

# Virtual Conferences

## A Guide to Best Practices

A community resource curated by  
the ACM Presidential Task Force on  
What Conferences Can Do to Replace Face-to-Face Meetings

### DRAFT FOR COMMENTS

*This preliminary draft report is still evolving quickly. To make sure everyone sees the most up-to-date version, we ask that you do not share the PDF itself; instead, please refer to this link:*

<https://www.acm.org/virtual-conferences>

## Abstract

*“Our conference organizing committee just decided to switch our physical conference to online. But the conference is supposed to start in three weeks, and none of us have ever even been to a virtual conference, much less put one on! Where do we start??”*

This document is a guide to the brave new world of virtual scientific conferences, assembled and curated by members of the Association for Computing Machinery’s Presidential [Task Force on What Conferences Can Do to Replace Face-to-Face Meetings](#).

Because so many conferences are going online in a short time, there are many organizers with urgent questions; at the same time, new insights, ideas, and experiences are being generated at a furious rate. We hope that this guide will serve both as a basic orientation for newcomers and as a repository of accumulated knowledge from the community.

As both heavy users of online technologies and researchers responsible for developing them, the ACM community is especially well-positioned to offer advice that we hope will be helpful to other groups dealing with the same problems.

<https://www.acm.org/virtual-conferences>

2020-03-28

**How to read this guide:** We hope this document will serve as a comprehensive resource for understanding, organizing, and running virtual conferences. If you want a quick start, you may want to jump straight to [Bootstrap Suggestions](#), and then read in reverse order from there.

**We warmly invite contributions** from readers! In particular, if you are an organizer of a *past* virtual conference, please tell us what you learned (there is an appendix where you can write as much as seems useful, plus a section in the main document for short summaries). If you are an organizer of an *upcoming* virtual conference, please let us know what questions you have that we have not considered yet. If you are an *expert* in any relevant area, please give us your thoughts.

Concretely, here's how to contribute:

- First, if you are reading a PDF version of this report, [follow this link](#) to reach the live Google Doc.
- Next, if you have ideas about things that could be *added*, please go ahead and add them (in an Appendix, along with a suggestion of where it might go in the final document, unless it is very clear where it belongs in the present structure). The Google Doc version of the report is a live document that you can directly type into. Your changes will be reviewed by an editor before becoming permanent.
- Similarly, if you see things that can be *fixed or improved*, please go right ahead and make the change if it seems uncontroversial; otherwise leave a comment by selecting some relevant bit of the text and clicking the + symbol in the right margin.
- If you have a reaction, question, or criticism, or an idea that you are not sure how to weave into what's here, please leave a comment in the document and/or reach out to task force members individually or as a group at [virtual-conferences@acm.org](mailto:virtual-conferences@acm.org). (But first, especially if your comment is a suggestion for something to add to the guide, please spend a little thought to see if you can add it directly to the document in its final form: this makes life much easier for the editors!)
- If possible, please sign in to your Google account before leaving comments or editing; this will help us understand who is contributing, and it will allow you to receive notifications if we respond to your comments.
- If you help us improve the document, please do add yourself to the list of contributors below.

**Contributors** (in alphabetical order):

Jeremy Baumberg, Susanne Boll-Westermann, Donna Cappel, [Francois Guimbretiere](#), [Vicki Hanson](#), [Srinivasan Keshav](#), [Konrad Kording](#), Clifford Lampe, [Rob Lindeman](#), [Crista Videira Lopes](#), [Blair MacIntyre](#), [Jeanna Matthews](#), [Gary Olson](#), Jens Palsberg, [Benjamin Pierce](#), Pat Ryan, Henning Schulzrinne, David Shamma, Alan Smeaton, John Tang, Dave Thomas

# 1 Introduction

The spread of COVID-19 is causing disruption world-wide, forcing conference cancellations, and leaving organizers scrambling for alternative ways of disseminating the work that was to be presented. In response, the ACM has convened a [Presidential Task Force](#) (PTF) to rapidly gather and disseminate best practices and immediately implementable options.

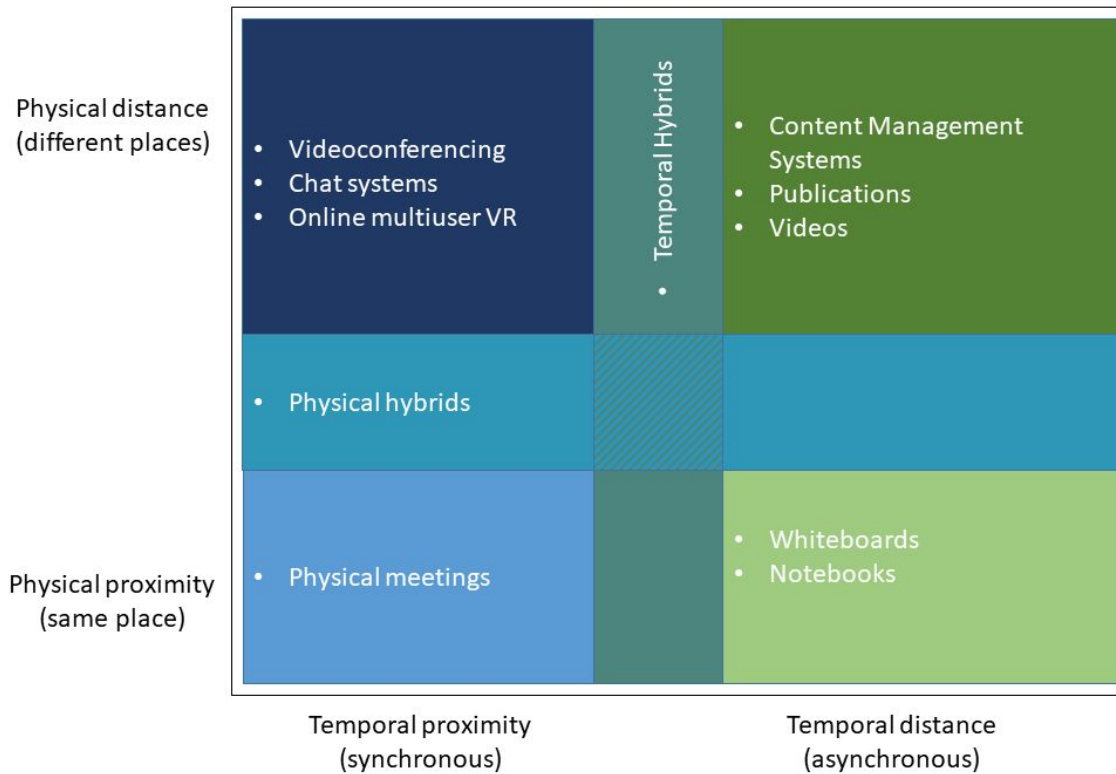
This guide is meant to shed light on the territory of online conferencing.<sup>1</sup> Fortunately, online conferences have been happening for a long time, mostly in niche communities outside the ACM. The guidelines presented here are mainly derived from knowledge acquired from those communities. However, since mid-March 2020, a few ACM conferences have rapidly adopted some form of online participation. As those events happen, we are asking the organizers to write up experience reports, which we will continually add to this document. Accordingly, we expect the document to evolve as we learn more about what works.

One of the most important takeaways from past experiences with virtual conferences is that they are not just about the technology that supports them, but they are, first and foremost, about *rethinking* and *retargeting* the things that organizers and participants normally do into new media and new forms of interaction. Virtual conferences need just as much organization as physical conferences. The roles in organizing committees are pretty much the same, but some of these roles will see their activities radically shifted from dealing with physical matters to dealing with online matters.

When thinking about conferences and the social activities surrounding them, it is useful to think in terms of two major dimensions: time and space.

---

<sup>1</sup> We focus on fully online conferences in this guide, since this domain is what people are trying to figure out right now. Some hints and pointers on physical/virtual hybrids can be found in [this appendix](#) (and you are very welcome to add more!).



On the bottom left of Figure 1, there are the regular physical meetings where activities happen in the same place at the same time. In situations such as the current pandemic, this part of this space becomes unavailable. Just above that, physical hybrids offer several strategies for allowing remote participation in physical conferences (multi-hub conferences, live streaming, etc.); that point of the space is also currently unavailable. What we have available at the moment is the top portion where we assume physical distance.

On the top right are the asynchronous collaboration tools, such as paper submission and review systems, conference websites, and publications themselves. Conferences have been exploiting that portion of the space for several decades as enhancers of physical meetings. In times of severe travel restrictions, conference organizers may opt to forego synchronous meetings altogether and focus only on their asynchronous “outputs”— published papers, pre-recorded videos, published software artifacts, and maybe even asynchronous Q&A. A good example of this model is explained in [this document](#). This is a viable and very simple fallback option for conferences that cannot take place physically, albeit one with some financial consequences (e.g., if there are costs associated with publications, organizers will need to tap into some revenue stream). But this model eliminates what makes a conference a conference: the real-time social interaction among participants in the concrete cultural context of a location and venue. Eliminating this component, or replacing it with interactions with long temporal intervals (e.g., text-based discussion forums), is, essentially, falling back to a publications-only model.

Our main interest in this guide is in the top left portion of the space-time chart: real-time, interactive “live” conferences taking place in some sort of online space. We are writing for organizers of academic conferences who want to create online spaces for real social interaction and networking and maintain some of the benefits of synchrony from their formerly physical conferences. We should emphasize, however, that although we use the word “virtual” throughout this guide as a synonym for “online,” we are *not* recommending that conferences attempt to reconstitute themselves in full-blown virtual reality, complete with 3D scenery, virtual exhibit halls, avatars, and all the rest. There have been some heroic experiments in this direction (e.g., the recent [IEEE VR](#) conference, and the long-running [Open Simulator](#) conference), but the technological demands, for both organizers and participants, are not for the faint of heart.

