IMPLEMENTING LIVE STREAMING FOR COMMON EDUCATION AND ENTERPRISE SCENARIOS

Streamed video has become part of our daily lives, and we're watching (and creating) more of it all the time, wherever we are and whatever device we may be using. As often happens, trends in the consumer market begin making their way inside campuses and corporate firewalls. IT admins everywhere are challenged to step up their game and meet the expectations of students and employees, or else risk losing them to more progressive institutions. ***How can you embrace live streaming with any-screen playback for your campus or workplace?*** *Let's dig in, focusing on three common scenarios and ways to address each.*

LECTURE CAPTURE & BROADCAST

Let's consider an example of a recurring class in a lecture hall, at which a speaker will present to those on site plus a remote audience of dozens or hundreds. You can take various approaches to ensure both ease of use and appropriate content capture. Ideally, the speaker won't spend time making the capture and broadcast technology work, but instead will focus only on the lecture topic. Here are three possible ease-of-use outcomes.

FAIR: Have the speaker go to a local web page or in-room appliance and press a Start button to begin capture and broadcast.

GOOD: Have the speaker or session coordinator schedule capture and broadcast to automatically begin and end at set times for each session.

BETTER: Set up a recurring schedule at the beginning of the semester that automatically kicks off and stops capture and broadcast for each class.

Let's look at several ways to set up for capturing content while striving for ease of use for the presenter.

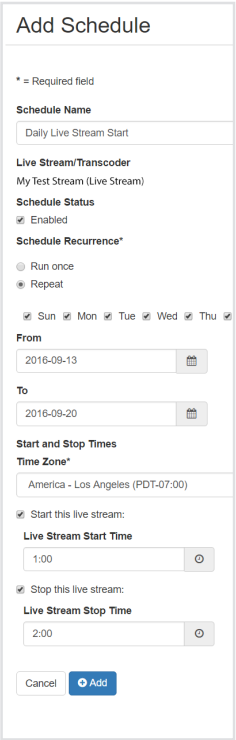
SINGLE NETWORK CAMERA. One of the easiest setups is to have just a single A/V input: a 720p-resolution network camera with built-in encoding that outputs industry-standard H.264 video and AAC audio. The camera will be pointed at the front wall, cleanly framing a marked-off presentation area in which the speaker will be standing and possibly projecting slides or writing on a white board. There is a good-quality ceiling microphone above the speaking area, feeding audio into the camera auxiliary input.

By limiting this setup to a single A/V source, especially by using a network camera and avoiding encoding and screen capture, you can eliminate many potential challenges and avoid any setup by the presenter, who just has to show up. The camera output is always on, and goes directly to a streaming server or service scheduled to record and broadcast at set times.

Perhaps you're still working on how to ***capture user-generated content*** *(UGC), store it, and deliver it using on-demand streaming. We have a blog post on this topic on our website, at wowza.com/UGC.*

DEDICATED COMPUTER. Having a dedicated computer at the front of the room can be a good option if you have several inputs, such as a USB camera, slides, a wired lapel mic with a 3.5mm or USB plug, and a USB ambient mic to catch audience questions. The video output would feed the room's projector. (If you're capturing a video source from a camera or other device that has only an HDMI or SDI output, you'll need either a computer than can accommodate an internal video-capture card or an external video adapter from a company such as Epiphan Systems, Magewell, or Blackmagic Design.) Presenters, wearing lapel mics, would present using the dedicated computer, typically placing their presentation materials in an accessible network storage folder before the session, or else bringing their materials on a flash drive several minutes before the session starts.

The encoding of the session would be done using desktop encoding software, such as vMix or Telestream Wirecast. Such products have built-in production templates (e.g., picture-by-picture encoding layouts for combining slides and video in a single video output). You can script such applications to start and stop when the presenter pushes a Start or Stop button on the computer desktop or, even better, at scheduled times, eliminating the need for the speaker to remember to start or stop the encoder software.



Part of the encoder configuration is setting the streaming server or service to use. You can automate the streaming so no script or presenter action is required. For example, you can set up Wowza Streaming Engine to loop a short video file until it detects an incoming stream from the encoder. In Wowza Streaming Cloud, you can schedule one-time and recurring events, using cloud resources only when they are needed to process and deliver the incoming feed from the encoder.

