WSU Videoconferencing
Current State and Recommendations

WASHINGTON STATE UNIVERSITY

Written by: WSU ITSAC Videoconferencing Subcommittee 06-08-18

Introduction

The ITSAC Videoconferencing Subcommittee was formed to evaluate the current state of videoconferencing at WSU. The goal of this committee is to identify challenges with WSU's videoconferencing service and develop recommendations for improvement of tools, application, and operation of delivery of courses via videoconferencing. Pursuing this goal also requires the committee to develop best practice standards for students and faculty participating in videoconferencing courses.

While the subcommittee primarily focused on the classroom environment, many of the recommendations found in this document can be applied to business meetings. However, it is the recommendation of this committee to conduct a separate detailed review of the business meetings service area.

For the sake of consistency, we will identify the delivery of courses via videoconferencing as "Academic Videoconferencing." Terms such as AMS, Zoom, Polycom, and Unite are often associated with or identified as this service. But these names and acronyms refer to a specific brand name or department name providing the videoconferencing service, and are thus confusing to use in this report. Also, please note that this report does not evaluate video components of LMS or online courses; it only evaluates academic videoconferencing at WSU that is operated by the Academic Media Services department.

Overview

This task force focused on recommending fixes and efficiency improvements to the Academic Videoconferencing service. The first task was to examine data to confirm or disconfirm a wide-spread perception among WSU leaders that "we can't do graduate education with our [current academic video conference service]" or presumably offer any course that relies on interactive teaching methods. We examined the student course evaluation data from every academic videoconference course last year and conducted a survey of instructors who have taught using this service. This data partially disconfirms the wide-spread perception of dissatisfaction by showing that approximately two-thirds of students and instructors are satisfied with their videoconference courses. However, the remaining one-third who are not satisfied, are very vocal about it. Although a minority, those who are dissatisfied have identified real problems that deserve resolution.

To solve these problems, the committee identified four layers of the academic videoconference service at WSU that affect the teaching-and-learning experience, particularly in ways that create problems in student learning, and in student and instructor satisfaction. This document is organized to provide the current state of each layer and the committee's recommendations. The layers are:

1. Behavior: This is the top layer, and it explores how instructors and students behave or interact with and through the academic videoconferencing technology (e.g., instructors modifying, or not, classroom management rules to adapt to audio delays).
2. Room Design: This layer explores how videoconference equipped classrooms are designed in terms of layout and type of technology installed (e.g., monitor and camera placement).
3. Administrative/Operational: This layer explores how the videoconference service is operated by WSU staff, from scheduling of rooms to technical support provided.

4. Technology Infrastructure: This is the bottom layer, and it explores the technology that carries video and audio information between remote locations, including servers, endpoints, software, and bandwidth.

All four layers affect learning and satisfaction with the classroom experience. To better define what an academic videoconference classroom experience should be, we identified the following standards, from the students' and instructors' points of view:

- Instructor is visible to all students at all sites, well enough so that students can read the instructor's face.
- Instructor's audio-visual material is visible and audible to all students at all sites.
- Students are visible at all sites to the instructor and to other students, well enough so that the students' faces can be read ("can see the whites of their eyes"), if not always, at least when they are speaking.
- All students are audible when they want to speak, and are not audible when they are not speaking.
- Audio transmission delays (e.g., half-second delays) should not inhibit students from speaking in class: i.e., instructors use classroom management rules to work around the audio delay.
- The instructor knows how to operate all the podium technology, including the videoconferencing technology.
- Students should be able to do presentations at any site, including with supporting A/V material, without technical delays or difficulties.
- Students at remote sites should not struggle trying to connect or dial in to their course.
- Classrooms utilizing videoconferencing should be accessible at least five minutes before class begins.
- Connections should be stable and offer consistent quality.

The above are general guidelines. More detailed guidelines have been drafted and are available as a supplement to this document.

To achieve these standards, further root-cause standards are presented later in this report for each layer.

