INCISOR™

NEWS FROM THE BLUETOOTH™ AND SHORT RANGE RF ENVIRONMENT ISSUE 68

IN INCISOR THIS MONTH

Welcome to the May 2004 issue of Incisor.

As the month before the largest event in the European wireless market – Wireless Connectivity World 2004, which takes place in Amsterdam next month - there is the usual feeling of tension and expectation in the air.

While these events may not be quite as big as they once were, there is no question that many, many companies - in the Bluetooth market especially (this event was of course formerly known as Bluetooth Congress) – focus major announcements on this milestone in the wireless industry calendar.

Incisor will, as normal, publish two special issues dedicated to this major conference and exhibition. In order to make sure your PR and marketing messages are with us in time, see page 13 for details of our publishing calendar.

Our normal feature sections are included, and are listed below:

Features:

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Texas Instruments launches Bluetooth hands-free platform

The automotive Bluetooth bandwagon rolls on. Worldwide, the importance of hands-free technology for improving safety while driving is reflected in legislation restricting the use of handsets in 43 U.S. states, 90 percent of the European market and many other countries. According to Texas Instruments (TI), consumers who want an after-market hands-free kit must choose between poor quality, self-installed units or professionally installed, high-quality, expensive units.

In response, TI has announced a Hands-Free Kit (HFK) Development Platform matched with a complete Bluetooth radio subsystem. The digital signal processor (DSP)-based platform provides real-time voice and audio-enhancing algorithms and includes a Bluetooth Daughter Card to enable development of high-quality, cellular handset accessories. TI believes that by leveraging the programmability and flexibility inherent in DSP technology, developers can use the combined HFK Development Platform and Bluetooth Daughter Card to create lower cost products with superior audio quality, Bluetooth wireless connectivity and differentiated hands-free designs with customized features.

Included in the HFK Development Platform is Clarity Technology's Clear Voice Capture echo and noise suppression software. CVC provides "full duplex" echo suppression for natural conversation and improved voice quality when used in high noise environments like automobiles by eliminating background noise, while also improving speech recognition accuracy.

TI also claims that an added benefit of the HFK Development Platform is its automotive-class power management system for safeguarding against the noise and voltages spikes of a vehicle's 12V battery. The HFK development platform has a separate FM transmitter so a caller's voice can be heard through the car sound system, eliminating the need for an external speaker.

"Texas Instruments recognizes that with the growing demand for hand-free kits, our customers want faster time to market with high performance products," said Mathew Divjak, HFK marketing manager, TI. "To give our customers a competitive advantage we've brought together fully-optimized audio and Bluetooth providers to create a comprehensive and open development platform targeted specifically at the hands-free market."

TI's HFK Development Platform is available now.

CSR appoints IVT as design support centre for embedded Bluetooth designs

CSR has appointed Bluetooth software specialist IVT Corporation as an official CSR design support centre for embedded Bluetooth designs. IVT will work closer with CSR customers implementing BlueCore Bluetooth technology from CSR and help to make it easier for companies to implement Bluetooth into their end-product designs.

China-based IVT offers a Bluetooth core protocol stack code called Bluelet, which is already qualified as a fully compliant v1.2 Bluetooth protocol stack.

Bluelet is made available as source or object code to meet the differing needs of embedded Bluetooth designers. IVT also has the experience of producing its own Bluetooth end products and reference designs such as their Integrated Class 1 CTP enabled GSM phone and associated access points or embedded audio headset solutions.

Clive Chelsom-Pill, Commercial Manager at CSR commented, "Combining IVT's excellent Bluelet protocol stack for embedded applications, its experience in working with end-product designs, and its proximity to our key Asian markets means that IVT is able to provide an important support service to customers using CSR's BlueCore."

RFI announces latest Bluetooth test capability

In tune with the market's increasing support of version 1.2 of the Bluetooth standard, Radio Frequency Investigation Ltd (RFI) has announced its capability to provide testing to this latest Bluetooth Core Specification adopted by the BSIG in November last year. Version 1.2 represents a major upgrade adding a number of important features to ensure ease of use and reliability of Bluetooth technology. Enhancements include Adaptive Frequency Hopping (AFH) opening up possibilities for complementary wireless technologies to co-exist in devices such as PCs, PDAs and mobile phones, Enhanced Data Rate allows higher bandwidth applications and faster connection set-up to enhance the user experience.

A key element of Version 1.2 is the backward compatibility with its predecessor Version 1.1, allowing devices from earlier generations to communicate with products enabled with Version 1.2.

As part of a continued partnership with Centro de Tecnologia de las Comunicaciones, S.A. (CETECOM), in Spain, RFI will perform the official Bluetooth SIG validation for Cetecom's new BITE Protocol Tester V1.1 and V1.2. The validation will be completed in two parts, firstly the validation of the existing V1.1 test cases on the new platform, will be completed, immediately followed by the validation of the new V1.2 test cases.

RFI has a full regulatory and Bluetooth Qualification service available for cellular, automotive and medical products.

Bluetooth's momentum In automotive continues

OEM (original equipment manufacturer) commitment to Bluetooth continues to increase, thanks to the growing availability of new Bluetooth-enabled devices such as mobile handsets, finds ABI Research in its new report – "Automotive Wireless Networks: Opportunities for Wi-Fi, Bluetooth, RFID, Satellite and Other Emerging Wireless Technologies".

The availability of Bluetooth-enabled handset offerings in North America has increased approximately 65% to date over 2003 levels, according to the research firm. Consequently, the amount of vehicle models available with Bluetooth in North America has also increased over 40% from the prior year.

"Thanks to growing commitment to Bluetooth on the part of device manufacturers, automakers are becoming less apprehensive about supporting Bluetooth in their models," states Frank Viquez, ABI Research's Director of Automotive Research.

Latest spec BMWs, including this 7 Series, lead the way with intergrated Bluetooth support

"Validating the technology was the first hurdle; now auto OEMs must look to differentiate their Bluetooth offerings and offer additional hardware functionality other than just car kits."

ABI Research finds that once this next hurdle is cleared, the full potential for Bluetooth in the vehicle could begin to be realized. When Bluetooth is leveraged alongside other wireless technologies such as 802.11, a host of new and extensive offerings could be enabled in the vehicle for telematics, entertainment, and mobile commerce.

According to the company's research, the global installed base of vehicles with factory-fitted Bluetooth hardware will reach nearly 22 million vehicles in 2008.

The ABI Research study provides insight into current and future automotive applications, from telephony and telematics applications, to safety and infotainment systems. The study explains the market potential for automotive wireless local and personal area networks (WLAN and PAN), and adjunct devices such as PDAs, handsets, and headsets. The study also provides a comprehensive player profiles section, and concludes with a detailed list of international market participants.

Epson announces wireless printing solution for Bluetooth-enabled Nokia camera phones

A Symbian based Bluetooth printing application has been developed by Epson and will enable customers with compatible Nokia camera phones to wirelessly print high quality photos in the home. Digital cameras are estimated to account for 55 percent of global handset sales by 2008. Epson aims to provide convenient, affordable, easy-to-use home printing solutions to customers from any digital photo device. The Bluetooth printing application has been developed with Nokia development tools.

