REMOTE PRODUCTION WITH LIVEU

A deep dive into remote production and LiveU technology

TABLE OF CONTENTS

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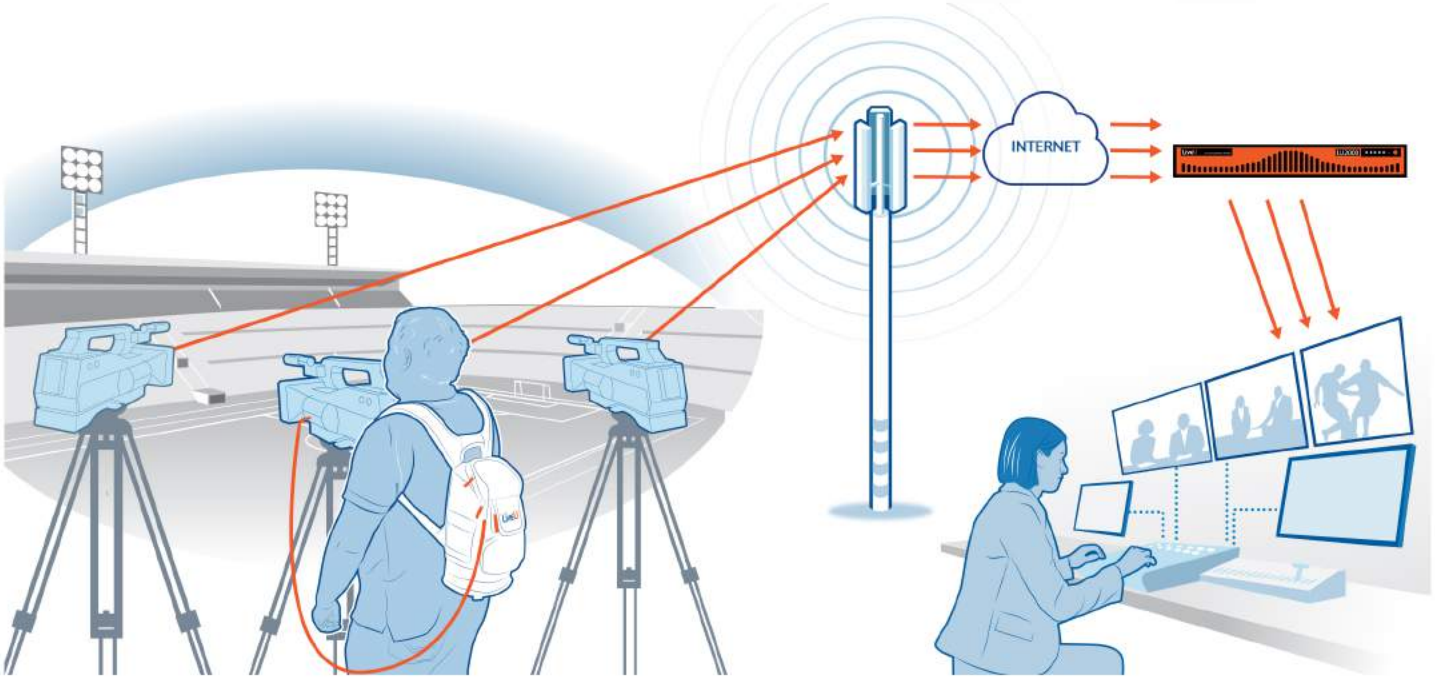
Traditional in-house productions involve technologies like tally, genlock, camera control, and producer-to-camera operator communications that are simple to implement in most studios and even stadiums via cabled or wireless connections. This white paper will show how all of these technologies can be replicated for remote productions via a number of LiveU products and integrated technologies.

As an overview, LiveU sells field units, encoders, receivers, and associated products that enable remote camera operators to send a signal from the event location to the production location using bonded cellular, Wi-Fi, and/or Ethernet connectivity. At the production location, the signal is decoded into an HD-SDI stream that can be input into the production like any other HD-SDI input. This form of remote production is often called Remote Integration, or REMI.



