



Android OPENS UP THE OPERATING SYSTEM FOR INNOVATION

**ENGINEERING
DIFFERENTIATION
INTO SMART PHONES**



**THE FUTURE OF
APPS LIES IN THE
ENTERPRISE AND
ON TV**



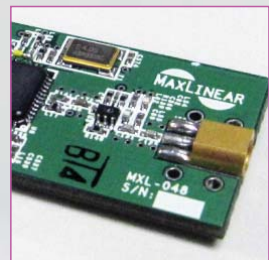
**G2 SMART PHONE
DELIVERS 4G
PERFORMANCE
WITH HSPA+**



**WHAT HAPPENED
TO FEMTOCELLS?**



**TUNERS AND
DEMODULATORS
MAKE FREE MOBILE
TV HAPPEN**



EDITORIAL BY LOUIS E. FRENZEL, *EDITOR-IN-CHIEF*

ENGINEERING THE DIFFERENTIATION INTO SMART PHONES

When you look inside a smart phone, what do you see? First, the radios. Most are dual-band or quad-band transceivers for the cellular bands used by the carriers. Today, all are 2G/3G capable. Each radio has its own power amplifier (PA). Next is the processor or processors. A typical unit today runs at 1 GHz, and most units have some DSP cores in there somewhere. The trend is toward a system-on-a-chip (SoC) rather than separate baseband chips and control functions.

A rather huge chunk of memory is also inside—RAM and flash both. Then there are the peripherals, namely the touchscreen, perhaps a separate keyboard, the microphone and speaker, and audio amps. Also inside are the auxiliary radios like Bluetooth, Wi-Fi, and GPS, maybe even FM. Don't forget the multiple antennas. And fi-



Louis E. Frenzel

nally there's the battery and all the chargers, regulators, converters, and power-management devices.

With only a handful of suppliers for these chips and other components, most smart phones look remarkably alike inside. They all do the same things, too. So how in the world do handset manufacturers really differentiate their product from all the others?

It seems like a new smart phone is announced every week (*Fig. 1*). As I review them, I keep asking myself what makes them different or better. Why would I

buy this one over that one or all the others? When the designers of a new smart phone get together to define their product, what are the real differentiators that will make it stand out and become a leader or the next hot product?

BRAND NAME

This is important today. "Branding" means the company reputation plus



1. Nokia's latest smart phone, the N8, has all the right stuff including version 3 of the popular Symbian OS, a touchscreen, a 12-Mpixel camera, and Ovi apps, but it hasn't been popular. What differentiator isn't working here?

some specific model. Apple is the best example. It's well known and reputable, and it offers good products and the coolness factor. Everyone wants an iPhone. BlackBerry is another good one. It is widely respected and the cause of lots of peer pressure in some companies, with a traditional image as well as the so-called CrackBerry addiction.

Reputation, word-of-mouth, and peer pres-

sure all factor into branding. So why is the Nokia brand so weak here in the U.S. when the company is still number one worldwide, especially in Europe?

CARRIER SERVICE

Not all phones are available at all carriers. You usually select the phone first and then take whatever carrier delivers it. Nevertheless, carrier reputation is a

differentiator. A bad carrier reputation will send a buyer off to a new carrier even if a particularly desirable phone is only available there. Carrier reputation varies widely in different areas.

A bad reputation is a factor that is propagated by individual users as they tell their friends and family about their poor experience. It's better to take a phone you're not as fond of than endure two years of lousy service. And how do you get a phone if none of the carriers carry it? That's part of Nokia's problem—that and high price.

OPERATING SYSTEM

I doubt that most smart-phone buyers select their next handset by what operating system (OS) it uses. However, it seems to be a growing factor because the OS is more important than ever. It defines how the phone acts, how easy it is to use, and its available applications.

Google's Android OS is well publicized and known, and many in-the-know buyers want in on that trend. Some consumers may even hear that a phone is clunky because of its OS. Even

though the phone may be usable, unfavorable word of mouth will doom it.

TOUCHSCREEN

Just about all smart phones today have a touchscreen. This one feature defines the modern smart phone. All smart phones perform zoom, pinch, and swipe. Some have a real keyboard, and some don't. The look, layout, and color schemes have a big impact on the buyer as well. Resolution doesn't seem to enter into this differentiation. Apple's iPhone 4 has killer resolution, but who buys an iPhone for that?

FEATURES

What new and different features does each phone have? Most are equivalent and offer the usual camera, with or without a flash, video recording, music player, GPS navigation, Wi-Fi connectivity, and Bluetooth. Most smart phones have all of these features, so there is little differentiation. Is dual-camera capability for picture phone calls a hot feature? Probably not. You can't really use it well while driving.

STYLE

Looks play a major role in most consumer purchases. The phone has to look good or cool—sleek, small, thin, and light. Style beat out antenna performance in Apple's iPhone 4, for example. Flip phones are essentially out, as consumers prefer the candy bar or slider today. A great deal of attention is spent on appearance, which is more of a differentiator than you imagine. Yet you have to wonder about its impor-

tance, though, since most smart phones look alike.

APPS

A year or so ago, apps weren't even a factor. "What's an app?" consumers would ask. Today, apps are hot and people want them. Apple is the leader here and will probably remain so. Android apps are growing exponentially, so they're also a factor. The others are really lagging but trying to catch up. It is a key differentiator today, for sure.



2. The Dell Streak tablet has a 5-in. screen, which seems like a compromise.

ONE THING THAT USUALLY DOESN'T INFLUENCE YOU

If you have owned two or more smart phones, you begin to worry about things that don't usually speak to you when you're buying them, like talk time. This is a big factor, as all of those radios and all that computing eat power.

Battery life is shorter these days. Better batteries are one part of the solution, as are better power-management techniques. Some con-

sumers may buy the smart phone of their dreams but quickly discover that it hardly survives the day with a fresh charge. Heavy usage requires a recharge during the day. That's not good.

WHAT TO LOOK FOR—AND NOT LOOK FOR

First, don't look for larger screens, which have topped out at just over 4 inches (diagonally). Anything bigger makes the phone much larger, and that's a no-no. Dell's new Streak tablet has a 5-inch screen (Fig. 2). It's also a phone. Maybe it will be popular, but I don't think so. If you have to have a larger screen, get a bigger tablet or a netbook.

I would like to be able to use the cell phone as a laptop modem. There are times when I need to, say, plug a USB cable into the laptop and the cell phone and use the phone as a data card. How hard could that be?

A forthcoming differentiator is TV—not network-delivered TV, over-the-air TV. Yes, FLO TV has been around a while and some consumers use it, but it has not been that big a factor in phone differentiation. Some

phones in Europe, Japan, and Korea already have broadcast TV and we're about to get it in the U.S.

The U.S. broadcast TV standard for mobile TV called ATSC-M/H is finalized and chips are in the works. The tuners will surely fit inside any cell phone, but the antenna is still a challenge. I bet that TV will be a major differentiator.

Radio is another factor. A few phones have FM, but they aren't common. The National Association of Broadcasters has asked Congress to mandate FM radio in cell phones. That's not a good idea. Besides, I want AM too. Chips to implement both have been around for years. The antenna is the limiting factor.

I can get AM radio on my iPhone. I go online via Wi-Fi and then go to the Web site of the AM radio station and stream the audio. It isn't a great way to get AM, but it is an alternative. Over the air would be better, and it wouldn't tie up the network. All I need is a 10-foot wire trailing from my cell phone to get it.

Anyway, you get the picture. What one feature would make you buy a smart phone? ■

INDUSTRY VIEW BY DANIEL BURRUS, *BURRUS RESEARCH*

THE FUTURE OF APPS LIES IN THE ENTERPRISE AND ON TV

No one can deny that the original telephone Alexander Graham Bell invented in 1876 has changed significantly. From a luxury item proudly displayed as the centerpiece of the home to something small, portable, and powerful that people keep within arm's reach 24/7, the humble telephone has evolved into a mini personal computer capable of much more than traditional voice phone calls.

With the advent of various smart phones, such as the iPhone, BlackBerry, and Droid, phones have gotten, well, smarter. People can now download apps (short for applications) directly to their phone to help them with a number of everyday tasks. Whether you want to check flight schedules, create a to-do list, convert currency, track your daily caloric intake, relax to soothing sounds, or perform any number of business or personal tasks,



Daniel Burrus

chances are there's an app for it.

As a result, businesses in every sector have been creating apps directly related to their core offerings. Some would even say that companies are "scrambling" to enter the apps market, believing that attracting additional customers and revenues is directly related to their app offerings.

Is creating apps a smart thing for businesses to do? Of course. Just as the phone has evolved, so has business. Having the ability to "touch" your customers when they're not in your store or on your

Web site is vital to stay competitive. Yet as technology and smart phones continue to evolve, and we know without a doubt that they will, the apps that companies create have to change too. And that's exactly where many companies are missing the mark.

WHERE WE GO FROM HERE

While creating apps with mass-market appeal is good, such as apps for finding a good restaurant or creating action lists, few companies are thinking about the evolution of apps and what the next generation will be. So what exactly will tomorrow's apps look like? The natural progression will be for apps to target the enterprise level. There will be apps for purchasing, logistics, supply-chain management, lead generation, patient care, and so on.

