# [***For the Gadget Universe, a Common Tongue***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:47KD-PN70-01KN-20G9-00000-00&context=1516831)

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**Body**

IT is too soon to describe the Bose family as an audio-world version of the Bush and Kennedy clans in politics, but they are off to a good start.

In 1964, Amar Bose, a Massachusetts Institute of Technology professor and inventor, created the renowned high-fidelity sound systems company that bears the family name. Now, his only son, Vanu, is gaining recognition for radio-design technology every bit as novel as the sound systems that his father pioneered.

The younger Bose's four-year old company, Vanu Inc., is a prominent innovator in the effort to use software rather than hardware to control how radios, ***cellphones*** and all other wireless communications devices recognize and manage signals. Early versions of the technology, known as software-defined radio, are beginning to be deployed in military communications equipment and cellular base stations.

The goal is to develop software and related components that recognize various wave forms at any frequency in the radio spectrum and choose the appropriate applications to process them. A single device could provide ***cellphone*** service no matter what the format or frequency, exchange wireless messages with laptop or hand-held computers, and communicate with walkietalkies or emergency services.

There is another potential benefit: being able to incorporate improved data speeds and features simply by downloading software, rather than replacing the customer's hardware or the companys network equipment.

"Why build a system to do one thing when you can build it with software to do many things and be upgradable to boot?" Mr. Bose said.

It is easier said than done. Software radio needs better antennas, advances in the chips that convert radio waves into digital streams of data and methods for using less power, among other things. But software radios potential is so staggering that many experts say its spread over the next decade is inevitable.

Software-defined devices are too power hungry to make them practical for handheld applications now, but eventually consumers will be offered ***cellphones*** that jump among the worlds competing signal standards depending on which gives them the best performance or price wherever they happen to be. Unlike today's dual-mode ***cellphones***, which are essentially two separate phones inside a single case accompanied by software that recognizes which one to turn on, true software phones would use the same hardware to interact with the incompatible networks.

Not only would a software phone have fewer components and, presumably, cost less to build, but it would also be easily reprogrammed to take advantage of improvements in the network. Consumers would not face decisions as they do today about whether to buy new phones to take advantage of advanced networks. Instead of facing vast, high-risk technology transitions once a decade, the ***cellphone*** industry could advance at a steadier pace, like the personal computer industry.

But there are more compelling uses for software radio technology that have drawn innovators like Mr. Bose and giant companies like Motorola and Boeing into the field.

The Defense Department in particular is counting on the technology to end the dangerous confusion that arises when different branches of the armed forces try to talk to each other, get data from satellites or control robotic weaponry with incompatible communications systems. Despite more than two decades of research and development, experts say, soldiers in combat often carry separate radio systems one to talk to one another and another to communicate with air support.

Similar barriers plague police, fire and rescue agencies, many of which intentionally bought incompatible radio systems to minimize interference with one another. But after Sept. 11, many are looking to software radio technology to give them the flexibility to bridge incompatible systems when coordination becomes critical.

More recently, the Federal Communications Commission has singled out software radio as a possible means for expanding use of the radio spectrum while reducing interference in the most crowded portions. Such devices could, in theory, start a phone call in the portion of the spectrum currently assigned to ***cellphones*** and jump temporarily into unused parts of the television or public safety spectrum if more space was available there.

Mr. Bose's background and his enthusiasm as he shows off his prototypes make it hard to believe he ever considered doing anything with his life besides playing around with signals.

Now 37, he recalls being delighted at his opportunities as a child to visit the Bose research labs. As an undergraduate at M.I.T., he plunged into the world of FM radio signals while typesetting a research paper for his father (on FM radio reception when signals arrive at different times after bouncing off various obstructions). "

That solidified my interest in the field and the math behind it, Mr. Bose said. I always felt I could figure it out if I sat down and worked hard enough on it."

But Amar Bose never pushed his son to do anything related to the family business, and Vanu Bose appeared for a time to be heading in quite a different direction. He did his initial graduate research on the design of skin patches as an alternative to needles or pills for delivering medicine. Coming on the heels of a two-year stint working with Project Orbis, which flies an eye-care hospital in a DC-10 to impoverished regions of the world, Mr. Bose's research focus pointed toward a career in medical technology.

