Showcasing Member Group Events:

Final Report of the
Recording and Broadcasting Working Group
to
Member Board Best Practice Committee

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Communication = Engagement

Communication, it turns out, is a "killer application" for the human race. Our ability to speak and exchange information via complex, variable messages distinguishes us from other species – even intelligent ones such as whales, dolphins and apes. From early times, people have augmented this ability by creating new and transformative technologies of communication: art, music, writing and travel all have long pedigrees, while printing was the technology which ended the Middle Ages and opened the door for the 18th century Enlightenment. In more recent time, the technologies of sound recording and motion picture recording were invented in the closing years of the 19th Century, whilst in the 20th Century radio and television became dominant broadcast technologies, followed by electronic mail: the killer application which drove the early growth of the Internet.

In the 21st Century, what role can Internet-based communication technologies play in our activities as a professional institute? There is widespread agreement that BCS needs to engage more fully with its members and the wider public. For many members, participation in the meetings and activities of a branch, specialist group, or other member group provide the major channel through which they can reap the benefits of membership, yet a common experience of member groups is that only a few percent of their registered membership actually attend meetings. A typical UK branch may have around 1,000 registered members, and some specialist groups have more: the largest having a membership of over 4,000, but find that its events are attended by a few tens of members. There are, of course, many factors that prevent members from attending meetings even when they have a desire to, including pressure of work, competing schedules, travel time or cost, and more. We therefore have an urgent need to make it much easier for any member, wherever they may happen to be situated, to access the content of group meetings and interact with other members of their group.

How can we extend the benefits to those who are not actively involved at the moment? Increasing the active membership beyond an "inner circle" of each group is a key objective. It seems clear that using new technologies could help break down the barriers of distance, time and cost which prevent some members playing a more active role and may be the most effective response to this problem. BCS already uses web technologies to support the web pages of most member groups, the Drupal Content Management System to support its Volunteer Portal, and has emphasised the value of social media such as LinkedIn for both individual members and member groups. Many active members have embraced these technologies enthusiastically, but has this helped us to reach those who are currently inactive? Probably not.

It seems clear that a more radical approach is needed. A report by the Electronic Publishing SG in 2005, an Audio Visual Media White Paper in the same year, and other reports of that era advocated the use of recording technology to support events. Subsequently, BCS invested in audio visual facilities and a Tricaster installation at its Southampton Street facility. A number of member groups have taken up the option to record their events for later publication on the web, or to broadcast them live, and there have been some notable successes: a number of good recordings have been posted and one live broadcast was viewed by over 150 members.

Yet experience has been mixed: some groups which were initially enthusiastic about recording have later discontinued the practice and, overall, it has not yet been widely adopted. Across the BCS's 105 Branches, Specialist Groups and International Sections, about 15% use recording technologies on a regular basis. The reasons are not hard to find: some of technologies used are expensive and

only available in specific locations, while others require high levels of skill for successful use. In general, the most successful groups have been those branches which could draw on the audio/visual services of a hosting location, often a university. In response to this, a number of groups have consciously ignored the major facilities and have opted instead to use low cost "home brew" methods, again with some notable successes; one recent web slide cast received over 2,000 views.

How then can we encourage a step change in adoption and shift to a paradigm where a majority of member groups regularly use recording and broadcasting technologies to make their events accessible to most of their members? It seems this can only be achieved by adopting technologies which are several orders of magnitude cheaper and easier to use than those of the past few years.

BCS has an urgent need to increase its engagement with its members and the wider IT community, as measured by the percentage of professionals who are members, the percentage of members who participate in BCS events, and the rate of member attrition. Whilst much progress has been made, these numbers are disappointing when compared with our aspirations as the Institute for IT. Effective communication must be the basis for change, with recording and broadcasting technologies providing one important channel for communication.

The Recording and Broadcasting Working Group

In late 2011, the Member Board Best Practice Committee set up the Recording and Broadcasting Working Group with a mission to find these technologies, trial them in real situations and popularise them via demonstrations and by developing guidance material. Specifically, the WG was requested to create good practice guidance for recording, broadcasting and archiving events, to:

- enable the majority of BCS member groups to record and broadcast their events as a normal practice, by recommending technologies and procedures
- develop activities and materials to be presented at BCS member group conventions
- review existing BCS facilities for recording, including the Tricaster system, and recommend improvements

Members of the working group were recruited from those who had expressed a strong interest in participating, or already had experience of recording member group events. A list of members is presented in Appendix A.

The first task of the WG was to conduct a survey of member groups which had already made a practice of recording events, and to learn from their experience. This yielded information from 17 member groups, primarily in the UK but including one international group, which used a variety of techniques to record or provide live broadcasts of their events, or which had a desire to use these technologies. Of these, approximately two thirds used video recording whilst one third used audio recording, and three groups had broadcast events by streaming them over the Internet. Experience was biassed towards those member groups which could draw on the resources of a hosting organisation, such as a university or the BCS London facility, and could command relatively large budgets[1]. Nevertheless, a small number of groups had developed innovative, low-cost methods. The results of the survey are presented in Appendix B.

1 i.e. budgets of £10,000 or above

These methods were primarily focussed on capturing the high value content of group meetings, especially talks given by well qualified or well known speakers, and to some extent on capturing working activities such as committee meetings. It became clear that to assess these methods we would need to understand the typical workflows involved in creating content via recording, editing, and broadcasting, and the longer term publication and archiving of that content.

A number of important lessons could also be inferred from looking at the experience of these member groups and of BCS's professional publications:

- some groups had started a practice of recording their events but had later discontinued this practice, due to changes in personnel, pressure of other activities, etc.
- most groups published their content via the BCS website, but some had also used publicly available web based services such YouTube
- across the range of BCS communications, there was no obvious correlation between the production values employed in creating each recording and the number of views achieved.

In some cases, the number of views did not justify the investment made whilst, in other cases, simple methods had been used to create content with significant numbers of views. We therefore concluded that any successful solution to the stated requirements must be:

- Sustainable
- Easily accessible
- Self promoting

and the test of these potential solutions would be whether they achieved widespread adoption, leading to new working practices, rather than the size of the document describing them.

How the Working Group set about this task

The working group realised that its prime objective was to enable member groups to communicate more and better, in order to foster greater participation in their events and engagement with their activities. A new opportunity to make radical improvements was opening up, driven by the emergence of new technology at lower costs than those used traditionally. This underlined the point that relying on approaches which need high value support services or use high cost equipment, could not meet the working group's objectives because they could not be replicated in a majority of locations, especially international locations.

However, the survey had also enabled us to identify a list of promising low cost technologies which might satisfy these objectives. Even here, it was clear that there might be many successful technologies and, therefore, the working group resolved to procure a number of hardware and software products and gain hands on experience with them, as a basis for evaluation. This required a budget of just under £1500. Equipment was only purchased after a careful selection process, and with a view towards retaining it for longer term use.[2] Members of the WG also contributed the use of their personally owned laptops, equipment, broadband connections, and software licenses plus their time, knowledge and skills to the evaluation process.

2 This equipment has now been assigned to the Kent and Oxford branches, and to the Southampton Street location.

Although not formally part of the working group's Terms of Reference, it appeared that web-based online meeting services might be relevant to the objectives and therefore the WG evaluated a number of these, either by studying specifications or via hands on trials. In addition, members of the WG were aware that merely accumulating recordings would not necessarily be a useful exercise, unless these recordings were easy to find and published in a form which could reach a wider audience. We therefore evaluated a number of web-based services for publishing content.

Categorising the Solutions

Many of the events which member groups wish to capture are formal lectures given by experienced speakers. A typical audience for such a meeting consists of a few tens of people; limits on the size, availability, and cost of rooms prevent this number being increased by more than a small margin. A live broadcast might enlarge the audience to one or two hundred participants (and there is some experience to support this), but the competing pressures of work schedules, personal commitments, and time zones will inevitably prevent some members participating in real time. By contrast, a good recording may reach an audience of hundreds or thousands, and may also reach people who are not members of BCS. Once again, there is some direct evidence to support this conclusion, plus a wealth of experience in the public domain which tends to confirm it.

Any successful solution must therefore address this **scale requirement**, and is likely to include some form of recording. But this may not be enough. Even a professionally produced recording may attract only a small audience if it is delivered months after the event in question took place. Since many events are intended to respond to topical issues, there is also a **timeliness requirement**. Live or time shifted broadcasting, as practised by the major media companies, does achieve the required timeliness but even these companies see great value in providing facilities which enable their audience to watch or listen on demand. An ideal solution would therefore include both live and recorded access to meeting content.

