Streaming for Video Engineers

With a little history thrown in

The Major Players

Players and Techniques

This is not a new industry:

Skype (2003):
GoToMeeting (2004):
Facebook Messenger (2008):

Postage stamp sized video, low frame rates. Has come a long with with ubiquitous broadband.

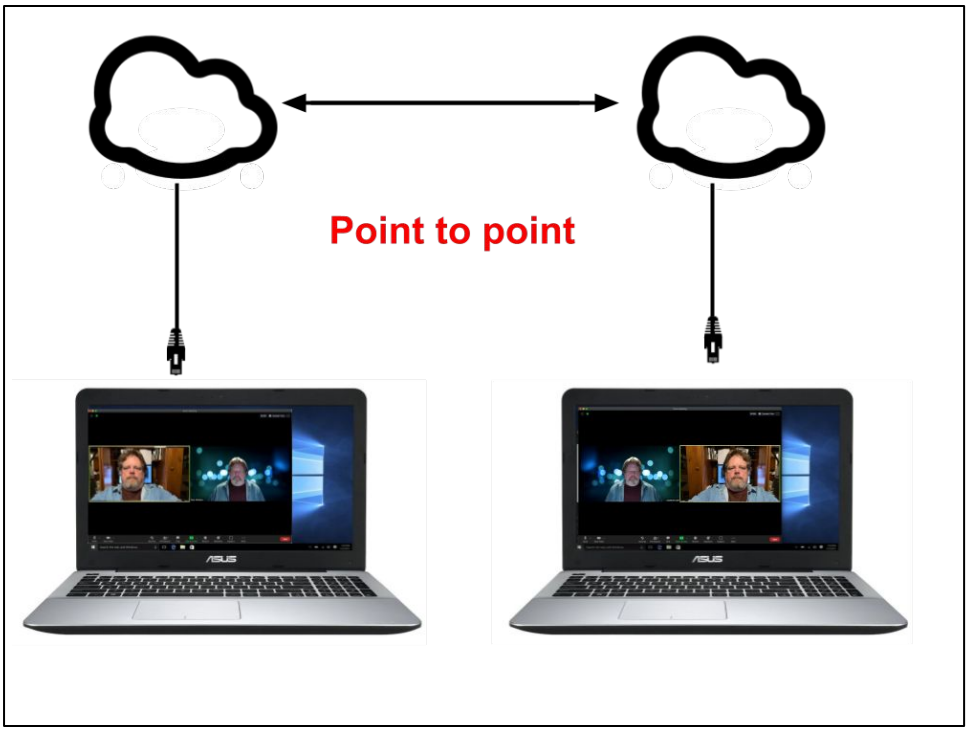
- Skype: Started in 2003 to make phone calls over the internet. Especially to relatives in other countries.
- GoToMeeting (2004): The original conferencing application. Dominated the market until Zoom came out.)
- Facebook Messenger (2008): Chat software turned into a video/phone app.

Products break down into three general focuses.

Point to point	Enterprise	One-to-many
Skype	Microsoft Teams	Zoom
*Meets & Teams	Google Meets	GoToMeeting
Zoom		Messenger
Point to point IP		Facebook Live
Niagara		YouTube Live
Comrex LiveShot		
Atem Mini Pro		
OBS		

