

Troubleshooting Call Admissions Control

VoWLAN Call Capacity

An important factor to consider in a Voice Over Wireless LAN (VoWLAN) is Call Capacity Planning. The number of simultaneous VoWLAN calls that can be supported on a given AP and channel is very important to understand. This value can vary depending upon the static parameters configured on the Wireless LAN Controller or IP Phone or the variations within the RF environment.

For example, the VoWLAN maximum capacity for a Cisco Unified IP Phone 792xG using the Cisco Unified Wireless Network with Load-Based CAC is expected to allow a greater number of calls than with Static CAC in an environment that has ideal RF characteristics. For example, you may get 14 VoWLAN calls per 2.4 GHz channel and 20 simultaneous VoWLAN calls per 5 GHz channel. These capacity values are based on assuming no competing high priority WLAN traffic and normal background noise that adhere to the appropriate best practice recommendations as outlined in the section of RF Design Validation.



Note

Because the 5 GHz spectrum generally features less noise and interference, there can be greater capacity with the higher carrier frequency implementation. The additional non-overlapping channels available in the 5 GHz spectrum also provides a great deal more call capacity for a given area.

TSPEC Admissions Control

Traffic Specification (TSpec) allows an 802.11e client to signal its traffic requirements to the AP. In the 802.11e MAC definition, two mechanisms provide prioritized access. These are the contention-based EDCF option and the controlled access option provided by the transmit opportunity (TXOP). When describing TSPEC features where a client can specify its traffic characteristics, it is easy to assume that this would automatically result in the use of the controlled access mechanism, and have the client granted a specific TXOP to match the TSPEC request. However, this does not have to be the case; a TSpec request can be used to control the use of the various ACs in EDCF. Before a client can send traffic of a certain priority type, it must have requested to do so via the TSpec mechanism. For example, a WLAN client device wanting to use the voice AC must first make a request for use of that AC. Whether or not AC use is controlled by TSpec requests is configurable with voice and video ACs controlled by TSpec requests, and best-effort and background ACs can be open for use without a TSpec request. The use of EDCF ACs, rather than the 802.11e Hybrid Coordinated Channel Access (HCCA), to meet TSpec requests is possible in many cases because the traffic parameters are sufficiently simple to allow them to be met by allocating capacity, rather than creating a specific TXOP to meet the application requirements.

Add Traffic Stream

The Add Traffic Stream (ADDTS) function is how a WLAN client performs an admissions request to an AP. The 792x client signals its TSPEC admission request to the AP in one of two forms:

ADDTS Action Frame-this occurs when a phone call is originated or terminated by the 792x client associated to the AP. The ADDTS contains TSpec and might contain a traffic stream rate set (TSRS) IE (Cisco Compatible Extensions v4 clients).

Association and re-association message

The association message might contain one or more TSPECs and one TSRS IE if the STA wants to establish the traffic stream as part of the association. The re-association message might contain one or more TSPECs and one TSRS IE if an STA roams to another AP.

The ADDTS contains the TSpec element that describes the traffic request. See [Figure 5-1](#) and [Figure 5-2](#) for examples of an ADDTS request and response between a Cisco Unified Wireless IP Phone 792xG WLAN handset and a Cisco AP. Apart from key data describing the traffic requirements, such as data rates and frame sizes, the TSpec element also tells the AP the minimum physical rate that the client device will use. This allows the calculation of how much time that station can potentially consume in sending and receiving in this TSpec, and therefore allowing the AP to calculate whether it has the resources to meet the TSpec. TSpec admission control is used by the WLAN client (target clients are VoIP handsets) when a call is initiated and during a roam request. During a roam, the TSpec request is appended to the re-association request.

```
802.11 Management - Action
```

