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Networking and wireless

Analysis: Satellite broadband

At a glance

- Satellite television services are widespread in the UK, so similar technology appears to have the potential to fill the broadband 'not-spots'.
- Satellites currently have severe limitations due to latency (delay) inherent in transmission, high costs and low available bandwidths.
- Improved satellite services are a trade-off between reducing latency in transmissions and the cost of providing the service.
- A number of two-way communications systems have been recently launched based on VSAT hardware and geostationary satellites.
- Mobile satellite technology is particularly expensive, although manufacturers are developing chipsets suited to mobile handsets.
- Satellite broadband technology is likely to remain a niche product in the UK for the foreseeable future.

Satellite and the broadband-not-spots

Lord Carter proposed a 2Mbps broadband 'universal service commitment' (USC) in the interim *Digital Britain* report, but this could prove difficult in rural areas where distance from the exchange makes an ADSL connection impossible.

Satellites have been used as trunk links to distribute television programmes and news organisations have used bulky mobile equipment to file reports from remote areas for some years. More recently, homes and small businesses have received broadband services through a satellite 'downlink' but sent outgoing requests via some form of dial-up connection. However, the equipment has been expensive and speeds limited.

Distributors are keen to deliver 'triple-play' offerings through the same dish, combining broadband with television and voice, bringing the total cost of the offering for some consumers below that for separate services.

Satellite orbits and latency

A major issue for all satellite systems is latency - the inherent round-trip delay as data travels from the service provider to the consumer. This is not a big issue for broadcast television but can severely hamper any form of voice or internet communication, especially web applications and games. The length of delay depends on the distance of the orbit of the satellite from earth. A simple classification uses four groups:

- **LEO** - low earth orbit, 160 to 2,000km. A 'constellation' of satellites is required, as each moves rapidly across the sky and can cover only a small area from these altitudes. Satellites in this orbit are often used to provide mobile telephone services, such as the Iridium network that has 66 craft at 780km (keeping latency to a minimum).

- **MEO** - medium earth orbit, 2,000 to 35,786km. Although a constellation is still required at this altitude, fewer satellites are needed to give global coverage as they take longer to traverse the sky and have a wider footprint. Low-cost GPS systems, which automatically adjust for latency, employ data broadcast from this distance.

- **GEO** - geostationary earth orbit, 35,786km. This is a special class of geosynchronous orbit in which, due to the net effects of gravity and the momentum, the satellite remains at a constant point above the equator. Geostationary satellites fly within pre-determined 'slots' to avoid causing radio interference with neighbours, creating an upper limit to the number that can be operational. Latency is a significant issue at this distance, with a single round-trip from a transmitter on earth and back to a ground-based receiver taking 253ms; two-way communications will take over half a second, by the time further delay due to the electronics is accounted for. Initial costs are extremely high as transmitters must be more powerful at this distance, making the whole unit heavier, and more fuel is required to launch. However, by delivering a 'stationary' signal, the reception equipment is simpler and can be made more cheaply, which is why nearly all satellite television systems are based on craft in this orbit.

- **HEO** - high earth orbit, above 35,786km. In addition to launch and equipment costs, satellites at this altitude have very little atmospheric protection from the sun's high-energy radiation. Some services are delivered to upper latitudes, where it is difficult to see geostationary craft from the ground, using HEO satellites on highly elliptical orbits.

The standard TCP protocol used for internet communications requires frequent acknowledgments, so performance enhancing protocols (PEPs), which intercept packets and spoof acknowledgments, are often used to mitigate latency on satellite networks.

Satellite transmission bands
Satellite communications uses microwave frequencies, which require direct line of sight between the receiving and transmission equipment. The following frequency ranges are commonly used:

- **C Band** (4-8GHz). These lower frequencies have longer wavelengths and require larger dishes (1-2m, 3-6 feet) for reception, but are not affected by 'rain fade'. Many terrestrial systems use C band, so satellite broadcasts have to be power-limited to minimise interference. Low power satellite phones and spatially restricted transmission systems (for example relays for television and international telephone calls) often use this part of the spectrum.
- **X band** (8-12GHz) is largely reserved for military purposes.
- **K_u band** or 'under K band' (12-18GHz). Transmissions at this frequency can be more powerful as they are not power restricted, while a shorter wavelength permits smaller dishes. Precipitation causes 'rain fade', which

cuts signal levels, especially at higher frequencies. Most domestic satellite systems use this waveband, including television and broadband.

- **K band** (18-26.5GHz) is entirely absorbed by water in atmosphere, making it unsuitable for long range communications.
- **K_a band** or 'above K band' (26.5-40GHz). Radio devices are more expensive for shorter wavelength equipment, but these frequencies are coming into use for broadband services.

VSAT systems

Modern, two-way systems are based on very small aperture terminals (VSATs) which consist of a small dish (60-120cm, 24-48 inches), outdoor electronics mounted on the dish and an indoor modem. Signals from the satellite can be concentrated into 'spot beams', permitting re-use of the same frequency over the satellite's broadcast area, and return transmissions combine multiple channels and multiplexing of data streams to maximise the number of simultaneous users.

BeyonDSL is marketing ASTRA2connect in the UK based on VSATs and geostationary satellites. An 80cm dish, utilising K_u band frequencies, provides up to 2Mbps downlink and 128Kbps uploads. The monthly fair use policy for the best service 'caps' data transfers at 2GB. (Use beyond the contracted data limit reduces the speed of the service.) The equipment and connection cost just under £350, installation £100 and monthly charges for the highest speeds are almost £85. Extra charges are incurred for the addition of satellite television services. A voice (VoIP) service is expected later this year.

Tooway, which is marketed through resellers such as Avonline, is a second example of this type of system. The existing service uses K_u and K_a bands, but faster 4Mbps speeds are expected when Tooway starts a new K_a band service in 2010. Avonline's offerings are all based on 2Mbps downlink and 348Kbps uplink, with pricing determined by the data cap. Installation of the £599 hardware costs £200, while monthly charges vary from almost £30 for 1.2GB to nearly £100 for 6GB of data. Tooway can be combined by some resellers with optional television services and a fair use policy, similar to that for ASTRA2connect, operates.

O3b

The O3b Networks service is aimed at the 'other 3 billion', as broadband backhaul (the 'trunk' connection back to the internet) in developing countries. Poor existing infrastructure and difficult terrain make the cost of conventional connectivity prohibitive for most new internet and mobile services. However, a network with a star topology around a satellite ground station is relatively low cost and practical - customers connect to the centre using standard ADSL, cable or mobile.

O3b will launch eight satellites in the second half of 2010 (although only five are required for 360 degree global coverage) and have planned for eight more. These spacecraft will form a LEO constellation, cutting latency to around 0.1s, with maximum downlink speeds of 10Gbps, aggregated across several K_a band antennae on the same satellite. Each transponder illuminates a 500km footprint on the ground.

Mobile satellite systems

A range of mobile technologies is available or being developed. For example, BGAN (Broadband Global Area Network) terminals combine telephony with a basic internet link (under 500Kbps) via Inmarsat's geostationary satellites. The cost of the terminal (around $2,000 $5,000, £1,350 to £3,350, depending on features) and typical 1s latency puts this type of system into the specialist use category.

Qualcomm's new combined 3G and satellite radio chipset that it announced for early 2010 will work in the lower frequency L and S bands, presumably with services based on a constellation of LEO satellites. Devices, which may be little larger than a mobile phone, will provide 'triple-play' mobile satellite services (MSS). No indication has been given for the price of the hardware or the services to be built on it.

The solution to not-spots?

Satellite technology looks attractive but faces high costs and severe limitations - even leaves can cut effective transmission on a line of sight connection. Some high profile satellite communications ventures went into bankruptcy around 1999, although many of the assets were bought up and are in use today.

The upland terrain in the UK, which is some of the most difficult for terrestrial broadband, is unlikely to be effectively served by geostationary satellites that appear relatively low on the horizon. LEO systems may become practical where a cluster of dwellings - possibly around a school - make a shared service possible. However, satellite broadband is liable to remain a niche service in this country for the foreseeable future.

Networking and wireless news

Ofcom frees up next generation broadband market

Next generation broadband networks will offer speeds of at least 40Mbps - faster than many primary schools use for their whole infrastructure. Although home access to broadband is not given the same performance guarantees as most schools receive, it will enable many learners to access rich video materials, engage in online gaming and use web conferencing at home, arriving at school with heightened expectations for the delivery of learning experiences.

'Super-fast broadband' will be delivered using cable technology (largely supplied by Virgin in the UK) and fibre (much of which will be supplied by BT), although other companies are involved throughout the delivery network. Use of fibre will mean replacing copper cabling to the street-side junction box (fibre to the cabinet, FTTC) or to the home (FTTH). FTTC is much cheaper as it means that all the 'tendrils' at the ends of the network do not need to be replaced.

Ofcom has stated its intention to allow companies that invest in new infrastructure to set their own pricing and for those that resell such services to price products on a basis that reflects the risk involved in such investments. Ofcom's statement also referred to research suggesting that 40 to 50 per cent of ducts that carry

underground cabling have space for fibre trunking to be added, although other factors may reduce these figures.

BT will be offering two types of access, passive and active. Passive access requires ISPs to install their own equipment on the end of lines rented from BT, while active access would mean purchasing the full service from BT's wholesale business unit, Openreach.

A BBC blog reports that the overlap of cabled areas with BT's target regions will bring next generation access to more than half of UK homes by the end of 2012, highlighting the potential to widen the digital divide, since access will be by no means universal and price differentials will deter some consumers from investing in such services. Lord Carter's interim Digital Britain proposals would only require a far lower minimum 'Universal Service Commitment' of 2Mbps.

Fibre broadband for British cities

BT has announced the first 29 exchanges that will get 40Mbps 'next generation' broadband access through fibre to the cabinet (FTTC). The exchanges are located in Edinburgh, Glasgow, Belfast, Cardiff, the Rhondda, London, Manchester, West Yorkshire and the Home Counties. The new service will be made available to premises connected to the named exchanges through third parties, including BT's retail arm. This is part of BT's £1.5 billion targeted at providing 'super-fast broadband' to 10 million homes and business premises by the end of 2012.

BBC News has reported comments from Neil Berkett, Virgin Media's chief executive, suggesting that the company will have options to provide speeds of 100Mbps and higher by 2010, although he remained unsure that was sufficient consumer demand to make such services profitable.