As you'll learn in this document, LiveU has engineered a number of technologies and protocols to enable many of the tools and workflows utilized in studio productions to be used in REMI productions.

FRAME SYNCHRONIZATION & GENLOCK

When shooting the same event with multiple cameras, having all of the camera feeds in sync is an important element. Otherwise, cutting from one camera to the other during production may create a jump forward or back in time which is visible to the user, such as a player being in a different location than the first camera angle. Systems that ensure frame synchronization, even when using units in very different locations, prevent this effect.

All LiveU units have some options when it comes to frame synchronization. LU600 and LU300 units on version 8.6 and earlier use **Precision Sync technology**. This allows units to be within +/- 2 frames of each other, even when no other further sync is used except for genlock on the receive unit (LU2000 and LU4000) output. This range can be reduced to +/- 1 frame if the sources are also genlocked, though it is not always possible (see the next sections).

The LU800, and any unit using version 9.0, is capable of perfect synchronization if the sources are also already in sync. If the sources are not already in sync, the synchronization is +/- 1 frame.

THE IMPACT OF GENLOCK

Genlock (Generator Locking) is a technique used to synchronize the output of multiple cameras shooting the same event. Most cameras input genlock as a signal over cable, often on a BNC connector. However, in many venues this cable connection isn't possible, though there are some wireless solutions available.

Note that many REMI productions do not genlock the cameras. The result is that even if other systems in the video chain, such as LiveU, have perfect synchronization, your end synchronization may be +/- 1 frame due to the initial signals being out of sync. Often, this +/- 1 frame is acceptable for REMI production, thus saving you the complexity and cost of genlocking all cameras.

CAMERA CONTROL/CCU

Camera Control Units (CCU) stands for a range of equipment and operations that enable some camera functions to be controlled remotely, typically over some sort of high-bandwidth connector such as fiber or triaxial cable. The camera operator still frames the shots, adjusting positioning, focus, and zoom, but the remote operator can adjust white balance and other camera color and video processing features that in total make up the camera's "paint" or its display of the view of the camera. Centralized control over these functions ensures consistent color for all cameras, which promotes smoother visual transitions when switching from camera to camera during the production.

Production cameras traditionally include the CCU as a physically separate hardware unit, but in some modern cameras may be entirely software or only be optional add-on features to cameras. For most cameras today that use a physical CCU, there are still software and digital controls over the functions of the CCU. This is where remote control comes in – the physical camera CCU may use a high data rate, relatively short distance connection (such as fiber or triaxial cable), but the software controls can be used from anywhere in the world that can access the local IP of the camera and its CCU.

LIVEU IP PIPE

The "local IP" is a key idea here – camera CCUs rarely include a built-in way to access these functions from across the public internet. They assume instead you will provide a VPN, tunnel, or other technology to access the IP address of the camera and take control of it. This is exactly where **LiveU's IP Pipe** comes in. It is a tunnel between the physical ports on your unit and the physical ports on your LU2000 receiver, or a virtual ethernet port in the cloud.

Using IP Pipe to control your camera's CCU takes a little bit of planning, and a bit of network know-how, but once configured, operation should be as easy as starting the IP Pipe tunnel and using the control software or hardware to control the camera. Remote operation is typically camera specific, and all productions use different networking schemas that address various security concerns. Of course, LiveU support can help you with detailed steps to get configured and up and running. Once accomplished, whatever connection method you would have used locally, you can also use over IP Pipe – for example, you could have a DHCP server in your production facility and DHCP (since it's a Layer 2 protocol) will be transported over the IP Pipe and devices on the far side will see it and use it.

CAMERA ROBOTICS OR PTZ CONTROL

The use case here is different from remote camera control, but the configuration and setup are very similar. PTZ cameras and robotic cameras and rigs also allow IP control – sometimes from a user interface served directly from the camera, sometimes from software, and sometimes from hardware such as a joystick and control box. In all cases though, those control options are communicating to the camera over IP, which will be routed over IP Pipe. As with CCU control, making the remote connection will vary from device to device, with considerations around security and networking identical to above.

