

# All Things Digital

Amateur Radio for the 21<sup>st</sup> Century  
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## THE BROADBAND HAMRADIO [MESH]

### NETWORK (BBHN)—Part 3

In this final part, we'll look at streaming one-way video and two-way audio using IP (Internet Protocol) cameras with a commercial program called "Blue Iris" then look at streaming two-way video/audio using a free Skype-like program called "Jitsi". I've written a series of supplementary BBHN articles (posted on my website); one is on using the free "iSpy Connect" software with webcams (either external USB or built-in) and you may want to read it first before proceeding on with this article.

### LIGHTS, IP CAMERA, ACTION!

An IP camera is a very small and portable microcomputer (see Figure 1) with a low-resolution video camera, IR (infrared) vision, microphone/speaker plus a built-in [hardware] webserver with wired/wireless network connectivity. It doesn't require a connected computer like a webcam does—all it needs is DC power and an in-range wireless/wired network. Most have remote control features called "PTZ" (pan, tilt and zoom) with the pricier ones having optical instead of digital zoom capability plus higher video resolutions.



**FIGURE: 1 “MESHERD” IP CAMERA**

They are fairly easy to program using any web browser to customize their webserver settings (see Figure 2) plus the browser allows for basic PTZ control and video/audio streaming (see Figure 3).

Real-time H.264 IP Camera Monitoring System																																	
<a href="#">Device Information</a> <a href="#">Date&amp;Time Settings</a> <a href="#">User Settings</a> <a href="#">Basic Network Settings</a> <a href="#">Wireless Settings</a> <a href="#">Remote Access</a> <a href="#">Email Settings</a> <a href="#">FTP Settings</a> <a href="#">Auto Capture</a> <a href="#">Motion Detection</a> <a href="#">Alarm</a> <a href="#">Schedule</a> <a href="#">Video</a> <a href="#">Image Settings</a> <a href="#">Audio Settings</a> <a href="#">Initialize</a> <a href="#">Back</a>	<table border="1"> <thead> <tr> <th colspan="2">Device Information</th> </tr> </thead> <tbody> <tr> <td>Device ID:</td> <td>IPCAM</td> </tr> <tr> <td>Device Type:</td> <td>C1F1S0Z0N0P1L0</td> </tr> <tr> <td>Network Connection:</td> <td>LAN</td> </tr> <tr> <td>Current Client:</td> <td>1</td> </tr> <tr> <td>Device Firmware Version:</td> <td>V3.2.1.1.1-20120815</td> </tr> <tr> <td>Device Embedded Web UI Version:</td> <td>2.5.08.3</td> </tr> <tr> <td>Mac Address:</td> <td>00:0d:c5:d7:30:42</td> </tr> <tr> <td>IP Address:</td> <td>10.208.247.61</td> </tr> <tr> <td>Subnet Mask:</td> <td>255.255.255.248</td> </tr> <tr> <td>Gateway:</td> <td>10.208.247.57</td> </tr> <tr> <td>Primary DNS:</td> <td>10.208.247.57</td> </tr> <tr> <td>Secondary DNS:</td> <td></td> </tr> <tr> <td>Start Time:</td> <td>2014-7-1 10:13:46</td> </tr> <tr> <td>SD Status:</td> <td>A card. Available space:552MB Capacity:950MB</td> </tr> <tr> <td colspan="2" style="text-align: right;"> <a href="#">Browser SD Card ..</a>   <a href="#">Format SD Card as fat32</a> </td> </tr> </tbody> </table>	Device Information		Device ID:	IPCAM	Device Type:	C1F1S0Z0N0P1L0	Network Connection:	LAN	Current Client:	1	Device Firmware Version:	V3.2.1.1.1-20120815	Device Embedded Web UI Version:	2.5.08.3	Mac Address:	00:0d:c5:d7:30:42	IP Address:	10.208.247.61	Subnet Mask:	255.255.255.248	Gateway:	10.208.247.57	Primary DNS:	10.208.247.57	Secondary DNS:		Start Time:	2014-7-1 10:13:46	SD Status:	A card. Available space:552MB Capacity:950MB	<a href="#">Browser SD Card ..</a> <a href="#">Format SD Card as fat32</a>	
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**FIGURE 2: SAMPE IP CAMERA SETTINGS**

Newer IP cameras have dedicated iDevice (Apple/Android) applications to connect (via the Internet) to the camera (see Figure 4) and the apps are generally easy to use but are usually limited to private streaming because most people don't want others accessing their feeds, however EmComm (Emergency Communications) mesh networking is different since we want as many people as possible who need a video/audio feed to have this access. In 2007, the city of Minneapolis was in the process of building a city-wide mesh network system when a major highway bridge collapsed and IP cameras were quickly deployed during the incident and they (and the mesh network) greatly assisted the city's emergency response teams.