Tomorrow's apps will be like having a virtual assistant

by your side. They won't just make you more productive with your work, they'll actually do some of the work for you. For example, in the medical field, we'll see apps for disease management, patient records, and remote diagnostics. The app will be more like an essential tool to perform a specific function rather than an ancillary item.

Aside from the app itself, the future of apps is also about where that app will be used. With Apple's launch of the iPad and soon competing smart pads by other manufacturers, apps are already finding new homes outside of the phone. Some smart-phone apps are compatible with smart pads. But even those companies aren't thinking big enough, both literally and figuratively.

Since smart pads have bigger screens and more processing power, why should they do the same thing as the phone app? Why not take advantage of that extra space and power

and come up with a new class of apps that can do things the phone apps can't? Companies must think about these key questions and address them if they want to be serious players in the future app market.

But that's just the beginning. The next evolution is apps for the television. Today's newer televisions are Internet enabled. (By the way, all of our devices will be Internet enabled one day.) The processor and the television browser are built into the TV set, so you don't have to plug a computer into your television. The TV is the computer.

With this comes the wide-scale use of Internet protocol television (IPTV). It's essentially TV over the Internet instead of on cable and satellite. In fact, many millennials use IPTV service for all of their television viewing rather than cable or satellite. Knowing this, it's only logical that we'll see apps for TV. Some new models already have them—television-level apps.

Flat-panel displays provide even more visual real estate and will most likely have faster processors. Many new televisions are also 3D equipped, meaning

your apps will be 3D too. In the app world, this is a game changer. Smart companies need to stay ahead of this evolution and create their apps accordingly.

STAKE YOUR CLAIM

If you look at the types of apps currently available in the app stores, you can see that most of the companies developing apps don't see the future of apps. These companies are creating simplistic and basic apps that don't account for future needs. They certainly aren't enterprise-level apps.

In fact, if you look for business apps in iTunes, the largest app store, you'll find numerous apps for such things as document scanning, creating to-do lists, and document sharing. Such apps are so common that some could argue they're commodities. Standing out in the business world requires you to be more than a commodity, though. You need to be a unique solutions provider. Tomorrow's apps will do precisely that.

Apps are a major tectonic revolution in computing. We went from servers,

Happy With Haptics: Touchscreen Users Get Feedback

HAPTICS IS THE science of touch. And with the significant movement to more touchscreens in phones, laptops, netbooks, and tablets, it's going to play a much larger role than it has in the past. By using haptics with its vibrating feedback, users get a more natural feeling to button clicks and touch motions. The result is an overall better user experience with games, handsets, and tablets.

Haptics kicks in when you touch the screen. Software running on an embedded controller senses that input. Then, the haptics software outputs signals to a special eccentric rotating motor that produces a unique vibration related to the touched item. The user gets appropriate touch feedback that is inherently lacking in all touchscreens.

Because haptics is such a special field, implementing it can be tricky. Now, Immersion Corp. is making haptics easier to include in a design. Its TouchSense 2500 solution comprises all the needed software and a reference design that facilitates haptics inclusion.

TouchSense 2500 enables haptic effects that enhance the user experience in touch-based PCs, slates, tablets, netbooks, notebooks, ultra-portables, and all-in-one computers. As momentum for touch input increases, haptics can provide a tactile response, making interactions more intuitive, satisfying, and exciting by restoring a "mechanical" feel to screens.

The solution supports integrated and advanced user interfaces (UIs) and touch gesture-based interactions. It may be integrated to generate a variety of effects from simple alerts to sophisticated touch gestures in touch pads, capacitive buttons, touchscreens, and virtual keyboards. Also, it includes product-specific reference designs and a haptics ef-

fects library. TouchSense 2500 supports both Windows and Android operating systems as well. Key features include:

- Cost-effective haptic effects to improve the user experience
- A drop-in haptic processor from leading IC manufacturers, with porting available for custom processors
- Product-specific reference designs that simplify the implementation of haptic effects that are suited to the device
- A streamlined haptic effects library that allows designers to readily select haptic effects through a single command application programming interface (API) designed for a wide range of UI elements including touchscreens, touch gestures, and capacitive buttons
- UI integration with capacitive buttons, alerts, touchscreens, and touch gesture-like tap, double-tap, swipe, spread, pinch, slide/drag, and long press
- I/O interfaces including I²C and USB
- Operating-system (OS) support including Android and Windows 7
- Low power consumption, minimizing the drain on battery life

TouchSense 2500 is being brought to market as off-the-shelf haptic processors from Immersion's chip partners. It may also be ported to a device manufacturer's specific chip to add haptics to its solution. Toshiba's innovative libretto w100 is the company's first product to incorporate Immersion's technology. ■

MD&D News Staff
Immersion Corp. • www.immersion.com

VGA Reduces Footprint By 32%

THE MAX2063 FROM Maxim Integrated Products is the industry's only fully programmable, multi-state, dual-channel, digital IF/RF variable-gain amplifier (VGA), according to the company. Maxim also calls it an easy to control device that delivers an unparalleled combination of VGA performance, programmability, and component integration.

The VGA is designed to provide unique "rapid-fire" gain selection for four customized attenuation states per path, fast 25-ns digital switching, and very low digital VGA amplitude overshoot/undershoot. Maxim says that it is an idea choice for the "fast-attack" automatic gain circuits (AGC) found in all 2.5H, 3G, and 4G wireless infrastructure transceivers, including GSM/EDGE, CDMA, WCDMA, LTE, and WiMAX applications.

The MAX2063 can serve as an IF or RF all-purpose VGA, interfacing directly with 50-Ω systems operating over the 50- to 1000-MHz frequency range. Since the stages within each path have their own RF input and RF output, it can be configured to optimize either noise figure (i.e., amplifier configured first within the cascade) or linearity (i.e., amplifier configured last).

In the latter configuration, the cascade yields a total gain range of 31 dB, a maximum gain of 21.3 dB, and a noise figure of 5.6 dB. The cascaded linearity offers 41 dBm of output third-order intercept point (OIP3), 56 dBm of output second-order intercept point (OIP2), and 19 dBm of 1-dB output compression point (OP1dB).

The MAX2063 starts at \$6.90. Analog and digital (MAX2062) and analog-only (MAX2064) versions also will be available. ■
MD&D News Staff
Maxim Integrated Products • www.maxim-ic.com

mainframes, and terminals to having our own desktops and PCs to having our own laptops. Our main computing devices are becoming our smart phones and smart

pads, which enable us to connect to the world from anywhere.

By making the smart phone and smart pad a multimedia PC powered by

dozens if not hundreds of apps, consumers can now have a powerful computer with them at all times. As a result, people from all walks of life and every industry

can do some amazing things they couldn't do before. That's a giant shift in thinking about phones and apps, and your company needs to be a part of it. ■

DANIEL BURRUS IS THE FOUNDER AND CEO OF BURRUS RESEARCH AS WELL AS THE FOUNDER OF VISIONARY APPS. HE ALSO IS THE AUTHOR OF SIX

BOOKS, INCLUDING THE HIGHLY ACCLAIMED *TECHNOTRENDS*, WHICH HAS BEEN TRANSLATED INTO MORE THAN A DOZEN LANGUAGES, AND *FLASH FORESIGHT*, DUE IN JANUARY 2011.

NEWS BY THE MD&D NEWS STAFF

G2 SMART PHONE DELIVERS 4G PERFORMANCE WITH HSPA+

T-Mobile really needed a new smart phone to stay in the 3G/4G game with AT&T, Sprint, and Verizon. Now it has one, and a good one at that. The Google G2 uses T-Mobile's recently expanded HSPA+ network. Made by HTC, which also produces Sprint's EVO and Verizon's Droid, the G2 also uses Google's Android 2.2 operating system (OS) and offers a slew of new Google functions.

A smart phone needs a fast network, and T-Mobile has one. Its recently rolled-out HSPA+ network is now available in 55 major U.S. cities serving more than 100 million people. The HSPA+ network has a maximum theoretical speed of 21 Mbits/s, but G2 users can expect downloads up to 14.4 Mbits/s—not bad for any smart phone, and better than most.

The G2 features a 3.7-in. touchscreen and a unique

hinge design that opens to reveal a full QWERTY keyboard (*see the figure*). It offers seven customizable home screen panels, including one with a dedicated panel with one-click access to favorite Google applications such as Android Market, which currently offers more than 80,000 apps.

A highlight of the G2 is its Snapdragon MSM7230 mobile processor, which combines Qualcomm's new HSPA+ capabilities and second-generation applications processor. The Snapdragon MSM7230 offers an 800-MHz CPU and is optimized to deliver exceptional performance, long battery life, and leading-edge multimedia and Web browsing with download speeds faster than other solutions currently in the market.

