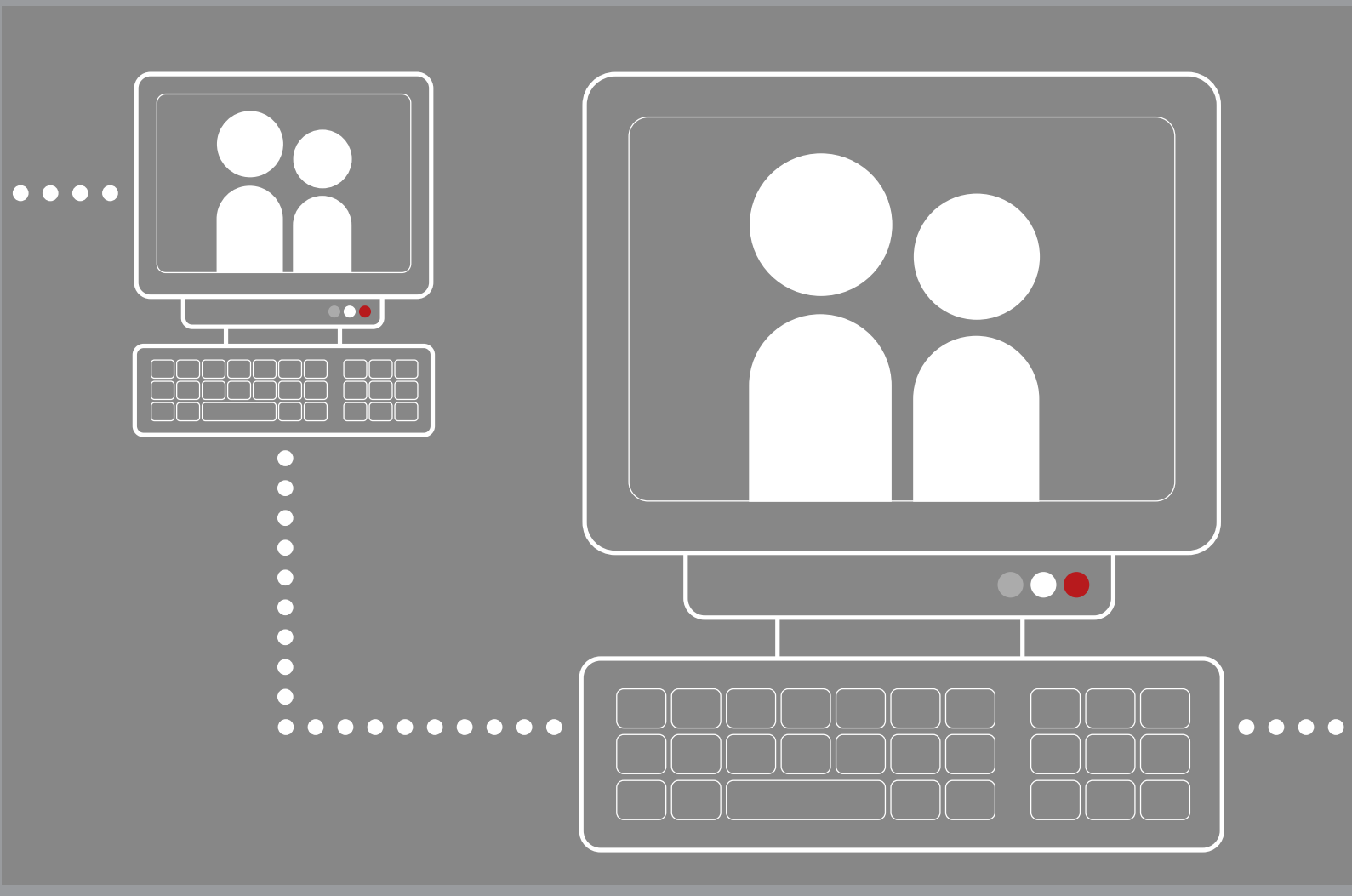
IT Managers Guide
to Webcasting in Local Government



This report was commissioned by
the Improvement and Development Agency (IDeA)
and carried out by Xpedita Limited.

