TECH TRENDS

● teknik

Prevas uses Android.

Better interface and improved functions with Android in Prevas' embedded system. *Page 8.*

■ case

Ocean Harvesting gathers energy from the waves.

With new technology and software from Prevas, wave power is becoming more economicalk. *Page 4.*

▲ innovation

Global patent!

With help from Prevas, Miris Holding has developed an instrument for analyzing milk. *Page 6.*

New Center of Excellence: Audio

Page 5.

NEW BUSINESS AREA
MANAGEMENT CONSULTING

PREVAS INTRODUCES
BOB THE POD
AT EMBEDDED CONFERENCE

Page 7.

Welcome to our conference issue of Tech Trends.
I'm proud to say that for the fifth year in a row, Prevas has won Sweden's top award for embedded systems, the Swedish Embedded Award in the Enterprise category, with Miris AB as the product owner and Prevas AB as the development partner.

World premiere for "Bob the Pod"

EDITORIAL

THROUGH CLOSE COLLABORATION we've helped Miris take its world-unique product for analysis of breast and dairy milk into a potentially very hot and global market. Many prematurely born infants are now receiving exactly the individual composition of milk that each of them needs thanks to Miris' instrument for fast, reliable and inexpensive analysis.

Other projects that we've participated in developing that serve the common good and have been commercially successful are in wave power, which is a potentially huge source of renewable energy. The Karlskrona company Ocean Harvesting has solved the problem by engineering for the waves' crests with a planetary gear, a counterweight and a ratchet in combination with software from Prevas, which has developed the control system. The time factor is important to Prevas' customers. In Ocean Harvesting's case, everything could be completed in just four man-months thanks to our consultants using object-oriented coding and reusing existing code components.

Prevas is a designated partner of National Instruments, and good technical collaboration with their development department gives us early access to their latest technical solutions.

Another area where we are at the leading edge in embedded systems is with the application of industrial Android. I see a clear trend in the users of the products that we help develop being influenced by today's smartphones. They expect the features they are familiar with, such as graphical user interfaces, readily available information, touch and gestures.

 If you have the opportunity to attend Embedded Conference, don't miss the world premiere of an industrial Android app when Olavi Kumpalainen introduces "Bob the Pod" – a wandering, very charming, 6-legged robot that he controls with his Android phone. The control board is a Raspberry Pi, which according to enthusiasts in the branch, is probably the coolest thing released in the embedded market for years. If you weren't at the conference, take a look at the article about the "Pod" here in Tech Trends. Olavi is a guru in the field of rapid prototyping using open source. * Pleasant reading!

JONAS MANN

*Business Area Manager
Product Development, Prevas*

Training in programmable logic

Prevas works with complex research and development services, and consequently, it is exceedingly important to us that we are always aware of the newest technologies, methods and tools. As an official authorized training partner of Xilinx, we can offer a good selection of scheduled courses in programmable logic. The current course schedule is at **www.prevas.se/kursschema.**

Winner of
Swedish Embedded Award

For the fifth year in a row, Prevas was nominated for the Swedish Embedded Award. Prevas competed together with Miris in the Enterprise category for this prestigious award. With help from Prevas, Miris Holding has developed an instrument for analyzing liquids. Read more about the product on page 6.

Several major orders in life science

Life science is an expansive field characterized by innovative and high-tech instruments and solutions. Prevas Center of Excellence for Life Science has signed a number of large and strategically important development contracts.
The total order value is approximately SEK 34 million.

Expansion in Sweden

Prevas has opened offices in Finspång, Jönköping, Karlskoga, Norrköping and Örebro. The new Prevas offices provide businesses in the respective regions with leading-edge expertise in embedded systems and industrial IT.

Hugo Hedberg new Prevas specialist in FPGA

A while back, Prevas opened the way internally for a new career path: technical specialist. Being so-designated means that a person has leading-edge expertise in areas of technology in which Prevas is active and sees a strong future.

KNOWLEDGE

Knowledge has the unique characteristic of growing the more it is shared.

This is one of the reasons for Prevas having opened the new specialist internal career path. An essential part of the specialist role is sharing knowledge.