"Digital photography is going to have a huge impact on consumer devices, especially as complimentary technologies such as digital cameras and mobile phones converge. Epson is committed to enhancing the user experience, by providing easy to use and convenient solutions for high quality printing in the home, whatever the digital photo device," says Richard Baylis, Sales and Marketing Manager, Consumer Products, Epson UK.

The Epson Bluetooth printing application for mobile phones will be launched for Epson's new photo printer PictureMate, which allows customers to print their photos conveniently at home. With the optional Bluetooth module users can print wirelessly from compatible Nokia phones. Consumers can enjoy the flexibility of choosing between different layouts, sizes and print qualities. And for the creative consumers Epson offers the choice to print the camera phone image with different frames, which can be applied after the photo is taken. The framed photo can then be viewed in the Nokia camera phone display before it is printed.

Incisor checked with Epson over why this system appeared to be limited to use with Nokia Bluetooth phones. It was confirmed that any Bluetooth phone will operate with the printer, but it is the software application developed with Nokia allows to allow the user to clean up digital images, add frames to images etc. that will only work with the specified Nokia phones.

The Bluetooth printing application will be compatible with the Epson PictureMate, Epson Stylus Photo R300 and Epson Stylus Photo RX600. The supported Nokia phones are 3650, 3660, 7650 and 6600 plus future Nokia mobile phones with Bluetooth functionality. The application will be available in spring 2004 and can be downloaded free of charge from the Epson website.

CSR Bluetooth enables Orange's SPV E200 smartphone

CSR has announced that the Orange SPV E200 uses its BlueCore Bluetooth solution.

Orange's third incarnation of the SPV, the E200, is claimed to be the first SPV smartphone to include Bluetooth technology.

With CSR's BlueCore silicon, the Orange SPV E200 enables a user to synchronise contacts with their PC or PDA or to wirelessly connect to a mobile headset or handsfree kit. In conjunction with many other features, the Bluetooth technology supplied by CSR supports the SPV E200 as a virtual office. Including Microsoft Outlook and Windows media player, the SPV E200 can wirelessly connect via Bluetooth to download and upload address books and calendar information from a PDA or PC.

The SPV E200 includes an MP3 player, so a user can take advantage of the 723kbps data transfer rate to download music files through a Bluetooth link. A user can then connect the SPV E200 to a Bluetooth enabled headset to listen to music files.

Andrew Thomas, Devices Technology Manager for the Orange Group, said, "With the SPV E200, you are one touch away from reading the news, sending a photo message, checking your email or synchronising your contacts. The Bluetooth technology supplied by CSR has enabled us to provide a phone that puts even more mobility into a smartphone."

John Hodgson, CEO, CSR, added, " We are beginning to see a shift in mobile manufacturers and suppliers outlook towards Bluetooth technology, and that is reflected in the increasing number of smartphones to include CSR's BlueCore silicon. Manufacturer's recognise the benefits that low powered wireless technology brings to their products and how Bluetooth technology eases the physical application of their new feature rich smartphones."

The Orange SPV E200 retails at GBP 149.99 and is available through Orange Shops and **www.orange.com.**

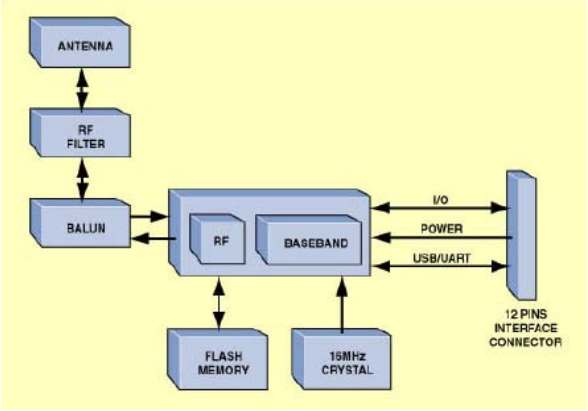
Asking the right questions is the secret to Bluetooth success

By: Hussein Mehdi, SMART Modular Technologies, Inc.

Bluetooth may seem like the perfect answer for countless short range wireless applications. However, after deciding to go with Bluetooth technology, the next step for the designer is to start asking the right questions.

While the performance figures in a vendor's data sheet are important, there are many additional issues to consider. For instance, designers should determine the usage scenarios and likely operating systems for the product, the anticipated product lifecycle and number of planned variants, if Bluetooth functionality will be embedded in the product or if it will be an external add-on, the profiles/services required to satisfy the product applications, and if the product packaging design allows for an embedded or external antenna.

As with most communications technologies, integration has increased and the number of required external components has decreased as Bluetooth chipsets/modules have evolved. In fact, the latest module solutions are a long way from the original chipsets, and they offer designers the means to implement Bluetooth technology with significantly reduced design risk (Figure: SMART module diagram). But, what do designers need to know to be successful, and how do they determine the best way to incorporate Bluetooth functionality into an application?



WHAT SHOULD I KNOW?

One important consideration when adding Bluetooth functionality to a design is to find out if the module or chipset meets the current Bluetooth standard, version 1.2, and/or if it is upgradeable. A good way to avoid delayed design cycles is to select a product that does not require additional Bluetooth certification or FCC/CE regulatory certification.

Designers should also consider choosing a Bluetooth solution that has leading edge performance and on-board memory. This will make the product more likely to last through a few generations of designs. Selecting a module with moderate performance characteristics might cut costs initially, but will likely require a complete redesign in the next generation.

MODULE OR CHIPSET?

The main advantage of taking chips and designing them directly on the PCB is saving on footprint. But the advantage pretty much ends there. Single chip/chipset approaches require RF design resources to provide filters, amplifiers, matching networks, oscillators, clocks, and antenna for both the Tx and Rx paths. It also requires extensive test equipment suites to verify and synthesize the design. And, in addition to significant design time, RF expertise, and verification, the design will also have to be certified for use in Bluetooth products.

In addition to the expected RF and baseband functionality, some of the latest Bluetooth modules offer additional functions, including a dedicated microcontroller, antenna and connector integration, as well as on-board FLASH memory, voltage regulators, filters, and crystals. These features offer simplified designs, lower development costs, and improved time to market.

If they are not using one of these highly integrated modules, designers must pay very careful attention to the layout of the Bluetooth PCB. Component placement, tracking, decoupling, grounding, shielding, board material are all factors that impact performance, and they are crucial in ensuring good RF performance. When using a pre-designed, pre-certified module, designers avoid these issues as well as the need to worry about these factors in their final design.

HOW DO I CHOOSE A BLUETOOTH MODULE?

When evaluating a Bluetooth module, consider the following:

- Bluetooth Qualification Body (BQB) certification
- FCC and/or CE approval
- Quality of ICs
- An integrated antenna
- On-board connectors; what is the interface configuration?
- Total cost: including any additional qualification and development time
- Level of integration and its impact on development time
- Ease of use
- Size and dimensions
- Number of available GPIO lines
- Compliance with Bluetooth specification v1.1
- If it is upgradeable to Bluetooth v 1.2
- Availability of HCI, and HCI UART Interface
- USB compliance
- Ability to modify parameters in order to customize
- Device Class
- Power requirement and dissipation
- Support for low-power or sleep operation
- RF Performance
- Bluetooth speed operation
- USB interface
- Piconet support
- Developer's kit:
  - Does it have the right interfaces?
  - UART/USB?
  - Can the user change control parameters?
  - How?
- Amount of memory (8 MB can enable WLAN coexistence and 1.2 BT spec compliance.)
- Upgradeability of firmware
- WLAN coexistence
- Operating and storage temperature ranges.

www.smartm.com

What goes around, comes around ...

