Development Platform
Designed to Speed
Market Application
Designs

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Outline

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Motivation for Testbed Platform

- **Education**
  - Complement theoretical courses in modern digital communications
  - Exposes students to implementation issues
  - Allow student to see their radio projects put into practice

- **Research**
  - completing the link between theoretical research and experimental research
  - allow exploration of issues in wireless cellular system

- **Compliant with open standards (SCA)**
  - Ensure that like the PC world there will be many vendor sources for:
    - reprogrammable hardware
    - middleware software
    - radio application software
    - upgrade kits
Signal Processing

- For older waveform
  - multiple radio sets can be implemented on the latest FPGA-DSP

- For new waveform
  - Processing requirements for wireless protocol grows faster than Moore’s Law
    - Hardware accelerators required
    - Multiple FPGAs and DSPs are required
      - 3 FPGA and one DSP for UMTS from vendor A
      - 1 FPGA and three DSP for UMTS from vendor B
  - New techniques also requires more processing power
    - MUD solution for UMTS requires 1 FPGA

Figure 1: Signal Processing Hardware
RF Module

- **Testbed**
  - 6U cPCI RF Cellular Module in the Rx 824-849/Tx 869-894 band
  - The figure shows how to use the testbed for other frequency band

- **Technology**
  - Multi-carrier transceiver
  - IF band Sampling
  - Up to 35 MHz bandwidth with current ADC
  - Mixer and IF filter are protocol independent
  - Digitized IF bandwidth contains the data from all the RF channels present in that bandwidth

*Figure 2. Accessing the desired frequency band with the available RF module*
Interconnection – RF and DSP

• Interconnection based on the requirements defined by OBSAI (Open Base Station Architecture Interface)
• Bidirectional bus capable of 30 Gbits of data per second in both direction
• Uses LVDS at 800 MHz
• Hardware consist of
  • RTM Node
  • RTM Switch Fabric
• Software consist of
  • Link Layer
  • Network Layer
  • Switch
• Many Configuration Possible
Radio Development Environment

Figure 3. Radio development process and tools
Conclusion

- Software radio testbed have been developed that
  - Provides the processing power required by new waveform
  - Supports newly proposed signal processing techniques
    - adaptive receiver, adaptive interference suppression, multi-user multistage RAKE receiver, adaptive turbo coding and exploration of many other novel techniques
  - RF front end allows research in antenna diversity, power amplifier correction technique and ultra wideband
  - A rapid prototype of the solution can be developed using code generated by the simulation tools and operating on the target hardware

- Future
  - The system will be integrated with Mitsubishi Virtual Field Test Simulator that
    - simulates the behavior of thousands of users bringing near real-life condition in the lab
  - Smart Antennas Support