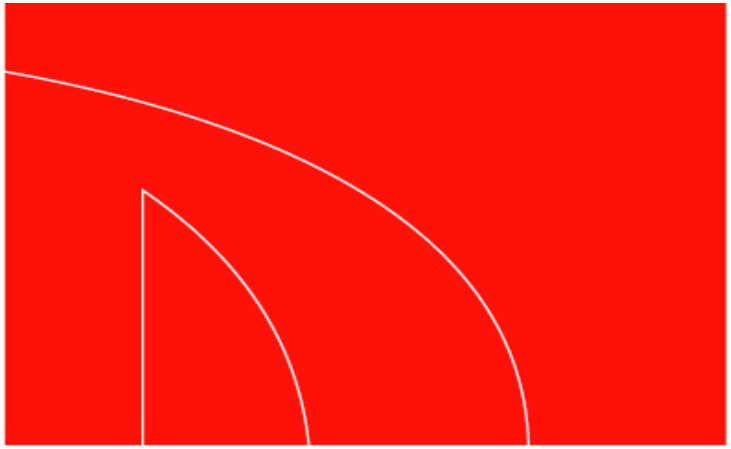

RADICAL HORIZON

# Development Platform Designed to Speed Market Application Designs

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# Outline

- Motivation
  - Education
  - Research
  - Future Acquisition Model
- Signal Processing
  - Computational Requirements
  - Signal Processing Hardware
- RF
- Interconnection
- Radio Development Process
- Conclusion

