

# Troubleshooting Voice with WCS

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## Problem Definition

Users deploying VoWLAN in their network need to make their way through various issues. The top two challenges are to make sure that there is enough coverage and that the controllers are configured right.

## Use Cases

The tool will be able to troubleshoot the following use cases.

- Poor call quality
  - Red/Yellow QoS – TSM Report
  - High Channel Utilization
  - High Roaming delay – TSM Report
  - Frequent Tx power changes
  - Low AP density - VRT
  - Channel change report/RRM changes
  - Roaming history - location - integration /12 roam history
  - RSSI report per client - distinguish
- Call drops
  - Packet loss on TSM
  - Frequent channel changes
  - Low AP density - VRT
  - Coverage Hole Alarms/Precoverage Events
- Not able to place a call
  - Basic 802.11 issues – Client Troubleshooting
  - Low AP density - VRT
- One-way audio
  - High Packet loss and High latency – TSM Report
  - No TSM records indicate incorrect UP marking
- Echo

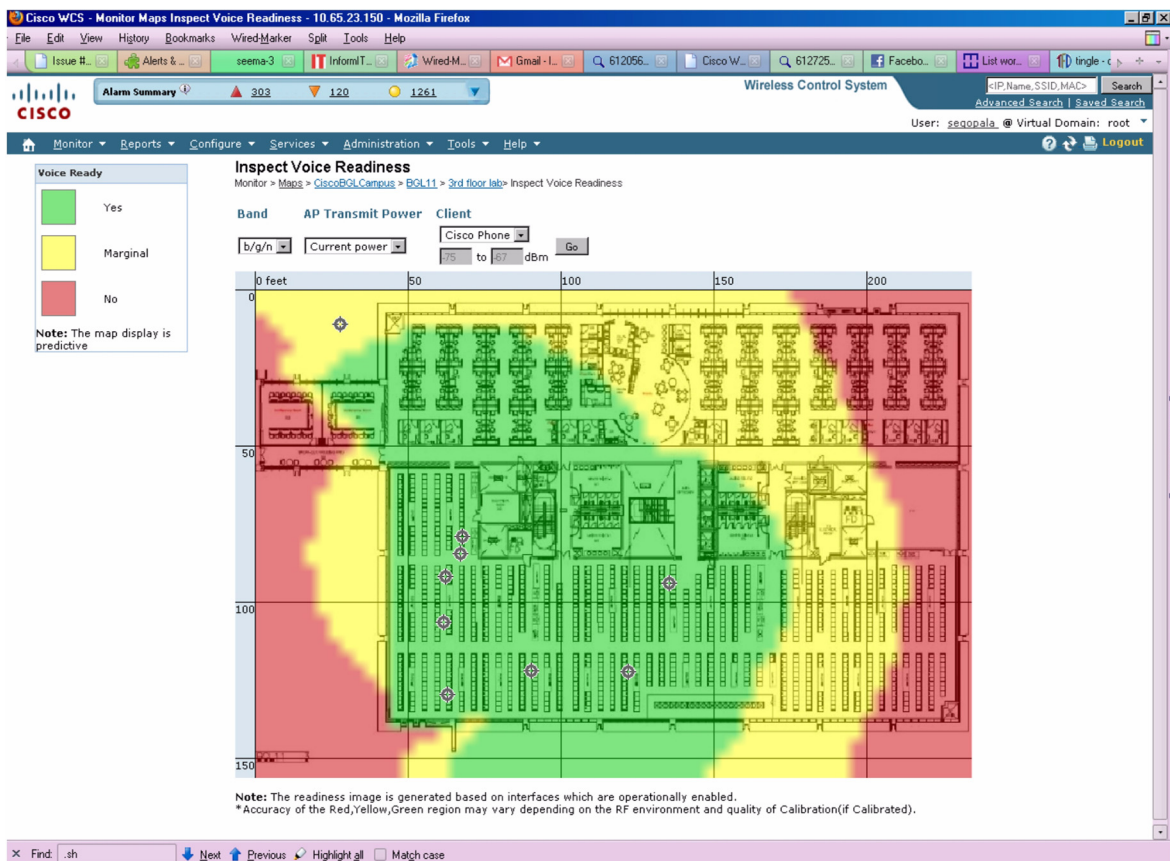
## Problem Definition

- High Packet Latency – TSM Report

Reference Attachment – Network-wide issue

- Run Voice Audit and attach report
- Voice Readiness Tool snapshot for the affected floor(s)
- RRM Dashboard snapshot
- Alarm/Event Counts
  - Coverage Hole Alarm
  - Precoverage Hole Event
- Reports per Controller/Floor Map
  - Historical TSM
  - Tx Power / Channel
  - Channel Utilization
- RF Issues
- Customers using WLAN for data, turned on voice, AP density not sufficient