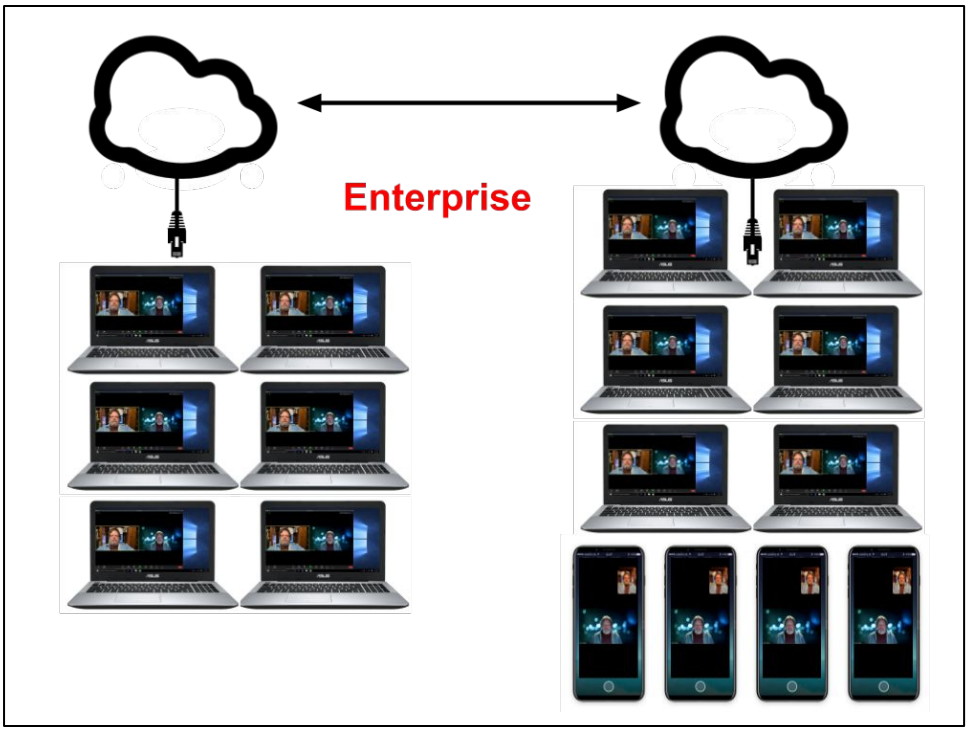
*Many of these platforms bridge focuses.

- Point to point, while there is flexibility as Skype can support more than two people it's far from tuned for it.
- Enterprise - Generally tied into large organizations, corporate, municipal and educational. Can be used with non members but not conveniently.
- One to many. Similar to Enterprise but works nimbly inside and outside of organizations. Focus on collaboration inside the tool rather than distributed across GSuite or MS tools. (MS Word - Google Docs - Outlook - GMail etc.)
    - One to Many broadcast mode, where people can just watch. YouTube is best example with Facebook similar at creating a traditional TV broadcast experience. With possible live interaction through platforms chat.



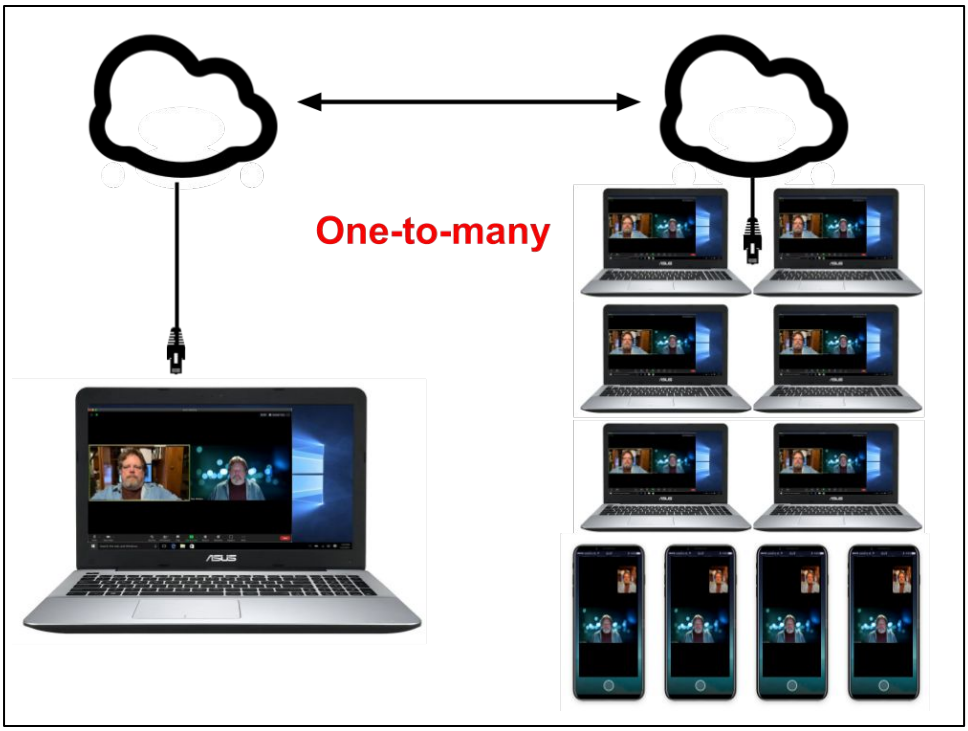
- Point to point, while there is flexibility as Skype can support more than two people it's far from tuned for it.