TALLY LIGHT

Camera operators, producers, on-camera talent, and other production workers benefit from knowing which camera is live at a given moment during the production. In a studio or cabled production environment, your software or hardware switcher can trigger a **Tally Light** based on which camera is currently live. However, in REMI mode, you must transport that trigger to the remote location. You have several options for this, depending upon your camera gear and switcher.

DIRECT USING THE LIVEU TALLY LIGHT

LiveU Tally Light is a standalone, USB LED Light that can be attached to virtually any camera and LiveU field unit. In the production facility, you then wire the GPIO output by your switcher of choice to the LU2000 receiver (via a GPIO to USB converter), and the LiveU Tally Light triggers (lights) whenever the switcher tells you it's live. This makes LiveU Tally Lights a good fit for cameras with no built-in tally function, or situations where the next two setups are not possible due to other limitations, such as cameras not having software support for Tally.

INDIRECT USING GPIO CABLE

Some cameras have built-in tally light function, which may even display in the viewfinder so that the camera operator can more easily see it. Such cameras will have a GPIO connector on either the camera itself, or on the CCU, to trigger the on-camera tally. You can also directly support this case using the LiveU Tally Light, as it has a pin-out connector that triggers a GPIO closure when the light is triggered. You connect the LiveU Tally Light into the Camera or Camera CCU, and whenever the tally light is lit, it triggers the GPIO and the camera's tally functions. You'll need a special cable from LiveU for this setup, so speak to your LiveU specialist if this is the setup you are using.

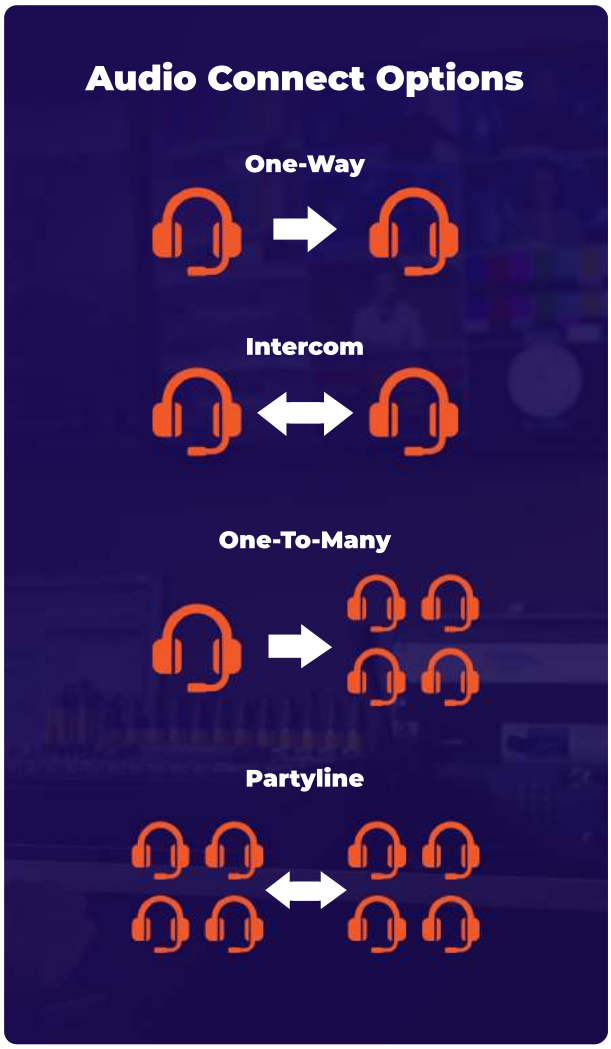
VIA IP PIPE

A last method of triggering tally is purely via software. In this case, some software controller at the production facility sends an IP signal to the camera, or to another device at the event location that lights the tally or triggers the camera's native function. In such setups, you will use IP Pipe to route these signals from the production location to the event location.

One possibility to consider – if the IP signal must make it to many camera locations in this setup, and those locations are not wired for ethernet networking, you could consider a private WiFi network, locked off to public or other use but extending the IP Pipe networking all the way to the camera locations.

