VBrick Streaming Video Deployment in the Cisco Unified Wireless Network Infrastructure

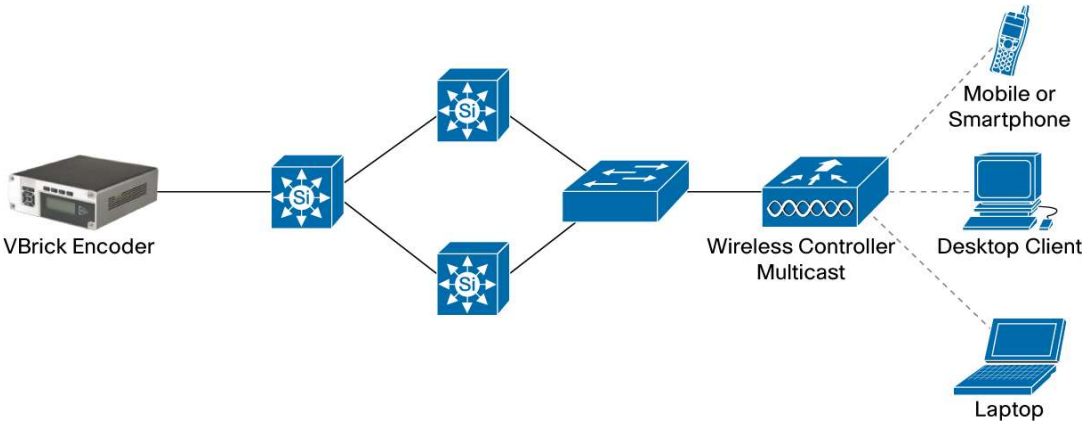
Overview

Corporations are using streaming video in numerous ways to boost employee productivity, facilitate training, and improve both internal and external communications. Although streaming video technologies have been used by businesses for well over a decade, most implementations were designed to operate over high-bandwidth wired or optical networks. With today's improvements in video compression, video transport protocols, and wireless network bandwidth, certain select streaming video products, such as VBrick Systems, can now reliably deliver high-quality video over wireless networks.

Many of today's enterprises and corporations routinely carry streaming video on their wireless networks.

Figure 1 shows a basic system setup that integrates the VBrick video system with the Cisco® Unified Wireless Network.

Figure 1. VBrick Systems Video Streaming Solution over the Cisco Unified Wireless Network



This deployment guide covers the system design factors and product configuration guidelines for VBrick Systems' video streaming products used in conjunction with the Cisco Unified Wireless Network infrastructure.

Note: VBrick Systems' hardware and software products are supported directly by VBrick's reseller channel partners. Cisco Technical Assistance Center (TAC) personnel are not trained to resolve problems related to VBrick products.

This deployment guide focuses on the specifics of VBrick's products operating in a managed wireless architecture. Technical support staff using these guidelines are expected to have a good working knowledge of basic network design, along with a solid understanding of network protocols and multicast transmission.

Recommended reading on Cisco's wireless products includes the following documents:

- http://www.cisco.com/en/US/tech/tk722/tk809/technologies_tech_note09186a0080810880.shtml
- http://www.cisco.com/en/US/docs/wireless/controller/7.0/configuration/guide/c70.html

These documents are available from Cisco at http://www.cisco.com with the proper login credentials.

Technical documentation on VBrick's products may be obtained from the VBrick website at http://vbrick.com/support/documentation.asp

Technology Overview

There are two basic types of sources that can originate a video stream. For live video, a hardware-based video encoder is used. This appliance takes in analog or digital video from a camera or other video source (Blu-ray, cable, or satellite feed, or video conferencing equipment), compresses it, and packetizes it into a stream that is sent over the network. Live video requires real-time or near-real-time delivery to the viewer, so low network latency of 300 ms or less is a needed for a good viewing experience. Video on demand (VoD), on the other hand, uses previously recorded video that is stored on and sent out from a VoD server. These VoD streams are delivered on a non-real-time basis and are more tolerant of network latency and packet jitter. In both cases, stream buffering done on the client helps to eliminate network disruptions and gives the viewer a smooth, continuous video experience.