The G2 also boasts an HD video camera for recording high-definition (720p) videos and a 5-Mpix-



T-Mobile's Google G2 smart phone should keep the company in the 4G hunt with AT&T, Sprint, and Verizon. Thanks to T-Mobile's expanded HSPA+ network, it boasts maximum theoretical speeds of 21 Mbits/s, with download speeds up to 14.4 Mbits/s.

el camera with LED flash and autofocus. Further, it features a pre-installed 8-Gbyte microSD memory card with support for up to 32 Gbytes, as well as a music player. Additional features include dedicated quick keys for one-touch access to your favorite Google shortcuts and applications, Adobe FlashPlayer-enabled Web browsing, pinch and

zoom functionality for Web browsing and the photo gallery, a built-in 3.5-mm headphone jack, a stereo headset and Bluetooth support, and Swype text input for fast, accurate communication.

The G2 is tightly integrated with Google Voice and is loaded with other Google applications such as Voice Actions and Google Goggles. In fact, it is one

of the first smart phones in the industry to offer the new Voice Actions feature of Google Search, which lets users control the phone with their voice for calling contacts and businesses, sending messages, browsing the Web, listening to music, and completing common tasks.

It is also the first smart phone to offer integrated access to Google Voice, so users can create a new account using their current mobile number right from the home screen. Google Voice then automatically transcribes voicemails to text so users can read them like an e-mail or text message from their phone or online. Additional pre-loaded Google services include Google Search, Gmail, Google Maps with Places and Navigation, YouTube, Google Talk, and Google Earth.

The T-Mobile G2 with Google will be available in the U.S. exclusively from T-Mobile. Current T-Mobile customers will have the opportunity to preorder the G2 in limited quantities later this month. Additional availability details will be shared in the coming weeks.

T-Mobile
g2.t-mobile.com

QUALCOMM DEDICATES SUBSIDIARY TO APP DEVELOPMENT

Qualcomm Inc. has announced Qualcomm Services Labs Inc. (QSL), a wholly owned subsidiary created to develop and introduce new services and applications that tap into the advantages of mobile technology. Designed to operate as an incubator, the company will explore ideas, technologies, and service models that can have an immediate impact in the marketplace as well as drive the adoption of Qualcomm's technologies.

QSL and its products will develop services and applications in five main areas: communication, information/entertainment, discovery, life automation, and digital to physical. As these services and applications mature, the company will determine if they will be transferred to a new or existing Qualcomm division or if they will be established as a separate business entity. Already, QSL has launched four services.

The Neer geo-fence-based location sharing ser-

vice solves communication and coordination problems by automatically sharing user-selected locations with that user's "inner circle." It is now available on the Android Market and will soon come to Brew MP and Apple's App Store.

The Qilroy social-messaging service enables location-based conversations to take place anywhere in the world. Users can instantly find people around them or at any interesting place in the world and then chat, post questions, and reply to others. It's available on Apple's App Store and on the Web at www.qilroy.com, and it will be available soon from Brew MP and the Android Market.

The Tapioca Magic Link intelligent URL shortening service allows content providers to share multimedia such as video and Web/WAP across devices like smart phones, feature phones, PCs, and smart-books. Available now, it's specifically geared for viral multimedia distribution across social networks.

And, the free Vive friends-based social recommendation service allows users to share recommendations, ratings, purchases,

and other activities with friends and other users in the Vive community. It gives users the freedom to recommend any content, organizes the content for quick access, translates content across platforms when needed, and rewards active and influential users. It's available on Facebook and will soon be on Brew MP and Apple's App Store. **Qualcomm Services Labs**
www.qualcomm.com/lqsl

PARTNERSHIP SUPPORTS RAPID PROTOTYPING AND APPLICATION INTEGRATION

On-Ramp Wireless has selected the IAR Embedded Workbench for TI MSP430 from IAR Systems for its latest Ultra-Link Processing (ULP) wireless technology. IAR Embedded Workbench will be packaged with the On-Ramp ULP wireless networking software development kit (SDK). IAR Embedded Workbench is preloaded with On-Ramp SDK source code drivers, providing the platform to quickly and reliably get the network up



and running for On-Ramp customers, according to the companies (*see the figure*). On-Ramp ULP technology is designed to offer high-capacity, long-range coverage, and ultra-low-power consumption without the need for repeaters. It fills a gap between existing communications platforms of higher-data-rate licensed spectrum cellular systems and free-spectrum short-range wireless radio platforms such as 802.11 and 802.15.4, the companies say. On-Ramp ULP wireless systems also are designed to solve the challenges of device monitoring, metering, and asset tracking in metro-scale and other difficult radio environments.

“We’re pleased to announce a new partnership

with On-Ramp Wireless and look forward to supporting their customers and offering them top-quality tools, support, and service,” says Nadim Shehayed, U.S. general manager, IAR Systems. “Our tools complement On-Ramp’s SDK, providing engineers with the capability to quickly develop highly optimized and target-specific compact code.”

IAR Systems
www.iar.com
On-Ramp Wireless
www.onrampwireless.com

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NEW RESEARCH LAB WILL INVESTIGATE 3D DISPLAY HANDSETS

The University of Oulu of Finland will host a collaborative research effort between Nokia and Intel. The Joint Innovation Center, which will be located at the Center for Internet Excellence at the university, will bring together two dozen researchers who will investigate mobile handset user interfaces over the next three years.

The research will focus on compelling new mobile user experiences. By taking

advantage of the rapidly increasing processing and graphics power of cell phones and other mobile devices, the lab will target 3D projects and virtual reality. Potential applications include home control and gaming as well as new paradigms for social networking.

The basis for the research is the MeeGo open-source mobile operating system, which is based on Intel's previous development work on its Moblin operating system (OS) and on Nokia's Maemo OS. Announced in February at Mobile World Congress, the Linux-based MeeGo software platform is designed for handsets, netbooks, tablets, in-car devices, and even TV sets. It can be used with ARM and x86 processors.

The collaboration's first efforts are focused on an eyewear-free 3D display. The work is based on concepts that say that it is possible to implement a 3D display on a small screen without special glasses. While the viewing angle for 3D is narrow, the approach seems acceptable for handset screens. Applications for such a display are also part of the R&D process.

No immediate practical output from the research is expected, as the objective is to establish a long-term process that will eventually result in real products. The plan calls for incremental steps in introducing innovations in practical products. Development tools and platforms are part of the research, which will allow expedient adoption of the software innovations. Open-source licenses will be available.

Center for Internet Excellence
www.cie.fi
Intel
www.intel.com
Nokia
www.nokia.com

SAMSUNG LAUNCHES GALAXY TAB

Powered by Android 2.2, the Samsung GT-P1000 Galaxy Tab boasts PC-like Web-browsing and other multimedia applications on a 7-in. multi-touch zoom WSVGA TFT-LCD (*see the figure*). The light, 380-g tablet also provides e-mail, voice and video calling, and SMS/MMS communication in addition to social networking, all experienced through an optimized user interface.



Measuring 190.09 by 120.45 by 11.98 mm and weighing 380 g, the Samsung Galaxy Tab provides communications connectivity, including voice and video calls and social networking, as well as HD multimedia functionality.

The Galaxy Tab supports Adobe Flash Player 10.1 for swift, seamless viewing of every single page on the Web, according to Samsung. Its Readers Hub e-reading application is designed for easy access to a vast digital library, while its Media Hub gateway leads to movies and videos. Its Music Hub provides similar access to a range of tunes.

The tablet includes 3G HSPA connectivity, with 802.11n Wi-Fi, and Bluetooth 3.0. It supports video conferencing and push e-mail. Also, it can provide voice telephony as a desktop speakerphone or as a mobile phone via a Bluetooth headset. Its front-

facing 1.3-Mpixel camera enables face-to-face video telephony over 3G, while its rear-facing 3.0-Mpixel camera captures still images and video for editing, uploading, and sharing.

Additionally, the Galaxy Tab features a 1.0-GHz Cortex A8 application processor. A wide range of multimedia formats such as DivX, XviD, MPEG4, H.263, and H.264 supports Full HD (1080p) video content. Its 4000-mAh battery can handle seven hours of movie playtime. And, its 16/32-Gbyte memory can be expanded with a 32-Gbyte MicroSD card.

The Galaxy Tab offers Google Maps, Latitude,

Places, and Google Maps Navigation (Beta) all via A-GPS, as well as Swype, Samsung Apps, and the ThinkFree document viewer and editor. Further applications will be available through Samsung Apps and Android Market. The device will be launched in Europe in mid-September and in other markets in the coming months.

Samsung
<http://galaxytab.samsungmobile.com/>

CONNECTED SERVICES ENHANCE THE SMART-PHONE EXPERIENCE

In tandem with the release of the HTC Desire HD and HTC Desire Z Android-based smart phones, HTC Sense offers a number of unique connected ser-

HTC Sense offers a series of connected services that are designed to enhance the mobile-phone experience for consumers who have the HTC Desire HD and other Android-based smart phones from the company.



vices called HTC Sense.com that promise to enhance the HTC mobile-phone experience (see the figure). These enhancements are expected to improve how users capture, create, share, and access multimedia content. They can record HD video or capture/edit images with a variety of camera effects.