We hope that this guide will prove valuable beyond the crisis we are currently living through. Over the past few years, there has been an increasing interest by many members of the ACM community in ways to support remote participation in conferences, as well as ways to organize online and mixed events. This increasing interest has been associated with community awareness towards [environmental sustainability](#) and [climate change](#), [diversity](#), [inclusion](#), and [economic justice](#). From an environmental perspective, for example, physical conferences incur CO2 emissions on the order of [hundreds or thousands of tons](#); in contrast, the carbon footprint of virtual conferences is on the order of hundreds of *kilos*. Virtual conferences may well become an integral part of the ways the ACM fosters community from here on out.

## 2 High-Level Planning

### 2.1 Organizing Committee

Virtual conferences are *conferences*. That is, they present a live, real-time program enacted and observed by people, and they foster real-time social interaction among participants. A corollary that may take organizers by surprise is that virtual conferences require as much planning and behind-the-scenes real-time logistics as physical conferences; it is a mistake to assume that a virtual conference will “just happen” if the organizers simply choose some real-time interaction platform and tell people when and where to show up.

Virtual conferences require organizing committees quite similar to those of physical conferences, including the need for volunteers during the conference, but with some significant rethinking required for each of the roles:

- **“Local” Arrangements:** The “venue” of a virtual conference is a platform, or a set of platforms, where social interaction will take place. As such, the “local arrangements” team will now need to include people with specialized technical skills, including audio-visual and streaming expertise, who will be able to decide on, and interface with,

the platform(s) where the social interaction will take place. The local arrangements team will also serve as, or interact with, the hosts of all the sessions.

- **Hosts** are responsible for starting and managing the live sessions. Although they are the owners of the sessions, they are typically hidden from everyone, except from those participating in those sessions during the “green room” period of the sessions (a period before the sessions start). They are the ones saying “3, 2, 1... live” and the ones with super-powers. Hosts may be volunteers who are part of the local arrangements team or they may be contracted professionals. More on this in [On-Site A/V support](#).
- **Session Chairs:** These are the moderators who make sessions of the conference work. Although they can be the same group of people who serve as session chairs in physical conferences (e.g., PC members), they require additional advice and training to make sessions successful social interaction spaces. Specifically, session chairs need to join the sessions at least 15 minutes before they start, make sure all presenters are there, and find them quickly if they aren't, introduce the session properly (“This is session so and so of conference X”), gather questions from the audience in chat channels, keep the flow, and keep track of time. In cases when presenters go unreasonably longer than their allotted time, session chairs can and, sometimes, must intervene, including by muting the speaker, as there may be strict time limits for the use of the platform.
  - In very small events, the role of session chair and host may be played by the same person, but for conferences even as small as 100 participants, that is not a good idea, as those roles require completely different skills.
- **Student Volunteers:** A virtual conference needs just as many student volunteers as a physical conference. Volunteers need to be present in each virtual meeting space, monitor the chat channels, greet participants, help session chairs gather questions, and interface with the rest of the organizing team when problems arise. They should be easily identifiable through visual cues, naming conventions, etc. Roughly, there should be one student volunteer per meeting room and chat channel, plus a few in a “landing” space for newcomers, if there is such a thing. Just like in a physical conference, student volunteers will need to be trained in advance and someone needs to oversee their activities during the conference.
- **Entertainment:** Some physical conferences include in their organizing committees a group of volunteers whose task is to set up an entertainment program that may include live music, outings, etc. This task is even more important in virtual conferences. Someone in the organization should be in charge of adding fun things for participants to do online together. (See [Ideas for Research and Experimentation](#) below.)

Given that virtual conferences take place in online platforms, which will be new for most participants, organizers cannot rely on speakers' prior experiences on giving conference talks. It is strongly advised that organizers set up training sessions ahead of time for speakers and session chairs, so that they can learn how to function in the platform(s) where the conference is taking place, and how to interact with people in other roles and with the audience. These training sessions can be as short as 15 minutes. Training speakers and session chairs is a task that can engage many student volunteers.

Another issue that organizers should keep in mind is that virtual conferences may be less forgiving than physical ones if something is not working as planned, such as a microphone not working or the location of a workshop changing. Testing and rehearsing ahead of time mitigates these problems.

## 2.2 Live Presence

One might think that the way to organize a virtual conference is as one big shared space, where everyone shares their media streams with everyone else. However, this approach is both technically challenging and not necessary for a successful meeting. For example, plenary sessions of physical conferences -- where everyone comes together -- have a clear separation between those on stage (one or just a few people) and those in the audience (possibly a very large group). Those on stage can be part of a smaller, media-rich shared space that is then livecast to the larger audience -- or even publicly onto the Web. Livecasting is cheap and efficient, and there are plenty of options to choose from.

Nevertheless, it is much more engaging when the audience itself also has a presence; the speakers on stage feel like they have a live audience, and the people in the audience feel that they are in a group, and not watching a video alone. Currently, one of the most effective ways to host very large groups of people in a shared space is using text messaging.

Independent of what media is chosen for rendering the presence of people and their content, the glue that binds participants together is text chat. There need to be several group chat channels, including all simultaneous participants in the conference, in each session, and smaller, specialized chat channels for smaller groups. This makes all the difference between a person watching a video of a talk by themselves, and watching a talk together, at the same time, with a group of like-minded people. It is important that the chat feeds back to the speakers during their live sessions.

There is a tension between too many channels (hard to watch them all, hard to get conversation going) and too few, unfocused channels. Besides a few public general channels (e.g. help and general), and a few private role-based channels (e.g. organizers, presenters, student volunteers), a good rule of thumb is to think of chat channels for the participants as individual rooms in a physical conference venue. You can even call them "Room A", "Room B", etc. So, rather than having one channel per session, which will quickly become confusing, consider having one channel per sequence of sessions; the temporal distribution of the presentations will be reflected in the chat of those channels.

Session chairs/channel facilitators are tasked with asking targeted questions to specific authors/presenters that get the conversation started. As with any social gathering, it takes organization and effort to avoid "dead space" and stimulate interaction and conversation.



The choice of [Platforms](#) should be made with the goal of reaching a good balance between participants' sense of presence, scalability, geographic reach, and simplicity. The number of expected participants has a tremendous impact on this balance.

## 2.3 Navigation

In physical conferences, navigation is naturally supported by the layout of the conference venue. However, even in those conferences, organizers need to do much more than letting people roam around. Specifically, a printed or online program, with the schedule and information about each session, including room numbers, the floorplan of the venue, etc., is a requirement for participants to be able to find the sessions and the people they are interested in.

In virtual conferences, navigation is equally important. The live sessions of virtual conferences need to be easy to find and get into. The online program needs to have information about when and “where” the sessions will take place, e.g., the Zoom meeting links, the Webinar links, the Slack channels, etc. All of this information should be presented through user interfaces that are easy to understand and that “teleport” participants to the “places” they want to go. (For concrete suggestions, see Navigation under [Ideas for Research and Experimentation](#))

## 2.4 Dealing with Time Zones

When participants are within a limited range of time zones, it may be possible to schedule sessions at convenient times for everyone. However, time zones are one of the biggest challenges of virtual conferences when participants live around the world.

There are no great solutions to overcome the fact that some people will be sleepy when others are wide awake. There are, however, some workable ones:

- Presentations can be recorded in advance, and then streamed at specific times, multiple times.
- Presenters can make multiple live presentations, possibly over multiple days, with at least one happening at a time that is appropriate for large time zone ranges. For example, 8am GMT (good for Europe through far-east Asia) and 5pm GMT (good for the US West Coast through Europe).
- Presenters can make one live presentation at some convenient time for them. That interactive presentation will be recorded and then:
  - Replayed at other times during the following 24 hours, or
  - Uploaded to a video store service, where participants in other geographic locations can watch asynchronously.
  - Volunteers may collect questions by asynchronous participants. A separate live session can be scheduled with the speaker for answering those questions.
- Plenary sessions can be much shorter (e.g., 2 hours) and happen at a time when most participants around the world can attend. For some it will be the beginning of the day,



while for others it will be the end. While there is no ideal time, 3pm GMT is a common choice, as it allows most of the world to participate before midnight and after 7am.

- Sessions can happen on a 24-hour rolling basis, scheduled according to the geographic location of the speakers.
- Smaller events, such as workshops, can be independently scheduled for the time block that is the most convenient to the registered participants.
- Breaks should be longer than 15 minutes, because a short bio-break for some may fall on meal time for others.

## 2.5 Carving out Mental Space

One thing that physical attendance accomplishes is help carving out the mental space for participation. What strategies can we use to encourage attendees to focus on a virtual event? Synchronous events may encourage attendees to prioritize participation and discourage the illusion that we will come back to that video later when we have time. Survey results show that participants value events designed to help with this (e.g., “I liked being able to watch the talks at my convenience but I probably watched fewer and was less engaged in discussions because of it.”).

Virtual conferences can have multiple audiences - one set of attendees wanting intense interaction over a short period and another set wanting more casual informal interaction with archival material. Formal paid registration and special events for registered participants could focus on attendees desiring intense interaction.