Video streams are transmitted over a network using one of two methods: unicast or multicast. With unicasting, a separate video stream is sent to each viewer. If a single unicast stream uses 500 Kbps of bandwidth, 10 streams use 5 Mbps of bandwidth. This delivery method works well if each viewer is watching a unique stream, but is very inefficient when multiple viewers are watching the same content.

Multicast protocols were developed to eliminate this problem. With multicasting, only a single stream is transmitted from the source. Stream replication to multiple destinations is performed in the network by routers and switches, thereby lessening bandwidth usage dramatically. One disadvantage with multicasting, however, is the loss of VoD capabilities since all viewers must watch the same video at the same time.

The VBrick Solution

VBrick Systems manufactures a range of video encoding appliances that are tailored to different applications. Depending on the customer's needs related to video resolution, encoding format, and bandwidth usage, the customer can select from two basic models: the H.264 and Windows Media appliances. Although these units vary in features and capabilities, they share similar network configuration parameters. Both of these models have been designed to stream video reliably over virtually any type of wired or wireless IP network. Careful attention has been paid to network transport protocols as well as packet shaping to minimize video disruptions if network errors occur. For the vast majority of wireless applications, the encoder is hardwired to the network and the client is a wireless device such as a laptop, smartphone, or mobile phone. However, VBrick encoders can also be configured to connect directly to a Wi-Fi access point such as Cisco Aironet® access points.

VBrick's newest encoder is the H.264 appliance, shown in Figure 2.

Figure 2. VBrick H.264 Appliance

Designed with corporate and enterprise applications in mind, the H.264 appliance supports both unicast and multicast streaming and includes a built-in unicast streaming server. With unicasting, up to 200 concurrent live streams are supported, while multicasting offers an unlimited number of live streams. The unit supports both standard and high-definition video resolutions and is fully integrated with the VBrick Enterprise Media System

(VEMS) video portal for live viewing, recording, and video on demand. Extremely low latency makes this product ideal for real-time video sessions. Composite, S-Video, component, High-Definition Multimedia Interface (HDMI), standard- definition/high-definition serial digital interface (SD/HD-SDI), and 3G-SDI video inputs are also included.

VBrick manufactures several other models of encoders that are designed to work over wireless networks, including its Windows Media appliance.