Using HTC Locations, a differentiated online mapping experience, users have access to instant, on-demand mapping without download delays or roaming charges. HTC Sense also includes an online e-reading experience employing an e-book store powered by Kobo and a mobile-optimized e-reader with the ability to highlight, annotate, and search for definitions as well as translate unfamiliar terms. Essentially, the HTC Sense.com service will allow registered users to

easily manage their mobile phone experience from their HTC phone or PC.
HTC America
www.htc.com

MULTICORE SOFTWARE DEVELOPMENT ANALYSIS ENVIRONMENT SUPPORTS OCTEON PROCESSORS

CriticalBlue and Cavium Networks Inc. now support Cavium's Octeon and Octeon II architectures within CriticalBlue's Prism software analysis, exploration, and verification product. Software developers can use Prism to build applications on multicore Octeon and Octeon II processors. A free 30-day evaluation copy of the Prism Core PSP for cnMIPS is available at www.criticalblue.com/prism/platforms/cavium/cavium.htm.

This release is designed to go beyond purely mapping software to multicore hardware as users can quantify the benefit of software migration to the dual-issue superscalar Octeon and

Octeon II families. Users also can analyze data cache misses and pipeline stalls on a thread, function, or source line level, resulting in an ability to see the impact of such cache misses on the overall concurrent schedule.

Furthermore, users can accomplish all of this on an existing unmodified software application running on a single-core model or development board. Beyond that, experienced multicore programmers will benefit from Prism's performance tuning and multicore software verification capabilities. A three-minute demonstration of Critical Blue's Prism capability on Octeon is available at www.criticalblue.com/prism/platforms/cavium/medial/cavium_controller.swf.

The Eclipse-based Prism embedded multicore programming system lets software engineers easily assess and realize the full potential of multicore processors without significant changes to their development flow. It analyzes the behavior of code running on hardware development boards, virtual machines, or simulators.

Also, Prism allows engineers to take their existing sequential code and, before making any changes,

a.



b.



c.



d.



The Nokia N8 (a), E7 (b), C7 (c), and C6-01 (d) will be the first smart phones to use the Symbian^3 open-source platform.

NOKIA SMART PHONES TAP SYMBIAN^3 PLATFORM

Nokia's N8, E7, C7, and C6-01 will be the first smart phones to use the Symbian^3 platform, according to the company (*see the figure*). The fully open-source operating system (OS) incorporates more than 250 feature updates and platform improvements compared to its predecessors, all designed to improve the user experience.

Symbian^3 provides HDMI support, so users can connect their smart phones to their HD television to share HD videos or high-resolution photos as well as stream live TV, films, and music over the Internet. The Nokia N8 and E7 will boast these capabilities.

The OS also supports multiple personalized home screens. Users can create different home screens to fit each aspect of their life, placing their applications, widgets, and shortcuts as well as e-mail accounts and social media channels wherever they want them.

Further, Symbian^3 supports multipoint touch

so users can swipe to scroll, pinch to zoom, and tap once to open functions. With the OS's improved memory management, users can run even more applications at once using a visual task manager to switch seamlessly between them with a swipe and a tap.

And, a new and advanced 2D and 3D graphics architecture delivers a fast and responsive user interface, Nokia says, maximizing the visual enhancements and smooth transitions in Symbian^3. Users, then, can personalize their phone to make it look the way they want.

The Nokia C6-01 and C7 are designed for social networking, apps, music, and games, with 3.2- and 3.5-in. touchscreens, respectively, offering 640- by 360-pixel resolution. The E7 is designed primarily for business users, including a range of pre-installed business apps and the highest level of platform security, according to Symbian. The N8 is available now, and the others will be available later this year.

Nokia
www.nokia.com
Symbian
www.symbian.org

explore and analyze opportunities for concurrency. Having identified the optimal parallelization strate-

gies in this way, developers can implement parallel structures and use Prism again to verify performance

efficiency and thread-safe operations.

The Octeon multicore MIPS64 processors are designed for intelligent networking applications ranging from 100 Mbits/s to 40 Gbits/s. With one to 32 cnMIPS cores on a single chip, these software-compatible processors integrate next-generation networking

I/Os along with security, storage, and application hardware acceleration for throughput and programmability for the Layer 2 through 7 processing requirements of intelligent networks.

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COVER STORY BY ABHIMANYU DAS, Assistant Vice President, Aricent Technologies

ANDROID OPENS UP THE OPERATING SYSTEM FOR INNOVATION

A revolution has taken place in the open mobile operating-system (OS) arena since Google's Android launched three years ago. The sheer market power of Google, the attractiveness of the platform's open environment for developers, an expanding number of connected consumer electronics, and an estimated 40 Android-based handsets planned for shipping in 2010 have created significant momentum for the technology.

According to CNN, Android-based smart phones surpassed Apple iPhone shipments in the U.S. for the first quarter of 2010, clearly showing how Android is open for innovation. If the mobile industry buzz is to be believed, the increasing prominence of Android may be instrumental in triggering the merger of Nokia S60 and Symbian and the subsequent creation of a whole new roadmap



Abhimanyu Das

for the mobile platform industry.

Over the past few years, quite a few Linux-based open mobile OS platforms have emerged: Bada from Samsung, LiMO from the LiMO Foundation, Moblin from Intel, Maemo from Nokia, MeeGO from Intel & Nokia (MeeGO = Moblin + Maemo), Android from Google, and ALP from Access. But Android's well crafted software stack with software development kits (SDKs) and Novell developer kits (NDKs), ease

of programming, Google's support, large user community, and periodic releases have made it a global, open OS for the wireless future.

Android has even successfully transcended beyond the mobile terminals space and is generating an increasing interest in the consumer electronics, automotive, home entertainment, video surveillance, and industrial equipment/control domains. Although Android is the quintessential fit for ARM processor technologies, commercial ports of Android are available on PowerPC, SH4 (Renesas), MIPS, and x86 platforms today. This portability makes it the most widely available mobile OS among all the other Linux-based open platforms.

Android offers the unique advantage of having a complete set of software for the device—an operating system, middleware, and key mobile applica-

tions—all bundled in a single package. Unlike the closed mobile phone OSs, such as iPhone OS 3.0, RIM, or Windows Mobile, Android is completely open, although both of its flavors have their share of challenges while offering distinct levels of user experience.

ANDROID'S WINNING EDGE

Android is maintaining its winning edge over other competitive Linux-based open mobile OSs. According to Gartner, 6.8 million Android handsets were sold in 2009, which

is a 3.9% share of global smart-phone sales. That's up from 0.5% in 2008, and it continues to grow.

The Android Market applications store is growing by leaps and bounds with more than 35,000 paid and free mobile applications, which Android users can readily download and use, while being a lot easier to access and manage than iPhone's App Store, for example.

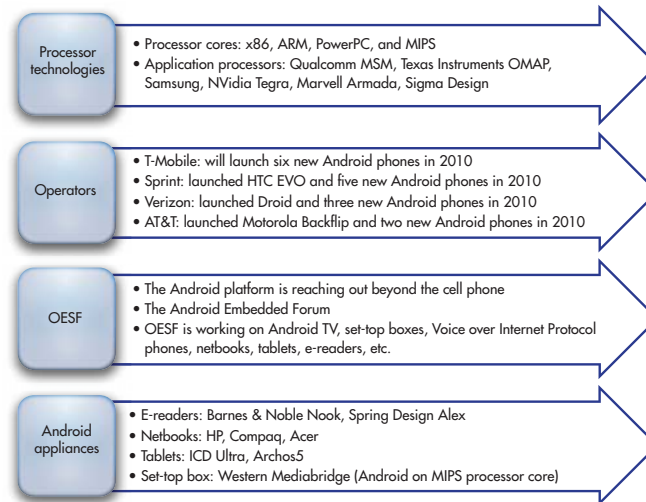
Smart-phone OEMs such as HTC and Motorola and independent software vendors like Ikiwo have reaped the benefits and introduced rich and

compelling user interfaces and applications on Android. The availability of these advanced and next-generation user experiences has catapulted Android straight into the league of the iPhone (Fig. 1).

BEYOND THE MOBILE PHONE

The core design of the Android OS is strongly influenced by the ARM processor architecture, which made it the de facto choice for mobile phones as the first complete phone software stack based on Linux. Since Android is based on Linux, there's a window of opportunity to make it available on other processor technologies and thereby extend it beyond the mobile-phone space.

The device OEM community has shown a keen interest in customizing Android for the typical non-ARM embedded areas such as consumer electronics, automotive, and home automation. Currently, Android is available on platforms such as MIPS, PowerPC, SH4, and x86 processor technologies besides ARM. The availability of Android across



1. The Android OS eco-system includes processors, users and adopters, promoters, and software applications. The Open Embedded Software Foundation (OESF) promotes Android's adoption.

ENLARGE

device categories and processor technologies, from cell phones to other consumer electronics, automotive, and home devices, has enabled developers to create an application once and then use it across devices with minimal porting efforts.

PORTING ANDROID

The task of porting Android to other processor technologies is not trivial, as Android is heavily influenced by the ARM architecture. So, what does it take to port Android to other processor technologies?

Android is a Dalvik VM (Java Virtual Machine) mobile software platform based on Linux. It is different from the VMs used in the standard J2ME platforms. J2ME platforms use Kilobyte Virtual Machine (KVM) and C Virtual Machine (CVM) for J2ME's Connected Limited Device Configuration (CLDC) and Connected Device Configuration (CDC) configurations, respectively.