In summary, many of the above standards can be achieved at the top layer (i.e., with simple behavior changes among instructors, and thus among students). While many of these improvements can be made with instructor training and unifying support models, standardizing design models and addressing legacy spaces used for instruction is critical to the success of this service. Additionally, please note that WSU's current academic videoconferencing infrastructure is at the recommended 5-7-year life span and is at or below capacity. This will need to be addressed with an initial investment and will require action within the next year.

Layer 1 – Behavior

Introduction

This section addresses the behavior/rules of engagement in the classroom and conference rooms. First, information was gathered through a Qualtrics survey that was sent to all faculty who taught via videoconferencing between fall 2016 and spring 2018, of which 59 of the 358 faculty responded. Additionally, student comments from fall 2017 were compiled, organized, and reviewed. Based on the data collected, we found the expectations of the students and instructors to be the following:

Current state

- Students are more positive on the evaluations of the experience than faculty are, though the majority of each are positive
  - o Most offsite students seem okay with the teaching experience but become frustrated when technology does not work.
  - o Instructors are concerned with making sure offsite students feel included, connected, and a part of the classroom experience. Instructors are also frustrated with technology problems that hinder them from having a smooth, well run classroom.
- Nothing about the technology enhances the learning experience for the students.
  - o Learning happens *despite* the technology glitches.
- Instructors are being asked to be technicians at various locations and are usually offered no advance training.
  - o This causes considerable frustration on the part of both students and instructors.
  - o At the same time, faculty and instructors tend not to plan sufficiently ahead to request training.
- In those courses that are positively evaluated, it's not just the absence of the problems above that are crucial, but also positive actions faculty take to adapt their classroom management rules to the videoconference environment. We include these actions in the next sub-section on recommendations.

Recommendations

Our basic recommendation is that all instructors receive training in how to teach in videoconference classrooms before teaching in one, no matter how experienced the instructor is in the traditional or even online teaching environment. Much as we do not allow instructors (experienced or otherwise) to teach a course online without training in how to adapt to the online environment, no instructor should teach in videoconference classrooms without analogous training. Instructional videos can be used to train faculty, staff, and students how to properly use the videoconference room. Such training should emphasize the following actions, as indicated by successful, satisfied, experienced videoconferencing instructors.

- Behavioral best practices - **Instructor**
  - o To include students at remote sites, faculty have done and should do the following:

- Perform a dry run before the semester starts. In doing so, learn how to operate the controls, at least enough to perform basic trouble-shooting when a technician is not available. See how one's material looks on screen.
- Travel to the other sites early in the semester, and teach from there, within the first 2 weeks.
- Show up 5 minutes before the start of class. This will enable faculty to engage with the students, ensure the computer is loaded and ready to go, etc.
- Require students to sit together at all sites (this allows a tighter zoom, thus making it easier to read students' faces).
- Notify trained technicians immediately if there is a technical issue with the course.
- Be mentored by another faculty.
  - Form a local campus committee for faculty helping other faculty to teach on the system. This committee would include a technical staff member.
- Learn students' names and voices at the remote sites.
- Have remote students shout out when they have questions, while strictly enforcing hand-raising at the local site. This prevents local students always getting their questions and comments in first due to not experiencing the audio delay that remote students experience.
- Cold-call specific students at the remote sites.
- Configure the video so that students at all sites can see students at all other sites, and not just when a student from a remote site is speaking (though, this is much easier to do when there is only one remote site instead of many remote sites).
- Make sure that students at all sites can see the visual materials.
  - Instructor should *not* use physical whiteboard in room; if instructor needs a whiteboard, a document camera or tablet computer should be used.
  - Instructor should not physically point to visual material on screen with hands or laser pointers, because students at remote sites can't see this pointing.
  - All visual material (e.g., font size in PowerPoint slides) should be large enough to be read by students in the back of the room. An extra-large font size should be used when a remote site uses a single monitor to display both the instructor camera feed and the visual material feed.
  - When possible, provide access to the presentation/slides prior to class, providing this does not decrease learning effectiveness (e.g., when notes contain spoiler information or contain answers to discussions questions).
- Be not only visible, but have *presence* to students at all sites.
  - The instructor should have appropriate lighting.
  - Instructor should not pace across front of classroom. This causes the instructor to walk out of the frame or sets the camera zoom back so far that remote students cannot read the instructor's face.
  - Instructor should look into the camera when speaking to remote students; this is much easier when the camera is placed on top of the monitor instead of off to the side (see Room Design).