Useful for doing interviews for live and or recorded broadcasts.



Enterprise - Generally tied into large organizations, corporate, municipal and educational. Tools can be used with non members but they are tuned for insiders.

- Can be used for point to point or one to many but generally used by teams working together, video enhancing communication.
- Great for interaction and collaboration with calendars, group editing of word documents and or spread sheets.
- Can be recorded or broadcast live to Facebook but being rather horizontally collaborative recorded results might be hard to follow.

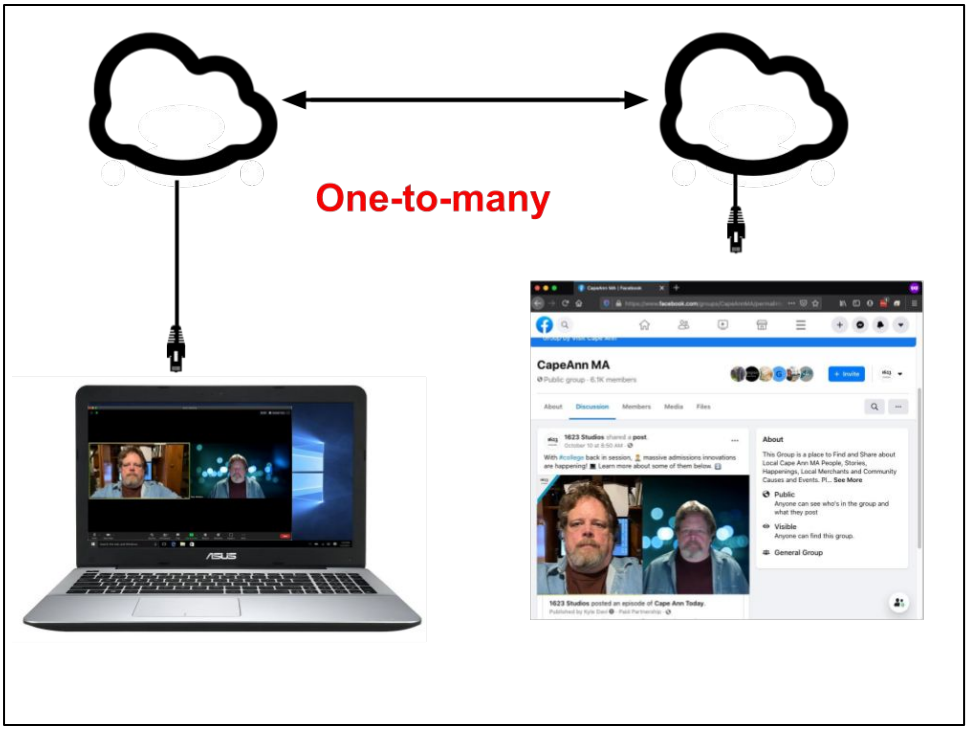


One to many. Most similar to a broadcast TV experience. The “one” can be a professor conducting a class, politician making a speech. Or a small team of presenter and moderator(s) who can prepare ancillary materials or moderate audience participation.