But it isn't mandatory, as per the CLDC and CDC specifications for KVM or CVM to be used in J2ME environments. Only a VM that adheres to the requirements of the J2ME specification is required. Many device manufacturers license the KVM or CVM from Sun

Microsystems for their J2ME implementation. They are not required for J2ME compliance.

PORTING ANDROID TO AN ARM-BASED BOARD

Porting Android to an ARM processor-based board is relatively easy compared to porting to a non-ARM based board. There are two steps.

First, designers need a stable Linux board support package (BSP), including the bootloader, Linux Kernel, and the device drivers for the ARM board. Two options are available.

With the first option, the Linux BSP (ideally with Linux 2.6.29 Kernel or later) for the board is already available, either from the OEM or silicon vendor or as a free download. Making it stable in your environment will require some work, though, and you may have to develop additional drivers to fully support your board. Or, you can purchase a commercial release from third parties. In the second option, you can develop the Linux BSP from scratch. Obviously, this will require time and effort to develop, test, and harden the BSP before it can be used on the target board.

There are two things to keep in mind. First, it is better to use the same version of the

Linux Kernel that the Android release is based on, as it will ease the Android porting effort on the Linux BSP. And second, you also may have to apply patches to the Linux Kernel for the target processor-specific functionalities. These patches are typically available from the silicon vendors.

Once a stable Linux BSP is available, the next step would be to port Android on it. Download the Android-specific patches from Google's Android site and apply them on the Linux Kernel. This will create an Android kernel that can then be downloaded on the board.

Figure 2 explains the Android porting steps required on an ARM processor-based board, assuming the Linux BSP is developed from scratch. If a Linux BSP that's configured for the target board is available, then the first step in the porting process won't be required or may be partially required for integrating additional device drivers for the board.

PORTING ANDROID TO A NON-ARM-BASED BOARD

Porting Android to a non-ARM based board is not trivial either, as it will require processor-specific adaptations. In addition to the porting steps mentioned above, more steps

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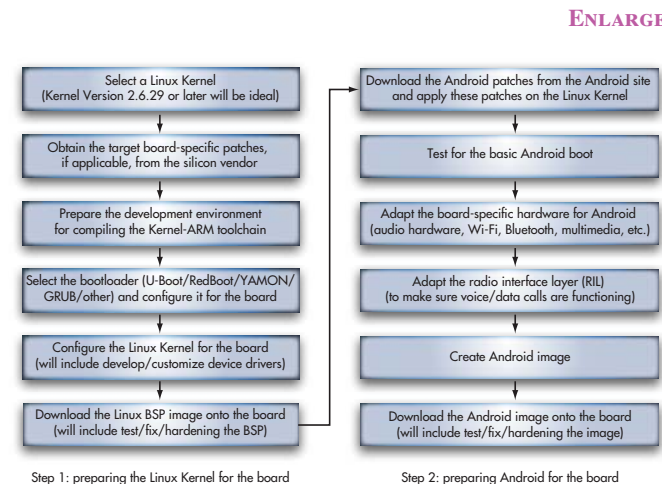
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are required after a stable Linux BSP is available for the board. Let us assume that we are porting Android on the Renesas SH4 Super-H processor.

To port Android on a different processor architecture like SH4 (Super-H), the following steps are essential. Approximately 4000 to 4500 lines of code must be updated for the port:

- Modify the Android build system to support the SH4 architecture.
- Port the Dalvik VM for SH4.
- Include architecture and build support.
- Include optimizations for Dalvik acceleration.
- Extend Bionic run-time library/linker support to accommodate the SH4 architecture.
- Hardware-specific adjustments are needed to leverage audio, video, and graphics.
- Port the Android media framework, especially the codecs.
- Port other libraries.
- Integrate Android-specific Linux Kernel patches into the board's BSP.
- Support the SH4 architecture technology in the Android SDK and Android



2. Porting Android to an ARM processor is a two-step process. Additional steps are needed for other processors.

targets in the customizable development system.

- Conduct the platform and integration testing of Android stack components. Very thorough testing is required.

The porting of the Dalvik VM and Bionic C library for the SH4 comprises the most critical and complex activities. Upon completing the porting, a thorough testing is mandated to validate the port.

While these explanations of the Android porting process on both ARM-based and non-ARM-based target platforms are brief, the actual implementation will require low-level and platform-level

expertise and a thorough understanding of the target environment, especially for the non-ARM platforms.

OPEN VERSUS CLOSED MOBILE OSs

Both the open (e.g., Android) and closed mobile OSs (e.g., iPhone, BlackBerry OS) have their shares of advantages and disadvantages. We won't bring Symbian into the closed OS bracket, as Nokia has positioned it as an open OS through the Open Symbian Foundation (OSF).

Among closed OSs, both RIM (BlackBerry OS) and Apple (iPhone OS) are very successful in offering their

solutions on proprietary platforms that only run on their smart phones. Apple especially has revolutionized the smart-phone look and feel with its state of the art next-generation user interface. The iPhone OS platform is under the complete control of Apple, and the applications are well aware of the hardware and the OS running underneath. Fragmentation is almost nonexistent.

Android, in contrast, is open and supported by the Open Handset Alliance (OHA) in the form of released smart phones based on Android, including those from HTC, Samsung, and Motorola. Since Android is open, OEMs can manipulate it to suit their needs. As a result, multiple flavors of Android are running on different hardware.

If this continues unchecked, Android will lose the cohesive platform ideology. On the positive side, any OEM or operator/OEM combination can build smart phones based on Android right from the ground up on new hardware without paying any licensing fee. Today, Android runs on a plethora of devices, including cell phones,

automotive, home appliances, and other consumer electronics devices like HDTVs and set-top boxes.

Another advantage for Android is the choice of processors. Android runs on a variety of processors, from 500-MHz ARM Cortex-A8 to MIPS Core-based processors to the 1-GHz Qualcomm Snapdragon. It's also being ported to the Power architecture and Renesas SH4 Super-H processors. This makes Android the single most widely available OS. In comparison, iPhone OS is available only on Samsung ARM Cortex-A8 processors mainly used in the cell-phone space.

While Apple's App Store is much richer, the Android Market is gaining ground with more than 65,000 apps available. And finally, Android has the support of multitasking and background notifications. iPhone OS 3.0 does not have these features, though iPhone OS 4.0 may include these elements going forward.

CONCLUSION

After two years, Android has the advantage over its close competitors, at least for now. In every

release of Android—from Version 2.1 (Éclair on Linux Kernel 2.6.29) to planned future releases like Version 2.2 (FroYo on Linux Kernel 2.6.32) to Gingerbread (Linux Kernel 2.6.33 or 34)—Android is constantly offering new innovative features. The adoption of Android beyond the mobile phone space is also increasing with every passing day, and new gizmos like e-readers, netbooks, and tablets are surfacing.

More recently, MeeGO, the new entrant in the open OS bandwagon, is being touted as the Android killer. Interestingly, though, Intel, one of the prime sponsors of MeeGO, is also a member of the OHA and there was an effort in place for porting Android on Intel's Moorestown Atom processor-based smart-phone platform. Now, Android has been successfully ported on the Moorestown SoC. Well, it's up to you to decide. But Android seems to have scored again and continues to be open for innovation. ■

ABHIMANYU DAS, ASSISTANT VP, HAS MORE THAN 20 YEARS OF INDUSTRY EXPERIENCE. HE CAN BE REACHED AT ABHIMANYU.DAS@ARICENT.COM.

TECH FEATURE BY RUPERT BAINES *Vice President of Marketing, picoChip*

WHAT HAPPENED TO FEMTOCELLS?

THE MARKET IS NOW RAMPING UP TO VOLUME, AND FEMTOCELL SERVICE IS ALREADY A REALITY FOR MAY CONSUMERS.

Toward the end of 2009, slower than predicted growth rates for the femtocell market had prompted some to ask whatever happened to this promising technology. The truth is that the market is growing, and volume is about to happen. In fact, 16 operators across the world have now launched commercial femtocell services, and many more will launch before 2010 is over.

AT&T, Vodafone, SFR, DoCoMo, Softbank, Optimus, and StarHub have all launched residential femtocells for consumers. Sprint and Verizon have been offering commercial solutions for far longer in the U.S., and Sprint is now offering upgraded 3G products. Some of the largest mobile network operators in the



Rupert Baines

world are now deploying femtocells, and this commitment is transforming the femtocell from a great idea to a reality. This evidence is supported by anecdotal evidence from the January 2010 Consumer Electronics Show in Las Vegas, where femtocells received a fevered reception.

Perhaps the premature assumption that femtocells weren't making an impact was based on overly optimistic forecasts, followed by a backlash as analysts made adjustments. For example, in November 2009, ABI Research reassessed its own

previous predictions on market growth, making the figures for 2010 more realistic, but maintaining the longer-term growth projections for the market.

As the year draws in and we see what the real shipments were, the generally accepted view is that femtocells saw a rapid acceleration in popularity during 2010 with more than 1 million units shipped. Despite its recent revision of market figures, ABI continues to forecast that by 2014, volumes will hit 40 million units per annum, while Dell Oro predicts more than 60 million.