**FIGURE 3: IP CAMERA REAL-TIME VIDEO FEED**

**FIGURE 4: IPOD IP CAMERA REAL-TIME VIDEO FEED**



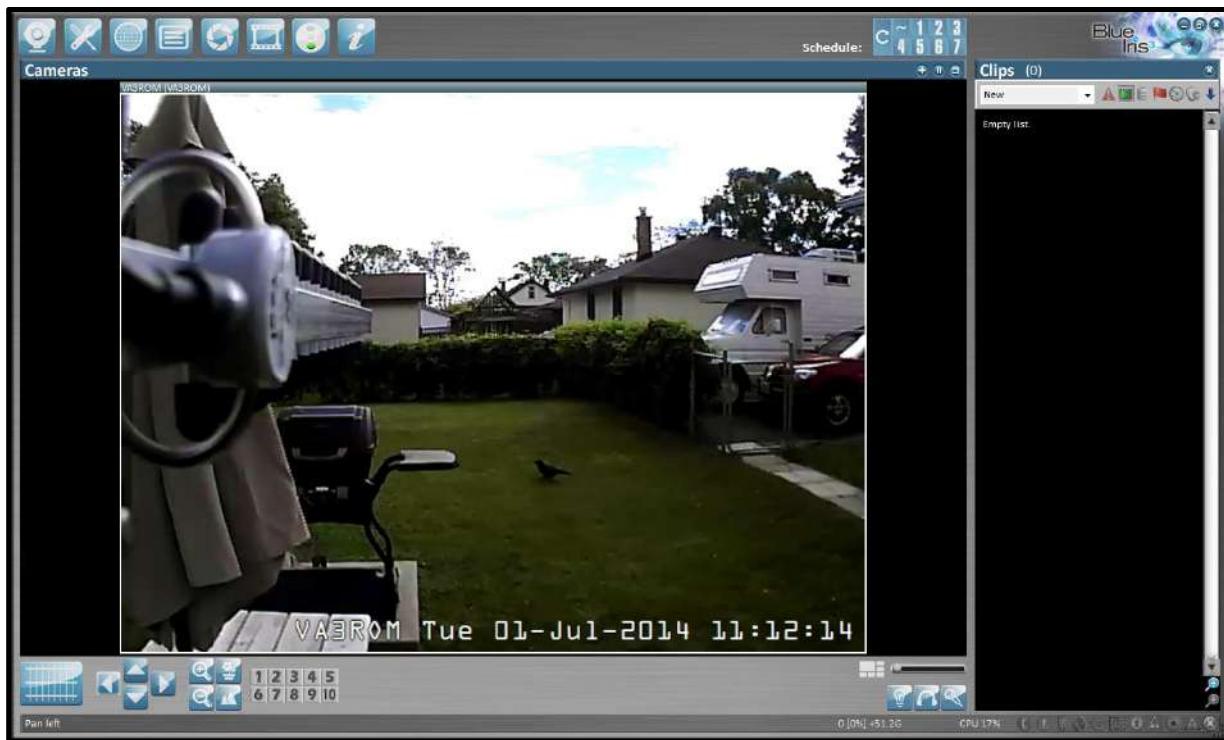
IPod IP camera remote video and audio feed from my first, cheap IP camera and its full-time IR filter which turned greens into violets!