And 3G to kill WLAN? This man thinks so!

Incisor interviews: Nick Eades · Marketing Director · Fujitsu Siemens

On returning from a period of navel-contemplation in Dubai in the early 'Nineties, Incisor publisher Vince Holton found himself working as sales and marketing director for an UK modem company called Communicate, which specialised principally in producing small modems to fit inside laptop computers, and evolved from this position to become a leader in designing cellular modems – very early mobile data without wires. To promote awareness of this industry minnow, Holton decided to employ the old trick of coat-tailing bigger players' success, basking vicariously in their afterglow.

Holton created a multi-company alliance including his own company Communicate, Lotus Development for its Notes software, IBM for the mobile computing platform – the ThinkPad, UK cellular operator Cellnet (the artist now known as O2) for the airtime, and – initially at least – Nokia to provide the cellphone. The project saw the five companies take to market what was branded as the first complete wireless mobile computing platform. Bearing in mind that this was in about 1992, the alliance was pretty much ahead of its time, and a great deal of publicity was created. Nokia kindly pulled out of the project just weeks before the press launch, and Motorola was invited in to replace the Finnish company at the last minute. This last uncertainty resulted in the project taking the first letters of the names of the other four main players names, so becoming CLIC (… in association with Motorola).

The main results of the project were that a) Motorola ended up buying Communicate, (which, as is always the case, then disappeared as a company), and b) Holton – having got the bit between his teeth for this type of work and also having created something of a brand in the CLIC acronym – left Communicate and founded his own company – the very Click I. T. Ltd that now publishes Incisor and other magazines.

Notebook series wrapped up with CONNECT2AIR airtime package from Vodafone

But the purpose of this story, lest you should be wondering, is to highlight one other enduring legacy of the project, and that is a friendship with at that time IBM brand manager for ThinkPad, Nick Eades. Holton and Eades were the main driving forces behind CLIC, badgering and cajoling the willing but resource-strapped execs of the other companies to make things happen. And, we shall see that as the title to this article alludes – there is some truth in the old maxim that what goes around, comes around.

Few people stay in one job forever, and after spending a further chunk of his life working under the Big Blue banner in the UK and in Paris, Eades broke out, and devoted a few years to Dell Computer, driving many an initiative from his position as marketing director. Then disenchantment started to creep in "A gradual but inexorable devolution of decision-making freedom for the European operation left me feeling that I was nothing more than an implementer of remote directives" says Eades.

It was time to move again, and for the last 12 months Eades has been marketing director for Fujitsu-Siemens, based in Bracknell in the UK. Under the watchful eyes of its joint shareholders, Fujitsu Limited and Siemens AG, the company claims to be the leading European IT provider.

And this is where the circle is completed, as a recent email from Eades to Holton revealed. Sharp-minded Incisor readers will remember that Incisor carried a news story two issues ago entitled "Fujitsu Siemens Computers and Vodafone UK unveil pay-per-month wireless laptop package" (issue 66 – March 2004). Eades suggested that Holton may wish to look at a new Fujitsu-Siemens press release, as it might have a ring of familiarity about it …..

Holton smiled when he saw the statement in the Fujitsu-Siemens press release that said 'Fujitsu Siemens Computers and Vodafone UK have launched CONNECT2AIR packages, which are described as 'first-of-their-kind' wireless computing packages that offer small businesses a radically new way to purchase IT.' Really? Or is this maybe an update to a former concept? In brief, Fujitsu Siemens and Vodafone were marketing a connected Wi-Fi notebook, complete with airtime agreement and monthly payment terms.

Behind the closed door of a Fujitsu-Siemens office, Eades conceded that the idea might not have been completely fresh, but that now, more than ever, there was a need for complete solutions. "We can see that all client computing devices will soon be mobile, and that completely mobile computing and connectivity will be mission critical. With the launch of the

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CONNECT2AIR packages we have taken away the need for enterprises to multi-source the components that they need."

PDAs Bluetooth and Wi-Fi enabled

The portfolio of Fujitsu-Siemens mobile computing products extends from Pocket LOOX PDAs, through three layers of notebooks – Amlo branded for the home user, Lifebooks for business users, Celsius Mobile for those in need of a mobile workstation, and finally to what are sometimes thought of as the oddball of the notebook sector - Tablet PCs. "Fujitsu-Siemens has really 'owned' the Tablet PC market for 11 years, and we are well established with clients such as the RAC (Ed. - the national institution that is one of the UK's longest established car breakdown repair and recovery specialists), the emergency services, the Ordnance Survey and airlines such as Lufthansa." Eades continued, "With the Tablet PC platform, customers have been able to dispense with expensive – to buy and support – proprietary solutions."

Fujitsu-Siemens claims dominant share of Tablet PC market

All of Fujitsu-Siemens mobile computing products have Bluetooth and WLAN as standard or as an option. Does this mean that customers are wireless aware, and ready? Eades had a yes and no answer to this question. "Yes – wireless is now huge, and our customers are 'wireless-aware'. You only need to have a couple of people in an office with a WLAN access point, moving their connected notebooks around and everyone wants to do it. But also – no, they may be wireless aware, but they are not wireless knowledgeable. If these same customers are asked to explain how Wi-Fi differs from Bluetooth, or Ultra Wideband, RFID, ZigBee or whatever, or which application each is most suitable for, they can't."

Eades emphasized with an anecdote just how happily people adapt to wireless connectivity. "We have had to ban people from sitting in internal meetings and continuing to do their email over a WLAN connection. I recently noticed one of our guys doing this. I excused myself from the meeting, went to my desk and sent him an email telling him to get off-line and concentrate on the meeting. Understandably, he was a little sheepish - but looking attentive - when I returned."

While customers may understand the benefits of a WLAN solution, this doesn't mean that they have any level of understanding of the various flavors. "There is little or no understanding of the differences between 802.11 a, b, g, WiMAX or any other WLAN standard" said Eades.

Other simple developments can trip understanding of wireless. "For Bluetooth it has been the widespread and low-cost availability of headsets. People are now starting to understand what Bluetooth is about – which is as a short-range cable replacement."

FORECASTING THE DEATH OF WLAN

Incisor's conversation with Eades reached its most interesting point when the Fujitsu-Siemens exec threw a curveball onto the field. "I consider that WLAN could be doomed, and its days are numbered." Picking ourselves up from the floor, we asked why? It is pretty bold, after all, to forecast the end of a technology that seems to have a long-term future.

"It seems to me that 3G could kill WLAN," said Eades, continuing, "This is because to achieve wide public availability as well as in-house solutions, Wi-Fi relies upon the deployment of a huge number of hotspots. This is extremely expensive and time consuming. To date there is little evidence of this being a profitable business for the operators to get involved with – although some of the hosts of the hotspots, such as Starbucks and McDonalds, report increased business as a result of such programmes. Bear in mind too that most of the companies with a vested interest in the business are relatively small IT companies. Then look at the other side of the equation. 3G networks are now coming on line, and nobody doubts that it is the cellphone companies that have the real marketing clout. Vodafone – the world's biggest operator will launch 3G soon, and this then has to be regarded as a reality."

