

## January 2005

**TechNews** is a technology, news and analysis service aimed at anyone in the education sector keen to stay informed about technology developments, trends and issues. Please navigate the newsletter by clicking on items within the table of contents below.

<b>Networking and wireless</b> .....	2
<b>Analysis:</b> Ultra Wideband (UWB).....	2
<b>Networking News</b> .....	3
Broadband Regional Aggregation Boards (RABs) close.....	3
Ofcom publishes spectrum framework review.....	3
LLU pricing fixed.....	3
40% of people no internet access in 2025.....	3
3.5G trials in UK.....	4
3G criticised by Which?.....	4
ZigBee ratified.....	4
WiMAX developments.....	4
European satellite positioning system to launch.....	4
MPLS market to double in four years.....	5
<b>Multimedia</b> .....	5
<b>Analysis:</b> OLED.....	5
<b>Multimedia News</b> .....	6
European digital content initiative.....	6
Research shows digital prints to overtake film prints.....	6
Study says inkjet photo printing better and cheaper than high street.....	6
Open digital media framework announced.....	7
Camraphone developments.....	7
Blu-ray vs. HD-DVD.....	7
Anti-scratch layer for optical disks.....	7
Digital content key to broadband services.....	7
Video search developments.....	8
iPod in education.....	8
<b>Hardware</b> .....	8
<b>Analysis:</b> Battery technologies and micro fuel cells.....	8
<b>Hardware News</b> .....	9
DfES ICT in Schools Survey 2004 published.....	9
Intel to launch 64-bit desktop processors in 2005.....	10
Dual Core chips in 2005.....	10
Cell Chip.....	10
IBM sells PC division.....	10
Moderate growth to push prices down in 2005.....	11
PC usage to double by 2010.....	11
New USB Flash drive form factor.....	11
Micro MMC flash cards.....	11
PCI Express "2".....	11
<b>Software and Internet</b> .....	12
<b>Analysis:</b> Linux on the desktop.....	12
<b>Software News</b> .....	13
New Becta email bulletin for content developers and providers.....	13
Libraries warned over new ISBN system.....	13
Analysts warn licensing costs could go up 50%.....	13
Microsoft to release 64-bit Windows and Server 2003 update in 2005.....	14
Google to digitise academic libraries.....	14
ICANN moves new domain names closer.....	14
Instant Messaging "threat centre" established.....	14
Linux server growth.....	14
New organisation to promote Open Source in the public sector.....	15
Wikinews.....	15
<b>TechNews Information</b> .....	15
Disclaimer:.....	15
To unsubscribe:.....	15
Feedback:.....	15

## Networking and Wireless

### **Analysis: Ultra Wideband (UWB)**

Ultra Wideband (UWB) is an emerging wireless technology that is expected to become widespread over the next few years. It has the potential to be a transformational technology, providing high speed wireless connections for a variety of devices, such as PCs and peripherals, handheld devices, mobile phones and wireless home multimedia systems (TVs, set top boxes, hi-fis, media servers). However, the IEEE 802.15.3a standards process for UWB has reached an impasse, with two groups of companies competing for their implementation of the technology to become the standard. It now seems likely that the matter will be decided in the market place, although a compromise standard incorporating both implementations has not been completely ruled out.

UWB technology has been around for a long time and has been used by the military for communications and radar applications. Ultra Wideband is based on pulsing a signal in very short bursts across a very wide bandwidth. Data is sent by altering the amplitude, phase or position of the pulses. OFDM and frequency hopping techniques have also been developed, which spread the bandwidth across different frequencies. The bandwidth can range from 500 MHz to several GHz. Unlike other radio technologies UWB does not need a carrier frequency. The spectrally wide signals have a very accurate spatial resolution and so can provide precise location information. UWB is largely a software defined technology using simple radio transmitters and could also be used to send signals over wires.

The current development of Ultra Wideband as a technology to connect devices and exchange digital media stems from the US FCC regulator's decision to make UWB spectrum commercially available. The specifications set out by the FCC have guided the commercial development of UWB. The FCC has allowed UWB to operate in the frequency ranges of 3.1GHz to 10.6GHz. Because it operates across a wide frequency range, the FCC has specified that it needs to transmit with extremely low power (-41dBm/MHz) to avoid interference with other wireless communications. These restrictions largely limit the uses of UWB to short range applications of around 10m. Therefore it is primarily seen as a cable replacement technology for Personal area Networks (PANs) and as a multimedia networking technology for streaming video and music in the home.

The US is so far the only country to have set specifications for UWB. The UK's regulator Ofcom is taking a lead on UWB in Europe and put forward proposals in December. These are broadly similar to the FCC rules but tighten up the regulations on interference. A draft European specification is expected in March 2005.

Two groups of companies, the Multi band OFDM Alliance (MBOA) and the UWB Forum are vying for their solution to become the UWB standard. The standards impasse has caused the MBOA, led by Intel and Texas Instruments, to create their own PHY and MAC layers outside of the standards process. This is competing with the Direct Sequence (DS-UWB) CDMA based UWB technology put forward by the UWB Forum and led by Freescale (a Motorola spin off).

The WiMedia Alliance (WMA) has backed the MBOA group and is developing a convergence layer that will allow UWB implementations such as wireless USB (developed by the Wireless USB Promoter Group) and wireless Firewire (1394 Trade Association ) to work with the UWB "standard". It is these cable replacement uses at speeds of up to 480Mbps that are expected to see the first mainstream applications. UWB multimedia home networking applications may see competition from Wi-Fi that has become familiar to many consumers and a faster version of Wi-Fi (802.11n) is expected in 2007.

DS-UWB is expected to be first to market as Freescale has released its first UWB samples to manufacturers. Freescale has an aggressive roadmap to boost speeds from 110Mbps to 1Gbps. Also, the UWB Forum has already had its chips approved by the FCC, unlike the MBOA solution.

Analysts have slightly different views about the likely success of UWB. IDC has been positive predicting growth of 400% from 2005 to 2008. They expect UWB to be successful despite the lack of a single standard. However, a study by ABI Research was more cautious commenting on the lack of a standard, higher than expected chip prices and threats from other emerging technologies. Most

believe that the MBOA group has the edge over DS-UWB because of the backing of large numbers of consumer electronics, computer and mobile phone companies. MBOA also has the Firewire and USB implementations backed and overseen by the WiMedia Alliance and Wireless USB Supporter Group. The 140 or so companies in the MBOA group should be able to provide a large array of complementary and interoperable UWB products and the marketing and branding to accompany them.

