debug
|      |      |-- coredump
|      |      |      |-- summary
|      |      |-- reboot
|      |      |-- info
|      |      |-- summary
|      |      |-- export

```

```
| | | -- log
| | | | -- all
| | | | -- level
| | | | -- module
| | | | -- conf
| | | | -- backup
| | | | -- keyword
| | | | -- detail
| | | | | -- all
| | | | | -- level
| | | | | -- module
| | | | | -- backup
| | | | | -- conf
| | | | | -- keyword
| | | | | -- before
| | | | | -- after
| | | | | -- start-time
| | | | -- before
| | | | -- after
| | | | -- start-time
| | | -- swm-log
| | | -- processes
| | | -- apm
| | | | -- msg-count
| | | | -- disk-size
| | | | -- timer
| | | | -- test-result
| | | | -- end-message
| | | | -- shared-memory
| | | -- event
| | -- ssh-server
| | -- telnet-server
| | -- ftp-server
| | -- filter
| | -- filter-stats
| | -- policy-map
| | -- class-map
| | -- firewall
| | -- sftp-server
| | -- ntp
| | -- timezone
| | -- clock
| | -- event-filter
```



```

|   |-- security
|   |   |-- radius-server
|   |   |   |-- config
|   |   |   |-- summary
|   |   |   |-- detail
|   |   |   |-- stats
|   |   |-- advanced
|   |   |-- hapd-stats
|   |   |-- hapd-ap-stats
|   |   |-- guestaccess
|   |   |   |-- help
|   |   |   |-- current-config
|   |   |   |-- config-user-detail
|   |   |-- captive-portal
|   |   |   |-- stats
|   |   |   |-- running-info
|   |   |   |-- config
|   |   |   |-- guest
|   |   |   |-- web-auth
|   |   |   |-- rad-msg
|   |   |   |-- rad-retrans
|   |   |   |-- failed-sta
|   |   |-- mac-filter
|   |   |   |-- summary
|   |   |   |-- detail
|   |   |-- ext-wips
|   |   |   |-- config
|   |   |   |-- list
|   |-- vrrp
|   |-- static-channel-group
|   |-- bridge
|   |-- etherchannel
|   |-- spanning-tree
|   |   |-- mst
|   |   |   |-- config
|   |   |   |-- detail
|   |   |   |   |-- interface
|   |   |   |-- instance
|   |   |   |   |-- interface
|   |   |   |-- interface
|   |   |-- interface
|   |-- sipalg
|   |   |-- configuration

```

```
| | | -- stats
| | | -- call
| | | | -- summary
| | | | -- detail
| | -- rrm
| | | -- config-summary
| | | -- help
| | | -- neighbor-list
| | | -- channel-status
| | | -- rrm-history
| | | -- sub-channel-group
| | -- locationtrack
| | | -- help
| | | -- config
| | | -- ap
| | | -- floor
| | | -- station
| | | -- rogueap
| | | -- roquestation
| | -- debugging
| | | -- lacp
| | -- port
| | -- lacp
| | -- http
| | -- https
| | -- snmp
| | | -- community
| | | -- user
| | | -- trap
| | -- pcap
| | | -- current-config
| | -- cluster
| | | -- config
| | | -- current-stats-all
| | | -- current-stats-apc
| | | -- help
| | | -- list-apc
| | | -- list-station
| | | -- summary-stats-all
| | | -- summary-stats-apc
| | -- wids
| | | -- help
| | | -- statistics
```

```

|      |      |-- current-config
|      |      |-- lists
|      |      |      |-- ap-whitelist
|      |      |      |-- ap-blacklist
|      |      |      |-- client-whitelist
|      |      |      |-- client-blacklist
|      |      |      |-- friendlylist
|      |      |      |-- oui-list
|      |      |      |-- ssid-whitelist
|      |      |-- rogue
|      |      |      |-- ap
|      |      |      |      |-- current-config
|      |      |      |      |-- list
|      |      |      |      |-- detail
|      |      |      |-- client
|      |      |      |      |-- current-config
|      |      |      |      |-- allow-limit
|      |      |      |      |-- list
|      |      |      |      |-- detail
|      |      |      |-- adhoc
|      |      |      |      |-- list
|      |      |      |      |-- detail
|      |      |      |-- rule
|      |      |      |      |-- friendly
|      |      |      |      |-- malicious
|      |-- wips
|      |      |-- help
|      |      |-- current-config
|      |-- stats-report
|      |      |-- conf
|      |      |-- current-stats
|      |-- stationtracking
|      |      |-- station
|      |      |-- conf
|      |-- preferred-calls
|      |-- vdm
|      |      |-- config
|      |      |-- policy-for-station
|      |-- sds
|      |      |-- radio
|      |      |-- wlan
|      |-- config-files
|      |-- rate-control

```

```
|  |-- tx-power-range
|  |-- os-aware
|  |-- os-aware-all
|  |-- monitor-radio
|  |-- voice
|      |-- station
|          |-- summary
|          |-- detail
|              |-- mac
|              |-- ip
|              |-- user-name
|              |-- tel-no
|      |-- active-call
|          |-- summary
|          |-- detail
|              |-- mac
|              |-- ip
|              |-- user-name
|              |-- tel-no
|      |-- complete-call