Quoting a recent report, Eades mentioned that 3G coverage – which doesn't need hotspots - would soon extend across all but 21% of the UK. "79% of the population lives in the coverage area, which obviously includes all of the major conurbations, and 2.5G will gap fill. Will there be Wi-Fi hotspots in the 21% that isn't covered? Of course not."

Eades' views are backed up by a number of the market research companies. In-Stat/MDR estimates that service providers worldwide will generate $80 million this year from WiFi access. In the U.S., In-Stat estimates that WiFi providers will take in about $28 million. This is as much revenue as Verizon Wireless, the nation's largest cell phone company, generates in 12 hours. Gartner says operators will not be profitable until at least 2006. Why have fee-based Wi-Fi hotspots failed, so far, to become technology's next big thing? Connection charges are high. Services do not offer ubiquitous coverage. There are a growing number of free wireless connections, so many users do not feel any need to pay for access. Some laptop users connect to their cell phone or cell phone network to go online. And this is just the short list!

Eades feels 3G devices such as Nokia 7600 will replace Wi-Fi as primary mobile connectivity transport mechanism

There is an impending geographical divide on the horizon, too. "The way the US cellular operators bill clients is very different, and 3G is likely to take off much more quickly here in Europe. This factor could really polarise support in the 3G versus WLAN debate, with the USA potentially becoming isolated in its ongoing support for WLAN."

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Eades doubts that the WLAN companies can win a war with the cellular operators, but for more than just marketing and commercial reasons. “Its not just money – it’s technology too. 3G is ten times faster than 2.5G, with 10 – 17 times data compression. In our own testing this is already feeling faster than Wi-Fi, even if it maybe isn’t yet. The CONNECT2AIR package we are now offering combines 2.5G - and soon 3G - plus Wi-Fi, and will connect to the fastest option. This may be 3G. If this is the case, and 3G is faster than Wi-Fi or home broadband, and has the global might of the cellular operators behind it, how can Wi-Fi compete in the long run?”

This is contentious but highly interesting talk. Whether Eades is right or wrong remains to be seen. That said, the views of a guy that has held down a series of high profile jobs with major IT companies, and with a mobile computing specialisation, probably hold as much water as those of most industry observers. Depressingly, our discussion was called to a halt by Incisor’s need move on to the next meeting.

We feel this topic bears further examination, and will report again in a future issue.

Lighting the way for Wi-Fi

Last Mile Communications, a UK start-up company, is making bold claims for its latest announcement. The company is promoting future plans that it says will revolutionise the WiFi telecoms market by enabling low-cost data connection through wireless transceivers installed inside lampposts. The existing network of lampposts and street furniture can be used as hosts for the devices.

Last Mile conceived and developed two technologies in the field of telemetrics and in vehicle information systems. The main products are WDirect which is the transceiver technology fitting inside of lampposts and street signs and MagicBook is the reception and information management technology.

The planned installation programme will see upwards of 150,000 lamp posts fitted with very low power wireless data transmission systems, turning the pavement and roads into an electronic carriageway. There will be no need to dig up the roads to lay cables and the problems of centralised and expensive network management systems are greatly reduced.

The main features of the system are the high bandwidth wireless data system capable of 40 to 400 MB/sec, large caches of memory in the transceiver posts and transmission at very low power levels with user exposure that Last Mile claims is approximately one thousandth of that of a mobile phone. Once fully set up, the lamppost transmitters will create a "microcell mesh" of coverage allowing instant data connection.

This system was developed by Last Mile Communications for traffic management, and has been extended to meet the needs of the public access wireless markets and of governments.

Antony Abell, CEO of Last Mile, discussing the potential of their new network said "If you look at how much electronics and storage you can get into a lamp-post, or a traffic light, or any other bit of ordinary street furniture such as a 'Keep Left' sign or a 'No Entry' indicator - it's impressive. We reckon that we can launch our system with a very conservative data service of up to 40 megabits per second for every user in the micro-cell around a lamppost. And we're confident that we can then upgrade the performance to a maximum of 400 megabits - maybe not for every user, but for several - in a 200-300 metre range. That's more data than anybody currently knows what to do with."

Extending embedded Bluetooth solutions

by Clive Chelsom-Pill, CSR

DESIGN SUPPORT IN CHINA

The appointment of IVT as an official design support centre in China for BlueCore-based products adds quality regional support for Bluetooth product developers, especially for embedded applications.

IVT has its own above-HCI v1.2-qualifed stack for example, which is optimised for memory efficiency and portability. This is backed by a broad applications experience which includes a comprehensive offering for PCs/PDAs/smart phones, and a wealth of access point designs. And the company's Beijing-located engineering base means that it operates with considerably lower overheads than many current Bluetooth design houses. For CSR customers developing products themselves, IVT is also able to provide support and customisation services for BlueLab software development kit users.

One of the reasons behind CSR's appointment of IVT is its focus on the emergent opportunities for Bluetooth with the convergence of mobile and fixed line telephony. Three of its six current access point designs offer CTP Profile support for example, in various voice and data flavours for PSTN, ISDN and ADSL telephony connections. And the design house has some interesting complementary experience with other wireless protocols as well.

More information: **http://www.ivtcorporation.com http://www.bluesoleil.com/**

A couple of IVT's example reference designs: a clamshell GSM phone with CTP-enabled class 1 Bluetooth, and a CTP-enabled ADSL access point - also class 1

A ONE-STOP EMBEDDED PLATFORM

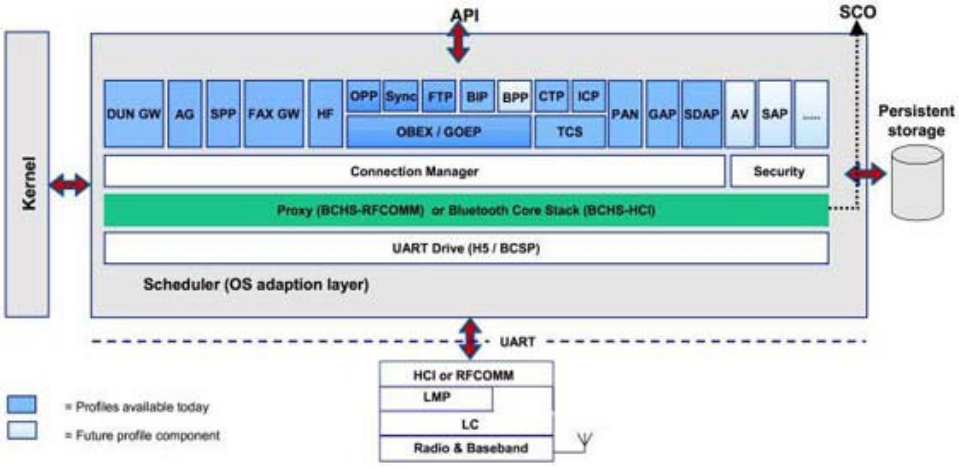
For companies developing embedded systems themselves, the combination of BlueCore silicon and CSR's own embedded software stack including profiles, BCHS, offers a platform for applications that substantially reduces time to market.

BCHS reduces risk by providing a single source solution. By focusing on a host stack optimized for mobile phone related applications (see below), CSR has been able to greatly reduce source code costs compared with commercial software environments. This trims non-recurring engineering expenses to a level that they become affordable by even the smallest developer. There's also an option that allows users to reduce up-front costs even further by opting for a down-payment and royalty arrangement.