Figure 7-1 VoWLAN Readiness Tool



# RRM Dashboard

Figure 7-2 Real Time - TSM Report

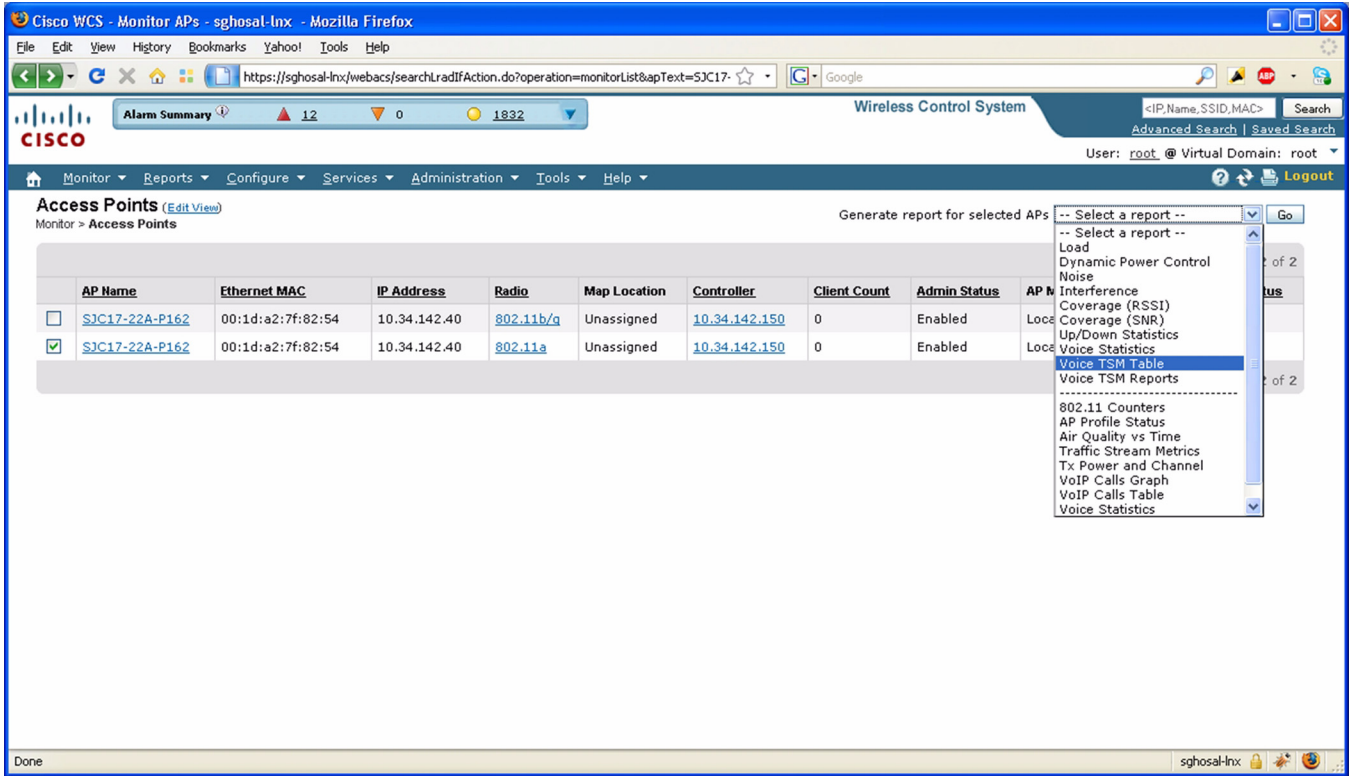


Figure 7-3 Client TSM Report

The screenshot displays the Cisco WCS Reports interface in a Mozilla Firefox browser window. The page title is "Client Traffic Stream Metrics : New". The breadcrumb navigation is "Reports > Report Launch Pad > Client > Client Traffic Stream Metrics > Client Traffic Stream Metrics Report Details".

**Settings:**

- Report Title: (empty text box)
- Report By: SSID (dropdown menu)
- Report Criteria: All SSIDs (list box)
- Reporting Period: Last 1 Hour (radio button selected)

**Schedule:**

- Scheduling:  Enable
- Export Format: CSV (dropdown menu)
- Destination: File (selected), /scratch/wcs/H/dist/wcs/linux/webnms/ftp-server/root/reports (text box)
- Start Date/Time: 03/21/2009 14:55 (calendar and time pickers)
- Recurrence:  No Recurrence,  Hourly,  Daily,  Weekly

**Customize Report:** Click here to customize report content based on your preference. [Customize](#)

**Report Run Result:**

**Client Traffic Stream Metrics** Wireless Control System

Generated: Sat Mar 21 14:59:13 PDT 2009  
 Report By: Client Mac Address  
 Client Mac Address: 00:1c:58:cc:ec:7c  
 Reporting Period: 3/19/09 2:59 PM to 3/21/09 2:59 PM

**Client Traffic Stream Metrics**

Time	Client MAC	OOS	AP Name	Radio Type	%PLR (Downlink)	%PLR (Uplink)
3/20/09 11:36 AM	00:1c:58:cc:ec:7c	Degraded	SJC17-12A-P083	802.11a	6.67	0.00
3/20/09 11:37 AM	00:1c:58:cc:ec:7c	Normal	SJC17-12A-P083	802.11a	0.00	0.00
3/20/09 12:27 PM	00:1c:58:cc:ec:7c	Degraded	SJC17-12A-P083	802.11a	1.69	0.00
3/20/09 12:29 PM	00:1c:58:cc:ec:7c	Normal	SJC17-12A-P083	802.11a	0.00	0.00

The bottom of the browser window shows the status bar with "Done" and the user "sghosal-lnx".

Figure 7-4 AP TSM Report

The screenshot displays the Cisco WCS interface for configuring and running a Traffic Stream Metrics (TSM) report. The top section shows the configuration form, and the bottom section shows the report results.

**Configuration Form:**

- Settings:** Report Title (empty), Report By (AP By Controller), Report Criteria (All Controllers > All Access Points), Protocol (802.11a/n checked, 802.11b/g/n unchecked), Reporting Period (Last 1 Hour).
- Schedule:** Enable (unchecked), Export Format (CSV), Destination (File: /scratch/wcs/H/dist/wcs/linux/webnms/Rp-server/root/reports/TrafficStreamMetrics), Start Date/Time (03/21/2009 15:05), Recurrence (No Recurrence).
- Customize Report:** Click here to customize report content based on your preference.

**Report Run Result:**

**Traffic Stream Metrics**  
 Generated: Sat Mar 21 15:05:49 PDT 2009  
 Report By: AP By Controller  
 Protocol: 802.11a/n  
 Reporting Period: 3/19/09 3:05 PM to 3/21/09 3:05 PM

Time	Client MAC	AP Name	Radio Type	Avg Queuing Delay (Downlink)	Avg Queuing Delay (Uplink)	QoS	% Packet with more than 20 ms delay (Downlink)	% Packet with more than 20 ms delay (Uplink)	% Packet with more than 40 ms delay (Downlink)	% Packet with more than 40 ms delay (Uplink)	Packet Loss Ratio (Downlink)	Packet Loss Ratio (Uplink)	Roaming Count	Roaming Delay
3/20/09 11:35 AM	00:1c:58:cc:ec:7c	S3C17-12A-P083	802.11a	5.00	1.00	Degraded	0.46	0.85	0.00	0.00	6.67	0.00	0	0
3/20/09 11:56 AM	00:1c:58:cc:ec:7c	S3C17-12A-P083	802.11a	5.00	1.00	Degraded	0.46	0.85	0.00	0.00	6.67	0.00	0	0
3/20/09 11:37 AM	00:1c:58:cc:ec:7c	S3C17-12A-P083	802.11a	0.00	0.00	Normal	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3/20/09 12:27 PM	00:1c:58:cc:ec:7c	S3C17-12A-P083	802.11a	5.00	1.00	Degraded	9.42	0.00	0.00	0.00	1.69	0.00	1	730
3/20/09 12:29 PM	00:1c:58:cc:ec:7c	S3C17-12A-P083	802.11a	0.00	0.00	Normal	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3/19/09 5:18 PM	00:1c:58:cd:3d:2c	S3C17-12A-P084	802.11a	0.00	0.00	Fair	0.00	0.13	0.00	0.00	2.19	0.00	0	0

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Figure 7-5 Tx Power / Channel Report