In many lecture style events, a primary tool of communication is a set of **slides** which the speaker has prepared beforehand. Because these often summarise key information and messages which the speaker wishes to present, many groups have adopted a practice of posting a copy of the slides on their web site after the event. This is usually a necessary, but rarely a sufficient, record of the event. Without the speaker's words it may be impossible to interpret the slides or understand their significance. In rare instances, a **transcript** of the meeting is provided. However, creating a transcript is a time consuming and/or expensive process and may be difficult without a recording, so a more effective policy is to create an **audio recording** and make this available.

Some people take the view that a combination of slides and audio (perhaps augmented with a photograph of the speaker) is a sufficient record of an event, while others have an innate interest in observing the actual speaker. This requires **video recording** and is a popular choice – as evidenced by our survey. Video may be recorded at **standard definition (SD)**, roughly equivalent to a normal TV or VGA computer monitor, or at **high definition (HD)**, equivalent to the latest televisions. A number of formats for video recording are in common use, but they all employ some form of data structure which contains both audio and video recording data. Each format is associated with a codec[3], which ensures that audio and video tracks are synchronised and played at the correct speed.

3 i.e. Coder/decoder – a software module which provides the coding and compression routines used

The MPEG-4 standard from the Motion Picture Experts Group also legitimises a wide range of different compression methods. It's common for a video file of type .mp4 to use the H.264 compression method for video and the AAC method for audio, but there are alternative compression methods. Popular video players such as Apple Quicktime, Microsoft Media Player and Adobe Flash include a number of codecs but may not be able to play all formats.

The **technical quality** of a recording is determined by factors such as audio sampling rate, video screen size, the compression technique used, and the reliability of the equipment, data storage, or network service. Even at the highest quality, screen resolution is rarely good enough to provide a clear view of the slides displayed in the meeting room, and video is therefore not a replacement for a separate copy of the slides, although certain techniques can be used to include a direct copy of slides within the final recording. Video can be an excellent way of capturing live demonstrations or the personality of a dynamic speaker, which might be lost in an audio recording.

The actual recording process can performed in a number of different ways. The simplest method is **offline recording**, in which data is recorded directly onto a memory card or other storage medium. This is the approach we use when taking a photo with a digital camera, using a portable voice recorder, or using a video camcorder. Another method is **online recording**, in which a capture device is connected to a computer and data is stored in the computer's memory or hard disk drive. This is the approach we use when using a computer attached microphone or webcam. In either of these methods, the objective is to produce a recording file which can be edited subsequently and published on a web site, providing a **time shifted broadcast** of the event. An even more sophisticated method is **live broadcasting**, in which data is captured via online recording and concurrently transmitted over a network such as the Internet, enabling an audience to participate in near real time. Concurrent transmission is sometimes known as streaming and may be combined with recording, so that the broadcast is saved as a permanent record of the event.

Since any of these recording techniques can be used at any recording quality, there are many possible ways of recording an event. Given this range, the WG decided to capture its findings about successful solutions as a **matrix of recommended scenarios** which member groups could adopt with the confidence of knowing that they had been tested. Each scenario was documented to provide a set of detailed recipes describing the equipment used, set up procedure, recording method, and post-event workflow, which member groups can employ to capture their events.

The numbers in the matrix below correspond to these scenarios. The scenarios themselves are described in Appendix C. In addition, a range of useful information on recording and a number of interesting case studies have been captured in the Telemeetings Solutions Wiki[4].

Recording Medium	Offline	Online	Live	Format	Publication Channel
Slides	0	-	-	PDF	Web site
Audio	1	2	-	MP3	Web site, Slideshare
SD Video	3	4	5	MP4, H.264	Web site, YouTube
HD Video	6	7	8	MP4, H.264	Google+, YouTube

The recommended techniques may be used in isolation, with a single microphone or camera, or in combinations using multiple microphones, multiple cameras, and various technologies which can

4 See http://telemeetings-solutions.wikispaces.com

capture the speaker's slides directly for inclusion in visual output. Professional broadcasters use very sophisticated equipment for **selecting a channel** from large numbers of input channels and for overlaying, or **mixing channels** to generate the desired output. Whilst professional techniques are beyond anything that member groups could attempt, simplified forms of the selection and mixing functions can be found in the equipment, recording software, and editing software which member groups may reasonably expect to use.

It's also worth mentioning that high quality or complex recording and editing techniques can generate very large quantities of data and high processor workloads, and therefore demand the use of fairly up-to-date computers and networks. More detail of these requirements is given in the individual scenarios, but most of the recommended methods will work successfully on many laptops purchased within the last two years.

In trials of the various techniques, it became apparent that the overall **perceived quality** of any recording is only partially determined by its technical quality. Many other factors including lighting, background noise, the placement of microphones and cameras, camera optics, and the use of techniques such as pan and zoom, can affect the perceived quality and in the worst cases render a recording unusable. It is particularly difficult to capture a good audio recording. We investigated a number of technologies including the use of low cost wireless microphones which can be worn by the speaker[5]. These are familiar in many events and especially valuable when a speaker chooses to move around during the course of his or her talk.

In addition to all this, speakers vary greatly in their accents, their ability to project their voice, their clarity of speech, and in the discipline with which they use the microphone and other technology. These and other “body language” factors may exert an overriding influence on the perceived quality of any recording.

Recording Solutions

In the last few years, the consumer electronics industry has been offering highly specified analogue and digital recording equipment at increasingly low prices. Modern laptop computers often have built in microphones, webcams and loudspeakers, but external recording devices are also available cheaply. Simple analogue microphones and headphones are available for a few pounds; the headset supplied with mobile phone often provides a free alternative. Portable wireless microphone kits, developed for amateur music events, are available for £60-£140. High definition studio webcams, which can be mounted on a tripod, are available for £30-£50 and include a microphone. High definition digital camcorders are available from around £150 upwards. Recent models have superior optics with wide range zoom lenses, automatic focus and exposure control, and record data onto standard format SD cards; high capacity storage cards are available for around £10. These camcorders also have a number of other useful features including sockets for various inputs and outputs.

The WG found that a 3.5mm microphone socket, allowing attachment of a range of external microphones, was particularly valuable, although this is only found on camcorder models from around £400 upwards. A camcorder and microphone combination, sufficient for high quality offline

5 Sometimes known as “tie clip” or “lapel” microphones

recording, can be obtained for around £500 which is an order of magnitude[6] less than the cost of a semi-professional recording set up, such as the Tricaster configuration installed at BCS Southampton Street. This puts it within the reach of any BCS branch or group.

Online recording techniques require the use of cameras and microphones attached to a laptop, which is usually placed at the back of the lecture room where a volunteer can manage a number of items of equipment. Webcams are ideally suited to online recording but have limitations such as fixed focal length and wide angle lenses, which mean they must be placed near to the speaker. To overcome this, the webcam must then be attached to a laptop at the back of the room via a USB extension cable. The WG used a 20 metre cable which included a repeater[7] successfully. Certain recording techniques which rely solely on the use of a microphone or a webcam can also give good results at a price of around £50, which is another order of magnitude less than the cost of a camcorder configuration.

More flexibility is offered by attaching a camcorder to the laptop but the WG found that the technology to enable this is not well developed. In the past, many camcorders were equipped with Firewire output sockets, enabling digital connection to a suitable port on a laptop. Unfortunately, modern consumer camcorders[8] have discontinued this practice in favour of providing an HDMI[9] output socket, which enables connection to a digital TV. Unfortunately, we could find no affordable solution for enabling HDMI connection to a laptop[10]. However, a simpler solution using analogue output from the camcorder is usually available by purchasing a video grabber device[11], which converts the analogue signal to a digital input via a USB port. This process reduces quality to that of an SD video input but is nevertheless adequate for some purposes. A number of these video grabber devices are available at prices around £20, but they must be chosen with care since there are also non-functional devices on the market.

The WG purchased and evaluated a range of equipment which included the following products:

- 3 Panasonic camcorders
- 3 ProSound wireless microphone kits
- 1 Microsoft Lifecam studio webcam
- 1 LogiLink USB Video Grabber
- Audio and USB extension cables
- 1 Tripod

Experience showed that these products could be used successfully on their own or in combination. The camcorders can be used for offline or online recording. The wireless microphone kits can be used for online audio recording, or in combination with a camcorder for offline or online video recording. The webcam can be used alone for online recording, or in combination with other cameras and microphones for online recording or live broadcasting. Both camcorders and the webcam can be tripod mounted to provide stable and appropriate views of the speaker and the projection screen. Detailed configurations are given in the scenarios.