Integrated hardware and software can provide significant additional gains in the performance and efficiency of the final design solution. For example, BCHS implements all the low power modes in Bluetooth, and is optimized to work with BlueCore silicon. Links automatically reduce power consumption if possible. Security is another area where integration pays dividends. BCHS is modular and can also be implemented at HCI or RFCOMM levels, providing considerable design flexibility for OEMs.

MORE V1.2 SUCCESS

In last month's column, I looked at the bigger picture of v1.2-compliant products, and touched on the fact that BlueCore featured in the first qualified end products. This success continues with the industry's first Bluetooth v1.2 headset from GN Netcom. In addition to implementing the mandatory Adaptive Frequency Hopping (AFH) technology, the headset exploits BlueCore's implementation of the optional 'Fast Connect' interlaced scanning features to reduce connection times by an order of magnitude. These features address both Bluetooth performance and the user experience, providing better audio quality in the presence of increasing levels of interference in the unlicensed 2.4GHz band, and the elimination of frustrating delays that can happen when trying to establish a link (which can take as long as three seconds today). With handsets containing the complementary v1.2 Bluetooth support scheduled for introduction soon, we can expect to see most headset manufacturers making similar upgrades.



The Bluetooth Profiles supported by CSR's own host development software, BCHS.

Clive Chelsom-Pill is Commercial Manager with CSR: contact clive.chelsom-pill@csr.com

WE TURN YOUR WIRELESS VISION INTO REALITY.

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And products into profits.

If your application demands high mobility, long battery life and no infrastructure support in a health care environment, then a Bluetooth solution may be the answer. The worlds largest OEMs trust SMART to deliver on their wireless vision, shouldn't you? For more information on how we can bring your vision to reality, please go to www.smartm.com/bluetooth.

TECHNOLOGY→PRODUCTS→PROFITS

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Turbo codes - key to the next generation of multimedia cellphones

By Erico Guizzo, for IEEE Spectrum Online

It's not often in the rarefied world of technological research that an esoteric paper is greeted with scoffing. It's even rarer that the paper proves in the end to be truly revolutionary.

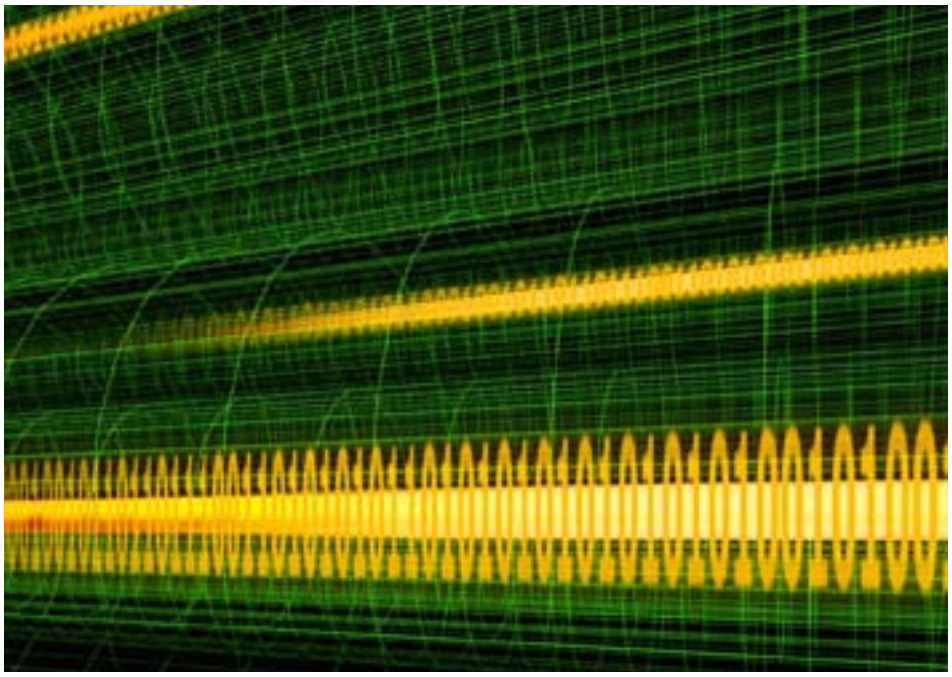
It happened a decade ago at the 1993 IEEE International Conference on Communications in Geneva, Switzerland. Two French electrical engineers, Claude Berrou and Alain Glavieux, made a flabbergasting claim: they had invented a digital coding scheme that could provide virtually error-free communications at data rates and transmitting-power efficiencies well beyond what most experts thought possible.

The scheme, the authors claimed, could double data throughput for a given transmitting power or, alternatively, achieve a specified communications data rate with half the transmitting energy — a tremendous gain that would be worth a fortune to communications companies.

Few veteran communications engineers believed the results. The Frenchmen, both professors in the electronics department at the Ecole Nationale Supérieure des Télécommunications de Bretagne in Brest, France, were then unknown in the information-theory community. They must have gone astray in their calculations, some reasoned. The claims were so preposterous that many experts didn't even bother to read the paper.

Unbelievable as it seemed, it soon proved true, as other researchers began to replicate the results. Coding experts then realized the significance of that work. Berrou and Glavieux were right, and their error-correction coding scheme, which has since been dubbed turbo codes, has revolutionized error-correction coding. Chances are fairly good that the next cellphone you buy will have them built in.

From a niche technology first applied mainly in satellite links and in at least one deep-space communications system, turbo codes are about to go mainstream. As they are incorporated into the next-generation mobile telephone system, millions of people will soon have them literally in their hands. This coding scheme will let



cellphones and other portable devices handle multimedia data such as video and graphics-rich imagery over the noisy channels typical of cellular communications. And researchers are studying the use of turbo codes for digital audio and video broadcasting, as well as for increasing data speeds in enhanced versions of Wi-Fi networks.

With possibilities like these, turbo codes have jumped to the forefront of communications research, with hundreds of groups working on them in companies and universities all over the world. The list includes telecommunications giants like France Télécom and NTT DoCoMo; high-tech heavyweights like Sony, NEC, Lucent, Samsung, Ericsson, Nokia, Motorola, and Qualcomm; hardware and chip manufacturers like Broadcom, Conexant, Comtech AHA, and STMicroelectronics; and start-ups like Turboconcept and iCoding.

Turbo codes do a simple but incredible thing: they let engineers design systems that come extremely close to the so-called channel capacity — the absolute maximum capacity, in bits per second, of a communications channel for a given power level at the transmitter. This threshold for reliable communications was discovered by the famed Claude Shannon, the brilliant electrical engineer and mathematician who worked at Bell Telephone Laboratories in Murray Hill, N.J., and is renowned as the father of information theory.

In a landmark 1948 paper, Shannon, who died in 2001, showed that with the right error-correction codes, data could be transmitted at speeds up to the channel capacity, virtually free from errors, and with surprisingly low transmitting power. Before Shannon's work, engineers thought that to reduce communications errors, it was necessary to increase transmission power or to send the same message repeatedly — much as when, in a crowded pub, you have to shout for a beer several times.

Shannon basically showed it wasn't necessary to waste so much energy and time if you had the right coding schemes. After his discovery, the field of coding theory thrived, and researchers developed fairly good codes. But still, before turbo codes, even the best codes usually required more than twice the transmitting power that Shannon's law said was necessary to reach

continued ▶

a certain level of reliability—a huge waste of energy. The gap between the practical and the ideal, measured in decibels—a ratio between the signal level and the noise level on a logarithmic scale—was about 3.5 dB. To chip away at it, engineers needed more elaborate codes.