One tension is whether to spread synchronous events out over more days to make it easier to combine virtual attendance with daily life or whether to encourage more intense interaction over a shorter period of time. Even at in-person meetings, multi-tasking can be common and there is often a limit to how much dense technical information can be consumed in one day. Without the need to limit travel time, we may settle on ~3-4 hours per day for virtual conferences rather than ~9-12 for in-person meetings. An in-person event that was normally 2-3 days might translate to a week-long virtual event, but without the travel time/expense/environmental impact and with more ability to attend to other duties and absorb new complex ideas over more time.

Participants should be advised to clear their calendars for the conference, and at least be aware of these issues. Even doing the virtual conference from home rather than the office, closing the door (if there is one), or placing a sign “live session, don’t interrupt”, are important choices.

## 2.6 Registration

The issue of registration is a really important part of planning a virtual conference. Being online, it is trivial to broadcast the sessions publicly to the entire world, e.g. livestreaming to YouTube. But that raises the question about registration: what is the value of registering for a virtual conference if the sessions are broadcast live to the entire world?

This is where social interaction comes in. The value of a conference, in general, is not just the talks, i.e. the “content”, but it’s also the social networking that takes place around and beyond the content. Registration can be justified for one or both of these components:

- **Content:** Organizers may choose to limit the live distribution of sessions to only registered participants, and may make those sessions publicly available at some point later. Alternatively, organizers may want to livestream the sessions publicly. Both options are technically possible. This decision has strong implications on the [technology choices](#), as some platforms support restricted participation while others do not.
- **Social interaction:** Organizers may want to limit real-time social interaction to only registered participants. Alternatively, organizers may open up the social interaction channels to the entire world.

While the issue of free vs. restricted distribution of live content can be debated, there are very strong reasons for requiring people to register and for limiting social interaction to those who do. For starters, without knowing who wants to interact it is very hard to plan a conference -- 30 people? 300 people? 3,000 people? In what parts of the world are they? Then, there is the issue of fostering community: conferences are typically focused on specific topics that attract those who are interested in those topics; opening up to the entire world may dilute the conversations. Additionally, there are [financial](#) and [security](#) implications, discussed in sections below.

Another issue to have in mind, at least during this early adoption phase of virtual conferences, is that the platforms may not be ready for interfacing with the registration services that we have been using for physical conferences. In virtual conferences, the check-in procedure is considerably different. Here are some issues to consider:

- Some of the systems listed in the section on [Platforms](#) include support for registrations, others do not.
- There may need to be interfacing work between a registration system and the conference platforms.
- Some of the interfacing work may fall on the organizers themselves, rather than on the registration vendors, especially in the early adoption phase of virtual conferences, when not many vendors are prepared for online check-ins.
- When negotiating registration contracts, the vendors will no longer be asked to travel and do on-site registrations, which should change the pricing.

## 2.7 Finances

After decades of organizing in-person physical conferences, the community now has substantial experience in planning their budgets. Virtual conferences obviously introduce substantial new variables into this process. Some expenses are eliminated (costs for the venue/site, food and beverage costs, on-site A/V, management and logistics costs related to venue) or drastically reduced (conference committee/program committee expenses). There are also new expenses (platform fees, different types of A/V and IT costs to support virtual conferencing). Some costs

may remain the same (proceedings, publicity, credit card processing fees, registration platforms) or we may find new ways of doing some of these things as well.

In addition, virtual conferences may drastically change the number and distribution of people who attend. Many physical conferences already have reduced registration and travel scholarships for students and other groups. If we remove many of the individual travel expenses related to the event, even more people may be able to participate.

Some of the initial experiments with virtual conferences have been offered for free, and this may be a reasonable choice for other conferences going virtual suddenly in response to COVID-19, if the corresponding SIGs are willing to take the losses. Longer term, organizers and attendees in our community should expect conference registration fees to be needed to support sustainable events, and this may also be a reasonable strategy even for this year. CHI, for example, is refunding registration fees automatically this year, but some attendees are already asking “What if we wanted to leave our registration to help CHI remain solvent?” Indeed, paying reduced registration may be easier than making a donation, vis a vis company and university policies. Some conferences are reducing or eliminating fees for virtual attendees but requiring that one author per paper register and pay.

By the end of 2020, we will have plenty of new data about attendance levels at virtual conferences. However, attendance numbers at free conferences may be skewed. People are more likely to express interest in or register for a completely free event, but then may not attend at all or may just casually attend as an experiment. Also, global disruption in work patterns due to COVID-19 are likely to skew the data from this year.

As background for the preparation of this guide, ACM headquarters has done an initial analysis of the data from 2018 conferences (that is, “closed” conference data, not anticipated budgets). They eliminated expenses related to physical conferences only (site costs, food & beverage, logistics, conference committee expenses, program committee expenses, conference management expenses, etc.) and added estimated platform costs (ranging from \$0 for very small conferences—assuming they could, for example, use ACM’s Zoom license—up to \$20,000 for very large conferences). They kept some expenses the same, including costs for publicity, platforms to handle registration, credit card processing fees, allocations to ACM and co-sponsoring organizations, and costs for producing the proceedings. It is worth noting that none of these costs include printed proceedings. For each event, they divided the total expenses by the actual attendee numbers from the on-site events. Averages were in the \$161-195 range, with medium-size events slightly less expensive than small events, but with very large events (over 1,400 people) more expensive than all others -- which may reflect the point at which conference organizers (volunteers) need additional conference management help from professionals.

Further analysis could help reveal more information about which portions of these expenses could be amortized over additional attendees, since virtual attendance may drastically shift the

number and distribution of attendees. We tried a rough estimate of how these costs would change with twice the attendance if we expect that substantially more people would be able to attend virtually. Some costs (like the registration system and credit card processing fees) might double, but other costs would remain the same (publicity, producing the proceedings). The estimated platform costs for a system like Zoom would increase but not double.

These numbers give a starting point for understanding what the registration costs of virtual conferences might look like going forward. As we run more virtual conferences with registration fees, we will get better data on how this may change attendance patterns. Charging fees at least in the \$100-\$200 range this year may help in many ways: it will provide more reliable estimates of who will actually be attending (important for planning upcoming events) and it will give us better data to help guide budgeting in the longer term.

However, organizers should be careful not to encourage an expectation that the price of virtual conferences will always be this low. In particular, there is almost certainly not enough overhead built in to maintain the long-term financial health of the sponsoring organizations (the SIG, ACM itself, etc.). A much more careful analysis will be needed to fully understand how prices should be set in the future.

For the moment, the main take-away is that there is a good argument that registration fees should *not* be set at \$0, even this year. Rather, organizers should look at their existing budgets, and rework them by eliminating the costs associated with the physical event. Requiring attendees to pay something for virtual conferences will also help organizers by reducing uncertainty about platform provisioning.

One short term issue for conferences that originally planned in-person meetings for 2020 is cancellation policies for hotels and airlines. ACM may have ongoing relationships with hotels that may give them some leverage. This could also be one additional good argument for offering a mechanism to request waived registration fees in reaction to the COVID-19 pandemic, but it is probably better for setting expectations long-term if we set a reasonable registration fee and then waive it where appropriate, rather than not charging any registration fee in the first place. Some conferences may need even higher fees this year to cover deposits on venues and services that will go unused.

To summarize this discussion: This year's COVID-19 situation is exceptional; ACM conference organizers should work with their SIG leadership in order to decide the right thing to do in such an exceptional situation -- maybe the SIG will absorb all the losses and the virtual conference will be free for all participants, maybe only authors will be required to pay a registration fee, maybe all virtual participants will pay a small registration fee. Going forward, however, virtual conferences will most certainly need to charge registration fees that cover all costs, including the costs of operating the SIGs themselves.

## 2.8 Preparing to Deal With Disruption

Any large gatherings of people/attention can be targets of deliberate attempts at disruption, trolling and other attacks. Conference organizers (and platform developers) should view their offerings ahead of time through the lens of possible disruptions. Many platforms offer controls such as “Mute all” or the ability to block a participant. However it is difficult for the presenter to manage these controls in real time without interrupting the presentation. This is one of many reasons to have other volunteers/staff in charge of that aspect and to actively designate co-host privileges ahead of time to those people.

It can be wise to have an explicit Code of Conduct that sets down rules for participants and the types of actions that will be taken when violated. Consider including things like a real name policy for attendees (similar to wearing a badge) and guidelines for whether it is acceptable to take screenshots or record other participants (e.g. allowed for personal use, but not for further distribution). Beyond that, consider testing your platform with an eye towards attendees being as disruptive as possible and then building in defenses for these kinds of disruptive actions<sup>2</sup>. For example, what would happen if one attendee attempted to impersonate a respected member of the community, or what would happen if attendees posted offensive comment or links to malware in the chat?

Appropriate defenses might include both prevention strategies and support for investigation, response, and censure after the fact.

## 2.9 Fairness and Inclusiveness

Another important issue to consider when planning a virtual conference is ensuring that existing economic disparities are not amplified by the move from physical to virtual. For example, one might envision technically sophisticated solutions that would be out of (economic) reach for many communities. So, while developing solutions, we also need to put in place mechanisms to support their deployment to *all* members of the community they will serve.

Some platforms may not be accessible in some geographic regions. For example, Google or Facebook services may not be easily reachable in China. If possible, organizers should systematically test availability and quality of services from regions where people have registered.

During COVID-19, many participants will need to watch and listen from home, but their internet connectivity may not support high-bandwidth streaming video. Thus, offering a fall-back option that allows asynchronous downloading or participation by audio-only, including dial-in by phone,

---

<sup>2</sup> [Black Hat Trolling, White Hat Trolling, and Hacking the Attention Landscape](#), Matthews and Goerzen, 2019.

can ensure that nobody is excluded by network constraints. This applies particularly to presenters, whose at-home bandwidth may not be sufficient to reliably stream video. (Make sure to check whether the platform you are considering offers local dial-in numbers across all regions of the world; some services may require an international call to join by phone!)