Unwiring is an increasing trend. The growing numbers of digital cameras, camcorders, digital music and video devices would benefit from a simple, robust high speed wireless link that could help reduce the proliferation of interfaces. Compatibility between devices will be the key to the success of UWB. Without an IEEE standard, the MBOA UWB group will have an advantage that could leave DS-UWB seeking different applications and a differentiated brand if it is to be successful. The first UWB products may appear by the end of 2005, but it is not expected to ship in numbers until 2007.

[http://www.intel.com/technology/ultrawideband/wireless\\_pb.pdf](http://www.intel.com/technology/ultrawideband/wireless_pb.pdf)

<http://www.uwbforum.org/>

<http://www.multibandofdm.org/>

## Networking News

### **Broadband Regional Aggregation Boards (RABs) close**

The DTi has closed the national aggregation board that oversees the process of combining public sector spending on broadband to lower prices. The fate of Regional Aggregation Boards (RABs) has been left in the hands of Regional Development Agencies. The boards have failed to achieve the savings on public sector broadband originally anticipated. So far only £3.5 million has been saved by RABs instead of the £200 million originally envisaged. The South West and North West RABs have announced that they are to close.

[http://www.adit.gov.uk/news\\_005.htm](http://www.adit.gov.uk/news_005.htm)

### **Ofcom publishes spectrum framework review**

The communications regulator Ofcom has published its review of the radio spectrum in the UK. Ofcom has made several proposals aimed at encouraging innovation and improving the efficiency of spectrum allocation that constitute a major overhaul of current regulations. Ofcom intends becoming technology neutral, allowing the market to decide the appropriate use of particular frequencies. Other proposals include recommendations for licensed spectrum to be traded on the open market, allowing license holders to sell their rights to other companies. More spectrum is to be made license exempt. Ofcom proposes liberalising 70% of the radio spectrum over time. Ofcom will maintain control of spectrum needed to meet international obligations.

[http://www.ofcom.org.uk/media\\_office/latest\\_news/nr20041123](http://www.ofcom.org.uk/media_office/latest_news/nr20041123)

### **LLU pricing fixed**

Ofcom has announced a new set of charging schemes for local loop unbundling (LLU) that could help to lower broadband prices and increase the availability of new services. LLU is the process in which internet service providers and telecoms operators can provide services direct to customers using BT's copper wires from local exchanges. Ofcom has been unhappy with the progress on LLU and began a review of LLU in May, since when charges made by BT to rival companies have fallen 70%. The new lower fixed prices came into force on January 1. The number of unbundled lines has more than doubled to over 26000 since May. Ofcom has set a target of 1 million unbundled lines by summer 2006. Several major companies have begun to invest in LLU and are offering users on unbundled exchanges faster broadband speeds and new services such as broadband television and voice over IP (VoIP).

[http://www.ofcom.org.uk/media\\_office/latest\\_news/nr\\_20041216](http://www.ofcom.org.uk/media_office/latest_news/nr_20041216)

### **40% of people no internet access in 2025**

According to a study by BT, 40% of the UK population will still not have home internet access by 2025. Currently around 50% of the population do not have internet access at home. The report suggests that the continuing digital divide will cause many to miss out on education and government services. Those on low incomes, the disabled and elderly are least likely to have internet access. A

new body, the alliance for Digital Inclusion has been set up to tackle the problem (see TechNews Autumn 04).

<http://news.bbc.co.uk/2/hi/technology/4076717.stm>

### **3.5G trials in UK**

mmO2 expect to launch High Speed Downlink Packet Access (HSDPA) services on the Isle of Man in the summer, before a European wide roll out. HSDPA, also known as 3.5G, is an upgrade to W-CDMA 3G mobile phone networks allowing much higher data rates than the current 384Kbps. The pilot is being carried out with Lucent Technologies and will use their IP Multimedia Subsystem (IMS). HSDPA has a maximum data rate of 14.4 Mbps, but client device limitations will initially restrict this to 3.6Mbps. Mobile phone network operators are looking to introduce HSDPA sooner than originally anticipated because of the challenge from new technologies such as EV-DO, Wi-Fi and WiMAX.

[http://www.mmo2.com/media/pr\\_041205.asp](http://www.mmo2.com/media/pr_041205.asp)

### **3G criticised by Which?**

A recent report by the Consumer Association magazine Which? has advised users to postpone buying third generation (3G) phones until the services and handsets improve. The report highlighted poor network coverage outside major cities and bulky handsets as the main issues. 3G phones offer faster connections and new multimedia services such as video calling. Orange launched their 3G service in December, joining 3 and Vodafone. None of the handsets tested by Which? achieved a best buy award.

[http://trial.which.co.uk/audio\\_visual\\_equipment.php?id=453?source\\_code=j8uw04](http://trial.which.co.uk/audio_visual_equipment.php?id=453?source_code=j8uw04)

### **ZigBee ratified**

The specification for ZigBee, a wireless sensor network technology based on IEEE 802.15.4, has been ratified by the ZigBee Alliance. The ZigBee Alliance is a trade body that will oversee testing and certification for ZigBee products. Products meeting the new specification are expected soon. ZigBee is intended to be a low cost, low power, low data rate wireless networking standard for sensor and control networks. The technology will primarily be used for industrial sensor networks and building control systems, such as security systems, smoke detectors/alarms, and heating and lighting controls. ZigBee enabled products create mesh networks, routing traffic via other devices. ZigBee works in the 2.4GHz band and provides maximum data rates of 250 Kbps, meaning that it should not compete with other wireless technologies. A report by ABI Research predicts that ZigBee enabled devices will number one million in 2005, but jump to 80 million by the end of 2006.

<http://www.zigbee.org/en/press/>

### **WiMAX developments**

A recent report from TelecomView predicts that WiMAX could compete directly with 3G mobile networks and fixed line broadband access (DSL, cable). WiMAX is based on IEEE 802.16-2004, which was ratified in June 2004. It is a standard for fixed wireless broadband access with maximum data rates of 72Mbps and a range of up to 30 miles. A mobile version of the standard is in development (802.16e), but is not expected until 2006/7. The TelecomView report suggests that WiMAX will have 40% of the wireless broadband market by 2009 and compete with fixed line services. Two wireless broadband companies, Telabria and Libera, are beginning to roll out WiMAX services in the UK.