Category Code:	17 WMM [24]
Action Code:	0 ADDTS Request [25]
Dialog Token:	1 [26]
Status Code:	0 Admission Accepted [27]
WMM	
Element ID:	221 WMM [28]
Length:	61 [29]
OUI:	00-50-F2 [30-32]
OUI Type:	2 [33]
OUI SubType:	2 TSPEC [34]
Version:	1 [35-39]
TS Info:	%0000000000000000000010010011101000 xxxxxx.. Reserved0 No Schedule 00..... TSInfo Ack Policy: Normal IEEE 802.11 acknowledgement100..... UP: 4 Video1.... PSB: U-APSD0..... Aggregation: Reserved0 1..... AP: EDCA - Contention based channel access11..... Direction: Bi-directional0100... TID: EDCA: 40 Traffic Type: Reserved
Nominal MSDU Size:	%00000000010010110 [39-40] Size Might not be Fixed Size: 160
Maximum MSDU Size:	150 [41-42]
Min Service Interval:	0 [43-46]
Max Service Interval:	0 [47-50]
Inactivity Interval:	0 [51-54]
Suspension Interval:	4294967295 [55-58]
Service Start Time:	0 [59-62]
Min Data Rate:	160 [63-66]
Mean Data Rate:	160 bits per second [67-70]
Peak Data Rate:	160 [71-74]
Max Burst Size:	0 [75-78]
Delay Bound:	0 [79-82]
Min PHY Rate:	12000000 bits per second [83-88]
Surplus Bandwidth Allowance:	1.2457
Medium Time:	0 (units of 32 microsecond periods/second) [89-90]

```

802.11 Management - Action
Category Code: 17 WMM [24]
Action Code: 1 ADDTS Response [25]
Dialog Token: 1 [26]
Status Code: 0 Admission Accepted [27]

WMM
Element ID: 221 WMM [28]
Length: 61 [29]
OUI: 00-50-F2 [30-32]
OUI Type: 2 [33]
OUI SubType: 2 TSPEC [34]
Version: 1 [35-39]
TS Info: %000000000000000000010010011101000
        xxxxxx.. .. Reserved
        .....00 ..... No Schedule
        ..... 00..... TSInfo Ack Policy: Normal IEEE 802.11 acknowledgement
        ..... 100..... UP: 4 Video
        ..... 1..... PSB: U-APSD
        ..... 0..... Aggregation: Reserved
        ..... 0 1..... AP: EDCA - Contention based channel access
        ..... 11..... Direction: Bi-directional
        ..... 0100. TID: EDCA: 4
        ..... 0 Traffic Type: Reserved

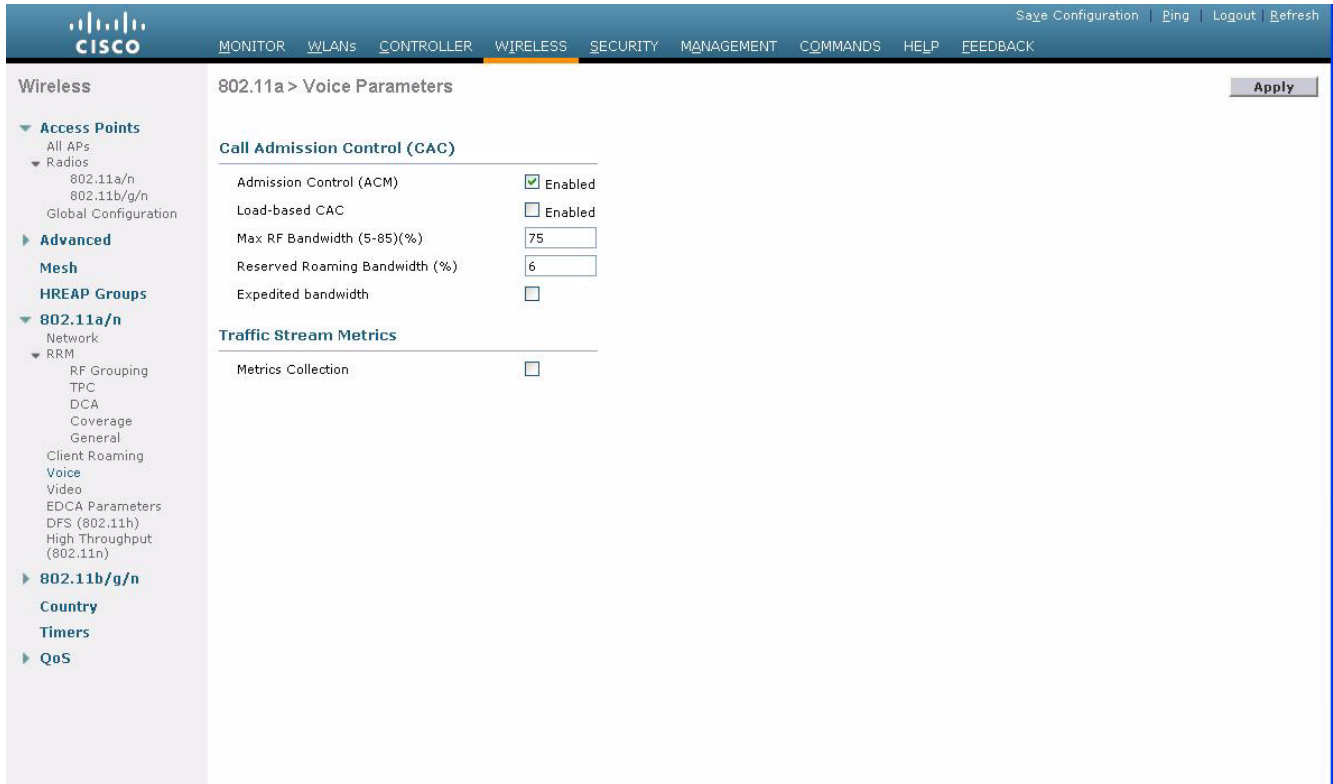
Nominal MSDU Size: %0000000010010110 [39-40]
        Size Might not be Fixed
        Size: 150

Maximum MSDU Size: 150 [41-42]
Min Service Interval: 0 [43-46]
Max Service Interval: 0 [47-50]
Inactivity Interval: 0 [51-54]
Suspension Interval: 4294967295 [55-58]
Service Start Time: 0 [59-62]
Min Data Rate: 160 [63-66]
Mean Data Rate: 160 bits per second [67-70]
Peak Data Rate: 160 [71-74]
Max Burst Size: 0 [75-78]
Delay Bound: 0 [79-82]
Min PHY Rate: 12000000 bits per second [83-88]
Surplus Bandwidth Allowance: 1.2457
Medium Time: 0 (units of 32 microsecond periods/second) [89-90]