The Manchester Digital Development Agency has announced a £500,000 project, funded by the Northwest Regional Development Agency, to connect 1,000 homes and 500 businesses in its Oxford Road area directly to the internet using fibre. The project, involving two universities and a local NHS Trust, will also work to deliver innovative services to the community, such as tele-healthcare using a video link to monitor the progress of patients with severe and chronic problems. The city's council is involved as it believes the investment should be made without waiting for commercial providers, although Rusholme, one of the BT exchanges listed for upgrade, is near this area.

Next generation broadband access could be used by colleges and schools to deliver highly engaging interactive learning experiences, teleconferencing between learners and experts, and a range of other high bandwidth networked services.

Mapping broadband Britain

PointTopic, a broadband research and consultancy service, has teamed up with a software and services company Gavurin to produce a tool that maps broadband access across the UK. The free version maps data at the local authority (sub-county)

level, showing broadband take up in numbers and percentages, as well as average download speeds calculated using two different methods.

An email address must be provided to access the free map, while subscription will give access to data at street level, differentiating between commercial and residential premises, and giving results for a range of demographics. The full data set will also locate 'next generation' broadband access areas.

This information may assist local authorities in developing home access projects and be useful to geography teachers looking at regional variations in services and economic development.

Ultra-speed 0.5Gbps copper networks coming?

The public focus for upgrading internet cabling has largely been on replacing copper with fibre, but technology to drive faster connections through copper has also been developing. Ericsson, one of the major telecommunications equipment manufacturers, has announced that it achieved more than 500Mbps (0.5Gbps) over 0.5km using six bonded pairs of copper cabling. In common with other DSL variants, the speed of VDSL2 decays with distance from the exchange - a single (non-bonded) link gives an optimum 100Mbps at 0.5 km and similar speeds to ADSL2+ beyond 1.6km (1 mile).

The underlying technology is VDSL2 (Very high speed Digital Subscriber Line 2), which is enhanced to prevent 'crosstalk' interference between the separate copper carriers. Ericsson expects the standards governing the 'vectoring' (that prevents crosstalk and optimises power efficiency) to be agreed by the end of the year. The company envisages its technology to be used largely as the 'backhaul' from mobile phone masts to fibre connections at exchanges, especially as new high speed HSPA and LTE ('4G') mobile phone technologies are rolled out.

VDSL2 was recognised as the ITU's G.993.2 standard in February 2006.

ENUM goes live

ENUM is an essential plank in the widespread adoption of VoIP, acting as a registry service that links the national telephone directory with the regular domain name system (DNS). Nominet has announced that this system is now live for the UK. VoIP, or voice over IP, allows telephone conversations to be carried across internet links, which makes such calls 'free' where the infrastructure and broadband service are already in place. (VoIP was covered in TechNews January 2009.)

ENUM, according to Nominet's statement, 'allows users to continue to use the existing phone number formats they know, whilst allowing the device to route the call using a DNS lookup'. This routing could be dependent on time of day, calling device used, originating number and other factors, giving the user control over how each request is handled. For example, learners could hold 'free' conferences with subject experts; voicemail messages could be automatically forwarded as audio attachments to an email address when an organisation was closed; or learners on work

experience could call mentors without having to know where they might be at a given time.

The ENUM registry will be operated by Nominet, but businesses (who are the main target initially) will sign up through third party registrars, in much the same way that internet domains are allocated at present.

Ofcom: inclusive access, 999 roaming, media literacy

Ofcom has announced five priorities to promote inclusion and access to telecommunications services:

- Broadband availability and take-up - Ofcom is considering how to reach the 40 per cent of consumers yet to take up available broadband access and what an appropriate strategy would be for implementing a 'universal service commitment'. (Lord Carter's interim Digital Britain report suggested a USC of 2Mbps.)
- '999 mobile roaming' - ensuring that mobile users can always connect to emergency services, even where they have no signal from their own service provider.
- Services for disabled people. A review will start by looking to update the text relay service for hearing-impaired users, which is based on 30-year old technology.
- Review the Universal Service Obligation (USO). The USO ensures that a country-wide service is available at a uniform price, with discounts for users on low incomes. Technical, social and market changes suggest a review is required - for example, the considerable drop in call box usage as consumers have acquired mobile phones.
- Media literacy. Ofcom has formed with other stakeholders a media literacy working group to develop the National Media Literacy Plan, as requested by the government in Lord Carter's interim Digital Britain report.

The five priorities form part of a consultation process that continues until 3rd June 2009. The full background report and executive summary can be accessed on the Ofcom website.

3GPP approves first femtocell standard

Femtocells, covered in TechNews September 2008, are 'indoor base stations' for mobile phones. Coverage for mobile networks within buildings is often poor due to the use of concrete, steel and other construction materials blocking radio signals. Femtocells link mobile phones, often for a single service provider, to a broadband connection, rather than the regular network. This provides coverage indoors, or in 'not spots', while taking the load off the carrier's regular infrastructure.

Femtocells are likely to be more widely used where a common set of standards governs initial hardware setup and updates, the mechanisms required to reduce interference and how security is achieved. The Femto Forum has worked with 3GPP and the Broadband Forum to agree the relevant aspects of 3GPP Release 8. (The

Third Generation Partnership Project, 3GPP, standardises many aspects of 3G mobile telecommunications.)

US carriers AT&T, Sprint Nextel and Verizon Wireless have either begun to sell the hardware or have plans to make it available, so this standardisation is a significant step for promoters of the technology. However, doubts remain over whether consumers will be ready to purchase the hardware and carriers be willing make tariffs sufficiently attractive to accelerate adoption.

Bluetooth 3.0 HS released without UWB

Bluetooth is a short-range wireless technology for connecting devices, for example linking wireless headsets to personal media players or pairing mobile phones to laptop PCs for synchronisation of contacts. Many current devices use the Bluetooth 2.0 or 2.1 standards that operate at a maximum of 3Mbps, which is sufficient for audio streams and connecting a PC to the Internet (via older mobile phones), but would be inadequate to transfer high quality pictures in bulk or to stream video content.

The Bluetooth standards body formally adopted Bluetooth 3.0 'High Speed' at its meeting in April. The new standard uses parts of the same 802.11 technology as Wi-Fi, giving it a maximum throughput of about 24Mbps, although devices using Bluetooth 3.0 HS will not necessarily be certified as compatible by the Wi-Fi Alliance. Hardware equipped with Bluetooth 3.0 HS will set up the pairing in the same way as older Bluetooth devices, before switching to 802.11 radio, meaning that the standard will remain backward compatible. Adoption of 802.11 also improves the power consumption of Bluetooth devices. The Bluetooth Special Interest Group (SIG) has produced a Gadget Guide to assist consumers purchasing Bluetooth hardware. New devices based on Bluetooth 3.0 HS are expected to become available at the end of this year or early in 2010.

Ultra-wideband (UWB) has been under development by a number of groups for wireless communication between devices in the home and elsewhere. The WiMedia Alliance has announced that it is in the process of disbanding and transferring its UWB specifications to the Bluetooth SIG and others. WiMedia's UWB uses 'pulse' radio in the 3.1Ghz to 10.6Ghz spectrum. By broadcasting the same data at low power on several channels simultaneously, UWB reduces interference with other wireless devices operating on similar frequencies, while limiting signal attenuation caused by walls and other obstacles. Current specifications have data transfer rates up to 480Mbps, although gigabit rates are envisaged. It had been suggested that Bluetooth 3.0 HS could set up a wireless connection and, where both devices had suitable radios, use UWB as the bearer. However, the Bluetooth SIG stated in an FAQ that resolving compatibility issues would prevent embedding UWB in the Bluetooth 3.0 HS standard..

Finnish study shows mobile users want to do more than call

A doctoral student in Finland, Hannu Verkasalo, has been exploring 'face time' on smartphones. Usage metrics for mobile phones tend to look at calls or use of the internet in isolation, rather than combing the two. 40 per cent of face time, based on

surveys of Finnish consumers and 'in-device usage measurements', is spent with the internet, games and multimedia applications. Use of some applications lags users' aspirations, especially email, where less than a third who want to do so actually use it on their phone. Given that 70 per cent of those who want to use the internet do so, this could either suggest that users do not know how to set up the email service they want, or that text-based input is too cumbersome. The study also shows that the 'top' quarter of users account for half of voice use and 87 per cent of internet browsing.

US schools test Microsoft's Geneva security technology

Schools in Washington State in the US are testing Microsoft's new Geneva security technology. In order to validate their credentials, parents will bring identity documents into their children's schools to form the basis of an electronic 'information card' that will be stored on each child's personalised netbook computer. When learners access secure websites or protected educational content, systems will access the stored information to confirm their identity. This pilot project is designed to implement a vision for 'end-to-end trust' first outlined by Microsoft at the RSA security conference a year ago and articulated in *Digital Playgrounds: Creating Safer Online Environments for Children*.

Information cards avoid the need for users to have specific user names and passwords, which are easily forgotten and often easy to guess, for each website they visit. Instead, users select an appropriate card for the particular website, which then requests encrypted digital tokens that verify the user's identity. (The system uses 'pair-wise' keys that are unique to the user and website, making it much more difficult to impersonate either party, as the keys must be mutually verified.) A previous TechNews article discusses OpenID, a system for verifying user's identities, which Microsoft has said it would support in its Windows CardSpace product. (CardSpace manages information cards.)

Multimedia

Analysis: Live streaming

At a glance

- Live video can provide access to people and resources in ways that were previously impractical or prohibitively expensive.
- Modern protocols and encoding standards, like UDP and H.264, can be used to capture and deliver content in the browser.
- Many live streams are captured and displayed through recent versions of Adobe Flash Player, although alternative media players and dedicated media servers are available.
- Many web-based services offer free live streams, so educational users will need to select a solution that matches their requirements.
- Use of live video needs to be set in an appropriate framework of technical and institutional policies.
- Learners receive considerable amounts of information outside formal education via video.

