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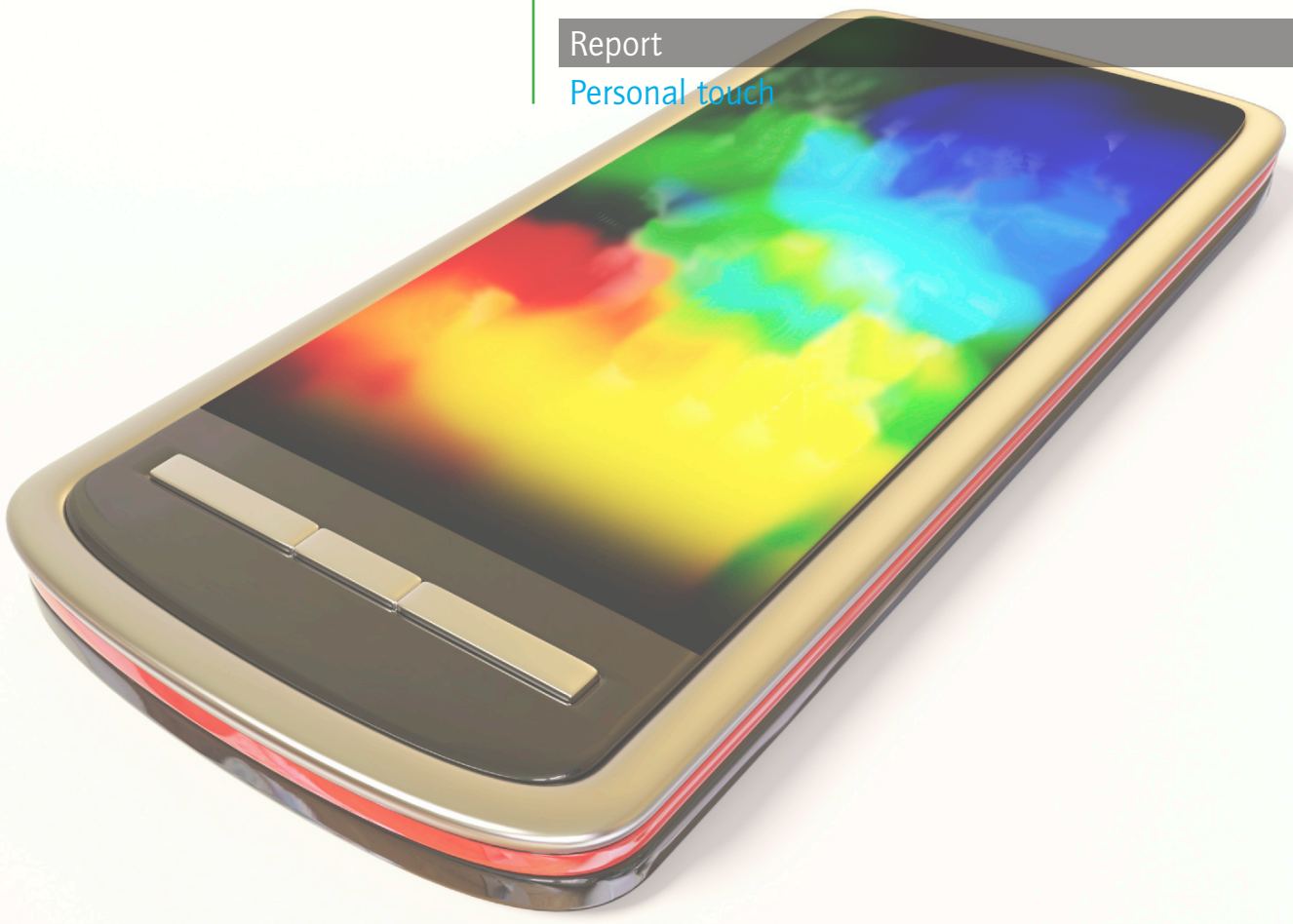
lighting, imaging & displays world



lighting, imaging & displays world is published 10 times a year. Each issue includes consultancy-level articles that provide independent analysis of the commercialisation of LEDs for illumination, new display technologies for consumer electronics and other imaging applications.

New processors released for next-generation imaging and displays

Processor manufacturer Nvidia has followed the announcement of its dual core Tegra 2 line of processors at the Consumer Electronics Show on 10-13 January 2011, with a quad core version at the Mobile World Congress in Barcelona, Spain, on 14-17 February.