Hugo Hedberg, an FPGA designer at Prevas' Solna office since 2008, is the latest to receive the designation that goes to those who have extensive knowledge of the specific requirements placed by various branches within their particular areas of expertise – and not the least, it demonstrates the will to share one's unique know-how with customers and colleagues alike.

Hugo Hedberg, 35, earned his doctorate at Lund University in implementation of image processing algorithms in hardware for FPGA (Field-Programmable Gate Array) and ASIC (Application-Specific Integrated Circuits) with special focus on mathematical morphology. FPGA can be thought of as an embedded programmable logic matrix and is an integrated circuit used in digital technology. Using FPGAs is considered by many engineers who develop embedded systems to be the best way of increasing performance through hardware acceleration, and at the same time, it provides the capability to link together different interfaces and IP blocks.

"An FPGA-based system gives the system architect a unique opportunity to combine performance and flexibility with low project risk and consequently achieve a predictable time to market," explains Hugo Hedberg. "It all comes down to which system properties the system architect is unwilling to compromise, and quite often, performance and flexibility are two of them. If this is the case, there are a limited number of system concepts to choose among since TCO (Total Cost of Ownership) is often lower for a FPGA-based system than for other system solutions with comparable performance. "When it comes to the system concept, it is very common that it ends up with a

combination of a CPU (Central Processing Unit) in some form and an FPGA to realize all desired system properties.

"It's a matter of simply choosing the best of two worlds, which is often referred to as the conventional two-chip solution. This is something that the FPGA manufacturers have naturally adopted, which resulted in massive investments to give the conventional two-chip solution in particular a competitor. "The result is what is called an SoC circuit (System on Chip) and in principle consists of a full-fledged CPU and programmable logic in the form of an FPGA in one and the same circuit. If this single-chip solution is well-received (a prerequisite for the unit cost decreasing), in the future we will experience a noticeable higher level of integration of the traditional software and hardware domain, and we will see FPGAs in increasing numbers of embedded systems."

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Hugo Hedberg
SPECIALIST WITHIN FPGA
EMBEDDED SYSTEMS DESIGN

PREVAS' NEW BUSINESS AREA

CHALLENGES CLIENTS WITH ENTIRELY NEW TYPE OF MANAGEMENT CONSULTING

General management consulting has been around for many, many years. Intelligent men and women have served as advisors to business leaders. They have provided the same advice that is based on general models and concepts used by consulting firms for decades to develop business or make processes more efficient.

PER MELIN who is a new business area manager at Prevas, is starting an entirely new type of management consulting. "I don't think the clients want to buy general advice any longer," says Per Melin. "Processes are often so finely adjusted that this

is not where the battle is being fought. I believe that the clients want to be challenged, that they want innovators who can serve as vitamin injections for their business model. To succeed with this, we are creating an organization that is based on the capability to see connections where no one else sees them, who are courageous enough to question yesterday's truths."

An additional base for Prevas Management Consulting is a larger initiative targeting specific branch challenges. Nearly all branches are undergoing change at hyper speed. Branches' business models are being torn apart over night; entire industries are changing or ceasing to exist. Serving as an advisor in this kind of climate requires

deep branch understanding in combination with ample latitude in strategic and technical innovation. Not general advice that preserves yesterday's solutions. Prevas Management Consulting is an excellent complement to our existing business areas and enables us to technically be able to realize innovations and meet technical change demands from our clients. If you would like to know more, please contact Per Melin at: per.melin@prevas.se