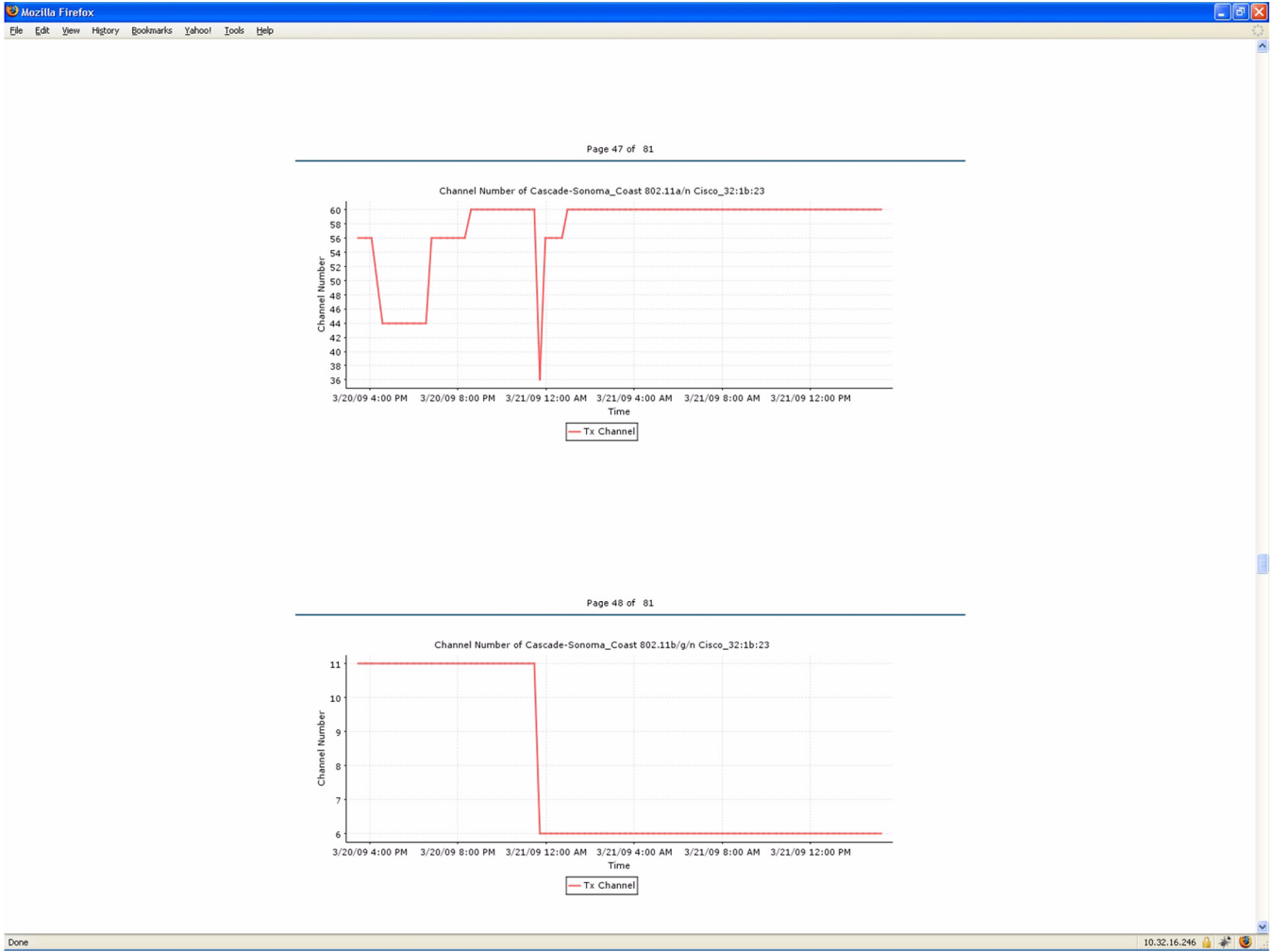


Figure 7-6 Channel Utilization Report

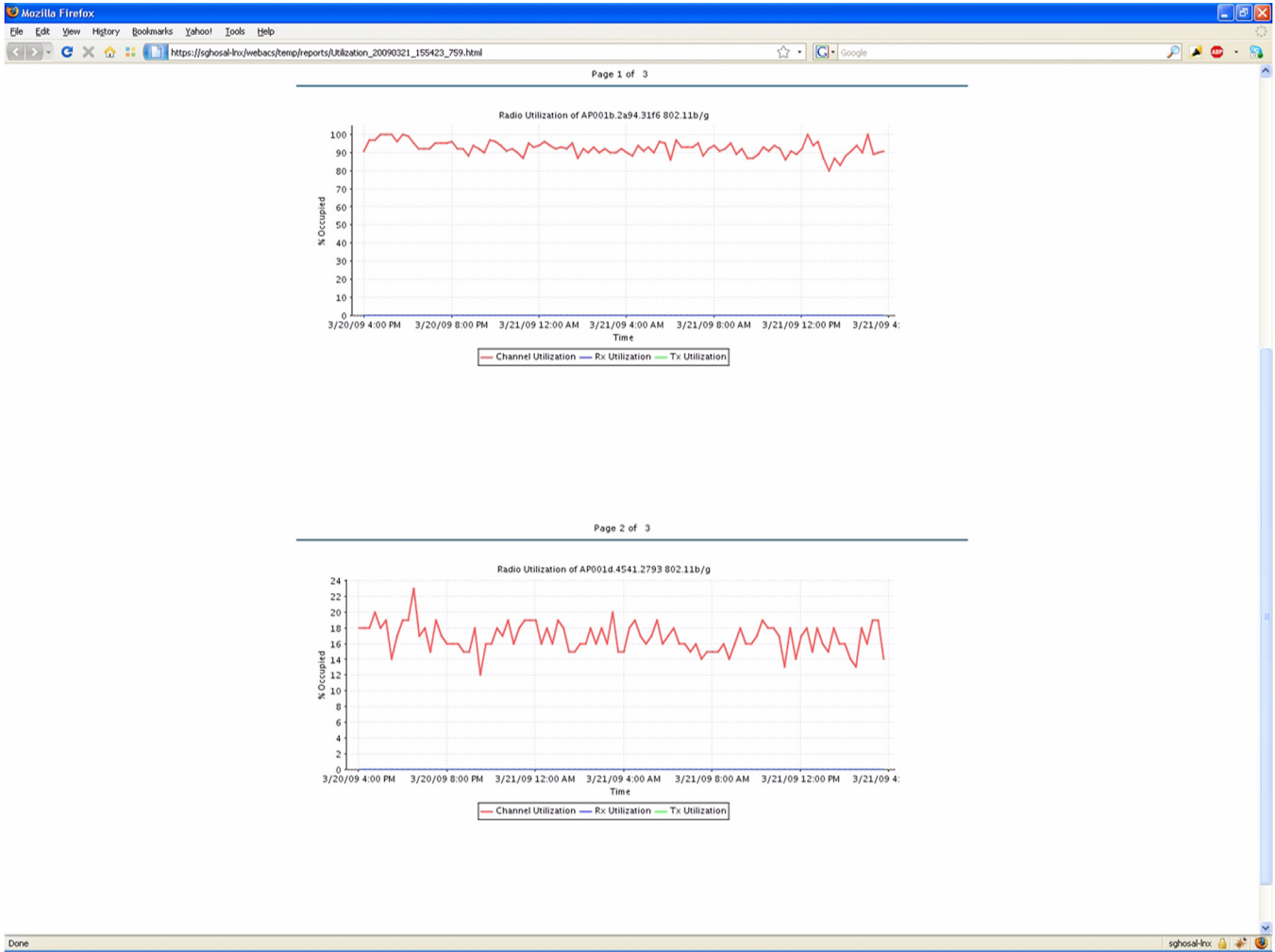


Figure 7-7 Coverage Hole Alarm / PreCoverage Event

The screenshot shows the Cisco WCS Event Details page for a Coverage Hole Warning. The page is titled "Coverage Hole Warning Details for Client:00:16:6f:8e:9b:32". The general information section includes the following details:

- Client MAC Address: 00:16:6f:8e:9b:32
- AP MAC Address: 00:1f:26:28:27:c0
- AP Name: wnbu-bgl11-41a-iap-ap8
- Radio Type: 802.11 b/g/n
- Power Level: 1
- Client Type: 2
- Wlan Coverage Hole Status: Enabled
- WLAN: alpha
- Category: Coverage Hole
- Created: March 19, 2009 8:20:40 PM PDT
- Generated By: Controller
- Device IP Address: [Redacted]
- Severity: Info

The Message section contains the following text:

Pre-Coverage Hole reported by '00:16:6f:8e:9b:32' was found on Controller '10.65.23.36' near 'wnbu-bgl11-41a-iap-ap8' with MacAddress '00:1f:26:28:27:c0'.

The Neighbor AP's section contains the following table:

MAC Address	RSSI	Radio Type
00:1f:26:28:27:50	-67	802.11 b/g/n
00:1f:26:28:27:c0	-69	802.11 b/g/n
00:1e:f7:74:f4:b0	-77	802.11 b/g/n
00:1f:26:28:27:10	-78	802.11 b/g/n



Figure 7-8 Air Quality vs Time

Report Run Result

### Air Quality vs Time Report Details

Generated: Sat Oct 31 01:09:35 IST 2009

Report By: Controller  
 Controller: All Controllers  
 Protocol: 802.11a/n  
 Reporting Period: Last 1 hour  
 Show: Upto 5 records

#### Busiest Clients

Client MAC Address	Client IP Address	Username	Protocol	Throughput	Utilization (%)
00:21:5c:85:bc:01	10.65.18.227	mvv	802.11n_5GHz	3.0Kbps	0.00
00:16:46:6b:38:16	10.65.19.87	vinsaini	802.11a	2.0Kbps	0.00
00:1d:70:97:bb:f4	10.65.19.82	vinsaini	802.11a	2.0Kbps	0.00
00:40:96:b0:64:78	10.65.18.217	CISCO\varmek	802.11a	2.0Kbps	0.00
00:21:a0:24:6a:52	10.65.19.93	supulicc	802.11a	<0.1Kbps	0.00

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Find: .sh    Next    Previous    Highlight all    Match case

Done

Figure 7-9 VoIP Calls Graph

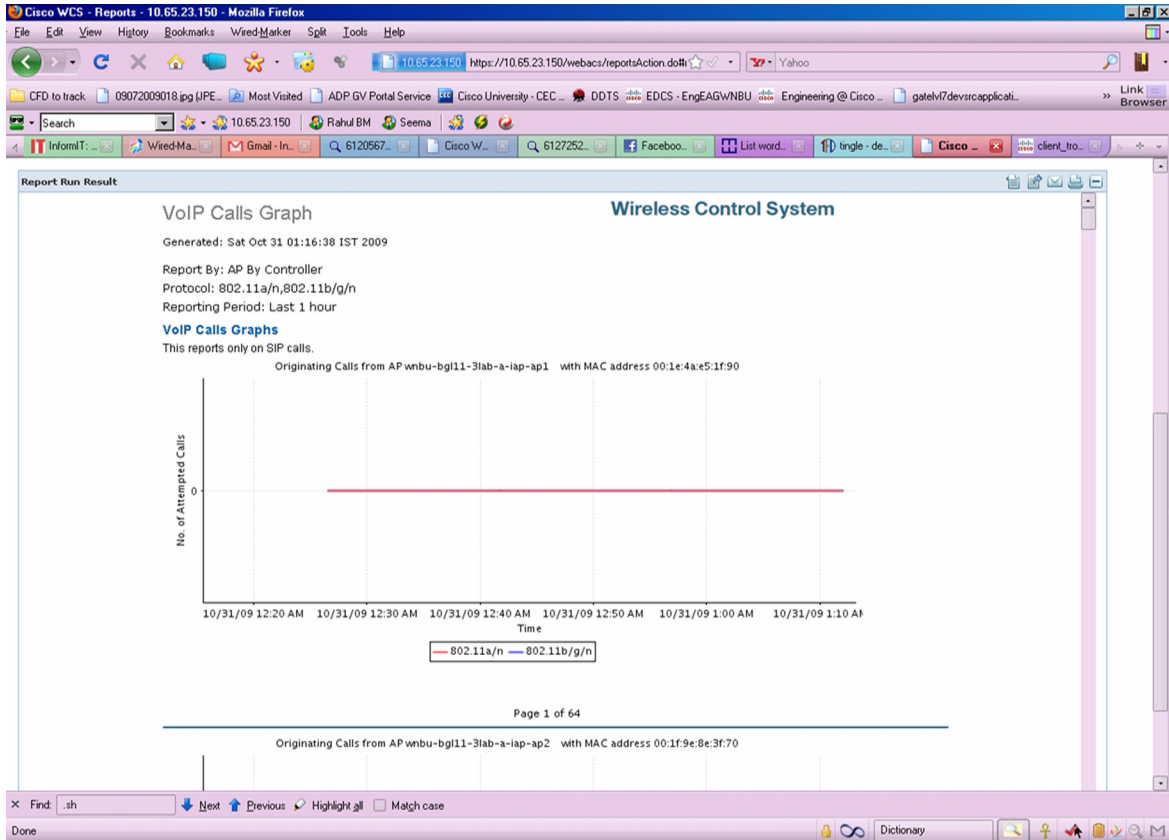


Figure 7-10 VoIP Calls Table

The screenshot shows a web browser window displaying a report from the Cisco Wireless Control System (WCS). The report is titled "VoIP Calls Table" and was generated on Saturday, October 31, 2009, at 01:26:19 GMT+05:30. The report is generated by AP By Controller for the protocol 802.11a/n,802.11b/g/n, covering the last 1 hour. The report notes that it only reports on SIP calls.

AP Name	802.11a/n Count	802.11a/n Duration (sec)	802.11b/g/n Count	802.11b/g/n Duration (sec)
3-1130-9A:80	0	0	0	0
AP0024.9752.7316	0	0	0	0
AP0015.63e4.f86d	0	0	0	0
wmbu	0	0	0	0
2	0	0	0	0
1510-RAP	0	0	0	0
AP0024.5036.0b00	0	0	0	0
AP0024.5036.4c00	0	0	0	0
AP0024.5036.3f00	0	0	0	0
ap:71:60:b0	0	0	0	0

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AP Name	802.11a/n Count	802.11a/n Duration (sec)	802.11b/g/n Count	802.11b/g/n Duration (sec)
AP0024.5036.7200	0	0	0	0

The browser window also shows a search bar with ".sh" entered and a "Done" status at the bottom.