The rise of the live stream
A report for Microsoft has found that watching video is the most popular online activity for Europeans and it predicts that all use of the internet will overtake hours spent watching television in June 2010. Much of this video comes from pre-recorded, 'on-demand' sources like YouTube and BBC iPlayer in the UK, but live streams (or 'webcasts') are growing in popularity. The BBC announced in November 2008 that its shows would be broadcast live to UK licence payers, a range of sport and music events are broadcast live for free or on a pay-per-view basis and US President Barack Obama recently live broadcast his first public 'town hall' meeting.

Video capture equipment and connectivity costs now mean that many conferences are looking to create live video streams for delegates unable to attend. The most recent versions of Adobe's Flash Player have incorporated video protocols that support effective live streaming, so a wide variety of web conferencing and video streaming websites have sprung up. In addition to broadcasting large events or enabling small group collaboration, these sites can be used to deliver live lectures and tutorials.

Streaming protocols
The main transport protocol on the internet is TCP (transport control protocol), which ensures that all packets arrive at the destination. To achieve this, TCP drops the transmission rate when packets are lost and resends them to ensure data integrity. The approach adopted by TCP is generally unsuited to streamed multimedia as it can slow down transmission and cause 'jittering' in the image and audio, unless a substantial amount of data is buffered as a contingency.

Streamed media is much more likely to be structured on UDP (user datagram protocol), which permits packet loss and can ignore packets that arrive out of order. While this can create gaps in playback, these are unlikely to be noticed (unless substantial) as media players have techniques to fill the gap. The growth in UDP may necessitate traffic management to prevent UDP traffic flooding the network at the expense of TCP.

The real-time transport protocol (RTP) is built on top of UDP specifically for multimedia applications, adding (among other features) sequencing information, so that applications can detect missing packets, and multicast. Normal internet communications are unicast, setting up a single pathway between host and client for duration of the session. Unicast systems do not scale well, as the required bandwidth is a direct multiple of the number of recipients that want the same data. Multicast data is transmitted without any information about the destination, with intermediate routers constructing tables of recipients (other routers or final destinations) that wish to receive the transmission. Other protocols are built onto RTP to manage communications, for example by ensuring audio and video streams are synchronised.

The content of transmissions is governed by further standards, such as H.264 for video compression, also called MPEG-4 Part 10 or MPEG-4 AVC. This was first

agreed in 2003, although it has been extended since, and is the main standard used by modern media players for HD video.

Viewing live streams
A large number of media players are available. In the past services such as YouTube used the Sorensen Spark or On2 VP6 codecs built into Adobe's Flash Player, but playback of HD clips is turning towards H.264 across a variety of video sharing sites. Apple's QuickTime version 7 and Flash Player 9 update 3 embedded H.264 for the first time, in addition to previous proprietary standards; Microsoft's Windows Media Player 12, which is slated to be released with Windows 7 early next year, will also support H.264.

Flash Player can be considered ubiquitous, with Adobe claiming an installed user base of over 98 per cent of all internet-connected PCs by January 2009. Flash video streams can be embedded directly into web pages and played back in most browsers across all the main desktop operating systems. This has tended to make it the medium of choice for both on-demand and streaming video applications, as no additional plug-in has to be downloaded and installed.

The situation for playback on mobile devices, especially phones, is not as well developed, with many phones unable to handle Flash or competing media players, except through proprietary applications.

Creating live streams
A webcam, modern PC and an embedded graphics processor (or basic graphics card) are adequate for many purposes, as the video is captured and sent back to the web using the protocols embedded in Flash Player, removing the need for a client-side streaming server. This assumes that a web video streaming service is being used to host the output, for example Bambuser, blogTV, Justin.tv, Mogulus or Ustream.TV.

The settings in Flash Player can be adjusted to select between audio and video sources connected to the PC (including compatible camcorders) and to grant permission for a website to access this hardware. Ustream.TV recommends an upstream bit rate of at least 300kbps, but some services may limit the maximum bit rate of a stream, especially for 'free' accounts. Some sites support Adobe's Flash Media Live Encoder (FME) to give choice of protocol (including H.264 for HD capture and playback), to provide greater control over the quality of video captured and to interface with a wider range of video capture hardware.

In addition to these 'public broadcast' sites, some offer subscription accounts that allow closed user groups. Alternatively, educational users may wish to use one of the many web conferencing services or take advantage of facilities offered by the Flashmeeting Project. Schools can use the E2BN FlashMeeting service which allows up to 25 users to hold a live video meeting. (This service is managed by the East of England Broadband Network, but teachers need not be from the E2BN region.) For example the EdTechRoundup podcast is conducted as a live stream and captured using the E2BN service, before the audio is extracted.

TechNews July 2008 featured an article on 'Media distribution' which includes discussion of relevant issues, such as network-edge caches and appropriate institutional policies for networked video.

Creating higher quality video
Users who need to create more 'professional' live streams, or who want to stream live video over their local intranet, will need a streaming server, such as Adobe Flash Media Streaming Server, Apple QuickTime Streaming Server, the open source Darwin Streaming Server for Mac OS or Microsoft Windows Media Services 2008. In common with all video services, these can generate high bandwidth demand, while internal firewalls and routers will need to be configured to allow video traffic onto relevant network segments and to give it the desired priority.

Hosted solutions are relatively expensive and need to be supported by high-end hardware to make best use of content captured. Attention will need to be paid to the quality of video camera, audio equipment, cabling, video capture card for the PC, speed of processor, mixing and editing software, network connection and environmental factors (such as appropriate lighting and background noise).

The West Midlands RSC wiki gives many pointers to effective practice and links to further information for use of synchronous webcasting tools and streaming video.

Selecting a solution
The range of services, hardware and applications for live streaming is rapidly evolving as broadcast live video gains in popularity and users get fast broadband connections. The following factors should be considered when selecting an appropriate solution:

- Quality, latency (delay) and reliability of video streams.
- The number of simultaneous contributors and viewers supported, and the consequent effect on quality of adding more users.
- Provision of added-value features, such as simultaneous chat, whiteboard, screen sharing and application sharing.
- Availability of content programming, enabling mixing camera views, insertion of clips, captioning and addition of subtitles, either live or post-capture.
- Limitations on archiving and replays.
- Facilities for embedding streams on blogs and uploading to other services, for example YouTube.
- Ability for users to legally 'destream' (download).
- Protection offered or limitations imposed by digital rights management (DRM), copyright and privacy policies.

Growing expectations
We live in a video-saturated world where learners increasingly gain information - outside formal education - from video sources. Many teachers and lecturers are bringing 'on-demand' video sources into lessons, but live streams (watching nesting

birds, talking to a museum expert or following a debate in parliament) can be more engaging. Live streaming also opens possibilities for other ways to reach learners, including the excluded and the sick, and new models for delivering learning across campuses or federations.

Delivering more learning through live streams would involve further research into effective course construction, investment in staff training and consideration of issues like copyright, privacy and e-safety. While delivery to a PC screen is likely in the short term, it will be necessary to plan for mobile clients as well. Much use in education is currently niche or experimental, but live streamed video is likely to make a much greater contribution in future.

Multimedia news

E-book update

E-book readers are used to store and display books, magazines and content downloaded from the internet in a low-power, lightweight device. Such readers will need to be convenient and at a sufficiently low price point if they are to be widely adopted by consumers. E-book readers could store large amounts of information traditionally held in text books and access further resources on the internet, as well as storing literary works, novels and magazines. (See E-books analysis piece in TechNews March 2008.)

Samsung has released some details of its forthcoming Papyrus reader, expected to launch in the summer. In common with the iLiad from iRex, the Papyrus reader will have a (smaller) 6-inch touch screen, allowing user to take notes and make annotations, plus contact, diary and other functions; 512MB of integrated memory will give storage for around 600 books of 300 pages each. Content will need to be downloaded to a PC and transferred using a USB cable, as it is not expected that the hardware will have wireless connectivity. The reader will be launched in Korea for around $300 (£205).

Amazon has announced a Kindle e-book reader application for the iPhone and iPod Touch, free to download from the Apple App Store. The application can synchronise reading on the iPhone with Amazon's Kindle hardware, since both have mobile connectivity, allowing users to pick up on one device at the point they left off on the other. Amazon says it now has 240,000 books formatted for the Kindle available for purchase and download. Although the iPhone application may prove popular with gadget-lovers, it remains unclear whether a wider audience will take to reading books on a mobile phone - the screen of the iPhone 3G is only 3.5 inches. Further, many school-aged users are likely to own more basic phones.

Sony and Google have reached an agreement for Sony to distribute over 500,000 'public domain' titles in EPUB format for Sony's readers through Sony's eBook store. Public domain book are out of copyright and freely available in digitised versions from a number of sources, including Project Gutenberg. Titles include works by Agatha Christie, Conan Doyle, Dickens and HG Wells, as well as the letters of Jane Austen.

Sony is continuing to promote the ePub book standard for e-books, first announced in July 2008. ePub is an open standard, previously known as the Open e-Book (OEB), which was discussed in the E-books article in TechNews March 2008.

Other e-book readers are available, for example from BeBook.

Colour e-paper developments

E-book readers are designed to store large numbers of electronic publications in hardware that can be read in daylight while using minimal power. E-books readers have the potential to contain the texts used for a complete course of study, but have the benefits of being smaller and lighter than a set of books, easily updated and (with planned technological advances) are able to display video as well.

Fujitsu has announced that it would begin sales of a new colour e-book reader in Japan in mid-April 2009. Most devices to date, including Amazon's Kindle, have used greyscale electrophoretic displays from E Ink, which use minute charged black and white capsules suspended in a viscous solution, manipulated using electrical fields to produce an image. The new FLEPia display, which Fujitsu calls 'first colour e-paper mobile terminal', appears to be based on the cholesteric LCD technology it licensed from Kent Displays in 2005.

Normal LCDs are unsuited to long-term use in e-book readers, as they use layers of polarisers and filters to selectively block and colour light from the white backlight. This means that they must be continuously powered and that much of the light is absorbed, limiting the brightness of the display and continually draining the battery. LCDs also need to be regularly refreshed to maintain an image, otherwise the liquid crystals would return to their stable state, which would let all light through, producing a near-white image.

Cholesteric LCDs (ChLCDs) are based on the principle of Bragg diffraction, in which light is selectively scattered from a crystal based on its wavelength; because the crystals have a highly uniform structure, they reflect a particular wavelength of light. ChLCDs use the alignment of liquid crystals to produce the same effect: electronics are used to heat the crystals and manipulate them into the correct orientation while in the fluid phase. Once the current is removed, they remain orientated to reflect the incident light at the desired wavelength. This behaviour can be used to produce a bi-stable system in which each liquid crystal cell either reflects light or transmits it, remaining in that state until re-orientated.