Many SIGs have established tools (student travel grants, geo-diversity grants, etc.) that could be repurposed to help level the virtual playing field, but we may need to consider new mechanisms, since first-class access to virtual spaces may require large up-front investments in, for example, network infrastructure. In some parts of the world, this may raise significant hurdles.

## 2.10 Accessibility

*[This section is still skeletal. There are a ton of issues, but we lack the expertise to enumerate them or offer guidance. Please help us fill it in!]*

Many people with sensory disabilities have ample experience of what works for them to collaborate remotely. Rather than assuming or guessing, work with these attendees to see if there are particular tools or particular ways of using tools that maximize their experience. If you do not have ready contacts, consider contacting universities that have a large number of blind or deaf students. For example, Gallaudet University has a small computer science group that has advised U.S. federal and state policy makers on how to support participants who are Deaf.

Participants who are Deaf and located in the United States may be able to use a dial-in conference line with their government-subsidized [video relay service \(VRS\)](#). The participant dials the conference number and a communications assistant at that service will translate the conference audio presentation into sign language, visible on a screen used by the person who is Deaf. This incurs no extra cost for the conference, but does require that the conference tool supports dialing in by phone. Some organizations also have on-staff sign language interpreters. If they can participate in a Zoom, BlueJeans or similar video conference, they can provide real-time interpretation. The IETF standards organization relied on the services of a captioner assigned to one of the attendees through his job to provide real-time captioning for all attendees.

Some platforms (e.g., Zoom) allow organizers to designate a participant to provide real-time captioning. There are professional services that will caption events remotely, for a fee. Compared to in-person events, it may be easier to, for example, find a sign language interpreter who can provide ASL or other sign language translation. Also, some video services such as YouTube can auto-caption stored videos. Microsoft offers AI-powered, real-time captioning in the latest versions of [PowerPoint](#), [Skype](#), and [Teams](#), and the PowerPoint feature even offers translating from a choice of spoken languages to a choice of textual subtitles. (With all these automatic services, organizers should check the quality of the captions!)



Organizers should also consider whether tools used for live sessions can be readily used with screen readers. Often, “Section 508” compliance provides some hints and the tool vendors should be able to provide guidance, as many of their customers, whether educational or government, have legal obligations to provide accessible services

## 3 Technology

This section describes platforms and technology to support virtual conferences. We begin with a discussion on conferencing [hardware](#) needed by participants, then move on to the very important A/V support, and finish with a detailed description of [communication platforms](#).

### 3.1 Hardware

For conference presenters, although it is possible to participate using only the built-in microphones, speakers, and cameras on their laptops/desktops, these tend not to be of sufficiently high quality. Specifically, built-in microphones, especially on laptops, tend to eagerly pick all other ambient sounds beyond the speaker’s voice -- keyboard typing, chairs squeaking, doors opening, dogs barking, etc. Also, the built-in microphone and speakers, without echo cancellation, frequently result in feedback loops that ruin the experience for everyone. For this reason, it is very important for presenters to look into more specialized hardware, and be careful to check their A/V setup they have ahead of time, making contingency plans if their setup fails during a live presentation. Specifically, it is a good idea to ask presenters to keep a phone handy in case they need to revert to calling in on a phone line. This is supported by most videoconferencing systems in widespread use today.

A relatively affordable and effective option is to use headsets with embedded microphones. For example, earphones for smartphones are an obvious alternative to built-in hardware (though presenters should be made aware of the noise they may introduce when they come in contact with clothes and hair). Gaming headsets are another alternative that avoids the problems of earphones; they are popular, not very expensive, and designed for being worn for several hours. Other, more expensive, alternatives include microphones used by podcasters, streamers, and vloggers (e.g., Blue Yeti); but be careful: just buying one of these microphones doesn't guarantee full benefit; one also needs to pay attention to how it is situated and mounted. In some cases, the built-in microphone can sound better than the headset. The audio quality of different options available to the presenter can be checked as part of a test session.

Another issue for video conferencing, in particular, is the lighting that the presenters have for themselves, as well as the angle of their camera. Many people do not realize that, if there are strong light sources, such as a window, behind them, their faces will turn dark and grainy. Again, this is an issue that can be detected in, and mitigated during, test sessions ahead of time. Ring lights, i.e., [light sources](#) in a [ring](#) shape that softens shadows (often used in portrait



photography), are a cheap and effective option for presenters to add to their setups, and they help make a more consistent lighting environment.

### 3.2 Internet Connectivity

During COVID-19, presenters may have no choice but to present from home, where internet bandwidth and reliability may be significantly lower than, say, at their academic institution. Networks in some geographic regions may experience network congestion that depends on the time of day, due to the increase in overall usage. Thus, organizers need to plan for handling unexpected disruptions or severely reduced quality during a live talk. For example, they may want to have a recorded version of the talk as a backup, in case the live presentation fails on short notice or even during the presentation. Or they can have presenters also dial in by phone, muting that backup connection until it is needed, with the A/V crew sharing the slides.

Presenters should ensure that their home internet connectivity is not degraded by simultaneous use by other members of their household. And hold the popcorn until after the presentation - microwave ovens are known to interfere with Wi-Fi.

Not all attendees may be able to watch live video reliably; providing downloadable content (e.g., MP4 files, not just YouTube URLs) may be helpful. Zoom and similar services can record sessions in MP4 format and can store the recorded content in the cloud, with download links that can be distributed to attendees.

### 3.3 “On-Site” A/V Support

A virtual conference is something like a live TV production.<sup>3</sup> In addition to the organizing committee, which plans ahead, virtual conferences need real-time audio-visual support related to the live production of the events. This might include operating software such as the Open Broadcaster Software (OBS), making sure the right speakers are in the right virtual spaces before their sessions, testing their microphones and presentations before going live, switching speakers during the sessions, making sure the session is being broadcast/recorded, looking out for technical and security disruptions, etc.

These activities fall, generally, under the responsibility of the host. For all but very small meetings, it is important to have someone serving as host who is not involved in the content of the meeting -- not a presenter, not a session chair, and not the student volunteer helping the session chair. In cases of very small meetings, this could be the same person but they do require different skills/expertise (platform controls vs content expertise). The analog in physical conferences is the activities performed by the A/V team vs. the session chair vs. volunteers who shuttle physical mics around the room, etc.

---

<sup>3</sup> For reference, SIGCHI has prepared some [detailed guidance](#) on video production.

For virtual conferences, it is wise to set up a back channel for out-of-band communication between the speakers and this team. Considerable backstage communications need to happen for a virtual conference to run smoothly.

This “on-site” A/V support can either be provided by a group of volunteers who are part of the organizing committee, or it may be contracted externally (or a mix of both). The exact contour of this support also depends on the platform. It is no exaggeration to say that A/V operation is the key to the technical success of the conference.

### 3.4 The Space of Communication Platforms

Before digging into the toolchest of communication technologies, let’s take a step back. Broadly speaking, a communication *platform* provides one or more communication *channels* that can be categorized along four orthogonal dimensions: synchrony, directionality, scale, and content.

- **Synchrony:** With *synchronous* communication, there is only ephemeral storage between content creation and consumption. In contrast, with *asynchronous* communication, storage allows creation and consumption to be separated by nearly arbitrary time delays. In the discussion below, we denote synchronous communication by ‘Sync’ and asynchronous communication by ‘Async.’ Storage also allows the content to be either *serial* or *structured*. With the former, content is consumed in (nearly) the same order as created. With the latter, consumption order may differ from creation order.
- **Directionality:** Communication can be *one-way* or *two-way*. These are abbreviated ‘1-way’ and ‘2-way’ below.
- **Scale:** The smallest possible scale is communication between two entities (‘1-1’). *Small-scale* communication (‘Small’) is between two and, say, 20 entities; *large scale* communication (‘Large’) goes beyond. Generally speaking, there is an expectation of privacy for one-to-one and small-scale communication, but not for large-scale communication.
- **Content:** The communicated content could be one or more of *text*, *images*, *audio*, or *video*, where video includes audio communication. These are abbreviated ‘Text’, ‘Image’, ‘Audio’, and ‘Video’.

Note that any synchronous channel can be converted *post hoc* into an asynchronous channel by adding recording, storage, and replay. In the other direction, an asynchronous serial channel, if content posted is read soon after posting, mimics a synchronous channel. Moreover, any two-way channel can be used as a one-way channel. Finally, a channel that can be used for large-scale communication can also be used for small-scale and one-to-one communication (except for loss of privacy), and a small-scale channel can be used for one-to-one communication.

We characterize any communication platform as a set of channels. A platform with two channels, say C1 and C2, is denoted [C1, C2]. If a platform supports more than one instance of a channel, this is denoted by a '+.' For example, a platform that supports one instance of a channel of type C1 but many parallel instances of C2 is denoted [C1, C2+]. Each channel is described by a sequence of “features,” in the form ‘(‘ {Sync | Async-serial | Async-structured} ‘/’ {1-way| 2-way} ‘/’ {1-1| Small |Large} ‘/’ {Text | Image | Audio | Video}’). Some examples will illustrate:

	<b>Synchronous or Asynchronous</b>	<b>1-way or 2-way</b>	<b>1-1, Small, or Large</b>	<b>Content type(s)</b>
<b>Videoconferencing</b>	Sync	2-way	Small	Video
	Sync	2-way	Small	Text
	Sync	2-way	1-1	Text
<b>Livestreaming system</b>	Sync	1-way	Large	Video
	Sync	2-way	Large	Text
<b>Chat rooms</b>	Async-serial	2-way	Small	Text, Image
<b>Digital library</b>	Async-structured	2-way	Large	Text, Image, Video
<b>Email (person-to-person)</b>	Async-serial	2-way	Small	Text, Image
<b>Email (mailing list)</b>	Sync	1-way	Large	Text, Image
<b>Telepresence robot</b>	Sync	2-way	Small	Video, Audio

With this notation, we can compactly denote competing communication platforms and to identify which communication platform(s) best match requirements.