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Per Melin
BUSINESS AREA MANAGER
MANAGEMENT CONSULTING
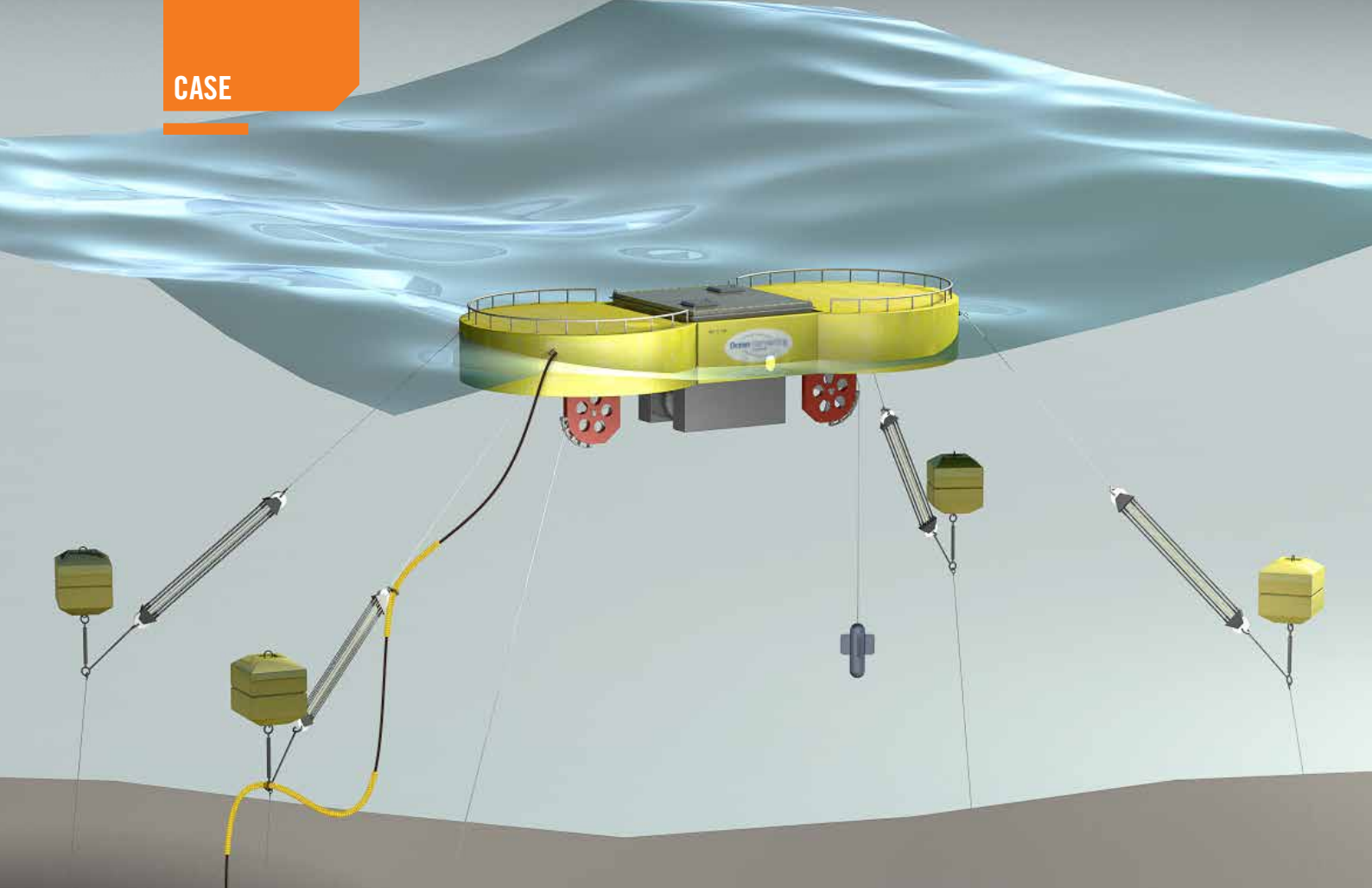
HOW TO HARVEST WAVE POWER

The full–scale model of Ocean Harvesting's harvester will be 24 meters long and 11 meters wide, and generate approx- imately 110 kilowatts of power with a capacity factor of 60 percent. This is twice as much as is customary in the branch.

IT IS IMPORTANT that wave power becomes competitive. The company calculated effi- ciency compared with the large sea-based wind power plants that are being built and believes that they will be competitive fairly early in the production cycle, by about 2020.