I&DeA improvement and development agency

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To request further reports

This report is part of a series based on the result of research carried out by Xpedita Limited into webcasting within the local authority setting. The following documents are also available:

- The full webcasting report based on a highly representative survey and a series of interviews carried out with local government staff
- A short 11 page summary of the full webcasting report
- A summary report for Communications Directors that tackles the question of where new technology sits in the traditional marketing mix

To request free copies of any of these please either:

Complete the online form found at :
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Introduction

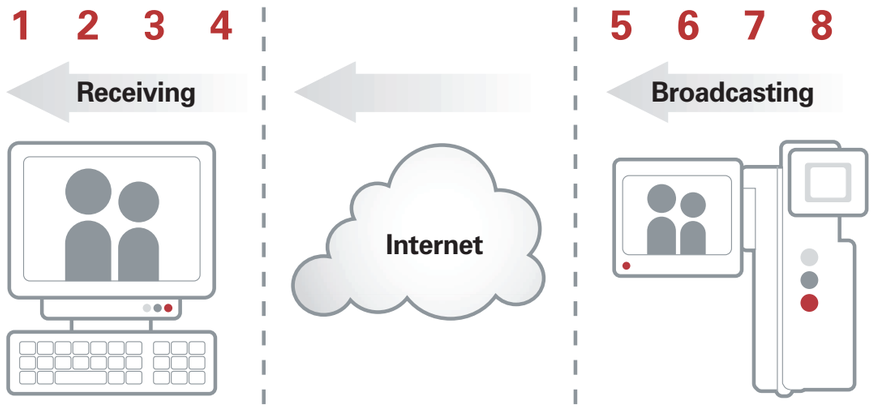
A recent survey suggested that most IT managers within the UK local government context thought that perhaps 20% of their staff could receive a Webcast. But automated checking of staff computers conducted amongst over 700 respondents to the survey suggested that staff with access to computers were quite well-connected, normally with a modern operating system such as Windows XP or 2000, a media player, and with broadband-speed connection.

The issue, therefore, lies in upgrading council networks in order for large numbers of staff to efficiently receive a webcast. IT managers can improve the webcast experience by ensuring 1) that their network is multicast enabled; and 2) that they have put a streaming media cache in place. In our survey, only 17% of IT managers said their network was multicast-enabled. A huge 69% said they were not sure. On the subject of a streaming media cache, 50% of council IT managers said they did use such a cache.

This report focuses first on receiving webcasts, and then on the more complex business of broadcasting them. It is intended to be a helpful general guide; each network is different and individual configuration should be handled as recommended by software and hardware manufacturers.

A simplified overview of Webcasting

The diagram below shows a simplified view of the webcasting process, representing an on-demand webcast delivered over the Internet. On the left-hand side is the process for receiving the webcast; on the right-hand side the process for broadcasting the webcast. The rest of this report follows this diagram from left to right.



1. A user's computer with SOUND and VIDEO cards, a compatible MEDIA PLAYER, and a connection to the network; (and a help desk familiar with what is needed);
2. Internal network which should be MULTICAST-enabled;
3. A STREAMING MEDIA CACHE which temporarily stores the webcast from the Internet for distribution to the internal network;
4. A connection from the cache to the Internet with sufficient BANDWIDTH via a FIREWALL which has been configured to allow streaming content to enter the internal network;
5. A connection from the server to the Internet with sufficient BANDWIDTH to allow for quick transmission of webcasts;
6. A STREAMING MEDIA SERVER (not a Web server) which delivers the webcast on demand from users;
7. A stream of content which is ENCODED in the proper streaming format to be compatible with the primary users' machines;
8. An initial capture of the video or audio to be webcast.

Part 1 – Receiving Webcasts

In this section, we concentrate on the elements that are necessary for users on an internal local government network to receive webcasts efficiently from a source over the Internet. Receiving a webcast from an internal server is similar, except that firewall configuration is not necessary.

Element 1 – The user's computer

The minimum requirements for viewing a webcast on a computer are:

- **a video card** (for video webcasts)
- **a sound card** (for audio and video webcasts)
- **speakers or headphones**
- **a media player**
- **a connection to the network**

In our automated survey of local government employees' computers, we recorded that over 90% of respondents' computers had Windows Media player, and over 10% had installed Real media player. Over 65% of purchasing specifications included the Windows player, and 67% included a sound card in their specifications. While the situation in each local council may be different, a majority of council employees with access to computers should be able to view webcasts on their machines.