Figure 7-11 Voice Statistics

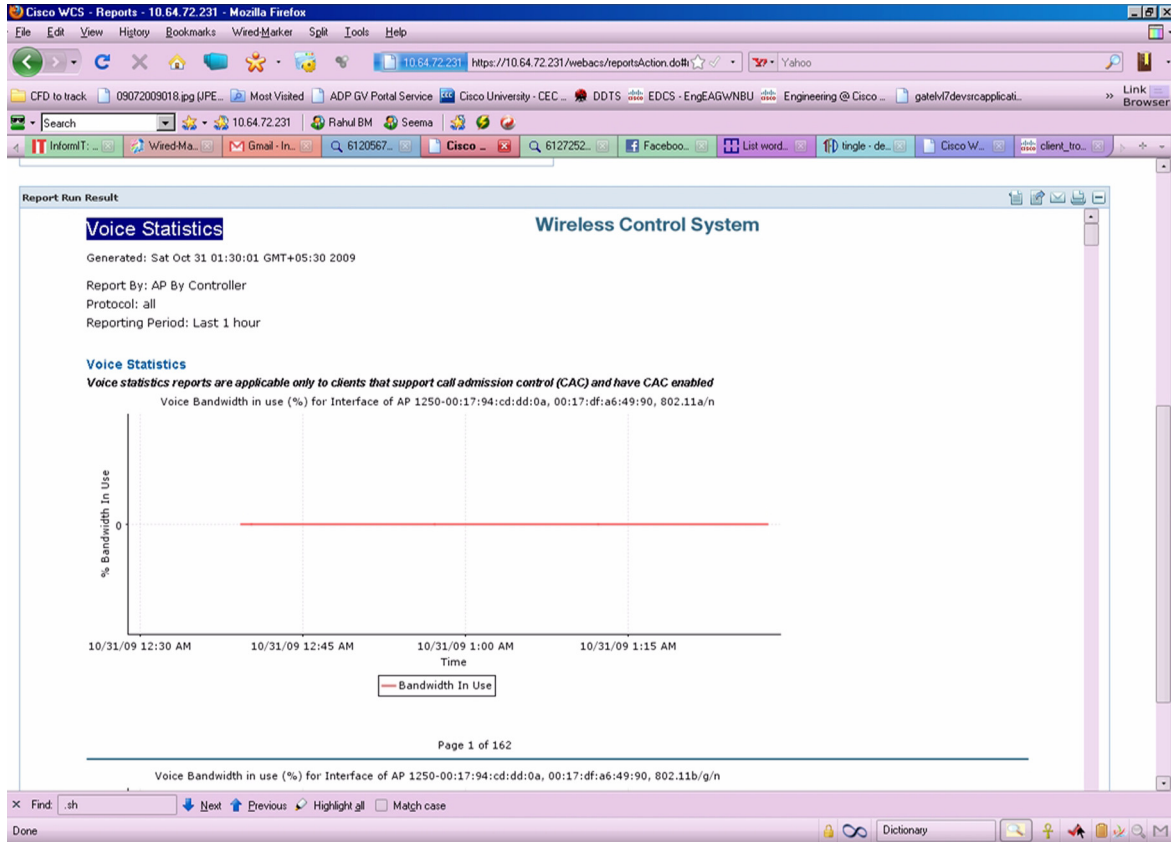


Figure 7-12 Voice Traffic Stream Metrics Table

The screenshot shows the Cisco WCS interface with the 'Voice Traffic Stream Metrics Table' displayed. The table contains the following data:

Time	Client MAC	QOS	%PLR (DownLink)	%PLR (Uplink)	Avg Queuing Delay (ms) (Downlink)	Avg Queuing Delay (ms) (Uplink)	%Packets > 40ms Queuing Delay (Downlink)	%Packets 20ms-40ms C
Tue Oct 27 17:21:47 IST 2009	00:21:6a:6c:da:e8	Degraded	100	0	0	0	0	0
Wed Oct 28 14:29:08 IST 2009	00:21:6a:6c:da:e8	Degraded	100	0	0	0	0	0
Wed Oct 28 17:23:07 IST 2009	00:1d:e0:34:b0:af	Degraded	100	0	0	0	0	0
Thu Oct 29 14:40:55 IST 2009	00:21:6a:6c:da:e8	Degraded	100	0	0	0	0	0
Thu Oct 29 15:09:25 IST 2009	00:21:6a:6c:da:e8	Degraded	100	0	0	0	0	0
Thu Oct 29 18:36:24 IST 2009	00:18:de:b8:92:75	Degraded	100	0	0	0	0	0
Fri Oct 30 13:37:46 IST 2009	00:21:6a:1d:1f:a2	Degraded	100	0	0	0	0	0

Figure 7-13 Voice TSM Reports (1 of 3)

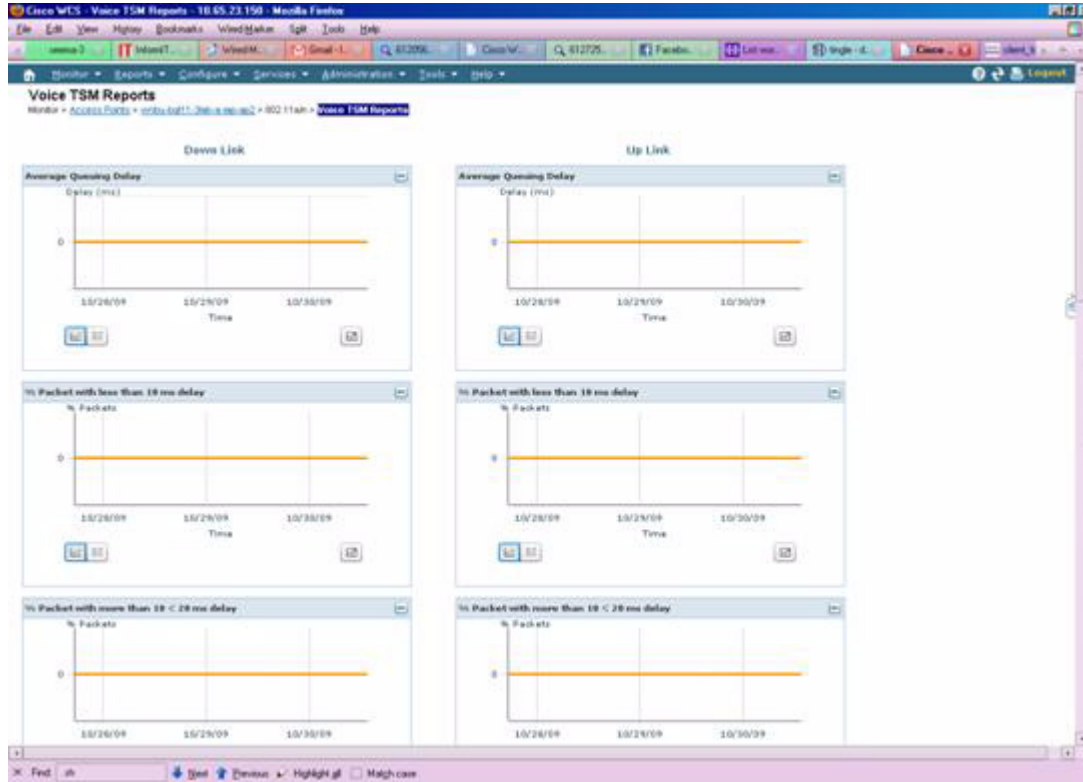


Figure 7-14 Voice TSM Reports (2 of 3)