Mikael Sidenmark, founder of Ocean

Mikael Sidenmark
FOUNDER OF
OCEAN HARVESTING

Harvesting, explains why the choice fell to mechanical intermediate storage of energy: "There are many good reasons for mechanical intermediate storage instead of electrical. It isn't just mechanical compo- nents that wear. Electrically, it is difficult to smooth the energy when it fluctuates so widely and has so many cycles. We calculate 4–5 million wave cycles per year and the best capacitor banks we are aware of can only manage one million cycles. After that, they're worn out and must be replaced. We have to begin with converting the waves' irregular motion into a mechanical force that can power the generator.

"But the waves' amplitude and frequency are constantly varying and the peak energy can be more than ten times higher than the waves' average energy. And when a storm blows in, the peak energy can be more than a hundred times higher than the average energy. On the other hand, a conventional generator is most efficient at an even speed and with an even load. The waves' considerable variations lead to the generator not being able to work efficiently. We therefore use an intermediate step that we call power take-up that smooths the energy using a counterweight and we can thus run the generator more evenly.

"It is there our innovation has the greatest impact. By intermediate storage of energy in the counterweight, we can also reduce the size of the components in the system, both the mechanical gearbox and the generator. The generator not only becomes more efficient, a smaller generator can also be used.

"It is Prevas that has developed the control system for us. We have a test rig we use to evaluate the principle, and the control system will be placed in a half-scale model that we've designed. The control system is there to regulate the extraction of energy from the system. The control system regulates the speed of the generator and consequently, the system regulates how quickly the counterweight will fall. The system balances the counterweight's trend so that it is kept around a specific average position. When the counterweight begins

to come too high, we increase extraction from the generator, and the counterweight consequently begins working its way downward. And when the counterweight has come too low, we reduce electricity production so that the counterweight begins working its way up again.

"The regulation system is based on the simple principle that it regulates electricity production towards the average energy extracted from the power plant. A computer detects the RPM of the winch drum and the counterweight drum with two encoders, and it's simply a matter of balancing the counterweight side against the winch side.

"Prevas developed the software based on our specifications. The software, which was written in LabVIEW, is run on National Instruments' CompactRIO platform. Even from the beginning, we were convinced that CompactRIO was the right way to go and Prevas supported the idea. CompactRIO is a durable and compact industrial computer system for control and monitoring tasks. It's fairly common in various development projects because it's flexible, powerful and modular-based.

"Both a DC generator and one that generates AC could have been used. We use an asynchronous three-phase generator from ABB. The cable that runs to land is a part of the platform's dynamic design. It goes down to the sea bottom along one of the anchor lines and then lays on the bottom with a wide bend radius; there will be wear. But the problem is not

unique to wave power; it also exists in other offshore installations.

"A wave power apparatus is optimized to move as much as possible, while an oil drilling platform is anchored much sturdier. In Norway however, they are running electrical power out to all oil rigs even though they bob on the waves of the Atlantic.

"The buoys are intended to be spaced at intervals of 40–50 meters and it is best to put out enough of them so that a number of megawatts can be generated. The cost for a system corresponds to the peak load exerted on the system, or maximum power when it comes to electronics. By reducing the peak loads, we can downsize all components, reduce the working area and make energy conversion more efficient.

"We feel that collaboration with Prevas has gone extremely well. They have conducted themselves very professionally and implemented our system in a short time.

"The control system is currently being demonstrated on our test rig, but the same system will be installed in the half-scale model that will be 12 meters long and be placed out at sea," says Mikael Sidenmark in closing.

Patrick Buschow is Prevas' regional manager for product development in the Malmö-Gothenburg area. He talks about the collaboration with National Instru-

ments and the work performed for Ocean Harvesting:

"We are a Select Partner of National Instruments, so we have good technical collaboration with their development department and have early access to their latest technical solutions.

"We developed the control system for Ocean Harvesting's wave power plant. We wrote the real-time system in the LabVIEW RT language to run on National Instruments' framework CompactRIO. Certain drivers were placed in a gate matrix circuit (FPGA). The control system features event management, logging, alarms and management of regulators, as well as a user interface for remote monitoring. Data comes to land via 3G telephony. The wave power plant just calls home.

