

# Wi-Fi hardware setup for Raptor streaming using UniFi gear

by Playback Technologies, Inc.

## What you need

- Ubiquiti EdgeRouter-X (ER-X) wired gigabit router – this assigns IP addresses to devices on your network.
  - The ER-X assigns all IPs for all the devices on your LAN. It's cheap enough, I'd setup a backup one.
  - If all of your ER-Xs are setup as described in this document, they can be interchanged, but the IP addresses of all your devices will change, so this shouldn't be done in the middle of a show.
- UniFi access points (APs) – these are the Wi-Fi transmitter/receivers
  - Two U6-LRs were used in this example.
  - I'd buy and setup a third AP as a backup, since things can get damaged on set.
  - Please note that the Cloud Key you're setting up must stay together with the APs you're setting up as a single kit. During the setup process they become "married" together, and must be reset to move them to another network.
- UniFi Cloud Key Gen2 (Cloud Key) – this is the controller that manages your APs.
  - Please note that this Cloud Key must work together with these APs as a single kit. During the setup process they become "married" together, and must be reset to move them to another network.
- PoE injectors or power supplies for the above items.
  - We suggest powering your APs from PoE injectors in your cart.
  - ER-X and Ethernet switch should be powered from AC adapters that came in their boxes.
- Gigabit Ethernet switch – this allows you to plug more than 4 devices into your network.
  - 8 ports is likely big enough. Count the devices you'll plug in to be sure.
  - A Netgear GS108 is a good choice, as it's front panel LEDs show both connection speed and activity.
- Ethernet cables (Cat5, 5e, or 6). Here's a list of cables you might use to hook up our example network:
  - 4 x male-female (M-F, or extension) cables, 3 to 6 feet long.
    - Leave one attached to each AP for easier setup and tear down.
    - Keep two hanging out of your cart, so you're able to completely remove long Ethernet cables.
  - 2 x long cables (100-200 feet, 300 feet is the longest cable you can use), for cart to AP connections.
    - Since M-F cables add more connections, their use might reduce the maximum available connection length. For example, you might find that 300 foot cables won't work while 200 feet work OK..
  - 7 x short cables, 1 to 3 feet long, to make Ethernet connections inside cart.
- A Computer (Mac or PC) with wired Ethernet connection (for router setup) and Ethernet cable is needed during setup.
- Smartphone or tablet with "UniFi Network" app installed is needed to perform this setup. Actually, Android phones might not work well. A tablet or computer is best if you want to manage your network while on set.

## Things you must choose

- EdgeRouter-X password (secret) \_\_\_\_\_ (we suggest keeping ubnt as the username)
- UniFi Cloud Key Gen2 (UI.com) login (secret): \_\_\_\_\_ and pwd \_\_\_\_\_
- Wi-Fi network name \_\_\_\_\_ and pwd \_\_\_\_\_
  - *NOTE: Your clients will need the above name and password to log into your Wi-Fi network.*
- Cloud Key (UCK) name \_\_\_\_\_
- AP #1 name: \_\_\_\_\_ AP #2 name: \_\_\_\_\_
  - We suggest the names on these last three lines be related.
  - For example, if your Wi-Fi network name is "BobVideo1", your Cloud Key could be "BobVideo1-UCK", and your APs could be "BobVideo1-AP1", "BobVideo1-AP2", etc.

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## Setting up EdgeRouter-X from a computer with a wired Ethernet connection.

As presented in this document, please setup ER-X first, then hook up and setup other components.

The following instructions set LAN connections eth1, eth2, eth3, and eth4 so they're available to your computers and devices. eth0 will be set to hook up to the internet, so it will not be available for computers in your cart.

ER-X should be new, or reset to factory specifications.