|          |-- summary
|          |-- detail
|              |-- mac
|              |-- ip
|              |-- user-name
|              |-- tel-no
|      |-- vqm
|          |-- help
|          |-- current-config
|          |-- summary-stats
|          |-- debug-stats
|          |-- current-stats
|          |-- history-stats
|          |-- alarms
|      |-- statistics
|          |-- ap
|          |-- radio
|          |-- wlan
|          |-- device
|          |-- station
|      |-- event
|      |-- sipmsg-log
|      |-- device
|      |-- debug-stats
|-- bss-if
```

A.3 clear

```

|-- clear
|   |-- air-quality
|   |   |-- count
|   |   |   |-- interferers
|   |-- stats
|   |   |-- station
|   |   |   |-- globally
|   |   |   |-- individually
|   |-- interference
|   |   |-- report
|   |-- vap
|   |-- ip
|   |   |-- igmp
|   |   |   |-- group
|   |   |   |-- interface
|   |   |-- rip
|   |   |-- pim
|   |   |   |-- sparse-mode
|   |   |-- nat
|   |   |-- ospf
|   |-- spanning-tree
|   |   |-- bridge
|   |   |-- interface
|   |-- 80211a
|   |   |-- voip-stats
|   |-- 80211bg
|   |   |-- voip-stats
|   |-- preferred-calls
|   |-- wlan-radio-service
|   |-- vcc-msg-counts
|   |-- cli-session
|   |-- interface
|   |-- arp-cache
|   |-- voice
|   |   |-- vqm
|   |   |   |-- all
|   |   |   |-- history-stats
|   |   |   |-- summary-stats
|   |   |   |-- current-stats
|   |   |   |-- history-file
|   |   |   |-- debug-stats
|   |   |-- active-call

```

```
| | | -- statistics
| | | -- event
| | | -- sipmsg-log
| | | -- debug-stats
| | -- sipalg
| | | -- stats
| | -- pcap-stat
| | -- security
| | | -- radius-server
| | | | -- stats
| | | -- hapd-stats
| | | -- hapd-ap-stats
| | | -- captive-portal
| | | | -- stats
| | -- cluster
| | | -- clear-all
| | | -- clear-apc
| | -- log
| | | -- debug
| | | | -- current
| | | | -- all
| | | | -- detail
| | | | | -- current
| | | | | -- all
| | | -- alarm
| | | -- actalarm
| | | -- alarminfo
| | -- vrrp
```

A.4 debug

```
-- debug
|   |-- processes
|   |   |-- config
|   |-- crash
|   |   |-- erase
|   |-- igmp
|   |-- lacp
|   |-- pim
|   |   |-- sparse-mode
|   |-- fqm
|   |   |-- acl
|   |   |-- function
|   |   |-- message
|   |   |-- qos
|   |-- nsm
|   |   |-- all
|   |   |-- events
|   |   |-- kernel
|   |   |-- mcast
|   |   |-- packet
|   |-- rip
|   |   |-- all
|   |   |-- events
|   |   |-- nsm
|   |   |-- packet
|   |-- mstp
|   |   |-- all
|   |   |-- cli
|   |   |-- packet
|   |   |-- protocol
|   |   |-- timer
|   |-- vrrp
|   |-- ospf
|   |   |-- all
|   |   |-- events
|   |   |-- ifsm
|   |   |-- lsa
|   |   |-- nfsm
|   |   |-- nsm
|   |   |-- packet
|   |   |-- route
|   |-- traceroute
```

```

|  |-- tcpdump
|  |-- irfm
|  |   |-- module
|  |-- rfsgw
|  |-- wids
|  |-- locationtracking
|  |-- cluster
|  |   |-- all
|  |-- guestaccess
|  |   |-- all
|  |-- log
|  |   |-- level
|  |   |-- logsize
|  |   |-- logcount
|  |   |-- on
|  |   |-- off
|  |   |-- detail
|  |   |   |-- level
|  |   |   |-- logsize
|  |   |   |-- logcount
|  |   |   |-- on
|  |   |   |-- off
|  |   |-- mstdout
|  |   |   |-- module
|  |   |   |-- level
|  |   |   |-- on
|  |   |   |-- off
|  |-- dhcp-info
|  |-- capwap
|  |   |-- trace
|  |   |-- log
|  |   |-- status
|  |   |-- ip
|  |   |-- statistics
|  |-- sipalg
|  |   |-- enable
|  |-- apm
|  |   |-- clear
|  |   |-- block-endmsg
|  |   |-- fail-endmsg
|  |   |-- capwap-result-code
|  |   |-- event
|  |   |   |-- AP_UPGRADE_STATUS

```



```
|      |      |-- shared-memory
|      |      |-- clear
|      |      |-- add-ap
|      |      |-- del-ap
|      |      |-- findApIdListWithWlanProfileId
|      |      |-- findWlanIdWithApgIdAndWlanProfileId
|      |      |-- findWlanIdWithApIdAndWlanProfileId
|      |      |-- findWlanProfileIdWithApIdAndWlanId
|      |      |-- findWlanIdSetListWithApgId
|      |      |-- findWlanIdSetListWithAp
|      |      |-- wlan
|      |      |-- reject-probe
|      |      |      |-- rssi
|      |      |      |-- time
```

A.5 file

- |-- file
 - | |-- download
 - | |-- upload
 - | |-- copy
 - | |-- remove
 - | |-- move
 - | |-- ls
 - | |-- pwd
 - | |-- cd
 - | |-- dump
 - | |-- df
 - | |-- verify
 - | |-- version

A.6 Etc

- |-- reboot
- |-- save
 - | |-- local
- |-- factory-reset
- |-- export
- |-- import
- |-- ping
- |-- traceroute
- |-- tcpdump
- |-- telnet
- |-- ssh

ANNEX B. Open Source Announcement (WEC8500/WEC8050)

Some software components of this product incorporate source code covered under the GNU General Public License (GPL), the GNU Lesser General Public License (LGPL) and BSD License etc.

