# A Roadmap for the Future of Multi-Site Videoconferencing – A Report for the UK e-Science Programme

**Author:** Michael Daw

**Author Affiliation:** SVE Group, Manchester Computing, Kilburn Building, University of Manchester, Oxford Road, Manchester M13 9PL. E-mail: michael.daw@man.ac.uk

**Keywords:** multi-site videoconferencing, advanced collaborative environments. Subject area SHARING.

## Abstract

By its very nature, the UK e-Science Programme is a highly distributed venture. There is a need to conduct meetings using videoconferencing technologies that enable people to collaborate without having to engage in excessive travel.

Different videoconferencing technologies are suited to different needs and may or may not be applicable to the needs of the UK e-Science programme. The e-Science Core Programme commissioned a report to compare videoconferencing technologies in order to guide future choices and to determine a roadmap for videoconferencing within the Programme. This paper is a summary of some of the report's conclusions.

The report looked at four major technology areas for videoconferencing – Access Grid, H.323/H.320, VRVS and non-studio-based videoconferencing. In order to aid comparison between the technologies, each technology area was examined using the same criteria – cost; ease of use; display, visual, and audio quality; networking issues; multi-site issues; collaborative tools; security; appropriate usage; and future potential. The report also examined interoperability between the technologies, among other pertinent issues.

### Access Grid

Access Grid uses commodity equipment, open source software and connectivity based upon IP multicast networking to achieve high quality, full-duplex audio and a large-scale display that allows multiple, simultaneous and often life-size views of participants at each site. The number of sites that can take part in events is very large.

Access Grid employs a metaphor that enables advanced collaboration through the concept of shared spaces into which are placed data and applications as well as media streams.

Security is achieved by encrypting audio and video and distributing keys via shared spaces. Access to these shared spaces is restricted using Access Control Lists.

The future of Access Grid will lead it more in the direction of "advanced collaboration" (rather than solely videoconferencing). Specifically, this includes: more integration with Grid computing tools for security and data management; an Open Source environment where developers are able to build integrated services and a framework in which services can be utilised within the Access Grid; improvements in audio-visual quality; improved network features.

 

**H.323/H.320**

H.323 is videoconferencing over IP; H.320 is over ISDN. Together these represent the mainstream of commercial videoconferencing. Systems usually take the form of hardware codecs into which are plugged microphones and cameras. Most new codecs support both of these protocols. H.323 videoconferencing has come to the fore over H.320 in the last few years, mainly because it utilises existing Internet connections and therefore represents a cost saving in terms of ISDN line rental.

A major strength of proprietary H.323/H.320 systems is video feeds that can be near to broadcast quality. However, for multi-site use, each video feed must be displayed within the same video stream, which can result in small images. The alternative is to make the video voice-selected, which means that only one site can be viewed at any one time.

H.323 conferences are insecure, as data streams travel over the IP network, usually unencrypted. Many users of H.323 will not use this technology if security is an important consideration. H.320 is inherently a much more secure system because media streams travel over dedicated ISDN lines.

**VRVS**

VRVS comprises a central web server and a worldwide reflector network that distributes media streams over unicast/multicast IP and adapts them for supported clients. VRVS can be employed by a wide variety of nodes with various software clients, which are either H.323 or "Mbone" (the multicast tools *vic* and *rat*). VRVS is used by a wide range of facilities (that have a commensurate range of set-up costs), from low-end platforms to fully equipped VRVS studios and – like Access Grid – VRVS is often used for large, multi-site conference events.

Security for VRVS is limited to administrator control of users and optional password session admission. Anyone who can obtain access to the video/audio data packets will be able to eavesdrop the meeting (unless the Mbone tools are used by all participants, in which case data packets may be encrypted).

Imminent developments within VRVS include user authentication; an increased number of virtual rooms; packet recovery; centralised control of audio and video; and selection of bandwidth ranges. Longer-term developments include: improved video formats; more support for future Internet protocols; architecture enhancement to support several thousands of users and/or conferences in parallel; and improved network features.

