

# Spearmint- or cinnamon-flavored handsets?

## An SDR the size of a Gumstix



Steve Jennis, PrismTech

### An interview with SDR expert PrismTech and their hardware vendor Gumstix

*Editor's note: At a recent Software Defined Radio Forum (SDRF) meeting in Portland, Oregon, PrismTech showcased their Software Communications Architecture (SCA) implementation on a small form factor "motherboard" by Gumstix. The SCA, along with a Common Object Request Broker Architecture (CORBA) middleware layer, is essential for building interoperable radios and waveforms. I caught up with PrismTech's Steve Jennis, SVP of corporate development, and Gordon Kruberg, CEO of Gumstix, to dig into the significance of this SDR implementation. Edited and excerpted comments follow.*

– Chris Ciuffo, Editor

**DSP:** *So you're running the SCA on a Gumstix motherboard. It looks cool because it's so tiny, but what's special about this?*

**JENNIS:** This is a client-funded activity, so we had to achieve some strict requirements. As you know, SDRs – and military programs in particular – have always suffered from the label that the SCA architecture is fat, heavy, and no friend to SWaP [Size, Weight, and Power]. Many implementations of the SCA, spearheaded by the DoD's JTRS [Joint Tactical Radio System] program, run 10-20 MB of memory, which has a direct negative impact on power consumption.

When we came to market about six months ago with a complete SCA implementation, which included the ORB, CORBA Services, and Core Framework claiming to have a local footprint of under 1 MB of memory, a lot of people raised their eyebrows, and suddenly the whole prospect of getting the SCA down to a handheld or even smaller looked like it was becoming a reality.

Once we did it for one client, we were very happy to work with Gumstix to convince the SDR customer base that this technology

is viable in a handheld or smaller form factor. What makes it really significant is that SDR is widely seen as a future technology for cellular and consumer communications. So the fact that this technology is becoming viable in smaller and smaller form factors that can be battery powered is potentially a significant breakthrough for the whole SDR movement.

**DSP:** *What exactly has been created?*

**JENNIS:** The product is called Spectra OE. Spectra is the brand name of our line of SDR products for tools and operating environments, and OE is Operating Environment. Inside that bundle you will find an embedded CORBA, which is the middleware. A number of CORBA services are specified by the SCA specification, like naming, lightweight lock service, and lightweight event service. And then there is the Core Framework, which is the deployment environment for the waveform. What we've done is a multilayered implementation that runs a real-time operating system.

**DSP:** *Is this implementation unique?*

**JENNIS:** One of the breakthrough aspects of this implementation is the fact that all of these layers are pre-integrated and delivered as one software license, whereas in the past, integrators had to license or build their own pieces. Not only were they messing with integration problems in terms of hardware and waveforms, they were also working with integration problems within the middleware layer, as well. So we've simplified

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that problem by integrating it into one package.

**DSP:** *Since the Gumstix motherboard is so small, that doesn't leave much room for a large memory array. Just how big is your software footprint?*

**JENNIS:** Under 1 MB, which is 90 percent smaller than previous code sets. This is a complete 2.2.x compliant SCA implementation, with nothing omitted.

**DSP:** *Let's talk about the Gumstix hardware implementation.*

**KRUBERG:** We're told that PrismTech chose our product because it's so easy to source; you can buy it directly from the website and all the information is there. Gumstix boards are designed for companies that don't want to spend a lot of time worrying about the hardware platform. [Editor's note: See Figure 1 for an example of a Gumstix motherboard.]

Many companies throughout the world use Gumstix technology, software companies that don't have the hardware skills and are looking for a small form factor Linux computer.

**DSP:** *But why use the Gumstix form factor?*

**KRUBERG:** We are less pervasive than other small form factors like PC/104. But we're also a tiny fraction of the size and a fraction of the power requirements when it comes to actually going into a real mobile device. So having something that is so power efficient is what drives use of the Gumstix.