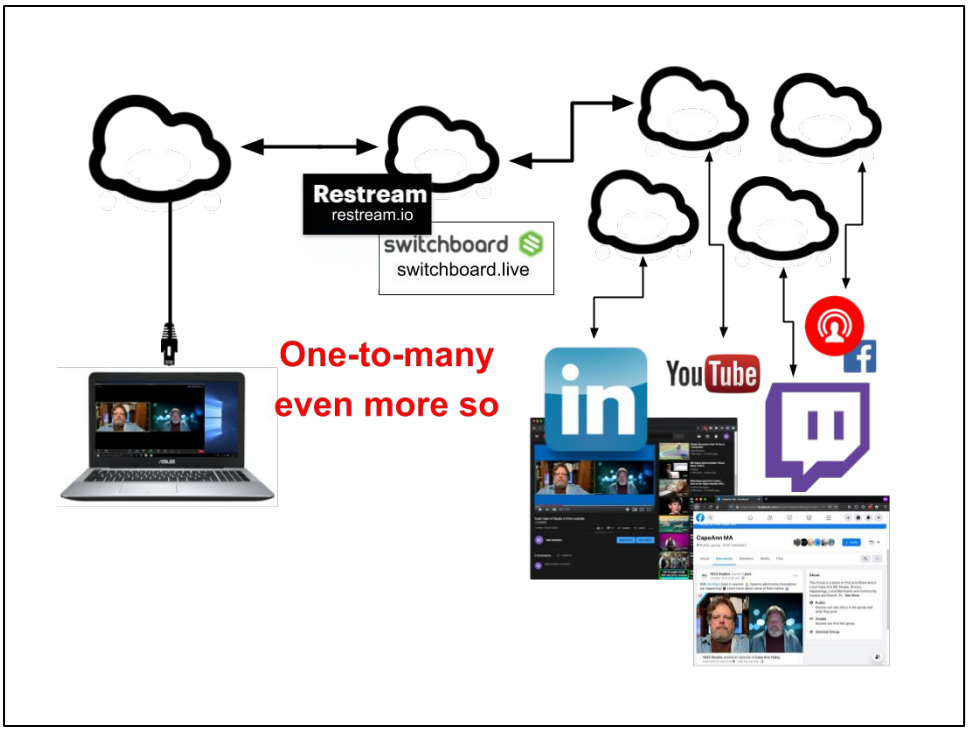
One to Many broadcast mode, where people can just watch. YouTube is best example with Facebook similar at creating a traditional TV broadcast experience. Loose virtually all of the audience interaction features participants. Though there is a bit of possible live interaction through Facebook and or YouTube’s comments feature.

Hybrids

Third party service providers that can be used to extend these basic implementations.



- Tools such as Zoom and Webex have the ability to connect social media (Facebook, YouTube, Periscope) platforms through RTSP to greatly open up the meeting to wider world.



- Web service providers Restream and Switchboard (among others) can take a single RTMP connection from say Webex and rebroadcast to multiple online video and social media platforms.
    - Shifting the complexity of setting up this up inhouse.
    - One click initiation, I've found these products interface easier to use that Facebook's API.

Fundamental new capabilities of streaming:

- Meeting participants can now be anywhere in the world.
- Presentations can now originate in multiple places at same time and viewers can be spread all over the world too.
- The line between presenter and viewer has substantially dissolved too.
- Reduced meantime necessary to “go on the air“.

- Streaming is a new way of communicating that is simultaneously more powerful, global and involves the participants more.
- It’s now possible to alert tens of thousands with only a few hours notice to an event. Using email and or Social Media infrastructure (groups, alerts and posts) the word can disseminate globally. The post or email conventialy contains the date time and link to join in.
- For educational institutions, vast horizons are being offered. It is no longer necessary to have a campus, dormitories and classrooms to provide an education when it’s possible to provide very complete presentations to anyone with a computer and Internet connection and the most valuable thing being offered are knowledgeable instructors.

Distinctive Features People Love:

Watch from where you like: Participants arrange where and how they participate.

Independent chat channel: Chat (discuss) without disrupting event. Questions can be collected by a 3rd person facilitator who relays them to the speaker.

Shared documents: Material being discussed readily distributable with convenient links in meeting.

Breakout Rooms: Independent groups can breakout, get to talk among themselves and then rejoin.

- Note: 3rd party administration is generally not part of free products.
- Breakout Rooms
  - We don't think discussion groups are recorded.
  - Like having different sub-conferences that can be joined and departed to the main meeting. Instructors seem to like discussion groups break out and talk.*

Common features across these tools.

- Video and audio (recordable).
- Screen sharing, some also allowing remote control.
- Sharing of files
- Recording made directly in the cloud.
- Collaboration, whiteboarding tools.
- Available on wide selection of devices through Apps or directly in browser.

- Big differences in depth and breadth these features are engineered and implemented.
- Enterprise tools have integrated Contacts. So your corporate contacts can be leveraged directly. While Zoom requires you maintain a seperate contacts list. (wonder if vCard import is possible)

Applications

Skype, The first streaming software

- Founded in 2003 to allow people to make internet phone calls via their computers.
- Video capability introduced in 2005.
- Multi-user capability introduced in 2011. Now allowing 50 members to a meeting.
- Widely used and straightforward operation.
- Long history of providing TV remote feeds.
- Broadcast-Quality version (Skype TX) available.