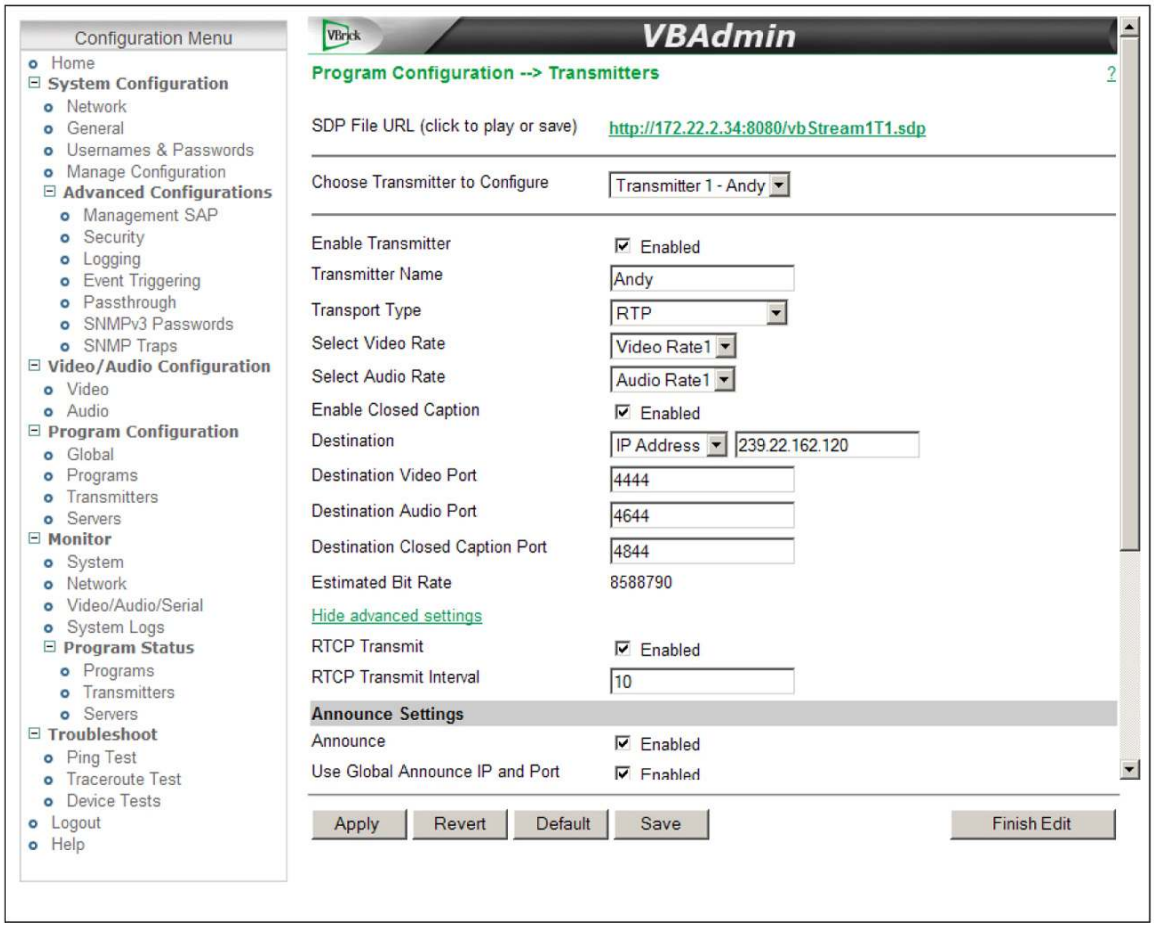
Network Configuration Guidelines

To easily accommodate a large number of concurrent viewers, the simplest and most versatile network protocol to use is multicasting. In this mode, the encoder is configured to transmit or push the aggregate video/audio stream to a multicast address or destination. To watch the video, clients simply issue a multicast “join” to the network; the encoder transmits continuously and does not depend on a client request to start streaming. For network transport, the Realtime Transport Protocol (RTP) is most commonly used; however, VBrick also supports H.264 video over Transport Stream. VBrick’s players, along with the majority of other software players and decoders, support this option.

To make it easy for viewers to learn about new video streams or “channels,” the encoder also periodically multicasts short announcement packets called Session Announcement Protocol (SAPs). VBrick’s VEMS video portal and StreamPlayer client software automatically detect and display this stream information in a channel guide. Precise setup information on the video and audio properties of a steam is sent to the decoder in special Session Description Protocol (SDP) packets. These packets contain essential stream information such as profile, bit rate, addressing, audio properties, transmission type, and content. The player or software decoder interprets this SDP information for optimal playback. When sending video using multicasting, the encoder periodically broadcasts the SDP to a predefined address using SAP multicast announcements.

The user interface for VBrick’s appliances is called VBAdmin and is accessible from any standard web browser. Figure 3 shows the VBAdmin configuration page used to define the destination multicast address of the encoder as well as other relevant information.

Figure 3. VBAdmin Configuration Screen



To configure the VBrick appliance for multicast, you must specify a valid multicast address in the destination IP address field on the Program Configuration --> Transmitters page. In the example shown in Figure 3, the destination IP address is 239.22.162.120.

Table 1 shows the relevant global and network configuration for the VBrick H.264, Windows Media, and MPEG-2 encoders when used in a wireless multicast environment.

Encoder	Menu Item	Parameter	Setting
H.264	Program Configuration --> Transmitters	Destination (multicast IP address)	Example: 239.22.162.120
	Program Configuration --> Transmitters	Announce	Enabled
	Program Configuration --> Transmitters	External Announce Settings	Use Global Announce IP and Port
Windows Media	Configuration: Encoder: Multicast	Multicast URL	Used in a player or browser to view the multicast stream
	Configuration: Encoder: Multicast	Multicast Destination IP Address	Example: 239.22.173.10
	Configuration: Encoder: Multicast	Time to Live	63
	Configuration: Encoder: Announce (SAP)	Transmit	Enabled
	Configuration: Encoder: Announce (SAP)	Time to Live	64
	Configuration: Encoder: Announce (SAP)	IP Address	Example: 224.2.127.254