That was the goal that persisted for more than four decades, until Berrou and Glavieux made their discovery in the early 1990s. When they introduced turbo codes in 1993, they showed it was possible to get within an astonishing 0.5 dB of the Shannon limit, for a bit-error rate of one in 100 000. Today, turbo codes are still chipping away at even that small gap.

Turbo codes put an end to a search that lasted for more than 40 years. "It's remarkable, because there's this revolution, and nowadays if you can't get close to Shannon capacity, what's wrong with you?" says R. Michael Tanner, IEEE Fellow and the University of Illinois's professor of electrical and computer engineering and provost. "Anybody can get close to the Shannon capacity, but let's talk about how much faster your code goes...and if you are 0.1 dB from Shannon or 0.001 dB."

It was the insight and naiveté typical of outsiders that helped Berrou and Glavieux realize what the coding theory community was missing. "Turbo codes are the result of an empirical, painstaking construction of a global coding/decoding scheme, using existing bricks that had never been put together in this way before," they wrote a few years ago.

Berrou says their work is proof that it is not always necessary to know about theoretical limits to be able to reach them. "To recall a famous joke, at least in France," he says, "the simpleton didn't know the task was impossible, so he did it."

Read the full story 'Closing in on the perfect code' at IEEE Spectrum Online - **www.ieee.org**

WiMAX hits rural France

In a move that seems to fly in the face of our notional idea that much of France is a sleepy, very rural haven of peace and low-tech tranquillity that we would like to retire to, just about the leading edge of wireless broadband technology is being deployed on a widespread basis.

WiMAX systems developed by Altitude Telecom (AT) of France have been chosen by the authorities of Vendée (in Western France) to cover the entire département (there are about 100 départements in mainland France, and they are roughly the equivalent of counties in England and Wales.). AT – the only French operator with a licence to deploy WiMAX - says that as the new broadband wireless technology can provide digital services over large areas, WiMAX constitutes a genuine alternative to wireline infrastructures, and has been covering increasingly large parts of the country.

AT states that in practical terms and as far as end-users are concerned, the advantages of WiMAX are manifold. For a start, the level of technical performance achieved by WiMAX means that speeds and quality of service are superior to SDSL. Immediate applications include high-speed Internet access, virtual private IP networks and Wi-Fi traffic collection (with Wi-Fi linked to LAN access). AT has already deployed WiMAX across several large French towns and two départements – including Vendée in the West and Orne in the North-West.

AT was chosen by the authorities of the Vendée département to cover its entire territory with WiMAX, which will provide broadband access for 96% of the population, rising to 99% with complementary DSL coverage. Some 20 base stations will be sufficient to cover the 7,000 sq km of the Vendée département. The network will be operational in June 2005 and the operator will then offer services for private individuals and businesses with speeds of up to 10 Mbit/s.

AT holds 3.5 GHz and 26 GHz wireless local-loop operating licences, on the back of which the operator is becoming a leading partner in France for local authorities developing WiMAX across their areas. The company has plans for expanding both within and outside France, and now offers its expertise on a franchise basis to foreign operators wishing to deploy digital facilities and broadband Internet connections for everyone.

...but ABI Research cautions against betting the bank on WiMAX just yet!

While Altitude Telecom pushes ahead with its WiMAX marketing campaign, technology research company ABI cautions that the standard has not reached a critical mass of support, and feels that there are some challenges to be faced.

Recent announcements have indicated that two large European mobile equipment makers — Siemens and Alcatel — have pledged to produce equipment compatible with WiMAX, also known as the 802.16 standard. As providers of mobile infrastructure, Alcatel and Siemens have a long history of providing gear to large multinational carriers, and their recent announcements will bolster the WiMAX cause. ABI Research has long stated that support from both large carriers and large diversified equipment manufacturers will be required if the WiMAX industry is to achieve $1 billion in annual revenue by 2009. While many vendors have pledged support for WiMAX, operators' plans for the technology remains guarded though actual spending on proprietary technologies surges.

Full-scale deployment for WiMAX hinges on the availability of the Intel chipset, which, in volumes, makes for lower cost equipment. Initial chipset production quantities are expected in late 2004, with equipment available towards the middle of 2005.

As vendors await the lower cost chips, demand for proprietary systems is set to grow by about 50% from 2003 to 2004, in unit terms. Early indications are showing growth across the board, but most typically in regions outside North America and Europe.

"The market cannot ignore the momentum behind some of these proprietary technologies. With equipment prices comparable or sometimes cheaper to those initially promised by WiMAX, the market for these technologies is growing at an incredibly fast clip," remarks Edward Rerisi of ABI Research. "However, in the end, WiMAX is poised to win, eclipsing spending on proprietary technologies by the decade's end."

WiMAX to drive broadband convergence

Emerging broadband wireless access technologies such as WiMAX and 802.20 will blur divisions between fixed and mobile broadband services, according to a new report from wireless and tele-communications consultants Senza-Fili and BWCS. Future BWA providers will be able to offer a single subscription including broadband access in the home and high-speed mobile data services on the move.

The report - WiFi, WiMAX and 802.20: The Disruptive Potential of Wireless Broadband - concludes that new 802-based BWA technologies have the potential to create new broadband services that transcend existing business models for DSL, cable and 3G. While this vision is at least five years away, report author Monica Paolini warns that service providers need to start positioning themselves today to take advantage of it.

She said: "While there is still some work to do on standards and interoperability, there is growing vendor momentum behind BWA technologies and WiMAX in particular. Service providers need to start making decisions now about technologies and market strategies so they are ready to ride the BWA wave when products become available."

Technologies such as 802.16 and 802.20 offer the potential to deliver both fully mobile broadband internet access (at speeds of up to 250kph) and fixed broadband services. These could be offered over the same infrastructure as separate services or as a combined broadband subscription. Paolini said: "Wireless broadband services that combine fixed and mobile access will be tied to the subscriber, rather than a location (home or office), with the subscriber free to use service anywhere within the coverage area."

While the mobile variants of 802-based BWA have the most disruptive potential, the first WiMAX products to appear will be designed for portability only. Based on the soon-to-be-ratified 802.16RevD standard, these will be designed for delivering broadband access to homes, offices and public WiFi hotspots. Service providers in the US, UK and South Korea are already carrying out trials of pre-WiMAX and pre-802.20 technologies for delivering broadband services in rural and metropolitan areas.

Paolini said: "BWA has had a few false dawns already but this time round we have more robust, cheaper technologies and standards-based contenders like WiMAX which have broad industry support. This threatens to have a huge impact on the economics and market potential of BWA services."

The new study forecasts that there will be 10 million BWA subscribers in the US alone by 2008. Of these the majority (49%) will be mobile business users.

Chinese government backs down over WAPI

Wireless industry news source Fierce Wireless (www.fiercewireless.com) has reported that China has backed away from plans to establish a proprietary security standard for WiFi, called WAPI, that would have required foreign WiFi vendors to use a different form of WiFi technology and to share some of their WiFi intellectual property (IP) with Chinese companies.