The processor, codenamed Kal-El, appears to be the successor to the Tegra 2. The new technologies are designed to power next-generation displays and imaging.

The Tegra line of chips combines general-purpose processors with graphics processing units (GPUs) on one chip.

Aimed at high-performance smartphones, the new chips enable 3D gaming and high-resolution video playback.

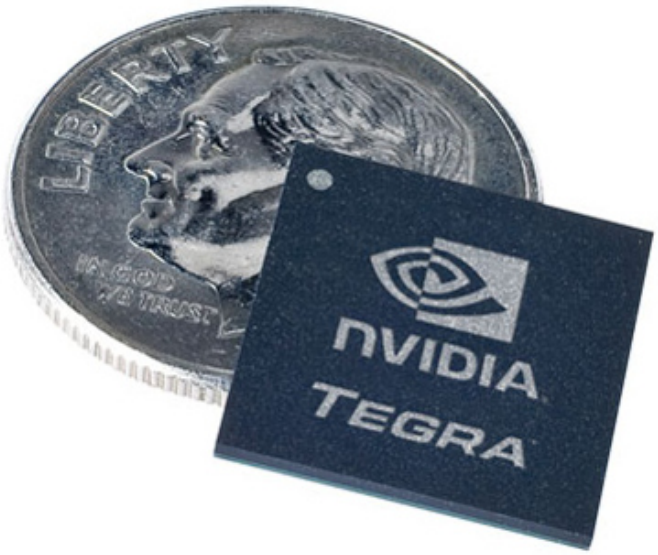
In addition to smartphones, the Tegra 2 will power the Samsung Galaxy Tab 10.1 and the Motorola Xoom.

Michael Rayfield, general manager of the mobile business at Nvidia, comments: 'We've entered the superphone era. People are looking at their mobile device as a computer first and a phone second.

'Tegra's brought new mobile experiences that haven't been possible before.'

Tegra chips are also being used by automakers in the next generation of on-board display systems. Nvidia has announced that BMW and Tesla Motors, a maker of high-end electric vehicles, will use Tegra chips in their on-board computer systems.

A Nvidia Tegra chip compared in size to a US dime (17.21mm)



Source: Nvidia

The Tesla Model S will use two Tegra processors: one to power the infotainment and navigation systems, the other in the instrument panel.

BMW will be using the chips for the in-car navigation systems of all of its models including the 7-Series, 5-Series, 3-Series, X-Series and the Mini Cooper.

Elmar Frickenstein, executive vice president of electrics and electronics, and driving experience environment at BMW, says of the deal: 'In our quest for superior graphics performance, no one came close to what Nvidia brings to the table.

'Our partnership represents the beginning of an exciting new phase for BMW drivers.'

This news underlines the emergence of computing in cars, as well as the merging of CPUs and GPUs.

AMD announced its Fusion series of accelerated processing units (APU) in 2006, in the wake of its merger with ATI.

The APU label was created to cover processors that contain both general (CPU) style processors and GPU style processors for graphics acceleration.

Until recently, the hybrid chips had seen little real-world action.

More integrated CPU/GPU products are expected in the future – earlier in 2011 Nvidia announced a six-year cross-licensing agreement with CPU firm Intel.

Camera arrays could replace high-resolution devices

Pelican Imaging proposes a new way to make cameras for smartphones and mobile devices. Rather than using one high-quality camera, Pelican Imaging's technology uses an array of smaller, cheaper cameras.

Dedicated software then stitches the many images that the array produces into a single image.

By using information from each of the cameras, the software can create a higher resolution image than any of the small cameras could alone.

Pelican's imager arrays are thinner than conventional mobile device cameras of similar resolution. This is because they are made up of many cameras with small lenses and short focal lengths.

A single camera of the same resolution would require a larger lens and a longer focal length. The focal length is what determines the depth of the camera enclosure.

Pelican's approach can also compensate for defects in the individual cameras.

This lowers the bar for manufacturing, as cameras with defects that would be unacceptable for single imager systems become acceptable.

Pelican illustrates the possible size advantage of its thin imaging array over a traditional imaging component. Notice that the profile of the phone on the right is much thinner than the one of the left

Source: Pelican Imaging

The chances of all the cameras in the array that capturing the same portion of the scene having a defect at that same spot are very small. By working together, the cameras can cover for each other's shortcomings.

