How to prepare a Local Area Network for online content delivery

What is online content?

Online content refers to materials delivered to a workstation via a network, such as the internet, intranet or even across a local area network from a CD server. Curriculum Online is a DfES programme of investment to give teachers easy online access to a wide range of digital learning materials that they can use to support their teaching across the curriculum. These materials make lesson planning and administration easier and faster, and free teachers to do what they do best - teach. These online materials will help teachers to make individualised learning a reality for all pupils. In addition initiatives such as the Key Stage 3 ICT Online Test which is being developed by QCA will open the door to online tests and assessments.

What are the minimum requirements for my network’s workstations?

The minimum specifications in this document are those that all schools should be striving towards in order that pupils and teachers can make use of the developing portfolio of media-rich content. This document aims to offer recommendations for minimum specifications based on the requirements for both the Curriculum Online programme and the Key Stage 3 ICT Online Test initiative. The Curriculum Online portal has been designed to be accessed by a wide range of equipment currently in use in education. It is viewable from a browser that is level four or later, however full use of many of the materials showcased on the portal will require a higher specification of machine than one typically running a level four browser. It is anticipated that many of these digital curricular materials will be accessed using a web browser either from the internet/intranet or via a CD- or DVD-ROM. For this reason, workstations used to access these materials will need to have the ability to run 5th generation or equivalent web browsers such as Microsoft internet Explorer version 5 or Netscape Navigator version 5.

Workstations

<table>
<thead>
<tr>
<th>Workstation Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New</strong></td>
</tr>
<tr>
<td>When purchasing new workstations they should meet or exceed this specification.</td>
</tr>
</tbody>
</table>

<p>| <strong>CPU</strong> | 1.7Ghz Intel, 1.3Ghz AMD or 800Mhz Apple Mac | Intel/AMD 1Ghz or 400Mhz Apple Mac | Intel/AMD 300Mhz or 233Mhz Apple Mac |
| <strong>Memory</strong> | 256Mb | 128Mb | 64Mb |
| <strong>CD/DVD</strong> | 32xCD or 8xDVD or CD/DVD server access | 32xCD | 4xCD |
| <strong>Hard Drive</strong> | 40GB | 10GB 20GB (in order to meet the min spec for KS3ICT) | 2GB |</p>
<table>
<thead>
<tr>
<th>Network Interface</th>
<th>100Mbps</th>
<th>100Mbps</th>
<th>100Mbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-writable media</td>
<td>Floppy, or other re-writable media</td>
<td>Floppy, or other re-writable media</td>
<td>Floppy, or other re-writable media</td>
</tr>
<tr>
<td>Graphics</td>
<td>Video card with 32MB memory 1024x768 @ 24Bit (8Mb)</td>
<td>Video card with 32MB memory 1024x768 @ 24Bit (4Mb)</td>
<td>800x600 @ 16Bit (2Mb)</td>
</tr>
<tr>
<td>Keyboard &amp; Mouse</td>
<td>UK keyboard &amp; pointing device</td>
<td>UK keyboard &amp; pointing device</td>
<td>UK keyboard &amp; pointing device</td>
</tr>
<tr>
<td>Monitor</td>
<td>15” or 17”, TFT where possible. 85Hz for CRT or 65Hz for TFT Must support 1024x768.</td>
<td>15” supporting 1024x768</td>
<td>14” supporting 800x600</td>
</tr>
<tr>
<td>Sound Output</td>
<td>16-bit soundcard output through stereo headphones or speakers with adjustable volume</td>
<td>16-bit soundcard output through stereo headphones or speakers with adjustable volume</td>
<td>Stereo headphones or speakers</td>
</tr>
<tr>
<td>Sound In</td>
<td>Recording capability</td>
<td>Recording capability</td>
<td>Recording capability</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows XP, Mac OS X, Linux or variant capable of supporting Java 1.2</td>
<td>Windows 2000, Mac OS 8.5, Linux or variant capable of supporting Java 1.2</td>
<td>Windows NT/98SE, Mac OS 8 or Linux</td>
</tr>
</tbody>
</table>

* You may wish to consider omitting or disabling removable media devices to avoid virus contamination or misuse

Other information on workstation specifications can be downloaded from the IPAS site here: [http://ipas.ngfl.gov.uk/downloads/docs/technical/TG04_1-4_Spec_ICTsuite.doc](http://ipas.ngfl.gov.uk/downloads/docs/technical/TG04_1-4_Spec_ICTsuite.doc)

**What are the minimum requirements for my network’s servers?**

There are generally two types of network - client-server networks and peer-to-peer networks. Client-server networks are based upon the centralisation of security, storage and administration using specific server computers. In a peer-to-peer network, resources and control are distributed across workstations. Client-server networks are preferable - they are more secure and easier to maintain and upgrade, it is recommended that they are implemented for networks of over 20 workstations.

The specification of your servers is dependent on many factors - two important ones are the size of your network and the way you will be using it. An exact specification cannot be given, however we recommend that any servers be, at the very least, the minimum specification stated by the vendor of your server operating system.