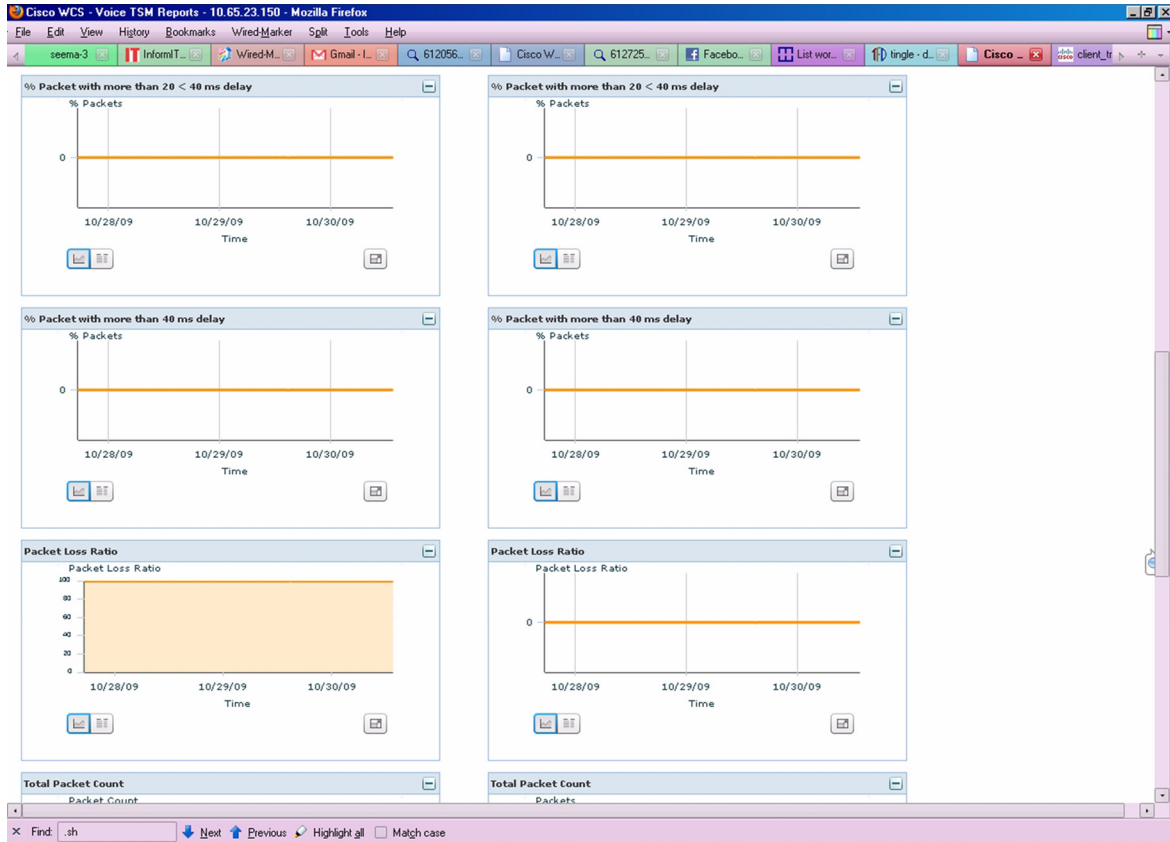
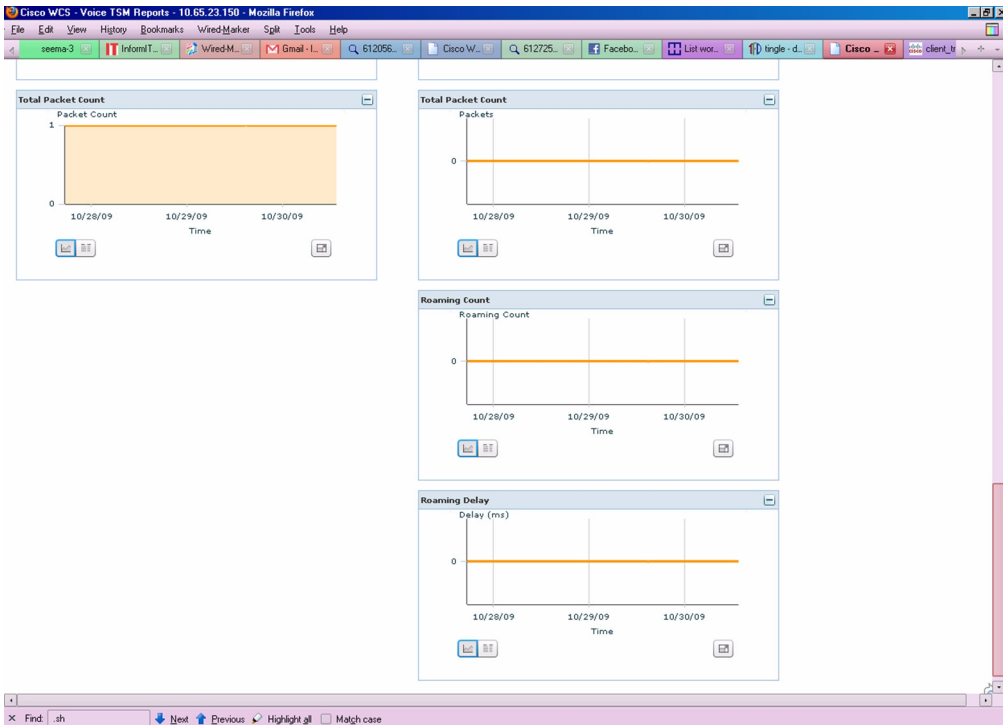


Figure 7-15 Voice TSM Reports (3 of 3)



## Configuration Issues

- Customers need to spend enormous time to configure controllers as per the 792xG Series wireless IP phone deployment guide
- Thick Deployment guide for 792xG Series wireless IP phone
- Difficult to check which configurations are altered, over a period of time

## Run Voice Audit and Attach Report

- The WCS does Online Auditing, in which device attributes are fetched from the network with Audit is run.
- WCS will ship with canned rules called VoWLAN Audit Rules (VRs), each of which will represent an individual configuration check. VR can be individually turned on and off by the user. Also some of the VRs may require user data as an input. Example of a VR: “Enable QBSS.”