6 I.e. a factor of ten
7 I.e. a small amplifier powered from the USB socket
8 At least, on European models
9 High Definition Multimedia Interface – a fast network architecture similar to Ethernet
10 Some modern laptops have HDMI output ports, but these will not usually function as input ports.
11 Also known generically as an “EasyCap” device

Post Event Workflow

Most recordings can be improved by post-event editing to remove unwanted material such as introductions, gaps in recording, fluffs, interruptions, etc. In some cases it may also be necessary to remove material that could be deemed offensive or libellous (see section on “Hygiene Factors”). Sometimes, an audio track can also be improved by using noise reduction software. Where multiple tracks have been recorded from a number of cameras and/or microphones, it may be possible to select the best material for inclusion in the final edited recording, although it is usually best to use a single audio track as a basis for synchronisation. It is also possible to add direct copies of the speaker's slides via a process of screen capture and to synchronise slide changes with the audio track. These actions are equivalent to the real time mixing of input channels, although performed after the event. In addition, the perceived quality and usefulness of a recording may often be improved by breaking it into manageable sections (say 20 – 30 minutes), and by adding titles or captions.

The WG evaluated a range of software for editing audio and video material, including:

- Audacity – a free, open source audio editor
- TechSmith Camtasia – a video editor available in a numbers of versions
- AnyVideoConverter – a free video converter and player
- Apple Quicktime Pro – a free video editor and player
- Apple Final Cut Pro – a semi-professional video editor

Audacity was developed primarily for music publishers, and supports both online audio recording from microphones attached to a laptop, and editing of audio tracks. It provides a visual metaphor for cutting, splicing and moving audio tracks as if they were pieces of tape, displaying each track as a waveform and allowing multiple tracks to be overlaid on each other. It supports playback of input or edited audio, for review. Additional utilities may be used with Audacity to generate compressed output files, such as an MP3 file, which are suitable for posting on the web.

Camtasia was designed to support the creation of marketing and training videos and webinars, and costs £76 for Mac computers or £250 for Windows computers[12]. It supports online video recording from cameras (such as webcams) attached to a laptop, and editing of video tracks. It also provides a visual metaphor, displaying waveforms for multiple audio tracks plus a virtual tape for video tracks. Using a number of audio tracks is useful and another particularly valuable feature is that it can record the contents of a defined area of the laptop screen, which enables a slide presentation or screen-based demonstration to be captured and then overlaid with an audio track, for example. Camtasia enables generation of compressed output files suitable for posting on the web.

Camtasia is only able to accept a limited range of video file formats as input, and will not accept files produced by some camcorders. However, we found that there are a number of freely available video conversion software utilities, which will accept a wide range of input formats and convert to other formats. Many of these also act as video players. One of the most useful of these was AnyVideoConverter. The Apple products are sophisticated and very capable, especially in the hands of a skilled person.

12 These are not equivalent versions. Non-current versions are also available cheaply on eBay.

Whilst appropriate editing can produce a polished and attractive final recording, it can also be a very time consuming process. Experience has suggested that a ratio of five or ten hours editing for one hour of recorded material may be quite common. Professional editing is therefore expensive and amateur editing is demanding in volunteer time. Unfortunately, many well-intentioned recording projects sink at the point where editing is either not completed, or the final recording is only produced long after the event has passed.

Broadcasting Solutions

The World Wide Web is the major delivery system for member group generated content and the action of posting a recording file on a web page provides an effective, on demand time-shifted broadcasting solution. This action is equivalent to posting a document such as a PDF file on a web page, which would normally be thought of as publishing, and has same benefit that the content may be viewed by a large number people over an extended period of time. So, for our purposes, broadcasting is broadly equivalent to publishing although they differ in their appearance at the user interface.

A document will usually be downloaded from a web server in its entirety and viewed via a utility such as the Adobe PDF reader. Similarly, a recording will usually be downloaded as a data stream which can viewed via a utility such as the Apple Quicktime player. This buffers the recording and plays it at the correct speed, independently of the download speed, allowing playing to start before the download is complete. A modification of this technique enables a server (often known as streaming server) to relay a data stream which it is receiving over a network, and therefore allows the player to buffer and play live broadcasts relayed from another location. The difference between live and recorded broadcasts is effectively transparent to the end user.

At the event location, the organiser of a live broadcast must adopt one of the online recording solutions described above and use additional software to forward the recorded data stream to a broadcast server. The WG evaluated the use of:

- Adobe Flash Live Media Encoder – a free upload and recording utility

and found it to be a sophisticated, semi-professional software which could be used successfully with a server running Adobe Flash Live Media Server. It enables detailed control over the resolution, aspect ratio and frame rate of the forwarded video data stream. However, some users would require training to use these capabilities effectively.

Many member groups have already adopted the practice of posting documents and recordings from their events on the announcement page for that event, usually a page within the BCS web site. This provides a satisfactory way of associating the content with the meeting announcement, which often includes a summary and details of the speaker, and is a convenient way of creating a permanent record of the event. Members of each group will usually find it easy to access content which is organised in this way, although they may encounter some incompatibilities between certain recording formats and particular web browsers.

Members of one group will, however, not usually be aware of content generated by another member

group and will experience difficulty in finding it, even if they are aware, because there is no standard convention within BCS for naming member group web pages.

The WG also evaluated the following web-based services for publishing and broadcasting content:

- YouTube (video hosting)
- Vimeo (video hosting)
- SlideShare (slides plus audio hosting)

Recordings which have been uploaded to these sites will be compressed and have their format converted to a standard form which avoids browser incompatibilities, and will normally be public and viewable by anyone. Once a recording has been posted on one of these sites, it is available indefinitely and the hosting site therefore acts as an archive.

Several member groups have experience with using YouTube and the BCS Publications department has an extensive archive of over 600 videos, with a total of over 100,000 viewings[13]. These range from videos with large numbers of viewings to others with very few, where the number of viewings probably did not justify the cost of production. A number of other organisations show examples of good practice[14]

Slideshare differs from this by hosting audio recordings and slide data, and enabling the audio to be synchronised with slide transitions to create an automated slide show. It is popular for online training[15] and one member group has used it successfully to host presentations which have received over 1,000 viewings each.

It's clear that web-based broadcasting services solve the immediate problems associated with posting content on the BCS web site, but they offer many other advantages as well. Users can search for content by name or by the name of the person or group posting it, and a person or group can set up their own customised broadcast channel which lists all their content. The service usually provides a good deal of valuable data about the usage of content, and data storage is free. These factors make web based services the obvious choice for broadcasting.

Online Meeting Services

Web-based online meeting services have been available for the past decade and have been widely used in a number of organisations. They are designed to support committee meetings and other similar events where a number of the participants are remote from the main meeting site, and aim to extend the meeting metaphor so that all participants can imagine themselves to be sitting round a table, with interaction taking place via each participant's individual laptop. Many of these services are modelled on earlier bespoke video conferencing services, but use a web browser or plugin as the presentation software and the Internet for communication. Most are offered as cloud-based services rather than software products.

Although support for committee meetings was not part of the Working Group's TOR, we decided to

13 See www.youtube.com/user/bcs1957
14 Notably www.TED.com/talks and The Royal Institution www.richannel.org.
15 For example Skills Matter www.vimeo.com/skillsmatter

investigate online meeting services because they appeared to offer convenient end-to-end solutions which might enable remote users to participate in typical BCS events. The WG evaluated the following, because they are either well-known or had been used by a member group:

- Adobe Connect
- AnyMeeting
- Apple FaceTime
- Cisco Webex
- Citrix GoToMeeting
- Google+ Hangout
- Second Life
- Skype

Skype is widely used for personal communication and has been used some professional broadcasters. However, an initial trial suggested that it was unreliable and more limited in function than other offerings, and it is therefore not recommended although it has been included in the evaluation. Apple FaceTime provides only person-to-person conferencing and was therefore discarded too.

Demonstrations of Second Life showed that its **virtual world** metaphor could be used to run online meetings by writing on a virtual whiteboard that each user could view. Nevertheless, each participant would need to create an avatar and navigate the virtual world, in order to find meeting locations and interact with other participants. This seemed unduly cumbersome, especially since there was no requirement for anonymity: one of the claimed advantages of this paradigm. It also became clear that rendering the virtual objects and players is expensive in processor time and requires a dedicated server, which is only practical where a hosting location is willing to provide the needed resources. For these reasons, Second Life was also discarded.

Adobe Connect and Cisco Webex have been widely used but appeared expensive and there is some evidence that they are losing market share to other services. They were therefore discarded too.

This left Citrix GoToMeeting, AnyMeeting and Google+ Hangouts as low cost solutions which might be suitable for member groups. All of these were tested by members of the WG. GoToMeeting is already used by BCS staff to support activities relating to the certification process, and BCS therefore has a licence. However, it wasn't clear whether this licence could be extended to cover member group activities, nor how this would work in multiple locations.

These three services were all easy to set up and use, were stable and had broadly similar function, allowing control of which participants joined the meeting and which laptop microphones and cameras were active, enabling screen sharing, and providing instant messaging and basic recording facilities. A detailed feature comparison is given in Appendix D.