- Skype - Skype TX
- You can now share desktops and files.
- Supported platforms Windows, Macintosh, Linux, Android, iOS, Symbian, and a number of Internet-capable TVs. From a practical point of view, anything that can connect to the Internet, including anything that can use Wifi, can be used.
- Most TV News operations have Skype systems that they are experienced in using. PBS Newshour uses it very prominently.
- Watermark
- Unique file sharing ability of recorded calls. Works like texting on your phone, send and receive files including just recorded video to your contacts.
- Not terribly reliable, buggy and if implemented by IT capability to connect outside organization might be disabled.
- Browser support only implemented in Microsoft Edge.
- Okay video quality.

Microsoft Teams, The Microsoft Way

Positives

- Closely tied to Office 365.
- Extensive collaboration within MS products.

Drawbacks

- Closely tied to Microsoft suite of products.
- Not really intended to just download and create an account and connect.
- No YouTube, RTSP or Facebook at time of writing.

- Teams
- Similar to Google Meets: An application that allows users to collaborate with all the different applications that the software developer makes, in this case Microsoft Office.
- Pitched toward enterprise - you need a Microsoft account, for best effect a Teams one.
- IT has features to control and secure communication through Administration controls. Powerful for keeping information secure. But also makes collaboration outside group potentially complicated.
- You're locked in to the MS environment, compatibility with other companies' applications and files convoluted or uncertain.

Google Meets, Google's Way

Positives

- Tightly integrated into Google's products. Can launch and invite into video calls very easily from email, calendar.
- Smooth collaboration and sharing G Suite team members.

Drawbacks

- Intended for use in G-Suite and base plan can't record!
- Have to be logged into GMail account
- Invitation and doc share not as advanced as Teams and Zooms.
- AV sync is behind competitors.

- Google Meets
- Pay G-Suite related product.
- Google's enterprise version of Hangouts a response to Skype and Facebook Rooms introduced around 2013.
- Now used as chat/video/audio/file transfer feature of Google's enterprise-level G Suite software environment. So you can use it to collaborate with others on Google Docs, Google Sheets (spreadsheets) and Google Slides (Presentations similar to powerpoints) and easily access places to keep them in the cloud (Google Drive).
- You're locked in to the Google environment, compatibility with other companies' applications and files convoluted or uncertain.
- Not so intuitive to use, at least not for me.

Zoom, The current market leader

Positives

- Popular, familiar to many and widely used.
- Functions from browser and well designed App.
- Breakout into meetings, Host delegation.
- Waiting Room for fine control of attendees.
- Windows, macOS, iOS, Android, (*Chrome and Linux).

Drawbacks

- Popularity opened up high profile criticism about security. Compounded by poor marketing communication.
- Document collaboration outside of Zoom's control.
- Breadth of features can be overwhelming.

- Zoom
- Very popular conferencing software designed from scratch for conferences and meetings.
- Can include up to 100 participants on the free version but limits multi person meetings to 40 minutes. Paid versions can include up to 1000 people and unlimited meeting times.
- Features include startup of the software with a simple click on a link (connect in App or browser)
- Screen (most developed, granular control of what is shared along with hardware shares like iPhone and other cameras) and screen sharing ability during a meeting in ways that non-tech guys find intuitive and powerful. Company has addressed a lot of the criticism by doing things like requiring passwords to join meetings, setting up a waiting room for the host to admit people from before the meeting starts and allowing the meeting host to easily mute, expel disruptive participants.
- Live to Facebook and other RTMP services.
- Pay accounts start at $15 a month. Up to 100 in a meeting.

- Cloud recording of meeting for handy distribution of captured file
- App records to .mp4 pretty efficiently

GoToMeeting, Pioneering conferencing software

Positives

- Was industry leader but 2020 changed that.
- Links into more focused versions for training etc.
- Nice console like meeting organizer.
- Public and straightforward about security, encryption.

Drawbacks

- Only fully supported on Chrome and Edge.
- Not as friendly to non registered viewers joining it.
- Irritating pop ups and polling windows in free version.

- GoToMeeting
- The original conferencing software created by the same folks who make LogMeIn, the software that allows you to log into and control a computer from a remote location on the Internet.
- Works on Windows, Mac and Android and some Linux flavors But limited browser support.
- Costs money (not a huge amount) but a hassle when installing in a rush, so it has been eclipsed by other software like Facebook Rooms, Skype and Zoom have better free offerings.
- Was big industry leader but Zoom has taken a large lead. Does the same thing as Zoom but not really as conveniently.