<http://www.telecomview.info/acatalog/Report.html>

[http://www.telabria.com/aboutus/downloads/telabria\\_wimax\\_nov04.pdf](http://www.telabria.com/aboutus/downloads/telabria_wimax_nov04.pdf)

### **European satellite positioning system to launch**

The European Council has agreed to launch a satellite positioning system called Galileo. The system is expected to begin operating in 2008 and will provide an alternative to the US controlled Global Positioning System (GPS). Europe has reached an agreement with the US to make the two systems interoperable. Many countries have been concerned that GPS is controlled by a single state.

Previously the USA has deliberately degraded the accuracy of GPS and even shut the system down in order to assist its armed forces. The agreement with the USA will allow either side to jam signals in a limited area, such as a war zone. The Galileo system should provide more accurate positioning information and better coverage than GPS. It is expected to drive investment in positioning

technology that could be built in to an increasing number of devices. Location Based Services (LBS) have a number of applications beyond basic navigation and several educational projects (e.g. Savannah) have investigated their use.

[http://europa.eu.int/comm/dgs/energy\\_transport/galileo/intro/future\\_en.htm](http://europa.eu.int/comm/dgs/energy_transport/galileo/intro/future_en.htm)  
<http://www.mobilebristol.co.uk/Savannah.html>

### **MPLS market to double in four years**

A recent report from the Yankee Group predicts that the Multi Protocol Label Switching (MPLS) router market will almost double to £1.5 billion by 2008. MPLS is designed to improve the routing and management of data packets. MPLS routers can read the headers on data packets and route them more efficiently according to Quality of Service and Class of Service categories. MPLS is being driven by the demands of new services such as voice and multimedia.

<http://www.computerweekly.com/articles/article.asp?liArticleID=135577&liFlavourID=1>

## **Multimedia**

### **Analysis: OLED**

Organic Light Emitting Diode (OLED) displays have received increasing attention in recent years. This emerging display technology has recently begun moving from research labs into products. Analyst firm iSuppli predicts that the OLED market will be worth \$430 million in 2004 up 74% from 2003. By 2010 they estimate the market could be \$4 billion. However, the technology still has several issues to overcome and it remains unclear whether it can challenge established alternatives such as LCD-TFT and plasma displays.

Over 100 companies are now involved in OLED display development, but most have licensed one of two versions of the technology: small molecule OLEDs developed by Kodak or polymer versions (Light Emitting Polymers) licensed by Cambridge Display Technology. OLED displays place thin layers of carbon based films (emissive layer) between a metallic cathode and a transparent anode. When a current is passed through the cell, positive and negative electrons recombine with the materials in the emissive layer and produce red, green or blue light, a process called electroluminescence. Small molecule OLED displays have their layers deposited using vacuum chambers. Polymer (chains of molecules) OLEDs have molecules suspended in liquid, which can be "printed" onto substrates.

OLED displays potentially have several advantages over existing flat panel technologies. OLED displays are capable of producing extremely bright, high contrast images with a wide viewing angle and fast response times. Crucially, OLED displays emit light rather than selectively blocking it as with LCD based screens. This makes OLED technology power efficient and helps reduce the size and weight of displays. OLED displays typically use 3 times less power than an equivalent LCD-TFT device.

The ultimate goal is to develop flexible display substrates with polymer transistors. Several prototypes of this kind of technology have been demonstrated. This would be a transformational technology allowing cheap displays to be used in new contexts and environments. The US Defence Advanced Research Projects Agency (DARPA) has invested heavily in this area. Flexible OLED displays (FOLED) could be rolled up and carried in a pen-style device; displays could be shaped to fit the contours of products or a building allowing almost any surface to become an electronic display.

However, there are several issues facing OLED technology. Firstly, there are several technical problems to be overcome. The lifespan of OLED materials (especially blue) cannot yet match that of LCD/plasma making them less suitable for continuous use applications. However, OLED displays are being used in mobile phones, cameras and PDAs, which are typically only used for short periods each day. Developers are working on new materials to improve lifetime, brightness and power efficiency. OLED materials are also susceptible to damage by oxygen and water posing manufacturing and encapsulation problems.

Secondly, by the time OLED displays are likely to be ready for the mainstream in 2007/8, it may be difficult to compete with the established alternatives on price and performance. The quality and power efficiency of LCD-TFT and plasma displays continues to improve as prices fall. Manufacturers have invested heavily in these technologies and will want to continue to see returns for some time to come. OLED displays may also face competition from other emerging display technologies such as electronic paper, mini projectors and Field Emission Displays (FEDs).

In 2003 Kodak launched the first mainstream device using a full colour OLED display. Other companies have used limited colour displays in shavers and car stereos. More recently OLED displays have appeared in mobile phones (Fujitsu, Sanyo) and MP3 players. Earlier this year Sony began mass production of 3.8" OLED displays which it has incorporated into a new PDA. This move was earlier than predicted by many analysts and has improved the roadmap for the technology. Although Philips, Samsung, Seiko Epson and others have demonstrated much larger displays, these are not expected to be mass produced until at least 2007. Philip's PolyLED division, are developing inkjet manufacturing processes that allow displays to be printed onto a substrate. It is this kind of "roll to roll" manufacturing process that could enable efficient manufacturing and allow OLED to compete with more established technologies.

It now seems unlikely that OLED technology will replace LCD-TFT in the near to medium term. Initial applications should continue to be small displays for battery powered devices. Larger displays may emerge in 2007/8, but these will remain complementary to other technologies. However, the eventual emergence of flexible displays could enable a whole new set of display applications.

[http://www.kodak.com/eknec/PageQuerier.jhtml?pg-path=1473/1481&pg-locale=en\\_US](http://www.kodak.com/eknec/PageQuerier.jhtml?pg-path=1473/1481&pg-locale=en_US)

<http://www.cdtitd.co.uk/>

<http://www.sony.net/SonyInfo/News/Press/200409/04-048E/>

## **Multimedia News**

### **European digital content initiative**

The European Commission has launched a Network and Electronic Media (NEM) initiative to create a long term strategy for digital content creation and distribution. NEM will encourage open standards and interoperability so that users can have digital content delivered seamlessly from any source to any device. Digital Rights Management (DRM) is seen as one of the major issues to overcome. The initiative is being backed by major telecoms and broadcast companies.