Acknowledgement:

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)

The software included in this product contains copyrighted software that is licensed under the GPL/LGPL. You may obtain the complete Corresponding Source code from us for a period of three years after our last shipment of this product by sending email to: oss.request@samsung.com

If you want to obtain the complete Corresponding Source code in the physical medium such as CD-ROM, the cost of physically performing source distribution may be charged. You may also find a copy of the source at <http://www.samsungnetwork.com/Home/Opensource>

This offer is valid to anyone in receipt of this information.

Below is the list of components covered under GNU General Public License, the GNU Lesser General Public License and BSD License etc.

Open Source Software	License
Apache HTTP Server	Apache License 2.0
lz4mt	BSD License
CyoEncode	BSD License
EventLog Library	BSD License
hostap-ct	BSD License
hostapd	BSD License
Libedit	BSD License

Open Source Software	License
libssh2	BSD License
Net SNMP-net-snmp	BSD License
OpenSSH	BSD License
Pure-FTPd	BSD License
Telnet	BSD License
ISC DHCP	DHCP License
Free Radius	GPL 2.0
Dproxy-Caching DNS Proxy	GPL 2.0
IP Utils	GPL 2.0
IPwatchD	GPL 2.0
NTP-The Network Time Protocol	GPL 2.0
TFTP Server and Client	GPL 2.0
Traceroute for Linux	GPL 2.0
Sys V Init	GPL 2.0
Linux Kernel	GPL 2.0
NetHogs-'net top' per process	GPL 2.0
compcache	GPL 2.0
DUMA library	GPL 2.0
GnuWin32-gzip	GPL 2.0
GNU Core Utils	GPL 2.0
ISC DHCP	ISIC License (BSD-)
FTP Lib Alt	LGPL 2.1
libnl-Netlink Library	LGPL 2.1
OSIP Library	LGPL 2.1
LIBSMI-Main	Libsmi License
libxml	libxml2 License
libxslt	MIT v2 with Ad Clause License
OpenSSL	OpenSSL Combined License
Zlib License	zlib License

Apache License

Version 2.0, January 2004

<http://www.apache.org/licenses/>

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

“License” shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

“Licensor” shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

“Legal Entity” shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, “control” means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50 %) or more of the outstanding shares, or (iii) beneficial ownership of such entity. “You” (or “Your”) shall mean an individual or Legal Entity exercising permissions granted by this License. “Source” form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

“Object” form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

“Work” shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

“Derivative Works” shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

“Contribution” shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner.

For the purposes of this definition, “submitted” means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as “Not a Contribution.”

“Contributor” shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

2. Grant of Copyright License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

3. Grant of Patent License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

4. Redistribution.

You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

- (a) You must give any other recipients of the Work or Derivative Works a copy of this License; and
- (b) You must cause any modified files to carry prominent notices stating that You changed the files; and
- (c) You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and

(d) If the Work includes a “NOTICE” text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and provide additional or different license terms and conditions use, reproduction, or distribution of Your modifications, or any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

5. Submission of Contributions.

Unless You explicitly state otherwise, Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

6. Trademarks.

This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty.

Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an “AS IS” BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

8. Limitation of Liability.

In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability.

While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS**APPENDIX: How to apply the Apache License to your work.**

To apply the Apache License to your work, attach the following boilerplate notice, with the fields enclosed by brackets “[]” replaced with your own identifying information. (Don’t include the brackets!) The text should be enclosed in the appropriate comment syntax for the file format. We also recommend that a file or class name and description of purpose be included on the same “printed page” as the copyright notice for easier identification within third-party archives.