AUDIO & COMMUNICATIONS

Having covered most of the connections physically related to the camera, let us now plan how to communicate between the crew and talent at the production location, and the crew and talent at the event location. This communication needs to be low latency and two-way. There are two options to solving this setup – using the built-in mic and speaker connectors on LiveU units or using IP pipe to route IP-based intercom back and forth between two locations. Your choice will depend largely on the comms system you already use.



COMMS WITH AUDIO CONNECT

Audio Connect is two-way, low latency audio communication between the LiveU field unit and the LU2000 or LU4000 receive server, even if that server is cloud-hosted. Audio Connect lets you plug into a two-way audio channel per LiveU channel, usually using analog connectors such as XLR. Workers at the event location then hear and speak to people at the receiver location using a headset or other mic and headphones or speaker plugged into the 3.5 mm, TRRS jack found on all LU units.

This, like all our steps above, benefits from a bit of pre-planning. For example, do you have analog in and out connections from your existing comms system? Do you need the protection of bonded connections on the audio? Is it important the audio be available directly from the unit's connector? If the answer to any of these questions is yes, you need Audio Connect, and you may need to add on to your existing comms system to ensure it has the right analog jacks to connect to all LiveU units in question.

COMMS WITH IP PIPE

Alternatively, if you already use an IP based intercom system, and do not need that system to interact with the headphone jack on the LiveU units, you may want to route your IP intercom system over IP Pipe. This is straightforward, as IP Pipe makes a Layer 2 bridge between any of your LU2000 receivers and your LiveU units. In this setup, one of the IP streams routed over that bridge would be your intercom stream, and any software or hardware normally used to receive that intercom stream would be used in the remote location.

TELEPROMPTER

Video: check, Audio: check, Communications: check. What else is involved in a production? Sometimes, depending on the location of your talent in your exact REMI model, you may need a teleprompter at the event location, but with the actual teleprompter data fed from the production location. Similar to other out-of-band feeds outlined above, there are two options when you need to route prompter data from the production location to the event location.

VIA VIDEO RETURN

One option for your teleprompter feed is LiveU Video Return. This uses a 1U rack mount software encoder at your production location, which accepts SDI input, and sends that video to multiple units in the field, including the LU600 and LU800 (LU300 does not support video return). On the LU600 and LU800, you can see the video feed on the unit's screen, or via a mini-HDMI connector on the unit. You can then plug this HDMI into your prompter hardware at the event location.

The video return feed uses the same connections the LU600 and LU800 is already using (similar to Audio Connect). Once you select to add on this option and configure the Video Return Server at the production location, the remaining setup is plug-and-play.

VIA IP PIPE

If your prompter of choice can be controlled or programmed over IP, you can have the prompter hardware in the field and the management console or software at the production location, and use IP Pipe to bridge those two.

ON-LOCATION MONITORING

Often, it's useful to monitor the fully produced feed at the event location. It could be as simple as an on-site producer who wants to see the "product." On-location monitoring may also be important when you have announcers on-site instead of at the production location, or other talent that needs to see the current live feed. Whatever the use case you can enable on-location monitoring via Video Return.