<http://www.nem-initiative.org/Default.asp>

### **Research shows digital prints to overtake film prints**

A recent report from analysts IDC predicts that printing of digital images will overtake that of film in 2006. IDC estimates that of the 86 billion prints made in 2004, 31 billion would be from digital files, whereas 55 billion would be from film. In 2006 51% of prints should be from digital sources, reaching 71% by 2008. The analysts predict that home printing will decline from 69% of digital prints in 2004 to 43% by 2008, chiefly due to the better value offered by high street and web based photo services. However, many digital images are never printed at all, being stored on computers and other devices, sent by email or simply deleted. Sales of digital cameras in 2004 surpassed that of traditional analogue models for the first time.

[http://news.com.com/Film+use+fading+like+an+old+photo/2100-1041\\_3-5483832.html?tag=cd.hed](http://news.com.com/Film+use+fading+like+an+old+photo/2100-1041_3-5483832.html?tag=cd.hed)

### **Study says inkjet photo printing better and cheaper than high street**

An investigation by PC Pro magazine has found that printing digital photos on inkjets can produce better and cheaper results than the high street or online services. The magazine tested various inkjets and found they produced good results that could be more fade resistant than photos from commercial printing services. The report found that commercial services were less expensive for 6x4 inch prints, but that anything larger was more cost effective on inkjets. The magazine also recommended using manufacturers' own ink cartridges to produce the most fade resistant prints.

<http://www.pcpro.co.uk>

<http://news.bbc.co.uk/1/hi/technology/4092653.stm>

### **Open digital media framework announced**

IBM, in conjunction with several partners including Adobe, Apple and Cisco, has announced a new digital media framework based on open standards. It is designed to give organisations "the most advanced capabilities to create, manage and distribute rich media content faster, easier and at lower cost." It is intended to help with the management and distribution of media files across different systems. It supports Java, J2EE, ISMA, 3GPP, MPEG, XML, Linux and H.264 Advanced Video Coding. New standards will continue to be added. The framework includes technology from the partner companies, in addition to IBM.

[http://www.marketwire.com/mw/release\\_html\\_b1?release\\_id=75030](http://www.marketwire.com/mw/release_html_b1?release_id=75030)

### **Cameraphone developments**

More digital cameras are sold incorporated into mobile phones than as stand alone devices. The performance of cameraphones continues to improve and is beginning to challenge low-end digital cameras. Earlier this year Samsung unveiled a 5 megapixel cameraphone and now Panasonic is set to move 3 megapixel models to the mainstream. Their Maicovicon camera module combines the camera sensor, digital signal processor (DSP), image stabiliser and infrared focusing in one small unit allowing for more powerful cameraphones without extra bulk. The unit is based on Molded Interconnect Device (MID) technology and claims to be more light sensitive than CCD or CMOS solutions. Other companies such as Varioptic and Philips are working on liquid (oil and water) camera lenses, which with no moving parts consume little power and can be made extremely small.

<http://www.digit-life.com/news.html?111645>

<http://www.varioptic.com/>

<http://www.research.philips.com/newscenter/archive/2004/fluidlenses.html>

### **Blu-ray vs. HD-DVD**

The competition to create the standard for next generation optical discs has seen several developments. Both of the competing technologies use blue lasers that focus a smaller beam than the red lasers in standard DVD devices allowing data to be packed more densely onto discs. The Blu-ray group backed by Sony, Philips, Panasonic and other major manufacturers has been boosted by TDK's new protective layer (see below). HD-DVD backed by Toshiba, NEC and Sanyo has the advantage that production of the discs will be very similar to current DVDs, allowing existing manufacturing facilities to be easily modified, reducing costs. HD-DVD has also been boosted by support from several Hollywood studios that could be crucial in determining the success of the two formats. Warner, Paramount, Universal and New Line Cinema, representing 45% of DVD output, have backed the format. However, Disney, Sony/MGM and Twentieth Century Fox have already backed Blu-ray and the standard is also supported by HP and Dell. The development of higher capacity optical discs is being driven by the growth of High Definition Television (HDTV). Standard Blu-ray discs are 12cm and can hold 25GB as opposed to HD-DVDs 20GB. Toshiba has also developed a dual disc system holding both DVD and HD-DVD content and JVC has developed a similar disc for Blu-ray. These would allow users to start building up a future-proof collection of high definition content without having to buy currently expensive HD-DVD players.

<http://www.blu-ray.com/>

<http://www.cdrinfo.com/>

### **Anti-scratch layer for optical disks**

TDK has developed a new anti-scratch coating for optical discs that should protect easily damaged DVDs and could help the emerging Blu-ray next generation format. TDK is already selling recordable DVDs with the new coating. They cost six times the price of standard DVD-Rs, but prices are expected to fall quickly. The Blu-ray Association is also backing the new coating. The data on Blu-ray discs is nearer the surface than with HD-DVD discs allowing greater capacity, but making them more vulnerable to damage. The new coating could avoid the need for protective cartridges for Blu-ray discs that would have been disliked by device manufacturers and users.

[http://news.com.com/Try+scratching+this+DVD/2100-1041\\_3-5455621-2.html?tag=st.next](http://news.com.com/Try+scratching+this+DVD/2100-1041_3-5455621-2.html?tag=st.next)

### **Digital content key to broadband services**

Analysts Ovum have said that content will be a major area for telecommunications companies over the next few years, but that the move from simply delivering network connectivity to providing compelling content that users will pay for is not straightforward. BT has recently announced the launch of BT Entertainment set up to provide broadband entertainment and educational content such as video on demand, games and online learning to users. The company believes that broadband is more suited to on demand services rather than "broadcasting". It also intends delivering content to devices other than PCs, which are currently only present in around half of homes. Other companies such as HomeChoice and Bulldog are looking to deploy broadband TV around the country taking advantage of reductions in the price of local loop unbundling (LLU), which allows companies to install their own equipment in BT exchanges and provide services directly to homes and businesses.

<http://www.ovum.com/go/content/c.377,52072>

<http://www.vnunet.com/news/1159718>

### **Video search developments**

Two internet search sites have announced new services to improve the ability to find video and audio resources on the internet. Yahoo has launched a video search engine using traditional methods such as metadata. Start up search provider Blinkx has launched Blinkx TV, which automatically captures TV and radio broadcast on the web and indexes them for searching. The service uses speech recognition technology to automatically transcribe video and audio clips, making the actual contents searchable. Traditional search engines have tended to be poor at finding streaming content. As digital video and broadband connections have increased, the demand for such services is growing. However, there are issues such as copyright and the size of files. IBM is working on a research project called Marvel that will index the actual images in video clips allowing them to be searched.