## BLUE IRIS

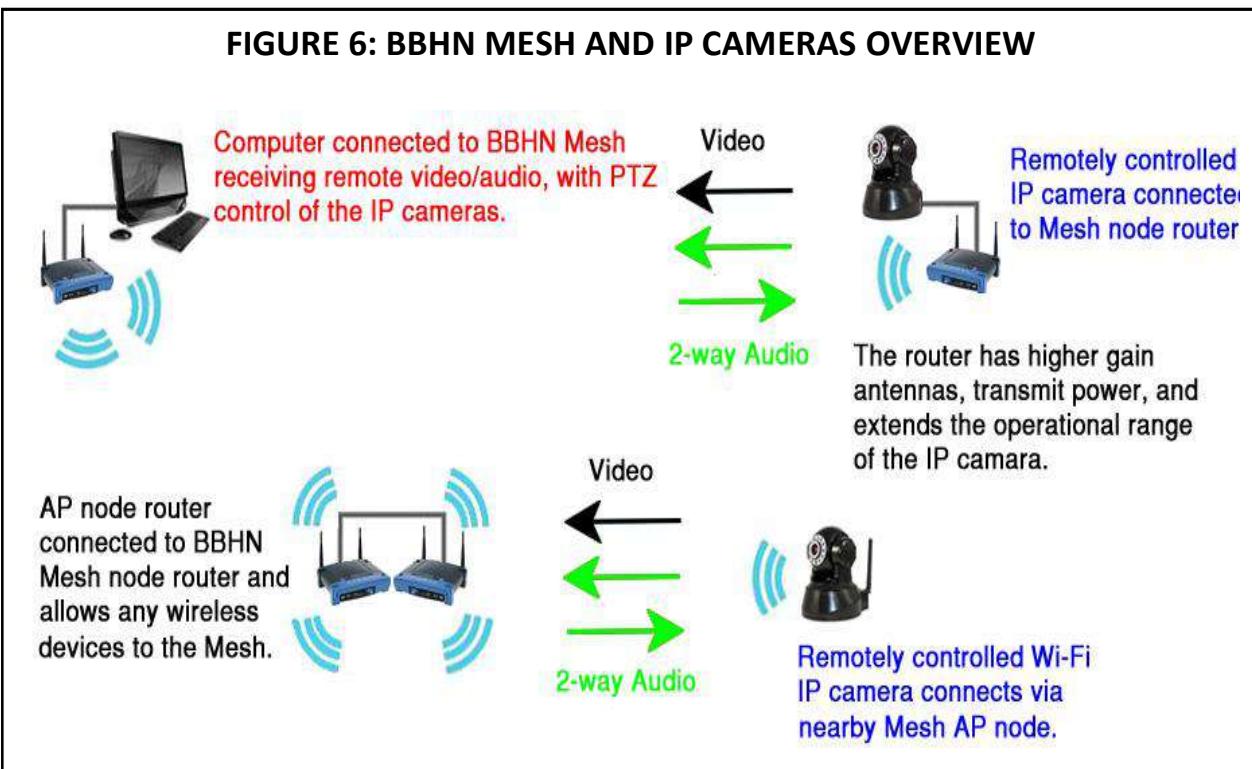
While the iSpy Connect/iSpy Server are very good free programs for general webcam use or simple IP camera control and video streaming, they aren't very easy to setup for IP audio streaming so you can both see and talk with someone on scene, but after searching for similar programs, I found Blue Iris (15-day free trial) and in under 5 minutes both my IP cameras were in streaming video and two-way audio (see Figure 5). It's that simple and easy to use!

Blue Iris setup on the host/control computer is a breeze, and it comes with many easy to use network features plus the professional version can handle up to 64 cameras (the basic free version only handles one camera). At the other end of the feed, you connect the IP camera to your mesh node router with an Ethernet cable (preferred) or use the IP camera's built in Wi-Fi to connect to connect through a wireless AP (Access Point) cabled to a mesh node router (see Figure 6).