Copyright [yyyy] [name of copyright owner]

Licensed under the Apache License, Version 2.0 (the “License”); you may not use this file except in compliance with the License. You may obtain a copy of the License at

<http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an “AS IS” BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

BSD 2.0 License

Copyright(c) <YEAR>, <OWNER>
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the <ORGANIZATION> nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

DHCP License

Copyright(c) 2004 by Internet Systems Consortium, Inc. ("ISC")

Copyright(c) 1996-2003 by Internet Software Consortium

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED "AS IS" AND ISC DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL ISC BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

Internet Systems Consortium, Inc.

950 Charter Street

Redwood City, CA 94063

<info@isc.org>

<http://www.isc.org/>

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright(c) 1989, 1991 Free Software Foundation, Inc.

51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.)

You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps:

(1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software.

If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents.

We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language.

(Hereinafter, translation is included without limitation in the term "modification".)

Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program).

Whether that is true depends on what the Program does.

- 1) You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
 - b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
 - c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole.

If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:
 - a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

- b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable. If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

- 4) You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 5) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.
- 6) Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

- 7) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License.

If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 8) If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
- 9) The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.
- 10) If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 11) BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 12) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the program's name and a brief idea of what it does.>

Copyright(c) <year> <name of author>

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or(at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright(c) year name of author Gnomovision comes with
ABSOLUTELY NO WARRANTY; for details type 'show w'.
This is free software, and you are welcome to redistribute it under certain conditions; type
'show c' for details.

ISIC License (BSD-)

ISIC is Copyright(c) 1999 Mike Frantzen, Chicago, IL, USA.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

Copyright(c) 1991, 1999 Free Software Foundation, Inc.

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price.

Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code.

If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library.

Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program.

We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License.

This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs. When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs.

These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances. For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow.

Pay close attention to the difference between a "work based on the library" and a "work that uses the library".

The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called “this License”). Each licensee is addressed as “you”.

A “library” means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The “Library”, below, refers to any such software library or work which has been distributed under these terms. A “work based on the Library” means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term “modification”.)

“Source code” for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

- 1) You may copy and distribute verbatim copies of the Library’s complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.
You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) The modified work must itself be a software library.
 - b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
 - c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.) These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works.

But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library. In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices. Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

- 4) You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

- 5) A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a “work that uses the Library”. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a “work that uses the Library” with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a “work that uses the library”.

The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a “work that uses the Library” uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library.

The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

- 6) As an exception to the Sections above, you may also combine or link a “work that uses the Library” with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer’s own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable “work that uses the Library”, as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

- b) Use a suitable shared library mechanism for linking with the Library.
A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy. For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system.

Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

- 7) You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:
 - a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
 - b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.
- 8) You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

- 9) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.
- 10) Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.
- 11) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances. It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.
- 12) If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

- 13) The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.
- 14) If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 15) BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 16) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

one line to give the library’s name and an idea of what it does.

Copyright(c) year name of author

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU Lesser General Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a “copyright disclaimer” for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library ‘Frob’ (a library for tweaking knobs) written by James Random Hacker.

Signature of Ty Coon, 1 April 1990 Ty Coon, President of Vice

That’s all there is to it!

libsmi license

Copyright(c) 1999-2002 Frank Strauss, Technical University of Braunschweig.

This software is copyrighted by Frank Strauss, the Technical University of Braunschweig, and other parties. The following terms apply to all files associated with the software unless explicitly disclaimed in individual files.

The authors hereby grant permission to use, copy, modify, distribute, and license this software and its documentation for any purpose, provided that existing copyright notices are retained in all copies and that this notice is included verbatim in any distributions. No written agreement, license, or royalty fee is required for any of the authorized uses. Modifications to this software may be copyrighted by their authors and need not follow the licensing terms described here, provided that the new terms are clearly indicated on the first page of each file where they apply.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE, ITS DOCUMENTATION, OR ANY DERIVATIVES THEREOF, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. THIS SOFTWARE IS PROVIDED ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

libxml2 License

Except where otherwise noted in the source code (e.g. the files hash.c, list.c and the trio files, which are covered by a similar licence but with different Copyright notices) all the files are:

Copyright(c) 1998-2003 Daniel Veillard. All Rights Reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE DANIEL VEILLARD BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of Daniel Veillard shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from him.

MIT v2 with Ad Clause License

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the names of the authors or their institutions shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from the authors.

LICENSE ISSUES

The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL please contact openssl-core@openssl.org.

OpenSSL License

Copyright(c) 1998-2004 The OpenSSL Project. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)”
- 4) The names “OpenSSL Toolkit” and “OpenSSL Project” must not be used to endorse or promote products derived from this software without prior written permission.
For written permission, please contact openssl-core@openssl.org.
- 5) Products derived from this software may not be called “OpenSSL” nor may “OpenSSL” appear in their names without prior written permission of the OpenSSL Project.