<http://www.blinkx.tv/about.php>

<http://video.search.yahoo.com/>

### **iPod in education**

Apple's iconic hard-disk based MP3 player has begun to find uses in education outside of just playing music. In August last year a pilot project between Apple and Duke University in the US distributed iPods to all new students allowing them to store and transport their files, record lectures, view schedules and download course information from an adapted iTunes website. More recently Brearley School in New York has required all students to purchase an iPod for language and classics lessons. Students at the private girl's school primarily use the devices to record speaking exercises and download audio files. Other hard disk digital media players with similar functionality are also available.

<http://www.duke.edu/ipod/>

<http://www.nytimes.com/2004/12/09/technology/circuits/09ipod.html>

<http://www.apple.com/education/products/ipod/>

## **Hardware**

### **Analysis: Battery technologies and micro fuel cells**

Battery life is one of the key limiting factors for mobile devices. Faster processors, better displays, wireless connectivity and memory approaching desktop proportions has put even more strain on the battery life of portable devices. Although, battery technology has improved incrementally, the improvements have been largely offset by the needs of more power hungry, feature rich devices. Power saving and management features coupled with more efficient processors and display technologies are helping to extend the battery life of mobile devices. However, to extend power capabilities to a whole day and beyond, better technologies are required. There are two main solutions: new battery technology and micro fuel cells.

At the 2004 Intel Developer's Forum (IDF) Intel stated its commitment to achieving "full working day" laptop battery life by 2010. Intel currently sees this being achieved through new battery technologies and power efficiency rather than fuel cells. Intel has set up the Battery Life Optimisation Program to share power management technologies and to encourage manufacturers to develop low power components.



The capacity of a typical lithium-ion battery has more than doubled since their introduction in 1990 through improvements in power density. More recently, lithium polymer batteries have emerged. They can be moulded to any shape to fit more efficiently into devices and are widely used in mobile phones, but power density is less than for cylindrical lithium-ion. Traditional lithium batteries are reaching the limit of energy density improvements, but several companies are working to meet this challenge. Pionics are developing more efficient lithium batteries that are planned to be launched in 2005. Sion is working on Lithium Sulphur (Li-S) batteries that are a lighter more power efficient alternative to lithium batteries: <http://www.sionpower.com/>. Zinc Matrix Power (ZMP), on the other hand, is creating rechargeable alkaline zinc batteries that could run for double the life of current lithium batteries in laptops: <http://www.zmp.com/>. These companies are receiving significant investment and if successful could allow today's devices to run for longer and help in the miniaturisation of future products.

Micro fuel cells have been touted as the next big advance in mobile power technologies for some years. Unlike batteries, fuel cells generate energy rather than storing it. This eliminates the need for recharging and it is envisaged that fuel cells could be simply and cheaply refilled with the fuel and air they need to operate. Micro fuel cells generate power through a chemical reaction between a fuel containing hydrogen and air. They produce water and heat as by products. Most research on fuel cells for mobile devices is concentrated on Direct Methanol Fuel Cells (DMFCs) that use methanol as a fuel. For a more detailed explanation of DMFCs see: <http://www.dtienergy.com/DMFCworks.html>

Many major manufacturers (e.g. NEC, Toshiba, Casio, Hitachi) and several start-ups (e.g. PolyFuel, MTI Micro Fuel Cells) are working to develop micro fuel cells for mobile devices. Prototypes have been demonstrated, but as yet no products have been launched commercially, prompting Gartner analyst Michael Reynolds to say "it's been next year for the last five years". There are still several technical and practical problems facing fuel cells. Fuel cells have some difficulty in meeting the dynamic power demands of laptops. This means that early implementations may be used to charge a traditional laptop battery rather than provide direct power. The size of fuel cells and the heat produced by many prototypes has also been problematic, although some manufacturers are overcoming this by using passive systems that do not require pumps. Development is concentrating on improving the polymer electrolyte membrane that extracts hydrogen from methanol and on increasing the concentration of methanol in the fuel mix.

The two major practical problems facing micro fuel cells are the lack of a delivery/refilling network and regulations banning methanol in aircraft. There is an IEC working group looking to design standards for fuel cell compatibility. Having standardised fuel cell cartridges would be important in delivering fuel cells through the retail sector. MTI Micro Fuel Cells has a deal with Duracell, which could help with the supply/refill problem. Methanol is classified as a dangerous chemical. NEC has said its fuel cells will be ready in 2005, but it has put back the launch until 2007 because of the current regulatory barriers regarding public transport. In December, the UN Experts on the Transport of Dangerous Goods sub-committee reviewed the carrying of fuel cells on planes. Following their recommendations it is likely that the International Civil Aviation Organisation (ICAO) will approve the carriage of micro fuel cells by 2007.

It seems likely that fuel cells will not be widely commercialised until at least 2007, although early products may appear in 2005/6. Even if technical problems can be overcome, availability and price will remain issues. Most analysts do not expect them to replace batteries, but be a complementary technology. ABI Research predicts that fuel cells will be taken up slowly, expecting 10-15% of laptops to be powered by fuel cells in 2012.

<http://www.fuelcelltoday.com/>

[http://www.toshiba.co.jp/about/press/2004\\_06/pr2401.htm](http://www.toshiba.co.jp/about/press/2004_06/pr2401.htm)

<http://www.andrew.cmu.edu/user/jfagan/sumdmfc.html>

## Hardware News

### DfES ICT in Schools Survey 2004 published

This report contains the findings of the 2004 survey of Information and Communications Technology (ICT) in Schools in England. This survey covers provision and usage of ICT in maintained primary, secondary and special schools in England, as at the year end 31 March 2004. Some of the key findings include: target computer to pupil ratios of 1:8 in primary and 1:5 in secondary schools have largely been met; 63% of primary and 92% of secondary schools have interactive whiteboards; spending on ICT was up on 2002 and 2003 figures; 54% of secondary and 21% of primary schools have wireless networks.

<http://www.becta.org.uk/research/research.cfm?section=1&id=3466>

### **Intel to launch 64-bit desktop processors in 2005**

Intel has confirmed that it will release 64-bit enabled x86 desktop processors in 2005, accelerating its previous schedule. The chips use 64 bit extensions to the existing x86/IA32 architecture, enabling 32-bit applications to run natively and allowing true backwards compatibility. 64-bit chips can process larger, more precise numbers in one clock cycle and can address vast amounts of memory compared to today's 32-bit processor limit of 4GB.

