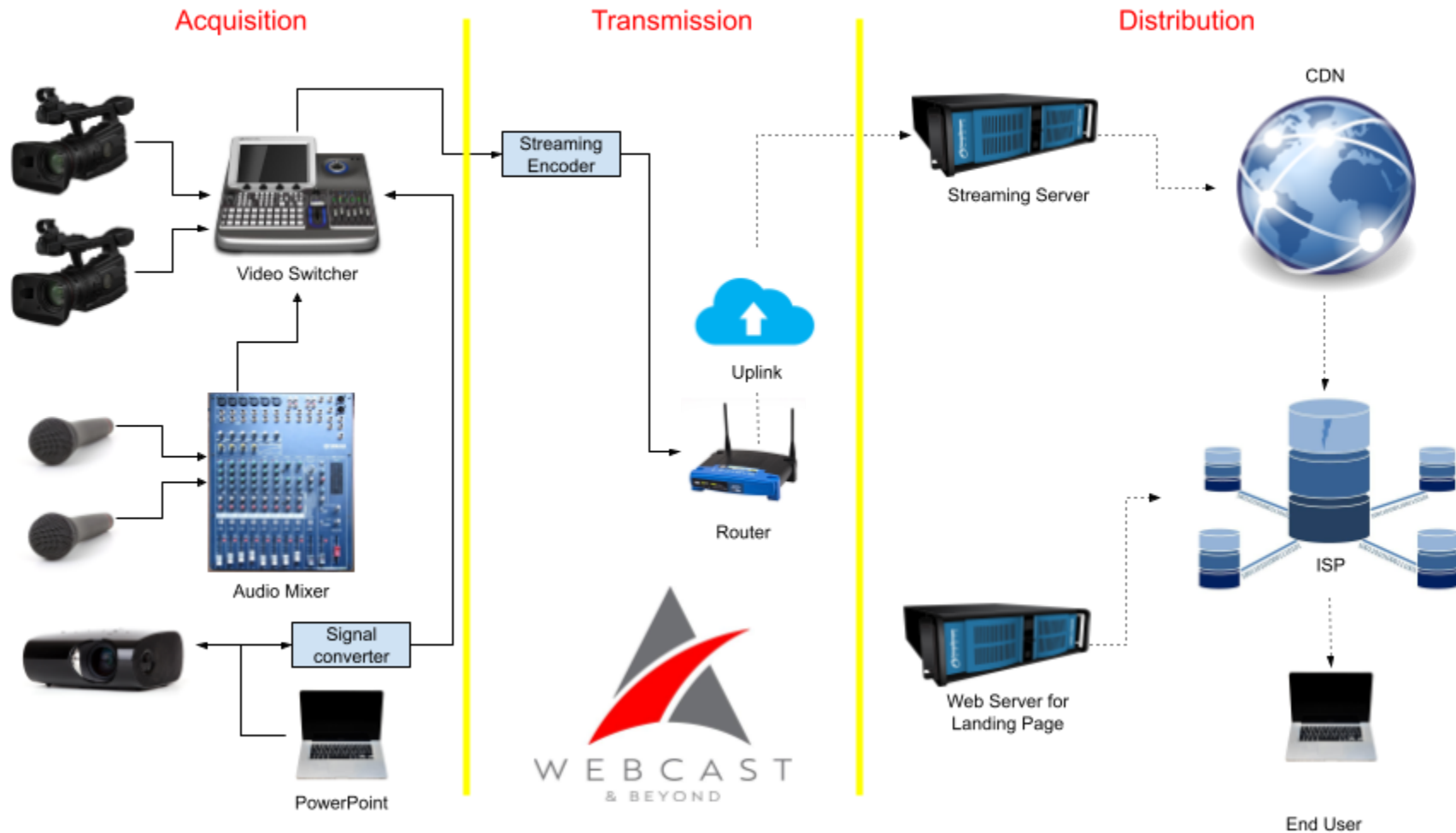


Event Live Streaming Cheat Sheet



Unravelling the Mystery of Live Streaming

Our intent is to educate you, the event coordinator/producer, about the overall live streaming process. This applies whether you are planning to do the job yourself or hire a professional live streaming provider. You might be wondering why you should bother reading this if you are hiring someone to take care of the details for you. Well frankly, it's in your best interest to have a top-level understanding of what's involved so that you can be informed of your options and choose the right vendor for your particular event.

The Live Streaming Process

In its simplest form, the live streaming process can be divided into three phases: Acquisition, Transmission, and Distribution (refer to the diagram above). If you follow the signal flow via the arrows on the diagram, it looks fairly simple except perhaps understanding what some of those components are doing. Keep in mind that there are many variations that are possible with the signal path. What's shown here is the most straight-forward concept for sake of illustration. So let's take a closer look at each phase and discover the important take-aways.