```

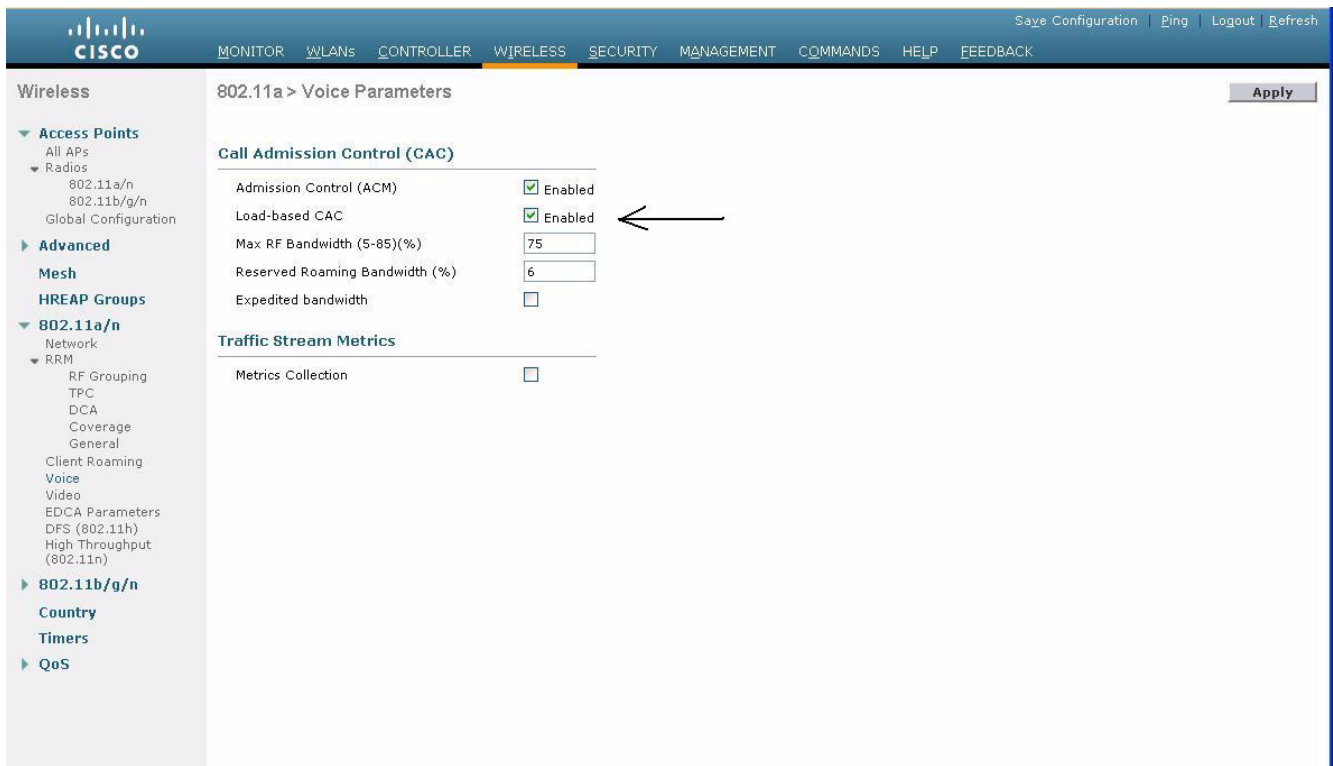
As mentioned previously, there are two types of Admissions Control. Static CAC is based on a percentage of the total Medium Times available and is measure in increments of 32 microseconds. In this section, we will cover how to configure Static and Load-Based CAC and also how to debug it.