AMD released 64-bit (x86 architecture) processors in 2003 and has been successful with the new chips despite the fact that there are few 64-bit PC applications available. The majority of desktop users do not currently need 64-bit processors, which have been mainly used in servers to run large databases or for specialist applications. However, high end users and gamers have been buying the AMD processors and Microsoft has announced that it expects to release the much-awaited 64-bit version of Windows XP in 2005, which should help move 64-bit computing to the mainstream.

[http://news.com.com/Intel+to+put+64+bits+in+desktops+in+2005/2100-1006\\_3-5482345.html?tag=nefd.top](http://news.com.com/Intel+to+put+64+bits+in+desktops+in+2005/2100-1006_3-5482345.html?tag=nefd.top)

### **Dual Core chips in 2005**

Intel has confirmed that it will launch its "Smithfield" desktop dual core processors in 2005, earlier than previously expected. A dual core mobile processor "Yonah" is expected in 2006. AMD also intends delivering the technology in 2005.

Dual core chips are essentially 2 processors on a single die (silicon wafer). They allow for lower clock speeds, less power consumption, cooler operation and the same or better performance than single core chips. Dual core processors can also run two threads simultaneously. This parallelism enables calculations to be divided between the two cores to increase efficiency. Alternatively, each core can handle a different application allowing true multitasking. In 2006 Intel expect 70% of its desktop chips to be dual core.

[http://www.theregister.co.uk/2004/12/14/intel\\_dual-core/](http://www.theregister.co.uk/2004/12/14/intel_dual-core/)

### **Cell Chip**

IBM, Sony and Toshiba are developing a next generation processor known as "Cell" that intends to bring high end processor technology to a variety of devices. The 64-bit chips will be multi-core allowing several processes to be handled in parallel and for each core to run a different operating system if desired. They will also include resource management, security and copy protection technology. The companies intend producing a variety of different versions suitable for devices from workstations to televisions. The chip will support various operating systems and the first Cell based products are expected in 2006.

<http://www.sony.net/SonyInfo/News/Press/200411/04-1129E/>

### **IBM sells PC division**

IBM, has sold its PC manufacturing division to Chinese computer maker Lenovo. The £900 million deal will make Lenovo the third largest PC manufacturer in the world behind Dell and HP. The deal is expected to be completed in the second quarter of 2005 and will give IBM an 18.9% stake in Lenovo. Lenovo will be able to use the IBM brand for five years and will be the preferred supplier of PCs to IBM. IBM generates \$11 billion annual revenues from its PC business, but the increasing commodity status of PCs is making it difficult to make profits from manufacturing. IBM is concentrating on providing services, software, consultancy and servers. The deal will also help IBM move into the growing Chinese market. It is too early to judge how the deal will affect brand loyalty, although surveys from Forrester Research suggest that 48% of IBM prospect companies will consider switching to rivals.

[http://www.ibm.com/news/us/2004/12/pcd\\_12\\_07\\_2004.html](http://www.ibm.com/news/us/2004/12/pcd_12_07_2004.html)

### **Moderate growth to push prices down in 2005**

IDC Research has predicted that moderate growth of 6.1% in IT spending and increased competition will drive hardware prices down in 2005. Handheld devices, networking equipment, infrastructure software and outsourcing services are expected to be strong in 2005, whereas prices for storage and blade servers are expected to fall.

<http://www.idc.com/>

[http://www.tomshardware.com/hardnews/20041202\\_125438.html](http://www.tomshardware.com/hardnews/20041202_125438.html)

### **PC usage to double by 2010**

A recent report from Forrester Research predicts that the number of PCs used around the world will grow from 575 million today to 1.3 billion in 2010. It is expected that most of the growth will come from emerging markets, such as China, India and Russia, which could be led by local manufacturers rather than major Western companies like Dell and HP. The report also says that price will be a key factor, which could encourage the use of open source software and operating systems like Linux.

<http://www.reuters.co.uk/newsArticle.jhtml;jsessionid=ICUK0FRK3UKLSCRBAEZFSEY?type=technologyNews&storyID=7089033>

### **New USB Flash drive form factor**

Lexar has announced a new USB card form factor for flash drives. The devices measure 31.75mm x 12mm x 4.5mm and use a standard USB Type A connector. It is hoped that the device's smaller size will allow it to be used in devices such as PDAs, digital cameras and other consumer electronic devices. Connector manufacturers are working with Lexar to create new sockets to allow the card to fit inside devices. By using the USB interface found in most computers, transferring data between mobile devices, cameras and computers could become easier. However, it remains to be seen how many device manufacturers will support the technology. The cards should be available in standard capacities next year. The technology may find competition from the new USB on the Go specification. This will introduce smaller connectors for mobile devices, lower power consumption and the ability for USB devices to interconnect without the need for a PC. The first devices to use the specification are beginning to appear.

[http://www.lexar.com/newsroom/press/press\\_12\\_13\\_04.html](http://www.lexar.com/newsroom/press/press_12_13_04.html)

<http://www.usb.org/developers/onthego/>

### **Micro MMC flash cards**

Samsung has developed new miniature multimedia memory cards (MMC) measuring 12x14x1.1mm. The MMCmicro cards have been submitted to the Multimedia Card Association for consideration as a standard. The new cards are about one third the size of current reduced size MMC (RS-MMC) and are intended for use in mobile phones and other portable devices. Samsung claims to have overcome power consumption problems with small memory cards whilst maintaining performance. The cards should be available next year in 32, 64 and 128MB capacities. As mobile phones are increasingly used to download digital content and to take photos and video, the need for small, removable storage has increased.

[http://www.samsung.com/PressCenter/PressRelease/PressRelease.asp?seq=20041214\\_0000080863](http://www.samsung.com/PressCenter/PressRelease/PressRelease.asp?seq=20041214_0000080863)

### **PCI Express "2"**

The PCI Special Interest Group (SIG) has voted to increase the throughput of the next generation of PCI Express cards to 5Gbps, double that of current versions. The next specification for PCI Express is due towards the end of 2005, but products are not expected until 2007. Higher speeds are needed to allow the interface to stay in line with higher Ethernet and storage interconnect speeds and to meet the demands of graphics cards.