Pelican Imaging has also hinted that the camera arrays will be well suited for capturing 3D images due to the spatial distances between each individual imager.

It went on to suggest that this could be applied to make cheap gesture sensors for human interface.

The idea of a software-controlled camera array has great potential for shrinking imaging devices.

California-based Pelican completed Series B funding of $10 million (€7.1 million) in October 2010, to help commercialise its technology.

The funding was led by Globespan Capital Partners, while existing backers Granite Ventures, InterWest Partners and IQT were also involved. The startup has now raised more than $17 million in total.

LG adopts 3D imaging in mobile devices

The Mobile World Congress (*MWC*) in Barcelona, Spain, on 14-17 February 2011 saw tablet and smartphone devices adopt 3D display and image capture technology.

LG announced at MWC that its new Optimus Pad (sometimes marketed under the name T-Mobile G-Slate) will feature a rear-facing stereoscopic camera for recording video in 1080p HD.

LG's newest smartphone, the Optimus 3D – also officially announced at MWC – also features a 3D display and a rear-facing stereoscopic camera.

A week before MWC, LG announced that it had secured a deal with Internet video firm YouTube to allow Optimus 3D users to upload 3D videos directly to its system. The deal is an acknowledgement from LG that there is a lack of mobile 3D content.

Films and high-end gaming are the mainstays of 3D vieiwing at the moment.

Including 3D cameras in the Optimus 3D and the Optimus Pad, in conjunction with the YouTube deal, will help 3D video to move into the mobile market, by essentially crowdsourcing content creation.

The launches follow the release of the *Nintendo* 3DS gaming device, with 3D imaging capabilities.

Front and back view of LG's Optimus 3D

Source: LG

Adaptive lenses adopt electrowetting

Liquid lens developer *Varioptic* is adopting electrowetting technology for its latest technology.

At Photonics West in San Francisco, California, the US in January, Varioptic demonstrated its latest line of liquid lenses.

New abilities of the lens/software duo include image stabilisation and much better low light performance than fixed lens imagers.

The LG Optimus pad features 3D display and imaging

Source: LG

Software-driven optical image stabilisation could be used to compensate for handshake blur.

Electrowetting, a reflective display technology reported in *Lighting, Imaging & Displays World (1.6)*, involves using surface tension to shape a liquid droplet.

A voltage is applied to alter the output of an electrowetting display, allowing optics that can change their characteristics variably and continuously.

Electrowetting was in the news earlier in 2011 after Netherlands-based display developer Liquavista was acquired by Samsung.

Liquavista uses electrowetting technology to create displays that could combine low power consumption with colour, video-rate output.

The technology has been seen as a competitor to e-paper, which until Q4 2010 offered only black and white output, and lacked the refresh speed to host video content, for instance.

Electrowetting displays are also targeted at the tablet computer and smartphone markets.

Liquavista has been using electrowetting technology to create low-power displays. The firm was bought by Samsung earlier in 2011

Source: Liquavista

New tablet computer launches converge in the 9–10-inch category

New 9–10-inch tablets were the headline launches at Mobile World Congress 2011 (MWC) in Barcelona, Spain.

The *Samsung* Galaxy Tab 10.1 and the *LG* Optimus Pad are the latest to enter the market in this size category.

The previously announced range of 9-10 inch tablets include the *Viewsonic* G-Tablet, the *Acer* Iconia and the *Asus* Eee Pad.

The LG T-Mobile G-Slate was technically announced on 2 February 2011 – but was launched as the LG Optimus Pad at MWC.

The *Motorola* Xoom is the most expensive device in this category at $800 (€579).

The Xoom supports 3G wireless data, though Motorola states that a software update will render the tablet compatible with 4G wireless networks later in 2011.

Jong-seok Park, president and CEO of LG Mobile Communications, said of the launch: 'With a flood of tablets hitting the market, we felt strongly that the LG Optimus Pad needed to set a new standard for what a tablet should be.'

Whereas other tablets have competed on small differences in components and performance, LG has attempted to distinguish itself from the crowd by adding 3D to the Optimus Tab.