Acquisition



This is the front-end production side which includes the cameras, microphones, PowerPoint images, pre-recorded videos, titles, graphics, and video switcher. In short, all the equipment and crew that make your event look and sound like a professional television broadcast. All the various input devices end up being routed to the video switcher which cuts between cameras, adds video effects and in many cases adds the graphic elements as well. Presentation and other visual media shown to the local audience has a Signal Converter box attached to the PowerPoint computer. This device converts the computer output into a high definition video signal that is compatible with the video switcher. The person operating the video switcher is often the Technical Director, whose job it is to direct the camera operators. The video switcher has a master program output signal that can be recorded and also routed to the Transmission phase.

Here are the questions you need to consider:

1. How many cameras do I need?
 - **One camera** is sufficient for very simple events, perhaps an announcement or a press conference. With one camera it may even eliminate the need for a video switcher (so long as you don't have to add visual media to the live stream).
 - **Two cameras** are the most versatile. With two cameras you have the ability to cut from close-ups to wide shots instantly without the need to pan and zoom which looks very unprofessional.
 - **Three or more cameras** are needed for large scale productions such as concerts, sporting events, talk shows, and award ceremonies. These types of productions may have traditional tripod mounted cameras along with roving hand-held cameras, crane mounted cameras or even iPhone cameras.
- What about covering the **audience**? You might want to get **reaction shots** from audience members or field questions from the floor.
2. What are my audio options?
 - **House PA system** - Most events that have a local audience also require a PA system. In this circumstance it makes sense to take a feed from the house PA. It won't be necessary for the live streaming crew to duplicate what is already in place. The house audio engineer and equipment could be provided by the venue or sometimes the live streaming team. In addition, there are situations where supplemental mics are a good idea specifically to capture ambient sound in the room (such as audience reactions, applause, etc).

- **Live stream audience only** - Some events are targeted for online viewers only. In this case the streaming crew would be responsible for supplying the audio which could range from one lavalier mic to several wireless handheld mics.
3. Is the lighting sufficient for video?
- This issue is often overlooked. Sometimes the stage has presentation screens behind the presenter and is left somewhat dark so as not to interfere with the visibility of the screens. This arrangement will not work well at all. Always make sure your presenters have adequate lighting when they are on camera.
4. Will there be Remote Presenters?
- Virtual events, hybrid events, and even in-person events utilize Zoom, Microsoft Teams or other broadcast tools to bring in presenters / talent from remote settings. Setting this sort of arrangement up is very tricky as it involves unique signal routing both to and from the remote guest. Care must be taken to prevent loopback echo and to properly re-size the incoming video to work with the video switcher.
 - Capturing a good signal from your remote guests is also important. Attention to lighting, camera position, background, internet speed, audio mic and monitoring all play a significant role in getting a high quality result.
 - There are remote production kits available which dramatically improves the remote feed when compared to a standard webcam.
 - Budget permitting, another option is to have a professional videographer set up the remote feed.
5. How many crew members do I really need?
- **Tight Budget** - Believe it or not ONE webcast technician can pull off an entire production. This includes setting up, running two cameras (both in the same position; one for close-ups the other for wide shots), running the switcher, and taking care of all the transmission tasks. This would have to be a very experienced, proficient professional. They also use specialized equipment packages that combine many of the streaming functions into one application. Another approach for the one-man crew is to use PTZ (Pan-Tilt-Zoom) robotic cameras than can be controlled remotely from one position.
 - **Two-man crew** - Typically one person can run the cameras while the other handles the switching and transmission. Two people on the job provides for better security in case something goes wrong. One person can troubleshoot while the other keeps the production going. Also, the larger the crew the quicker the set-up and teardown time.