Encoder	Menu Item	Parameter	Setting
	Configuration: Reflector: Multicast	Multicast Destination IP Address	Example: 239.22.173.10
MPEG-2	Configuration: Encoder: Destination 1 & 2	Destination IPv4 Address	Example: 239.22.123.249
	Configuration: Encoder: Announce (SAP)	IP Address	Example: 224.2.127.254

To extend the multicast reach of VBrick's encoders across limited bandwidth Wide Area Networks (WANs), most VBrick encoders support reflecting. With reflecting, the originating VBrick encoder sends a single unicast stream across the WAN to a VBrick reflector located at the remote site. This VBrick reflector takes the incoming unicast stream and converts it to a multicast stream (or multiple unicast stream), where it is then sent to multiple viewers. At the remote site, the multicast network may be wired or wireless. With this technique, an unlimited number of viewers at the remote site can watch the video while using only a single low-bandwidth stream over the WAN.

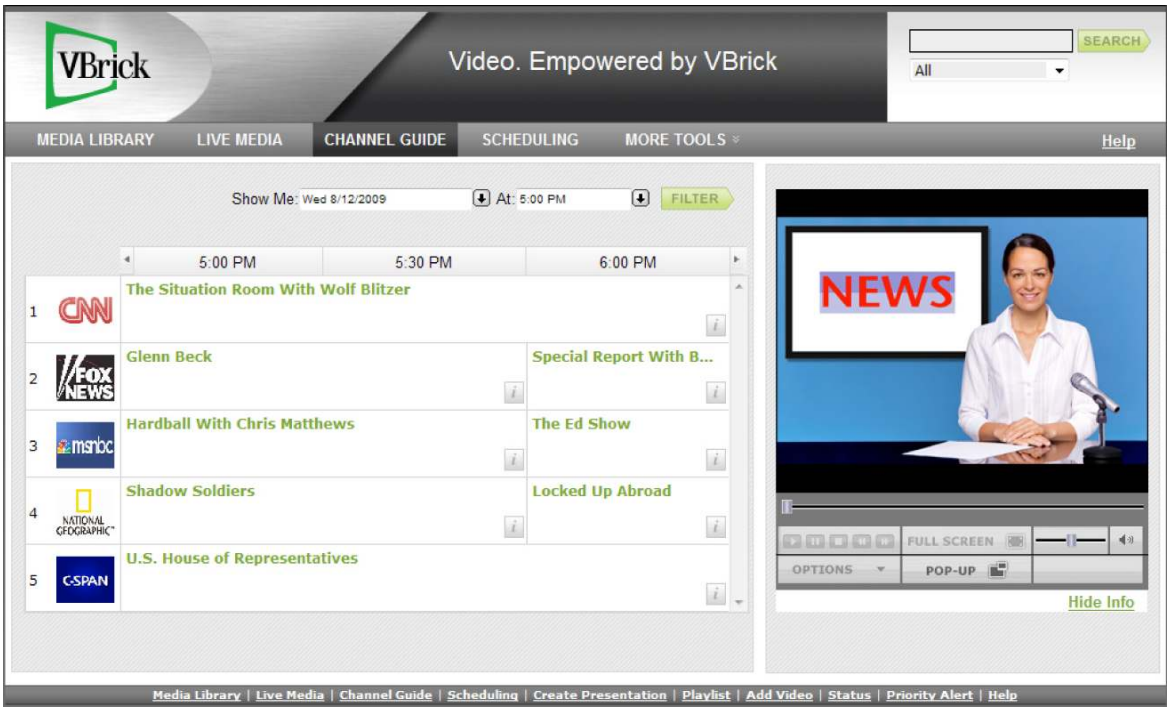
VBrick Enterprise Video System

Large corporations that need to deliver multiple live and stored video streams across their enterprise networks appreciate the convenience and ease-of-use of the VBrick Enterprise Media System (VEMS). VEMS is a complete media management software suite that makes it easy for users to create, manage, and view live and stored video and rich media presentations. The system features the following enterprisewide capabilities:

- Web-based video portal supporting standard and high definition video and DVD-like player controls
- Centralized video recording capabilities
- Interactive multimedia presentations with synchronized slides, video, and audio
- Interactive channel guide for local video channels and TV
- User access controls that integrate with Microsoft Active Directory and Lightweight Directory Access Protocol (LDAP) directory services
- Scheduled broadcasts, presentations, and recordings
- Intelligent video distribution and bandwidth conservation
- Powerful content search, tagging, and filtering capabilities
- Detailed usage reports
- Support for a wide variety of video formats, including H.264, Windows Media, MPEG-2, and MPEG-4

Figure 4 shows the VEMS live channel guide.