- Instructors should know how their podium works, including videoconferencing and A/V equipment.

- Behavioral best practices - **Students**
  - Sit together, shoulder to shoulder, at all sites to allow a tighter zoom shot, which then allows people at other sites to better read their faces when they are not speaking.
  - Turn on the lights and close the blinds when in rooms that have windows.
  - Follow instructor's rules on mute button use.
  - No side conversations.
  - Speak clearly.
  - Speak freely at remote sites; at local site, speak when called on.
  - Show up on time, and if at remote site, show up early to ensure that all connections are made and working.
  - Notify instructor immediately if there is a technical issue with the course.

Layer 2 – Room Design

Introduction
This section addresses the physical configuration of academic videoconference spaces for WSU classes and meetings. It examines the design of visuals (cameras and monitors, presentation of visual materials to distant sites), audio (microphones and speakers), and operation (controls for using the system), then makes recommendations for each.

Current state
While the current state of most WSU GUC classroom designs generally meet these guidelines, the smaller conference room spaces used for classes at learning centers, extension offices, and other remote sites (such as school districts) require more consideration.

- **Visuals:**

  Generally, most (80%) rooms have at least one large, high-resolution (720p) screen that allows the reading of faces and visual materials to most students wherever they may sit in the classroom. In fact, most (60%) rooms have separate screens for showing people (i.e., instructor and students at other sites) and visual material (e.g., PowerPoint slides, document camera). However, due to the current connection rate standard (see below in Layer 4 section) when computer-based content (e.g., PowerPoint slides) is sent alongside video of the people, the content is given bandwidth priority which reduces the quality of the people, making it difficult to read faces unless zoomed in on one person.

  Another visual issue in approximately 30% of the rooms is a misalignment of camera and monitor such that the camera is not placed on top of the monitor. This misalignment forces students and instructors to not look into the camera when they are talking to someone on screen, and thus not make virtual eye contact. In such cases, it is sometimes confusing to know when one is being addressed.

A third issue in some classrooms is lighting. In some larger new classrooms there is only one stage light, which creates the tradeoff of: a) switching on the light and lighting up the instructor while washing out the front-of-room screen, or b) switching off the light and putting the instructor in the dark while making the screen more visible. There should be no such forced tradeoff. Another lighting issue in rooms that have windows – which is most of the conference rooms that are often used as classrooms – is that often students are backlit by sunlight and thus their faces are not visible.

- **Audio:**

  There is a wide variety of microphone systems in use across the system. Some rooms lack the end-user control to mute the table or ceiling mics while some rooms do provide the end-user with this control. Some conference rooms used as classrooms have remote controls that allow the user to mute the mic, while others do not provide such remote controls. Even in rooms where students can mute their mics, they often don't know how or forget to do it. Thus, it is a common occurrence that extraneous noises (e.g., zipping a bag, smacking paper on a mic) and side-conversations interrupt class. While students think they are being quiet, sensitive mics amplify their noises to conversation levels or louder. Worse than being merely annoying, when three or more sites are connected, these noises make it difficult to hear the audio from the other sites and change which site's video is the dominant image on everyone's monitor. For example, imagine a course where the instructor in Pullman is broadcasting to Vancouver and Spokane. If a student in Vancouver makes loud noises, then the audio from Pullman is significantly reduced to the students in Spokane. Additionally, the dominant video image in Spokane no longer shows the Instructor in Pullman, but shows the room in Vancouver.

