Published on FierceBroadbandWireless (http://www.fiercebroadbandwireless.com)

The Grand Scheme Beyond Femtocells: Smart Distributed WBB Networks

By
Created May 21 2008 - 3:20pm

INDUSTRY VOICES

By Robert Syputa, Partner & Senior Analyst, Maravedis Inc.

Femtocells have advanced into the market as a way to extend coverage and offload capacity of 3G networks. This is a method of distributing the signaling and bandwidth load to local area networks, enhancing building penetration that is currently limited by 3G WCDMA technology and network architecture.

Femtocells have little ability to become self-organized or perform network management functions. WiMAX and LTE, on the other hand, are based on highly adaptive OFDMA air interfaces and IP communications that enable architecting of self-configured and distributed networks. They become part of the broader unified communications industry movement toward smart, distributed networking that is augmented by distributed storage and application servers. The largest opportunities for WiMAX are Smart Distributed WBB Networks, SDWN, and Purpose Use of Multiple Spectrum bands (PUMS).

This article will sketch the rationale and basics behind SDWN for key segments and players.

SDWN Description:

The SDWN wireless interface layer is based on scalable OFDMA, adaptive modulation and power control methods that enable the network to adapt to a variety of channel bandwidths, range, multi-path environments, and attenuating signal conditions and usage.

The same factors that are now driving intelligent wired networks are amplified by the nature of wireless: limited available spectrum. MIMO- beam forming, smart antenna and smart power regulation built into remote and mobile stations can achieve very high localized performance while working as an adaptive layer within the managed network.

Distributed and Virtual SDWN Networks

Groups of aggregated remote stations (RS) and mobile stations (MS) can handle authentication, QoS, and security functions:

- Virtual base station functionality: enables hand-offs and localized routing and network optimization.
- Multiuser MIMO (MU-MIMO): enables a single base station to transmit to multiple remote (RS) or

mobile stations (MS) simultaneously over the same frequency band, thereby increasing the sum and processing gain bandwidth, while decreasing latency and increasing signal path reliability.
- Collaborative MIMO (Co-MIMO): as compared with conventional MIMO in which a terminal is served by one unique base station, a co-MIMO terminal is served by multiple base stations or RS. Inter-cell interference is very often a limiting factor to wireless network capacity. Co-MIMO uses non-coherent signal combining, which dramatically reduces inter-cell interference. This can be effective in cell edge and tiered networks.
- Network MIMO-AAS: enables adaptive use of a variety of smart antenna techniques from multiple radios.

The sub-channel signal measurement, estimation and error correction techniques used in WiMAX & LTE systems provide knowledge essential to building self-organized networks. This capability combines with OFDMA's finely grained sub-channelization methods to enable an evolution of smart WBB network architecture. Early manifestations can be seen in products and development plans from technology leaders including Alvarion, Alcatel-Lucent, DesignArt Networks and picoChip.

The term ‘WiMAXmesh' is used by some companies to describe SDWN functionality for multi-hop relay network capabilities now being implemented into WiMAX integrated circuits and network devices. Currently, WiMAXmesh can include on-board or local memory and storage, support for multiple external network interfaces and optimized network routing capabilities. We prefer the term SDWN to signify a richer set of capabilities that will lead to smart distributed network evolution well beyond that implied by WiMAXmesh, a take-off on the popular, but limited, WiFi mesh architecture.

The Scalable Network Architecture of SDWN includes:

- Macro Cell Base Stations (BS): typically aimed at tower installations;
- Mini Cell BS: typically aimed at rooftop & similar deployments;
- PicoCell BS: typically for indoor and shadow area network enhancements;
- Femtocell: typically aimed at local area access networks.

SDWN will enable localized storage and servers, mobile and temporary networks.

SDWN methods can deliver a significant reduction in network deployment and operating costs. SDWN displaces the need to do much of the configuration and allows various types of deployments that better fit the environment.

Key Companies and Market Dynamic

Key stake holders in SDWN development include most major companies involved in WiMAX and 3G-LTE including:

- Alcatel-Lucent: A leading developer of co-MIMO, MU-MIMO technologies
- Alvarion: An early implementer of distributed network capabilities
- Cisco: We think that Cisco intends to become the leader in SDWN for both WiMAX and LTE. Products may not appear for up to two years.
- Intel: Offers distributed processor architectures and enabling IP.
- Nortel: An early leader in MIMO-OFDM and is continuing development toward SDWN
- Motorola: The company is not as visible but has developed corresponding IP
- Ericsson: Has recently entered submittals to 802.16 that correspond to work in LTE.
- Huawei: A rising developer in SDWN technologies.

- Numerous efforts are underway among WiMAX, LTE and multi-mode chip and smaller equipment suppliers. picoChip and DesignArt are noticeable examples.

Markets

SDWN is highly motivated by the need to deliver cost effective networks able to respond to high bandwidth demands from both enterprise and consumer markets. The need to be integrated as part of enterprise level networks compels development of self-configuring, self-organizing WBB networks. The growing demand for personal broadband, including social networking and video media, will propel the pace of SDWN developments.

We believe that SDWN will develop over the next 10 years to become two to four times larger than the conventional centralized wireless broadband network market.