### 3.5 Specific Platforms and Tools

A comprehensive table comparing many specific platforms along several dimensions can be found [here](#).

This table is an essential companion to this document, but the information is more manageable in spreadsheet form.

## 4 Nuts and Bolts

Now it's time to get down to details. In this section we first analyze the communication requirements for all the [components](#) of an online conference. Then we offer some specific platform and technology [recommendations](#) for conferences of different sizes, as a starting point for organizers.

### 4.1 Supporting the Parts of a Conference

Just like a physical conference, a virtual conference has many parts with different requirements.

#### 4.1.1 Program Committee Meeting

The next step for most conferences is to choose papers. Since online program committee meetings are a well established practice at this point, we have focused most of our attention on the other parts of a conference in this guide. But here is a [nice chart](#) comparing physical and virtual PCs along several dimensions, compiled by Emina Torlak (PLDI 2020 PC chair). And [this Appendix](#) has some detailed experience reports, to which we invite you to add your own!

#### 4.1.2 Plenary Sessions

A plenary session is one that all participants are encouraged to attend. In a plenary session, there may be administrative announcements, keynote addresses, and award presentations. Plenary sessions are typically not run in parallel to other sessions, and they are intended to be of general interest to all participants—both of which lead to typically larger audiences (than, say, paper sessions). Keynotes typically involve only one speaker and the session chair.

Plenary sessions critically require a broadcast video (Sync/1-way/Large/Video) communication channel. If conference attendees want to discuss a keynote in progress (which they do!), then the platform or a supplementary concurrent platform needs to support (Sync/2-way/Large/Text) communication. An alternative form of plenary session is a *webinar* where participants can view pre-recorded video presentations using a (Async-serial/1-way/Large/Video) channel.

#### 4.1.3 Paper sessions

*Paper (or breakout) sessions* often run on parallel tracks, are typically grouped thematically, and typically involve several presenters, one after the other. Session themes can either be created / discovered on the accepted papers, provided ahead of time as guidance to submitters, or grown organically (e.g., in the “[unconference](#)” model). This requires a [(Sync/1-way/Small/Video)+, (Sync/2-way/Small/Text)+] communication platform. In an alternative format, paper presenters

upload pre-recorded presentations that can be viewed on an (Async-serial/1-way/Large/Video) channel.

To make parallel sessions effective, there should be an efficient method for attendees to know what is currently on/planned, and how to find it (e.g., links on a website). Moreover, presenters need to have a clear understanding of how and what to prepare content for their session, and what systems/platforms they will need to master to present.

As an alternative to live paper presentations, organizers may choose to use a hybrid model consisting of pre-recorded talks with live Q&A. Pre-recorded talks can either be watched asynchronously or livestreamed, followed by a live virtual discussion. That prerecorded talk can be archived in the Digital Library with the paper and/or rebroadcast at other times. The availability of videos for replay also helps if someone has limited bandwidth or compute resources, or if their Internet connection fails. Cautious organizers may wish to request pre-recorded videos from their presenters even if they intend to present 'live' to insure against failure.

#### 4.1.4 Workshops, Doctoral Consortia, and Tutorial Sessions

Workshops and tutorial sessions can take many forms at conferences, including half-, full- or multi-day events. Larger ones may share many of the attributes and needs of whole conferences, including plenary and paper sessions, as well as more interactive or "hands-on" experiences, where attendees may be expected to prepare and/or bring equipment with them (e.g., laptops with specific software preinstalled).

Depending on the structure of the given event, much of the technology and support can be handled using the same infrastructure (e.g., screen sharing interaction with a particular software tool) as that of the main conference sessions. These sessions are often also smaller, and the variability in the participants' background and level of sophistication might be greater, depending on the nature of the topic.

#### 4.1.5 Poster, Exhibitor, Birds of a Feather, and Demo Sessions

These sessions are even smaller and more intense than paper sessions or workshops, typically involving a presenter interacting with a just handful of participants. Poster/demo sessions can be supported by (Sync/2-way/Small/Video)+ channels, where participants can join a videoconferencing session with the presenter as moderator. Such sessions benefit from having a way for the presenter to share a screen over a (Sync/1-way/Small/Video) channel, perhaps with a (Sync/2-way/Small/Text,Image) whiteboard channel to communicate ideas.

Unlike physical conferences, where poster sessions are synchronous, a virtual conference allows *asynchronous* poster sessions, where a poster can be made available for a certain period of time, and registered participants can participate in a threaded chat discussion about the poster, with periodic inputs from the poster presenter, potentially during scheduled live

appearances. This can be supported by a [(Async-structured/2-way/Small/Text, Image)+] platform, such as Piazza, especially one that is able to provide alerts when new contributions are made to the discussion.

A possible direction that some intrepid organizers may want to explore is to use a Virtual Reality (VR) platform for these sessions. While the technology for large-scale VR might not quite be there yet for the main plenary sessions of a large conference, the expert consensus seems to be that smaller events like poster sessions can work well in virtual environments. Specific requirements to think about for this kind of synchronous, small group interaction include:

- Ways of knowing what posters are available (e.g., poster/exhibitor/demo “fast forward”/teaser session).
- Ability to hop around between posters
- Ability to see demos being done, with VNC-like control
- Ways to find out which posters or demos are popular
- Ways of leaving messages for others
- Virtual whiteboards that poster presenters can use to help explain their ideas

#### 4.1.6 Hallway conversations, receptions, and mealtimes

Physical conferences afford many occasions for unstructured social interaction—indeed, for many of us, this is the main attraction of conferences. Recreating (or at least approximating) structures to support such interactions is a big topic, so we defer it to a top-level section [below](#). For the moment, we just note in passing that informal communications of many forms can be supported by a {(Sync/2-way/Small/Video)+} communication platform.

#### 4.1.7 Speaker Preparation

Presenters and speakers should also keep in mind some practical tips. Use a quiet space, isolated from noises from pets, family members and others, if possible. This is another way in which companies and universities may support their employees by providing dedicated presentation rooms tailored to this purpose that can be reserved. Turn off phone ringers, and be mindful of anything visually distracting in the background (or using the virtual background feature offered by many video tools). Prepare some drinking water (just as what’s provided at speaker lecterns) and set a timer (since there may not be any session chair timing feedback).

For example, speakers might want to consider presenting to even a small live audience rather than being alone staring at a camera. Audience feedback can help bring the best out of a presenter. (Of course, even small live audiences may not be possible under COVID restrictions, and this also may become less necessary with platform features to connect the presenter to audience reactions, such as highlighting the video of a few audience members who have marked themselves as available for sampling/ really engaged).

It is also worth thinking about the additional requirements/expectations placed on speakers. In a traditional in-person event, speakers give their presentations once and respond to questions. Many of the proposals in this document involve asking speakers for significantly more time — giving several presentations in different time zones, preparing an archival presentation (with additional pressure to perfect/polish), preparing a video of the presentation in advance of any live presentations as a backup in case there are technical problems in the live session, monitoring and responding to questions in a text-based forum for the duration of the conference (as well as before and after the conference), preparing a 30-second video “teaser” of their talk to help attendees choose which virtual sessions to attend, etc., etc. Some presenters may welcome increased visibility and increased opportunities/additional formats in which to deliver their message (somewhat like preparing the 1-sentence, 3-sentence, 5-minute, 15-minute versions of your “elevator pitch” when attending a conference). However, other presenters may push back on expectations of increased responsibility without prior discussion and buy-in.

#### 4.1.8 Archival storage

At the end of a conference, papers and videos need to be archived in a suitable platform that provides [(Async-structured/1-way/Large/Text,Image,Video)] interaction. Some alternatives are presented [here](#). It is worth noting that in a virtual conference, unlike a physical conference, *all* interaction can be preserved, not just papers and talks. It may be interesting, for example, to archive and mine audience interactions from poster sessions.

Each community will need to establish new rules and expectations about which interactions are preserved and shared. One desirable feature of in-person conferences is the opportunity for “off the record” interactions, and this feature is in danger of being lost if everything is recorded. Can we carve out ephemeral spaces in virtual conferences? (Indeed, even presenters may not necessarily want their presentations preserved forever; how do we accommodate such cases? One option might be to make material only available and accessible during the conference, to registered participants who sign waivers to adhere to this. Another option that might be more acceptable to some presenters is the ability to submit screen sharing plus audio rather than video.

Privacy issues around archival storage (and other aspects of virtual meetings) are a major concern going forward that the community will need to address. For example, some in-person conferences have used name tags that mean “it is ok to take my picture” and others that mean “do not take my picture.” What will be the equivalent in virtual spaces?