- Plug an Ethernet cable directly between your computer and the eth0 port on your EdgeRouter-X. Power on the ER-X and computer.
- In the next step, you'll set manual networking parameters. The following two blocks describe where to do this on either MacOS or Windows.
  - *The networking parameters are set on MacOS in System Preferences / Network. Click your wired LAN adapter in the list on the left side of the window, then choose "Manually" vs "Using DHCP" under "Configure IPv4". If you choose Manually, you'll then be able to enter the numbers, below.*
  - *In Windows, go to "Settings" / "Network & Internet", then click the "Properties" button under "Ethernet". Click the "Edit" button under "IP assignment" to choose "Manual" vs "Automatic (DHCP)". If choosing Manual, you must also click to set "IPv4" to "On", then enter numbers, below.*
- Set the computer networking parameters to manual, with the following settings:
  - IP or IPv4 address: 192.168.1.100*
  - Subnet mask (if present): 255.255.255.0*
  - Subnet prefix length (if present): 24*
  - Gateway (or router): 192.168.1.1*
  - DNS (if present): no entry needed*
- Open a browser on your computer and navigate to 192.168.1.1 to manage your EdgeRouter-X.
  - *Ignore any "certificate error" or other security warnings when you open this page.*
  - *You may need to click "Advanced", then "Proceed to 192.168.1.1"*
- Log into the router – the default user and password are both ubnt
- When the router interface appears, verify that it's running firmware version is 1.10.9. The version is displayed in the top left corner of the interface. If it's not v1.10.9, please download and install that version as described in the section titled "How to update EdgeRouter-X firmware from a computer".
  - *Firmware v1.10.11 and v2.0.9h2 change IP address assignments every time the ER-X cycles power.*
- At "Basic Setup" / "Do you want to start with the Basic Setup Wizard?", click "Yes".
  - *If you didn't get that question, click "Wizards" in the top right corner, then click "Basic setup" in the top left corner of the main window.*
- Assign new IP address range
  - In the central part of the screen, click "LAN ports (eth1, eth2, eth3 and eth4)" to expand that section
    - *NOTE: If you don't see this section heading, click the gap in the box underneath the box surrounding "One LAN" to show "Address" box*
  - At "Address", enter 192.168.5.1
- Under "User setup", enter the password you want to use to manage your EdgeRouter-X under "Password" and "Confirm password".
  - *You may change the user name from ubnt, if you'd like.*
  - *NOTE: Nobody else will need to know this user and password information.*
- Click "Apply" button, then in the windows that appear, click "Apply Changes", "Reboot", then "Yes, I'm sure" to restart router.
  - *Wait a few minutes for router to write changes and restart.*
  - *Move Ethernet cable plugged into ER-X over to a port that's not eth0, since that port will not be utilized in this configuration.*
- Set the computer networking parameters back to "Using DHCP" or "Automatic (DHCP)".

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## Hook up power and Ethernet to all components

*NOTE: Please turn off AC power while hooking up all components.*

- Ethernet switch
  - Get gigabit Ethernet switch and AC power adapter.
  - Plug power adapter into AC power outlet and plug the other end into the Ethernet switch.
  - *NOTE: It would be best if you're able to see the front panel LEDs on your Ethernet switch. A damaged cable may only connect at 100mbps instead of gigabit, before it's bad enough to fail completely.*
  - *NOTE: All Ethernet ports on the switch are the same and can be used for any of these connections.*
- Cloud Key
  - Get Cloud Key and PoE injector.
  - Plug PoE injector into AC power outlet.
  - Connect a short Ethernet cable between Ethernet switch and the LAN port on the PoE injector.
  - Connect a short Ethernet cable between Cloud Key and the PoE port on the PoE injector.
    - *NOTE: It's best if your Cloud Key is positioned so you can see it's LCD front panel. The IP address it displays is where you'll go if you want to manage your network while on set.*
- Access Point
  - *NOTE: repeat this section for every AP you're setting up.*
  - Get AP and PoE injector.
  - Plug PoE injector into AC power outlet.
  - Connect a short Ethernet cable between Ethernet switch and the LAN port on the PoE injector.
  - Connect a M-F Ethernet cable to the PoE port on the PoE injector.
  - Connect a M-F Ethernet cable to the AP.
  - Connect a long Ethernet cable between these two M-F cables.
- Ethernet router (ER-X)
  - Get ER-X and power adapter.
  - Plug power adapter into AC power outlet and plug the other end into the Ethernet router.
  - Connect a short Ethernet cable between your switch and port eth1, eth2, eth3 or eth4 on the ER-X.
- Other devices
  - Raptors, Videohubs, or other computers should be attached to your network with an Ethernet cable. These can be plugged into any free port in your Ethernet switch.