  As discussed in the Layer 1 section, another issue is the audio delay. When participant speaks at one site, it often takes a half-second before the other site(s) hear the person. While a half-second may not seem like much, it is long enough to hinder back-and-forth discussions among sites because the usual live in-person technique of timing one's response to another person's pause no longer works, and parties end up feeling like they are interrupting each other. Thus, audio delay often squelches classroom conversation. Compounding the delay problem is that the audio is gated. Gating makes it harder to join a conversation if the other site is louder; the loudest site "wins" the gate. As discussed above in the Layer 1 section, it is possible to manage this audio problem through adjustments in instructor and student behavior. In fact, we suspect that the variance in satisfaction with videoconference teaching – especially the *variance* between those who believe discussion-based pedagogies cannot be used and those who believe it can be used – largely may be a result of varied experiences where some have made the behavioral adjustment and some have not.

- **Controls:**

  Instructors often do not know how to operate the videoconference controls in their room. Specifically, many do not know how to dial in, zoom cameras, control cameras at other sites, mute/unmute, or connect computers. How much of this activity instructors should be doing depends on how much technical support is available, and that varies by the campus or college, as well as the design of the room. Slightly compounding the problem is that training for controls in one classroom may not apply to the next classroom. Control layout, both physical remotes and touchscreens, as well as on-screen menu options, varies extensively from room to room because of the generation of equipment, operation standards, and budget at the time of design and installation.

Recommendations

- Before undergoing any renovation or creation of a videoconference space, consultation should be obtained from local videoconference staff for guidelines and recommendations. Faculty who have taught in a videoconference space also should be consulted.

- Draft a general-purpose design guide for sites, with contact information for further design and renovation support at each campus. Update as needed to stay current with the technology and equipment being utilized.

- Where applicable, use standardized podium controls and remote controls of videoconferencing systems, so that each new room does not require new control training.

- In classrooms where the camera and monitor are not aligned, cameras should be moved so that they sit on top of the monitor(s).

- In classrooms where there is only one light switch for the front of the room, lighting should be rewired so that instructors at the podium can be lit up without casting light onto monitors and washing out those images. Alternatively, brighter monitors or projectors could be installed.

- If bandwidth cannot be increased, then instructors and technicians should always deselect content (e.g., laptops, computers, document cameras, etc.) so that a blank image is not being sent out to monitors that still consumes bandwidth and thus reduces image quality of the camera feed.

- Because the audio delay and gating issues are inherent to the technology, instructors and students should learn specific rules of speaking, as recommended above under Layer 1.

- Institute a site/room certification review process:
  - For WSU campuses/Learning Centers
    - The centralized videoconferencing infrastructure team should perform an annual review of all sites. Following an approved standardized checklist, this team will certify rooms to be used for instructional purposes.

- A central listing of sites and capabilities should be created and maintained with contact information and technical capabilities.
  - For new sites, and non-WSU sites
    - When new sites are requested to be connected to the system for classes, and *before* students are enrolled, the videoconferencing group should perform a site survey to determine its suitability for use for the class. That information should be provided to the requesting department with technical recommendations on whether the site is compatible or not, and to what degree it adheres to the design guidelines. The department can then determine if they want to move forward with delivering the course to that location, with full understanding of issues that may arise if the site is less than 100% compatible.
  - Non-WSU sites should be re-evaluated each semester.

Additional area to be explored: Students connecting from home

While system capacity and funding for licensing isn't adequate at the current time to allow students the flexibility of connecting to classes from home, it is a feature that many have asked about. This could allow students, especially at the other campuses, the flexibility of coming to campus or not to attend classes. This could allow a better fit with their commuter lifestyles, and possibly allow students to attend classes that they would not be able to if they had to travel to a campus. It also may allow for expansion into other areas that we're not reaching now (Portland, or more rural locations for instance).

However, the complexity, reliability and cost of adding this capability may be extensive. Also, there are significant policy, technical, and support hurdles to overcome. Thus, if considered, this should be considered *cautiously*.

Layer 3 – Administrative/Operational

Introduction

This section addresses the Administrative/Operational model for the various campuses and colleges. We focused on the academic classes; meetings will still need to be evaluated further. Many of the ideas are the same for both academics and meetings.

Current state

Each campus has their own video conference operational staffing and support model. While the main sites of Pullman, Spokane, Vancouver, Everett, and Tri-Cities provide similar base support for connecting classes/events, the level of active monitoring varies based on staffing levels and technology installed. It is important to note that departmental spaces, extension offices, learning centers, and other partner sites have inconsistent support and do not follow a specific model.