Webex (Cisco product)

Positives

- Functions from browser and well designed App.
- Incorporates existing Cisco and Polycom HD infrastructure.
- More economical, more features $, pay by month
- Streams to FB Live, YouTube and RTSP platforms
- History of professional hardware buildouts.

Drawbacks

- Not as popular among general population.
- Split between Webex Teams and Webex Meetings.

Webex

Positives

Comes from the company that already makes a lot of the networking hardware that IT people are using. History of integration into enterprise-level systems.

Negatives

Was big industry leader but Zoom has taken large lead.
Does the same thing as Zoom but not really as well. More steps and hoops.

Webex Meetings and Webex Teams

Facebook Rooms Evolution of Facebook chat

Positives

- Highly developed contact infrastructure.
- Infrastructure offers far more way to communicate.

Drawbacks

- Participation requires facebook membership.
- Newest to the game.
- Facebook often blocked in corporate environments.
- Participants will be mercilessly advertised too subjects discussed in your presentation for weeks!
- It's Facebook!!!!

Facebook Messenger Rooms

Facebook Messenger added instant message capability and eventually talk/video to Facebook in 2008. File sharing exists and screen sharing is being added. Multi-user capability in the 'Rooms' version that was just introduced to compete with Zoom. Allows up to 50 multiple members of a conversation to appear as multiple tiled images. People can be added to a conversation while the conversation is taking place.

Issues To Watch Out For, Getting along with IT

- Negotiate and confirm bandwidth capacity.
- Do dry run to establish your IT needs.
- Confirm there are no IT rules that will block the application or it's communication, both sides.
- Schedule to avoid other IT activity interrupting your connection.
- If wireless, confirm decent signal in area 1st thing.
- Do dry run to confirm all necessary passwords, software or drivers are present.
- If broadcast is done from Smart Phone or computer disable software that competes for resource or will interrupt with notifications.

- Make sure you have sufficient bandwidth along the entire signal route. Bottlenecks will make for stuttery video. And may even put interruptions in the sound. Or worst of all interrupt other mission critical operations.
- Rehearse the setup ahead of time when network traffic is likely to be representative of the load you'll have to deal with during your show.
- Confirm there are no IT rules that will block the application/device or it's communication.
- Warn the IT people involved so they don't do anything that might interfere with your transmission. (Like disconnect the port we were using to stream from, which happened to me.)
- If you're using your phone or cellular modem, move to an area with better reception or stronger WiFi. Check bandwidth with an application like Speed Test – a reasonable value is 2Mbs.
- Check the login procedure. A Zoom conversation can be started by clicking on a link. But other applications may require you to download their software first (Facebook

- Rooms) or to be a registered user (Google Meets). All this needs to be set up before the transmission can start.
- Shut off other applications on the computers/devices being used.
- Your hardware of theirs?: Different communities tend to have standardized on particular applications, such as Zoom for government meetings, Facebook for individuals, and Google for the scientific/academic community. The IT people involved may have shut applications like Skype and Facebook out of the machines they administrate. In general, people will present better with software they're familiar with, so you'll probably get a better show if you can download a version of what they're using onto your laptop in the studio. But do this in advance, learn a bit how how the software works and practice with it to make sure there are no surprises.

-You can try turning off video from that particular source (audio only.)

Big Iron

Discussed so far, computer or smartphone based products. In some cases dedicated hardware is preferable

Typical advantages:

- Increased reliability (Linux) and Failover Support.
- Live encoding for multiple platforms.*
- Ad Insertion Capability and Closed Captions. *
- Precise audio control.
- Remote control production.
- Higher quality video compression.

Portable integrated control room and streaming

- Turnkey streaming solutions.
- More dependable
- No competing software on the platform.