The differentiating feature of our form factor is that we picked the smallest size we could and still implemented a "non-embedded" Linux device. That is, it's a complete Linux implementation, but somebody who is used to working with a full root environment can have as big a root file system as they want and can pack whatever they want into it. Their code can be recompiled straight from an x86 desktop or server environment.

**DSP:** *Your module is fundamentally an x86 SBC?*

**KRUBERG:** No, it's a PXA270 Marvell XScale with a full MMU used in handheld appliances, supplemented by a Marvell chipset. Our boards run from 400-600 MHz, and the Marvell CPU can operate on less than 1 W. The Gumstix boards can operate down as low as -25 °C, and each Gumstix



Figure 1

board itself is 20 mm x 80 mm, which is really just a fraction larger than an average stick of chewing gum, depending on which connectors you've got on it.

**DSP:** *Does the Gumstix motherboard need massive hard disk or other large flash storage?*

**KRUBERG:** If you wanted, you could mount a network root FS, or have a hard disk connection over the USB port sitting right there on the desk. The Gumstix verdex motherboards also have 32 MB of flash and 128 MB of RAM, so they're not crippled as far as memory is concerned. User-configurable I/O is available via various other daughtercards.

In fact, you can stack cards on each side of the motherboard and essentially end up with a "pack of gum." So in the PrismTech implementation, I imagine that a "pack" can implement a full SDR complete with software.

**DSP:** *So where is the PrismTech Spectra OE running?*

**KRUBERG:** It runs in the non-volatile memory of the Gumstix motherboard itself, so it all resides onboard as opposed to running off of a hard disk somewhere.

**JENNIS:** From our perspective, there's a big trend toward using open source operating systems, so Linux is important. There's also a big trend toward using COTS products rather than a hand-built, custom-designed product. So that's another reason the Gumstix form factor would be interesting to these guys.

Just putting yourself in our client's position for a moment, you are going to need something that is small, commercially available, low cost, and runs an open source operating system. I think that these would be the factors that would point radio vendors to Gumstix.

**DSP:** *I agree. What does one of these Gumstix modules cost?*

**KRUBERG:** The motherboards right now range from \$99 to close to \$200 each. We publish our retail and volume prices, which you can find online at [www.gumstix.com](http://www.gumstix.com).

**DSP:** *Virginia Tech recently announced their open source SDR initiative called OSSIE (<http://lossie.wireless.vt.edu/trac>). How does this compare?*

**JENNIS:** The Virginia Tech open source version has been around for several years. It's really a first-generation implementation. So really, you get what you pay for.

**DSP:** *Can you summarize the value proposition of the PrismTech/Gumstix implementation?*

**JENNIS:** The real secret behind this marriage between the Gumstix motherboard and the Spectra OE SCA Bundle is the fact that you get SCA compliance (2.2.2) with all the pieces required to implement the SCA on a module that is small, off-the-shelf, runs in an open source environment, and low power/low cost. This thing could literally stick inside the digital recorder I've got sitting here in front of me.

The volume proposition is even more significant. The volumes of radios are exponentially greater than, say, VME boards. The way to make SDR available to the man on the street is to drive down its cost to be attractive in the same sort of volumes as cellular handsets. We think it's a big step on the way to taking SDR out of the back room and down into the handset. And it's only when it gets into commercial use where the military guys are going to benefit at the economies of scale they are looking for.

*Steve Jennis is SVP of corporate development at PrismTech in Burlington, Massachusetts, where he is responsible for devising, implementing, and coordinating the company's strategic business plans throughout its worldwide operations. Steve has more than 20 years of experience in sales, marketing, and general management positions at high technology organizations. Prior to joining PrismTech in 1994, he was the general*

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***W. Gordon Kruberg** is president and CEO of Gumstix in Portola Valley, California, where he manages the company's overall vision, day-to-day operations, and product development. Beforehand, Gordon founded, financed, and maintained executive roles in more than 30 U.S.-based companies. His background includes managing investments in software, biotechnology, and medical technology startups. Gordon holds an AB in Human Biology, an MS in Industrial Engineering from Stanford University, and an MD from Northwestern University.*