Departmental videoconference-enabled conference rooms do not fit into a good operational model because they are scheduled by departmental administrative staff and are not in the General University Classrooms systems. Moreover, there are variations across campuses about how much permission from departmental administrative staff is needed to schedule classes. Often, this creates opportunities for misinformation and breakdowns in communication resulting

in class-meeting start-up delays and lackluster support. In addition to room scheduling, resource scheduling (e.g., an open channel) is also required to ensure rooms can be connected to the correct virtual room. This is an intensely managed process which does not easily allow agility for last minute changes or modifications.

- Service model:
  Historically, the WSU videoconferencing service was a highly managed service where technicians were watching and proactively making on-the-fly decisions. Much of this model is legacy and was driven by the limits of technology. As classrooms have undergone enhancements, remote support and automation has allowed for a more self-service or hybrid option combining both service models.

- Application and Infrastructure support model:
  Currently, WSU has a virtual team supporting the infrastructure and assisting/troubleshooting connectivity issues across the state. While this model is effective, employees are split between multiple organizations which has created confusion in leadership and direction. Additionally, some staff have assigned duties outside of the service area making it challenging to define and grow the central support offering.

Recommendations

- First, we recommend creating baseline operational process standards. Specifically:
  - Trained technicians must be on time to get technology up and running. This would include:
    - Doors unlocked 10 minutes before the start of a class or meeting.
    - Connection verified.
    - Monitors on and showing the correct images.
    - Microphones unmuted.
    - If conference room is being used, make sure a remote control is available.
    - Camera adjusted correctly.
    - Double-check that nobody has turned off the speakers.
  - Trained technician talks to students on the first day of class to explain how the system works, how to best interact with the instructor and other students, how and why to mute and unmute, answer technical questions, etc.
  - Trained technicians must respond to a class needing assistance within five minutes of receiving notification.
- Second, we recommend changes to the service model. Specifically:
  - A combination of both managed and self-service is preferred. While faculty are not technicians, and thus they should not be expected to be a technician as well as the instructor during lectures, basic control options do not require deep technical knowledge. Indeed, faculty operating their own controls would help with the flow of class. Note that we refer there to front-end controls, such as switching of content from computer to document camera to laptop, but not to the backend technology (e.g., adjusting resolution settings).
  - All classes are dialed in automatically (either by the system or technician), not by the instructor nor the student.
  - Trained technicians on each campus should be fully aware of the videoconference classes and meetings that are on their campus each day. This could easily be accomplished with having a campus calendar that shows all videoconference

activity in the main trained technician area (control room, help desk or other business area).

  o The above specific recommendations will need to be re-evaluated if the video conference technology model changes.

- Third, department-controlled rooms need to be better served by technicians, especially if the room is being used as a classroom. A departmental administrative assistant is not a qualified technician. Additionally, department-controlled classrooms need to be scheduled utilizing the same process and system as GUC spaces. This provides visibility and supportability by the local and central videoconferencing support team.

- Fourth, while this report does not evaluate what it would take for any student who wishes to connect from a remote location (e.g., one's own desktop or phone app), under special, approved circumstances a student or guest speaker may wish to connect. There must be extenuating circumstances as to why the student cannot come to the videoconference classroom (perhaps such as an accommodation/accessibility need per Student Affairs guidelines). Also, the instructor must agree to the solution (have the right of refusal), and it must be approved and supportable by videoconferencing support services. After approval is granted, final approval should be granted by the department chair. Finally, the student must be made aware that the connection quality or reliability to the course from their home/hotel/etc. is not the responsibility of WSU staff.

- Fifth, we recommend a standardized method to connect guest lecturers to a class so that the guest is just part of the class.

- Sixth, we recommend the application and infrastructure support model be dedicated to and focused on the service as well as centralized under unified leadership and direction.

- Finally, all videoconferencing credited courses should have the option to be recorded for archive and accessibility purposes. Faculty can still opt-in to having their courses recorded, but the infrastructure should be setup automatically for them.