So, why have femtocells taken longer to come to fruition than some expected?

SOME BACKGROUND

Femtocells are a very new technology. The first developments and prototypes were on show at conferences in 2007, but real products have only been available since 2009.

Roughly speaking, the technology arrived in 2007. The technology issues were solved in 2008 (Iuh standard for connection; proof that interference was something that could be solved and that femtocells would not break the macro network). The first trial ("friendly customer") launches were in 2009, but there was still work to do on productizing (e.g., OSS/BS, provisioning, billing, and other "boring but essential work"). With those issues more or less solved this year, only now can carriers support high volumes.

The technology behind femtocells is far from trivial. Operators have approached their deployments carefully, ensuring they "cover all the bases" to give consumers confidence in the solution. But long before the deployment stage, companies in the femtocell ecosystem were working on overcoming the substantial technological hurdles involved.

Femtocells actually include far more intelligence than traditional basestations. Because of this change in the way tasks are partitioned in the network, femtocell chips like the picoXcell family from

picoChip need to provide enhanced security features for authentication, location detection, and encryption as well as the prevention of denial of service attacks (*see the figure*).

Conventionally, the basestation ("Node B" in 3GPP jargon) is the radio stage, while the radio network controller (RNC) handles the intelligence and management. The RNC sets up and tears down calls, controls power levels and session parameters, allocates bandwidth to users, and supports handoff between sectors or cells. It is the bridge between the radio access network (RAN) of basestations and the core network. One RNC can control many basestations.

But in a femtocell, all of this intelligence is localized. Managing calls, controlling interference (which is crucial, so femtocells don't damage the network by transmitting inappropriately), and interfacing the radio with the broadband network securely all are RNC functions. So a femtocell isn't just a basestation, it also integrates the smarts of the RNC—and a lot more too.

OVERCOMING OBSTACLES

The security issue has been solved. Indeed, one of the strengths of femtocells is their very strong security compared to Wi-Fi. To begin with, everything in wireless is secured with strong encryption. There are theoretical attacks. But even GSM, which is an old technology, is still robust against all practical attacks, and 3G is stronger still.

Then there are end-to-end techniques. For example, the core must authenticate the handset, but also vice versa, so it is very hard to intercept. Cellular was designed to be secure in a way that Wi-Fi never was. (There is a value to calls.) Finally, it is hard to eavesdrop or intercept calls if you do not know who to listen to. A perhaps surprising fact is that the phone number is not used. An IMSI number that only maps to the phone number in the core identifies the handset.

Interference management has been a worry over the last couple of years, but it can be solved. Femtocells are an example of "cognitive radio," and perhaps one

of the first mass-market examples, where they “fit in” and adapt to the environment. This is also called a self-organizing network (SON).

Femtocells improve the performance of the customers that are connected to them. (This is fairly obvious as customers now get a direct connection, at short range, instead of a poor one far away.) In a neat twist, femtocells also improve performance for everyone else too by reducing interference levels and taking the other customers off the macro. (The customers with poor connections who need to shout to get signal through raise the noise floor for other users.)

The early deployments were based around proprietary architectures and end-to-end solutions. But as ever in telecoms, we are moving toward standardized solutions with cross-vendor interoperability testing (IOT). The first step toward this was 3GPP’s Iuh standard for connecting a femtocell to the gateway. Another was the adoption of TR-196 as a management system—an extension of the Broadband Forum’s TR-069, which is widely used to manage

hundreds of millions of ADSL modems. The Femto Forum is coordinating a series of plugfests to help secure cross-vendor IOT and standards.

With the technical challenges largely resolved and operators convinced of the value that femtocells will bring to their networks, the next hurdle to overcome was rollout. In 2009, Vodafone and AT&T both soft-launched their femtocell offerings with little marketing might thrown behind them.

For example, AT&T conducted a small rollout in Georgia, primarily because the networks wanted to “test the waters” before embarking on a full-scale rollout. Staff needed training and billing, and other functions needed to be out in place.

These soft launches have already been solidified with more intense rollouts in 2010. Vodafone initially launched its Home Access Gateway Service in the U.K., six months before rebranding and fully launching what it now calls SureSignal. Vodafone is now promoting it as a major strand of its offering, guaranteeing its in-house

coverage. Once again, it is another element of the process that has taken time and therefore led to the reassessment of ABI’s market forecasts, but operator rollouts are now building up substantial momentum.

AT&T had an extended soft launch. But this summer, the 3G Microcell went national. Other launches—including Softbank with a very aggressive offering of a free femtocell with free DSL, Telefonica in Spain, and Sprint upgrading to a 3G femtocell—are all further evidence of the acceleration.

WHAT’S NEXT

With these time-absorbing technical and rollout issues essentially overcome, the market is free to grow. As residential femtocells become real and ramp in volume, we are starting to see the idea broadening with “greater femtocells” to serve enterprises, college campuses, and many-multiple users. For instance, we started with residential products in Wi-Fi, but then in stepped



The picoChip PC302 is an integrated baseband system-on-a-chip (SoC) used to implement femtocells for the consumer market. It can be used with LTE, HSPA+, and multiple-input multiple-output (MIMO) and provides 64-state quadrature amplitude modulation (64QAM) that can provide data rates to 21 Mbits/s downlink and 5.7 Mbits/s uplink.

Aruba, Meru, and Airespace (now Cisco). The same is happening with femtocells as companies like Spidercloud are developing very specific enterprise femtocells.

PicoChip has also anticipated this. Last year we launched the PC8219E, the first “greater femtocell” to cater to the needs of enterprise, metro, and rural locations. Also, we recently announced the PC333. With 32-user capacity, 2-km range, and support for vehicular mobility, the PC333 blurs the boundaries between femtocell and picocell, or even microcell, in enabling low-cost, wide-area open access deployments in areas where carriers need to cost-effectively enhance coverage and capacity.

The PC333 explicitly targets “public access” femtocells, where the dramatic impact on capital expenditures and operating expenditures make deploying 3G coverage possible in places that previously weren’t

economically practical, with a disruptive impact on the whole cellular ecosystem.

Although femtocells are often seen in terms of residential applications, there is a growing recognition that the advantages they deliver, in terms of capital and operating expenditure, can be more broadly applicable. This represents a fresh opportunity for the market.

For 3G, femtocells are very important, delivering benefits to consumers and a powerful business case for carriers. But for 4G systems like WiMAX and Long-Term Evolution (LTE), they become critically important. The whole rationale of these technologies is to deliver high-speed broadband services. But of course, that requires a good channel, which means that the terminal is close to the basestation.

As such, the LTE network of the future will consist of a few sophisticated macrocells for wide-area seamless coverage

(albeit at low rates) and a large number of densely deployed “small cell” base-stations. These technologies will benefit from the economies of scale and SON techniques pioneered by residential femtocells, but they may be described as metro basestations (after their similarity to metro Wi-Fi), picocell 2.0, or greater femtocells.

The evidence is therefore clear that femtocells can no longer be dismissed as a flash in the pan that will never become a reality for consumers. They are here now and here to stay, and they will radically change the wireless infrastructure industry. These high-performance, low-cost devices will change the industry in much the same way that high-performance, low-cost PCs changed the computing industry 25 years ago. ■

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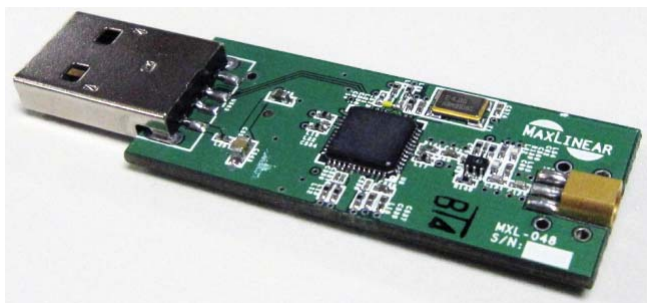
NEW PRODUCTS BY THE MD&D NEWS STAFF

TUNERS AND DEMODULATORS MAKE FREE MOBILE TV HAPPEN

Over-the-air digital TV is free in the U.S. All you need is a TV set to receive it, though most TV sets aren't portable. But progress is underway to bring U.S. digital TV to laptops, netbooks, cell phones, auto entertainment systems, and other mobile devices.

The American Television Standards Committee (ATSC) A/53 digital TV standard uses eight-level vestigial sideband (8VSB) modulation and MPEG2 video compression, generating a 19.3-Mbit/s digital stream. It's optimized for fixed operation.

With so much focus on cell phones and other portable equipment, ATSC initiated work on a mobile or handheld (M/H) standard several years ago and finalized it in October 2009. Known as A/153, this complex standard adds extra for-



ward error correction (FEC) and other coding schemes to make it more robust in mobile conditions. Local TV stations now can begin transmitting A/153 signals along with their regular A/53 fixed digital signals.

The Open Mobile Video Coalition (OMVC) is conducting field trials to determine the efficacy of the standard and the circuits and equipment available to implement it. In fact, MaxLinear's MxL111SF ICs are being used in mobile devices from Dell and Hauppauge Computer Works that were developed for the ATSC-

M/H field trials now ongoing in Washington, D.C.

