



The Access Grid

AG on a personal computer; and using VPCScreen

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Introduction

The Access Grid (AG) is a fully featured and flexible video collaboration tool. Although there isn't a typical Access Grid Room (AGR), an AGR usually has three (or four) screens which are linked to operate as one large projection screen, referred to as the display wall. In addition, multiple cameras (usually three) provide video streams. There is, as well, a single audio stream. For an overview, see [1].

However, the AG software does not require a fully featured AGR. For example, the AG software can be run on a desktop or laptop: it's free (and open source) and all that is required is a video source (such as a web-cam), an audio input and output device (such as a set of headphones with a microphone), and a good internet connection. In this case, this AG configuration is referred to as a Personal Interface to the Grid (a PIG). Another low-cost setup is to use a desktop with two large LCD monitors (to give more screen 'real estate' for displaying video streams and content) with a single or multiple video sources and an echo-cancelling microphone.

Within AMSI, most of the teaching of advanced mathematics AG sessions and AG seminars are conducted in a presentation mode where interactive remote control of the software is not required. Although current practice is usually to transmit the presentation via VNC¹, in these cases the use of VPCScreen (rather than VNC) is recommended as it has several advantages (see below).

Personal interfaces to the grid (PIGs)

There are many versions of video conferencing software available. The Australian Research Collaboration Service, ARCS, provides support for Access Grids which is 'great for room-based video-conferencing' and EVO² which is 'particularly suited to desktop installations' (see <http://www.arcs.org.au>). If video conferencing is desired for communicating between a few isolated researchers, then EVO is likely to be a good choice since it requires less bandwidth and is more forgiving with respect to the quality of the internet connection. The AG is designed to support fully-featured collaboration (not just video conferencing) and generally has higher bandwidth requirements. It is suggested that a good connection to support a PIG, should have a minimum of an upload rate of about 1 MB/s and a download rate

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¹Virtual network computing (VNC) is a graphical desktop sharing system.

²EVO is a PC-based multipoint collaboration tool which features advanced videoconferencing.

of at least 3 MB/s. Cable or ADSL2 internet connections have been successfully used, but some adjustments may be required for acceptable collaboration (for example, reducing frame rates for each stream). Obviously, the more sites connected (and video streams transmitted), the more bandwidth required!

Usually, different video conferencing systems cannot be used together, but EVO to AG bridges are under development and hoped to be available in Australia very soon. This would mean that an EVO user could use a lower bandwidth internet connection and participate within an AG session.

For most mathematicians wishing to use the AG, it is recommended that for an established AGR, support should be provided by specialist IT staff. However, a limited number of PIGs can be used

- to monitor AG sessions,
- to record AG sessions (using AGVCR),
- to participate in small interactive sessions (rather than use a full AGR),
- as a personal AG (that is, join in from your office as an example),
- to assist with resolving clashes (when the main AGR is already booked).

With respect to clashes, note that the AMSI program of collaborative teaching of advanced mathematics (usually as Honours courses) tries to avoid clashes, but this cannot be guaranteed since the Honours mathematics classes are not timetabled nationally. The AGR Honours classes are timetabled locally as part of the host university's Honours timetable — when remote sites express an interest in the subject the Honours lecturer and Honours coordinators negotiate to try to avoid possible clashes. In the current semester, an RMIT student wished to take an Honours course remotely, but there was a partial clash since the RMIT AGR was already booked for another AMSI AGR Honours course. This partial clash could have been dealt with by using a PIG (although RMIT was fortunate to be able to use the AGR at the Victorian Partnership for Advanced Computing, VPAC, which is a five-minute walk away).

The video and audio hardware for a PIG is different to that used in a full AGR. Any decent webcam is fine for the video. However, as in all AG facilities, it is essential to have high-quality audio equipment and special attention is required to eliminate echoing. A quality headset combination with speakers that enclose the ears and a microphone is good since audio feedback between the mike and the speakers is avoided. Another option is to use an echo cancelling mike and speaker set that is plugged in via a USB port¹.

The AG homepage, <http://www.accessgrid.org/>, has a wealth of documentation, tutorials and downloads available. The AG software is platform independent: it runs under Windows, Mac or Linux (although currently there are some audio issues with the Mac platform). To install the AG software, download the installer from the right-side panel at <http://www.accessgrid.org/software>. It is suggested

¹Examples of suggested hardware can be found at <http://www.arcs.org.au/products-services/collaboration-services/video/audio-devices> and <http://www.accessgrid.org/hardware>.

to choose a stable release version. On any Windows computer (laptop or desktop, running under XP or Vista), it is highly recommended to choose the Access Grid bundle².