"Everything could be completed in just four man months thanks to us using object-oriented coding and reusing existing code components," says Patrick in closing. ✳

New Center of Excellence: Audio

TEKNIK Developing good audio solutions is much more than just producing good measurement results. Each individual design decision affects the final results and the quality of the sound. Audio and audio design is an area of expertise that places high demands on experience, innovative problem-solving and broad theoretical knowledge.

Prevas has acquired solid competence and experience in audio design. This competence, combined with investments and focus, forms the foundation of our new Center of Excellence, Audio. Here we can meet growing needs that are unique to this branch and can help our clients to compete in a global market.

Do you want to know more?
Contact Hjalmer Nilsson at Prevas,
hjalmar.nilsson@prevas.se. ✳

MIRIS

behind global patent for analysis of milk

WITH PREVAS' ASSISTANCE, MIRIS HAS DEVELOPED AN INSTRUMENT THAT CAN HAVE MAJOR POSITIVE EFFECTS FOR NEONATAL CARE, AS WELL AS THE DEVELOPING COUNTRIES.
THE INSTRUMENT ANALYZES FLUIDS SUCH AS DAIRY AND BREAST MILK.

THE MEASUREMENT METHOD IS BASED on mid-IR spectroscopy (Miris stands for Mid-Infra-Red Intelligent System). The analysis instrument can analyze the composition in a variety of different liquids. The present focus is on milk analyses with measurement of the content of fat, protein, carbohydrates and energy. Maris' instrument is also used to analyze for example, meat, fish and pharmaceuticals. One very important application area for Miris' instrument is in breast milk analysis. The nutritional content in breast milk can be analyzed, and additives can be individually adapted if needed for infants born prematurely. The analyses can be performed on site at a neonatal ward, allowing immediate adaptation to suit the individual child's nutritional needs. Miris' instrument is the only instrument in the world approved for use for individual nutrition of prematurely born infants, and close

collaboration is already underway with leading resear-chers in the neonatal field regarding further development of the methods for analysis of breast milk.

"There is a tremendous need to analyze and check donated and stored breast milk at hospital neonatal wards," says Tony Malmström, who is one of the foun-ders of Miris and the company's CEO. "Prematurely born infants thrive best on consistent and stable nutri-tion, what is often referred to as individualized nutri-tion. And this means that the nutritional content of the milk must be checked. Our analytical instrument HMA (Human Milk Analyzer) needs a mere 1–3 milliliters to provide a quick and reliable analysis of breast milk, and the cost is low."
Miris' analysis instrument is the first portable mid-IR instrument for milk analysis. It is small, fast and easy to

care for, which makes it easy to use out in production.

"With Miris' instruments, large and expensive instruments can be replaced with small, portable units at lower prices without having to compromise on performance and quality," says Tony Malmström.

"Within foodstuffs production, the correlation between performance and price is attractive and it opens an extensive market for analysis of dairy milk in for example, India and China. The purpose is to avoid dilution and the addition of toxic substances to the milk."

Johan Bergsten, sales manager at Prevas in Uppsala has this to say: "The first portable mid-IR instrument for milk analysis on the market has an entirely new platform. The platform is designed for flexibility to enable development of the next generation of Miris' instrument, as well as adaptation to customer demands that arise. It is exciting that a small Swedish company can make such a breakthrough in the global market with a unique and innovative technology that benefits society and that only they possess. Working together and in a matter of only seven months, we have been able to deliver a complex system and put it into production. It's very gratifying to know that we have been nominated for the Swedish Embedded Award."

Rapid development with the latest technology

The background to collaboration with Prevas has to do with the processor module that constitutes the base in Miris' instrument being unexpectedly withdrawn from production. Miris was then faced with the choice of either reconstructing its instrument for another commercial processor module, or developing its own processor module adapted to the existing instrument design. In consultation with Prevas, Miris chose the second option. In a short space of time, Prevas developed an adapted processor module for Miris, based on the Freescale i.MX-53-processor (ARM Cortex A8). The new processor module leaves other parts of the instrument untouched, and thus is compatible with the already installed instrument base. Prevas has also developed an adapted Windows Embedded Compact 7 image for the new module.