The Fujitsu display fuses red, blue and green layers onto a black background; each layer has its own electronic grid to control its pixels and each cell in the layer is separately addressed to produce a composite colour display. A single scan of the display, which takes about 1.8s, creates a 64 colour image; two further scans (taking eight seconds in total) increase the number of potential colours to 260,000, although no details are given of how this improvement is achieved. The eight-inch display has an XGA resolution of 768 x 1024 pixels and is powered by a battery that Fujitsu state will last for 40 hours (based on displaying one new 64-colour page per minute).

Content for the FLEPia, which can be downloaded via USB, Wi-Fi or Bluetooth, is largely based on e-book formats suited to Japanese reader software. The maximum capacity, based on a 4GB SD card, would be about 5,000 books, each of about 300 pages. The device, which runs on Windows CE 5.0, is only available in Japan and costs around £720.

Partners with the University of Cincinnati have claimed that their full-colour electrofluidic display could produce 'better than 85 percent “white-state reflectance”', which makes it nearly equivalent to a normal printed page. Electrofluidic displays use tiny reservoirs of pigment in an aqueous solution which, when a voltage is applied, disperse their pigment across a defined area under the display surface; when the voltage is removed, surface tension in the liquid causes the pigment to rapidly draw back into the reservoir.

A report in Technology Review states that electrofluidic pixels can change between white and black in a millisecond, which is considerably faster than other e-paper display technologies, and can be spaced to give a resolution of 300 dots per inch. (Competing technologies may have screen refresh rates between a second and eight seconds for a full page, which is inadequate for video.) The technology is being commercialised through Gamma Dynamics, which believes that colour versions of the display will have much better contrast ratios (the difference between white and black) than competing systems. The construction of electrofluidic devices is extremely thin, so they have potential for flexible displays too.

Bridgestone Corporation, better known for its tyres, has incorporated pen input into its colour 'QR-LPD' e-book reader. A previous version of the device was too slow for pen input, with screen refresh rates for an A4 page of between 10 and 15 seconds, but engineering changes to the driver system in a new version enable it to refresh in 0.8s. The Tech-On report gives few details of the underlying technology.

Mobile touchscreen for 3D gestures

Mitsubishi has demonstrated a '3D' touchscreen which can sense the distance of the user's finger from its surface. The PhysOrg reports that the screen has two modes that prioritise dimensional resolution according to the finger's distance from the surface: when touching the screen, the device uses its 'contact state resolution' of 0.2mm along the x- and y-axes; when in 'proximity state' the resolution drops to 10mm in the horizontal, while prioritising sensitivity in the vertical plane by monitoring more sensors. The movement of a finger can be sensed as far away as 20mm (nearly an inch).

The demonstration device had a 640 x 480 pixel capacitive touchscreen measuring 5.7 inches (14.5cm) across the diagonal. In one demonstration, hovering over an icon on the screen brought up a 'context' menu, rather than executing the assigned function. The system can process position fast enough, say Mitsubishi, that slow movement could be used to scroll while a faster flick would bring up a different screen. According to a PC Pro report, the technology is close to commercialisation,

although no dates are given, and suggests that it could appear on smaller devices, such as smartphones.

Microsoft researching improved gestures

Gestures are becoming extremely important for input on a range of devices, from mobile phones, through information screens and interactive 'tables', to large 'touch walls'. Apple was recently reported to have successfully applied for patents on some of its touch techniques, so developing alternative gestures may be extremely important.

Microsoft researchers asked users which gestures they associated with various commands. The findings are summarised in a paper, *User-defined gestures for surface computing*, presented to CHI '09 at the start of April. The study involved 20 literate, non-technical, English-speaking, adult respondents, who often suggested a 'slash' for cut, a tick to accept, scribble out for undo and signed a question mark for 'help', but ideas for other commands were more divergent. Some commands might be represented in three dimensions, so one respondent suggested beckoning for 'help'. The researchers asked the respondents to provide both single-handed gestures and ones using both hands for each of 27 commands. According to the paper's authors:

> Our findings indicate that users rarely care about the number of fingers they employ, that one hand is preferred to two, that desktop idioms strongly influence users' mental models, and that some commands elicit little gestural agreement, suggesting the need for on-screen widgets.

The paper proposes a standardised set of gestures for common interactions and a taxonomy for classifying such signs. The authors also comment on the implications for 'surface' technologies and other interfaces, suggesting that greater accuracy will be achieved where cameras can track actions in the third dimension, rather than relying purely on touch. The researchers suggested that their study be followed up by taking a new group and showing videos of the proposed gesture set to them, with a list of possible commands, to see whether they matched them in the same way.

Projector with laser light-source creates larger, brighter image

Sanyo has developed a projector that can create a 100 inch (250cm) HD video image from a range of 25 inches (63cm). Although this ratio is not as good as some other Sanyo products, which can give an 80 inch image from a little more than 3 inches, the system uses a laser light source to produce a brightness of 7,000 ANSI lumens and very rich colours. (Projectors used in classrooms and small lecture theatres tend to range from 1,500 to 3,000 ANSI lumens.) The prototype is a massive 2.4m long, but Sanyo believes that this can be reduced before the product is commercialised for use in conference halls and other larger spaces.

Several other manufacturers sell short-throw projectors.

Lasers to create better displays

Lasers can be tuned to produce a specific wavelength of light, so accurate red, green and blue laser sources could produce much deeper, richer colours at higher resolutions when combined in a display.

A European research project has built VECSELs (vertical external-cavity surface emitting lasers) that use frequency-doubling technology to up-convert light from infrared to the green part of the visible spectrum - a set of wavelengths that was previously difficult to produce, especially from low-cost processes that can be integrated with standard semiconductors. This technology could be used to create compact laser projectors, as well as any other device requiring fixed frequency or tuneable lasers that produce light anywhere across the near infrared to ultraviolet spectrum.

Another research team, from the Centre of Molecular Materials for Photonics and Electronics (CMMPE) at Cambridge University, has been developing new materials for liquid crystal cells that create laser sources which have a frequency governed by the voltage applied across them. These liquid crystals can be organised in a two-dimensional pattern, with voltages set to simultaneously create the red, green and blue light required for a display when 'optically pumped' from an ultraviolet laser source. This arrangement removes the need for separate red, green and blue lasers to drive the display.

BBC iPlayer gets HD upgrade

The BBC's iPlayer online service, used by millions of people in the UK to catch up on missed television and radio shows, has been upgraded for HD video. The BBC states that the quality of its 'standard definition', now used for most programmes, is 'as good as most Freeview channels'.

The BBC blog says that around 40 hours of high definition (HD) television programmes will be added weekly to its roster, using the 720p format. (720p is the lower of the HD formats, yielding a 1,280 by 720 pixel image.) The technology will use the H.264 standard (also known as MPEG-4 Part 10) for video compression, with a preferred bit rate of 3.2Mbps. However, the latest player uses an 'adaptive' bit rate to optimise the speed of the stream to the available bandwidth. In order to deliver HD video for download, the BBC has also re-developed its desktop download application to run in Adobe AIR. This provides a way for users of Mac OS and Linux, in addition to Windows, to view programmes offline.

The new version of iPlayer could put significant pressure on both ISPs and users' own home networks, due to the increased demand for bandwidth. iPlayer is second only to YouTube in the UK for video traffic, and use of both is rapidly increasing. Consumers with low usage caps may need to customise the iPlayer interface to ensure that they are not penalised for excessive use. Schools and colleges may also need to look at how iPlayer performs (where use is permitted) to ensure that it is not flooding networks with additional traffic.

Google Voice service launched

Google has launched a voice over IP (VoIP) service, known as Google Voice, which allows users to connect multiple phones to a single number and choose which one rings according to the number calling, to listen in to the call before actually picking it up, create a simple conference call and get text transcriptions of voicemail messages. The service, which has other features, is managed via the internet and can be accessed through a mobile browser.

The service, based on an earlier purchase of GrandCentral in 2007, is focussed on current users in the United States. Although no UK service has been announced, the entry of Google into this market indicates the importance that the company places on fully digital communications. Investment in current infrastructures may be inhibiting transition, but telephones services are moving into a 'unified communications' era. Other companies, such as Skype and Vonage, provide VoIP services in the UK. VoIP in education was covered in TechNews in March 2009.

Low cost games console for developing world

Zeebo has developed a new games console for emerging markets. The system will be entering a highly competitive market dominated by Microsoft's Xbox, the Nintendo Wii and Sony's Playstation 3, so why is might this one succeed? The answer, in the company's view, lies in directing its strategy to the developing world, where existing hardware is very expensive and game developers are wary of piracy undermining their profitability. Zeebo suggests that 800 million people will join the 'middle classes' in the next decade, offering real growth opportunities.

The new console is based on a 528Mhz ARM 11 processor, with a chipset and graphics accelerator from Qualcomm, and 1GB of flash. Output is only VGA (640 x 480 pixels), but the assumption is that users will connect it to a standard television and play games that (to Western expectations) are 'outdated'. Nevertheless, this reduces the hardware requirements, allowing the company to launch the device in Brazil for $199 (about £135), and opens up a large 'back catalogue' of games that many consumers in emerging markets will never have played when first released. To enable easy distribution and to combat piracy, games will be downloaded via a built-in 3G mobile connection. According to Wired, updates will be done wirelessly while the console is idle and the price of games (about $10 each) will contribute to the 3G connection to avoid mobile contract charges. This approach to distribution also allows for control of content according to local laws. Three USB ports will enable connection of controllers and other hardware, while an SD card slot can be used to upload and display photographs.

Zeebo's homepage mentions 'education', but no further details are given of what types of related content are envisaged. The makers hope to get the price of the console down to $150 (£105) soon after launch.

Siftables at TED

The Technology, Entertainment and Design (TED) conferences often have extremely thought-provoking keynotes, with internationally renowned speakers addressing leading edge topics. During one of this year's talks, David Merrill, a graduate student

from MIT demonstrated, 'Siftables'. (A video of the presentation can be seen here.) These are small - about 2 inches (5cm) square - programmable blocks which have infrared communicators on each edge, accelerometers, Bluetooth wireless connectivity and a display on the top surface.