#### 4.1.9 Summary

Taking into account the requirements presented above, we can come up with the attributes of an ideal communication platform to support a virtual conference. Such a platform would need to support:



- Plenary sessions with shared video and a parallel discussion track [(Sync/1-way/Large/Video), (Sync/2-way/Large/Text)] or [(Async-serial/1-way/Large/Video)]
- Parallel paper sessions with support for audience interaction both with the speaker and amongst themselves [(Sync/2-way/Small/Video)+, {Sync/1-way/Small/Video), (Sync/2-way/Small/Text,Image)]
- Parallel synchronous poster/demo sessions with support for screen sharing [(Sync/2-way/Small/Video)+, {Sync/1-way/Small/Video), (Sync/2-way/Small/Text,Image)] or asynchronous using a [(Async-structured/2-way/Lg/Txt, Im)+] platform.
- Archival storage (Async-structured/1-way/Large/Text,Image,Video)

Unfortunately, no single tool today provides this range of functionality. Organizers will, therefore, need to pull together a set of tools to meet these requirements. In doing so, we urge organizers to err on the side of simplicity and focus on ease of navigation.

## 4.2 Bootstrap Suggestions

We have covered a lot of ground in the discussions above; organizers looking for quick advice about how to move their conference to a virtual setting may be left wondering where to start.

The bare minimum that the platform(s) must provide is (a) broadcast screencast for presentations (slides, demos, etc.), (b) broadcast audio with good quality control (e.g., a volunteer-staffed greenroom, etc.), and (c) well organized text chat with moderators. If these things seem under control and the organizers want to take on something more, then one could add (d) some kind of bidirectional audio for one-to-one or small groups, again with good quality control including decent headsets for participants.

This section offers some concrete suggestions that can be used as starting points for organizing and for choosing technology for conferences. We begin with some simple steps to take if you are going virtual under a tight time crunch. We then move on to focus on more suggestions for conferences of three different sizes: small (< 200 participants), medium (around 600 participants), and large (> 1,000 participants). These suggestions are not intended to promote a specific system over any other alternative tools; rather, they are simply intended as examples to bootstrap discussions of how to take conferences online. A more comprehensive table comparing many specific platforms along several dimensions can be found [here](#).

### 4.2.1 Going Virtual in a Time Crunch

If the conference really is in three weeks, there are a few things organizers can do to continue to support the dissemination of the work while adding some elements of synchrony that bring the community together. Organizers should take these as “bootstrap suggestions” only—starting points for discussion—and should feel free to experiment with other options.

First, ask authors to pre-record their talks, and upload the videos to YouTube. Link those videos from the conference website. This involves very low overhead on the part of the conference organizers, as they do not have to deal with supporting the live presentation of all these talks. Additionally, set up a few synchronous sessions for Q&A for groups of authors and panels using one of the videoconferencing and/or Webinar systems (e.g., Zoom). Consider also setting up a Slack workspace for participants to chat before, during, and after the live sessions. If the organization has the cycles to set it up, it should be relatively easy to broadcast keynotes using Zoom webinars or Crowdcast.io. In the same vein of low overhead for conference organizers, workshop organizers can easily self-organize into video conferencing sessions, with some coordination on the part of the workshop chairs.

Make sure to talk to your SIG leadership on what to do about registration fees. Within the ACM, the SIGs are the internal structures financially responsible for the conferences. They may be able to absorb all incurred costs (publications, etc.), or not.

The next few subsections contain “bootstrap suggestions” for when organizers have a bit more time to plan. These concrete suggestions should be reassessed in the context of the rest of this guide: having enough time to plan, alternatives can and should be considered. In this case, the main issue to consider is the number of participants, which tends to correlate with the complexity of the conference.

#### 4.2.2 Small Conference or Large Workshop

Size	Fewer than 200 participants
Events	Talks (all single-track), workshops
Platforms	Zoom Meeting + Slack
Before the conference	
Prepare “Venue”	Schedule one Zoom meeting per day, spanning the entire duration of the talks. Schedule separate Zoom meetings for each workshop.
Navigation	Make a nice navigation page, i.e. the online program schedule, with the right links to the Zoom meetings and Slack channels.
Community	Recruit student volunteers and session chairs. Define who is responsible for what sessions, and train them.
Prepare presenters	Invite your presenters for test sessions well before the conference starts. Make sure they have appropriate A/V equipment (especially good headphones and microphone), and that they know how to give their presentations. .

DRAFT FOR COMMENTS

Consent forms	Remember to collect consent forms from all presenters regarding recording and/or broadcasting their presentations.
During the conference	
Hosts	Persons on the control board of the A/V session(s). Should drive all A/V checks of the speakers, be ready to mute/unmute people, be on the lookout for <a href="#">Zoom bombing</a> . Responsible for recording and streaming, if those options are chosen. Have two hosts, especially if the number of participants is close to 200. Ensure that all participants are initially muted and that only the host can designate a presenter.
Session chair	Introduces the session and the speakers, keeps time and flow, choses questions from the audience via hand-raise feature or text, closes the session. When speakers go unreasonably long with their presentations, session chairs now have the power to cut them off.
Presenter(s)	<i>The usual</i> . May share screen.
Student volunteers	Be visible as volunteers (e.g., naming convention). Greet newcomers to the shared chat channels in Zoom, answer questions from participants. Help prepare the presenters before the conference starts. Monitor chat channels. Organizers should devise a mechanism for volunteers to bring audience questions to the attention of the session chair.
Breaks	Consider fun activities during the shared breaks, such as stretching exercises or polling for the cutest pet or the best Zoom background, with an official award. Make sure breaks are at least 30 minutes, because of time zone issues.
Unstructured sessions	Consider breaking the audience into small random groups using the “breakout rooms” feature of Zoom.

### 4.2.3 Medium-Size Conference

Size	Around 600 participants
Events	Plenary talks, parallel technical sessions, workshops, tutorials, posters
Platforms	Zoom Webinar or Crowdcast.io, Zoom Meeting, Slack
Before the conference -- same as small conference, with the following differences:	
Prepare	Schedule the sessions: plenary sessions as Webinars, parallel technical

DRAFT FOR COMMENTS

“Venue”	sessions as Meetings or Webinars, depending on size. Schedule should account for 20 min before for A/V checks. Prepare Slack channels for plenary sessions, general help, technical support, etc.
During the conference -- same as small conference, with the following differences:	
Plenary sessions	Have the presenters and the session chair as “panelists” of the plenary sessions. Everyone else is just in listening mode. Consider recording the sessions for archival and replay. If attendees span large geographic areas, consider scheduling additional Webinar sessions for replaying the recorded plenary sessions at different times during the same 24 hour cycle.
Other sessions	Depending on the expected size of the audience, choose either Webinar or Meeting. Consider recording and replaying for the same reasons as plenary sessions.
Posters session	One Zoom meeting per poster, with a nice Web page that participants can use as navigation, or some other semi-structured way of presenting and previewing the posters.
Breaks	Consider scheduling shared breaks as separate meetings, and doing fun activities together.
Unstructured sessions	Consider organizing fun things to do online, and/or encouraging participants to self-organize ahead of time for that purpose. Some platforms offer the option of random breakout groups of a specified size to encourage spontaneous meetings.

#### 4.2.4 Large Conference

Size	Over 1,000 participants
Events	Plenary talks, parallel technical sessions, workshops, tutorials, posters, demos, commercial exhibitors, 3rd-party events (recruiting, etc.)
Platforms	Crowdcast.io or Intrado, Zoom Meeting, Slack
Before the conference -- same as medium-size conference, with the following differences:	
Community	Recruit a <b>large</b> number of student volunteers, session chairs, and hosts. Define who is responsible for what sessions, and train them.
During the conference -- same as medium-size conference, with the following differences:	

Demos	Similar to a poster session but may be more spread out in time, and with fixed start times throughout the day. Consider providing a nice Web page as navigation and entry point to the Zoom meeting rooms.
Commercial exhibitors	Similar to demos. Web page navigation is very important for giving visibility to exhibitors. Announce these events in social media under the conference's accounts. If using Intrado, it has special support for this function that you may want to take advantage from.
3rd-party events	Facilitate and advertise but do not host. Have the other parties host those events in their own platforms at the time of your conference.
Unstructured sessions	Additionally to the ideas mentioned above, consider hosting a live music event, or a twitch party. Consider having a separate committee for planning these unstructured activities.

## 5 Fostering Social Interactions

Informal, unstructured social interactions are one of the main reasons people go to conferences—and one of the areas where people commonly believe virtual meetings are doomed to fall short. There are no obvious opportunities for “hallway connections”, nobody is “trapped” at the conference and thus seeking people to talk to, not being restricted to an exclusive group changes the social contract, etc. On the bright side, now that virtual meetings are a fact of life, there is no shortage of creative ideas floating around for how organizers can construct opportunities for unstructured and even serendipitous interaction. Hence, although this is arguably the most important part of this guide, our suggestions are somewhat experimental and open-ended.

Events that separate full, in depth presentations and detailed questions from their social, networking aspect may be effective. Some have called for virtual conferences to be augmented by a single yearly event that combines the communities of many related conferences (e.g., a combined in-person networking conference for SOSP/OSDI, ASPLOS, NSDI, FAST, PLDI, POPL, MICRO, ISCA with separate individual virtual conferences). Survey results show that graduate students missed the opportunities to be introduced to senior researchers by their advisors and felt they missed out on opportunities to network for jobs in virtual conferences.

The bare minimum that the communication platform must provide, in order to support informal interactions, is support for many conversations in parallel, either text or video. But such platforms can be used in many ways. To discuss options in more depth, it is useful to distinguish four main modes of informal communication.

1. **Large groups, topically coherent.** A number of scientists may have similar interests, they may organize a group of talks in a session of the conference and then have dinner together. Ultimately, these groups can take control of subfields and provide leadership.
2. **Small groups, randomly generated.** For example, a group of people getting coffee might randomly stand next to one another. This produces links between people that work in different subsets of research covered by a conference.
3. **Small groups, topically generated.** A group is interested in a common topic, a few people ask questions, and then other scientists congregate with them after a talk. This often produces the beginnings of new fields.
4. **One on one conversations** between people with similar interests. This is often where new collaborations are bred.