Figure 4. VEMS Channel Guide



In Figure 4, each of the video streams shown at the left side of the guide are live TV channels that originate from a VBrick encoding appliance. Also included is a program guide for major cable channels showing upcoming programs. Users simply click on the TV channel icon or show name to begin playback.

Figure 5 shows the user interface for the VEMS media library that contains video-on- demand content. Playback controls such as pause, fast forward, and rewind are available with this interface.

Figure 5. VEMS Media Library

Configuring the Wireless Multicast Feature in the Cisco Wireless LAN Controller Software

With Cisco Wireless LAN Controller Software Version 6.0.188.0 and later releases, the Cisco Unified Wireless Network supports reliable multicast over wireless, which greatly improves the quality of video streaming.

To reliably use the wireless multicast feature, the wired network should have full multicast support. In the controller, you must enable multicast support and set the multicast mode to multicast. You must also enable Internet Group Management Protocol (IGMP) snooping. Enter the following commands in the command line interface:

```
(talwar-2) >config network multicast global enable
(talwar-2) >config network multicast mode multicast 226.226.226.226
(talwar-2) >config network multicast igmp snooping enable
```

In the web GUI, you can enable multicast and IGMP snooping as shown in Figure 6.

Figure 6. Enabling Multicast Mode and IGMP Snooping Using the Cisco Wireless LAN Controller Interface

To enable multicast in multicast mode, you can also use the GUI as shown in Figure 7.

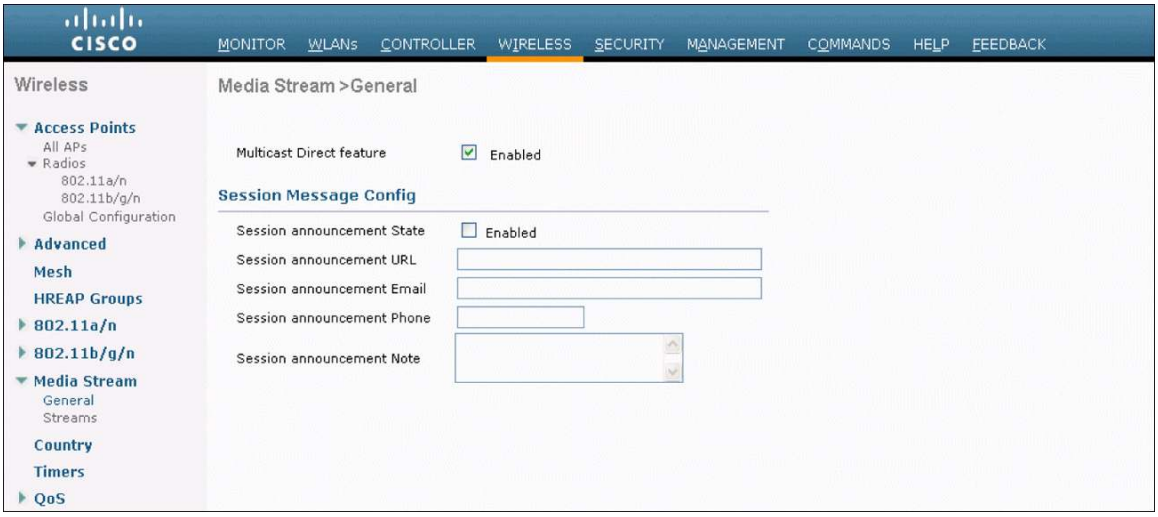
Figure 7. Configuring multicast mode and multicast address

Now you need to enable reliable multicast globally in the controller. If you hare using the command-line interface, enter the following:

```
(talwar-2) >config media-stream multicast-direct enable
```