*NOTE: After all components are hooked up, please turn on the AC power.*

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## Setup UniFi CloudKey Gen2

- Setup ER-X as described earlier in this document.
- Attach Ethernet cable (with internet access) from your home or office network to ER-X port eth0, leaving other connections (from steps on previous page) in place. This internet connection will only be needed while doing initial setup of these components.
- Run “UniFi Network” app (from Ubiquiti) on iPhone or iPad with internet access.
  - Grant it the permissions it requests.
  - It will probably discover your Cloud Key (UCK-G2) automatically. If it doesn’t, click “Setup new device”, to find your Cloud Key.
- Click “Set Up” at “One device found”.
- Enter name for your Cloud Key, as selected on initial page of instructions. Click “done” or “Next”.
- If you don’t have a UniFi account, create one at “Create UI.com account”.
  - If you already have one, click “I already have an account”, and enter your username and password on the next page and click “Done” or “Next”.
  - *You might see an iCloud “Save password” dialog appear, where you can click “Save Password” or “Not Now”.*
- Click “Finish” at UniFi Network, keeping all default selections.
  - UniFi will display “Setting up Network”, then “Finishing up”. This process should take about a minute.
  - *If UniFi Network asks to send you notifications, we suggest you grant this permission.*
- You should now see a window with the name of your Cloud Key at the top, and 5 tabs along the bottom. It should say “No active clients” under “Clients”.

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## Setup Access Points

- Click on the “UniFi Devices” tab (the “two circles” icon along the bottom of the window that looks like a UniFi AP) to show your UniFi devices. You should see all your APs listed, each on it’s own line.
  - *If any of these devices have a little blue graphic just to the right of the name, that looks like an arrow pointing down onto the top of an IC, that means it’s got a firmware update available. Please apply firmware updates to all devices now, before proceeding.*
  - Applying Firmware Update
    - Click on a device that has a firmware update available. At the bottom of the detail window, click “Upgrade to...” button.
    - Click to confirm that you want to upgrade the firmware, then click the back button to display the previous list. You should see an orange “UPDATING” status while the firmware update is happening.
    - Wait for all APs to say “READY TO ADOPT” before continuing.
- Click on the first AP that says “READY TO ADOPT”.
- At the bottom of the next page, click “+ Adopt Device”.
  - *The orange device status will change to “ADDING”, then “GETTING READY”.*
  - When it shows “CONNECTED” in green, continue to the next step.
- Click the blue “Configure” label in the upper right corner.
  - Click “Alias”, and enter the name for this AP, from the first page of this document.
  - Tap on “Band steering”, and set it to “Prefer 5 GHz”.
  - Click blue “Save” in the upper right corner of this window.
- Click left arrow in upper left corner of the window to return to your list of APs.
- The AP you just setup should now show a solid blue LED. Now is a great time to go put a label on the AP, so you can tell them apart (if they’re all the same model).
- Repeat steps in this section until all your APs have been setup.