It wasn't immediately obvious how any of these services could be used to support lecture style events, where the assumption is that a speaker will be standing in front of an audience rather than sitting at a desk. Another problem is that a laptop supporting this kind of event would normally be placed at the back of a lecture room, remote from the speaker. In addition, all the services evaluated

set a relatively low limit[16] on the number of interactive participants. Whilst this would be sufficient for most committee meetings, it would not be sufficient to enable a large number of members to participate in an event. For these reasons, we initially concluded that online meeting software was inappropriate for member group events.

However, the reason for this limited scalability is that all participants have full interactive capabilities. Much greater scale can be achieved via a non-interactive broadcast. We found that, uniquely, Google+ enables this by allowing the meeting coordinator's account to be linked to a YouTube account. Selecting the option “Hangout on Air” when the online meeting is initiated causes the shared meeting display to be broadcast live[17] via this YouTube account, supporting an effectively unlimited number of viewers. When the meeting is closed, a recording of the meeting is automatically posted on the YouTube account. This feature, together with the fact that Google+ is free, makes it a good candidate for broadcasting events.

None of this would be sufficient unless we can also show that an online meeting service can be used for lecture style events. Fortunately, Google+ also supports multiple cameras installed on a single laptop, including external webcams and externally attached camcorders, and allows the meeting coordinator to select which camera and microphone is used during the Hangout. The selection can also be changed during the course of the event, allowing dynamic selection from the available input streams. The meeting coordinator can therefore act a broadcast producer.

Trials showed that a tripod mounted webcam, connected via a USB extension cable to a laptop at the back of the room, could offer a very simple solution for both broadcasting and recording an event. These combined factors make Google+/YouTube Hangouts the obvious choice of starter solution for member groups and this has been documented as Scenario 8.

Facilities at Southampton Street

Whilst the main focus of the WG was on developing techniques and procedures which could be used by any member group, it's clear that an enhanced capability can be provided at BCS purpose built meeting facility in Southampton Street where equipment can be shared between a number of member groups. This facility has the following audio/visual facilities:

- meeting room data projectors
- meeting room cameras
- public address system with meeting room loadspeakers
- microphones, including lectern microphone, tieclip and handheld
- input sockets for the public address system
- output socket from the meeting room projector, known as iVGA

Whilst a member group event will normally use some of these facilities, for example a data projector and potentially a microphone and PA system, the facilities are generally not integrated with the recording facilities described above. For example, there is usually no way to take an output from the PA system for recording, so that a separate microphone must be used for this purpose. This may lead to both the PA system and a recording system being used in parallel, which is

16 Usually less than or equal to 16 participants
17 Actually, with a delay of from 10 to 20 seconds

cumbersome. Alternatively, a recording system may be used independently of the PA system, which is sometimes advantageous.

In addition, Tricaster equipment is available at Southampton Street, offering a semi-professional broadcast system with the following capabilities:

- Control of meeting room cameras
- Selection and mixing of input channels, including cameras and iVGA
- Recording and broadcasting of the mixed output channel

In the hands of a trained operator, or preferably two operators, the Tricaster system can produce high quality output as evidenced by its use in BCS publications and some member group recordings. Its relatively sophisticated mixing facilities mean that post-event editing work is greatly reduced although there may still be a need for editing, for reasons explained below.

Tricaster was made available for use by member groups in 2009, together with an extensive guide and training sessions provided by an external company. It has been used by a number of groups with varying levels of success, ranging from complete failure to the successful implementation of a live broadcast with over 150 online viewers. Overall, however, experience has been less than satisfactory for a number of reasons:

- the complexity of the system and extensive training required mean that many groups have not acquired, or have failed to maintain, the skill levels required to use Tricaster effectively
- its use is limited to certain rooms, as a result of its integration with the PA system
- operation has proved to be time-consuming, as a result of the customised set up and shutdown procedures which must be followed and the need for post event editing
- the system has suffered from a level of unreliability requiring frequent maintenance, but BCS staff have limited problem determination skills on this equipment

For these reasons, Tricaster is not well matched to the needs of many member groups although it is a valuable resource for high profile or prestigious events. There is a clear need to widen the pool of skills which enable this system to be operated satisfactorily. Recent trials have shown that a simple way to use Tricaster to good effect is to record synchronously both the sound from the PA system and iVGA pictures as displayed to the audience. This requires no intervention by the operator during the lecture and can subsequently form the basis for editing in other pictures, e.g. of the speaker, captured by one or more camcorders. It is also a good way of capturing pictures displayed by the speaker which are not in Powerpoint format, such as Internet demonstrations or personal video clips.

The Role of Social Media

The BCS has endorsed the value of social media for a number of years and several member groups have used social media offerings including:

- LinkedIn
- Twitter

However, experience has been mixed. The use of LinkedIn for building a network of contacts is widespread amongst BCS members, and a LinkedIn discussion group for BCS members has been used extensively. By contrast, individual member groups which have set up their own discussion groups have seen relatively low levels of activity. There are some suggestions that announcing events via LinkedIn or Twitter increases attendance, and it's possible that usage will increase over time, but there is no clear evidence yet that these forms of social media encourage the reach and range of participation which we would wish to see.

It's worth noting, however, that YouTube, SlideShare, and Google+ are themselves social media with similar functionality for building personal networks, posting messages, and for hosting content, enabling searching, endorsement, recommendation, and so on. They are also well adapted for video and audio content, in contrast with other social media offerings which emphasise documents and still photographs. LinkedIn has the capability to host SlideShare presentations.

Google+ is particularly valuable for its unique capability to host online meetings and link these to other forms of content. It seems clear that it could offer benefits to any member group as a support mechanism for committee meetings, with few barriers to its adoption. Any group which adopts this practice would then find it easy to extend its usage to lecture style events, and thence to recording and broadcasting via YouTube. It's also fairly clear that one possible limitation of broadcasting, its one-way non-interactive form of communication, can be overcome by providing a feedback channel using a social medium such as instant messaging or Twitter.

It seems clear that social media provide many opportunities for supporting member group activities and potentially developing new ways of working, but there is a need to develop effective ways of exploiting them. In addition, they are likely to evolve rapidly and particular attention should be paid to the new opportunities they may create.

Hygiene Factors

Some people have expressed concerns over privacy, security and intellectual property rights in relation to recording and broadcasting, and especially in relation to electronic meetings and public broadcasts. It's therefore worth outlining the main factors which member groups should consider when setting up an event.

Intellectual Property Rights

In a professional context such as a BCS meeting, many speakers will agree to a bargain where they give their time and information freely and, in return, receive the endorsement of a professional institute and free publicity for themselves and their organisation. Since this is not a commercial transaction, no money changes hands and neither the member group nor BCS should seek a monetary gain from such an event.

Therefore, the organiser should determine whether the event in question is open to all (this is the case with the majority of events organised by BCS member groups), in which case it is a public meetings and any content delivered during such a meeting becomes part of the **public domain**. The presenter should not divulge any proprietary, confidential or secure information nor seek to gain any such information from others present. In addition, the presenter should not make statements which

are defamatory or damaging to the BCS.

Assuming this is the case, the organiser should also ensure that the speaker owns the copyright of any material he or she presents and is willing to release it, in order to protect BCS against subsequent charges of copyright infringement. Where the speaker does not own this copyright, he/she should obtain permission to use the material from the copyright owner. The organiser should also inform the speaker that he/she wishes to record and/or broadcast the event and obtain the speaker's consent. Copyright remains with the speaker or other owner but, providing permission is obtained, there should be few problems with intellectual property rights.

A model letter from the organiser to the speaker outlining these conditions is given in Appendix E. Written consent (e.g. an e-mail) in response to this letter would provide satisfactory evidence that they have been adhered to. However, if the meeting does not conform to the model described above, then the speaker should seek advice from the BCS legal department.

Privacy

Many member group events are open to non-members and are therefore public meetings. In the course of such a meeting, personal information about the speaker or other attendees (such as their appearance, experience, attitudes, ethnic background, etc.) may become known. When a meeting is recorded or broadcast this information may become widely known and there are few ways of controlling its release, potentially infringing the data protection rights of these attendees. In the course of recording an event, members of the audience may also be recorded, for example when asking questions. Therefore, to protect their privacy, the organiser should inform the attendees that they may be recorded and what action they should take if they wish to avoid this, for example to leave the meeting or to sit in a reserved area of the room.

Security

The technologies and methods described here are unsuitable for communication which will include proprietary business information, personal information, or information relating to national defence and security. Any member group which has a need to communicate this kind of information should consider carefully how it is managed and only use appropriate technologies.

Where member groups make use of cloud-based social networking services such as Google+ and YouTube, they should recognise that any content communicated via these services effectively becomes public and may be seen by large numbers of people. It is therefore important that this content does not include material which is confidential, personal, or defamatory, and it becomes the responsibility of the person chairing an event to ensure that this is so.