- 6) Redistributions of any form whatsoever must retain the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>)”

THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT “AS IS” AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE OpenSSL PROJECT OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This product includes cryptographic software written by Eric Young (eyay@cryptsoft.com).
This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Original SSLeay License

Copyright(c) 1995-1998 Eric Young (eay@cryptsoft.com)
All rights reserved.

This package is an SSL implementation written by Eric Young (eay@cryptsoft.com).
The implementation was written so as to conform with Netscapes SSL.

This library is free for commercial and non-commercial use as long as the following conditions are adhered to. The following conditions apply to all code found in this distribution, be it the RC4, RSA, lhash, DES, etc., code; not just the SSL code. The SSL documentation included with this distribution is covered by the same copyright terms except that the holder is Tim Hudson (tjh@cryptsoft.com). Copyright remains Eric Young's, and as such any Copyright notices in the code are not to be removed. If this package is used in a product, Eric Young should be given attribution as the author of the parts of the library used.

This can be in the form of a textual message at program startup or in documentation (online or textual) provided with the package.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgement:
"This product includes cryptographic software written by Eric Young (eay@cryptsoft.com)"
The word 'cryptographic' can be left out if the routines from the library being used are not cryptographic related:-).
- 4) If you include any Windows specific code (or a derivative thereof) from the apps directory (application code) you must include an acknowledgement: "This product includes software written by Tim Hudson (tjh@cryptsoft.com)"

THIS SOFTWARE IS PROVIDED BY ERIC YOUNG "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED.

IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The license and distribution terms for any publically available version or derivative of this code cannot be changed. i.e. this code cannot simply be copied and put under another distribution license **[including the GNU Public Licence.]**

The zlib/libpng License

Copyright(c) <year> <copyright holders>

This software is provided 'as-is', without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution.

ANNEX C. Open Source Announcement (WEA302/WEA303/ WEA312/WEA313/WEA403/WEA412)

Some software components of this product incorporate source code covered under the GNU General Public License (GPL), the GNU Lesser General Public License (LGPL) and BSD License etc.

Acknowledgement:

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)

The software included in this product contains copyrighted software that is licensed under the GPL/LGPL. You may obtain the complete Corresponding Source code from us for a period of three years after our last shipment of this product by sending email to: oss.request@samsung.com

If you want to obtain the complete Corresponding Source code in the physical medium such as CD-ROM, the cost of physically performing source distribution may be charged. You may also find a copy of the source at <http://www.samsungnetwork.com/Home/Opensource>

This offer is valid to anyone in receipt of this information.

Below is the list of components covered under GNU General Public License, the GNU Lesser General Public License and BSD License etc.

Open Source Software	License
hostap-ct	BSD License
wpa_supplicant	BSD License
hostapd	BSD License
The tcpdump project	BSD License
hostapd	BSD License

Open Source Software	License
ICS DHCP	BSD License
mini_httpd-small HTTP server	BSD License
netkit-routed	BSD License
WIDE Project	BSD License
The libpcap project	BSD License
net-snmp	BSD License
OpenSSH	BSD License
Radvd	BSD License
ISC DHCP	DHCP License
RedBoot	eCos license version 2.0
Bridge-Utils	GPL 2.0
BusyBox	GPL 2.0
GNU Core Utils	GPL 2.0
Free Radius	GPL 2.0
GNU grep	GPL 2.0
buildroot	GPL 2.0
memtester	GPL 2.0
module-init-tools	GPL 2.0
mtd utils	GPL 2.0
linux net-tools	GPL 2.0
NMAP	GPL 2.0
ntplib	GPL 2.0
procps	GPL 2.0
socat	GPL 2.0
wpa_supplicant	GPL 2.0
Sys k Logd	GPL 2.0
Sys stat	GPL 2.0
Sys V Init	GPL 2.0
GNU Term Cap	GPL 2.0
Util Linux	GPL 2.0
wireless-tools	GPL 2.0
dhcpcd	GPL 2.0
Linux Kernel	GPL 2.0
GNU Wget	GPL 2.0
wput	GPL 2.0
Dnsmasq	GPL 2.0
Ethernet bridge tables-ebtables	GPL 2.0

Open Source Software	License
IGMPproxy	GPL 2.0
inadyn	GPL 2.0
iproute2	GPL 2.0
IPTables	GPL 2.0
NTFS-3G driver	GPL 2.0
NX-ROUTED	GPL 2.0
pppoe	GPL 2.0
TspctPlugin	GPL 2.0
Zebra	GPL 2.0
Netfilter	GPL 2.0
Bash	GPL 2.0
GNU awk	GPL 2.0
inetutils	GPL 2.0
GNU sed	GPL 2.0
Iperf	Iperf License
Atheros-based WiFi Hardware Abstraction Layer	Kaffe ISC License
libnl	LGPL 2.1
LZMA SDK	LGPL 2.1
OpenSSL	OpenSSL Combined License
Vim	Vim Charityware License v 5.3
zlib	zlib License

BSD 2.0 License

Copyright(c) <YEAR>, <OWNER>
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the <ORGANIZATION> nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

DHCP License

Copyright(c) 2004 by Internet Systems Consortium, Inc. (“ISC”)
Copyright(c) 1996-2003 by Internet Software Consortium

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS” AND ISC DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL ISC BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

Internet Systems Consortium, Inc.