Or use the web GUI as shown in Figure 8:

Figure 8. Enabling Multicast Direct Mode



Now you need to define a stream for reliable multicast. To do so using the command-line interface, enter the following:

```
(talwar-2) >config media-stream add multicast-direct test 227.227.227.227
227.227.227.228 detail 5000 1500 periodic video 8 fallback
```

You can also use the template option:

```
(talwar-2) >config media-stream admit test
```

Figure 9 shows how use the GUI to define the multicast stream for reliable multicast:

Figure 9. Defining the Multicast Stream for Reliable Multicast

Now you must enable the reliable multicast for the WLAN. To support reliable multicast, the feature needs to be enabled for the specific WLAN. In addition, the WLAN's quality of service (QoS) needs to be configured as "gold" or "platinum." For example, enter the following commands:

```
(talwar-2) >config wlan qos 4 gold
(talwar-2) >config wlan media-stream multicast-direct 4 enable
```

Figure 10 shows how to define the QoS for the WLAN using the GUI:

Figure 10. Defining the QoS for the WLAN

Now that you've enabled multicast on the controller, you should check to be sure that reliable multicast has been enabled for both radios.

Reliable multicast should be enabled by default for both radios. In the command-line interface, you can check this as follows:

```
(talwar-2) >show 802.11a media-stream rrc
Multicast-direct................................ Enabled
Best Effort..................................... Enabled
Video Re-Direct................................. Enabled
Max Allowed Streams............................. Auto
Max Video Bandwidth............................. 0
Max Voice Bandwidth............................. 75
```

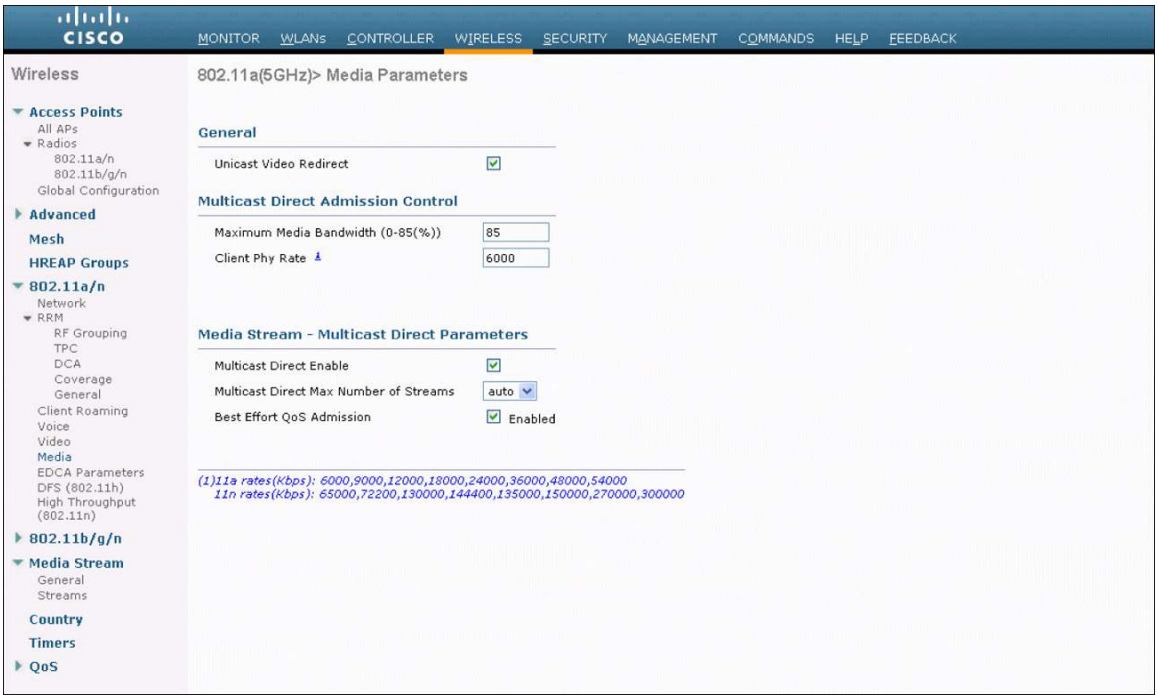
```
Max Media Bandwidth.............................. 85
Min PHY Rate..................................... 6000
```

