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Home
News & Articles
February 2001
Editorial Calendar
Subscriptions
Buyer's Guide
Advertising
Upcoming Events
Resources
Staff/Contacts

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Technology Frontline

BridgeWave Communications Doesn't Reinvent The Wireless Modem

BridgeWave Communications was founded on two core beliefs. The first is that Millimeter Wave spectrum (microwave, above 20 GHz) technology was vastly underutilized in the deployment of broadband wireless systems. BridgeWave's second core belief is that "wired" broadband technology is pretty good – reasonably priced, offers reasonable performance, and the factor preventing broadband technology from being more widely deployed is… the various inadequacies of the wired infrastructure.

Basically, BridgeWave Communications has developed a system that "fakes out" cable and DSL modems and their associated "head end" systems to thoroughly emulate a conventional cable and DSL infrastructure… without the wires.

The Usual Problem

Where cable modem and DSL service is available, it works pretty well and costs are, for the most part, reasonable. The (usual) problem is that those service areas are limited – cable infrastructure is slow and expensive to refit for use with cable modems, and DSL suffers from severe distance limitations and limited deployment.

Wireless is an obvious choice for bridging the gaps of cable modem and DSL deployments, but wireless presents a new set of issues – lack of standardization, higher costs, and incompatibilities with existing equipment. For example, a cable modem service provider that wants to provide service via wireless must qualify a completely different set of equipment, deploy it, maintain it, monitor it, spare for failures, etc. Wouldn't life be simple if cable modems and DSL modems could simply be used with a wireless adapter?

BridgeWave's principals, several with extensive microwave communications experience, felt that such a "wireless adapter" for cable modems and DSL modems was, in fact, feasible, and that there was plenty of spectrum available in the Millimeter-wave bands above 20 GHz for such high-bandwidth wireless services.

Signal Code Modulation

At first glance, BridgeWave's system would seem to be a simple "transverter" – a Radio Frequency (RF) converter device that transforms one band of frequencies to another band of frequencies. In the case of BridgeWave, "up-converting" the VHF and UHF television frequencies used on cable television systems to Millimeter-wave frequencies.

One reason such a simple "transversion" wouldn't work is that the inevitable

noise present in a wireless system would impair the signal – cable modems use high-order modulation that is intolerant of noise (one reason cable systems have to be re-engineered for cable modems to be offered).

Digital techniques could be used to sample the original analog signal of the cable modem, transmit the digitized waveform as a digital signal, and then recreate the original analog signal at the receiver. A problem is that, to recreate the analog signal accurately enough, the signal must be sampled very rapidly, resulting in a digital signal that would consume far more bandwidth than the original analog signal.

BridgeWave's technology, which they call Signal Code Modulation (SCM), is far, far more sophisticated than a simple transverter, and even more sophisticated than a purely digital system. SCM combines some of the best techniques of digital and analog technology in SCM.

SCM works by sampling the original analog signal in "two passes". The "first pass" is a conventional analog-to-digital conversion, resulting in a crude (digital) approximation of the original analog waveform. The "second pass" measures the differences between the original analog signal and the "first pass" digitized signal. These "differences" can be thought of as a "correction factor" for the digitized signal.

The "differences / correction factor signal is then "expanded" to make it more immune to noise. The "expanded" analog signal is then interleaved with the digital signal and transmitted, consuming no more bandwidth than the original analog signal, but with much greater immunity to noise.

When the signal is received, the process is reversed. The analog signal is recovered and "deflated", and then applied to the digital signal, recreating the original analog signal.

BridgeWave's system is totally transparent – cable modems interoperate with cable "head end" equipment just as if there were a cable television wire plant between the two units rather than a connection to a radio.

Relatively Simple

BridgeWave's technology keeps the radio unit relatively simple. Note that SCM does not involve "decoding" the cable modem signal, routing, or other "complex" tasks normally associated with wireless technology. Nor is a cable modem or DSL modem modified in any way. Instead, the BridgeWave system, conceptually, at least, is refreshingly simple, and potentially could cost substantially less than more complex broadband wireless systems.

Competition

It remains to be seen if BridgeWave's vision of using off-the-shelf cable and DSL modems for wireless use stands up to wireless equipment that is purpose-built for such use. Another issue is BridgeWave's use of Millimeter-wave spectrum, considering that such spectrum typically requires licensing, and there are significant range and other issues with Millimeter-wave spectrum.

For example, the Wireless DSL Consortium chose to adapt cable modem Data Over Cable Service Interface Specification (DOCSIS) technology for wireless use in the 2.5 GHz MMDS spectrum. This approach was chosen to leverage the development efforts and cost-effectiveness of cable modem technology, adapted to the unique environment of wireless.

Partnerships

BridgeWave has partnered with BreezeCOM in a technology exchange program, and BreezeCOM has invested in BridgeWave. BridgeWave has partnered with Scientific Atlanta (SA) to integrate SA's cable modem technology with BridgeWave's technology, and Scientific Atlanta has also invested in BridgeWave. BridgeWave has also partnered with Copper Mountain Networks in their CopperWireless initiative.