The Motorola Xoom

Source: Motorola

The tablet computer is the newest significant addition to our technology-dominated lifestyles. *Lighting, Imaging & Displays World* assesses its expected impact

Personal touch

The tablet computer has become the biggest news in the technology world since the launch of the iPad in January 2010. Over the past year other devices have emerged and, at the *Consumer Electronics Show* in January 2011, many more tablet devices were exhibited. Whether this category of products becomes as integrated into our everyday lives as the smartphone or laptop remains to be seen – but understanding the market for tablets will certainly be crucial for much of the electronics industry in the next few years.

The current working definition of a tablet is any portable computer that is not a phone and not a laptop. A definition by exclusion is usually a bad one, but this is in use now because developers and the consumer electronics market have yet to decide what a tablet is with any greater specificity.

One could add that most tablets are smaller than the largest laptops and larger than phones. To go further it could be said that tablets are built around the screen – that is, the screen is the most prominent feature of a tablet, generally taking up a majority of the surface space of the device.

Like many technological innovations, tablets have their conceptual roots in science fiction. The television series *Star Trek* has imagined tablet computers since the 1960s.

Tablet computers were also featured in the spin-off series, *Star Trek: The Next Generation*, which aired in the late 1980s and the early 90s. *Star Trek*'s imagining of the tablet evolved considerably in the years since the original series. The tablets that appear in *The Next Generation* (called PADDs in the series' scripts, short for Personal Access Display Device) are slim devices with prominent displays that cover most of the top surface of the device.

The PADDs are fairly prominent, and seem to have replaced paper for handing over reports, reading books and working on. The PADD props that appear in the series look much like the real tablet computers of today.

Figure 1
Uhura uses a clipboard-like tablet computer with a stylus in the original *Star Trek*
Source: Paramount Pictures

"Whether this category of products becomes as integrated into our everyday lives as the smartphone or laptop remains to be seen – but understanding the market for tablets will certainly be crucial for much of the electronics industry"

Beyond desktop

One of the reasons is that tablets are moving away from traditional operating systems (OS).

Microsoft tried for years to market tablets with traditional OS, specifically Windows. These tablets looked more like laptops and some even had full keyboards that could be revealed by moving the screen. The failure of those products is part of what led to the move to non-traditional OS.

Traditional OS refer to the type used on desktops and laptops for the last 20 years. These are products like Microsoft Windows, *Apple* OS X and (desktop) Linux. Traditional graphical OS present programs by giving each program a window on the screen.

Content management

The OS draws a little border around each program's screen real estate and then the program itself is allowed to generate an image to place within this border. This approach allows the user to manage multiple concurrent programs, by moving program windows around the screen and re-ordering them in a metaphorical stack of windows.

The window approach works well for devices with large screens. When a screen has pixels to burn, each program can be displayed on a smaller portion of the screen. When screen resolution and physical screen space are at a premium, each application needs the entire screen to effectively display information and the window system does not work.

This difference of scale is not simply a function of screen resolution. If it were, presumably in time, the resolution of small screens will become large enough that traditional user interfaces (UI) will again be applicable.

The difference of scale is also limited by human factors. If small screens eventually have resolutions comparable to today's desktop screens, then we could make UI features that are the same size in pixels, as in traditional OS.

Though the features – buttons, text boxes, window borders – are the same resolution, they would be physically very small. This strategy is limited by human eyesight and for finger touch devices, by the pointing resolution of a human finger.

Figure 2
Apple's iPad led the flurry of tablet devices that run non-traditional OS
Source: Apple

Buttons and UI elements must be large enough that people can see and point at them. Smaller screen devices, phones and tablets require new UI designs.

Software developers and UI engineers working on software for mobile devices discovered the screen size problem back in the 1990s when developing personal digital assistants, which were the first consumer mobile devices that were general-purpose PCs. These were products like Palm Pilots and similar devices that ran either PalmOS or Windows CE.

Needs

These early entries indicated that as well as differing hardware and power needs, a new OS was required to allow for changes in the UI design..

The tragedy of this second realisation is that there would be very little cross-compatibility between applications designed to run on traditional OS and mobile OS. However, this is not a simple incompatibility. A normal

Figure 3
The Motorola Xoom, launched at Mobile World Congress 2011, runs Android 3.0, Honeycomb. The Xoom also features the same NVIDIA Tegra 2 dual-core processor that is used in the next generation of BMW automotive navigation systems
Source: Motorola Mobility

Figure 4
An HP TouchPad running WebOS. WebOS was initially developed by Palm as the modern successor to PalmOS. In 2010 Hewlett Packard acquired Palm and the WebOS software
Source: HP

software platform incompatibility is usually based on code semantics.