If we are to move conferences into the online realm without losing much of their substance, we need at least to be able to replicate all four modes. Fortunately, over the last few years people have experimented with ways of doing so.

(1) To get topically coherent groups to organize mostly takes a number of people taking the initiative. For example, there are more and more online journal clubs (e.g., [this one](#)). Solving this problem is relatively easy, we just need people to feel entitled to run such small scale events. Adding relevant recommender systems promises to make this problem more efficient (cf. all kinds of [science recommender systems](#)). This is similar to things like “Birds of a Feather” sessions that are used at several large conferences (e.g., SIGGRAPH, IEEE VR).

(2) When getting a big group together people can congregate around self-defined topics. (e.g., in [#neurodrinking](#)). This could be far more useful if there was good software for doing that (e.g., [this](#)).

For problems (3) and (4) we need algorithms that assign people to groups or one-on-ones based on topic similarity. People are extensively [experimenting](#) with such ideas. Past experience is that such matching can even improve real-world conferences. It is that concept that is central to the upcoming ([neuromatch.io](#)) conference.

*[We would love to see other ideas! No matter how mundane or how crazy, please add them (in the [Ideas](#) section below is probably the easiest place)...]*

## 6 Ideas for Research and Experimentation

Our primary concern in this guide has been to survey best practices based on existing technology. But along the way we have heard *many* creative ideas for either using old tools in new ways or creating new tools to better support virtual conferences. This describes the ones that have come to our attention so far. *Please add more!*

**Navigation:**

- To ease navigation problems in complex virtual meeting spaces, we could give participants a magical teleportation pad that they can keep in a handy browser window (or carry around with their avatar in VR, or whatever). It could be used to search/find/mark and jump to sessions/posters/etc. It could also include a friend locator.
- A great example of how to add navigation to Zoom-based virtual event spaces using the Zoom API: <https://twitter.com/blinry/status/1242566839344836608?s=20>

**Social interaction:**

- Invite participants to make a list of 4-6 people that they would have hoped to run into at the conference, then send emails to these people to schedule half-hour video chat sessions at some point during the conference.
- Conversely, organize “virtual lunch tables” where a senior member of the community is placed at a table and then others (e.g., students) can sign up to join the table for a certain length of time. Or consider a “Dagstuhl lunch model”, where participants are randomly assigned to lunch tables, with the intent of having different groups for every meal.
- Consider chill-out corners — places where people can just join and chit chat in some virtual places during the breaks, even with coffee in their (physical) hands or a drink in the evening.
- Provide a way for participants to advertise “sign-up sheets” (e.g., links to a Google Sheet with a list of open meeting slots and an invitation for others to fill in their name in the slot they want) that others can fill in to schedule one-on-one sessions.
- Replace coffee breaks with “Chat roulette”: randomly organize Zoom (or whatever) sessions of 2-4 people. When someone decides they have had enough of one conversation, they get randomly assigned to a different group.
- Expand the time allocated to (virtual) poster sessions, where participants can wander around and gather in small groups to discuss posters displayed in the virtual space.
- Science Meetup: The idea is to match like-minded scientists who have not met before: at morning coffee every day [time-zone matched, or across time zones], 5 min minimum time; each swaps one slide (from initially registered set in a conference list).
- During large, social mingle times during the virtual conference, experiment with the research conference equivalent of the “kiss cam” popular at sports arenas. Have a human director semi-randomly, occasionally feature one member of the audience, such that their video window gets enlarged for everyone (probably prompting them to do a fun pose or facial reaction). Controls that allow audience members to mark themselves available (or not) for such selection would be a necessary addition.
- Scavenger Hunt: Questions could encourage people to dig into the papers or presentations. Could be done individually or in teams. Awards/acknowledgements for winners.
- Consider spaces for speakers to meet each other (a “speaker’s lounge” room or a speakers Zoom session for introductions).



- Consider ways to highlight speakers to attendees (similar to speaker's badges at physical conferences) and perhaps special breakout rooms for attendees to continue asking questions of a speaker after their talk.
- Consider if a virtual version of “ badge ribbons” make sense. At many physical conferences, attendees can get ribbons of various sorts and stick them to their badges--e.g., “my first time at this conference.” (In some cases these can become quite complicated, including your interests, your status and even puzzles — you need to meet a certain number of people to decode the puzzle).

#### **Sense of presence:**

- In physical conferences, speakers often use cues from the audience to gauge and tune their talks in real time. In a remote physical setting, one can use a wide-angle camera to project a large audience back to the remote speaker on their second monitor. Similarly, for a virtual audience, one might select a sample of the audience (getting their permission) to display to the speaker. [It would be great if platforms had an API that allowed one to pan through a sample of the audience or alternatively merge headshots into a compact video collage.] Again, controls that allow audience members to mark themselves available (or not) for sampling would be helpful.
- There are ways to replicate applause or approval for speakers, and for the other attendees of a session. Many platforms offer reaction options like thumbs up, likes or other emoticons. Hosts can also unmute everyone's microphones for an applause period at the end of a talk. This helps show enthusiasm and gives crucial feedback on how the content is perceived. (Alternatively, you can just have small meetings in a social VR system or game. AltspaceVR is quite amenable to this, but I've seen meetings take place in Minecraft, Roblox, etc. In these you can see your audience, though you don't get cues like facial expressions.)

#### **Fun things to do together:**

- Contests of several kinds: best Zoom background, cutest pet, ...
- Watch parties (on Twitch, for example, but not only).
- If your community has creative members, reach out to them to livestream something fun/interesting. Even something as seemingly boring as [programming](#) can be fun!
- Live music (see [this article](#))
- Virtual group yoga sessions (see [this](#))
- Quizzes or competitions done through video
- There are lots of party game systems such as Jackbox or Houseparty

#### **Exhibitors hall:**

- Good match for VR (see [pictures of OSCC](#))
- Some form of an 'exhibitors hall' is also possible in video conferencing, with some good Web design work. For example, give a meeting room to each exhibitor, and organize all those meeting rooms in a nice, visually appealing Web page. Then, inside each of those rooms, the exhibitors would be sharing the screen for demos and presentations, while

people come in and out. Schedule fixed times for these activities, and give visibility to them through social media and announcements in Slack.

#### Privacy and Security:

- Although it is very easy to collect data in virtual conferences, be very careful about using virtual conferences' data for research! This must not be done without IRB approval and explicit consent from participants. As a matter of principle, no data that is expected to be transient (e.g. chats, emoji reactions, etc.) should be stored anywhere by anyone. The participants themselves must be made aware of this, lest some of them deploying bots that collect this kind of data.
- On the other hand, you cannot control the technology and what bad actors do with it. Make sure to inform participants that there are no guarantees of complete privacy, and that any private conversations they may want to have with other participants should be moved to other channels outside of those provided by the conference.

#### Other topics:

- Consider how a virtual conference might parallel your physical conference in the future.
- Although many conferences almost completely hand over leadership from year to year, consider having a working group set up now to plan how the conference might change over several years.
- Consider having a group studying how the conference works through recordings, ethnographic study, interviews, etc.

- 

## 7 Resources and Links

### 7.1 Examples of Virtual Conferences

- [VEE](#) (Virtual Execution Environments, 2020)
- [ML4HPC](#) (Workshop on the Convergence of ML & HPC, 2020); *just finished -- an experience report is being written*
- [ASPLOS](#) (Architectural Support for Programming Languages and Operating Systems, 2020); *just finished -- an experience report and a summary of the post-conference survey are being written*
- [IEEE VR 2020](#); some [early observations](#) on how it went
- [ICLR](#) (International Conference on Learning Representations, 2020); [virtual attendance](#) page
- [PAM](#) (Passive and Active Measurement, 2020)
- [ICANN](#) (Internet Corporation for Assigned Names and Numbers, 2020)
- [Environmental Humanities](#) conference (this one has been virtual for a while)

- [OSCC](#) (Opensimulator Community Conference, 2020); virtual since 2013: see Crista Lopes's [blog post](#)
- [IEEE ICBC](#) - blockchain conference
- EuroSys 2020 – the physical conference is canceled
- SIGCSE - registration is over 1200
- The Web Conference, <https://www2020.thewebconf.org/>
- ISCA
- ACM HYPERTEXT 2020 – HT2020
- [UIST 2019](#)
- [The World in 2050: Imagining Just Climate Futures](#): A Nearly Carbon-Neutral Conference (from 2016)
- [ohbmx](#), a 24 hour twitter-only conference (!)
- ICMPC15/ESCOM10 (Conference on Music Perception and Cognition and European Society for the Cognitive Sciences of Music, 2018), a semi-virtual conference with 4 hubs; [Technical description](#) and [ethical considerations](#)

A [list of other examples](#) can be found in [Flying Less in Academia: A Resource Guide](#)

## 7.2 More Advice on Organizing Virtual Conferences

### Good places to start:

- The Nearly Carbon Neutral Conference [white paper](#) and a [recent article](#) on this long-running virtual meeting; the white paper is long, detailed, and informative
- University of Alberta's [Virtual Conferencing TOOLKIT](#); they have been doing this since 2013 and their white paper is long and informative
- [How To Run A Free Online Academic Conference](#), a comprehensive “workbook” full of questions that conference organizers should be asking themselves when planning a virtual meeting