Recording of the session can take place on the encoder, writing to a network drive for on-demand streaming delivery after the event ends. When using Wowza Streaming Engine or Wowza Streaming Cloud for delivery, you can also record the stream on the server or to cloud storage. This can reduce the load on the dedicated computer, and may simplify your workflow for the subsequent on-demand streaming.

ON-SITE APPLIANCE. An option that can increase reliability for multiple inputs is to use an encoding appliance. These purpose-built boxes typically simplify setup, have built-in production templates, and reduce maintenance. Some appliances meant for in-room use have one-button controls for a presenter to easily start and stop the capture, encoding, and local recording.

One thing appliances often can't do is load presenter materials. For that use case, you'd typically want to output video from the presenter's laptop and split the signal to both a projector and the appliance.

You can set up streaming to automatically take place when your encoder sends out video, or else you'd still have that workflow component to manage for each event. Alternatively, NewTek and Wowza have addressed this with a new 1RU rack-mount appliance, the MediaDS (wowza.com/solutions/mediads), that incorporates an encoder, production tools, a streaming server with adaptive bitrate delivery, and even a player—built on the power of the industry leaders in streaming hardware and software.

Most appliances offer recording right on the box, to a flash drive, or to a network drive. When using Wowza Streaming Engine or Wowza Streaming Cloud for delivery, you can also record the stream on the server or to cloud storage.

These are just a few of many options for capturing and broadcasting lectures and similar gatherings, all of which range in complexity, features, and cost. With some experimentation, you should find a combination that provides the right balance to meet your business goals.

INTERACTIVE TRAINING

Adding viewer-feedback capabilities to a live broadcast, such as text chat or two-way video, can provide valuable interactivity for scenarios such as distributed learning. One option is to use a web conferencing service, such as Skype for Business or GoToWebinar. Potential downsides to this approach include (i) adding another technology set to administer, (ii) per-host or

per-user monthly fees that increase with audience size, and (iii) bandwidth costs and Internet gateway congestion in your network if the server technologies are not hosted on premises.

Assuming that you'd prefer to go with extending your streaming workflow to include real-time interaction with your audience, let's consider the added requirements and possible challenges.

LOW LATENCY. Whether you want real-time two-way audio/video or just text messaging, you need to understand the impact of latency. If a presenter says something, but due to video delay it's several seconds before viewers hear what was said, any questions viewers ask—even as text messages—may not reach the presenter in time to address them naturally.

Latency is an issue because most one-to-many live streaming video today is delivered with built-in delays, helping ensure that any temporary network congestion between the presenter and viewer won't cause buffering during the viewing experience. In real-time audio and video communications, latency is ideally less than 150 milliseconds in each direction to avoid long pauses or people talking over each other.

You can read more, including how streaming protocols factor in, in a recent Wowza blog post and video series about low-latency streaming (wowza.com/low-latency-101).

SCALING. HTTP adaptive bitrate streaming (with latency commonly in the range of 20–45 seconds) scales well across tiered servers and distributed networks to reach massive audiences. Conversely, real-time audio and video conversations with more than a few participants are typically hosted on a single server, limiting the size of your audience to the capacity of that server and the network links connecting to it. This is one of the reasons that some web conferencing services cap audience sizes at 50 to 250 participants.

Adaptive bitrate streaming, which you may have experienced from services such as Hulu and Netflix, adapts every few seconds to changing bandwidth and playback conditions, sometimes getting a bit fuzzier for a few seconds if conditions degrade and then snapping back to a higher quality as conditions improve. The goal is to ensure uninterrupted playback, even if the video quality occasionally varies.

For real-time audio & video communications with latency of less than 150ms, Wowza Streaming Engine can deliver low-latency Flash streaming for infrastructures where Flash is still supported. Wowza Streaming Engine also recently added support for WebRTC streaming. Both technologies can scale up by using more powerful computers with sufficient bandwidth.

What about situations where the massive scaling and broader client reach of HTTP adaptive bitrate streaming is needed for your interactive sessions, or where you need only text chat, and a little more latency is acceptable? Wowza Streaming Engine also provides low-latency settings that can reduce real-world audio and video latency to 1-2 seconds. Wowza Streaming Engine has built-in WebSocket and HTTP Provider capabilities that allow you to build and host text chat on the same server you stream from. You can also embed a text chat area on your event web page using a low-cost third-party text chat service to handle the messaging.