5-4

Figure 5-3 Static CAC Configuration Example

The screenshot shows the Cisco Wireless configuration interface. The left sidebar contains a tree view with 'Access Points' expanded, showing 'Radios' and 'Global Configuration'. Under 'Radios', '802.11a/n' is selected. The main content area is titled '802.11a > Voice Parameters'. It features a 'Call Admission Control (CAC)' section with the following settings: 'Admission Control (ACM)' is checked and set to 'Enabled'; 'Load-based CAC' is unchecked and set to 'Enabled'; 'Max RF Bandwidth (5-85)(%)' is set to '75'; 'Reserved Roaming Bandwidth (%)' is set to '6'; and 'Expedited bandwidth' is unchecked. Below this is a 'Traffic Stream Metrics' section with 'Metrics Collection' unchecked. An 'Apply' button is located in the top right corner of the configuration area.

Configuration Item	Value
Admission Control (ACM)	Enabled
Load-based CAC	Enabled
Max RF Bandwidth (5-85)(%)	75
Reserved Roaming Bandwidth (%)	6
Expedited bandwidth	

Figure 5-4 Load-Based CAC Configuration Example

This screenshot is identical to Figure 5-3, but with an additional configuration change. In the 'Call Admission Control (CAC)' section, the 'Load-based CAC' option is now checked and set to 'Enabled'. A black arrow points to this checkbox. All other settings remain the same as in Figure 5-3.

Configuration Item	Value
Admission Control (ACM)	Enabled
Load-based CAC	Enabled
Max RF Bandwidth (5-85)(%)	75
Reserved Roaming Bandwidth (%)	6
Expedited bandwidth	

In an effort to understand how Static CAC works with regard to allocating bandwidth, you need to understand the basics with regard to the math. In circumstances where the 792xG Series wireless IP phone uses a G.711 codec and the Cisco Wireless LAN Controller is configured to utilize data rates in accordance with Cisco VoWLAN best practices, a single uni-directional RTP stream will utilize 538 Medium Times, or 1076 Medium Times per call.

An AP supports a total of 31,250 Medium Times, which is defined in the 802.11e standard and is an RF measurement used by TSPEC for Admissions Control. In a Static CAC configuration, the Medium Times are multiplied times the Max RF bandwidth and Reserved Roaming Bandwidth and divided by the number of calls that are made against a single Access Point during Association.

For example, if Static CAC has been configured using default settings, codecs and data rates in accordance with VoWLAN Design and Deployment Best practices, the formula to calculate the total number of calls is as follows:

If each uni-directional RTP stream utilizes 538 Medium Times, you would multiply that times 2 to determine to the total MT's per call. In this example, it is 1076 MTs per call.

- $31250 \text{ (Medium Times)} * \text{Configured Max RF Bandwidth} \setminus 100 = (\text{maxBw})$
- $(\text{maxBw}) * \text{Configured Reserved Roaming Bandwidth} \setminus 100 = (\text{roamBw})$
- The (roamBw) should then be subtracted from the (maxBw), and then divided by 1076 yielding the total number of calls allowed on the VoWLAN.

**Note**

By default the Max RF Bandwidth is 75% and Reserved Roaming Bandwidth is 6%.