Layer 4 – Technical/Infrastructure

Introduction
This section addresses the technology and infrastructure required to provide and transport academic videoconferencing statewide. This layer is focused on servers, software applications, networking, and the technical support of this infrastructure.

Current state
Across the state of Washington, the quality of connections and bandwidth varies, for two main reasons. First, WSU's main sites are connected via the Washington State K20 network, which has capacity, visibility, is highly available, and resilient. Other local providers, which can have limited bandwidth, visibility, and require handoffs to other providers, can result in variances in quality and reliability. Second, some WSU buildings (primarily in Pullman) have limited bandwidth and/or connectivity. This creates a bottleneck when the bandwidth demands to a single building are already at or nearing capacity. Under this condition, building a new room or connecting an existing room will result in poor connection quality and end-user experience.

WSU has three, appliance based, multipoint control units (MCUs) that currently provide the connectivity for academic courses at WSU. Appliance-based systems are proprietary, single function systems that must be replaced at the end of their lifecycle. Two of the three appliances are five years old, and the third, which has experienced systematic failure and has since been deemed unsuitable for production use, is seven years old. Traditional life cycles for these appliances allot for 5-7 years before they are deemed end of life. The failing appliance accounts for 25% of WSU's total video conferencing capacity. To exacerbate the issue, because there has been significant growth over the last five years in the use of videoconferencing and little investment to increase capacity, our infrastructure is currently at or below capacity. While we continue to pay approximately $150,000 in maintenance contracts to support the current infrastructure, current cost estimates to refresh the appliance-based infrastructure as-is, is more than 1 million dollars. Because we do not have a budget to refresh this infrastructure and to temporarily deal with capacity issues, last year WSU Spokane and AOI purchased a small pool of licensing for a software-based system (Pexip) that leverages virtualized resources. This small investment ($15,000) was just enough to support the offloading of room-based meetings, providing minimal resources to meet the daily workload.

As mentioned above, endpoint devices (e.g., the codecs in the classrooms) are inconsistent in generation, functionality, and serviceability. This is largely due to neglect and/or budget constraints.

Recommendations

Our primary recommendation is to remove and replace the appliances. Note that in the past 3-5 years, videoconferencing technologies have moved away from appliances and we have begun to use software-based solutions that leverage standard hardware, support virtualization, have cloud options, and allow for geographic load balancing, which is critical for long-term growth and sustainability. This committee recommends a central investment in a new software-based system to support all the WSU videoconferencing needs. Once fully invested, this solution will support our current model and allow us to move to a self-service model for meetings where users can meet when and where they want. This will enable us to sunset the Polycom infrastructure which will save considerable capital money long-term on appliance refresh.

With an initial investment of approximately $300,000 and an annual budget after year one of approximately $250,000, WSU will be able to provide the quality and capacity needed to support our academic mission long term as well as fund the 5-year refresh lifecycle.

In the meantime, we recommend the following activities be performed on the current system:

- Annual site-to-site stress-testing to ensure bandwidth is available for quality videoconferencing.
- Work with each campus to identify subpar connectivity between buildings and plan for upgrades to improve quality of delivery.

- Provide an annual compatibility matrix which identifies what devices will work within the standards for academic instruction. (this will be part of the site/room certification noted in layer

Final summary

After reviewing the current academic videoconferencing environment, we discovered that it works better than is rumored – mainly, discussion-based courses can be taught using it, quite well – providing some inexpensive adjustments are made. However, going forward, because some of the current technological infrastructure is reaching end-of-life, some hardware needs to be replaced with software. To these ends, our primary recommendations include:

- All instructors who teach via academic videoconferencing receive training in how to manage student behavior in this unique environment.
- The standards by which academic videoconference classrooms are designed need to be updated so that new rooms are designed more effectively. Also, about 30% of existing rooms need minor updating to these standards (e.g., positioning cameras on top of monitors).
- Technical support across campuses requires some standardization, in part so that instructors do not have to be their own technicians.
- In the next year, we make the initial investment and begin sunsetting the appliance-based solution and transition completely to a software-based video-conferencing solution by year 2.