Server guidelines can be found as part of the ICT Suite guide on the IPAS site here: [http://ipas.ngfl.gov.uk/downloads/docs/technical/TG04_1-4_Spec_ICTsuite.doc](http://ipas.ngfl.gov.uk/downloads/docs/technical/TG04_1-4_Spec_ICTsuite.doc)
Combining Curriculum and Admin Networks

It is recommended that schools should combine Curriculum and Admin networks, provided there is sufficient Technical support available to merge and continuously maintain the networks.

There are many considerations when merging curriculum and admin networks. In order to be able to combine the two networks their needs to be sufficient technical support to both plan and perform the task and to ensure that maintenance of the combined network is performed thereafter.

The benefit of a combined network affords teachers the flexibility to access admin data from any workstation on the network, but this should not mean that any pupil can access admin data from any workstation and therefore security and integrity of the data is a major issue when combining the networks.

What sort of local area network (LAN) infrastructure is required for online content?

An overview of specifying LANs can be found here:

http://ipas.ngfl.gov.uk/downloads/docs/technical/TG07_1-2_specifying_LANS.doc

It is anticipated that the purchase of digital materials through initiatives such as Curriculum Online will have a great impact on a school’s local area network (LAN) due to the level of processing required by the workstation, the increase in network utilisation and the increased usage of higher internet bandwidths. To prepare for the impact that Curriculum Online will have, we recommend that you follow these guidelines:

Network topology

Topology is the term used to describe the way the different elements of your network are arranged. There are many different topologies, however the recommended and most common of them is the star topology. In this arrangement, each workstation is connected by one cable that runs into a centralised point - a switch or a hub. Each switch or hub is then connected via what is commonly referred to as a backbone.

Some older networks may also use coaxial cable (or 10base2) to connect Ethernet in a bus topology. We recommend that you replace these networks with newer technology such as the star topology using CAT 5e cabling. During installation additional fibre optic or CAT 5e could be run between network distribution points (switches, hubs and servers) for redundancy in the event of failure. In effect running two cables where you would normally run one.

Thin client

A thin client solution is one method of utilising legacy equipment. A server can be configured to run applications for a client thereby reducing the specification required for the workstations. This offers a use for legacy systems. Server costs will increase slightly since they would be doing almost all of the processing. In addition schools should be aware of the higher level of knowledge required to administer this type of network and be aware of its limitations. This is by no means the only use for thin client methodology and further information can be found here:

http://www.ictadvice.co.uk/index.php?section=te&cat=007000&rid=1810

Network cabling and equipment

The type of cabling used in an Ethernet network largely defines the speed at which the network can run. Most Ethernet networks use category 5 or category 5e cabling to provide 10, 100 or 1000Mbps transmission speeds. We recommend that your network runs at 100Mbps and, if your network is fairly large (300 – 1000+ workstations), that your backbone is connected at 1000Mbps. Fibre optic is the
industry preferred medium for backbone use. In cases where distribution points are further than 90m apart fibre is preferable.

As stated above, workstations can be connected via switches or hubs. Hubs are 'non-intelligent' devices that simply pass all network traffic to every workstation. The workstation must then determine whether the network traffic it receives is intended for it or not. Switches are intelligent devices that will only send network messages to their intended recipients making them more efficient than hubs. The price of switches is similar to that of hubs, so it is recommended that, where possible, hubs are replaced with switches throughout the network.

**Wireless networking**

Wireless networking, as the name suggests, involves virtually no cabling at all. Computers within range of a wireless access point can communicate with the network. There are advantages and disadvantages to wireless networking; it offers flexibility and mobility, however, due to the current bandwidth limitations, wireless networks should be seen as an addition to a school's network and not as its prime network.

Security is also a concern for wireless networking. Because it is easy to access, a wireless network needs to be made secure with the use of passwords and encryption. In other words, access to the network via a wireless connection must only be allowed to authentic users.

More information on wireless networking is available here:


**What kind of wide area network equipment will be needed?**

Wide area networking (WAN) is the term used to describe networking over long distances. For the purpose of this document WAN refers to the equipment used to facilitate internet connectivity to your network. Considerations fall under the following headings:

**Multimedia cache**

A multimedia cache is a computer that stores frequently-used internet resources locally for use by multiple concurrent users. When a workstation requests a resource from the internet, the cache is checked first. If the resource is already stored locally then it is immediately served to the workstation without the need to place any burden on other wide area network equipment. We recommend that schools adopt the use of a cache to improve web page access times, reduce bandwidth demand and hence reduce the need for a larger broadband connection and reduce cost. Additionally, the cache can be pre-populated with information from CDs and DVDs - this information can then be shared across the network.

IMPORTANT NOTE: Ensure you contact your LEA prior to purchasing a cache system.

For more advice on Multimedia cache servers see:

http://getconnected.ngfl.gov.uk/info/downloads/caching_systems.doc

http://www.ictadvice.org.uk/downloads/whatis/caching_tech.doc

**Bandwidth**

Bandwidth is the term used to describe the volume of traffic that can travel across networks and the volume of traffic that your network can receive from the internet in a given time. The greater the
bandwidth, the quicker your internet connection will be. Bandwidth is measured in bits per second (bps). Figures are usually stated in thousands of bits per second (Kbps) or millions of bits per second (Mbps). How much bandwidth an individual institution will need is dependent on many factors including the number of connected computers, usage patterns and the efficiency of the LAN. Currently, the DfES is mandating Regional Broadband Consortia (RBCs) to install symmetrical 2Mbps connections. This is a minimum however and requirements may vary. DfES expectations for primaries are 2Mbps and 8Mbps for secondaries by 2006.