**Non-Studio-Based Videoconferencing**

A typical use of non-studio-based videoconferencing uses commodity software (usually based on H.323), a desktop computer, a video cam, and a microphone headset, located in a non-dedicated space. This solution is suited to informal one-to-one meetings where it is useful for participants to see each other or to conduct limited data sharing. It is also useful as supplementary to studio-based facilities when studios are unavailable or inconvenient, such as when large timezone differences are involved.

The use of inexpensive, non-specialist equipment for non-studio-based solutions severely limits the quality of experience (in terms of audio, video and collaborative tools), which means that this solution does not lend itself to a realistic 'sense of presence'. However, the quality of this solution may be much improved by relatively inexpensive additions, such as cheap echo cancellation or hardware codecs.

Most solutions of this type have only limited (or non-existent) security.

 

The future of non-studio-based videoconferencing solutions relies upon the direction that commercial organisations that develop such solutions are willing to take. However, they are likely to have limited future potential for the types of intensive, collaborative, multi-site conferences for which the e-Science programme requires facilities.

**Interoperability**

Interoperability between the technologies is important so as not to exclude certain users. However, in most cases, the scope for interoperation is limited.

VRVS interoperation with H.323 is integral; VRVS interoperation with H.320 may be achieved by use of the H.323/H.320 bridge facility provided by many proprietary codecs. VRVS-Access Grid interoperation requires minor configuration changes to Access Grid nodes in one direction and use of a VRVS server in the other direction. Access Grid-H.323/H.320 interoperation, although possible, is problematic for many reasons and useful development work should be conducted in this area.

All the systems under consideration by this report are able to interoperate with the telephone, which can provide a fallback solution for audio or to provide a greater level of security.

Difficulties in interoperation are compounded by the use of different (and usually incompatible) booking systems.

**Report Recommendations**

A major outcome of the report was to produce recommendations for improvements to videoconferencing within the e-Science Programme. Many of the recommendations relate to Access Grid because this is currently the predominant technology with the Programme and, unlike VRVS and H.323/H.320, has no associated formal support structure.

- Create an e-Science advanced collaborative environments research and development effort
- Formalise Access Grid support, including deployment advice through existing agencies
- Enable full interoperability between Access Grid & VRVS
- Enable maximum interoperability between Access Grid & H.323/H.320
- Deploy and support multicast bridge(s) as a stopgap measure for non-multicast-enabled Access Grid sites
- Reduce Access Grid resource implications by working more closely with commercial vendor(s)
- Improve local networking in support of IP-based videoconferencing
- Investigate improvements for multi-site booking systems

All these recommendations were accepted by the JISC Committee for the Support of Research (JCSR) and have had approval for full funding or for further investigation.

**Acknowledgements:** Co-contributors for the original report were: Stephen Booth (University of Edinburgh), John Brooke (University of Manchester), Kate Caldwell (University of Cambridge), Liz Carver (BAE Systems), David De Roure (University of Southampton), Alan

Flavell (University of Glasgow), Philippe Galvez (California Institute of Technology [Caltech]), Brian Gilmore (University of Edinburgh), Henry Hughes (UKERNA), Ben Juby (University of Southampton), Ivan Judson (Argonne National Laboratory), Jim Miller (inSORS Integrated Communications, Inc.), Harvey Newman (California Institute of Technology [Caltech]), Chris Osland (Rutherford Appleton Laboratory), Sue Rogers (University of Cambridge)

**References**

*Multi-Site Videoconferencing for the UK e-Science Programme* (available at http://umbriel.dcs.gla.ac.uk/Nesc/general/technical_papers/UKeS-2002-04.html)

**Vitae**

Michael Daw is Chair of the Access Grid Working Group of the UK Grid Engineering Task Force, Technical Director of SC Global 2003 and Chair of European Access Grid. He is responsible for Access Grid support across the UK, is active in the development process for AG2.0, led by Argonne National Laboratory, and is Project Manager of MUST, which is looking at the applications of IP multicast protocols in Grid technology.

 