Tip:

Network managers might be able to user automatic upgrading features to ensure the latest version of Windows Media player or Real player is installed on client machines. Otherwise, they should take care that encoding is done into a format compatible with the version on client machines, which may be an older version.

Tip:

Don't forget to tell your IT helpdesk staff that you plan to support webcasting, and explain what is necessary from the user point of view.

Element 2 – Multicast-Enabled Network

The easiest way to explain multicast is to contrast it with unicast, the default mode for many switches and routers. In a unicast network, the network processes each stream of content separately. Three watchers of a webcast council meeting, for example, would equal three streams of content, each eating up bandwidth on the network. Let's say the stream of content was 300Kbps. On a unicast network, that would be 900Kbps. But on a properly managed multicast network, only 300Kbps would be consumed in each network link. **The diagram opposite illustrates the point.**

Each of the council workers on a machine indicated in bold wishes to view the 300Kbps committee meeting webcast stream that is being webcast live. On a multicast-enabled IP network, the streaming server or cache sends out a single stream, which is replicated on two ports by the first router, sending the stream both up and down the router hierarchy. Each router in turn relays and replicates the stream as needed – this is shown by the heavy lines in the diagram above.

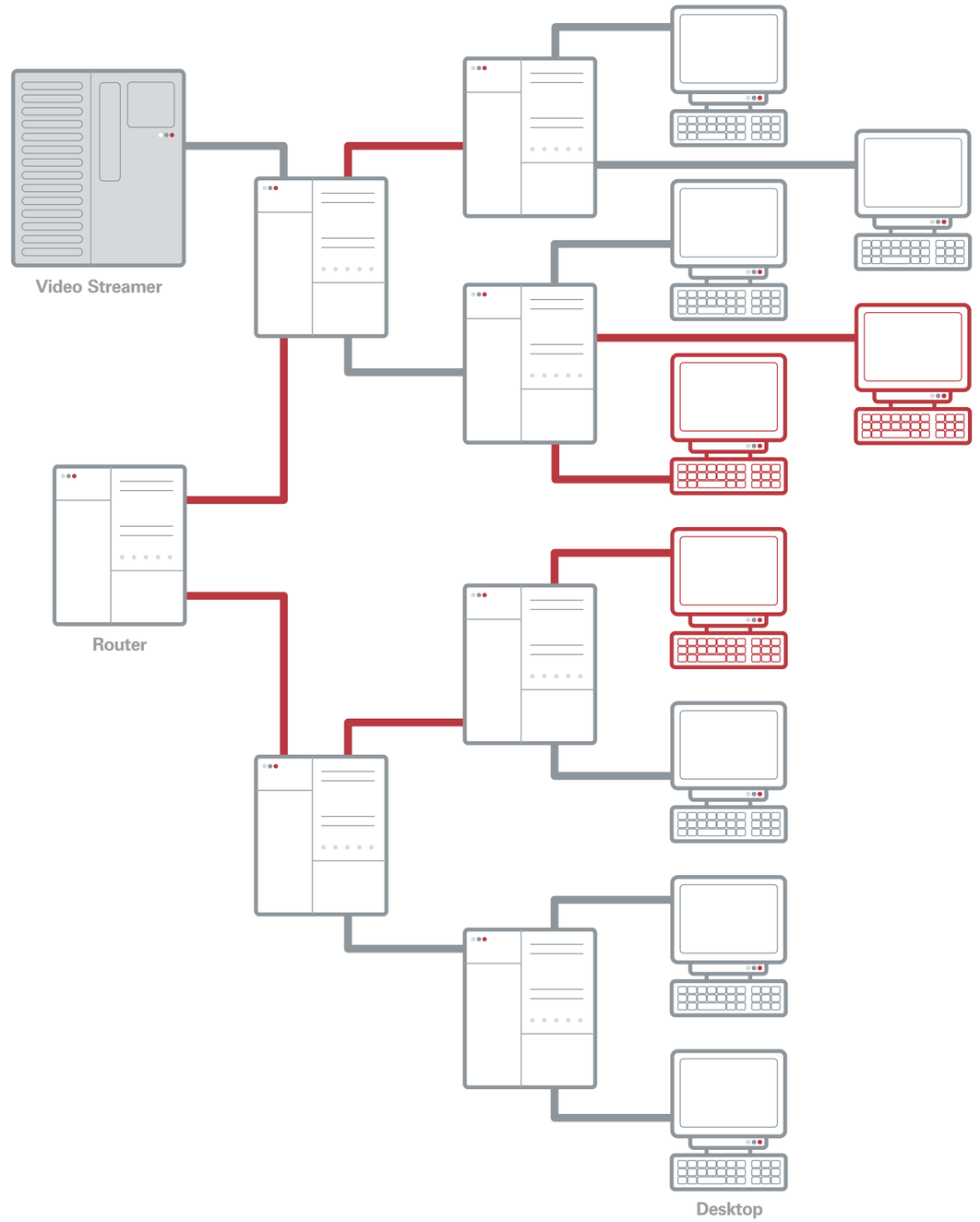
Thus, in order for multicasting to work properly on a network, each router and switch on the network must be multicast-enabled.