He was lured back into the signal processing fold by David Tennenhouse, a professor who hired him as a teaching assistant and then persuaded him to lead a software radio study financed by the Defense Department. The four-year project produced an experimental software radio format called Spectrum Ware, a Ph.D. for Mr. Bose and the core technology used to found his company.

The company's first notable product, quite unintentionally, was a battle with M.I.T. over property rights to the technology he invented as a student. The university wanted $1.25 million over eight years in licensing fees, assorted royalties ranging from 4 percent to 10 percent on software and hardware products Mr. Bose might develop, and a 6 percent ownership stake.

It was an impossible demand for Mr. Bose, who wanted to follow his father's example of investing heavily in research and avoiding becoming beholden to venture capitalists out for quick profits.

Vanu Bose eventually worked out a compromise with the university, and these days his energies are focused on software radio's future and his company's place in it. In a field that includes giants like Motorola and L. M. Ericsson and startups like AirNet and QuickSilver, Vanu stands out as the company most committed to designing systems that use common processors, open-source products like the Linux operating system and reusable chunks of software.

"Vanu has got a unique approach," said Allan Margulies, chief operating officer of the SDR Forum, a trade group for companies trying to develop standards and regulations to support the spread of software-defined radio.

Relying heavily on such general-purpose building blocks sacrifices some of the performance benefits of using specialized chips and programs. It has also allowed others using more specialized components to get to market faster with products that fulfill some of software-defined radios potential. But the goal is to position Vanu and the companies that license its software to ride the coattails of the huge investments that companies like Intel and Advanced MicroDevices make each year to improve general processors.

"Moore's Law is working for us," Mr. Bose said, referring to the observation that the general cost of processing tends to fall by 50 percent every 18 months.

If the strategy works, devices incorporating Vanu software will be upgraded more often and more easily than those of other software radio designers. That in turn could accelerate the speed at which software radio technology becomes inexpensive enough to be embedded in most radio devices.

"They are the first people to really push software radio commercially," said Eric Blossom, head of the GNU Radio Project, which is coordinating efforts by programmers and systems developers to develop software radio devices using completely unpatented and freely shared technology.

So far, the pushing has netted Vanu and its 25 employees researchand- development contracts, including some with Bose to use Vanu technology for projects unrelated to software radio. The company was also part of a team led by Boeing working on an early stage of the Joint Tactical Radio System project, the Defense Department's effort to develop a software radio strategy for the armed forces.

But other startups are further along commercially. AirNet, for example, has sold systems enabling overseas phone companies to switch to higher-speed signal formats without having to install new equipment at every base station; instead, customers will simply download software from a central office.

Mr. Bose said his company expected to conclude new licensing and consulting deals by this spring.

"Getting their first major sale is their critical challenge," said Peter Cook, a former Motorola scientist in Phoenix who has become a wellknown software radio consultant. "Ericsson, Motorola, Nokia -- the equipment companies who could pick this stuff up and run with it -- have been following developments but are reluctant to jump in because they make a lot of money selling maintenance to todays base stations. If a company like Vanu can break through with one big customer, the market could come tumbling after them."

[*http://www.nytimes.com*](http://www.nytimes.com)

**Graphic**

Photos: THE VANGUARD -- A prototype device designed to utilize Vanu software radio technology. (Jodi Hilton for The New York Times)(pg. G6); NEW LANGUAGE -- Vanu Bose at his office in Cambridge, Mass. Software will increasingly let disparate devices communicate, he says, and make them easily upgradable. (Jodi Hilton for The New York Times)(pg. G1) Chart: "Conquering Babel"Each wireless device, like your ***cellphone***, cordless home phone, walkie-talkie or baby monitor, is designed to have processing for a specific frequency band and technical standard, limiting it to communicating with like devices. The field of software-defined radio, including the form being advanced by Vanu Bose, aims to put the processing burden on easily modified software, providing many potential advantages. UPGRADES -- When more advanced systems reach the market, like new generations of cellular technology, consumers and wireless-service providers often have to replace their hardware. In a software-defined system, software can simply be modified, enabling faster, cheaper upgrades. COMPATIBILITY -- Devices operating on different frequencies or standards -- like an 800-megahertz digital police radio and a firefighters' analog radio in the VHF band -- are unable to communicate. At an emergency scene, a mobile base station with special software could receive the police transmission and resend it as an analog VHF signal. (Source: Vanu Inc.)(pg. G6)

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