The initial idea was inspired by children's play blocks, where infants learn by manipulating a tangible object, but Siftables are a very high-tech replacement. The infrared system allows the blocks to detect the proximity of others, creating interaction according to the program downloaded over the Bluetooth connection. Examples shown by Merrill included the following:

- 'Pouring' and mixing colours between blocks. (The accelerometer senses the pouring motion.)
- Rearranging simple equations, with the numbers, operands and results displayed on the surface of each block.
- Word games based on random letters.
- Controlling the display of cartoon characters in a projected story by selecting and holding up the appropriate block.
- Music sequencing controlled by 'adding' Siftables together and moving others near to add colour to the composition.

Although the demonstrated activities could largely be replicated on a normal screen, or even a multi-touch interactive table, Siftables do have the advantage of being tangible, with some limited capability in three dimensions. Current uses often involve 'play', which may seem most suited to younger learners, but the team are hoping to develop further activities that challenge higher order thinking. The MIT Media Lab team have patented Siftables and are seeking to commercialise the idea.

Hardware

Analysis: Thought control

At a glance

- EEG and fMRI systems can be used to detect the aggregate effects of brain activity.
- Brain activity is localised according to the operation of particular cognitive systems, reflecting thoughts, feelings and mental processes.
- Considerable research has been undertaken by the military into thought controlled systems, especially augmented cognition.
- Brain-computer interfaces (BCI) have been produced, largely based on EEG sensors.
- BCI systems have been used to control games; assistive hardware; text input and robots.
- Thought assistive technology could be very beneficial to disabled users, but significant practical and ethical issues surround other applications of thought detection in education.

Mind reading technology
The ability to read another person's mind has probably been on everyone's wish list, but we are at a stage where technology can offer a very crude version right now. Our brains are composed of around 100 billion neurons that work on electrical signals which indicate what is occurring in the brain. Although no one really knows how these physical signals translate into thought, it has become apparent that different regions of the brain are active when people have particular emotions or are undertaking certain types of mental activity.

Thought-control could offer a host of applications for controlling devices, avatars, and complex systems. We are still a long way from the scenario in the film *Firefox*, where Clint Eastwood flies a Russian plane using thought alone, but prototype systems have already demonstrated that complex interactions may be possible.

Detecting brain processes could open up a whole sphere of possibilities for people with disabilities, from controlling a prosthesis using thought alone, to allowing people with so-called 'locked-in' syndrome to communicate with the others.

Considerable expenditure on thought control has been authorised by the US Department of Defence through its agency DARPA. Modern defence systems rely on computers to automate their capabilities, to give that 'edge' the military need, so cutting out physical controls could considerably increase responsiveness. Nevertheless, there is concern that thought-controlled systems would not accurately and reliably sense the operator's intentions.

Brain-computer interface
To control a system using thought, there has to be some form of brain-computer interface (BCI). Many people would have strong reservations about embedded sensors (although the cochlear implant is an example of one device that has had notable successes for profoundly deaf people), so most systems rely on headsets.

From the late nineteenth century researchers have been aware that electrical signals from neurons produce 'brainwaves' at various frequencies. Electroencephalography (EEG) detects these brainwaves through a network of sensors placed on the head, displaying the results as a graph. Signals detected are an aggregate of many millions of neurons at work and depend on the orientation of each nerve cell, so they cannot pinpoint very specific brain responses, let alone predict how the input will vary between individuals. Most devices on the open market (or soon to become available) use output from EEG-type sensors to control devices.

EEG can be supplemented with other measures of 'biofeedback', including:

- ECG - electrocardiogram, indicating heart activity
- EOG - electroculogram sensors, which record gross eye movements
- fNIR - functional near infrared, measuring the level of oxygenation in blood supply to the brain.

The greatest recent advances in understanding when different regions of the brain operate have come from detecting changes in blood flow using functional magnetic resonance imaging (fMRI), which can elicit brain activity in three dimensions in real time. fMRI also aggregates activity, but it is much more accurate than EEG as it can produce images with spatial resolution down to 1mm. Although non-invasive and without the risks posed by X-rays, MRI relies on strong magnetic fields generated from bulky equipment, which is unlikely to be made portable in the near future.

In a section of a CBS television *60 Minutes* report, reproduced with a transcript on the CNET website, a reporter is shown pictures of objects related to tools and to houses. Without 'training', a computer accurately identified the ten pictures that the reporter had been shown, purely on the basis of fMRI results. One of the researchers featured from Carnegie Mellon University, Marcel Just, described the technique as 'thought identification' rather than mind reading.

Augmented cognition
A person's cognitive state can greatly affect the performance of complex tasks, such as driving, flying a plane or teaching. Influences on your mental state include tiredness, alcohol and cognitive overload. The latter results from too much information overloading sensory and control systems, and can lead to serious mistakes. DARPA has funded research (involving UK firm Qinetiq) into reducing overload on fighter pilots using augmented cognition (AugCog). Sensors in an EEG headset and the simulated cognitive cockpit (CogPit) sense pilot overload and reduce incoming information, bringing the most critical data to the fore and automating tasks like deploying defensive measures.

Results from this research, which has already shown some success, could be applied to other rapid-response, high-stress environments, such as air traffic control or stock trading.

Sensors and controllers
Several companies are developing EEG-based headsets, including NeuroSky and Emotiv. The NeuroSky MindSet hardware contains an embedded logic chip linked to single sensor, detecting two main mental states ('attention' and 'meditation') using a 0 to 100 scale, although other information, including raw EEG data, can be monitored. The NeuroSky device is reported to cost between $50 and $80 (approximately £35 to £55) and is expected to be distributed by original equipment manufacturers (OEMs) as part of a bundle. A clip on YouTube from ABC news shows the NueroSky system in action.

Emotiv's EPOC 'neuroheadset' is more comprehensive, with 14 sensors and a full software development kit (SDK) that can be used to detect parameters from three suites of mental states:

- Affectiv - measuring 'discrete emotional states'
- Cognitiv - detecting 'conscious thoughts'
- Emotiv - identifying facial expressions.

The EPOC system is wireless, powered by a lithium battery (which the company says will last for 12 hours of continuous use), comes fitted with a gyroscope to detect head movement and is expected to retail at $299 (£205). The EPOC headset can be seen in action on this Stonehenge 'game' video on YouTube.

Applications
Research systems and consumer products have been designed (largely) around EEG based systems, including:

- Mindball - a game in which participants try to get a ball into the opponent's goal by deliberately relaxing.
- Mind Flex - a puzzle toy in which the player tries to navigate a ball around a short course. The ball hovers in stream of air, as shown on this CBS video on YouTube. Mind Flex is expected to retail at $80 (£55).
- Artistic control of 'visuals' to accompany music. The MindVJ system could be used like Soundbeams for sensory stimulation.
- A text input system used to send a message to Twitter - letters were 'selected' as they flashed on an alphabetical grid. This system could be used by people with severe physical disabilities.
- A wheelchair that has been adapted to respond to 'thought commands'.
- BCI devices to monitor a driver's cognitive status, although other types of sensor might be both cheaper and more acceptable.
- Thought-controlled robots developed by University of Washington and Honda. The Mental Augmentation through Determination of Intended Action (MAIA) project was formed to research this area.
- Various kinds of 'brain training', such as SmartBrain and systems from Transparent Corporation.
- Neural marketing - companies like EmSense research response to advertisements and media messages.

Measuring and directing learning
Response to advertising and brain training are areas where some companies have made strong claims with little substantive evidence, whatever the technological or psychological basis of their system. It is tempting to think that identifying thoughts would give educators a clear idea indication of the effectiveness of different pedagogies, but it is also a highly contentious area when it comes to identifying the effects of any one intervention.

It has been suggested that 'electrophysiological markers', detected using BCI devices, could indicate progress along a desired learning pathway - when a learner shows the appropriate neural response it would be time to move to the next stage. If it becomes possible to identify particular areas of the brain that 'light up' as knowledge is assimilated or skills mastered, it would become possible to more closely control learning programmes. However, such responses need to be identified and proven to be common across many learners.

Mind reading or mind control

These ideas may lead some to Aldous Huxley's dystopian vision of conditioning in *Brave New World*. To what extent can society invade a person's deepest privacy in the sanctum of their inner thoughts? Can neurological signals be used deterministically to govern education and is the path of 'programmed learning' one we wish to follow? If we can 'read' minds, will it be a short step to controlling them? This technology is particularly fraught with ethical issues, but there is no doubt that neurological interfaces to control external devices could significantly enhance the lives of people with severe physical or communications disabilities.

The CBS interviewer pushed Marcel Just from Carnegie Mellon University to predict how long it would be before there would be "a machine that'll be able to read very complex thought". He said five years.

Hardware news

Thought-controlled robot

The Honda Research Institute has created a thought-controlled version of its Asimo robot. The new Honda brain machine interface (BMI) technology combines electroencephalography (EEG) and near infrared spectroscopy (NIRS) in helmet-mounted sensors to (respectively) measure electrical activity and cerebral blood flow. A complex processing system analyses changes to these values and wirelessly instructs the robot to make the appropriate response.

The system only deals with four simple movements at present - using arms, legs and the tongue - but the researchers claim over 90 per cent accuracy. However, a report from TechNewsWorld states that calibrating the machine for an individual takes two hours and that Honda would not do a live demonstration for fear that the user's concentration would be too readily distracted. The report quotes Yasuhisa Arai as saying, "I'm talking about dreams today... Practical uses are still way into the future."

A previous system demonstrated by Honda in 2006 relied on functional magnetic resonance imaging (fMRI) to measure brain activity, but this would have been impractical for commercialisation as it required extremely costly and bulky equipment, and produced strong magnetic fields.

Hardware control using in-ear sensors

Sensors embedded in specially adapted headphones can detect minute movements in the ear caused by changes to a person's facial expression. These movements can be used to control devices, from MP3 players to washing machines, depending on how the host microcomputer has been programmed.

The 'Mimi' (or ear) switch could be used for hands-free control of gadgets for drivers, or as an aid for people lacking movement in their limbs needing a simple means to control household appliances. The inventor, Kazuhiro Taniguchi of Osaka University in Japan, suggests that the sensors could also be used for active monitoring of elderly people, to detect patterns that suggest that the person is unwell and to alert relatives or medical staff.