Increased reliability (Linux) and Failover Support. Avoiding the pitfalls of consumer OSs.
Ad Insertion Capability and Closed Captions.
Audio Normalization CALM

The players

Aterne
Comrex LifeShot
Digital Rapids
Elemental
Envivio
Haivision
Viewcast
Digital Rapids
Haivision
Viewcast
Optibase Vitec

Portable systems can be taken to locations like conference venues, sporting events and special events

Studio-in-a-box

Integrating with Crestron and AMX:

Older systems (Crestron was started in 1971, AMX in 1982) designed for one-man management of conference facilities, auditoriums and classrooms, so the presenter doesn't need to:

- Change slides, steer PTZ cameras, switch video inputs going to displays, mute/enable audio inputs, control audio levels, adjust PA, room lighting, curtains, screen positions, etc.
- Each device you want to control needs an interface module to allow a central computer to send it instructions. As A/V technology has grown, these companies have supported an increasing number of devices and features.
- Control code is typically written for each particular room in a proprietary language by a programmer who needs to be familiar with the language and capabilities of the devices he wants to control.
- The programmer has the capability of authoring a specific control user-interface, so he can present all the functionality to operators in a very intuitive and natural way.
- These systems are extremely common in facilities that have been around for a couple of years.

Very common room control systems used to control auditoriums and conference centers.

Nowadays people often have more than one screen: One with the presentation being shown, another one with a shot of the attendees (remote and in overflow room) and a confidence monitor facing the host/presenter so they can see if they're in the picture, that the presentation is legible and on the correct slide, and if anyone wants to ask a question.

Negative
Code written by specialized Crestron programmer, typically for each facility
Older technology harder and more expensive to update and integrate with the latest developments in software.
Generally less flexible
Not integrated with Zoom's recording and distribution capabilities.

Integrating with Crestron and AMX:

Issues

- The facility may not have been designed with streaming in mind. Especially for showing gallery views of all the participants or keeping cameras from accidentally displaying when the they're moving.
- You'll probably have to adjust the functionality written into the Crestron/AMX control and pay a programmer to write it. (Everybody is redoing their facilities right now, so these programmers are BUSY. Don't expect big discounts.)
- Make sure the new equipment you plan to get will work with your old stuff the way you think.

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PRACTICAL ISSUES UNIQUE TO STREAMING

Negotiating between desktop streaming/meeting and existing infrastructure.

How where things done before COVID-19

- Faculty positive about changes in style, curriculum?

Universal for all participants.

- Clearly experience entire program, AV, notes, chat.
- Make presenters comfortable with technology.
- Recreate as much of original experience with questions, two way asking of questions.

Classroom-centric educational seminars are probably the most ambitious streaming setups done today and in common use in our area. Doing a class from an instructor's' home laptop to a collection of students joining from home on their laptops is easy to do with Zoom, but incorporating live on-location lectures in existing facilities that pre-date Covid can complicate things rapidly, especially if you're streaming your whole curriculum and have to post large amounts of media quickly without much time to do editing or fill in gaps.

From a production point of view, the important thing is the need for all participants: present, online or watching later to be able to see all the media, speak and be heard, and for the host/instructor to see and have control over everything going on (like calling on people who have questions). Then there is the need for all the recordings to be promptly posted and viewable.

Good sound and social distancing:

Basic improvements

- Headset for presenter at least. AirPods popular and wireless.
- Affordable and better sounding, Rode Wireless Go lav.

Multiple mics require more precise audio control and filtering.

- Pa mic system tuned and producer controllable Bosch DICENTIS
- Existing multi microphone installations, active mixers like Shure SCM820

Apple AirPods

Rode Wireless Go

Bosch DICENTIS

Shure SCM-820

Good practice to give host/presenter a lav or mic/headset so they can be heard clearly as they move around or turn head. They also reject some room noise and other members in the meeting either live or coming through computer speakers.

Audio mixers capable of automatically adjusting for varying volume levels and preventing feedback from creeping into the room speakers (needed so the host/presenter can hear people and call on people asking questions) will make everyone much more understandable. Zoom and other conference software have some capabilities in this area but dedicated devices like the Shure 820 are superior.

If you're using the 'Breakout Room' feature, it's easy to have different people in the same room being part of different conversations. Give them all headsets to keep all the conversations apart.

For other people in the room, it's common to distribute desktop

microphones that they can mute to keep extraneous corridor noise or idle chatter from contaminating the sound. Distribute these desktop mics widely and richly so everybody is near a mic, including people in the corners of the room. The closer all the participants are to microphones, the better they'll be picked up and the more unwanted extraneous noises will be kept out. Arrange the desktop mikes so people automatically face forward to get good shots of their faces.