Debugging Static CAC

Scenario:

In this scenario, the Static CAC configuration is as follows:

- Max RF Bandwidth: 40%
- Reserved Roaming Bandwidth: 6%

Using the Formula outlined above, we can conclude the following:

- $31250 \text{ (Medium Times)} * 40\% \setminus 100 = 12500 \text{ (maxBw)}$
- $12500 \text{ (maxBw)} * 6\% \setminus 100 = 750 \text{ (roamBw)}$
- $12500 \text{ (maxBw)} - 750 \text{ (roamBw)} = 11750 \text{ (avail_Bw)} \setminus 1076 \text{ (bw_req)} = 10.92 \text{ calls.}$

From the example, we can see that based on a Max RF Bandwidth of 40% and Reserved Roaming Bandwidth of 6%, the VoWLAN will yield 10 calls with the 11th call being denied access to the WLAN. Please refer to [Figure 5-5](#) through [Figure 5-9](#), which outline how Static CAC can be debugged.

Figure 5-5 Debugging Static CAC Example (part 1)

```
(WiSM_4) >show ap summary
```

Number of APs..... 1

Global AP User Name..... Not Configured
Global AP Dot1x User Name..... Not Configured

AP Name	Slots	AP Model	Ethernet MAC	Location	Port	Country	Priority
AP1252-b5:c8	2	AIR-LAP1252AG-A-K9	00:23:04:eb:b5:c8	default location	LAG	US	1

```
(WiSM-4) >show client summary
```

Number of Clients..... 27

MAC Address	AP Name	Status	WLAN	Auth	Protocol	Port	Wired
00:13:02:03:fb:a3	AP1252-b5:c8	Probing	N/A	No	802.11b	29	No
00:18:ba:78:cb:fa	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:5e:f7	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:62:6f	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:63:fe	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:66:17	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:b5:9c	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:b9:5c	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:ba:82	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c1:d8	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c4:1e	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c4:d5	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c6:07	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c6:13	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c6:f1	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1a:a1:92:c7:03	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1b:d4:54:52:60	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1e:7a:ba:d0:0e	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1e:7a:ba:d7:ac	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1e:7a:ba:dc:92	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No !! Call 11 !!
00:1f:6c:7a:12:c1	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:1f:9e:8b:29:50	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:22:90:fd:a6:31	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:22:90:fd:a9:6a	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No !! First Call !!
00:22:90:fd:a9:b5	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:22:90:fd:a9:e8	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:22:90:fd:aa:0f	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No
00:23:33:41:63:6f	AP1252-b5:c8	Associated	1	Yes	802.11a	29	No

```
[BEGIN SNIP]
```

Figure 5-6 Debugging Static CAC Example (part 2)

```
(WiSM-4) >show ap stats 802.11a AP1252-b5:c8
```

```

Number Of Slots..... 2
AP Name..... AP1252-b5:c8
MAC Address..... 00:23:04:eb:b5:c8
Radio Type..... RADIO_TYPE_80211a
Stats Information
  Number of Users..... 26
  TxFragmentCount..... 4272
  MulticastTxFrameCnt..... 113
  FailedCount..... 2
  RetryCount..... 657
  MultipleRetryCount..... 0
  FrameDuplicateCount..... 1
  RtsSuccessCount..... 1
  RtsFailureCount..... 0
  AckFailureCount..... 657
  RxFragmentCount..... 0
  MulticastRxFrameCnt..... 0
  FcsErrorCount..... 201
  TxFrameCount..... 11774
  WepUndecryptableCount..... 0
  TxFramesDropped..... 0

Call Admission Control (CAC) Stats
  Voice Bandwidth in use(% of config bw)..... 0
    Total channel MT free..... 0
    Total voice MT free..... 0
    Na Direct..... 0
    Na Roam..... 0
  Video Bandwidth in use(% of config bw)..... 0
  Total num of voice calls in progress..... 0
  Num of roaming voice calls in progress..... 0
  Total Num of voice calls since AP joined..... 0
  Total Num of roaming calls since AP joined.... 0
  Total Num of exp bw requests received..... 0
  Total Num of exp bw requests admitted..... 0
  Num of voice calls rejected since AP joined... 0
  Num of roam calls rejected since AP joined.... 0
  Num of calls rejected due to insufficient bw... 0
  Num of calls rejected due to invalid params... 0
  Num of calls rejected due to PHY rate..... 0
  Num of calls rejected due to QoS policy..... 0