950 Charter Street
Redwood City, CA 94063
info@isc.org
<http://www.isc.org/>

Full eCos license

This is the full text of the license as found on files within eCos covered by the eCos license. It should be read in conjunction with the GNU General Public License (GPL) on which it depends.

This file is part of eCos, the Embedded Configurable Operating System. Copyright(c) 1998, 1999, 2000, 2001, 2002, 2003 Red Hat, Inc. Copyright(c) 2002, 2003 John Dallaway
Copyright(c) 2002, 2003 Nick Garnett Copyright(c) 2002, 2003 Jonathan Larmour
Copyright(c) 2002, 2003 Andrew Lunn Copyright(c) 2002, 2003 Gary Thomas
Copyright(c) 2002, 2003 Bart Veer

eCos is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 or (at your option) any later version.

eCos is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with eCos; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA.

As a special exception, if other files instantiate templates or use macros or inline functions from this file, or you compile this file and link it with other works to produce a work based on this file, this file does not by itself cause the resulting work to be covered by the GNU General Public License. However the source code for this file must still be made available in accordance with section (3) of the GNU General Public License.

This exception does not invalidate any other reasons why a work based on this file might be covered by the GNU General Public License.

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright(c) 1989, 1991 Free Software Foundation, Inc.

51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.)

You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps:

(1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software.

If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents.

We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary.

To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The “Program”, below, refers to any such program or work, and a “work based on the Program” means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language.

(Hereinafter, translation is included without limitation in the term “modification”.)

Each licensee is addressed as “you”.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program).

Whether that is true depends on what the Program does.

- 1) You may copy and distribute verbatim copies of the Program’s source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
- a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
 - b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
 - c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole.

If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:
 - a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

- 4) You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 5) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

- 6) Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.
- 7) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License.

If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 8) If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
- 9) The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation.
- If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

- 10) If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 11) BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 12) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

<one line to give the program's name and a brief idea of what it does.>

Copyright(c) <year> <name of author>

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright(c) year name of author Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type 'show w'.

This is free software, and you are welcome to redistribute it under certain conditions; type 'show c' for details.

Iperf License

Copyright(c) 1999-2007, The Board of Trustees of the University of Illinois
All Rights Reserved.

Iperf performance test

Mark Gates

Ajay Tirumala

Jim Ferguson

Jon Dugan

Feng Qin

Kevin Gibbs

John Estabrook

National Laboratory for Applied Network Research

National Center for Supercomputing Applications

University of Illinois at Urbana-Champaign

<http://www.ncsa.uiuc.edu>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software (Iperf) and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimers.

Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimers in the documentation and/or other materials provided with the distribution.

Neither the names of the University of Illinois, NCSA, nor the names of its contributors may be used to endorse or promote products derived from this Software without specific prior written permission. THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE CONTRIBUTORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

Copyright(c) 1991, 1999 Free Software Foundation, Inc.

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price.

Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code.

If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library.

Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License.

This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs. When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the “Lesser” General Public License because it does Less to protect the user’s freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs.

These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances. For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users’ freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow.

Pay close attention to the difference between a “work based on the library” and a “work that uses the library”. The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called “this License”). Each licensee is addressed as “you”.

A “library” means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The “Library”, below, refers to any such software library or work which has been distributed under these terms. A “work based on the Library” means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term “modification”.)

“Source code” for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

- 1) You may copy and distribute verbatim copies of the Library’s complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

- 2) You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
- a) The modified work must itself be a software library.
 - b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
 - c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.) These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works.

But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library. In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices. Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy. This option is useful when you wish to copy part of the code of the Library into a program that is not a library.
- 4) You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.
- If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

- 5) A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a “work that uses the Library”. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a “work that uses the Library” with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a “work that uses the library”.

The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a “work that uses the Library” uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library.

The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

- 6) As an exception to the Sections above, you may also combine or link a “work that uses the Library” with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer’s own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable “work that uses the Library”, as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy. For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

- 7) You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:
 - a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
 - b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.
- 8) You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

- 9) You are not required to accept this License, since you have not signed it.
However, nothing else grants you permission to modify or distribute the Library or its derivative works.
These actions are prohibited by law if you do not accept this License.
Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.
- 10) Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.
- 11) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all.
For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.
It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.
- 12) If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
- 13) The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation.
If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

- 14) If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 15) BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 16) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

one line to give the library’s name and an idea of what it does.

Copyright(c) year name of author

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU Lesser General Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a “copyright disclaimer” for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library ‘Frob’ (a library for tweaking knobs) written by James Random Hacker.