# 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

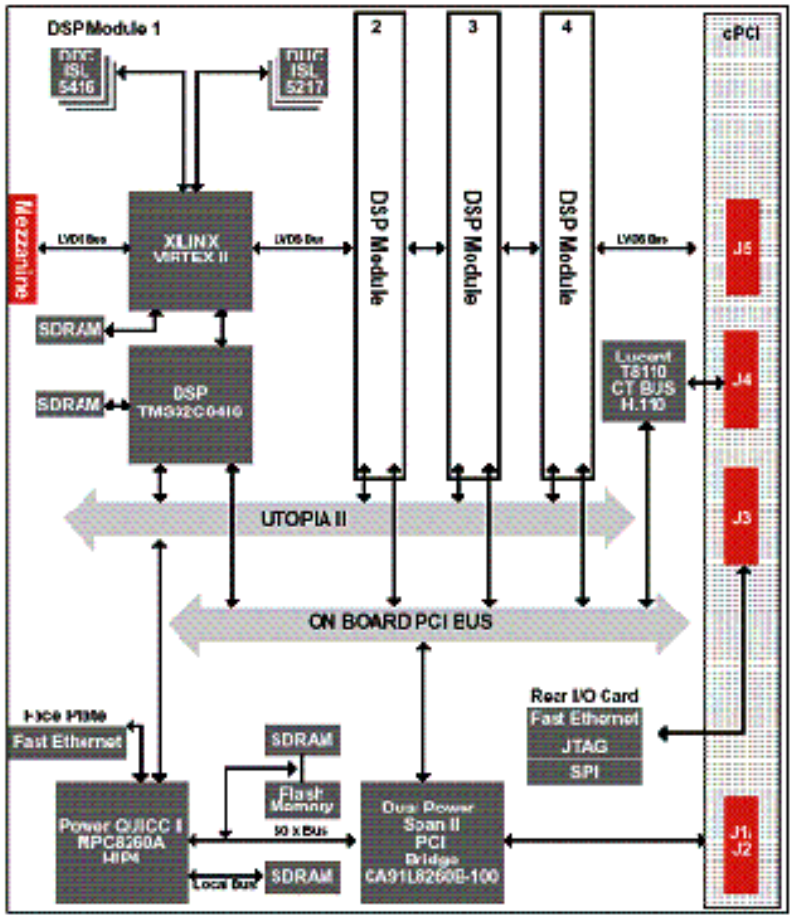


Figure 1: Signal Processing Hardware

# 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

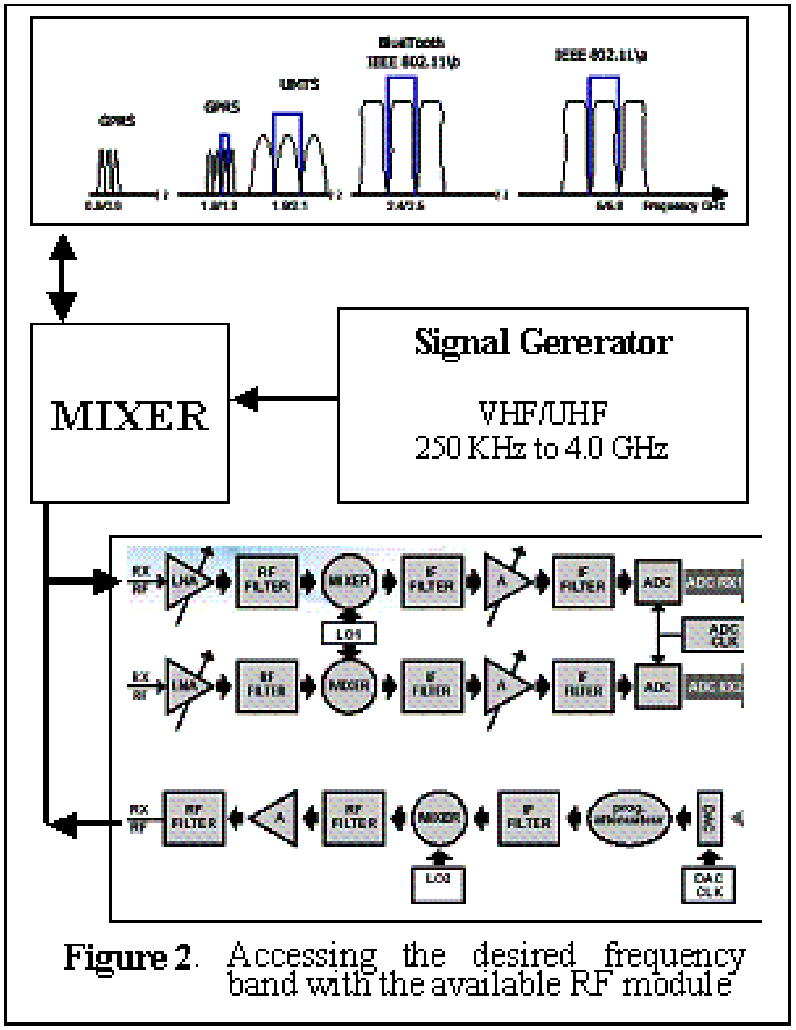


**Figure 2**. Accessing the desired frequency band with the available RF module

# 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

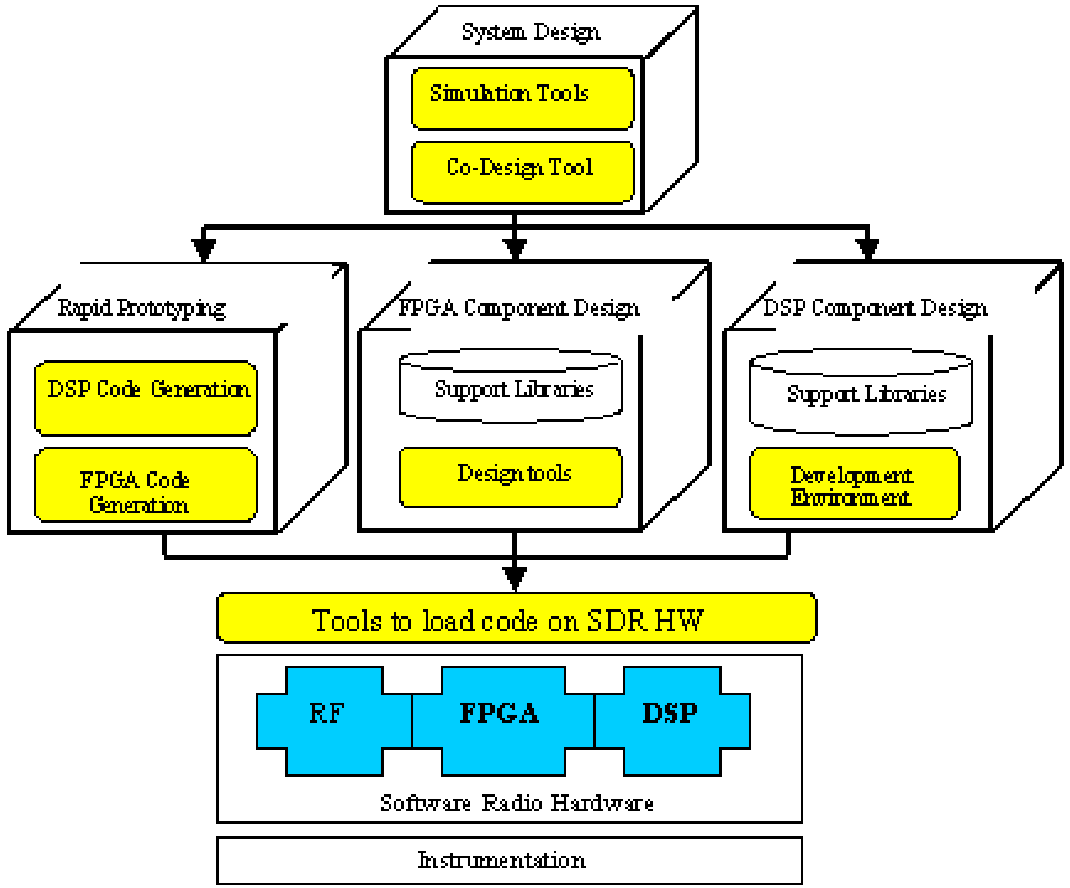


**Figure 3.** Radio development process and tools

# 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