Most conference applications have a way to mute people logging in from remote laptops. Usually the microphones on these remote stations are defaulted to being muted so the rest of the audience doesn't have to listen to barking dogs, crying babies or jackhammers on the sidewalk. If there really is a jackhammer out on the street, the local listener trying to hear the audio will be getting a headset soon enough.

Last word:

- First thought should be audio as always. Second, the visual presentation. You often don't need to show the presenter except maybe to open/close the show although they'll probably like it if you do.
- Avoid over-complication or hiding the underlying workflow. Glitches will happen and if not addressable by staff running the show the entire audience will know.

With the advantages in modern technology like PTZ cameras, automated switching to the active speaker, automatic audio mixing, automatic recording and letting the presenters create their own Powerpoints, you can make much nicer presentations with one just one crewmember than we were ever able to make with traditional show production crews.

THE END

Contents of Zoom chat window with comments and extra links.

Aavery Mundt : What about Slack?
Slack would also kinda fall into the Enterprize. While not quite the same as Google Meets or Microsoft Teams it is a product that provides many features to organizations beyond video conferencing.

Stu Lipoff in Las Vegas : All the Zoom traffic goes thru China which is the real security problem
This is a concern of course. If Zoom is being accurate about it's stated plan to implement public/private key encryption security should be pretty tight. Although Zoom's still going to know where and who you are conferencing with. .

Brook laptop : Zoom now allows you to lock to the US server only.
I did read about this too which should alleviate some of the concerns.

Marty : That's why many companies won't use Zoom . May breach

security.

Stu Lipoff in Las Vegas : I find WEBEX very unstable and it crashes many computers unless it is the only active app
Good to know Stu, thanks!

Aavery Mundt : Espn has been using a hybrid Cisco streaming and VPN hardware system for remote broadcasts.
I was aware Cisco has a presence in the video only industry but did not know they had such specialization. Thanks Aavery.

Stu Lipoff in Las Vegas : It is worth checking out which services allow the participants to use only port 80 as many enterprise IT departments and hotel rooms for travelers block other than port 80.
Another good point. Many of the these apps use UDP and TCP protocols so they would get blocked.

Aavery Mundt : We run into port issues frequently with TVU, LiveU, Dejero, and haivision.
My experience with Comrex's LiveShot has been similar. It needs inbound UDP traffic to pass on 9001 and outbound, UDP at 3478 and TCP at 8090. I always stake out location first, test. Also have it's cellular modems ready to go.

Aavery Mundt : We've had significant issues with cellular bonded modems at the Boston Marathon. Mostly due to saturation issues.

Stu Lipoff in Las Vegas : What about the need for time base correctors to make the remote video feed broadcast quality. What is the impact of using TBC on lip sync.
It'd be interesting to know how solid say connections between more

professional hardware using IP video are. Never had any sync trouble with what comes through LiveShot. Computer based applications like Skype and Zoom are rather squishy with frame rates and sync. Recorded files often need transcoding before usable by sensitive software and hardware.

Stu Lipoff in Las Vegas : I find the best way to stream a conference room with several people is for each participant to use their personal cellphone in front of them and let video follow audio.
I'd be interested to know more about this and other methods people find give good results.

Aavery Mundt : Dugan audio makes some excellent products for sounds equalization and mic issues.
Dugan, thanks for the tip.

David Acker : Lip sync issues occur with Frame Syncs, expecially those with multi-field or frame processors
Wish I'd seen this during the meeting so could have explored your experience more.

Robin : For broadcast framesync, scalers and lipsync.
Same with this question. I'd like to know what you'd recommend Robin.

Foxboro Cable Access info@fcatv.org : should you end screen share so we can see presenters?

David Acker : "Me" is David Acker...

Paul Cintolo : Any ballpark idea of how much some of the restreaming services cost per month?

For all practical purposes Restream is $34 dollars a month. It's their only plan where the logo does not show.
Switchboard Live is more expensive.

MP : Please share the recording and slides if you can. Thanks Mitul Patel

Stu Lipoff in Las Vegas : Thank you for an interesting topic and content

Stu Lipoff in Las Vegas : Look at OBS Studio, ManyCam, and Spark O Cam for local switchers and the ability to ingest remote IP video streams

- OBS
- ManyCam
- SparkoCam

Tim MacArthur : Thanks Bob, Matt & Marty. (Also great additions Stu and Aavery)!