## Setup WiFi network.

- Click the “Settings” tab (the icon at the bottom of the window that looks like a gear), then click “WiFi”, and click “Add new WiFi Network”.
- At “Name”, enter your Wi-Fi network name (chosen on page 1)
- At “Password”, enter your WiFi network password
  - *If you’re using an iPhone or iPad, you may need to click “Choose my own password” before you’re able to enter your password.*
- Click “Add” to create the WiFi network.
  - *NOTE: Mesh networking is enabled by default.*

## Finished!

- Unplug the Ethernet cable (with internet access) from your ER-X port eth0, and you’re all done!

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## Network management

- If you're connected to the internet, the UniFi Network app can manage some aspects of your network. However, when your network lacks an internet connection (like when you're on set), the UniFi web interface lets you manage all settings.
- The web interface is easier to use from a larger display, like an iPad or computer.
- From a web browser on a device connected to your network, navigate to the IP address shown on the front panel LCD of your Cloud Key, and log in with your UI.com credentials.
- If you're going to use the web interface, we suggest turning off the "new UI" option. Some users have reported that the new UI doesn't yet offer all the controls of the "classic UI".
- If you find yourself using the UniFi web management interface often, you might want to set your Cloud Key to have a static IP (like 192.168.5.5), so it won't change, making it easier to get to from an iPad or computer. You can do this from the web interface.

## Wi-Fi channel bandwidth

- UniFi devices currently default to using 40Mhz channels for the 5Ghz radio, and 20Mhz channels for the 2.4Ghz radio. We've left these default values in this set of instructions.
- There are often many Wi-Fi devices on set, and streaming video doesn't require too much bandwidth.
- If you have trouble getting good Wi-Fi connections on set, changing your 5Ghz radio to use a 20Mhz channel bandwidth might make it easier for the AP to connect with all your devices, but it will limit the Wi-Fi speed each device will receive. But, streaming video doesn't need much Wi-Fi bandwidth, so 20Mhz channels should be fine. You would make this change in the UniFi web interface.

## Resetting router or access point to factory specifications *(optional)*

- Power on device, let it sit for a few minutes so it's completed it's power-on sequence.
- With power still applied, find the "Reset" hole in the rear panel, and gently push a straightened paper clip through the hole, depressing the hidden button inside. Keep the button pressed for 10 seconds, then release.
- The device will restart. When it comes up, it will be reset to factory specifications.

## EdgeRouter-X notes

- The EdgeRouter-X (ER-X) takes about 75 seconds to power-on and start serving IP addresses. Your computers might assign themselves an auto-config IP address (that looks like 169.254.x.x) while waiting on the ER-X to start.
- We tested the Ubiquiti Security Gateway (USG), as an alternate router. It takes about 2.5 minutes to start (which is about twice as long as the ER-X), and when it starts, it doesn't announce its presence to the Raptor, so the Raptor doesn't automatically get an IP address. The ER-X is a far better solution for VA carts.
- We've found that ER-X firmware v1.10.9 works well. Some newer versions (at least v1.10.11 and v2.0.9 hotfix 2) have a problem where they don't serve the same IP addresses to devices after a power cycle of the router.
- A router should provide the same same IP address to devices after everything powers off and back on.

## iOS Wi-Fi "Private Address" feature

- iOS 14 Wi-Fi "Private Address" feature causes iOS device MAC addresses to change often, which causes a router to assign a different IP address as often as every day. This can be disabled by going to Settings / Wi-Fi, tapping on the VA Wi-Fi network, and setting "Private Address" to off.

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## How to update EdgeRouter-X firmware from a computer (optional)