[http://www.pcisig.com/news\\_room/news/press\\_releases/2004\\_12\\_15/](http://www.pcisig.com/news_room/news/press_releases/2004_12_15/)

## Software and Internet

### Analysis: Linux on the desktop

The Open Source operating system, Linux, has transformed itself from a niche application to become a mature presence in infrastructure implementations. It has won acceptance in the back office, becoming the fastest growing operating system, seeing 43% annual revenue growth in the server sector in 2004 and running on 67% of web servers. An ecosystem for Linux has developed and major players are heavily involved in commercial applications of Linux. IBM, Novell, HP and others have added weight behind the operating system easing fears of lack of support or accountability. However, relatively few organisations or consumers have installed Linux onto desktops and Microsoft still has over 90% share of this market.

Recently, there has been increased momentum behind Linux on the desktop with several countries (e.g. China, Brazil, Spain) launching projects. Munich City is deploying Linux on 14000 desktops and the Japanese government has a programme to install Linux desktops in schools. Linux PCs are being sold in Walmart supermarkets and major vendors like Sun, Red Hat and Novell have launched new, more mature, versions of desktop Linux. In the UK, the NHS has bought 5000 Sun Java Desktop Licences saying that it is a "viable desktop for certain user communities". IDC predicts that the Linux PCs will grow from 3% of the market in 2003 to 7% by 2008. Many organisations in the public sector around the world are beginning to look at Linux, although it is unclear how far this is a negotiating tactic to achieve lower prices for proprietary software. Gartner has also suggested that a large proportion of Linux growth is coming from price sensitive emerging markets where the operating system is installed on inexpensive PCs only to be later replaced by pirated copies of Windows.

The key advantages of Linux and other open source software are usually seen as: cost savings, hardware independence, support for open standards, access to code and avoidance of vendor lock-in.

It is important to remember that deploying open source software is not free and involves implementation and support costs. However, there are potentially cost savings in two main areas: software licence costs and hardware costs. For education, saving on licence costs is an obvious attraction. Just as significant is the ability to install Linux on a wide range of platforms and to run it successfully on older, lower specification machines. This allows institutions to continue to use computers that may not be able to run the latest proprietary software and would otherwise become redundant. Often these older machines are deployed as thin clients, where the applications are run and managed from central servers. See Linux Server Terminal Project: <http://www.ltspp.org/>. Also see Becta technical paper on thin clients for some of the advantages and disadvantages of thin client networks: <http://www.becta.org.uk/technicalpapers>. By using Linux on the desktop and open source office productivity suites like OpenOffice, schools can also provide software to students and teachers for home use and lessen the risk of using unlicensed software on networks.

There have been several Total Cost of Ownership (TCO) studies comparing Linux to proprietary software. Many of these have been commissioned by one or other camp and have proved contradictory. Becta will shortly publish an information sheet on open source software in schools, based on the findings from the TCO data and case study collection from schools using open source software. However, TCO will vary from organisation to organisation and decisions should be taken on individual circumstances after an analysis of the costs and benefits.

Some of the disadvantages of Linux on the desktop are seen as the lack of functionality in some applications and the lack of open source equivalents of some proprietary software. Most educational software developers do not currently support Linux. There are also concerns over interoperability, file format compatibility, the need for user training and the costs involved in migrating to Open Source. Linux also faces disruptive legal challenges. Most analysts agree that despite improvements in Linux, Windows still offers better integration, a wider range of applications, easier management, wider hardware driver support and a larger skills base for providing support. Institutions may also find some resistance to the use of non-familiar products from students, teachers and parents.

The Office for Government Commerce (OGC) published a report on open source software in the public sector at the end of October 2004. The report was based on year long proof of concept trials in

various organisations. The report was largely positive, finding: "Open Source software is a viable and credible alternative to proprietary software...for meeting the requirements of the majority of desktop users." <http://www.ogc.gov.uk/index.asp?docid=2190>

The OGC study and other reports highlight Linux as a suitable alternative for users who use a web browser, email and basic office productivity applications. This constitutes a large proportion of desktop use. Although many educational applications and services will not run directly on Linux, there are several methods of running Windows applications on Linux systems, each with its own performance and cost issues. It is also possible to run a mixed environment of Linux and Windows machines and content is increasingly available online.

Many see the launch of the next version of Windows (Longhorn), scheduled for 2006, as a key time for Linux. Longhorn will be a major upgrade for organisations and is likely to involve significant migration costs, including higher specification PCs. Linux may be widely considered as an alternative at this time. Organisations should ignore the hype and propaganda from both sides of the Linux argument. The choice of operating system needs to be seen as part of the wider IT plan and should be based on functionality and suitability to the requirements of the organisation.

[http://www.osdl.org/docs/linux\\_market\\_overview.pdf](http://www.osdl.org/docs/linux_market_overview.pdf)

<http://www.schoolforge.net/>

<http://www.seul.org/edu/>

## **Software News**

### **New Becta email bulletin for content developers and providers**

Becta is currently redeveloping its advice and guidance area aimed at everyone involved in designing and creating digital resources for education, whether in the public or commercial sectors. One of the new services is a short monthly email bulletin for content developers and providers. It will focus specifically on the needs and interests of all those involved in developing digital resources for all phases of education. The bulletin will contain updates about new advice and guidance available from Becta, information about key developments affecting the sector and a round up of relevant opportunities, publications and events.

The first edition will be distributed at the end of January and will also be available online. To be added to the distribution list for each edition, simply send an email stating that you would like to subscribe to: [contentdevelopers@becta.org.uk](mailto:contentdevelopers@becta.org.uk)

The Content Development team at Becta is also keen to hear your views about what kinds of advice and support you would benefit from as a content developer. You can either send your comments to the email address above, or if you would be interested in talking directly to a member of the team, email Clair Davis ([clair.davis@becta.org.uk](mailto:clair.davis@becta.org.uk)) or telephone 024 7679 7229.

### **Libraries warned over new ISBN system**

Due to lack of capacity the current 10-digit ISBN book numbering system is to change to a new 13-digit standard from January 1 2007. The International ISBN Agency is warning publishers and organisations such as libraries to make sure their IT systems can cope with the change. They are keen to avoid problems similar to the "Y2K" bug when systems could not handle the change to the year 2000. Also, for the first time, there will be a core set of descriptive metadata elements, based on ONIX, associated with the ISBN and required from publishers when registering ISBNs.

The new standard has been approved by the International Standards Organisation and will be published next year.

