Fixed Broadband Wireless Access Networks

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Application Note

Introduction

Fixed Broadband Wireless Access (F-BWA) networks deliver broadband data rates to business and residential customers. One of the more common network architectures for F-BWA is a point-to-multipoint (PMP) architecture where one base station delivers service to multiple users in different locations as shown in Figure 1.

First generation networks were designed by applying cable modem technology to create a wireless solution. The resulting networks have substantial performance limitations and restrictions on their deployment, primarily due to the following two technical issues:

- Poor response to link impairments: First generation systems do not respond well to rain fades, obstructions, or non-line-of-sight (NLOS) conditions. They require very tall base station antennas and line-of-sight (LOS) access to all of the customer-premise-equipment (CPE).
- Poor response to co-channel interference: Wireless systems, particularly in unlicensed bands, have to cope well with co-channel interference.

In addition, first generation networks as a whole suffer other limitations, such as expensive CPE equipment and high installation costs. Regardless, the market for broadband access is as strong as it ever has been, and it is now a challenge to the F-BWA technology providers to overcome the limitations of the first generation of equipment and compete effectively with DSL, cable, and satellite technologies.

Next generation PMP F-BWA networks are being designed to address the limitations of first generation networks, using a combination of several technologies, all of which require high performance, flexible signal processing subsystems.

Modulation Techniques

The most advanced developments utilize adaptive modulation schemes to improve the quality-of-service (QoS). Lower order modulation schemes, such as QPSK, can be used when the link impairments are high, and higher order schemes such as 64QAM can be used when link impairments are low. This helps a PMP F-BWA base station to dynamically adapt to changing conditions for each subscriber to ensure a specified QoS.

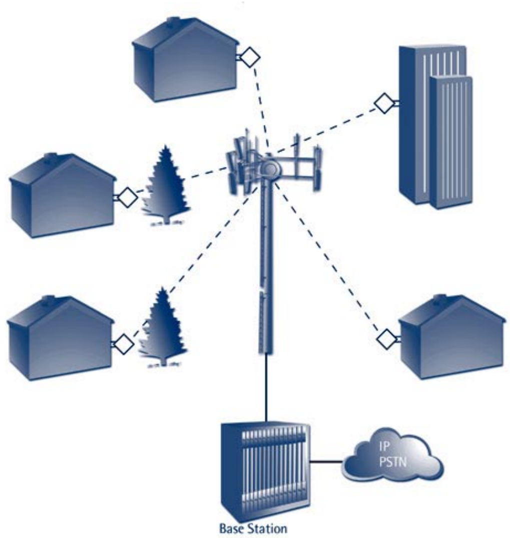

Figure 1: Simplified F-BWA Network

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Adaptive Coding Techniques

Forward Error Correction (FEC) coding introduces overhead and as a result reduces the payload data in a wireless system. In ideal conditions, it is optimal to use lower order FEC coding to increase the payload data throughput, but when impairments are high, it is desirable to switch to higher order FEC coding to ensure a specified QoS. Many next generation F-BWA systems are employing adaptive coding schemes to optimize their throughput and maintain a high QoS.

Interference Mitigation

Interferences in PMP F-BWA systems include obstructions, rain fades, and co-channel interference from other transmission sources. Many new systems are utilizing smart antenna techniques, including adaptive beamforming, to increase the signal-to-noise ratio, cancel interfering signals, and increase the coverage area of F-BWA base stations.

In addition to these, experimentation with different air-interfaces, such as OFDM, TDMA, and CDMA, are attempting to increase the quality and coverage of F-BWA networks.

All of the technologies listed above are best implemented on a high-performance, scalable, software reconfigurable signal processing platform designed for wireless processing and dataflow. Spectrum's flexComm product line is optimized to solve all of the signal processing challenges in second generation F-BWA systems. Spectrum's SDR-3000 product line provides an IF-to-Ethernet subsystem ideally suited for next generation PMP F-BWA base station development and deployment. Figure 2 shows an example partitioning of a second generation F-BWA base station onto the SDR-3001 platform. In addition to providing unparalleled processing performance and data movement, the SDR-3001 also provides hot-swappable components and passive backplane interconnects to create high-availability solutions critical for reliable wireless infrastructure.

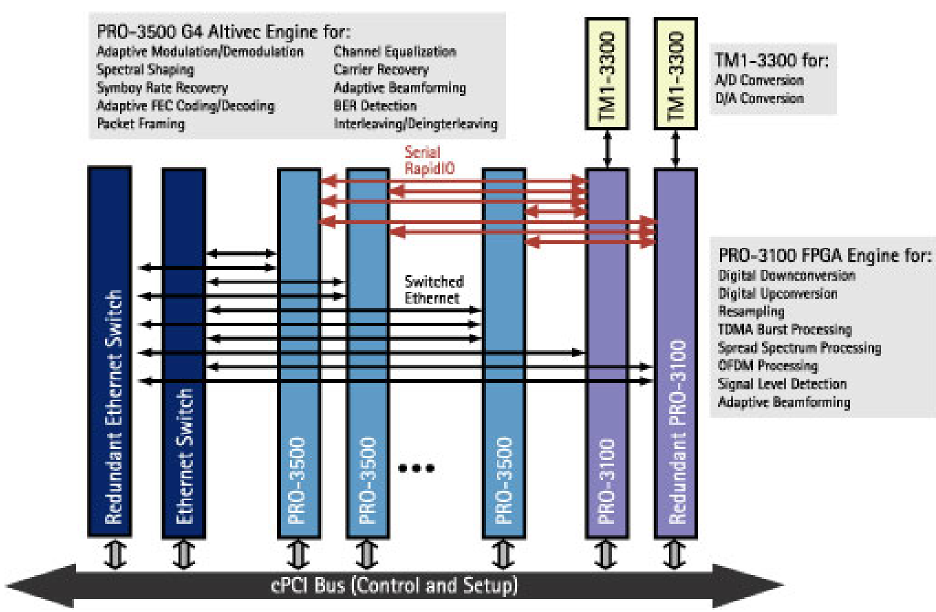

Figure 2: SDR-3000 Digital Transceiver Subsystem Architecture

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