- Download firmware update file
  - On an internet-connected computer, navigate to: <https://www.ui.com/download/edgemax/edgerouter-x> to download the latest firmware file for your router.
- Hook up EdgeRouter-X to computer
  - Plug an Ethernet cable directly between your computer and the eth0 port on your EdgeRouter-X.
  - Disable Wi-Fi on this computer (if present)
  - Set the computer networking parameters to “Manual”, with the following settings:
    - *IP or IPv4 address: 192.168.1.100*
    - *Subnet mask: 255.255.255.0 (if present)*
    - *Subnet prefix length: 24 (if present)*
    - *Gateway: 192.168.1.1*
    - *DNS: not needed (if present)*
  - Open a browser, and navigate to 192.168.1.1 to open the EdgeRouter-X management screen.
    - *Ignore any “certificate error” or other security warnings when you open this page.*
    - *You may need to click “Advanced”, then “Proceed to 192.168.1.1”*
  - Log into the router – the default user and password are both ubnt
- Update firmware
  - At the bottom left part of the page, click “System”, scroll down to “Upgrade system image” and click the “Upload a file” button. Select the firmware file you downloaded, earlier.
  - *NOTE: When you start uploading the file, circular arrows will start moving – the upload takes a long time --between 1 minute and 10 minutes. When the upload is complete, your browser will offer to download a file called “upgrade.json”. This may be your only indication that the firmware update has completed – the circular arrows will still be moving.*
  - If you see an “Upgrade Complete” window, click “Reboot”, then “Yes, I’m sure” to reboot the router.
    - *Instead, if your browser offers to download “upgrade.json”, you don’t need to download it. Instead, just scroll down to the “Restart device” section, and click the “Restart” button. You’ll need to click a few more confirmation buttons, and then your EdgeRouter-X will restart.*
  - After your EdgeRouter-X restarts, log into the router again, and verify that the firmware version reported in the top left corner matches what you installed.

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## Goal

Provide a Wi-Fi network so iPads and iPhones connected to the Ethernet network in a Video Assist cart can watch locally streamed video.

## Networking 101

A network is a collection of computers and computer-like devices that can communicate with each other.

This document will instruct you on setting up a local area network (LAN) that includes a wireless access point (AP) for streaming over Wi-Fi. Ethernet is the standard for physically connecting all these devices. Ethernet supports wired connections between devices using Ethernet “category cable” and connects wirelessly using the well established Wi-Fi standards.

TCP/IP is the communication protocol that lets your Raptor, iPads, iPhones, MAC laptops, and even your HD-SDI router talk together over Ethernet and Wi-Fi on your LAN. It requires each device to have a unique identifier, called an IP address.

Normally, there is a single router on any network whose job it is to assign a unique IP address to every device, by using dynamic host configuration protocol (DHCP). We will setup your Ubiquiti EdgeRouter to assign IP address to the devices on your network. (A switch is often confused with a router, but a switch only provides additional wired Ethernet connections to expand the number of devices attached to the network, without providing DHCP services.)

The Ubiquiti EdgeRouter offers many advanced features and configurations that we will not use, including creating multiple networks, VLANs and being able to create multiple DHCP servers. Do not be overwhelmed – just follow the step-by-step instructions.

## Networking 101 - a little deeper

IP addresses are 32-bit binary numbers. We humans do not efficiently read binary strings of numbers - can you imagine memorizing a 32-bit long number like 1010 0101 1111 0000 1111 0000 1010 0101? A 32-bit IP address is subdivided into four 8-bit segments called octets. The four octets are written in “dotted decimal” to make them more manageable to write out and remember. An IP address in dotted decimal notation looks like 192.168.5.38.

IP addresses are divided up into special “classes” and uses. Most IP addresses are for connecting private networks and computers to the public internet, but some are reserved for private networks (intranets) like we will use. IP addresses in the range of 192.168.0.0 to 192.168.255.255, 172.16.0.0 to 172.31.255.255, or 10.0.0.0 to 10.255.255.255 are reserved for private networks.

With a gigabit router wired into the cart, network settings will not change when you connect or disconnect your Wi-Fi access point. The router assigns IP addresses to wired and Wi-Fi devices in the 192.168.5.x range.

You will need a laptop or other computer with a wired Ethernet connection to perform the initial set-up of both the Ubiquiti router and the Ruckus access point. You will connect to each of these devices one at a time, to perform their setup.