Cloud-based services are often provided on standard contracts which enable them to be withdrawn at short notice, do not specify data location, and may not provide guaranteed levels of service. Working practices which are based on the reliability and continued availability of these services therefore carry some risk of unexpected disruption. Any group planning to use these services should assess this risk and develop a mitigation strategy for the situation where these risks occur.

Findings and Recommendations

The Working Group observed that the increasing commoditisation of Information Technology has created low priced products and services with similar capabilities to those available only in higher priced, specialist products a few years ago. This, coupled with the rapid rise of Social Media services, has led to a situation which enables most BCS members to develop skills and undertake projects which were previously unachievable.

Our experience[18] leads us to believe that recording, editing and broadcasting technologies have clear benefits in increasing member engagement, enable all members to participate more fully in member group activities. These technologies should therefore be more widely adopted by BCS member groups.

To facilitate this, we offer the following findings and recommendations:

1. **Finding:** The limited experience to date confirms that recordings of member group events can achieve significant numbers of viewings, when compared with typical numbers of attendees at these events, and therefore increase engagement with groups and their activities.

   Recommendation: Each member group should be encouraged to develop a recording and broadcasting strategy, describing what events it plans to record and what level of investment is appropriate to enable this.

2. **Finding:** The WG has demonstrated that low cost methods can be effective for recording, editing, and broadcasting. However, there is no "one size fits all" solution to recording and broadcasting requirements and therefore we have documented proven configurations as a set of scenarios.

   Recommendation: Each member group should assess which technique, or combination of techniques, best suits its style of operation and is the most effective for each event, starting with simple techniques and developing the use of more sophisticated techniques over time.

3. **Finding:** There is an urgent need to increase the pool of knowledge and skills available to support recording and broadcasting activities.

   Recommendation: Each member groups should be encouraged to appoint a committee member as Recording Officer, to act as a focal point for recording activities and the development of skills.

4. **Finding:** At major regional locations, especially Southampton Street, there is a need for an inventory containing a range of equipment and software which can be shared amongst member groups to minimise costs and maximise benefits. This will need to be supported by booking procedures, maintenance functions, and training activities to be fully effective.

   Recommendation: Best Practice Committee should establish an initial inventory at Southampton Street. This should include equipment purchased by the Working Group,

18 E.g. For a survey of almost one hundred Advanced Programming SG members see Appendix F.

the Tricaster system, and potentially other equipment and software.

5. **Finding:** The Tricaster system is under-utilised to the extent that current levels of usage do not provide a good return on the investment in this equipment.

   Recommendation: Further improvements to the system should seek to eliminate the need to reconfigure hardware and software for each user, and should include the provision of headphones and enhanced documentation. These should be supported by streamlined procedures for booking the system and intensified training for staff and volunteers.

6. **Finding:** Products, techniques and procedures are likely to change as technology evolves. It will be important to re-assess them regularly and update best practice. The Volunteer Portal is likely to be an important channel for this information.

   Recommendation: Best Practice Committee should document techniques and scenarios for using recording and broadcasting equipment and continue to act as a focal point for the development and dissemination of techniques and skills. Equipment, software and techniques should be reviewed after two years.

7. **Finding:** There is a need for a support infrastructure including financial, IT, facilities, training, legal, publications and marketing functions which enables volunteer recording activities to be fully effective.

   Recommendation: Member Board should work with BCS HQ to develop cooperative working practices so that the activities of volunteer members are supported by appropriate staff functions.

8. **Finding:** There is a need for a central repository of recordings which can act as an easily accessible focal point for searches and an archive of significant content, especially where that content has potential log term significance or interest. In addition, contact should be tagged with appropriate keywords to facilitate searching. The most effective way to achieve this is to use one or more of the social media described above.

   Recommendation: Best Practice Committee should set up the appropriate social media accounts and establish procedures for promoting/migrating material from member group repositories to the central repository and tagging it with appropriate terms.

9. **Finding:** Member groups may suffer setbacks from time to time which may curtail or limit their recording activities. We need incentives to sustain and positively reinforce these volunteer activities. One of the best incentives is publicity, for example in ITNow or on the home page of the BCS web site.

   Recommendation: Member Board should work with the BCS Publications Department to identify the best recordings produced by member groups and showcase them in BCS publications.

10. **Finding:** Although not part of its TOR, a by product of the WG activities was an assessment of electronic meeting software. This identified Google+ as the most useful offering and

showed that it could provide effective support for committee meetings of member groups, highlighting the opportunity to use it more widely.

Recommendation: Member groups should be encouraged to adopt Google+ as tool to support their committee activities.

11. **Finding:** Whilst BCS continues to endorse the use of social media by member groups, it appears that there is no strategy for integrating the various forms of social media to gain best use from each and to reap synergistic benefits.

    Recommendation: Best Practice Committee has initiated a study of social media and should aim to identify the best ways of exploiting their synergy with recording and broadcasting techniques..

Appendix A: Members of the Recording and Broadcasting Working Group

The members of the Recording and Broadcasting Working Group were as follows:

- Jose Casal-Gimenez, Agile SG/Kent Branch
- Christopher East, Internet SG
- Terry Friedman, Data Management SG
- Anthony Harrison, Enterprise Architecture SG
- Kwasi Owusu, Oxford Branch
- Colin Pearson, Internet SG
- Geoff Stone, Oxford Branch
- Conrad Taylor, BCS member
- Motassim Thupsee, Mauritius Section
- Paul Woolman, Scottish Health
- Geoff Sharman, Advanced Programming SG (Chair of WG)

This list includes both the initial members and those co-opted later. One member resigned before the completion of Working Group activities.

Appendix B: Previous usage of Recording and Broadcasting Technology

The table summarises responses from a member group survey conducted on December 2011. At that time, fifteen groups (approximately 14% of all member groups) were actively recording some or all of their events, and two were planning to do so. Young Professionals Group had been active previously but was no longer recording events at the time of the survey.

Group	Contact	AV type	Hardware	Software	Edit Software
Abu Dhabi	Yasir Karam				
Advanced Prog	Geoff Sharman	Audio	Wireless mike	Audacity	Audacity
Central London	Funmi Adeusi	Video	Tricaster	Tricaster	
Delhi	Darman Dev Sood	Audio	Webcam	GoToMeeting	GotoMeeting
Dell Computer	Victor Smith	Audio			
Hampshire	Brian Luff	Video	Professional		
Health Scotland	Paul Woolman	Video	Camcorder	Webex	Video3
Hertford	Mike Barwise	Audio	Professional	Reaper	Reaper
Internet SG	Colin Pearson	Video	Tricaster	Tricaster	Ulead
IRMA SG	Andy Moattari	Video	Tricaster	Tricaster	
Kent	Jose Casal	Video	Webcam	Camtasia	Camtasia
Mid-Wales	Tim Davies	Video	Professional	Panopto	Panopto
Oxford	Kwasi Owusu	Video	Camcorder	Camtasia	Camtasia
PROMS-G	Terry Freedman	Audio	Voice recorder	Voice recorder	Audacity
Southwest	Paul Dowland	Video	Camcorder		
Tayside	Corrado Mella	Video	Professional	Livestream	
Wiltshire	Keith Philip				
YPG		Video	Tricaster	Tricaster	

Appendix C: Recording and Broadcasting Scenarios

The basic idea behind the Recording & Broadcasting scenarios is that they can act as simple recipes which any member group, even one with a low budget and limited skills, can adopt in a straightforward way. They have already been tested and used for routine events, so any group adopting one of them can be reasonably confident that it will work. The scenarios are also graded so that skills developed using the early scenarios can be re-used and enhanced with later scenarios. Additional training material and resources to enable their adoption will be documented via the Volunteer Portal.

Nine recording scenarios are defined:

0. Documentation only
1. Offline Audio
2. Online Audio
3. Offline SD Video
4. Online SD Video
5. SD Video Live Broadcasting
6. Offline HD Video
7. Online HD Video
8. HD Video Live Broadcasting

In all cases, “audio” implies that both slides and audio will be captured and “video” implies that slides, audio and video will be captured.

The context for any recording activity is a meeting or event at which an expert speaker presents material which has value for a wider audience, or as reference material. Whilst it has been customary for each speaker to provide a copy of their slides in PDF format[19], it is often difficult to reconstruct the speaker's argument, or recall the finer points, without a record of their words. For this reason, audio is usually a more valuable part of any recording than video and all recordings should include an audio track.

Most speakers will use electronic slides (and possibly other electronic material) as visual aids to support their presentation. It's important to capture these as well as the audio/video stream, but experience to date suggests that video capture is not an ideal way of doing this: too often, a video camera is used to capture the speaker's face at the expense of the slides. Therefore, a PDF file or direct “screen grab” of the electronic material must be captured as well. Once captured, it is often desirable to synchronise the slides with the audio/video stream and merge them into a single stream for publication. The offline and online scenarios differ in the way in which this is achieved.