Taniguchi, who has also invented a switch mounted on glasses that monitors a user's temples, hopes that devices incorporating the new system will be available in two to three years.

Pressure sensitive touchscreens coming

Researchers at New York University have created technology for 'Inexpensive Multi-Touch Pressure Acquisition Devices' (IMPAD). Common mechanisms to capture touch either detect changes in electrical capacitance across a surface caused by the presence of a finger or use cameras.

IMPAD consists of a few, very thin, pressure sensitive layers bonded onto a surface. The main sensing mechanism is formed by a perpendicular array of wires that make contact where the screen is touched, giving the location of the finger or other pointing device. (Capacitive touch screens will only work with a finger.) Measurement of pressure is governed by a coating of force sensitive resistor (FSR) ink, which consists of microscopic bumps that make contact and conduct an electrical current related to the pressure applied.

IMPAD uses wires spaced by quarter of an inch in both the horizontal and vertical planes, considerably reducing the number of electrical connections that must be made. The accuracy of the screen, which the team suggests can be as high as 100 dots per square inch, comes from algorithms that interpolate position using the combination of location and pressure. The algorithms also support multiple touch input. Although the current prototype is opaque, alternative transparent materials could be bonded to a screen to achieve the same result.

Manufacture of touch screens using this approach would be fairly inexpensive, so they could be equally used in a mobile phone or for a touch-sensitive wall. The researchers are considering commercialising the product through a spinoff company.

Intel processor update

Intel's Moorestown platform is aimed at the class of hardware it terms Mobile Internet Devices (MIDs).These sit somewhere between smartphones and netbook PCs, offering highly portable hardware that has some desktop capabilities, especially for browsing the internet, a mobile connection and a very low power drain. Nevertheless, with the development of increasingly fast, sophisticated smartphones and aggressive competition among netbook manufacturers, it remains to be seen whether MIDs will find an adequate niche in the consumer market place.

The 'Moorestown' designs will be based on Intel's Atom processor, launched a year ago, and are expected to come to market in 2010. Even though Moorestown relies on Intel's current 45nm silicon (due to be replaced at the end of the year with 32nm processor technology), the demonstration showed a MID platform running on a tenth of the power taken by an existing Atom design. The 'Lincroft' system-on-a-chip (SoC) processors combine the main logic with graphics, video processing and a memory controller to reduce the length of data pathways. This integration, along with Intel's 'Hi-k' silicon, reduces power consumption and increases processor speed.

Intel also announced new Atom designs for MIDs and said that it expects to release version 2 of its Moblin operating system at the same time as Moorestown. Ars Technica, reporting from the Linux Collaboration Summit, says that Intel is seeking to reduce boot times for systems running Moblin to around two seconds. In addition to MIDs, Moblin is designed for embedded systems such as car computers and other integrated controllers. The governance of the Moblin project was handed across to the Linux Foundation early in April.

VIA, Qualcomm and Texas Instruments are among the companies using their own silicon, or processors from ARM, to build mobile computing platforms.

Intel's first desktop processors based on its latest Nehalem microarchitecture were launched in November 2008. Nehalem embeds the memory controller onto the main processor silicon and uses Intel's QuickPath Interconnect technology to greatly improve data transfers. Intel has subsequently introduced Nehalem to its 45nm Xeon server and high-end workstation lines and has announced a new 8-core Nehalem-EX range that will become available at the end of this year, also for the server market. It is not clear that this will be a 32nm design, but reduction in transistor size would mean shorter data pathways, faster processing and lower power consumption. However, the reduced size of the components creates a higher risk of signal leakage which, in turn, could lead to data errors. Intel's 'Hi-k' silicon used in the 32nm process is designed to reduce such leakage and improve performance.

At the other end of the processor scale, the Nehalem-EP (code-named 'Jasper Forest') is to be incorporated in Intel's platform for embedded applications. According to PC Advisor, the 'EP' stands for 'efficient performance', partly delivered by integrating the input-output hub with the main processor. The platform, which will have single, dual and quad-core versions, is aimed at in-car 'infotainment' systems, industrial automation and storage systems.

Alternative server chips are available from companies such as AMD, while VIA, Qualcomm, Texas Instruments and ARM are among the competitors in the embedded market.

OLPC to use Via processors

The One Laptop Per Child (OLPC) project originally aimed to support education by providing large numbers of laptops to developing countries for $100 (about £70) each. OLPC has announced that its Gen 1.5 build for the XO laptops, which is a technology refresh rather than a complete redesign, will use VIA C7-M processors and associated chipsets, rather than AMD components. The processor can be clocked up to 1Ghz, although lower speeds will improve power consumption and reduce heat generation. Memory will be increased to 1GB (against 256MB now installed) and solid state (flash) storage upgraded to 4GB, with an optional factory-installed 8GB storage available instead. The video and audio have been improved on the new chipset to incorporate better 3D graphics, HD video and HD audio. The OLPC team hope to retain the existing price point (thought to be around $189) and power consumption. The new XO-1 laptops are expected to be available to

developers late in August; meanwhile, the founder of the OLPC project, Nicholas Negroponte, has suggested that an XO-2 remains two years away.

Intel's Classmate reference design is aimed at a similar market segment.

Rapid-charge batteries coming soon

Lithium-ion batteries are found in most portable devices, from mobile phones through to laptop computers. Although lithium-ion largely overcomes the 'memory effect' of older rechargeable alkaline battery technology, such cells still take a long time to charge. Not only is this inconvenient, but manufacturers must make compromise decisions between the weight of a device and charging time - if charging times were reduced to seconds, devices could be made lighter by using smaller batteries.

Researchers at MIT have discovered that materials currently used in batteries can be manufactured in a way that considerably accelerates the passage of the charge-carrying lithium ions. To the surprise of the scientists, they discovered about five years ago that the ions were travelling far below the rates predicted by mathematical models. Further study revealed that the ions moved rapidly through 'tunnels' in the material, but were unable to move across the surface to get to the entrances. The team has now reengineered the structure of the material to allow the ions to flow freely, so they rapidly access the tunnels. The new design reduces charging times by a factor of 20 to 30 (as well as the ability to discharge) and will become commercially available, the team believes, in about three years.

EU tightens rules for power supplies

Transformers used in external power adaptors for laptops, small printers and charging units (used for mobile phones and other gadgets) constantly use power while plugged in to a live socket - this not only wastes electricity but costs consumers and institutions significant amounts of money. New European Union rules, which will come into force in two stages in April 2010 and April 2011, govern the power that can be used while units have no load (in other words not powering or charging a device) and under normal use.

The Techworld report states that, without load, new power adaptors for devices like mobile phones and MP3 players must consume no more than 0.5 watts from next April and less than 0.3W from April 2011. Larger power supplies (rated over 51W) must be at least 86 per cent efficient when providing power, while 'smaller' units are subject to a sliding scale. These new measures align with the Energy Star regulations in the US. According to the EU press release, the power used for adaptors is expected to be cut by nearly a third by 2020 - equivalent to the annual energy consumption of Lithuania, or three million tonnes of carbon dioxide.

Motion sensors put monitors on standby

Computer displays can waste considerable amounts of energy and are a drain on corporate and public sector budgets when left unattended. Modern operating systems can be set to turn off inactive displays after a given period or to turn off the whole system over night. (Liverpool University estimates that 1,600 library-based PCs could be wasting £2,400 per week.)

Monitor manufacturers are taking a variety of approaches to reducing energy consumption of displays. EIZO's method is to fit motion sensors, which have a range of 120cm (47 inches), to two of its latest FlexScan models. These infrared devices will switch the display to 'power save' mode if a person (rather than an inanimate object) is not detected within 40 seconds and will wake it up again when a user is present.

Researchers teach PCs to 'sleep talk'

While switched on, PCs can be either fully on or in some form of standby mode where the processor and all the main functions are basically shut down. Many users find the latter inconvenient, as they want to know if a VoIP call or instant message has come in, or to allow backup and virus-scanning tasks to be performed while the machine is idle.

A researcher from UC San Diego has collaborated with Microsoft and other partners to develop a USB device that takes over network-connected tasks, which need limited processing power, while allowing the main hardware to enter sleep mode. The hardware includes a processor, memory, flash storage and a 'lightweight' operating system. The 'Somniloquy' device effectively impersonates the main PC on the network while the host is sleeping and can buffer downloads, waking the PC when it needs to offload data to the hard drive or to run more intensive tasks. Yuvraj Agarwal estimates energy savings of 60 to 80 per cent, depending on the model of PC, and hopes that the hardware may soon be directly built into network cards, although the current system can be deployed without reconfiguring routers or making significant changes to the host PC. No mention is made in the article about how this system could support disk-intensive tasks like backup and no indication is given of likely costs.

Hardware-assisted malware protection

Intel is researching a security technology that it has dubbed Processor-Measured Application Protection Service (P-MAPS). In the past, the whole of a consumer operating system (OS) has been the trusted environment in which applications operated, but this exposes them to possible attacks from malware. P-MAPS uses hardware to create a 'trusted computing base' (TCB) that is a subset of the entire operating environment, so that an application can run in a separate, secure space.

The P-MAPS system is 'OS agnostic', so it can run with a variety of operating systems, so long as an appropriate service can be called to create a P-MAPS virtualised environment. Intel Trusted Execution Technology (TXT) is built into the chipset, with embedded authentication codes that can be checked to ensure that the P-MAPS environment is not being spoofed by malicious programs. Further protocols allow applications within the TCB to communicate with remote servers and process secure data on the host system.

Software and internet

Analysis: OpenID

At a glance

- OpenID is an open, free, standards-based specification for managing identities on the internet.
- OpenID performs functions similar to Shibboleth, although it does not provide a full single sign-on service.
- Relying parties use OpenID protocols to authorise users against information held by identity providers.
- The same OpenID 'URL' can be used on a wide range of websites.
- OpenID is complementary to OAuth. The latter is an open protocol controlling access to third party data once the user has been authenticated.
- There are competing identity services, but OpenID is becoming increasingly widely recognised.

The identity issue

Storing information on the web, social platforms, email, banking - so many websites require users to log in. Each website has different standards for access - some need user names, others email addresses, a few insist on inclusion of numbers or non-standard characters in passwords - and requirements have changed over time as users have accreted online identities. Regular web users end up with multiple identities but often use the same password for each as they struggle to keep track of the requirements of each site.