<http://www.collectionscanada.ca/iso/tc46sc9/isbn.htm>

### **Analysts warn licensing costs could go up 50%**

Analysts Gartner have warned organisations that software licensing models are not keeping up with advances in technology potentially increasing costs by as much as 50% by 2006. Multi core processors, utility computing and virtualised hardware are all trends that may not fit current per processor licensing models. However, META Group has contested Gartner's figures predicting annual rises of only 10%. Microsoft recently agreed to licence multi core processors with a single licence and other suppliers may follow suit.

<http://software.silicon.com/applications/0,39024653,39126177,00.htm>

### **Microsoft to release 64-bit Windows and Server 2003 update in 2005**

Microsoft has readied first release candidates of its 64-bit versions of Windows and Service Pack 1 (SP1) for Server 2003. The final releases are scheduled for the first half of this year. Windows XP Professional and Server 2003 x64 Editions that will support AMD and Intel 64-bit chips (see hardware news) have been delayed several times. Windows Server 2003 SP1 will include several security enhancements similar to those in XP SP2. However, there will be no new Service Packs for Windows 2000. Instead there will be an "update rollup" of several patches next year, available to users who have installed Service Pack 4. Mainstream support for Windows 2000 will end in June 2005, but extended support will be available to 2010. Support for NT4 ended on January 1.

<http://www.microsoft.com/windowsxp/64bit/default.mspx>

<http://www.microsoft.com/windowsserver2003/evaluation/overview/roadmap.mspx>

[http://news.com.com/Microsoft+nears+release+of+64-bit+Windows/2100-1016\\_3-5481660.html?tag=nefd.top](http://news.com.com/Microsoft+nears+release+of+64-bit+Windows/2100-1016_3-5481660.html?tag=nefd.top)

### **Google to digitise academic libraries**

Internet search engine Google is to digitise some of the books from key academic libraries around the world. Once scanned, the books will be able to be searched and read online. The libraries of Oxford, Harvard, Stanford and Michigan Universities are involved in the project along with the New York Public Library. However, the libraries have initially set limits on the number and range of works to be digitised. Most of the project will concentrate on out of copyright books. Despite the limitations, rare and out of print works will be widely available around the world for the first time. It is estimated that it will take six years to digitise the 7 million books at Michigan. Other projects to make books available online, such as Project Gutenberg also exist

<http://www.msnbc.msn.com/id/6709342/>

<http://www.gutenberg.org/>

### **ICANN moves new domain names closer**

The Internet Corporation for Assigned names and Numbers (ICANN), which oversees the distribution of domain names and unique IP addresses, has put two new top level domain names (TLDs) to the final approval stage. This means that .mobi and .jobs should soon join the more familiar TLDs such as .com. The two domain names came from a list of ten TLDs proposed by various companies. For example .mobi was proposed by Microsoft, Vodafone and Nokia and when approved the consortium will manage that domain. This process, known as sponsored TLDs, is seen as a more efficient and competitive way of creating global TLDs. .post and .travel are also in final approval stage and another 5-6 TLDs are expected to be approved early next year.

<http://www.icann.org/announcements/announcement-13dec04.htm>

<http://www.icann.org/tlds/stld-apps-19mar04/stld-public-comments.htm>

### **Instant Messaging "threat centre" established**

Several major Instant Messaging (IM) companies have set up a threat centre to combat the increasing problem of IM and peer-to-peer security problems such as viruses and worms. Subscribers to the service will receive free email alerts of threats, together with risk assessment and management advice. Major IM companies such as Microsoft, Yahoo, Jabber and Antepo are backing the centre, which is being led by IMLogic. Security companies like McAfee and Symantec are also involved. A recent study by Radicati Group predicts that 80% of organisations will be using IM by 2008. Currently 20% of organisations worldwide are officially using the technology, although this figure reaches 85% in North America. Although more organisations are using tools to manage and control the use of IM, in many cases IM clients are installed by users. A study in the UK by Hitachi Data Systems found that only 22% of UK businesses actively monitor IM. IM applications can be easily installed by users and can bypass many firewalls. IM can spread worms and viruses, allow attackers remote access to systems, and disclose sensitive data. Instant messages are not usually encrypted, and authentication is weak allowing impersonation of users.

[http://www.imlogic.com/im\\_threat\\_center/index.asp](http://www.imlogic.com/im_threat_center/index.asp)

### **Linux server growth**

According to figures from IDC Linux server revenue increased 43% in the third quarter of 2004 compared to 13% growth for Windows based systems. IBM remains the top server vendor followed by HP. Open source Linux operating system based servers have now become commonplace in infrastructure deployments. Vernon Taylor from IDC said: "When all manifestations of Linux operating systems are counted, Linux is clearly a mainstream solution".

<http://www.idc.com/getdoc.jsp?containerId=32153>

### **New organisation to promote Open Source in the public sector**

60 European Open Source providers have formed a new organisation called the Open Source Consortium (OSC) to promote the use of Open Source software in the public sector. The OSC intends offering independent advice to organisations considering open source solutions as well as accrediting providers.

<http://www.opensourceconsortium.org/>

### **Wikinews**

Following the success of Wikipaedia, the online collaborative encyclopaedia, a beta news service called Wikinews, has been launched. Wikis are webpages that can be created and edited by anyone using a standard web browser. They are becoming an increasingly popular method of collaboration in business and education. Although, numerous wikis appear on the web for anyone to see and edit, many organisations also use the technology on private networks. Several open source wiki engines can be freely downloaded from the internet.

[http://en.wikinews.org/wiki/Main\\_Page](http://en.wikinews.org/wiki/Main_Page)

<http://wiki.org/wiki.cgi?WelcomeVisitors>

## **TechNews Information**

### **Disclaimer:**

While every care has been taken in the compilation of this information to ensure that it is accurate at the time of publication, Becta cannot be held responsible for any loss, damage or inconvenience caused as a result of any error or inaccuracy within these pages. Although all references to external sources (including any sites linked to the Becta site) are checked both at the time of compilation and on a regular basis, Becta does not accept any responsibility for or otherwise endorse any information or products contained in these pages including any sources cited.

We cannot be aware of the uses to which you may put this information nor of the environment in which you are working. Consequently you should take care to obtain professional advice relating to your circumstances before making use of this information.

### **To unsubscribe:**

<http://lists.becta.org.uk/mailman/listinfo/technews>

### **Feedback:**

We welcome your feedback. Email comments to:

[technews@lists.becta.org.uk](mailto:technews@lists.becta.org.uk)