The differences between the scenarios therefore lie in the nature of the material captured (either audio+slides or audio+video+slides), the equipment used, the file size generated, and the effort required. All recordings should normally be followed by an editing step, during which the recording is improved and converted into an appropriate format for publication. The scenarios may also be combined in various ways to achieve a given group's goals. For example, it may be desirable to have a live broadcast of an event at moderate quality and subsequently produce a higher quality, edited version for longer term reference.

19 Not all groups have adopted this practice; they should be encouraged to do so before attempting a recording.

Scenario 0: Documentation only

This represents existing good practice where a record of the meeting is provided in the form of a copy of the presenter's slides, or a transcript of what was said, or both. These documents should be provided in PDF form because that is most widely used and is the most convenient for downloading over the web. The advantages of this scenario are that documentation is compact, easily transmitted over networks, and requires no additional skills. The disadvantages are that the presenter's slides seldom provide a complete record of the meeting, and that transcripts are expensive or time-consuming to produce.

Scenario 1: Offline Audio

This scenario uses an inexpensive digital voice recorder, sometimes equipped with a tie clip microphone, to record an audio stream to a storage device in the recorder. The speaker carries the voice recorder in his/her pocket. Typical recording devices use an SD card for storage and have a capacity of around 30 minutes of audio. [For very short recordings, a smart phone could substitute for the voice recorder but this is not recommended for larger/longer meetings.] There is no control of the recording device while it's being used, and speaker slides must be captured separately, usually as a PDF file.

Data from the storage card must imported into a computer running an audio editor such as Audacity. The editing and publication process follows the same approach as that described in Scenario 2, and there is generally no synchronisation between audio and speaker slides although they may be manually synchronised for web publication via SlideShare.

Scenario 2: Online Audio

This scenario uses a microphone connected to a laptop computer, equipped with recording software, to capture an audio stream directly to the computer. Recent experience with remote microphones, including directional microphones, suggests that sound quality may be unreliable unless the microphone is actively managed. Therefore, a tie clip microphone is normally a better option, connected to the laptop via a long cable or a wireless microphone kit, using an audio jack or USB connector. Some speakers like to move around and are unhappy with the idea of being tied to a cable, so a wireless microphone is the recommended solution.

The wireless kit consists of the microphone plus a small battery powered transmitter which is worn by the speaker, and a base station receiver which is connected to the laptop[20]. An advantage of a wireless kit is that the receiver and laptop may be positioned remotely from the speaker. It is often convenient to operate this configuration from the back of the lecture room, where a volunteer can start and stop the recording, monitor levels, switch microphones, etc without disturbing the speaker.

Normally, the software used for recording is also used for subsequent editing. With a suitable hard disk drive installed in the laptop, or an external hard drive, recordings of one hour up to several

20 Simple kits support only one microphone; more sophisticated kits include one or more hand held microphones in addition to the tie clip microphone, and use multiple channels to the receiver. Prices range from approx £60 to £150.

hours may be captured easily. The best known software for this purpose is the free, open source Audacity which may be downloaded from http://audacity.sourceforge.net/download/ [21]. Other audio recording software may also be used, but will usually be priced. Alternatively, both slides and audio track may be captured using Camtasia, by selecting no camera input.

Audacity provides a convenient "dashboard" style user interface for operating the recording, plus a waveform display used during recording and editing. It stores recordings using the .aup file format and supports editing in this format, although a faster computer may be required for editing. There is a fairly comprehensive tutorial at http://wiki.audacityteam.org/wiki/Audacity_Wiki_Home_Page. The edited recording can be converted to MP3 format for distribution using an additional software package known as Lame. Speaker slides must be captured separately as a PDF file because Audacity does not support capture of this data. There is no synchronisation between slides and audio, and two files must be published to capture the complete recording. However, when a recording is published on the web using the SlideShare service, slides can be manually synchronised with the audio track.

Scenario 3: Offline SD Video

This scenario uses a digital camcorder plus microphone to record a combined audio + video stream to a storage device such as an SD card or a hard disk drive. Normally, the camcorder should be mounted on a tripod somewhere towards the back of the lecture room where it will not disturb the speaker and should have a long enough focal length lens to make this possible. A number of popular makes of digital camcorders are currently available with wide range zoom lenses, which makes it possible to select a convenient focal length[22]. Most camcorders have a built-in directional microphone but sound quality may be unreliable and therefore use of an external microphone is recommended. This could be a camera-mounted microphone or a wireless microphone of the type described in Scenario 2. In either case, it's important that the camcorder have an input socket for the external microphone, to enable both audio and video tracks to be recorded on the storage device. We recommend the Panasonic HC-V700, priced at around £400, as a product which has this feature.

Standard Definition (SD) video uses a resolution roughly equivalent to that used in conventional analogue TV pictures or VGA computer monitors, and often defined as 720 x 576 pixels. This enables long recordings to be captured on a single storage card although the length of recording also will depend on the storage capacity of the card. SD cards are currently available with capacities up to 32 Gbytes, which should allow several hours recording.

The camcorder and microphone combination is usually operated by a volunteer during the meeting. The combined audio + video tracks on the storage device must then be imported into a computer running a suitable video editor such as Camtasia. The editing and publication process follows the same approach as used in Scenario 4, but note that Camtasia is also capable of capturing speaker slides (or other displayed information) so that synchronisation between the slides and audio/video track may be established during editing.

21 It's important to select the right version for the platform you are running. Audacity was developed primarily for recording stereo music but may be used in mono mode and at a lower sampling rate for speech.

22 Prices range from around £50 to £400, with a number of good quality models available for around £200.

Scenario 4: Online SD Video

This scenario uses video camera and a microphone, both of which are connected to a laptop computer equipped with recording software, to capture audio and video streams directly to the computer. One advantage of this approach is that the recording software can also capture the speaker slides via “screen grab” technology and synchronise it with audio/video stream during the recording.

The choice of cameras which may be connected to a laptop includes external webcams and camcorders attached via a digital bus, such as Firewire, or an analogue to digital conversion device, often known as a USB video grabber. Some higher priced video cameras from around £1000 have this feature, but we were unable to find it on consumer models. However, most camcorders provide an analogue output signal which may be converted to an SD quality digital signal via a conversion device. These are readily available at around £20 and we recommend the LogiLink USB video grabber. This is supplied with drivers for Windows computers and free open source driver is available for Mac computers from www.bentrask.com. The camcorder may also be equipped with an external microphone as described on Scenario 3.

Most external webcams have a short focal length lens and must be placed close to the speaker. This requires a USB extension cable for connection to the laptop, since it is normally convenient to locate this and other equipment at the back of the room where a volunteer can start and stop the recording, manage camera angle, recording levels, etc. Camcorders usually have wide range zoom lens and may be placed at the back of the room, close to the laptop and other equipment.

To make use of the “screen grab” function in recording software such as Camtasia, the speaker's slides must be installed on the same laptop which is being used for the audio/video recording. It is therefore necessary to copy the speaker's slides to the recording laptop before the session begins. The person operating the laptop should be alert to following the speaker's slide changes as they occur.

Normally, the software used for recording is also used for subsequent editing. File sizes will typically be an order of magnitude larger than with audio recording but a modern laptop with a suitable hard disk drive, or a high capacity external hard drive, should enable recordings of several hours to be captured easily. Experience suggests that Camtasia[23] is suitable for this purpose. Its “screen grab” function uses a rectangular marquee to denote the area of the screen to be captured and this would normally be positioned over the window used for the speaker slides, but could capture the output from any application. The benefit of performing this screen grab in realtime is that accurate synchronisation may be achieved while avoiding work may during the subsequent editing process.

Camtasia is available from Techsmith Labs, together with other related products. See http://shop.techsmith.com/store_Action=DisplayHomePage&Currency=GBP&Locale=en_GB&SiteID=techsmit for details. It provides a convenient “dashboard” style user interface for operating the recording, plus a waveform display similar to that provided by Audacity for the audio stream, which is used during recording and editing. It records composite files in its own format and supports editing in this format, although a faster computer may be required for editing. As previously noted, speaker slides may be

23 Camtasia is priced at £76 for Mac and £230 for Windows computers.

incorporated into the video output stream and synchronisation established during the editing process. The combined audio/video stream may be converted to MPeg4 format for publication on the web. Tutorials are also available from the Techsmith web site.

Scenario 5: SD Video Live Broadcasting

This scenario uses the Tricaster system to both record and broadcast SD quality video. A full description is beyond the scope of this report; users should refer to the Tricaster manual and undertake specific training. Tricaster can only be used in the Wilkes 1 and 2 rooms in the Davison Building.