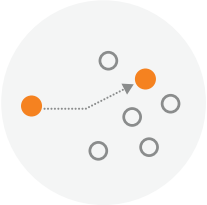
ALL-HANDS MEETINGS & ON-CAMPUS EVENTS

Many organizations get their start in live streaming with a decision to stream their next all-hands meeting, graduation ceremony, TV-like streaming channel, etc., to the whole company or student body. Although streaming at scale outside the firewall has become relatively easy with HTTP adaptive bitrate streaming across a CDN, the IT staff often discovers quickly that scaling out to a very large audience within the firewall can be a big challenge.

If you have an organization with hundreds or thousands of simultaneous viewers in one or more buildings or campuses, proceed with caution.

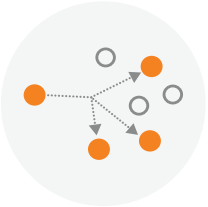
Here are your three primary options.

UNICAST. There are two main forms of live unicast streaming, in which each client goes to an upstream application server to request the video.

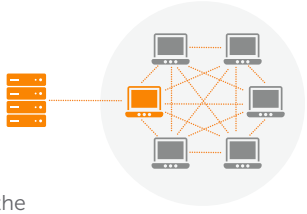


- **Direct streaming.** Each client goes directly to an origin streaming server and requests the content. This is the least scalable approach, as all streams go back to a single server and potentially clog a single network segment. Assuming sufficient network throughput, scaling is achieved by scaling up to a server with more capacity.

- **Tiered architecture.** In a tiered model, whether you are using traditional or HTTP streaming, you offload streaming from the origin server by fanning distribution out to edge servers in subnets throughout the organization's or campus's network, minimizing streaming traffic across major network segments. This typically adds a cost and management burden to support the edge servers. In some cases, especially when using only HTTP streaming, you may be able to make use of existing web caching servers and appliances.



MULTICAST. IP multicast streaming, much like an old-fashioned TV tower, sends out one signal on a network that any viewer can "tune in" to via their local router. It therefore requires that all of your network routers are multicast-enabled, which typically involves either configuration changes or a potentially costly network hardware upgrade. It may not satisfactorily address any Wi-Fi streaming bottlenecks in the network, leading to poor playback experiences, so organizations sometimes block live streaming over Wi-Fi. When Wi-Fi streaming does work well, multicast is arguably the most efficient way to deliver a live stream.



PEER-TO-PEER. Peer-to-peer (P2P) streaming, also referred to as application multicast, peer acceleration, grid delivery, and mesh networking, spreads the stream from an origin seed server to one or more nodes in each subnet, which then share the stream with others in that subnet. When designed properly, this offloads the vast majority of network traffic from major segments and onto local routers. Unfortunately, peer-to-peer streaming originally got a bad reputation among network administrators, both for the language the P2P clients were based on (Java) and the association with applications such as Napster and BitTorrent. Today, with the use of WebRTC and HTML5 for native in-browser plug-in-less playback, those concerns have mostly diminished. Want to know more? Read a detailed discussion of P2P streaming, multicast, and unicast (wowza.com/P2P-streaming).

WHICHEVER DISTRIBUTION METHOD MAKES THE MOST SENSE TO YOU, WOWZA CAN HELP.

- Wowza Streaming Engine software delivers unicast streams directly and via tiered networks using both traditional streaming formats and cacheable HTTP formats. We even provide a free load-balancer application, and for networks with dozens of edge servers, a free multi-server management tool. For a more packaged approach, you can also deploy a solution such as Kaltura eCDN, powered by Wowza.

- For multicast, Wowza Streaming Engine delivers traditional MPEG-TS and RTP multicast streams, which work natively with players such as QuickTime and VLC. For even better performance and to avoid client-side player installations, Wowza Streaming Engine also powers Ramp AltitudeCDN Multicast+ (see wowza.com/HTML5-ramp), a recent innovation that delivers HTML5-browser-compliant HTTP streaming to desktops tunneled through multicast, giving you a great blend of network and playback benefits.

- On the P2P side, Wowza Streaming Engine software can act as the origin and rollover servers for peer streaming solutions from Hive Streaming, Viblast, Streamroot, Peer5, and others.

Summary

Whether you're helping your organization broadcast live presentations to a small group, interact with remote training participants, or reach everybody at once, the common options we've covered here should help you understand some key alternatives and decision points. Do you have more questions? Find detailed information, how-to videos, case studies, and more at wowza.com.

To learn more about how others are using Wowza streaming technology, visit wowza.com or contact sales@wowza.com.