Signature of Ty Coon, 1 April 1990 Ty Coon, President of Vice

That’s all there is to it!

LICENSE ISSUES

The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL please contact openssl-core@openssl.org.

OpenSSL License

Copyright(c) 1998-2004 The OpenSSL Project. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)”
- 4) The names “OpenSSL Toolkit” and “OpenSSL Project” must not be used to endorse or promote products derived from this software without prior written permission.
For written permission, please contact openssl-core@openssl.org.
- 5) Products derived from this software may not be called “OpenSSL” nor may “OpenSSL” appear in their names without prior written permission of the OpenSSL Project.
- 6) Redistributions of any form whatsoever must retain the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>)”

THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT “AS IS” AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE OpenSSL PROJECT OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This product includes cryptographic software written by Eric Young (ey@cryptsoft.com).
This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Original SSLeay License

Copyright(c) 1995-1998 Eric Young (eay@cryptsoft.com)
All rights reserved.

This package is an SSL implementation written by Eric Young (eay@cryptsoft.com).
The implementation was written so as to conform with Netscapes SSL.

This library is free for commercial and non-commercial use as long as the following conditions are adhered to. The following conditions apply to all code found in this distribution, be it the RC4, RSA, lhash, DES, etc., code; not just the SSL code. The SSL documentation included with this distribution is covered by the same copyright terms except that the holder is Tim Hudson (tjh@cryptsoft.com). Copyright remains Eric Young's, and as such any Copyright notices in the code are not to be removed. If this package is used in a product, Eric Young should be given attribution as the author of the parts of the library used.

This can be in the form of a textual message at program startup or in documentation (online or textual) provided with the package.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgement:
"This product includes cryptographic software written by Eric Young (eay@cryptsoft.com)"
The word 'cryptographic' can be left out if the routines from the library being used are not cryptographic related:-).
- 4) If you include any Windows specific code (or a derivative thereof) from the apps directory (application code) you must include an acknowledgement: "This product includes software written by Tim Hudson (tjh@cryptsoft.com)"

THIS SOFTWARE IS PROVIDED BY ERIC YOUNG "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS;

OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The license and distribution terms for any publically available version or derivative of this code cannot be changed. i.e. this code cannot simply be copied and put under another distribution license **[including the GNU Public Licence.]**

VIM LICENSE

- 1) There are no restrictions on distributing unmodified copies of Vim except that they must include this license text. You can also distribute unmodified parts of Vim, likewise unrestricted except that they must include this license text. You are also allowed to include executables that you made from the unmodified Vim sources, plus your own usage examples and Vim scripts.
- 2) It is allowed to distribute a modified (or extended) version of Vim, including executables and/or source code, when the following four conditions are met:
 - a) This license text must be included unmodified.
 - b) The modified Vim must be distributed in one of the following five ways:
 - i) If you make changes to Vim yourself, you must clearly describe in the distribution how to contact you. When the maintainer asks you (in any way) for a copy of the modified Vim you distributed, you must make your changes, including source code, available to the maintainer without fee. The maintainer reserves the right to include your changes in the official version of Vim. What the maintainer will do with your changes and under what license they will be distributed is negotiable. If there has been no negotiation then this license, or a later version, also applies to your changes. The current maintainer is Bram Moolenaar {Bram@vim.org}. If this changes it will be announced in appropriate places (most likely vim.sf.net, www.vim.org and/or comp.editors). When it is completely impossible to contact the maintainer, the obligation to send him your changes ceases. Once the maintainer has confirmed that he has received your changes they will not have to be sent again.
 - ii) If you have received a modified Vim that was distributed as mentioned under a) you are allowed to further distribute it unmodified, as mentioned at I). If you make additional changes the text under a) applies to those changes.
 - iii) Provide all the changes, including source code, with every copy of the modified Vim you distribute. This may be done in the form of a context diff. You can choose what license to use for new code you add. The changes and their license must not restrict others from making their own changes to the official version of Vim.
When you have a modified Vim which includes changes as mentioned under c), you can distribute it without the source code for the changes if the following three conditions are met:

The license that applies to the changes permits you to distribute the changes to the Vim maintainer without fee or restriction, and permits the Vim maintainer to include the changes in the official version of Vim without fee or restriction.

You keep the changes for at least three years after last distributing the corresponding modified Vim. When the maintainer or someone who you distributed the modified Vim to asks you (in any way) for the changes within this period, you must make them available to him.

You clearly describe in the distribution how to contact you. This contact information must remain valid for at least three years after last distributing the corresponding modified Vim, or as long as possible.

- iv) When the GNU General Public License (GPL) applies to the changes, you can distribute the modified Vim under the GNU GPL version 2 or any later version.
- c) A message must be added, at least in the output of the “:version” command and in the intro screen, such that the user of the modified Vim is able to see that it was modified. When distributing as mentioned under 2) e) adding the message is only required for as far as this does not conflict with the license used for the changes.
- d) The contact information as required under 2) a) and 2) d) must not be removed or changed, except that the person himself can make corrections.