Vocabulary

The programs are built on systems that the OS provides – systems that are different on various OS. Adapting an application to use the different but generally equivalent systems of another OS is called porting. This transformation involves changing the vocabulary that the program uses to match that of the new OS.

However, adapting an application designed for traditional OS for mobile use is not an issue of vocabulary. The entire design philosophy of the application may be inappropriate for a mobile device. For instance, an application that displays a lot of information on the screen at a time using fine graphs, small text or has many small buttons cannot be adapted to a mobile platform without a fundamental redesign of the way it works. This is a task on the order of creating an entirely new program.

Figure 5
An Asus Eee Pad running Windows 7
Source: Asus

Input

Another reason that traditional OS are unsuitable for tablet devices is that the point-and-click, mouse-and-keyboard interface is deeply ingrained in the design, and the ecosystem of applications designed for them. From the beginning, tablets were imagined with stylus or touch interfaces, guided by the concept of replacing paper.

Traditional OS assume that the user has a keyboard for text entry. Entering text with a keyboard is easy, and traditional OS capitalise on this by using text entry for many functions. Yet text entry with a stylus or a finger is not so easy and tabletised versions of traditional OS have had difficulty solving this issue. This was a major contributor to the failure of the Windows XP and Vista based tablet-style laptops of the last decade.

Tablet OS

The trend toward non-traditional, smartphone-style OS for tablets is epitomised by Google's Honeycomb (*Android 3.0*), Apple's iOS, and HP's WebOS. All originated as small device OS: iOS began as iPhone OS, Android began as a smartphone OS and WebOS traces its beginnings to PalmOS.

These systems, by virtue of their small device origins, have a different approach to UI than traditional desktop versions. Another factor in their favour is that they integrated touch from the beginning.

Desktop OS internalises the concept of mouse and keyboard interface at a surprisingly fundamental level, presenting challenges to folding touch and multi-touch interfaces into them as optional features.

Windows 7 is the main fully-fledged desktop OS that has a noticeable presence on tablets. Microsoft has put great effort into tablet and touchscreen Windows offerings for years with little success. That lack of success may have

Tablet OS factsheet

OS	Maker	Type	Based on	Products
iOS	Apple	Non-traditional	Mac OS X	iPad, iPhone, iPod Touch
Honeycomb	Google	Non-traditional	Linux	Motorola Xoom, various smartphones
WebOS	HP	Non-traditional	Linux	HP TouchPad, Palm smartphones
Windows 7	Microsoft	Traditional	Windows	Asus Eee Pad, High-end tablets and laptop/tablets

Source: Pira International

been due to the difficulty of integrating touch systems into Windows XP.

Microsoft claims that touch systems were given a higher priority in Windows 7 and that they received attention from early in its development. The *Asus Eee Pad*, due for launch in Q1 2011, priced to compete with the iPad,will test the market's acceptance of a Windows 7 tablet.

Windows 7 also caters to devices that cross the boundary between laptops and tablets. The *Dell Latitude* is a recent model in a long line of rotatable-screen laptop/tablets. The distinguishing feature of these laptops is that they can be used with the screen up and the keyboard visible, like a normal laptop, or with the screen folded down and the keyboard hidden like a tablet.

Modern tablets

This is a point that Apple has been keen on for years (to great effect): replace tablets with desktop computers, laptops, personal music players or smartphones. On any computing device with a screen, the software is what the user sees and interacts with.

A desktop computer is not just a device that runs a Microsoft or an Apple OS: it is a PC or a Mac, even though both OS could run on any number of hardware configurations.

Software can differentiate a hardware product and inspire consumer loyalty. People would not argue about the relative benefits of PCs or Macs so much if there were not so many intensely loyal consumers on both sides of the argument.

More recently we have seen the beginnings of this same phenomenon in smartphones. Of course there are Apple fanatics, but now we are beginning to see diverse devices marketed as Android phones.

Software

With iOS and Android the dominant OS in the tablet market, the software loyalty phenomenon applies as well.

The contest between Android and Apple may replace that of PC and Mac, with Google cast in Microsoft's role.

It is yet to be seen just what impact Microsoft's Windows Mobile 7 will have on the smartphone market though – and should the company transfer this into the tablet form, it could easily become a three-way battle for supremecy in the consumer market ■

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