**FIGURE 5: IP CAMERA AND BLUE IRIS REMOTE CONTROL WI-FI VIDEO FEED**



**FIGURE 6: BBHN MESH AND IP CAMERAS OVERVIEW**



## BLUE IRIS QUICK START

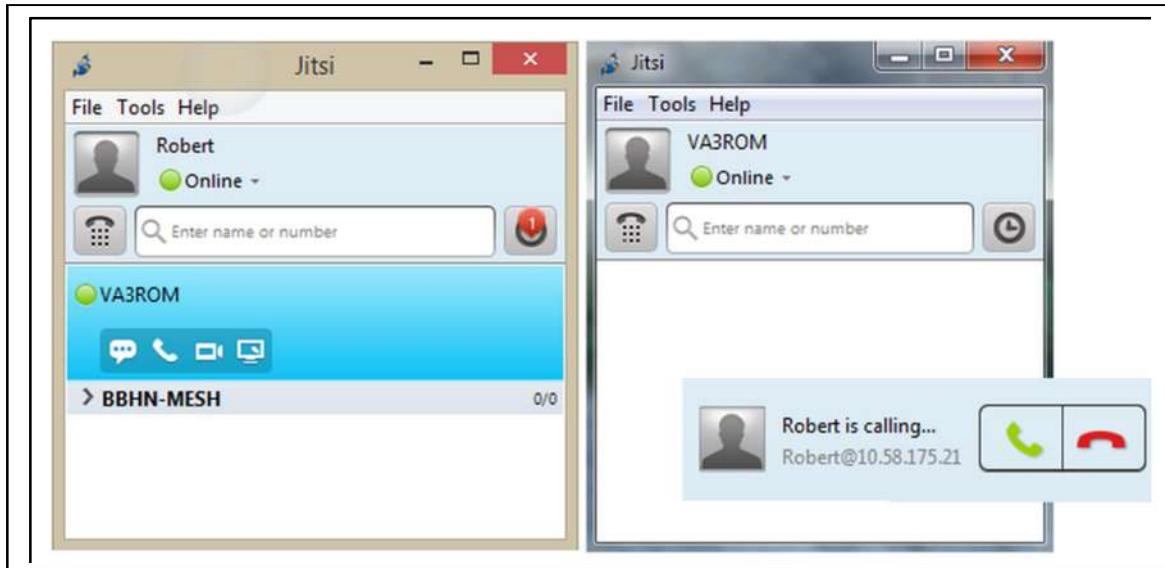
### VIDEO

1. Click 'Add camera' icon. ('Network IP camera configuration' form appears).
2. Type in the camera's IP address, port, user name/password.
3. Select camera model from the drop-down pick list.
4. Click 'OK' button

### AUDIO

5. From the 'New camera' form 'Audio' tab section, click 'Enable audio capture hardware' checkbox.
6. Click 'OK'.

If the IP camera is detected and configured properly, you'll soon see and hear the live video/audio feed, and anyone else who knows the IP address and node name/password can also access the IP camera, or you can stream a separate, controlled feed from your computer using Blue Iris. The rest of the IP camera settings are user preferences like 'Record [video/audio] on motion detection', sending email alerts, posting snapshots to a website, recording schedules, etc., but for BBHN use, I turn off all the extra features and control things manually. Blue Iris is installed on both my Windows tablet and laptop because the registration number can be easily transferred from one to the other but you can only run the program on any one device at the same time (on the same network).