VIA VIDEO RETURN

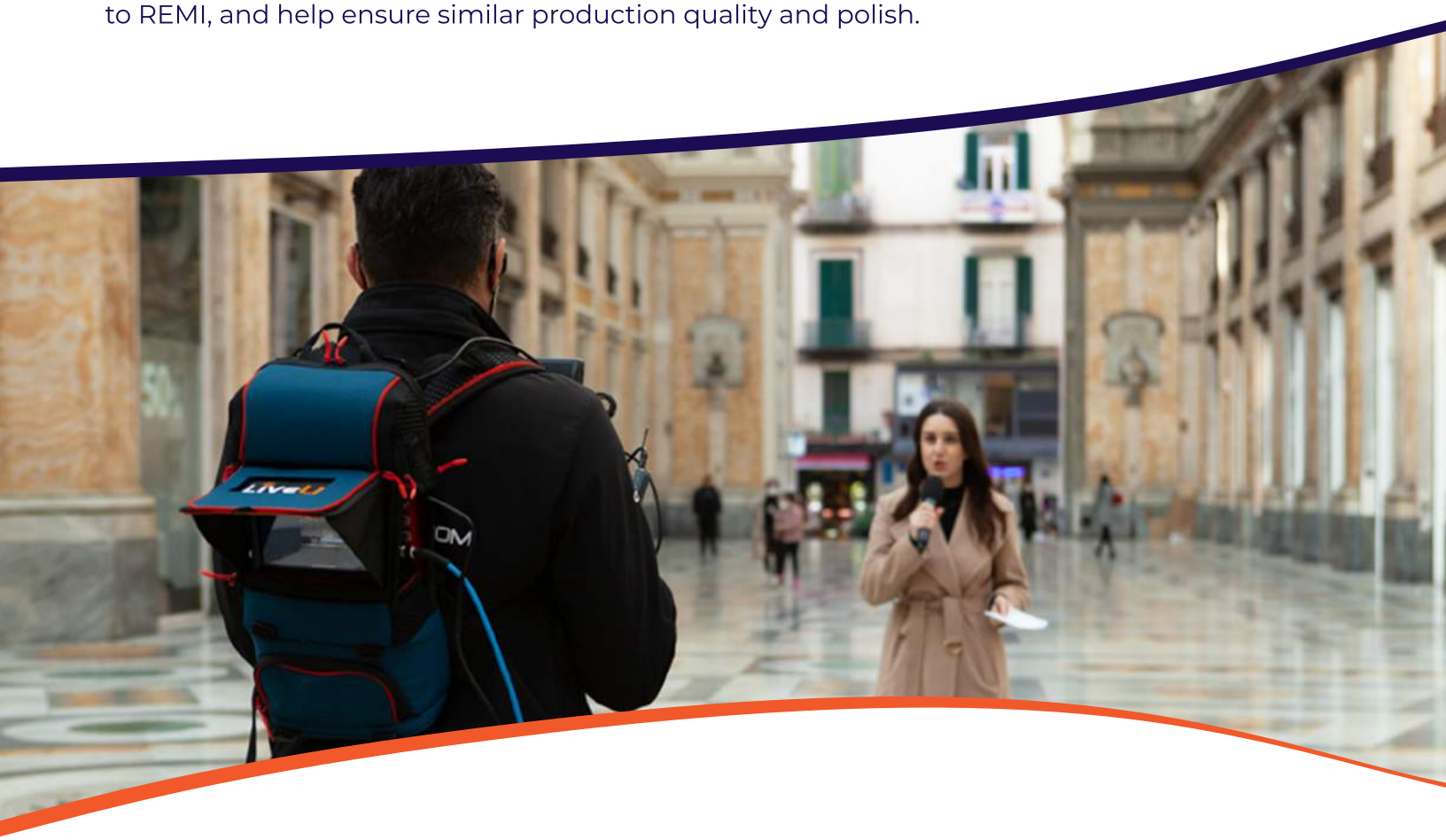
The primary method is with Video Return, described under the prompter section. You can send a high-quality feed from the production location to multiple units in the field to be viewed on the screen on the unit or via its HDMI connector.

An important note, each Video Return Server can accept up to two inputs, and on each unit, you can rapidly switch between different available video return feeds. So, if in your planning you opted to use Video Return as your solution for prompter, for example, you can also use it as a solution for remote monitoring. You can make a decision unit by unit which video return feed you are seeing and can switch as your needs during the production change.

And as noted, this may be a third or more stream in your list of available Video Return streams. It does not need to block other uses of Video Return, you just need to plan accordingly on the number of video inputs you need at the production location via Video Return Servers.

SUMMARY

REMI production is an increasingly popular alternative for many video producers. As described in this document, LiveU products and technologies enable you to deploy and use many of the same production technologies and techniques that you use in your studio in your REMI productions. This should simplify the transition to REMI, and help ensure similar production quality and polish.



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