Chinese officials also said the country will adopt a new technology piracy prevention plan designed to protect the IP of foreign vendors. China made the announcement on the 21st April at a press conference in Washington, D.C., attended by U.S. Commerce Secretary Don Evans, U.S. Trade Representative Robert Zoellick, and Chinese Vice Premier Wu Yi.

The announcement came as a relief to U.S. WiFi equipment vendors. Many American firms had claimed that WAPI was designed to give China's WiFi companies an unfair competitive advantage. Other critics also claimed that WAPI was designed with a so-called "back door" that would allow the Chinese government to spy on WiFi Internet connections. Intel and Broadcom led the charge against WAPI, threatening to boycott the Chinese market if the government stuck to its original policy. Other vendors, however, had hinted that they might be willing to use WAPI.

Wayport selected as McDonald's US Wi-Fi service provider

McDonald's has chosen Wayport as its provider of high-speed broadband connectivity and Wi-Fi - 802.11b/g - high-speed Internet service in the U.S., this being part of the continued roll out of hot spots within locations of the Golden Arches company.

McDonald's selected Wayport after testing through a pilot program of its carrier grade high-speed Internet solution and 24/7 customer care in the San Francisco/San Jose, Portland, Boise and Raleigh markets. During the pilot program, Wayport and McDonald's solicited interest from customers ranging from mobile professionals to soccer moms and students. Survey feedback showed that these customers took advantage of Wi-Fi at McDonald's because of the accessibility of the restaurants and due to Wayport's user-friendly and secure Wi-Fi experience through network support for VPNs and personal firewalls.

McDonald's and Wayport are already converting hundreds of existing pilot locations in Seattle, Chicago and New York over to Wayport service with more announcements regarding additional markets to follow in the coming months.

"We are extending McDonald's rich history of offering our customers quality food and service, convenience and value that is relevant to their daily lives by adding Wayport's Wi-Fi service across the U.S.," said Jim Sappington, McDonald's Vice President of U.S. Information Technology. "We want the Golden Arches to be the first choice for a great meal and wireless Internet access."

Participating wireless-enabled restaurants are listed on **www.mcdwireless.com** and **www.wayport.net.** McDonald's customers can also identify participating restaurants by signage that displays the Golden Arches in the universal Internet @ symbol. Walk-up customers can pay $2.95 for a two-hour wireless Internet connection, with other pricing options available from Wayport including a $29.95/month unlimited use plan across the entire Wayport network. Service options available via roaming partners will be announced soon. McDonald's Wi-Fi customers will also enjoy customized content, including free digital versions of USA Today, New York Times and BusinessWeek.

"Wayport's neutral host strategy and relationship with McDonald's will deliver on the promise of making Wi-Fi ubiquitous and accessible to millions of customers who need to stay connected and productive when traveling locally, regionally or nationally," said Dave Vucina, CEO of Wayport. "The broadband family needs a seamless extension of home and office connectivity, and McDonald's is the perfect venue to meet that need."

Extreme Networks pushes access point boundaries

Extreme Networks claims that its Altitude 300 wireless port is the first Wi-Fi certified dual-radio Access Point (AP) capable of concurrently supporting 802.11b/g and 802.11a connectivity with Wi-Fi Protected Access (WPA) security.

Extreme's goal is to ensure that customers can be confident that the 300 AP will interoperate with the broadest spectrum of other vendors' hardware compliant with the standard. The solution works with Extreme Networks' Summit 300-48 switch, a 48 port device supporting wired and wireless networking with standards-based Power over Ethernet (PoE) and advanced management and authentication capabilities.

"Having the industry's first dual-radio, dual channel Access Point certified by the Wi-Fi Alliance for simultaneous b/g and a connectivity demonstrates Extreme Networks' commitment to delivering enhanced, high-bandwidth WLAN solutions that are complete, secure and seamless to deploy," said Vipin Jain, vice president and general manager of the LAN Access Group at Extreme Networks. "Customers implementing Extreme's WLAN solution can be confident that our products will work with a variety of Wi-Fi CERTIFIED third-party client devices without locking them into proprietary solutions."

WeRoam enlarges WLAN roaming activities in North America

The global WLAN roaming platform WeRoam, a service offered by Swiss-based TOGEWAnet AG, announced three new strategic partnerships at the recent "WLAN Event" congress in London. In Surf and Sip, FatPort and Concourse, WeRoam has added three successful Wireless Internet Service Providers (WISPs) in North America to its group of partners and has extended its WLAN roaming network by over 500 hotspot locations. Over 8,000 hotspots worldwide have already connected to the WeRoam network.

Surf and Sip provides high-speed wireless Internet access in cafes, hotels, restaurants and other high traffic public establishments. The company has developed, and continues to expand, a national network of today more than 300 locations in the US. In the UK Surf and Sip operates the WLAN access at the well-known "Caffé Nero" coffee shops.

Concourse Communications is an operator of in-building, wireless networks in large, communications-intensive properties. In particular, Concourse is well known for managing wireless, voice and data networks in airports. Today Concourse operates 28 Wi-Fi hotspots at several airports nationwide.

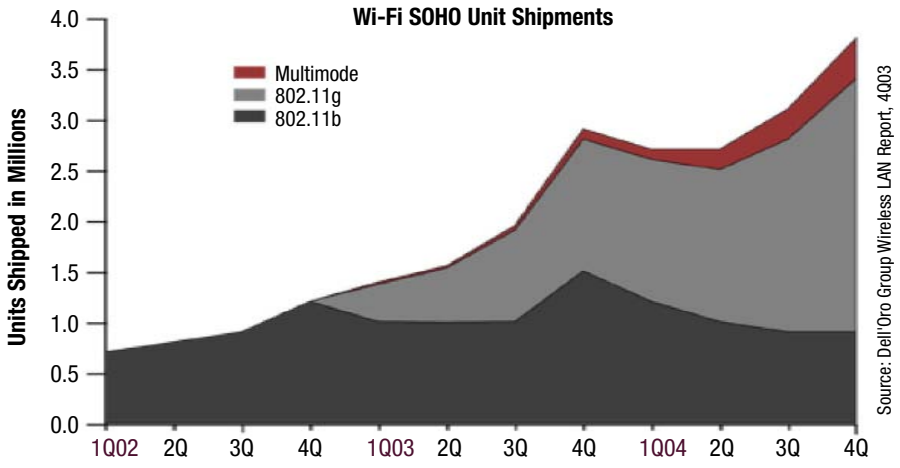
FatPort operates the most extensive network of hotspots in Canada with over 150 locations. The focus of the company is to provide the millions of mobile workers with immediate high-speed access to their email, company's intranet, or any other internet activity they require.

Being a neutral roaming platform, WeRoam builds a bridge between the WISPs as hotspot operators and mobile operators and telecommunications companies, whose clients subsequently gain access to thousands of Wi-Fi hotspots throughout the world. By providing the roaming services, WeRoam is also serving the authentication and clearing. WeRoam also provides WLAN users with secure, wireless Internet access through SIM authentication. This removes the need for voucher cards, temporary passwords and similar time-consuming login processes: The SIM card and a PIN are all that is needed.

Worldwide 802.11 market exceeds $500 million in 4Q03, driven by SOHO sector growth

According to market research firm Dell'Oro, growth in the Wireless LAN market during 4Q03 came primarily from the SOHO Infrastructure (Access Points-SOHO plus Broadband Gateways) or "SOHO" and NIC markets, which grew a combined 16% on a revenue basis compared with 3Q03. On a unit shipment basis, the SOHO market grew 21% versus 3Q03 and specifically 802.11g which grew 40% sequentially.