```

Figure 5-7 Debugging Static CAC Example (part 3)

```
(WiSM-4) >debug cac all enable

*Dec 12 01:19:45.106 2009: Call Access Control accounting TSPEC to MAP AP1252-b5:c8 MAC 00:22:90:93:4c:60
*Dec 12 01:19:45.106 2009: 00:22:90:fd:a9:6a Allocating voice bw for ms on AP AP1252-b5:c8 00:22:90:93:4c:60
slotId 1
tid = 6 maxBw = 12500 bw_req = 1076 totalVoiceBwAlloc = 1076

*Dec 12 01:19:45.106 2009: 00:22:90:fd:a9:6a sending ADD TS to AP 00:22:90:93:4c:60 slotId 1, for client
00:22:90:FD:A9:6A tid = 6 up = 6, upsd = 1, bw = 1076

!! --- First Call --- !!

*Dec 12 01:19:45.106 2009: 00:22:90:fd:a9:6a Sending Successfull ADD TS resp to mobile on AP
00:22:90:93:4c:60 slotId 1

*Dec 12 01:19:45.106 2009: 00:22:90:93:4c:60 AP slotId 1 voiceBw = 12500 videoBw = 0 voiceBwAlloc = 1076
videoBwAlloc = 0 availBw = 11750

*Dec 12 01:19:45.106 2009: 00:22:90:fd:a9:e8 ADD TS from mobile on AP 00:22:90:93:4c:60 slotId 1 up = 6,
tid = 6, upsd = 1, mediumTime = 1076, TSRSIE No

*Dec 12 01:19:45.106 2009: 00:22:90:fd:a9:e8 up=6 tsid=6 direc=3
NomMsduSize=208
MaxMsduSize=208
MinServIntvl=0
MaxServIntvl=0
InactIntval=0
MinDataRate=83200
MeanDataRate=83200
PeakDataRate=83200
MinPhyRate=12000000
SBA=0x2999
MediumTime=1076

!! --- End First Call --- !!

[END SNIP]
```

For the purposes of this troubleshooting guide the length of the debug was reduced, however, when issuing the “debug cac all enable” command on the Cisco Wireless LAN Controller, you will noticed that as additional calls are made one after another on the same AP, the available bandwidth (Medium Times) decrements by 1076 per call until the Medium Times (availBw) are exhausted. Once exhausted, the AP will send the following error seen in the output below. The will result in a “Network Busy” message on the 792xG Series wireless IP phone.

Figure 5-8 Debugging Static CAC Example (part 4)

```
[SNIP CONT']
```

```
!! --- Eleventh Call --- !!
```

```
*Dec 12 01:19:45.106 2009: 00:1e:7a:ba:dc:92 ADD TS from mobile on AP 00:22:90:93:4c:60 slotId 1 up = 6, tid = 6, upsd = 1, mediumTime = 1076, TSRSIE No
```

```
Wed Jul 22 06:13:14 2009: 00:1e:7a:ba:dc:92 up=6 tsid=6 direc=3
```

```
NomMsduSize=208
```

```
MaxMsduSize=208
```

```
MinServIntvl=0
```

```
MaxServIntvl=0
```

```
InactIntval=0
```

```
MinDataRate=83200
```

```
MeanDataRate=83200
```

```
PeakDataRate=83200
```

```
MinPhyRate=12000000
```

```
SBA=0x2999
```

```
MediumTime=1076
```

```
*Dec 12 01:19:45.106 2009: Max stream Size is 168000
```

```
*Dec 12 01:19:45.106 2009: 2009: Max streams number is 2
```

As you can see below, the bandwidth required is 1076 (bw_req = 1076) and the Maximum Bandwidth is 12500 (maxBw = 12500). Since the bandwidth allocated has reached 10760 (bwAloc = 10760), that leaves 1740 Medium Times, of which 750 (roamBw = 750) has been allocated to Reserved Roaming Bandwidth, resulting in 990 Medium Times remaining. Finally, this results in insufficient bandwidth and thus causes the following output to be seen in the “debug cac all enable” on the Cisco Wireless LAN Controller.