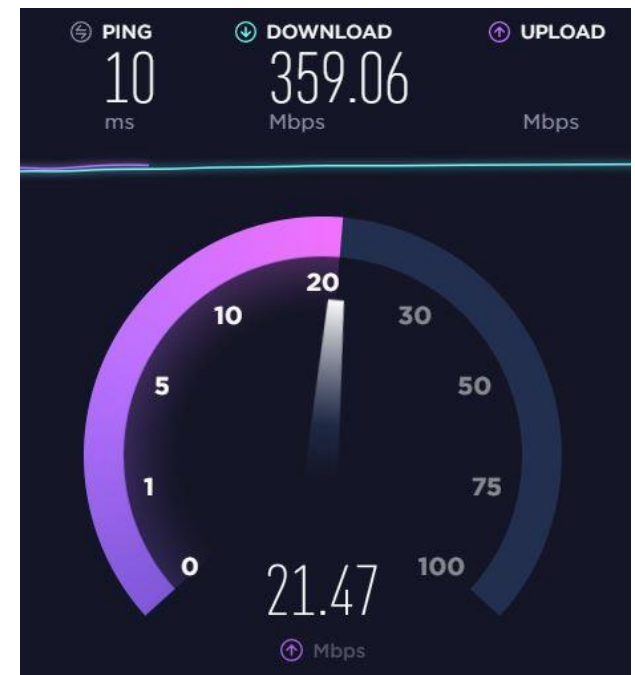
- **Multi-member crew** - High budget shows rely on a crew with specialized talents including:
 - Individual camera operators
 - Audio engineer
 - Video engineer
 - Technical director
 - Producer
 - Stage manager
 - Graphics operator
 - Video playback operator
 - Teleprompter operator
 - Lighting / grip specialist
 - Webcast / encoding engineer
 - Broadcast / uplink engineer

This represents the other extreme, where top quality results and reliability trumps cost. The actual number of crew members will vary depending on the type of event that is being covered.

Transmission

The next phase of the live streaming process involves taking the audio/video signal from the video switcher then encoding it for delivery over the internet. As shown on the diagram there is a box called the “streaming encoder.” This device takes the program audio and video and converts it into an internet-based signal. It also assigns a specific URL (internet address) as the destination for the stream. The destination is usually a cloud-based streaming server which is designed to process the encoded stream for delivery to the end users watching the event.

The encoded signal connects to the venue’s router which in turn transmits to the streaming server through a path known as the “uplink.” The uplink is typically a high-speed internet connection hosted by the venue’s Internet Service Provider (ISP). The ISP must provide a consistent, reliable data path without interruption or congestion from other onsite traffic.



Questions to consider:

1. What resolution do you want for your stream?

- Resolution refers to the video frame size; the dimensions in pixels.
 - Ultra HD / 4K = 3840 x 2160
 - High Definition = 1920 x 1080 or 1280 x 720
 - Standard Definition = 640 x 360 or 854 x 480
 - Mobile quality = 427 x 240

High resolutions look best when viewed full screen, however they require more bandwidth on both the uplink connection and the end user's connection. More bandwidth usually translates into more cost. Note that social media platforms provide free bandwidth on the Distribution portion of streaming but you will have to make provisions to ensure there is enough bandwidth available for the uplink.

2. What uplink options are available at the venue?

- Ideally, you should request: a *dedicated hard-wired ethernet connection* with a minimum of *10 Mbps up/down bandwidth*.
 - *Dedicated* refers to a non-shared connection. The full bandwidth is available for live streaming and is not compromised by other users using the same router.
 - *Hard-wired ethernet connection* refers to a direct connection to the router with an ethernet cable, so as to avoid Wi-Fi, which is less stable.
 - *10 Mbps up/down bandwidth* refers to an optimal internet speed of 10 Megabits per second for sending (up) and receiving (down). This number will accommodate a high definition 1920 x 1080 uplink with extra "cushion" to allow for varying network conditions. It may be the case that 10 Mbps is not available. If you use a lower speed uplink then it will be advisable to lower the stream resolution as well. There are articles online to help with this. [Recommended Encoding Settings](#)

3. Do you need to provide your own internet uplink?

- Some venues simply don't have internet or what they offer is too slow. What then?
 - **4G / 5G Wireless** - In many areas a solid LTE connection using a USB modem or hotspot will work. The drawback is the data connection can be unpredictable over time, especially if there are lots of people in the crowd using their smart phones.
 - **Bonded Cellular** - This technology combines several different internet connections into one solid uplink connection. This could be a wi-fi signal, a tethered smart phone, and a few USB modems preferably on different carrier networks. If one of the devices drops the connection, the others keep going thereby providing redundancy and reliability.
 - **Satellite** – This is older technology but is quite reliable BUT expensive.

4. Do you need a secondary back-up encoder?

- If your broadcast is mission critical you might want to consider installing a back-up encoder. This means you are sending 2 uplink streams to the streaming server. If anything goes wrong with the primary stream the streaming server automatically switches to the back-up stream.
- Another approach is to have the second encoder feed an entirely different streaming server with an alternate link for the end user to use if the primary stream has technical problems.