Of course, every switch and router is different so it is not possible in a guide of this kind to give specific directions. However, multicast has been standard on routers and switches since the mid-1990s, so it is normally a relatively simple configuration task.

Tip:

Multicasting improves network performance whenever a stream of data needs to be delivered to multiple clients on the network at the same time.This applies to any data, not just video or audio streams. Therefore, multicast-enabling your network will probably result in noticeably more efficient use of your internal network bandwidth in general.

Do I need this? Possibly. If you are planning on members of your organisation watching live webcasts, where the streams are delivered simultaneously, multicast-enabling your network is essential for efficient bandwidth usage. Where most webcast viewing will be on-demand, multicasting is not as vital, although it will probably improve network efficiency generally.



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Element 3 – Streaming Media Cache

If multicasting is the key to the efficient delivery of simultaneous streams, a streaming media cache is equally critical to enable on-demand webcasts to be viewed using the minimum amount of bandwidth. Even with live streaming, a streaming cache can significantly improve the network performance of a multicast-enabled network. Having a cache can also improve the quality of the webcast for the final user by avoiding network congestion that occurs on the Internet.

A streaming media cache works like other forms of Internet caches. Normally a separate hardware box, it temporarily stores all forms of streaming media that come from outside the internal network (typically from the Internet) and then acts as a relay point, delivering the streams as needed within the network without the need to connect externally.

However, several factors mean that a typical Internet proxy cache is unsuitable to cache streaming media. First, streaming media files are typically much larger than HTML pages, images, or other conventional web objects. This means that while a typical cache may store the whole of the cached file, for certain types of streaming media this is impractical as the disk space would quickly be filled. Second, streaming delivery requires a significant amount of disk and network I/O bandwidth, which ordinary servers have difficulty supporting properly. Finally, clients often demand a much higher level of interactivity during playback – features like fast-forward and rewind, for example. Standard caches are unable to support these advanced functions.

Further, because of these reasons, and particularly because of bandwidth management issues, co-ordination between multiple streaming media proxies can become important, improving the aggregate cache space, efficiently balancing loads, and improving system scalability. Therefore, if your bandwidth requirements also indicate that you may need multiple streaming caches, investigate the co-ordinating capabilities of these caches. You may need to install software to enable them to co-ordinate. The best place to go for information on the right configuration for you is a streaming media cache manufacturer.

Do I need this? Possibly. While it is technically possible for users to receive webcasts without a streaming cache enabled on the network, if many people watch it will cause high usage of expensive network bandwidth, and may disrupt normal use of other applications.

Element 4 – Firewall settings

Because of concerns about bandwidth usage and malicious content, many network managers have configured their firewalls to disable streaming traffic, which might include both outgoing and incoming connections into the network.

Streaming traffic includes a variety of protocols and formats, used by different types of streaming servers. UDP (User Datagram Protocol) is more suited to streaming than TCP and is often used. Firewalls may reject UDP traffic altogether or mis-report it as fragmentation attacks, port scans, or other potential security issues. Normal TCP traffic can carry streaming content, it is simply less efficient in doing so.