Single sign-on (SSO) is supported by a number of systems, notably Shibboleth in many UK educational establishments, in order to reduce this problem. Once the user has signed on to the system, a 'session' cookie is written to the browser's cache while the user is logged on, allowing other sites in the same 'federation' to authorise the user without requiring further identity details. (The Identity article in TechNews September 2007 covered Shibboleth and other identity tools.)

This approach can work well where the organisations involved agree anonymous authorisation protocols and mutual recognition of users' details. Schools and colleges have a particular advantage in this respect as they can be confident that the identity recorded in the institution's access records belongs to a known individual. However, it becomes much more difficult on the 'open' web where users are dealing with completely new sites and providers with unknown users. OpenID is gaining recognition as a credible alternative.

What does an open authentication system offer?

OpenID is an open protocol, now governed by the OpenID Foundation. It is based on a standard that is free to use, so it can be built into any authentication system, and can reduce costs as the identity problem is delegated to a third party. The system is user-centric, in that it relies on the user to provide details to an identity provider and to select how those details are issued to sites seeking confirmation for authorisation.

Neither the sites and services that use OpenID, nor identity providers have to register or become licensed; indeed it is possible for individuals to become their own OpenID providers through embedding appropriate code into a personal website. The system is based on the same underlying technology framework as used to lookup websites from the URL of a page, so there is little new to learn.

The OpenID Foundation believes that this open, free, standards-based approach will draw in users and encourage rapid adoption. Since users will be able to quickly sign up and use a website, it may encourage user-participation in projects and services, although it becomes equally possible for dissatisfied users to move to a competing website.

Principles of OpenID
There are three basic parties in OpenID:

- The website user
- The relying party (RP) - the website requesting an identity check
- The identity provider (IDP) or OpenID provider (OP) - the service authenticating the user's details.

The service works as follows:

- Relying parties advertise the availability of the service using the OpenID logo.
- The user provides an 'identifier' (but no password) in the form of an OpenID URL, such as http://anyuser.openid.idprovider.com.
- The relying party's web server deconstructs the URL by requesting the user's 'web page' from that server.
- Under the popular 'checkid_setup' mode, the web browser is redirected to the identity provider's page to 'log in' using secure HTTPS protocols.
- While logging in, the user confirms that identity credentials should be passed to the relying party. This acts as a basic check against 'phishing' style attacks.
- The identity provider passes control back to the relying party, which will carry out a cross-check to ensure that the credentials have come from the purported identity provider.
- Returning to the website of the same relying party during another browsing session will normally require no further authentication, so long as the user is signed in with the identity provider.

There are an increasing number of OpenID providers, including myOpenID, myVidoop and VeriSign, as well as services, such as Google's Blogger and Yahoo, that are implementing OpenID provision as an optional extension to existing services.

Relationship to OAuth
OpenID is an open protocol that underlies identity verification services, whereas OAuth is an open protocol that authorises data transfers from one service provider to another.

For example, the popular Twitter microblogging service has inspired an array of third party applications that use data from Twitter, many of which currently require provision of your Twitter identity to the third party. This is insecure, as the third party could actually use that information to change contact details, including your password. In future, an OpenID account could be used to log in to Twitter. If a third party wanted your Twitter information to use in another service (such as analysing your Twitter followers or posting links to online photos on your Twitter timeline), OAuth would negotiate that transaction without the third party seeing your Twitter sign-in details. This is a hypothetical scenario at the time of writing, although recent attacks on vulnerabilities in the Twitter service mean that something like it could become reality.

OAuth has maintained a policy of separation from OpenID, although it is often used in conjunction with it. If OAuth became an extension to OpenID, this would require users to be authenticated under OpenID before OAuth could be used; separation allows OAuth to be combined with other identity verification services. OAuth is analogous, to a degree, with the Systems Interoperability Framework (SIF) being piloted for Becta by schools in Birmingham and Northern Ireland.

Barriers to adoption
Services and users already have considerable investment in existing identity services. Although becoming more widely known, adoption of OpenID is only beginning to pick up and many users have yet to hear of it or understand its advantages.

Commercial platforms competing in this general space, including Facebook Connect, Google's Friend Connect, Microsoft's Windows Live ID and MySpaceID, tend to rely on proprietary protocols or are tied in with specific offerings from the associated brand. OpenID will need to gain significant share to provide a realistic alternative. Services, such as Yahoo, that obscure an OpenID login behind commercial branding may be restricting recognition of the advantages of OpenID.

In the educational arena, Shibboleth provides a similar service based on verified identities. The UK Access Management Federation for Education and Research created by Becta and JISC provides a pool of trusted services and identity providers that work together with Shibboleth (and other similar federated or trusted systems) to provide a single sign-on service. OpenID lacks this federated structure that promotes mutual trust between all the players.

Open ID providers can work in any location where they have an internet connection. This raises the pervasive issue of data protection, especially where the identity provider is storing personal data in non-UK jurisdictions.

One of the greatest advantages of OpenID - centralisation of identity management - also makes it vulnerable: a hacker accessing your OpenID records would also be able to enter all your linked sites. (The 'forgot your password' links on normal login pages would provide much the same access if the user's email address was hacked.) Nevertheless, OpenID providers, unlike relying parties, will have security of your identity as a core of their business. Some services provide alternate profiles that the user can expose according to the level of personal detail that a particular site requires.

Future
OpenID appears to be gaining support in the 'social software' space, allowing users to rapidly access and experiment with a variety of Web 2.0 tools. Microsoft has announced its intention to integrate OpenID into its Windows CardSpace identity management technology and PayPal has joined the OpenID Foundation board, signifying growing acceptance of OpenID as a reliable standard for serious commercial use. Regional Shibboleth identity providers could also become OpenID providers, allowing educational users to link blogs and other external resources to educational services, such as e-portfolios. This could bring the anonymous nature of Shibboleth into conflict with OpenID, in that the users' identities could be tracked through their use of OpenID.

Identity management and user authorisation are significant issues in accessing web services, but there remains no single, clear market leader in the field.

Software and internet news

New browser versions - available and in beta

All the major browser developers have recently announced new products, upgrades or test (beta) versions. **Internet Explorer 8** (IE8), which is available for download now, is the latest version of Microsoft's browser. Microsoft claims that IE8 has 'improved security and privacy', as well as faster performance using fewer system resources, and much higher compatibility with official HTML and other internet standards. New features include:

- Visual search suggestions. When a search term is typed into the 'instant search box ', visual representations of pages from the user's favourites and bookmarks, and from sites such as Amazon and Wikipedia, are presented to aid searching.
- Accelerators allow users to right-click on locations to get a map or on words for a definition, as well as providing a link to email highlighted content. Accelerators must be installed to access services in this way.
- Web Slices bring commonly used data into the favourites bar. These are somewhat akin to user-defined RSS feeds, except that website developers must identify appropriate parts of a web page in order to deliver the data.

Add-ons (largely ActiveX controls) and other resources, including directories of Accelerators and known Web Slices, are available from the Internet Explorer Add-ons Gallery. The update to IE8 will eventually be rolled out through automatic

updates, but system administrators can opt out by deploying the Internet Explorer 8 Blocker Toolkit in advance

Much of the development work around browsers is focused on three issues: speed, mobile versions and HTML 5. Speed is particularly governed by the rate at which browsers can handle Java and other script languages that govern the display of many interactive web pages. Developments among the main browsers competing with IE include:

- Apple's **Safari** version 4 for Windows and Mac OS X operating systems.
- Mozilla's **Firefox** version 3.1, which is now in its third beta for Linux, Mac OS X and Windows. Although the beta is called v3.1, the release version is likely to be known as v3.5.
- Mozilla have stated that the next Firefox version after 3.5 will be targeted for release by mid-2010. Although known as v3.6, they suggest it should be referred to as **Firefox.next**.
- The mobile version of Firefox, known by its codename **Fennec**, has begun its first cycle of beta testing. The latest version is available for the Maemo operating system on Nokia's N810 internet tablet, although emulated versions are available for Linux, Mac OS X and Windows.
- Opera Turbo is being tested to improve performance on slow internet connections. **Opera** have identified the trouble that many users experience when browsing the internet across slow mobile connections as a development priority. Opera Turbo redirects traffic (except secure connections) through Opera's servers, compressing content to reduce bandwidth requirements and increase speed.
- Google has reintroduced a 'beta channel' for **Chrome** so it can try out enhancements. Google claims that the version released in mid-March is 25 per cent faster compared to the 'stable' version on general release. Ars Technica reports on the open source project to bring Chrome to Mac OS X.

New standard for 3D web browsing under development

3D environments are growing in popularity for virtual worlds (such as Second Life), games and more serious applications. Companies, for example Lateral Visions, have created 3D interfaces for websites (using browser plug-ins) which users can explore, navigating with mouse and cursor keys to examine objects and visit related sites.

Khronos and Mozilla have joined together to produce an accelerated 3D web applications standard that they hope will be in place next spring. The aim will be to make the OpenGL graphics language, available through all mainstream desktop operating systems, work with ECMAScript (or similar) to produce 3D effects. (ECMAScript is the overarching standard to which JavaScript - used to produce AJAX web applications - is linked.) Mozilla also proposes the use of OpenGL ES, the subset of Open GL for embedded systems and mobile devices, to make such applications work across many types of hardware.

Fast 3D graphics would enable more complex visualisations of design ideas and data over the internet, allow users to browse websites as 'rooms', make online game

creation easier and could give rise to many more types of virtual world for educational and social interactions.

MultiPoint enables multiple interaction in Windows

Providing adequate technology for classes of pupils puts pressure on budgets - a problem that is generally far more acute in developing countries. A range of technology is available, for example NComputing's X-series devices, to share the processing power of a single PC between several sets of screen, keyboard and mouse.

Microsoft Research in India has taken a different approach with its MultiPoint software development kit (SDK) by allowing multiple users to share a single screen. The software hides the default windows cursor and creates individual pointers for multiple mice. Microsoft says that the system has been trialled with 30 to 40 mice working simultaneously and that there is nothing in principle to prevent extension of the idea to multiple keyboards. Programming using the SDK requires .NET and Microsoft's Visual Studio 2005 with WPF extensions.