The holiday season is typically very strong for the wireless LAN market and 2003 was no exception. Consumers are increasingly networking their home in order to share a broadband Internet connection among multiple computers. Moreover, consumers are beginning to network their gaming devices and consumer electronics in order to access both content and services on the Internet, and to share content across their home network.



In contrast, after two quarters of approximately 20% sequential growth, the Enterprise WLAN market declined 8% in 4Q03. This decline is expected to be temporary, with the Enterprise market seeing a return to growth in 1Q04.

UK government provides support for RFID development

A Richmond, UK-based company has won a Smart award to develop and produce an electronic tagging and tracking system for packaged items based around RFID technology.

ITPCO Ltd won the Smart Micro project award, (now renamed Research & Development grants), from the Department of Trade and Industry's Small Business Service (SBS), which aims to encourage innovation in England.

The company has been working on the development of an electronic tag that uses Radio Frequency Identification (RFID) for packages in warehouses. According to ITPCO, the RFID system has many advantages over the current barcode system. The tag can be invisible, water or mud resistant and stores up to 1 kilobyte of information that can be read through a scanner as English sentences.

Managing Director Foroutan Parand said: "This new system will enable people to update

information for individual products and supplier information will be available on the tag. It will improve efficiency as you can have a maintenance history from the manufacturer to the end user and can double check to see if the product is genuine. The other advantage is that you can read many products at the same time. You could have 50 gadgets pass through a supermarket type reader system and they will be scanned and read simultaneously. Thanks to this award, we've managed to forge ahead with this project."

The Grant for Research and Development is designed to help individuals and small and medium-sized businesses research and develop technologically innovative products and processes. It is a development of an existing Smart scheme and provides support for different types and sizes of project. Grants range from £20,000 for small projects, while for exceptional projects involving the development of high cost technologies with strategic importance for an industry or technology sector or with quality of life benefits, grants are negotiable up to 35% of eligible costs up to a maximum grant of £500,000.

RFID security and access control applications to skyrocket

A new wireless development survey from Evans Data has found that security and access control are the most likely applications to use RFID (Radio Frequency IDentification) technology with 3 in 10 survey respondents planning an RFID implementation saying that they plan on developing security applications first. Other likely applications are: inventory and asset management, and industrial tracking.

Evans Data's research suggests that RFID has a small number of applications deployed presently but is expected to increase by 450% in the next year and a further 96% in 2006.

"RFID is still in the process of becoming. It holds amazing promise for access control and inventory management but there is another edge to that sword, the privacy concerns about the use of RFID technology to track individuals without their knowledge or consent," said Jason Kaczor, Evans' wireless analyst. "It will remain a very interesting technology and, as the data has shown, RFID is poised to make 2004-2005 its biggest year ever."

Other findings from the March 2004 survey of 450 wireless developers found that:

- More than a third of survey respondents have already implemented a Wireless LAN (WLAN) and another third expect to incorporate a WLAN within the next two years. To secure those WLAN's, the most likely security mechanism is Wi-fi Protected Access (WPA) followed by Wireless Equivalent Protection (WEP) and Extensible Authentication Protocol (EAP) and its various forms.
- Cost of airtime is the biggest barrier for mobile device and services adoption. Developers in North America are the least likely to be affected by Cost of Airtime issues and Latin American developers are the most likely to be affected with more than half saying airtime costs are a significant barrier to adoption.
- Wireless devices need to have a means of getting the information out and it appears that developers recognize this with almost half indicating that it is "absolutely" or "probably" important for wireless devices to have printing capabilities.

Ember buys ZigBee technology from CCL

Ember Corporation has purchased a portfolio of 802.15.4 radio frequency (RF) integrated circuit technology from Cambridge Consultants Ltd (CCL) and hired the engineering team that developed it.

This enables Ember to offer radio, network and software in an integrated 802.15.4/'ZigBee' package that serves the market for low- cost, low-power networking applications. The market for ZigBee chips is expected to reach half a billion units by 2008, according to analyst Kirsten West of West Technology Research Solutions. "The potential size of these new wireless markets totally dwarfs anything we have seen so far with early consumer wireless standards," West said.

The CCL deal gives Ember, exclusive rights to CCL's 802.15.4 single-chip architecture, which supports low-power radio communications in demanding environments such as industrial facilities, a license to use CCL's library of low-power radio components; and a wide range of digital communications intellectual property. Ember also gets two years of CCL's integrated circuit development services to accelerate product development.

Paired with Ember's embedded mesh networking intelligence, CCL's radio technology will create a single-chip platform for mesh networking applications such as building security, heating, cooling, lighting and ventilation; inventory control; industrial controls; and transportation infrastructure safety monitoring.

"This acquisition proves our commitment to the market and to consolidating key intellectual property - networking and radio - in one product," said Ember CEO Jeff Grammer. "Companies developing 802.15.4-based products need radio and networking technologies that interoperate seamlessly, instead of spending valuable development time stitching them together. Coupling our current partner-based development strategy via Chipcon with outstanding in-house expertise makes Ember the sound choice for these companies."

The development team, now part of Ember, will be the core of an expanded European presence based at CCL's facilities in Cambridge, UK. Ember Europe now becomes the 'fabless' silicon arm of Ember Corporation. The subsidiary also includes Ember's existing UK sales and service staff and former CCL associate director Jim Schoenenberger, who takes the position of director of business development.

Ember will also port its EmberNet mesh networking platform to the CCL platform, and continue EmberNet development for next-generation products.

Incisor Directory of Bluetooth industry companies

As time goes on, more and more companies join the Bluetooth Special Interest Group (SIG), becoming part of the global network of companies that are working to take Bluetooth technology to market.

On an ongoing basis, Incisor includes a listing of companies providing products and services within the Bluetooth sector.

Beyond the simple listing, wherever there is an open book icon (📖) alongside the company name, you will be able to obtain more information and contact details for that company by clicking on the icon. This provides a link to an expanded profile of that company.

Incisor continues to be the only continuously published magazine dedicated to Bluetooth technology, and is received at more than 1200 companies across the world, and enjoyed by an estimated readership of 25,000 individuals. To add your company or a profile for your company to this directory listing, email: directorylisting@click.co.uk

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Wireless industry calendar of events

DATE	EVENT	LOCATION	NOTES	LINK
May 14 - 15 2004	2004 Wireless Telecommunications Symposium	Pomona, California, USA	An IEEE forum for industry, government and academic leaders and experts on wireless Internet and WML, UWB, 802.11, Bluetooth and 3G/4G.	http://www.csupomona.edu/~wtsi/
June 8 - 10 2004	Wireless Connectivity World	Amsterdam RAI, Netherlands	-	www.wiconworld.com
Sep 27 - Oct 1 2004	3GSM World Congress Asia	Suntec International Convention & Exhibition Center, Singapore	-	http://www.gsmconferences.com/3gsmasia/
tbc, October 2004	WiCon Asia	Singapore	-	www.wiconworld.com/asia
November 8 - 10 2004	WiCon Americas	Santa Clara Convention Center	-	www.wiconworld.com/americas

Further Bluetooth events will be added to the calendar as soon as they are announced. See notes below regarding editorial submissions.

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