In order to enable viewing of streaming, certain specialised ports need to be opened on the firewall. Access to these ports can be restricted to a limited range of IP addresses for added security. For example, only webcasts from the IDeA could be allowed. These ports depend upon the streaming server used by the webcast provider. **The table below gives the standard ports.**

Port	Protocol	Streams
554	UPD/TCP	RTSP, permits RealMedia G2 and QuickTime streaming
1755	UDP/TCP	MMS, permits Windows media streaming
7070	UDP/TCP	PNM, permits legacy streams from RealMedia pre-version 5.0

Streaming media server vendors are well-aware that many streaming-specific ports are commonly blocked. Therefore several of them – including RealNetworks, Microsoft, and Apple, have released servers with embedded HTTP support, meaning that streamed content is embedded in a normal HTTP request. This type of streaming requires no special firewall configuration, and is in fact quite difficult for network managers to distinguish from legitimate web traffic.

Do I need this? Probably. It is certainly possible, depending on the setup of the webcast provider, that you will be unable to receive webcasts if you don't properly configure the firewall.

Part 2 – Broadcasting Webcasts

In this section, we concentrate on what is necessary for local government users to send webcasts outside their network. These might be local council meetings, important public hearings, or other types of content, and may well be going to a variety of listeners. In addition, the webcast might be live, or might be recorded for later on-demand delivery. Each of these scenarios raises different challenges.

It is very common for businesses to outsource all or some of their webcasts to a provider working with a content delivery network (CDN for short). In the short term this may prove cost-effective. In this section, we review how a council wishing to keep this activity in-house might understand the demands that would be placed on their network. Also, it may be possible to use a CDN and still film and encode the webcast in-house. The optimum solution depends upon the council. However, it is perfectly possible to start small, perhaps with an internal webcast or a small public trial, and then to assess whether and where an external provider would prove helpful.

Element 5 – Sufficient bandwidth

In broadcasting your content, whether outside or inside the internal network, one of the first questions you need to answer is how much bandwidth you will need in order to deliver your audio or video stream to the wider world. There are two basic ways in which this is normally estimated. Data transfer refers to the amount of data that goes from point A to point B. Bandwidth refers to the size of the link (e.g., 1 Megabit per second) between A and B, down which any amount of data could be transferred given enough time.

Tip:

There are 8 bits in a byte, 1,024 bytes in a Kilobyte (KB), and 1,024 Kilobytes in a Megabyte (MB), and 1,024 Megabytes in a Gigabyte (GB). Data transfer is measured in Megabytes or Gigabytes. Bandwidth, on the other hand, is measured in Megabits (not Megabytes). One kilobit (Kb) is 1,024 bits, and one megabit (Mb) is 1,024 Kilobits. Thus you should divide bytes, Kilobytes, or Megabytes by 8 to get bits, Kilobits, or Megabits.

Estimate data transfer requirements as follows:

File size x number of files x number of views

Say, for example, you have five videos of approximately two minutes each, which are a cool 1.2 Mb each. You estimate that each video will be viewed 200 times during the month. The formula says that 1.2 MB x 5 videos x 200 views = 1.2 GB streamed each month. This is your monthly data transfer requirement for streaming. Normally you would use this calculation if you are primarily delivering video or audio on demand.
In order to estimate bandwidth requirements, the key variables are the rate at which the stream is encoded and the number of concurrent users you need to support. Note that multicast-enabling is not normally possible over the Internet so when streaming a file outside the internal network each stream must be calculated separately. The formula to estimate bandwidth requirements is as follows:

Stream size x number of concurrent users

Thus, in order to send out three concurrent streams of your local council meeting which has been encoded at a rate of 300 kbps (kilobits per second), you will need 3 x 300 kbps = 900 kbps, or a little less than a 1mb line. Normally you would use this calculation if you are delivering a live broadcast. Don't forget you will need to allow space on your network for any existing activity.

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Element 6 – Streaming Media Server

A streaming media server is a core element of any content delivery network. Like web servers, streaming media servers deliver content on request to clients on the Internet or in internal networks. However, streaming media servers and Web servers are not the same!

We recommend, along with most experts, that you dedicate separate computers to be your streaming media servers. While theoretically you could install both a streaming server and a Web server on a single computer, in practice the two often conflict and therefore there will be a severe impact on performance, manageability, reliability and scalability.

How many servers you need will depend upon the amount of content you are planning to stream and the number of concurrent users. Refer to the manufacturer's guidelines for help on the quantity of servers needed.