Broadband information can be found here:

http://www.ictadvice.org.uk/downloads/whatis/broadband_tech.doc

Information on how to get broadband is here:


Routers

Routers are the devices that direct network traffic from one network to another, for example, from a school LAN to the internet. The router acts as a gateway between sites. It examines each packet of data for its destination address and then forwards each packet accordingly.

The type of router (or gateway) is normally dictated by the type and speed of the internet connection. Most routers are small units that carry out a dedicated routing task and they normally require little maintenance once configured.

Firewalls

Firewalls are designed to protect a network from being attacked by users external to the network. They create a barrier through which only authorised traffic can pass. Although firewalls are becoming more important to protect networks that have ‘always-on’ connections to the internet, they are also used by users that have dial-up internet access.

We recommend that schools should invest in firewall protection where this service is not provided by their local education authority or other service provider. Firewalls require professional setup and administration. Schools purchasing a firewall should consider procuring installation, configuration and management services also, except where there are suitably qualified IT professionals on site.

Firewall information is available from here:

http://www.ictadvice.org.uk/downloads/whatis/firewalls_tech.doc

Proxy servers

Proxy servers are designed to carry out all the internet requests, such as requests for web pages, for a group of computers situated on a LAN. A network of several hundred PCs can be ‘hidden’ behind just one proxy server and this provides extra security for the network, as it appears as one busy internet user rather than an entire LAN of users.
How does it all fit together?

The following diagram shows how the router, firewall and proxy server integrate into the network.

![Diagram showing router, firewall, and proxy server integration into the network.](image)

What are the requirements for technical support?

As schools become increasingly reliant on IT infrastructure for the delivery of online content, applications and services, effective proactive and reactive support of that infrastructure will be paramount. We recommend that schools invest in dedicated technical support, whether supplied in-house, by the LEA or by a third-party supplier. Becta’s Technical Support Advisory Service (TSAS) have developed a Framework for ICT Technical Support (FITS) which helps you introduce best practice processes for managing the support and delivery of ICT at your school. The TSAS advice will be available in early September under technical support on: [http://www.becta.org.uk/](http://www.becta.org.uk/).

How can I protect my network and its users?

Every area of a school’s network requires an element of security, from the physical housing of the server to the data coming in through the external WAN connection. An insecure network is vulnerable to attack from hackers and sensitive information can be stolen. These and other issues are why network security is of high importance.

Security can be split into two main areas: physical and logical security. Physical security involves ensuring the actual equipment is housed securely and that only authorised people have access to it. Logical security involves using software to ensure that your network only grants access to data to users who are verified as authentic.

The launch of Curriculum Online is intended to stimulate access to and widespread use of online resources. It will therefore be even more important to maintain adequate protection against computer viruses. Computer viruses are malicious programs written to travel over networks to different computers and, in many cases, to cause damage. Schools should invest in anti-virus software and maintain regular updates of the virus definitions database for all machines in the school.

Protecting users from inappropriate material is also of concern. The internet is a forum for all of society and therefore reflects society in its entirety. As you would not allow a child to wander the streets unsupervised nor should children be allowed to explore the internet without being protected from danger. You should install filtration software if it isn’t provided by your internet service provider. Third-party software offers many options but as a minimum it should include:

- web address blacklists
- web page content filtering
- e-mail filtering by key word within the message header and message body.
Blacklists require regular updates to ensure maximum filtering capability. Filtering software should be provided as part of a managed service.

Of course, filtering software is not a 100%-effective solution to the problem of child internet safety, but it is a good start for when direct supervision is not possible or no longer deemed necessary.

Finally, it is of paramount importance that pupils’ personal data held on management information systems (MIS) should be stored in accordance with the Data Protection Act 1998.

Further filtering information and guidance can be found at: http://stagesafety.ngfl.gov.uk/ and here http://ispsafety.ngfl.gov.uk/.

**Backup**

Backup strategy and devices are an essential element of any curricular or administration network. Unfortunately this is often only realised once essential data loss occurs. It can not be stressed enough, how important it is to maintain an up to date archive of essential data. More information on backup strategy and equipment is available here:

http://ipas.ngfl.gov.uk/downloads/docs/technical/TG11_1-1_backup_devices.doc and also covered in the Availability and Service Continuity processes of the FITS framework available in early September under technical support on http://www.becta.org.uk/.

**Further Reading**

Useful information, guidelines, and tools can be found using the following links:

http://www.ipas.ngfl.gov.uk/lr/nwb/htm/main.html

http://www.ictadvice.org.uk/

http://www.becta.org.uk/

http://www.ngfl.gov.uk/

http://www.safety.ngfl.gov.uk/

http://www.ipsafety.ngfl.gov.uk/