Tricaster is a semi-professional recording and broadcasting system incorporating a camera control console, a video mixing desk, and a personal computer. The console enables individual control of the meeting room cameras which may be panned or zoomed via a joystick control. It also allows pre-set camera positions to be programmed and selected at the press of a button, so that the meeting coordinator can select a particular view quickly. The video mixing desk enables the coordinator to view the output of all cameras and select in real time which will be used for output to a recording device or broadcast channel. In addition to cameras, the mixing desk can be used to select pre-recorded still pictures, e.g. BCS logo, meeting title, etc., and external video feeds from other sources such as the data projector which is showing the speaker's slides. The mixing function includes transition effects such as fade in/fade out. The PC is used to host recording software and manage the resulting files. Video output can be forwarded to an external streaming server by running Adobe Flash Live Media Encoder, which will encode the video stream in Flash format and allows specification of a URL where the server can be found.

In the hands of a skilled operator, Tricaster enables real time selection of which inputs should be recorded or broadcast, thereby avoiding work which would otherwise be required during the editing stage. However, it also requires significant preparation before each event to set up camera positions, meeting titles, video feeds, etc., and processing after the event to render recorded data into a compressed form suitable for long term storage. Video data is recorded at SD quality because that is the capability of the meeting room cameras and the iVGA feed from the data projector.

Scenario 6: Offline HD Video

This scenario is essentially the same as Scenario 3 because most modern consumer camcorders have HD capability. When recording in HD mode, they will capture video at a resolution of either 1280 x 720 pixels or 1920 x 1080 pixels (“full HD”). At 1280 x 720 resolution, approximately two hours recording can be captured on a single 16 Gbyte storage card, or approximately four hours on a 32 Gbyte card. At 1920 x 1080 resolution, recording times are less than half these numbers.

Some modern digital cameras, particularly digital single lens reflex cameras, have an HD video recording mode which also records to an SD memory card. Whilst these cameras have a wide choice of superior lenses which can be used with them, in practice they are less useful for video work because of limitations in storage capacity or maximum recording time, which may be as little as 20 minutes.

Even at HD resolution, direct video capture of the meeting room projector screen is usually inadequate and therefore it's necessary to include copies the speaker's slides during the editing process, in the manner described for Scenario 3.

Scenario 7: Online HD Video

This scenario is similar to Scenario 4, using HD capture devices in place of SD devices. These include HD webcams, especially tripod mounted studio webcams which are now available at around £50, or HD camcorders. Unfortunately, as noted above, consumer HD camcorders provide digital output only in the form of an HDMI connection, which can be connected to a device such as digital TV or Blu-Ray recorder but not to most laptops. There are a few conversion devices available which provide the needed connection to a laptop, although these are typically priced at several hundred pounds. Another option may be a semi-professional video camera with a Firewire connection. We found one model available at somewhat over £1000, although most are priced at several thousand pounds. Second hand cameras with this capability are sometimes available more cheaply on e-Bay. As noted before, the use of cheap analogue-to-digital conversion devices reduces quality to SD level.

For this reason, HD quality video is probably not achievable at the present time. However, SD quality is adequate for web access and it's worth bearing in mind that typical web video publishing sites, such as YouTube, will apply high levels of compression to video content.

Scenario 8: HD Video Live Broadcasting

The combination of HD video capture devices, as described in Scenario 7, and the Google+ online meeting software enables high quality videoconferencing between small groups of participants. While not specifically designed for lecture style meetings, Google+ can be adapted for use in that situation and offers an “on air” option which enables video data from the meeting to be broadcast live to a related YouTube account and recorded there automatically. As noted above, YouTube compresses the video stream and reduces quality to approximately SD resolution. However, the immediacy of a live broadcast is very appealing to some audiences and the reduction in quality may be acceptable in that context. A sensible approach is to make a higher quality recording in parallel (using the technique described in Scenario 3), which can be edited and posted on the web at a later time.

At least two participants must be available to set up the online meeting, before it can be broadcast. These participants must have Google+ accounts but those viewing the broadcast do not need Google+ or YouTube accounts. The online meeting is established by the meeting coordinator who should initiate a hangout and invite at least one other participant, preferably a volunteer using a nearby laptop. Live broadcasting is triggered by selecting “Hangout on Air” while setting up the online meeting, which causes the screen data to be transmitted to a linked YouTube account where it will appear as video. To view the broadcast, participants merely have to search for the meeting coordinator's channel or find it via an e-mail link. A recording is automatically posted when the meeting is closed.

By default, the hangout will use the built-in webcam and microphone in the coordinator's laptop, and those of other participants. It's usually a good idea to ensure that these other cameras and microphones are muted, to avoid distracting pictures, minimise background noise and avoid feedback occurring. In practice, it is essential to monitor both the online meeting and the YouTube broadcast to confirm that video and audio quality is acceptable, which may require use of three laptops.

The coordinator should then should select the camera and microphone to be used for broadcasting, via the Hangout Settings panel. For example, video input of the speaker may be captured from a cable connected webcam placed nearby or from a camcorder attached via a video grabber device, as described in earlier scenarios. Similarly, audio input may be captured from a webcam or from a wireless microphone worn by the speaker, where the base station is connected to the meeting coordinator's laptop. These settings can be changed during the course of the hangout, enabling the use of close up, wide angle, and other camera views. Speaker slides or demonstrations may also be shown by selecting the “share screen” option, but note that a copy of the slides must be installed on the coordinator's laptop. Google+ also supports “applications” such as text chat which may be run within the hangout window. The chat facility is certainly useful but we have not explored the further potential of such applications.

Appendix D: Comparison of Web-based Online Meeting services

General (product independent) observations

These products were easy to set up and use. We evaluated them in comparison to each other and in comparison to conventional telephone conferencing.

All the products offered audio+video conferencing and all will work on almost any laptop or desktop computer. However, that does not necessarily mean you will have a satisfactory experience! To be effective, both presenter and audience members need a relatively new, high specification computer and a good broadband connection. The primary reason for this is that audio and especially video quality degrade with older machines and poor network connections. This is experienced as jerky (or sometimes frozen) pictures and delayed and/or distorted sound.

All the products use a hosting server and offer the capability to support VOIP (Voice over IP) communication. In addition, some offered audio-only conferencing and/or interoperation with the conventional telephone network as alternatives. These options are intended to increase the reach of conferences, but experience with them is mixed. In some cases a phone line may provide better audio quality but in others, VOIP has been found to offer superior audio quality.

All the products are essentially designed for participants each of whom are sitting at a desk, using short range webcams and microphones such as those built in to modern laptop and desktop computers. Some products also recommend the use of headphones. This is helpful because it eliminates echoes which can occur when the loudspeaker output from a computer is picked up by the participant's own microphone. However, echoes can also occur where a number of participants are in the same room and, in that case, only one of them should have his/her loudspeaker enabled. The headset supplied with a smartphone (which combines microphone and earphones) works well for this purpose and, when used with the built-in webcam in a laptop, gave a very good videoconferencing experience. External USB-connected webcams and camcorders also work, and are the key to using these products in lecture-style events.

It's very useful for the presenter (or meeting coordinator) to have facilities which enable control of the overall conference. These may include the capability to:

- mute the microphones of other participants,
- share his/her screen with other participants (enabling documents, presentations, or other information to be displayed),
- assign presenter status to another participant or take it back from them,
- invite other participants to join, and to
- start or stop recording the conference.

The products had broadly similar function in these areas but differed in detail. Most also provided a list of participants and the capability to "chat" with other participants by sending them an instant text message. This has proved to be extremely useful for feedback to the presenter or for side conversations.

Some products provide the capability to schedule a meeting and send e-mail notices to participants, or to initiate an immediate conference via a “meet now” function. (In the latter case, the presenter will have to inform participants that the meeting is starting via some other channel.) Some also provide the capability to list scheduled meetings and review a list of past meetings. Some of the

products included a basic recording facility, although only Google+ enabled this to be linked to a YouTube account.

None of the products would share screens when the presenter's screen was put into slideshow mode. This means they cannot be used on the same computer as the presentation material, when the presenter is using a data projector. However, we cannot normally rely on a presenter to manage the video conference and therefore recommend that a separate cameraman or meeting coordinator do this. He/she should have a duplicate copy of the presentation material on his/her laptop for use with the screen share function, and advance it in step with the presenter. The meeting coordinator will normally be remote from the speaker and will also control a wireless microphone, camcorder, or cable-connected external studio webcam to obtain an effective recording.

Specific (product dependent) observations

One key difference between the products is that GoToMeeting and Skype use downloaded client applications, while AnyMeeting and Google+ Hangouts are purely browser based. This affects both the conferencing experience and other factors such as security. The GoToMeeting client is downloaded via an encrypted connection with Citrix to reduce the risk of a corrupted clients being obtained. When running, it provided both presenter or participant with a "control panel" which could be minimised or expanded at will. It also provided a window which contained video conference pictures and screen share output. This helped with management of the area of the screen being used for the presentation. AnyMeeting and Google+ used a single browser window with a relatively fixed layout for these functions.