While configuring a streaming media server is beyond the remit of this guide, there are a few principles to bear in mind for optimum performance.

Servers for on-demand content are normally limited by how fast your content can come off the storage disk. SCSI is the fastest connection and is very often used. The iSCSI standard is also becoming more and more prevalent, allowing data housed in different facilities to be linked over long distances.

Servers should have excellent data access speed. This means the speed of the processor and the amount of RAM will be significant factors, and that network interface cards (NICs) need to be high-bandwidth, and server should be connected by Gigabit Ethernet or ATM.

Tip:

For more on configuring streaming servers and networks, visit ***www.streamingmedia.com***

Elements 7 and 8 – Capturing and encoding the stream

It is beyond the scope of this guide to advise on the aesthetics of film-making, but from a purely technical perspective video or audio intended for webcasting requires a few additional steps.

Capturing
Firstly, and most obviously, the recorded video or audio must be transferred to a digital format. This step is referred to as 'capturing' the stream. Capturing to digital should normally be done either using a Firewire connection from your digital camera or recorder, or using a video capture card. It will then normally be edited with a digital editing suite, although of course with a live webcast this is not possible.

This video file, normally, will turn out to be of huge size. As a guideline, five minutes of uncompressed video will consume nearly one gigabyte (GB) of space on your hard drive, and thus will be far too large for either downloading or streaming. So the video must be compressed.

Encoding
Encoding a stream for webcasting involves saving it in a format that allows compression at your end and decompression at the client end – this is referred to as a 'codec' (for compression/decompression). You will normally need a separate piece of software in order to encode video, whether it is a specialised cleaner/compression/encoder suite or a full-service video editing suite. Before choosing which codec to use, you need to ask yourself some questions about the file you will be sending and the audience you will be addressing.

1. Are you planning to broadcast live or will this be a recorded webcast available on demand by users?
2. Which format of player does the majority of your audience have?
3. How fast a connection does the majority of your audience have?

Our research has shown that most council employees have Windows Media Player and broadband connections. However, if you are targeting a particular group of staff their configurations may well be different. If you are intending your webcast for the public, you should investigate the situation in your area. It is common to offer webcasts in a number of formats to suit the viewing audience, that is, one version for modem users, another for broadband users, etc.

Tip:

Make sure you use the right video codec for your server! QuickTime video codecs will not be compatible with RealPlayer, for example. A test run is always in order. An excellent source of information about codecs is ***http://www.discreet.com/support/codec/***

Your suite will have a series of tickboxes for you to choose from:

- **video format** (in this example, Windows Media)
- **delivery method** (in this example, Web)
- **data rate**
- **frame rate**
- **size of video viewing area**

The data rate, frame rate, and size of the video viewing area all affect the quality of the final video that the audience sees. The higher the data rate and frame rate, and the larger the size of the window, the larger the bandwidth and memory consumed by the file, and the better the quality. Normally, however, there have to be trade-offs. Experimentation and testing are required, although most video cleaning/compression/encoding suites now offer a series of templates to help you.

Tip:

You may want to encode your video in multiple formats to suit multiple players.

Receiving a Webcast:

- ☑ Make users aware of the timing of the webcast (if live).
- ☑ Check their computers properly equipped.
- ☑ Upgrade their media players remotely (if possible).
- ☑ Notify the helpdesk of likely problems.
- ☑ If the webcast is live, Multicast-enable your network (and test it).
- ☑ If the webcast is on-demand, install the proper number of streaming media caches to reduce bandwidth usage (and test them).
- ☑ Check that the proper ports and protocols are enabled on your firewall.
- ☑ Ask the webcasting source for a test webcast.

Broadcasting a Webcast:

- ☑ Check whether outsourcing to a content delivery network would be suitable.
- ☑ To help plan, get data about the likely audience of the webcast, in terms of both quantity and technological setup
- ☑ Estimate your data transfer, bandwidth and hard drive requirements, and plan how you will meet them.
- ☑ Install a streaming media server(s) and test it.
- ☑ Create a plan for capturing the video to digital and editing it.
- ☑ Decide codec(s) you will use to encode the video.
- ☑ Do a trial run with receivers both inside and outside the network.

Contact Information

For further information about this series of reports please contact the IDeA or Xpedita.

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