If reliable multicast is disabled on the radios and you want to enable it, enter the following:

```
(talwar-2) >config 802.11a media-stream multicast-direct enable
(talwar-2) >config 802.11a cac video max-bandwidth 70
```

Or use the GUI as shown in Figure 11:

Figure 11. Enabling Reliable Multicast on the radios

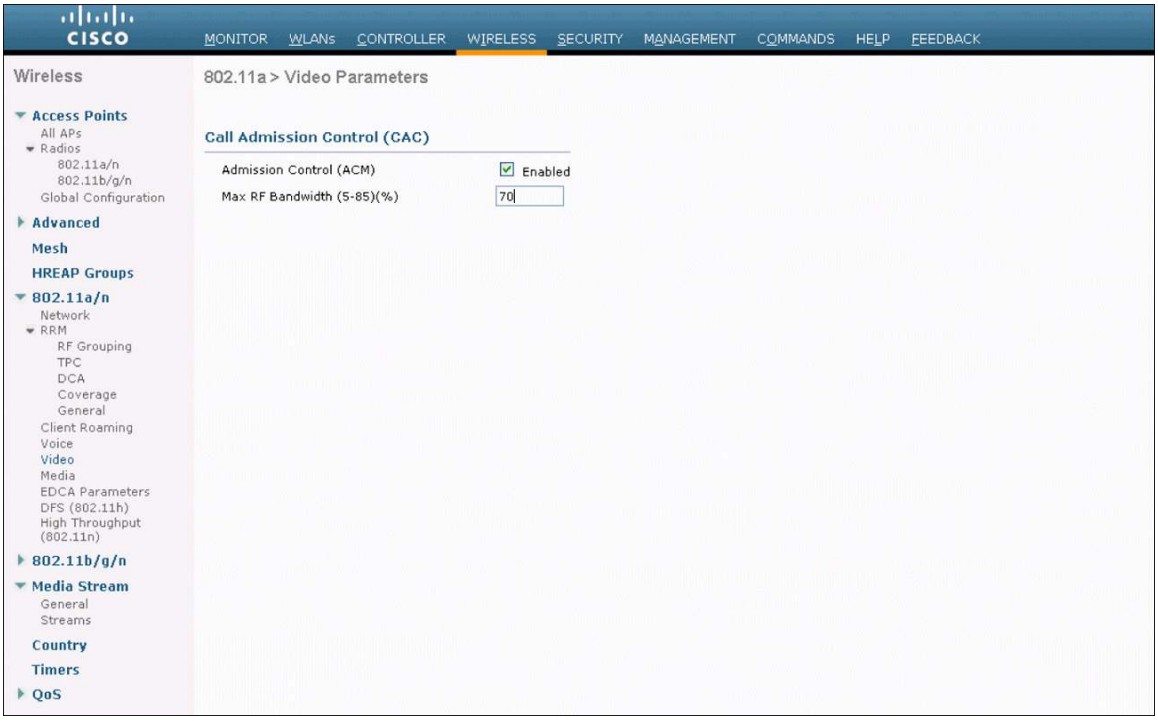


As a last step, enable video Call Admission Control (CAC). Using the command-line interface, enter:

```
(talwar-2) >config 802.11a cac video acm enable
```

Or use the GUI as shown in Figure 12:

Figure 12. Enabling Video CAC



System Verification

Once the VBrick appliance and Cisco Unified Wireless Network components have been properly configured, a wireless client such as a laptop PC is needed to verify multicast- over-wireless playback. You will also need to obtain the latest version of VBrick's StreamPlayer client software. During testing, a live camera and microphone or other video source (for example, a DVD player) must be connected to the VBrick appliance. Follow these steps:

1. Contact VBrick Systems to obtain the latest version of StreamPlayer (currently version 5.0).
2. Follow the instructions to install this software on your wireless Windows laptop or PC.
3. Launch StreamPlayer to view a list of the live streams on the wireless network (you will see an entry based on the SAP announcement coming from the VBrick appliance).
4. Double-click on the stream name to launch the stream.

The live video and audio playback will begin.

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