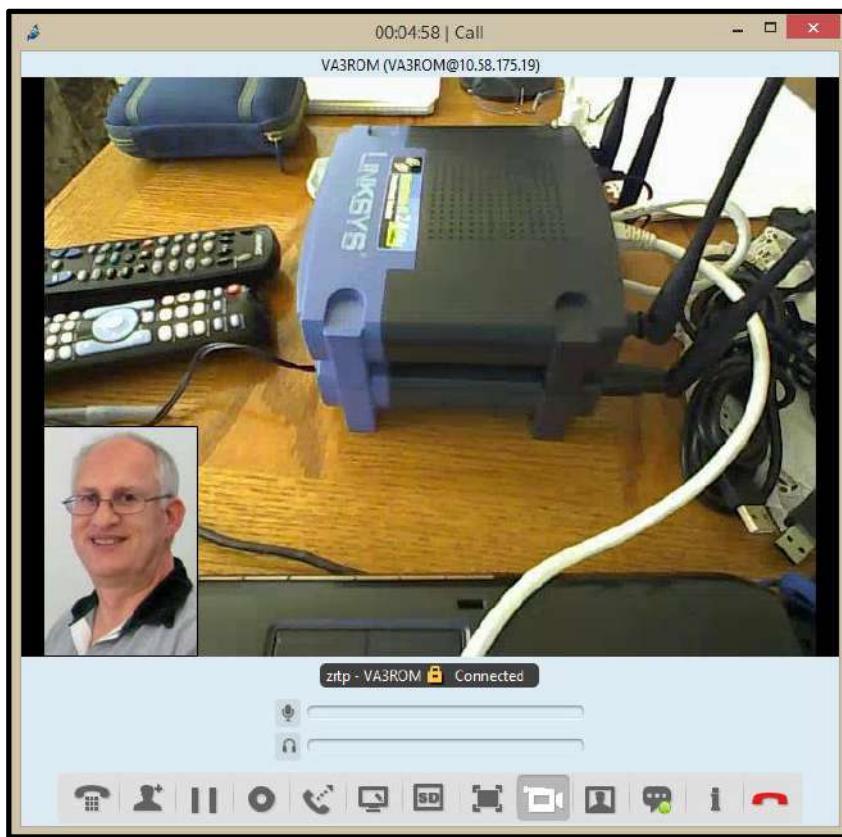
**FIGURE 7: JITSI TWO-WAY CALL STREAMING VIA BBHN-MESH NETWORK**

### JITSI ME LIKE SKYPE

You may already use Skype but Jitsi (see Figure 7) is a far more powerful (free) variant for Voice over Internet Protocol (VoIP) program used for video/audio (face-to-face) one-on-one "phone" calls, conference calls, texting, long-distance education, meetings, etc., using your computer's (or iDevice's) built-in or added-on multimedia features like webcams, speakers, microphones or other input device and a network connection (wired or wireless).

Unlike IP cameras, you can stream video/audio back and forth in two or more directions and can have many connected participants. Jitsi (Bulgarian for “wires”) is a free program (formerly called “SIP Communicator”) supporting several operating systems and many popular VoIP/text/chat systems. Because of this, many people are switching from Skype to Jitsi for regular Internet VoIP use, but the real power comes from its ability to work “off the grid” and make connections without any Internet connectivity by creating what are called “registrarless” [sic] SIP (Session Initiation Profile) accounts. The SIP is a digital communications methodology developed for VoIP that allows everyone on the same network to communicate (peer-to-peer, one-to-many and many-to-many) without needing to route through a central Internet VoIP server and is just perfect for mesh networks!

**FIGURE 8: MESH-NODE ROUTERS FOR JITSI CALLS**



pair because a static IP address is required at all times for the SIP (it's '@' + the IP address of the node).

I run Jitsi on all my computing devices and especially like using it with my Windows tablet using an AP to connect to my personal BBHN Mesh (see Figures 8 and 9). Normally, BBHN users with mesh node routers tethered to their laptops, desktops, etc., use Jitsi to contact others via the SIP account which is “branded” to the specific IP address of the router/computer

An iDevice can use an AP to connect to a BBHN SIP user but the opposite isn't as easy because the iDevice's IP address can change since it depends on the specific AP path used unless the iDevice user stays in one spot and always uses the same AP; you'll understand this point much better once you start using Jitsi. The Jitsi website has easy to follow program setup and use instructions and it's a very easy and intuitive program to use especially if you already use Skype.

**FIGURE 9: RUNNING JITSI ON MY WINDOWS NOTEBOOK THROUGH A MESH AP**



## MY FINAL

Well, that's enough meshing around—for now. This one aspect of Amateur Radio is growing by leaps and bounds plus mesh networks are really big in the commercial world because you're already using them without even knowing it!

The brilliant BBHN programmers have released new firmware for Ubiquiti routers, 5.8GHz routers plus a firmware upgrade for the LinkSys WRT series so mesh networks aren't limited to 2.4GHz and above anymore because the 70cm band is also being used by Hams with cross-banding between the GHz routers!

In the next column, we'll revisit microcontroller units (MCUs) and have a look at the Arduino Uno and some applications to go with.—73

## REFERENCES AND RESOURCES

### **BBHN (HSMM-MESH)**

<http://tiny.cc/r8kyix>

### **Blue Iris**

<http://tiny.cc/g9kyix>

### **Foscam Canada**

<http://tiny.cc/3alyix>

### **iSpy**

<http://tiny.cc/hclyix>

### **Jitsi**

<https://jitsi.org>

<http://tiny.cc/86kyix>

### **Minneapolis Bridge Collapse (video)**

<http://tiny.cc/pdlyix>

### **Wireless Networking on 420MHz (video and PDF)**

<http://tiny.cc/relyix>

<http://tiny.cc/v4kyix>

### **All Things Digital**

<http://tiny.cc/cwlyix>