This 'bundle' includes the all-in-one installer for Windows and installs all of the required versions of the various pieces of software that are used for the AG. For installation, check the boxes for all the add-ons (such as VPCScreen and AGVCR), as this will provide superior functionality. After installation, the Venue Server should be changed (in the box below Navigation) to <https://vv3.ap-accessgrid.org:8000/Venues/default> which is the address for the Asia Pacific Access Grid Venue Server, the most commonly used Venue Server in Australia.

A small- to medium-sized room AG node

Whilst it is possible for two people to crowd around a laptop PIG, it is not ideal. For small groups in a small- to medium-sized room, a low cost AG node can be run by augmenting a PIG with larger monitors: usually two 40+ inch LCD screens are favoured. In this case, one echo cancelling mike and speaker will be adequate. Some rooms are set up in this manner: for example, the AGR at the Mackay campus of CQ University Australia (see Figure 1). Another variation, is the University of Melbourne AGR2GO which is a mobile AG node (with a laptop and two 40-inch LCD screens) which can be wheeled on a trolley to any room which has wheelchair access and an appropriate internet connection.



Figure 1. Left: A PIG: an AG node on a laptop. Right: The CQU Mackay small room AGR.

VNC or VPCScreen

Computer scientists and IT support professionals are familiar with using the software VNC to remotely control computers. Within the AG context, VNC is used to provide the capability to remotely control presentations, webpages and other electronic content within an AG session. To facilitate this, the AG shared application VenueVNC is generally used to support the sharing of electronic material.

²http://www.accessgrid.org/files/AGTK3.1_easyinstaller.exe.

VenueVNC simply acts like a wrapper for VNC, in which it passes additional information such as hostname and password, thus making it simpler for AG operators to connect to VNC. One of the benefits of using VNC (or more specifically VenueVNC) is the ability for each site to be able to remote control and operate the software on the presenter's computer. This allows remote sites the ability to be able to write directly on the same Word or PDF documents, control presentations at different times, or take turns at controlling the same Maple or Mathematica file.

However, the use of VNC comes at a cost. This cost can be associated with the fact that VNC clients utilise a separate unicast (not multicast) connection to a VNC server, in which it has been found that large (more than eight) simultaneous connections cause delays in interactivity. These problems can be addressed: the Canadian coast to coast AGR seminar series uses VNC Reflector and multicast versions of VNC are also available.

There are further problems with VNC. The add-on AGVCR is the cassette recorder for the AG session: everything is recorded (all of the video and audio streams) for the AG session. Unfortunately, if VNC is being used to transmit the presentation material, then this presentation material is not recorded. Another VNC problem becomes evident if an attempt is made to show a movie (such as an mpeg file) and an animation (such as a Maple or Mathematica animation). VNC usually shows a black region where the movie or animation is running at the host AGR.

For standard lecture presentations and seminar presentations, remote control is never desired, so VNC is not always a good choice: the use of VPCScreen is recommended. VPCScreen captures and streams: the whole screen, a screen region or a selected window. This can be recorded with AGVCR (see documentation at the Access Grid home page, or [2]). Unlike VNC, VPCScreen can stream a movie or animation (the VPCScreen software has a fixed frame rate of 10 fps, but this is generally adequate). Maple animations at a Maple frame rate of 18 fps have been tested and they work well. (Note that usually a lower frame rate, say about 5, is used for animation demonstrations.)

Conclusion

Collaborative teaching of advanced mathematics across Australia via the Access Grid is expanding with the participation of New Zealand. National seminars are also offered over the AG. For many participants, the use of a fully featured AGR is recommended. However, there are occasions (such as dealing with clashes or monitoring) where the use of a PIG is valuable. For many mathematicians, AG sessions are mostly conducted in a presentation mode where interactive remote control of the software is not required. In these cases the use of VPCScreen (rather than VNC) is recommended. Use of VPCScreen results in transmission of the computer screen (or part thereof) as a video stream within the AG multicast broadcast. Besides scaling up well to many AG nodes, it can be recorded by the AGVCR so that it is simple to record the full AG session.

Acknowledgements

The first author's position at AMSI is, in part, supported by the *Collaboration and Structural Reform* project, nGame, funded by the Australian Government and based at the University of Sydney. The second author's position at ARCS is funded by the Department of Innovation, Industry, Science and Research (DIISR) through its Platforms for Collaboration (PfC) capability within the National Collaborative Research Infrastructure Strategy (NCRIS).

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