- 3) If you distribute a modified version of Vim, you are encouraged to use the Vim license for your changes and make them available to the maintainer, including the source code. The preferred way to do this is by e-mail or by uploading the files to a server and e-mailing the URL. If the number of changes is small (e.g. a modified Makefile) e-mailing a context diff will do. The e-mail address to be used is {maintainer@vim.org}
- 4) It is not allowed to remove this license from the distribution of the Vim sources, parts of it or from a modified version. You may use this license for previous Vim releases instead of the license that they came with, at your option.

The zlib/libpng License

Copyright(c) <year> <copyright holders>

This software is provided ‘as-is’, without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution.

RF Radiation Exposure Statement:

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 50 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

ABBREVIATION

A

ACL	Access Control List
AES	Advanced Encryption Standard
ALG	Application Layer Gateway
AP	Access Point
APC	Access Point Controller

B

BPDU	Bridge Protocol Data Unit
------	---------------------------

C

CAC	Call Admission Control
CAPWAP	Control And Provisioning Wireless Access Point
CCM	Counter mode encryption with CBC-MAC
CCMP	Counter mode encryption with CBC-MAC Protocol
CCTV	Closed Circuit Television
CDR	Crash Detect and Report
CHDC	Coverage Hole Detection and Control
CLI	Command Line Interface
CSMA/CD	Carrier Sense Multiple Access/Collision Detect
CVO	Controlled Voice Optimization

D

DCS	Dynamic Channel Selection
DECT	Digital Enhanced Cordless Telecommunications
DFS	Dynamic Frequency Selection
DHCP	Dynamic Host Configuration Protocol
DNAT	Destination NAT
DNS	Domain Naming Service
DPC	Dynamic Power control
DSCP	Differentiated Services Code Point
DTIM	Delivery Traffic Indication Message
DTLS	Datagram Transmission Layer Security

E

EAP	Extensible Authentication Protocol
EAPOL	EAP over LANs
EDCA	Enhanced Distributed Channel Access

F

FFT	Fast Fourier Transform
FIFO	First-In-First-Out
FMC	Fixed Mobile Convergence
FTP	File Transfer Protocol

G

GARP	Gratuitous Address Resolution Protocol
GbE	Giga Bit Ethernet
GI	Guard Interval

H

HO	Handover
----	----------

I

IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPWATCHD	IP WATCH Daemon
IV	Initial Vector

L

LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LSA	Link State Advertisement

M

MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Management Information Base
MIMO	Multiple Input Multiple Output
MSTP	Multiple Spanning-Tree Protocol
MTU	Maximum Transmission Unit

N

NAT	Network Address Translation
NMS	Network Management System
NSSA	Not So Stubby Areas
NTP	Network Time Protocol

O

OKC	Opportunistic Key Caching
OSPF	Open Shortest Path First
OUI	Organizationally Unique Identifier

P

PHY	Physical layer
PIM-SM	Protocol Independent Multicast-Sparse Mode
PoE	Power over Ethernet
PMK	Pairwise Master Key
PSK	Pre-Shared Key

Q

QoS	Quality of Service
-----	--------------------

R

RADIUS	Remote Authentication Dial-In User Service
RF	Radio Frequency
RPM	Revolution Per Minute
RRM	Radio Resource Management
RSSI	Received Signal Strength Indication
RSTP	Rapid Spanning-Tree Protocol
RTP	Real-time Transport Protocol

S

SDS	Samsung Downlink Scheduler
SIP	Session Initiation Protocol
SNAT	Source NAT
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SSH	Secure Shell
SSID	Service Set Identifier
STP	Signaling Transfer Point

T

TBTT	Target Beacon Transmission Times
TKIP	Temporal Key Integrity Protocol

U

USB	Universal Serial Bus
UTC	Coordinated Universal Time
UTP	Unshielded Twisted Pair

V

VAP	Virtual Access Point
VATS	Voice-Aware Traffic Scheduling
VLAN	Virtual Local Area Network
VoIP	Voice over IP
VPN	Virtual Private Network
VQM	Voice Quality Monitoring
VRRP	Virtual Router Redundancy Protocol

W

WAN	Wide Area Network
WDS	Wireless Distribution Service
WEM	Wireless Enterprise WLAN Manager
WEP	Wired Equivalent Privacy
Wi-Fi	Wireless Fidelity
WIDS	Wireless Intrusion Detection System
WIPS	Wireless Intrusion Prevention System
WLAN	Wireless Local Area Network
WMM	WiFi Multimedia
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access Version 2

WEC8500/WEC8050 (APC) Operation Manual

©2013~2014 Samsung Electronics Co., Ltd.

All rights reserved.

Information in this manual is proprietary to SAMSUNG Electronics Co., Ltd.

No information contained here may be copied, translated, transcribed or duplicated by any form without the prior written consent of SAMSUNG.

Information in this manual is subject to change without notice.