Figure 5-9 Debugging Static CAC Example (part 5)

```

*Dec 12 01:19:45.106 2009: 00:1e:7a:ba:dc:92 Can not allocate bw for ms on AP 00:22:90:93:4c:60 slotId 1 ac
= 2, assoc = 0, bw_req = 1076, maxBw = 12500, bwAlloc = 10760, roamBw = 750
*Dec 12 01:19:45.106 2009: 00:1e:7a:ba:dc:92 TSPEC from mobile (up = 6), Not enough bandwidth.
*Dec 12 01:19:45.106 2009: 00:1e:7a:ba:dc:92 Sending Failed ADD TS resp to mobile on AP 00:22:90:93:4c:60
slotId 1

!! --- End of Eleventh Call --- !!

(WiSM-4) >show
p stats 802.11a AP1252-b5:c8

Number Of Slots..... 2
AP Name..... AP1252-b5:c8
MAC Address..... 00:23:04:eb:b5:c8It coul
Radio Type..... RADIO_TYPE_80211a

Stats Information
  Number of Users..... 26
  TxFragmentCount..... 4272
  MulticastTxFrameCnt..... 113
  FailedCount..... 2
  RetryCount..... 657
  MultipleRetryCount..... 0
  FrameDuplicateCount..... 1
  RtsSuccessCount..... 1shes all that
RtsFailureCount..... 0
AckFailureCount..... 657
RxFragmentCount..... 0
MulticastRxFrameCnt..... 0
FcsErrorCount..... 201
TxFrameCount..... 11774
WepUndecryptableCount..... 0
TxFramesDropped..... 0

Call Admission Control (CAC) Stats
  Voice Bandwidth in use(% of config bw)..... 86
  Total channel MT free..... 0
  Total voice MT free..... 0
  Na Direct..... 0
  Na Roam..... 0
Video Bandwidth in use(% of config bw)..... 0

  Total num of voice calls in progress..... 10

  Num of roaming voice calls in progress..... 0
  Total Num of voice calls since AP joined..... 10 !! Active VoWLAN calls !!
  Total Num of roaming calls since AP joined..... 0
  Total Num of exp bw requests received..... 0
  Total Num of exp bw requests admitted..... 0
  Num of voice calls rejected since AP joined.... 1 !! The 11th Call was denied as seen above !!
  Num of roam calls rejected since AP joined..... 0
  Num of calls rejected due to insufficient bw.... 1 !! Rejected Call !!
  Num of calls rejected due to invalid params.... 0
  Num of calls rejected due to PHY rate..... 0
  Num of calls rejected due to QoS policy..... 0

(WiSM-4) >debug disable-all

[SNIP CONT' END]

```

Debugging LBCAC

Load-Based CAC on the other hand is significantly more difficult to debug. LBCAC is dynamic with regard to the algorithm used to decrement Medium Times from the total that is available. LBCAC takes into consideration different metrics, such as load, Co-channel interference, SNR, etc. and will therefore yield different results when tested. From our experience, it is very difficult to yield consistent results as RF fluctuates and changes within the given environment. Results tend to vary from one cell area to another and even in cell areas that yield the same signal strength.

At Cisco, we have seen consistent results with regard to LBCAC tests performed in a shield room, however, those results are only an indication to us of how the 792xG Series wireless IP phone might perform under the most ideal circumstances. In the real world, results will vary significantly. It's important to understand that RF is dynamic in nature and while a single AP might allow 15 calls on Tuesday, it may yield more or less the next day as environmental circumstances change. Overall, LBCAC does yield a greater number of calls per AP due to the mechanisms it uses to decrement the available Medium Times. Remember, with Static CAC, a bi-directional RTP stream decrements a fixed value of 1076 MT's from the available bandwidth, while LBCAC will factor in other variables and might only decrement 700 or 800 medium times per call. The only way to conclusively determine why results in LBCAC changes so dramatically in a single area is to take wireless sniffer traces and perform Spectrum Analysis within a given environment and utilize that data to isolate root cause. If call capacity is of vital concern and your WLAN is not yielding the expected results, it's ideal to ensure that your VoWLAN deployment adheres to all of the outlined VoWLAN Design and Deployment Best practices and each phone sees at least 3 Access Points with an acceptable RSSI.

Chapter Summary

It's important to understand that the purpose of TSpec admission control is not to deny clients access to the WLAN; it's to protect the existing VoWLAN calls and to ensure that quality does not degrade. Without the implementation of CAC, any additional calls above and beyond the available bandwidth available will cause an overall degradation of quality to all VoWLAN users.