The MaxLinear-equipped mobile devices are being used in a nine-station mobile digital TV consumer trial sponsored by the Open Mobile Video Coalition. More than 200 consumers equipped with the specially designed beta Dell Inspiron Mini 10 Netbooks and 160 users with Sprint mobile phones are part of the trials, which started in July and will run through October.

The single-chip MxL111SF digital terrestrial receiver includes an ATSC-M/H-compliant silicon

tuner and USB interface. It has been designed into a variety of products including "USB stick" DTV receivers from Hauppauge Computer Works.

In the U.S. alone, more than 100 TV broadcast stations are broadcasting mobile DTV services in the ATSC-M/H format, including stations in 15 of the top 20 local markets. For TV stations, the cost of broadcasting channels in both ATSC and ATSC-M/H formats is relatively minor and opens up new ways to reach consumers. While the U.S. is the largest consumer market using the ATSC broadcast standard, it has also been adopted by Canada, Mexico, South Korea, Honduras, and other countries.

The highly integrated MxL111SF system-on-a-chip (SoC) features an integrated DVB-T demodulator and USB interface. It can be used, for example, in a USB dongle designed to bring TV to a laptop or netbook. This chip is a full RF front end with low-noise amplifier (LNA) and mixer. It requires an external ATSC demodulator, but it does not need an external surface acoustic wave (SAW) filter.

The chip boasts a 44- to 885-MHz tuning range. It offers low power dissipation (450 mW) and full programmability. The MxL111SF also meets the exacting requirements of the ATSC A/74 Receiver Performance Guidelines, making it appropriate for stationary and mobile TV applications. Available in a 7- by 7-mm 48QFN package, the MxL111SF is a cost-effective solution for a variety of consumer electronic products and form factors.

One solution to the demodulator need is the Santana ATSC-MH (A/153) core from Iberium Communications. This digital demodulator core is now available for the U.S. mobile digital TV (DTV) market. It fully complies with the mobile DTV standard ATSC-MH (A/153). Along with the existing Garcia ATSC (A/53)/quadrature amplitude modulation (QAM) demodulator core, the Santana completes the company's portfolio of products for the ATSC-based DTV markets.

The Santana A/153 core targets next-generation mobile devices like mobile phones, portable media players, and laptop and

notebook computers. It uses advanced algorithmic features such as time-sliced operation and an efficient ASIC microarchitecture design to provide IC vendors with a low-cost, low-power solution that will meet the demands of next-generation consumer products. Its design is highly customizable to meet diverse customer needs and requirements. The company also offers DTV demodulator cores for the global DTV market, including ATSC, ATSC-M/H, DTMB, DVB, and ISDB.

Iberium Communications
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LNAs ENHANCE BASESTATION RF PERFORMANCE

The MGA-633P8, MGA-634P8, and MGA-635P8 low-noise amplifiers (LNAs) from Avago Technologies enhance RF performance while enabling space and cost savings for both new and redesigned wireless infrastructure basestations, according to the company. They also offer ultra-low noise figures

of 0.37, 0.44, and 0.56 dB, respectively.

These LNAs come in a compact footprint with a low profile, measuring 2.0 by 2.0 by 0.75 mm³ in an eight-pin quad flat no-lead (QFN) package. They boast high gain ranging from 17.4 to 18 dB as well as high linearity—1-dB gain compression measurement (P1dB) of about 22 dBm with an output third-order intercept point (OIP3) greater than 35 dBm.

Furthermore, the LNAs are based on gallium-arsenide (GaAs) enhancement-mode pseudomorphic high-electron mobility transistor (E-pHEMT) technology (0.25 μm) and comply with the European Union's Restrictions on Hazardous Substances (RoHS).

The MGA-633P8 is designed for optimum use between 450 MHz and 2.0 GHz. The MGA-634P8 handles the 1.5- to 2.3-GHz frequency spectrum. And, the MGA-635P8 targets frequencies between 2.3 and 4.0 GHz. Wireless infrastructure applications include Long-Term Evolution (LTE), WiBro, UMTS, GSM, and CDMA.

The MGA-635P8 costs \$2.31 each in 10,000-piece



quantities.
Avago Technologies
www.avagotech.com

VIDEO PROCESSORS INTEGRATE CORTEX-A8 AND C64x FOR MEDIA- RICH APPLICATIONS

The Da Vinci DM37x video processors from Texas Instruments target media-rich portable applications. Integrating the ARM Cortex-A8 and C64x+ DSP core, imaging and video accelerator (IVA), 3D graphics proces-

sor (on the DM3730 only), and high-performance peripherals (USB 2.0, SD/MMC) on a single system-on-a-chip (SoC), the DM3730 and DM3725 suit applications that require HD video processing or a large amount of data processing such as navigation systems, media players, and portable communications.

The DM37x processors are software compatible with the OMAP35x generation of processors and are pin-to-pin compatible with the Sitara AM3715 and AM3703 processors, allowing for an easy product migration strategy

to higher-performing options. Customers moving to the DM3730 from the OMAP3530 can expect a 50% increase in ARM performance, a 40% increase in DSP performance, and double the graphics performance while consuming approximately 40% less power.

The 800-MHz C64x DSP and hardware video accelerator enable audio and HD 720p video decoding and encoding (audio and video codecs included) at 30 fps independently of the ARM processor. This permits additional expansion on the ARM processor to run more

high-level applications and a rich, responsive 2D or 3D graphical user interface for applications such as industrial personal digital assistants. The programmable DSP engine permits multiple general signal processing tasks such as digital filtering, math functions, and image processing and analysis.

Furthermore, TI offers a complete software development kit (SDK) that provides everything developers need to evaluate the device and begin development on the DM3730 evaluation module (EVM) in minutes. The TMDX-EVM3730 EVM includes a TI Bluetooth Wi-Fi module. The SDK includes a Linux kernel 2.6.32 board support package complete with graphical user interface, graphics, applications, demonstrations, and development utilities.

Additionally, the SDK offers a royalty-free library of DSP-optimized signal processing algorithms accessible from the ARM processor through a set of easy to use application programming interfaces (APIs). The DSP library offers more than 80 algorithms, including multime-

dia decoders and encoders, math functions, digital filtering including fast Fourier transform (FFT), and image processing including image filtering and analysis.

Support for the Linux and Android operating systems is available today. Windows CE support will be available in the fourth quarter of 2010. Customers can begin designing by downloading the DM3730 software for use on the TMDXEVM3730 EVM, available for \$1495. Customers also can develop on the BeagleBoard-xM open-source community board equipped with the DM3730, available from Digi-Key for \$179. The DM3730 will be available starting at \$25.60 in 1000-unit quantities.

Texas Instruments
www.ti.com

VCXOs REDUCE JITTER AND PHASE NOISE

The PureEdge family of silicon-based voltage-controlled crystal oscillators (VCXOs) from On Semiconductor reduces costs and provides ultra-low jitter and phase noise compared to alternative so-

lutions, the company says. According to On Semi, the NBVSBaxx series is ideal for providing low-jitter, stable reference clock in networking, SONET, 10-Gbit Ethernet, basestations, and broadcasting equipment.

The NBVSBaxx devices are designed to meet the requirements of 2.5- and 3.3-V low-voltage positive emitter coupled logic (LVPECL) clock generation applications offering a low-jitter (0.5 ps) reference clock. The ability to power these devices with a 2.5- or 3.3-V supply enables design flexibility and simplifies the product bill of materials, driving further system cost reduction, the company says.

A High Q fundamental mode pullable crystal and phase-locked loop (PLL) multiplier is used to provide industry-standard frequencies from 60 to 700 MHz with a guaranteed pullable range of ± 100 ppm and frequency stability of ± 50 ppm. Also, these oscillators offer a tri-state enable/disable feature, allowing the user to turn the output on and off across the entire industrial temperature range of -40°C to 85°C .

The NBVSBaxx devices come in a hermetically sealed 5.0- by 7.0- by 1.9-mm ceramic CLCC-6 surface-mount device (SMD) package. They cost \$6.50 each in lots of 1000.

On Semiconductor
www.onsemi.com

REFERENCE DESIGN ABETS POPULAR 4G LTE CHIPSET

According to Altair Semiconductor, its Digital Dividend (Band 20) Reference Design is one of the world's first such designs and the only one that has already completed IOT testing with tier-one infrastructure vendors. It features the company's FourGee Long-Term Evolution (LTE) chipset and interoperability-tested software stack. It's also viable for use in a range of products, like USB dongles, customer premise equipment (CPE), and routers, all of which users can expect to be market-ready by the end of the year.

Due to reliable propagation characteristics, Digital Dividend spectrum will become especially important for use in rural-broad-



band installations. Digital Dividend is UHF spectrum that, until now, has been used for analog television broadcasting. As consumers switch from analog to digital televisions, this spectrum has become available for use in carrying mobile broadband signals. Additionally, as per the GSMA, it is approximately 70% cheaper to provide mobile broadband coverage over a given geographic area using Digital Dividend spectrum than with the 2.1-GHz spectrum currently employed for 3G services.