### Other useful discussions:

- A [comparative slide deck](#) on four major virtual conference platforms (Intrado, Convent, Digitell, Crowdcast) by Juan Miguel de Joya
- SIGCHI's [advice](#) on video production
- Crista Lopes's talk at the 2020 Virtual Conferencing Workshop ([VR in VR](#)), part of the [IEEE VR](#) conference *[need a link to a recording of this talk!]*
- [Thoughts on “GDC \[Game Developers Conference\] in VR”](#)
- ["Ten Simple Rules for organizing a non–real-time web conference"](#) at Plos Computational Biology
- Rob Lindeman's 2009 short paper on [running a PC meeting in SecondLife](#)
- Welch, C. J., Ray, S., Melendez, J., Fare, T., & Leach, M. (2010). Virtual conferences becoming a reality. *Nature chemistry*, 2(3), 148-152.
- Srinivasan Keshav's 1994 paper [Experiences with Large Videoconferences on XUNET II](#), an early foray into this area

## 7.3 Miscellaneous

- Crista Lopes’s [keynote at UIST 2019](#) on running conferences in VR
- The [SIGPLAN Climate Committee Report](#), which (among other things) discusses a number of alternative models such as physical/virtual hybrids, multi-hub conferences, and regional conferences, with an eye to reducing carbon footprints
- Microsoft Academic’s post on [Impacts of COVID on the CS research community](#) offers “an analysis [already somewhat dated] of the COVID-19 impact on the computer science (CS) research community to help enable conference organizers and institutions to respond accordingly and manage the impact.”
- The [Virtual Conferences section](#) of [Flying Less in Academia: A Resource Guide](#), a huge collection of resources on reducing conference travel
- Meredith Reitman’s [Guide to Using Zoom](#)

## 8 Appendices

### 8.1 Organization of the Task Force

#### 8.1.1 Founding Documents

The original [Proposal](#) for the task force, and its official [Charter](#) from the ACM.

#### 8.1.2 Members

[Crista Videira Lopes](#), University of California, Irvine, USA (Task Force Co-chair)

[Jeanna Matthews](#), Clarkson University, USA (Task Force Co-chair, member of ACM Council, Former SGB Chair)

[Benjamin Pierce](#), University of Pennsylvania, USA (Task Force Executive Editor, SIGPLAN Vice Chair, chair of SIGPLAN ad hoc [committee on climate change](#))

[Blair MacIntyre](#), Georgia Tech, USA (Chaired IEEE VR 2020)

[Gary Olson](#), University of California, Irvine, USA (Former SIGCHI Treasurer; Chair of CSCW Steering Committee, chaired CHI, CSCW, DIS, and many non-ACM conferences)

[Rob Lindeman](#), University of Canterbury, NZ (Chaired IEEE VR 2010)

[Francois Guimbretiere](#), Cornell University, USA (Chaired UIST 2019)

[Srinivasan Keshav](#), University of Cambridge, UK (Former SIGCOMM Chair)

Ex-officio members:

[Vicki Hanson](#) (ACM CEO, Former ACM President)

Pat Ryan (ACM COO)

Donna Cappo (ACM Director of SIG Services)

## 8.2 Experience reports

*If you have been involved in organizing a virtual conference, workshop, PC meeting, etc., we invite you to create a subsection here describing what you learned in as much detail as you want!*

### 9.3.1 CHI 2019 virtual PC meeting

Here are some instructions, guidance and best practices for running your virtual PC meeting on December 8th and 9th. Each SC should respond to let us know whether they will be onsite in Montreal during the PC meeting, or remote. Much of the guidance for best practices in running a successful virtual meeting comes from previous years' SCs and ACs. A huge shout-out of thanks for sharing!

#### **Timing of the virtual meeting:**

- As much as possible we would like you to run your virtual meeting to coincide with the meeting in Montreal:
  - starting at 09:00 EDT, ending at 18:00 EDT on Friday
  - Starting at 09:00 EDT, ending at 15:00 EDT on Saturday

#### **Videoconference tool:**

- Like last year, we will have access to BlueJeans as our videoconferencing tool, with a separate channel for each subcommittee. We will send out the BlueJeans meeting information as soon as the links have been finalized.

#### **Many virtual subcommittees used a collection of tools:**

If you are not familiar with these tools, check them out now: install them today and ask questions ASAP. You can use whatever tools you wish in your Subs, but these are the kinds of things for which you want support during the meeting like:

- BlueJeans [ed: or Zoom] for videoconferencing
- PCS for reviews
- Trello for maintaining shared view of paper status (which were accepted, rejected, tabled, and which papers were coming up for discussion)
- Slack/Skype: to indicate which paper was currently being discussed (helpful for those who are conflicted and are off BlueJeans, to know when to return, and to alert those who needed to leave for conflicts.
- Because of so many tools, multiple devices or large displays are definitely useful

#### **Good practices:**

- SCs or an assigned SV should meet with every AC before the virtual meeting to ensure their technology setup works (BlueJeans, Slack, Trello)
- You may wish to consider having a pre-PC dry run/rehearsal meeting with all your ac's

## DRAFT FOR COMMENTS

- Have the SCs be strong facilitators in the meeting, and share instructions on how to engage and interact, with the ACs
- As SCs often take turns running the meeting, the other SC (or an SV) should be monitoring and updating Trello for paper status and the Slack channel to invite conflicted ACs back to meeting
- ACs should be encouraged to create private Slack channels or side Skype chats to discuss specific papers
- Real-time attendance is mandatory for the entire meeting, regardless of time zone.
- Because it can be hard to engage the “room” in discussion beyond the 1AC and the 2AC, set up clear instructions on how to “raise your hand” to be heard. Otherwise, jumping into a conversation can be challenging particularly in large groups.
- Use headphones: (Important!) If possible, everyone should connect with headphones to avoid feedback. Everyone should be muted when not speaking. It is harder to speak spontaneously, but you do not want to listen to the sounds of people typing, having side conversations, background arguments between dogs, etc...
- Two remote ACs who happen to be from the same institution generally should not be co-located during the meeting, as it makes all of the other ACs feel even more remote or isolated.
- Do as much work as you can ahead of time - add additional ACs early and take care of as many borderline papers before the meeting as possible. Spend the majority of the meeting time on any remaining borderline cases.
- One subcommittee had planned breakout groups on Day 2, to discuss a particular paper or a group of papers. This takes the place of hallway conversations in a physical meeting.
- In addition, here are a set of AC instructions that Jeff/Pernille produced for last year ([https://docs.google.com/document/d/1n6n8KWvd9NRNPrEIhtL4xHuPs\\_WjfsDJAxO0A6ncP6Y/edit#](https://docs.google.com/document/d/1n6n8KWvd9NRNPrEIhtL4xHuPs_WjfsDJAxO0A6ncP6Y/edit#)) that has some good guidance as well.

### **Some things that were missing or problematic last year and for which new solutions are needed:**

While the above tools and practices generally worked well, there are still a few issues that you should look out for. If you have ideas on any of this, please share! This is a collective effort and we are all learning as we go along.

- No good way with these tools to have temporary typed discussions that was accessible to those not conflicted, and that could be erased easily before the next discussion started.
- Hard to send links or other content, or just chat with whoever was in the “room”
- Would have been nice to have a slack channel auto-created for every paper, that just included those who were not conflicted
- PCS does not provide views to ACs that look like the SCs’ view. Papers that ACs have conflicts with do not show up in their view, so hard, even with Trello, for ACs to realize that a paper was coming up for discussion that was not in their view. Also, the AC view

does not show the name of the reviewers, and it is not easy with large groups to keep an SC view shared with all participants through BlueJeans.

- BlueJeans worked well and was robust, but it can be hard to gauge the feeling of the room - cannot tell when people in the room are all nodding in agreement.
- Hard to engage everyone in discussion, and hard to have lots of discussion. But ACs felt like the virtual meeting was more tiring than in person (time zone issues, hard to stay focused when virtual), so more breaks might be useful. This is also made harder due to the greater lack of social engagement. Including time at the beginning of the meeting for people to introduce each other, and during breaks, to chat and catch up could be useful. Perhaps think of ways to build banter & fun. One sub last year used giphy integration in Slack for a dash of humor and personality in the meeting.
- Because of a need for anonymity, there was no good way to discuss the best papers amongst the virtual subcommittee.
- Managing the session creation is always a tough job at CHI, virtual or not. One thought here is, if using trello for keeping a shared view of the accepted papers, a trello board could be setup to allow ACs to collect groups of papers (within your subcommittee) that could form reasonable sessions.

Please also read an account of the first virtual subcommittee:

<http://sigchi.tumblr.com/post/143440663545/reflections-on-the-games-play-virtual-committee>

## 8.3 Hybridizing Physical and Virtual Conferences

This guide has mostly focused on fully virtual meetings, but the issues and ideas overlap with those around hybrid meetings. Here are some notes we have gathered:

- Remote participation robots
  - See Herring, Susan C. "Telepresence robots for academics." *Proceedings of the American Society for Information Science and Technology* 50.1 (2013): 1-4.
  - There have been some experiments at [CHI](#) (but with limited success and at significant cost).
- Regional hubs
  - Within SIGCOMM, one of the solutions that has been discussed is the possibility of regional hubs that would have all the current/best technology and infrastructure. This could offer an intermediate step to a fully virtual event by limiting travel to being "local", which could both lessen climate impact and mitigate aspects related to propagation of infectious diseases.
- Multiple hubs
  - [Effects of Internet-based multiple-site conferences on greenhouse gas emissions](#)
- Examples
  - Collective Intelligence 2020 <https://ci2020.weebly.com/>