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BOB THE POD
at Embedded–conference

Olavi Kumpulainen and Sten-Gullik Jansson at Prevas in Solna have built "Bob the Pod", a wandering robot. After the conference, Olavi plans to use it in his Embedded Linux training package.

TECHNOLOGY "I actually wanted to make a spider with eight legs, but there was the risk that it would have been too big and heavy because among other things, it would have needed more servos. So we decided on a machine with six legs, a hexapod. From this we got the last name Pod and then Bob, which almost rhymes with Pod. I hope management goes along with us saying that Pod stands for Prevas Open Design. Now I have a few weeks to find an acronym for Bob," says Olavi with a chuckle.

It has taken about six weeks to create the robot and its mechanics, electronics and software. Each leg is controlled by two servos. One controls up-down motion, the other forward-reverse. Olavi controls it with his Android smartphone.

"The control board is a Raspberry Pi, probably the hippest thing released this year on the embedded market," says Olavi Kumpulainen.

"Just to control the twelve servos, a high-end 700-megahertz processor is needed, but because Raspberry Pi only costs $35, we can base the solution on Embedded Linux, which was already ported to the hardware. Besides the standard components in Embedded Linux, we have added an interpreter for the standard programming language Python that we used to write the actual application code for Bob."

This is the fifth time that Olavi Kumpulainen has held a presentation at the Embedded conference. The theme for this year's presentation is Rapid Prototyping using Open Source.

"Python is a very capable language, so developing an app goes really fast," says Olavi Kumpulainen. "As an example of Python's efficiency, a minimal web server can be written on just two lines of code. Because it's scripted, the 'round-trip' time during debugging is substantially reduced. I can immediately see the results of a piece of code in the target system without the code needing to be recompiled. This is a major advantage because Bob's legs barely moved at all like I wanted on the first try.

"The choice of Linux and Python also means that someone else can easily add functions, such as a camera, so that Bob sees where he's going without irregular surfaces causing problems. Partitioning of the system also prevents new functionality from interfering with my code for leg control.

"I've spent 25 years shoehorning program code into hardware that's been all too small. It's great that hardware has become both cheaper and more powerful. This is really a trend break. Even solutions from desktop and server Linux can now be used in embedded systems. Not everything of course, but more than a year ago. This doesn't mean we have the green light to hack and add code as we please – system development must not be chaotic!"

When we pass the pantry on the way out to take a few pictures, Bob the Pod quickly draws the attention of a small troop of curious coworkers. But it is not just adult colleagues who are fascinated by Bob. Olavi

> **BOB THE POD HAS A BODY OF BLACK & WHITE PLASTIC PRINTED BY A 3D-PRINTER.**

mentions that he tests at home during the evenings. "But I have to wait until the kids have gone to bed," he says. "Otherwise I can't have it to myself."

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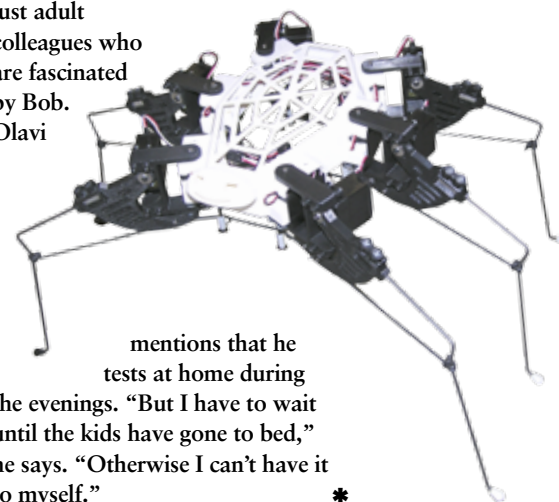
PREVAS DEVELOPING EMBEDDED SYSTEMS USING ANDROID

TECHNOLOGY

What we are seeing i today is that the users of the products we participate in developing are largely influenced by smart-phone usage," says Kristoffer Andersson at Prevas. "This means that the products we help our customers develop must mimic smartphones when it comes to usability, ease of access to information and the various gestures found on smartphones and tablets."