## VoWLAN Audit

- Validates the controller configuration against deployment guide recommendations or preconfigured criteria.
- Default configuration check is based on the *792xG Deployment Guide*.
- Allows customization of the configuration validation for other client types.



- Some configuration validations are version dependent.
- Can be initiated on demand.

Figure 7-16 VoWLAN Audit Tool

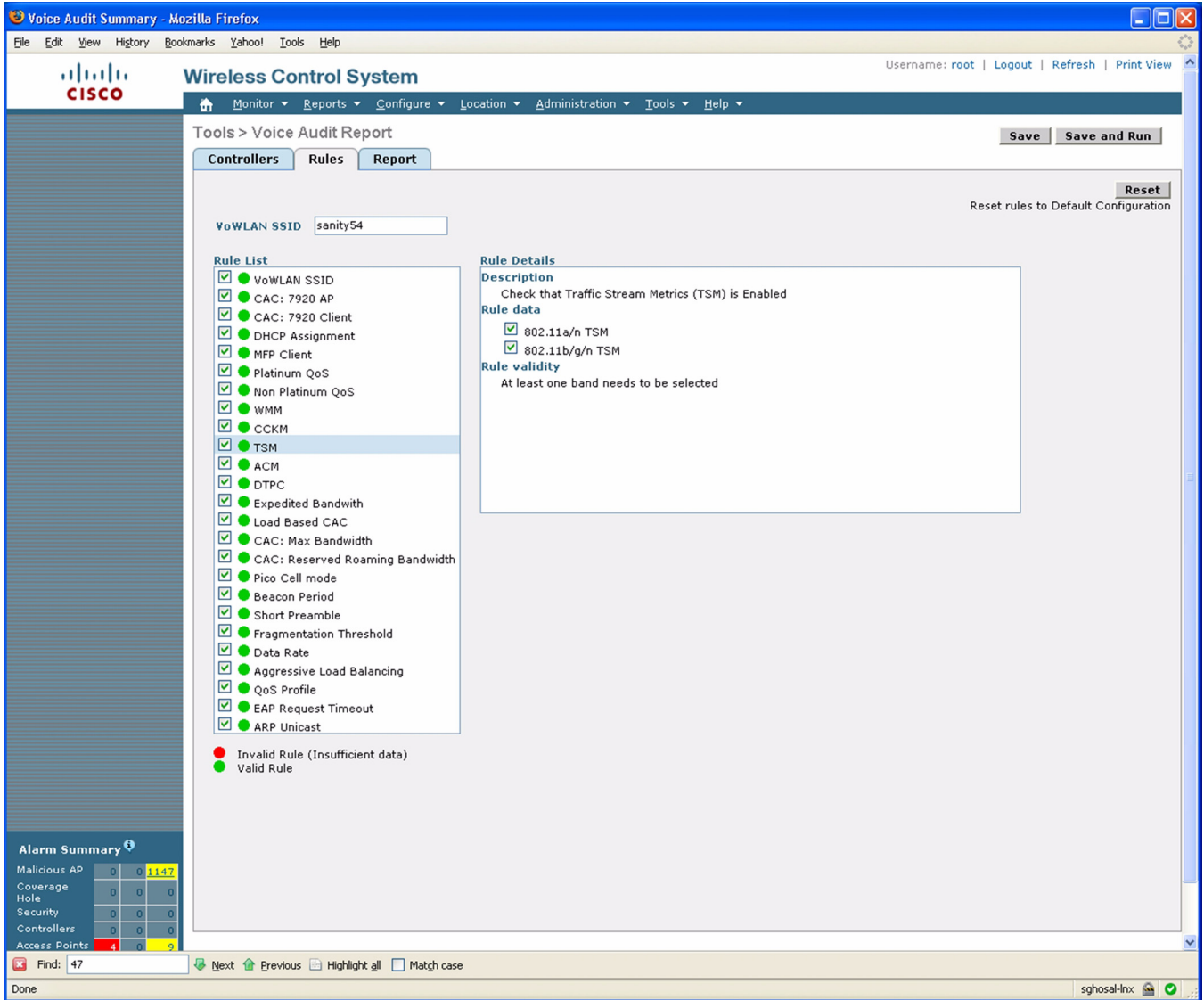


Figure 7-17 VoWLAN Audit Reporting

The screenshot shows the Cisco WCS Voice Audit Summary report. The report is titled "Voice Audit Summary" and shows the following data:

Audit Status	Start Time	End Time	#Total Devices	#Completed Devices	#Rules
Complete	10/27/09 2:45 PM	10/27/09 2:45 PM	3	3	22

IP Address	Rule	Result	Details	Time
10.65.23.36	ACM	Violation	ACM not Enabled for 11a/n interface for Video, ACM not Enabled for 11b/g/n interface for Video	10/27/09 2:45 PM
10.65.23.36	Data Rate	Violation	Data rate configuration of the device did not match with the Rule definition. The violated parameters are: 6Mbps 11b/g, 9Mbps 11b/g, 11Mbps 11b/g, 12Mbps 11b/g, 24Mbps 11b/g	10/27/09 2:45 PM
10.65.23.36	Aggressive Load Balancing	Violation	Global Aggressive Load Balancing not Disabled	10/27/09 2:45 PM
10.65.23.36	EAP Request Timeout	Violation	EAP Request Timeout configured in device = 31 did not match with the Rule data = 30	10/27/09 2:45 PM
10.65.23.39	ACM	Violation	ACM not Enabled for 11a/n interface for Video, ACM not Enabled for 11b/g/n interface for Video	10/27/09 2:45 PM
10.65.23.39	Data Rate	Violation	Data rate configuration of the device did not match with the Rule definition. The violated parameters are: 1Mbps 11b/g, 2Mbps 11b/g, 5.5Mbps 11b/g, 6Mbps 11b/g, 9Mbps 11b/g	10/27/09 2:45 PM
10.65.23.39	Aggressive Load Balancing	Violation	Global Aggressive Load Balancing not Disabled	10/27/09 2:45 PM
10.65.23.41	ACM	Violation	ACM not Enabled for 11a/n interface for Video, ACM not Enabled for 11b/g/n interface for Video	10/27/09 2:45 PM
10.65.23.41	Data Rate	Violation	Data rate configuration of the device did not match with the Rule definition. The violated parameters are: 1Mbps 11b/g, 2Mbps 11b/g, 5.5Mbps 11b/g, 6Mbps 11b/g, 9Mbps 11b/g, 6Mbps 11a, 9Mbps 11a, 24Mbps 11a	10/27/09 2:45 PM
10.65.23.41	Aggressive Load Balancing	Violation	Global Aggressive Load Balancing not Disabled	10/27/09 2:45 PM

## VoWLAN Audit Rules (VRs)

### Check VoWLAN SSID

User needs to define a set of VoWLAN SSIDs. Each controller will be checked for the existence of a subset of the user defined SSIDs.

### Enable ARP Caching

This is a check box for user to enable/disable this option. This is a controller configuration.