Distribution

Now this is where it gets interesting. Let's start with the people viewing; the end users. To get access to the internet they need to have their own Internet Service Provider, or at least access to a public ISP over Wi-Fi. Once internet connectivity is established they click on a link which takes them to your landing page, the web page with the live streaming player and any other relevant information about the event. The landing page is hosted by a web server which can be your company website, a social media platform, or a private video streaming service. A streaming video player is embedded on the landing page. The live stream itself typically does not originate from the web server, but gets piped directly to each end user from the streaming server. In effect, at least two servers are necessary to watch a webcast, although this process is transparent to the end user. The streaming server in the cloud handles the connection requests from each person watching and works in concert with the Content Delivery Network (CDN) to handle distribution to each end user in the most efficient route available. It should be noted that the CDN allows for the webcast to be scaled up as more people sign on to watch. It essentially "multiplies" the capacity of the streaming server by using a special network of additional geographically positioned servers.



This whole distribution component is often referred to as the "streaming destination" or the "streaming platform." Think of YouTube Live or Facebook Live. These social media services provide the distribution to all your end users free of charge. All you have to do is set up an account with them, obtain a URL and stream key for their streaming server, and program these values into your streaming encoder. The stream key is a unique identifier, similar to a password that protects your streaming account. In addition they provide a CDN. Both companies include a web server to host the video player for your end users (although YouTube Live allows you to embed the video player on your own website as an option). What they offer is truly amazing because the cost to provide the bandwidth for all of the streams going out plus the cost to maintain the network is significant. Private streaming platforms typically charge monthly membership fees plus bandwidth charges that go up as the number of viewers goes up.

Questions to Consider:

1. What streaming destination/platform should I choose?
 - **Social Media:** Facebook Live, YouTube Live, Twitch -
 - PRO's = Free, built-in audience, promotional tools, built-in landing page
 - CON's = Not private, content ownership issues, low customer support, copyright blocking (example - If copyrighted music exists anywhere on your program your stream can be automatically blocked), restrictions on stream duration
 - **Paid Service:** Vimeo, DaCast, Akamai, Wowza, Brightcove, and many others -
 - PRO's = Privacy, security, pay-per-view options, custom registration, password protection, customer support, white label options, No automated copyright issues, custom landing page
 - CON's = Fee based service; must pay for access and bandwidth (the number of end users multiplied by the length of time they watch)
 - **Meeting / Webinar Platforms:** Zoom and Microsoft Teams are popular for virtual events. Although these systems were originally designed for webcams, it is now possible to connect professional video and audio devices instead of webcams. This will dramatically improve the sound and picture quality however live streaming platforms are still superior for best broadcast quality. One advantage that Zoom has over live streaming is low latency (lag time). If you want interactivity with negligible lag time then Zoom or Teams might be the best way to go.

- **Multiple Destinations:** It is possible and sometimes desirable to stream to more than one destination simultaneously. For example, you might want a feed to Facebook, your own website, and YouTube. To accomplish this you either send three uplink streams from the venue OR you use a cloud-based service that takes your one uplink and redistributes it to the other three destinations. One popular option for re-streaming is restream.io.

2. What type of video player do I need?

- Each streaming platform typically offers different features for their video player. Here's what to look for:
 - Embedding - Can you embed the player in your own web page or does it have to remain on the platform's landing page?
 - Full screen button - Most people prefer to expand the video to full size.
 - DVR - This is a great feature. It allows the end user to go back in time to review or even join the stream late and start watching from the beginning.
 - Instant Archive - How about an immediate archive recording ready to watch the instant the event ends? No uploading of a recording and waiting for processing.
 - Multi-bitrate - Your stream would have several bitrates to choose from. The idea is to allow the end user to pick the best stream for their device and the quality of internet connection.
 - Adaptive bitrate - This feature is the best. It automatically detects the end user's device and connection speed and delivers the best stream possible. They never have to think about it!
 - Chat box - This feature provides interactivity so that end users can respond with comments and questions during the live event. Some platforms offer this as an external window on the landing page. Others build it in as an expandable window to the side of their video player.
 - Highlight Clips - With this option you can select snippets of your live stream and offer them as separate on-demand videos. You don't need editing software, this can all be done "in the cloud", even while the live stream is still going.



3. What type of Analytics do I want?

- It's important to get reports about your live stream such as, how many unique viewers? How long did they watch? What geographic regions are they from? And so on. When choosing a streaming platform make sure you are satisfied with the analytics reporting they offer.

Conclusion

Thank you for taking the time to read this. We certainly hope this cheat sheet made sense. Obviously, we left out many details but our intent was to educate you about the basics. Now you're prepared to make well informed decisions as you plan out your live streaming strategy. If you are looking for a full-service live streaming company to partner with we can handle all of the details or round out your existing crew. Our website is: <https://webcastandbeyond.com>

Happy and successful live streaming!