Activities referred to by the developers in Microsoft's Channel 9 video clip generally envisage each user 'owning' a portion of the screen in which Flash games and other activities run for that user. However, another video show pupils using the Mouse Mischief software for polls, puzzles, creation of images and fill-in-the-blank activities. Many of the resources were originated by teachers using PowerPoint. Microsoft sees this as a way of engaging pupils using the same computer as they collaborate - the social element of learning could be beneficial rather than a distraction. There may be exemplars and lessons to be learnt from this software that could be applied to multi-touch environments.

Microsoft has a range of videos and case studies based on use of MultiPoint in India, the Philippines, Vietnam and Chile on the MultiPoint microsite. The company is involved in a project with 140 pilot schools in Thailand, where the education authorities are looking to roll the system out to 14,000 computers, with the aim of maximising the utility of that hardware.

Social Desktop to drive collaboration

Microsoft Research has been developing the Social Desktop. This software allows users to share documents stored on a local drive with collaborators across the web: each document gets its own URL, a preview and a space for comment and annotation. The system relies on Microsoft's Azure web service to store the public elements, the Silverlight environment for display and interaction, and a live internet connection to the computer hosting the original file.

Collaborators can view a document or folder in Social Desktop on any computer with a Silverlight-enabled browser, without knowing the location of the file on the host computer or the structure of its filing system. URLs can be published by any means, including email, social networks and micro-blogging services, and permissions can be added to control access; tags and other metadata are stored online to facilitate

searching. An introductory Microsoft Channel 10 video can be seen on YouTube. Microsoft currently categorises the project as 'proof of concept'.

Games trends

Delivering educational content can have similar issues to distributing games - engaging content is often interactive, uses rich multimedia and requires substantial bandwidth to download. (Of course, educational content need not share these features to be effective.) This type of content is often sold on a DVD but requires an internet connection to download the latest patches. If delivered entirely over the internet, the total package could take hours to install and take users over download limits related to the service they have purchased.

AWOMO speeds up the gaming experience by prioritising content that the user needs at the beginning - especially an installer and the main executables (already patched to the latest version). Once the user has begun playing the game, other content, such as the next levels and video 'cut scenes' between levels, which often comprise the bulk of big game installations, can be downloaded in the background. The service adapts the rate of buffering onto the user's local disk according to the speed of the internet connection. This approach also means that users who decide not to finish a game will not have the 'unused' content downloaded to their hard drive, saving download capacity as well as disk space.

One of the most popular 'first person shooter' games of the 1990s, Quake, has been re-engineered to play inside the browser. Quake III is now available as a free, ad-supported 'arena' game (without 'mission'-style levels) through the Quake Live website. The game, which runs in real time via a browser plug-in, demonstrates the level of graphical sophistication now possible in content delivered over the web.

InstantAction, which also delivers games through the browser, has just come out of beta. According to a report on CNET News, Brett Sayler from InstantAction said that the browser-based environment allowed players to pick up game play from any PC, that it should reduce illegal copying and would let smaller game developers trial ideas without the investment costs associated with big game launches.

Another online service, OnLive, will be running beta tests over the summer with a view to rolling out across the US late in 2009. Gamers on the subscription service will be able to use a variety of devices to play versions of retail games online, but will need an OnLive MicroConsole to use a standard television. The company says that game play on a television will require a 1.5Mbps connection to stream the live video content, while HD resolution (720p at 60 frames per second) will need at least 5Mbps. Games will run in a data centre, where any software updates can be applied, while users' PCs will effectively act as thin clients. (See TechNews January 2009 for more on thin clients.) According to a BBC report, the company has developed specialist video decoding processors for their MicroConsoles that cost less than $20 to manufacture. In order to limit latency (delay between the user's actions and the response on screen) to under 80ms, OnLive aims to have five data centres across the USA, putting most of the population with 1,000 miles of one of their servers. Video compression will inevitably mean some minor 'artefacts' will appear on screen

Entropia Universe is the first online game platform to be given a banking licence. Entropia delivers a communal, 3D gaming experience over the web, although gamers must download a 1.3GB client to participate. A variety of 'planets' are planned, in addition to the current Planet Calypso, in which items can be bought and sold using Project Entropia Dollars (PEDs). Mindark, the developers, say that the currency will have a fixed exchange rate of ten PEDS to one dollar. According to BBC News, the Swedish banking authorities, who have issued the licence, will back deposits to the in-world bank with a guarantee up to (approximately) £42,000.

Ars Technica covers a report from NPD Group showing that a quarter of the people they surveyed played online games and that nearly 90 per cent of these used a PC. The number playing online had increased significantly from the previous year (up 6% overall). After the PC, the most common systems were Microsoft's Xbox 360 and the Nintendo Wii.

Research by YouGov for the British Board of Film Classification (BBFC) says that three quarters of parents want to see games controlled by an independent regulator. Reporting the research, PC Advisor states that nearly 80 per cent believe that images from games affect children's behaviour.

New educational video content channels

Google's YouTube video service has launched an 'EDU' microsite featuring content from academic providers. Most of the institutions currently signed up are US universities and colleges, but there are many useful videos available across a wide range of subjects and further partners are asked to express an interest. Effectively, the service is a directory and index of existing YouTube channels; therefore, automatically permitting unfiltered access to only the EDU content may prove difficult. YouTube said this began as a 'volunteer project'.

Academic Earth is a completely new service that provides free videos of selected lectures from six of the 'top' American universities, although there is an open invitation for other institutions to become partners. Content is indexed by lecturer as well as by subject, with a total of more than 1,500 videos, many of which can be downloaded. Lecturers are currently open to all visitors, but the site has a registration facility for creating personal favourites, which could be used in future to provide additional services.

New common IWB format released

Interactive whiteboards (IWBs) from a number of different manufacturers are available in numerous classroom and lecture theatres in education. In the past, it has been difficult to transfer content, other than standard presentations, from one type of board to another, as each uses its own proprietary file format.

All the UK vendors have worked with Becta to create the new interactive whiteboard common file format, which defines the way many types of interactive content can be shared between teachers using different types of hardware. In addition to interaction between the user and basic shapes, the format extends to linked documents and

websites and to multimedia elements including audio, video and Flash activities. The file format contains details of packaging of content ready for use by IWB software and an XML structure for the defined elements.

Google Street View available for UK

Google's Street View service has arrived in the UK and caused controversy. The widening of Street View to the UK and Netherlands was announced by Google in mid-March, with coverage of the largest cities and some tourist destinations like Oxford and York. The Street View cars, with a set of cameras on their roofs to take regular shots all around the vehicle, have also been to some rural areas around Aberdeen, Belfast and Norwich, so geographers have plenty of opportunity to compare locations within and between countries. (Other countries that already have some coverage include US, France, Spain, Italy, Japan, Australia and New Zealand.)

The controversy has arisen from people recognising their own homes and people on streets. Google has a policy of automatically blurring faces and car number plates, although it has not always been totally effective, but they also say that they will remove any image on request. Villagers in Broughton, near Milton Keynes, objected to a Street View car covering their village, based on privacy fears and a perception that it could facilitate crime.

Street View has wide curriculum applications, including enabling learners to match photos to features on maps; to compare locations; to use as a backdrop to imaginative writing; and to discuss civil liberties and privacy.

Europeans will use internet more than TV by 2010

Europe logs on, a report based on research carried out for Microsoft, says that Europeans will be using the internet more than watching television by June 2010. Among other statistics, it says that:

- Internet use in 2008 accounted for 1.5 days per month of the average European's time, up 27 per cent from 2004.
- The PC is declining as the device used to access the internet and will account for only half of all access in five years' time.
- Just over a quarter of Europeans watch video (either short clips or full length).
- For young adults - or 'generation digital' as the report calls them - 'TV means video, delivered on demand. In fact, one in seven 18-24 year-olds now watch no live TV at all'.

In the UK, BBC News cites Hitwise statistics showing YouTube and the BBC iPlayer as the top UK video destinations, with the latter growing over 150 per cent in twelve months. Although most of the content on iPlayer is video, a tenth of visitors are now coming from BBC Radio websites, with the Archers particularly popular. Many searches relating to music now use YouTube as a surrogate search engine, rather than dedicated music sites, putting it in second place to Wikipedia for such information.

These statistics further emphasise the trend towards consumers using internet rather than 'traditional' media, of rapidly growing video consumption and a move towards mobile hardware as the device of choice. Learners will increasingly have this technology in their hands and will expect to find information through these means.

The tribes of mobile gadgeteers

The Pew Internet and American Life Project has produced *The Mobile Difference*, a report into the gadget preferences and mobile lifestyles of groups within the US population. The report defines two sets of five cohorts.

Adults '**Motivated by Mobility**' (39%):

- **Digital Collaborators** (8%) who prefer to use technology to collaborate and share their creativity with others.
- **Ambivalent Networkers** (7%) who are heavy users of mobile devices, but who can be irritated by how they impact on their lives.
- **Media Movers** (7%) who like to create or seek out and record interesting digital 'nuggets' to pass them around their online social networks.
- **Roving Nodes** (9%) who use mobile devices to manage their lives, especially through email, SMS and websites.
- **Mobile Newbies** (8%) who are new to the mobile digital world, but like to be a part of it, especially using their new mobile phones.

Adults who are the '**Stationary Media Majority**' (61%):

- **Desktop Veterans** (13%) who prefer landline and other cabled access for regular access to digital information.
- **Drifting Surfers** (14%) who are light users, familiar with a range of technology but who say they would be happy without it.
- **Information Encumbered** (10%) who find that there can be too much information online and often feel inadequate to deal with technological problems.
- **The Tech Indifferent** (10%) who are unenthusiastic about digital lifestyles, although most have a mobile phone.
- **Off the Network** (14%) who do not have the technology - they may never have had it, or the may have become disenchanted with it.

The report emphasises the difference in attitude to mobile technologies between the two major groupings, aligning each of the ten cohorts with a typical demographic and the types of technology they prefer. While these groups could be seen as somewhat artificial constructs from data which overlap in reality, it is worth considering that both learners and educators will often tend to display characteristics of one cohort. Although the exact figures will be different in the UK, this report underlines the growing awareness of learning preferences and can inform the way that new technologies are introduced, supported and built into institutional environments.

TechNews Information

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