He believes that users and developers will choose Android over the competitors because Android already has these functions built in. Moreover, Android is based on open source code, which is more or less free from licensing constraints. The licensing disputes currently underway in the mobile branch affect development and this is one reason why he does not want to call Android entirely license-free. But he points out that patent wars have always been with us, including between cell phone manufacturers.

"What makes Android so attractive is that Android has a Linux core and the associated file system with system software," says Christoffer Andersson. "It's good that all code, except the core itself, is linked to a C library called Bionic that has a BSD license. This enables a Linux-based system to be created that to a great extent, is not GPL-licensed. This holds true as long as you don't insert GPL-licensed code, something that standard Android doesn't have. Android also has middleware that provides a uniform API for the system software and the core from the application layer."

He also feels that Android is well integrated, which provides major advantages that facilitate development of the interface between man and machine. Moreover, it does not need to look like an Android interface just because it is Android. He also mentions that it is easy to adapt the controls and graphical interfaces to the preferred design for the product.

"Often when we develop products, we work with an industrial designer and follow the language of design that the product is to have," he says.

On the other hand, he does not see it as a unequivocal benefit that there are many developers accustomed to working with Android:

"General experience of app development is relevant during application development for an embedded system based on Android. For example, how you customize a GUI and exploit the functions of Android. To develop an own product that is based on Android however, we need other skills, and these are in the integration of system software for specially developed hardware. Here experience from building an embedded Linux system is more relevant than experience from app development. There are however, quite a few special solutions in Android that do not follow 'standard Linux', so even those who have worked with Embedded Linux have quite a bit to learn.

"The embedded systems we develop often have larger packages of applications on the application layer, where the actual function of the product is implemented. Here it is an advantage to be able to program in C and C++ since it's often a matter of time-critical and resource-poor functions. It thus doesn't have to be Java-based, which is preferable in development of the GUI.

"When we talk about Android in embedded systems, it's generally not app development that is decisive, but rather the difficulty in adding system software on custom electronics with specific functions."

Regarding the risk of Android being divided into different variants, as has happened with Unix, Linux has no problem with the actual core because it is published with GPL licensing. So all code for the core must be published, even if most does not enter the mainline. He does however, see a problem with splintering when it comes to software that the users run, so-called userspace. Moreover, BSD and the Apache license permit manufacturers to not publish their patches.

"You can always choose to later develop from scratch in Linux instead," says Kristof-

fer Andersson. "In some cases, Android is also too resource-demanding to be appropriate. Linux is actually just a core, so to build up a complete system using Linux, you need several different components from different types of sources, with for example, Qt being a framework for among other things, development of graphical interfaces. Being able to adapt your system software entails that Embedded Linux with appropriate frameworks can be a better alternative in many applications."

He does not however, see Apple as becoming a competitor within embedded systems. As long as Apple does not license IOS for other manufacturers' hardware, it is all too closed. Microsoft's Windows Phone however, and to a greater degree Windows Embedded, offers a more attractive middle way. Windows Embedded is licensed for independently developed hardware. He believes that Microsoft products are competent and have an advantage in that they offer an integrated tool suite for developing applications and system software.

"We'll see an increase in industrial automation in coming years," says Kristoffer Andersson from Prevas. "Which OS will dominate is hard to say. All three alternatives have their advantages and the choice is heavily dependent on the company developing the products, their experiences and knowledge, as well as how sensitive they are when it comes to the legal aspects. Regarding licensing, Android, Linux and Microsoft differ considerably. But if we look at the tools they have for development, they are strikingly similar. This applies both to development of graphical interfaces and application development that comes in layers during actual interface development. Working with the tools naturally differs, but as a developer in one environment, you will feel familiar with the others.

"We often speak of open source code being 'free software', but 'free' does not mean that no costs are involved. Maintaining the tools and building up the environments are things that are expensive, and in this aspect, it can be cheaper to buy development tools and licenses instead of working with open source code."

If you would like to know more, contact Kristoffer at:
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INNOVATION FOR GROWTH

Prevas
www.prevas.com