Altair Semiconductor
www.altair-semi.com

PROGRAMMABLE DSP CORE BOOSTS PERFORMANCE AND POWER EFFICIENCY

Fully integrated systems-on-a-chip (SoCs) represent a key trend in mobile device design. Separate processors are giving way to multiple embedded cores, including cores for DSP operations. In handsets, DSPs are widely used for filters as well as for voice and video compression and decompression operations.

Leading this trend, the 1-GHz CEVA-X1643 DSP core from Ceva Inc.

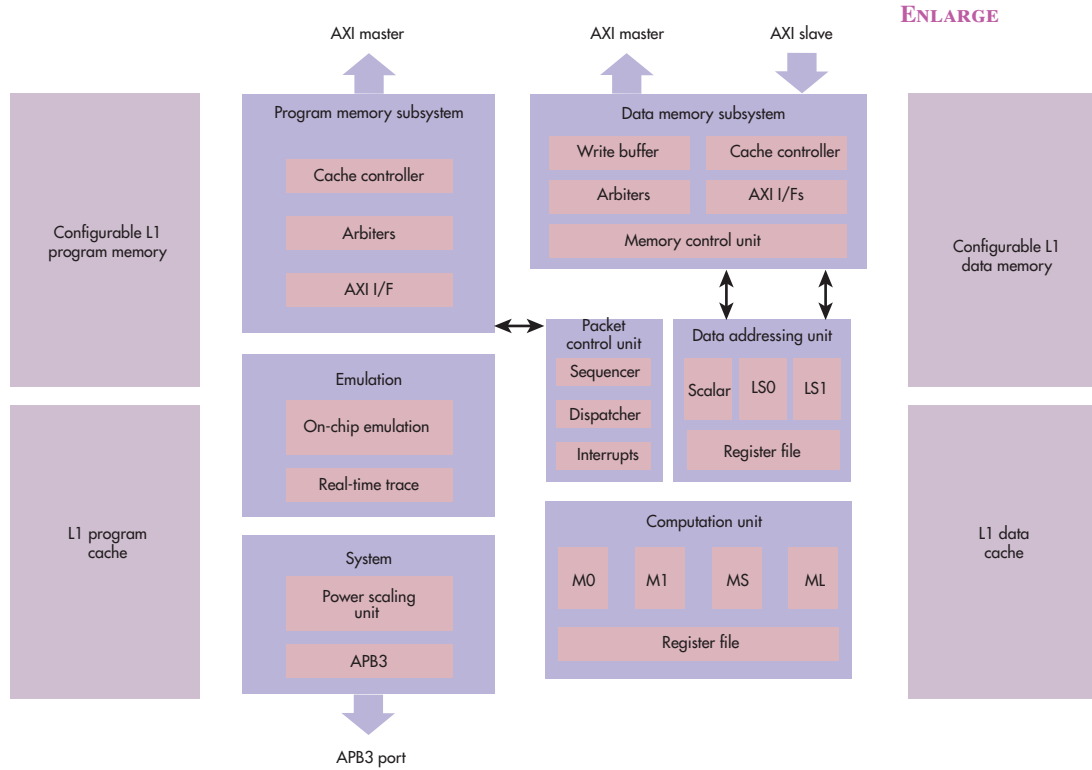
is designed to boost overall chip performance for a broad range of applications, including wireless and wireless communications, surveillance, and portable multimedia. It takes advantage of the architectural efficiency and mature software development environment of the company's existing CEVA-X family of DSP cores.

The CEVA-X1643 improves on its predecessors with support for an advanced data cache and tightly coupled memory architecture, which streamlines software integration and software porting from

other DSP platforms and reduces overall time-to-market. It also provides memory management support, simplifying the real-time operating system (RTOS) and multi-tasking.

The core's integrated power scaling unit (PSU) enables a highly energy-efficient architecture. Also, its configurable 64/128-bit AXI system busses support high memory bandwidth. The core additionally provides inherent support for seamless migration from Texas Instruments' C6x C-code. It boasts more than 1-GHz DSP performance using standard 40-nm process technology at worst-case conditions. And, it's fully compatible with all CEVA-X products.

The CEVA-X1643 DSP produces a significant performance boost, combining a very long instruction word (VLIW) architecture with single instruction multiple data (SIMD) capabilities. Its 32-bit programming model supports a high degree of parallelism, including the ability to process up to eight instructions and 16 SIMD operations per cycle. With a well-balanced pipeline, it can surpass 1 GHz in chips implemented at the



ENLARGE

40-nm technology node.

Further, the CEVA-X1643 uses ARM's high-performance Advanced eXtensible Interface (AXI) memory subsystem, which supports configurable AXI bus width, parallel read and write transactions, read after write transactions, and other advanced capabilities, ensuring target performance is met in a real-life system. The use of de-facto industry standard system buses together with a fully cached CEVA-X processor enables high performance, a shorter design cycle, and easy

integration into the target SoC.

The core's innovative PSU provides advanced power management for both dynamic and leakage power. The core supports multiple clock sources and power domains associated with the main functional units, such as the DSP core and the instruction and data caches. The PSU supports multiple operational modes ranging from full operation, debug bypass, and memory retention to complete power shut-off (PSO).

Additionally, the AXI full duplex buses offer low-power

features, such as the ability to shut down when no data traffic is present. The CEVA-X1643 offers significant energy savings for both battery-operated and stationary devices as well, which is a critical factor in an increasingly energy-conscious world.

The CEVA-X1643 supports easy migration from off-the-shelf DSP chips such as the Texas Instruments C6x to incorporating DSP cores into proprietary SoC designs. The combination of a compiler-friendly eight-way VLIW

and SIMD architecture, an advanced data cache architecture, and memory management capabilities enables licensees to efficiently migrate legacy code and ensures similar DSP performance levels at a significantly lower price point.

An improved software tool chain also makes the conversion to the X1643 DSP core fast and easy. The CEVA-Toolbox software development, debug, and optimization environment enables near-optimal system performance to be achieved using standard C source code. CEVA-Toolbox includes the Application Optimizer tool, which allows application developers to easily develop software purely in C-Level, eliminating time-consuming, handwritten assembly coding.

This results in significantly better overall performance and a shorter design cycle for SoC designs. As an example, the Application Optimizer was used to implement the AMR-NB (Adaptive Multi Rate-Narrow Band) vocoder on the CEVA-X1643 DSP core and required just 18 MHz when compiled out-of-the-



box (for worst-case frames and streams).

The CEVA-X1643 is currently available for licensing.

CEVA Inc.
www.ceva-dsp.com

HANDHELD SPECTRUM ANALYZER COVERS UP TO 43 GHz

The devices in the MS272xC Spectrum Master series from Anritsu Co. boast the broadest frequency range ever available in a handheld spectrum analyzer, according to the company. The analyzers in

the lineup provide an assortment of applications to test the RF physical layer with the goal of making it easier than ever for field technicians, monitoring agencies, and engineers to monitor over-the-air signals, locate interferers, and detect hidden transmitters. The family's five models provide frequency coverage of 9, 13, 20, 32, and 43 GHz, respectively.

These analyzers eliminate the need to carry heavy benchtop spectrum analyzers into the field to measure signals above 20 GHz, such as those used in microwave backhaul applications. They also integrate a spectrum

analyzer and can be ordered with a channel scanner and interference analyzer to conduct all common field measurements, eliminating the need for multiple instruments. Further, they can incorporate a number of 3G and 4G options to measure Long-Term Evolution (LTE), HSPA+, W-CDMA, CDMA/EV-O, GSM/EDGE, TD-SCDMA/HSDPA, and WiMAX signals.

The MS2726C Spectrum Master offers a 27-second sweep time for a 43-GHz span with a 30-kHz resolution bandwidth. But it doesn't sacrifice accuracy for speed, Anritsu says, as it delivers -100-dBc/Hz phase

noise at 10-kHz offset at 1 GHz and dynamic range of 104 dB. Designed with a broadband preamplifier, all of the models in the series have -160-dBm sensitivity at 1 GHz and 147-dBm sensitivity at 40 GHz to detect small signals. And, their intuitive menu-driven screen is designed to make it easy to conduct all measurements.

Anritsu also offers an analysis package as well as its Master Software Tools, enabling users to conduct detailed evaluation of measurement data. The company says that engineers can use the devices' built-in reporting tools, mapping,

folder spectrograms, and 3D spectrograms to easily identify interference sources. These tools are designed to eliminate the need for more expensive, larger, and heavier benchtop instruments as well as third-party spectrum monitoring software.

The Spectrum Master series features a rugged housing that's designed to withstand the day-to-day operations associated with field use. At 8 lb, users can easily carry the devices up towers. The analyzers also have a field-replaceable long-life battery and a wide operating temperature range of -10°C to 55°C. Its large daylight-visible display makes it easy for users to see results in any environment. Display modes include a red night vision mode and black and white mode, as well as two full-color modes.

Available now, the MS272xC Spectrum Master devices have a delivery time of six to eight weeks ARO. The MS2722C has a U.S. starting price of \$15,950. Accessories such as directional and portable antennas are available as well.

Anritsu
www.anritsu.com ■

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