### Enable CAC

- User needs to provide VoWLAN SSIDs.
- CAC needs to be enabled.
- User might provide Maximum Allowed Bandwidth and Reserve Roaming Bandwidth. The device config should have at least the user defined Bandwidth.

- Expedited Bandwidth needs to be enabled.
- All the above will be checked for all the user defined SSIDs.

## Enable TSM metric

- User needs to provide VoWLAN SSIDs.
- TSM metrics need to be enabled for user defined SSIDs.

## Enable DTPC

- This is an interface-based configuration. User will be able to enable/disable per interface.
- AP configuration might have overridden this controller configuration via custom power assignment and this will result in AP level violation.

## Enable DHCP server override

User needs to provide VoWLAN SSIDs. DHCP override option will be checked for all SSIDs that matched with the user defined SSID. Note that only one violation will be raised for multiple mismatches across SSIDs.

## Check that Platinum QoS is used for VoWLAN

User needs to provide the VoWLAN SSIDs. If a user-defined SSID is not present in the controller, then the rule will not be applied. The rule will be applied only when a matching SSID is found.

## Check that Platinum QoS is not used for non-voice WLAN

User needs to provide VoWLAN SSIDs. For all SSIDs excluding the user-defined ones, the QoS policy should be set to non-Platinum.

## Check that QoS policies are left at default

One violation will be generated even if there are multiple mismatches across different QoS Profiles.

## Check RF configuration

- Beacon period: 100
- DTIM period: 1
- Fragmentation threshold: 2346
- Short preamble: Enable
- Pico cell mode: Disable

- Each will generate an instance of violation for each RF configuration mismatch

## Check that Data rate configuration is as below

- Disabled: 1, 2, 5.5, 6, 9, 11
- Mandatory: 11
- Supported: 12,18,24,36,48,54

**Note**

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User will be able to change the values for each category. Note that only one violation will be raised for all mismatches.

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## Disable aggressive load balancing

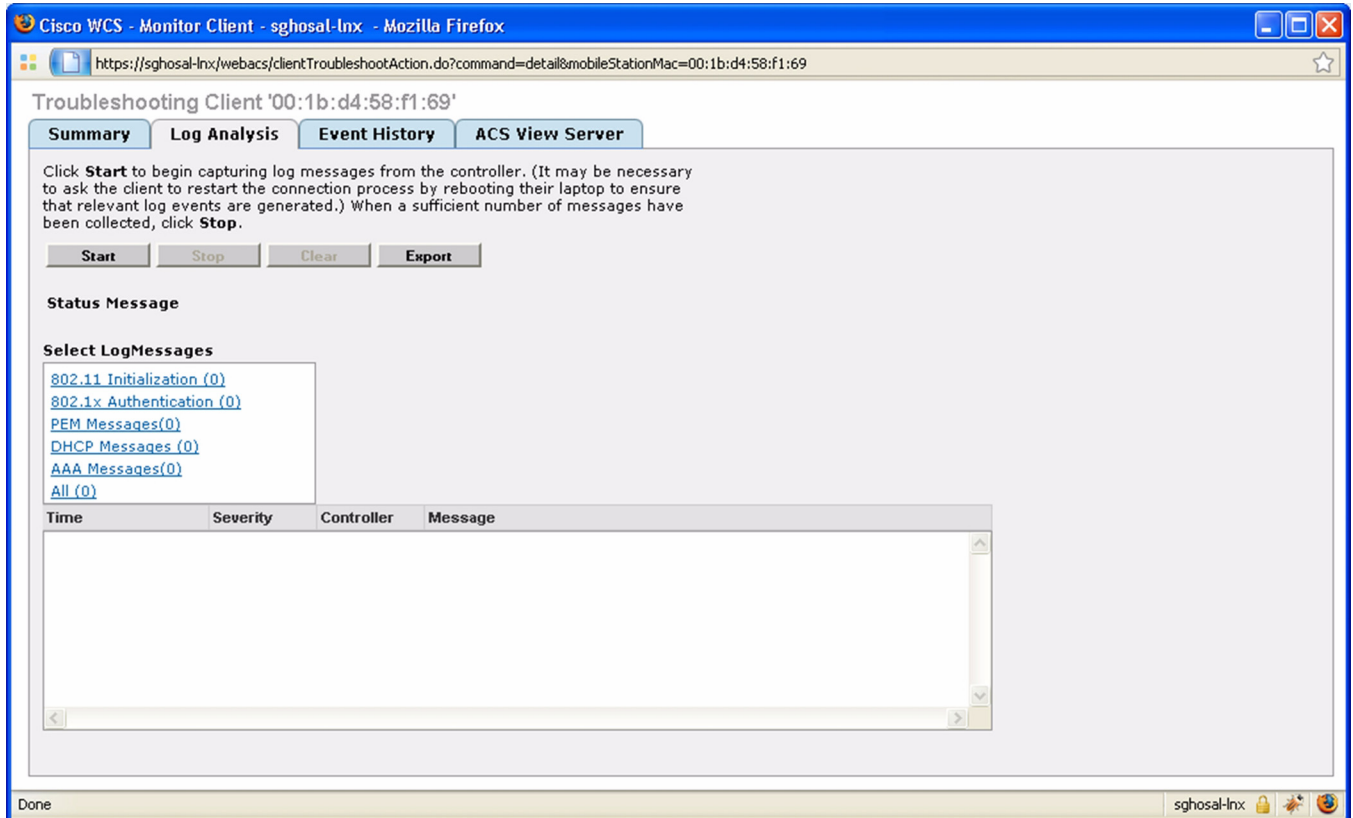
The user must provide VoWLAN SSIDs. For the user-defined SSIDs, check if load balancing has been turned off.

## Additional rules

- WMM being set to “Allowed”/”Required”
- CCKM being enabled
- Pico Cell mode being disabled
- EAP Request timeout being set to 20 sec
- ACM being Enabled

# VoWLAN Client Troubleshooting

Figure 7-18 Troubleshooting Client



Troubleshooting of client is divided into following categories (msgType)

- dot11(0) - dot11-related messages.
- dot1x(1) - dot1x, authentication-related messages.
- pem(2) - Policy Enforcement Module – client state machine related messages.
- dhcp(3) - DHCP-related messages.
- aaa(4) - AAA-related messages.
- voice(5) - Voice-related message. This is new msg type that will be added.
- misc(6) - Miscellaneous messages, such as Roaming, etc.

## TSPEC Codes

**Table 7-1**      *Actions Required for Each Status and Reason Code*

<b>Code</b>	<b>Meaning</b>
0x03	APF_STATUS_CCX_QOS_ADDTS_NO_BANDWIDTH
0xc8	APF_STATUS_CCX_QOS_UNSPECIFIED_FAILURE
0xc9	APF_STATUS_CCX_QOS_POLICY
0xca	APF_STATUS_CCX_INSUFFICIENT_BANDWIDTH
0xcb	APF_STATUS_CCX_INVALID_QOS_PARAMETER