GoToMeeting enables meetings to be scheduled using a unique meeting id (of the form 123-456-789) for each meeting. Participants can only join the meeting by giving this id, which the presenter will have sent them via e-mail or phone. AnyMeeting also enables meetings to be scheduled but asks the presenter to set up a generic id (of the form BCSRBWG1) which is used for all meetings. This will initially be e-mailed to participants but can then be used to gain access to subsequent meetings. To compensate for this, AnyMeeting provides a capability to lock out further attendees (beyond some initial list of invitees) from a specific meeting. This reduces the likelihood of snooping but probably doesn't eliminate it altogether. (On the other hand, it might be simpler if meetings are intended to be public.) Google+ and Skype do not allow meetings to be scheduled. They require the presenter to invite other participants directly, avoiding the security issue associated with scheduled meetings.

The products have different business models and pricing strategies. GoToMeeting offers a basic subscription priced at £29+VAT (i.e. £34.80) per month for up to 16 participants, with a one month free trial. If larger numbers of participants are required, the corporate edition must be purchased and pricing is not given (presumably negotiated). AnyMeeting offers three subscription choices:

- free, supporting up to 200 participants but carrying advertisements before, during and after the meeting
- $17.99 (approx £11.25) per month for up to 25 users with no advertisements
- $69.99 (approx £43.75) per month for up to 200 users with no advertisements

This pricing model will presumably appeal to non-corporate users and seems very competitive. Both Google+ and Skype are free. Google+ is limited to 11 participants and seems to be aimed at informal work groups which require impromptu discussions. Skype is traditionally aimed at families and other non-work groups which require low cost calls, although it charges for calls to

participants using conventional telephones.

Feature Comparison

Feature	**GoToMeeting**	**AnyMeeting**	**Google+**	**Skype**
Scheduling meetings				
Schedule a future meeting	Yes	Yes	No	No
Security id for joining meeting	Specific[24]	Generic[25]	N/A	N/A
Meeting functions				
List participants by name	Yes	Yes	Yes	Yes
Relay participant audio	Yes	Yes	Yes	Yes
Show participant video	Yes	Yes	Yes	Yes
Connect via telephone	Yes	Yes	Yes	Yes
Mute own microphone	Yes	Yes	Yes	Yes
Blank own camera	Yes	Yes	Yes	Yes
Text chat with participants	Yes	Yes	Yes	Yes
Share presenter's screen	Yes	Yes	Yes	Yes
Change presenter	Yes	Yes	Yes	N/A
Managing meeting[26]				
Separate control panel	Yes	Yes	Yes	No
Minimise control panel	Yes	No	Yes	N/A
Notify meeting status via voice/beep	Yes	No	No	No
Mute other microphones	Yes	Didn't work	Yes	No
Take control of other keyboard	Yes	No	No	No
Recording				
Audio recording	Yes	Yes	No	No
Video recording	No	No	Yes	No
Recording format	WAV file[27]	Unknown[28]	MP4	N/A

24 Used for one meeting only
25 Used for all subsequent meetings
26 Provides functions enabling the presenter to control actions of other partipants
27 Windows version only
28 Recording is held on the AnyMeeting server

Appendix E: Model Invitation Letter for Speakers

This model invitation letter is intended to provide useful background and a legal basis for the implied contract between the speaker and a member groups. Each group should modify it to suit their own procedures.

Dear *Speaker,*

Thank you for agreeing to speak to a meeting of the British Computer Society *Member Group.* BCS is the UK's chartered institute for IT and one of the leading information technology societies internationally, with over 70,000 members worldwide. [*Insert sentence about your Member Group*.] You can find out more about our activities at http://www.bcs.org.uk/member*group*/.

Our meetings are held in the BCS London facility located in the Davidson Building, 5 Southampton Street, London WC2 7HA, which is very close to The Strand. The nearest Underground stations are Covent Garden and Charing Cross. Bus Service 91 from Kings Cross/Euston and Serivce 11 from Liverpool Street come direct to Savoy Street. Meetings start at 6pm (tea and coffee available from 5:30pm) and end around 7:30pm. We are unable to offer a fee but will pay reasonable travel expenses and would be delighted if you could join us afterwards for refreshments.

If you have not done this already, **please send us a title for your talk, plus a one paragraph summary and brief biographical information** so that we can publicise your talk on our website. We will also distribute this information to members via e-mail prior to the meeting. If you have a passport sized photograph of yourself which you would like us to use, please send this as well in JPEG format.

The meeting room is equipped with a data projector and **we encourage speakers to bring their own laptop computer** with presentation and/or demonstration, wherever possible. However, we can also provide a laptop if you would prefer to bring your slides on a USB memory stick. Please let us know if you will need this and any other requirements you may have. Speakers will have approximately 60 minutes for their talk, plus time for questions. Good practice suggests that no more than 30 slides will be needed for a presentation of this duration. Please bear in mind that presentations may be seen by an international audience; use diagrams where possible and always spell out acronyms on first use.

Meeting are usually well attended but there are inevitably many members who cannot be present. Therefore, we ask you to provide us with a **copy of your slides in PDF format** before the meeting or, alternatively, a link to a web site where the slides may be viewed. We also have a practice of recording and/or broadcasting talks for the benefit of those unable to attend and ask for your consent to be recorded on this occasion.

Your talk should not include any material that is confidential, proprietary, personal, or defamatory. You should own the copyright of any material you present, or have the permission of the copyright owner to use it. Please confirm in writing as soon as possible that these conditions are met and that you are willing to give us the right to redistribute slides and recordings, and make broadcasts.

We look forward to hearing your talk!

Sincerely,

Appendix F: Survey of Member Attitudes to Media

This data is derived from a survey of almost one hundred members of Advanced Programming SG in September 2012, using the following question. The data may not be representative of attitudes in other member groups.

What is/would be your preferred method of participating in APSG events? (multiple responses allowed)

Attend a lecture in person	79%
Watch a video recording	59%
Watch a live video broadcast	30%
Participate in a face-to-face discussion	25%
Listen to an audio recording	21%
Participate in an audio/video conference	14%
Listen to a live audio broadcast	11%

Appendix G: Glossary

Audio recording A recording of a data stream which includes only audio (sound) information, often as an MP3 file, or both audio and slide information as, for example, a SlideShare presentation.

Channel A stream of audio or video information to be recorded or broadcast; a broadcast location (e.g. web site, frequency) where that information can be found.

High Definition Video information recorded at a resolution of 1920 x 1080 pixels and 24 frames/second, equivalent to HD television.

Live broadcast An audio or video stream which is available from a broadcast channel in real time, i.e. while the event is in progress.

Mixing desk A console which enables selection and/or combination of multiple audio or video streams into a single stream for recording or broadcasting.

Offline recording Recording an audio or video stream directly to a storage devices such as a memory card or hard drive.

Online recording Recording an audio or video stream via a connection to a computer. The stream is processed by software on the computer and recorded as a data file.

Perceived quality The quality of a recording or broadcast as experienced by a person, as determined by whether text is legible, or voice is understandable, etc.

Recording format The specific data organisation used to capture an audio or video recording on a storage medium. Different formats may be used for editing from those used for replay, which usually employ compression to reduce storage usage. A number of popular video formats are in use but no standard dominates.

Scale requirement The requirement that BCS content be accessible by large numbers of people.

Scenario A configuration of equipment and software, together with a recording technique, which has been tested and documented. Scenarios may be used as recipes, singly or in combination with each other.

Slides A copy of the speaker's slides, usually in the form of a PDF document.

SlideShare A social media web site which enables a presentation to be published as an slideshow, optinally with accompanying sound track. See http://www.slideshare.net/

Standard Definition Video information recorded at a resolution of 720 x 576 pixels, corresponding approximately to the quality of a standard television broadcast or VGA monitor.

Technical quality The quality of a recording as defined by video pixel resolution and/or audio sampling rate. Whilst this limits the overall usability of a recording, it doesn't guarantee that it will be useful: see perceived quality.

Timeliness requirement The requirement that recorded information be available soon after an event takes place. Information usually has decreasing value over time, so that delay in posting a recording may reduce its value significantly.

Time shifted broadcast An audio or video stream that is available for public use at a later time than the event where it was created.

Transcript A document which records the actual words spoken at an event, or an edited version of those words, usually as a PDF file. A transcript may be produced in real time or from an audio recording, by a person who listens and types.

Video recording A recording of a data stream which contains both video and audio information, or video, audio and slide information. There are a number of widely used formats for video recording, including Adobe Flash, Apple Quicktime, and Microsoft Media format. A video recording should normally be viewed via a software player for the relelvant format, or converted to another format via a utility program.

Vimeo A social media web site which enables video recordings to be published. See http://Vimeo.com/

YouTube A widely used social media website which enables publication of video recordings and live broadcasts. See http://www.youtube.com/