WiSER: Dynamic Spectrum Access Platform and Infrastructure

Project Objectives:

This project is aimed at the development and community release of a Wideband Software Extensible Radio (WiSER) platform along with a reference implementation for small outdoor deployment of a multi-node dynamic spectrum network.

Technology Rationale:

Dynamic spectrum technologies are strategically important to the wireless community because of the urgent need to alleviate spectrum congestion resulting from ongoing exponential growth in mobile data usage. The proposed WiSER platform is a second generation wideband open-source SDR platform that will enable new experimental research in the fields of dynamic spectrum and cognitive radio networking. This platform enables a richer range of experimental dynamic spectrum research than is currently possible because of its key technical features: operation across 400MHz-4000MHz in 125MHz increments, hardware acceleration for real-world PHY waveforms at speeds of 100 Mbps and higher, hardware virtualization capable of supporting multiple radios on the same platform, and an open-source software toolkit.

Technical Approach:

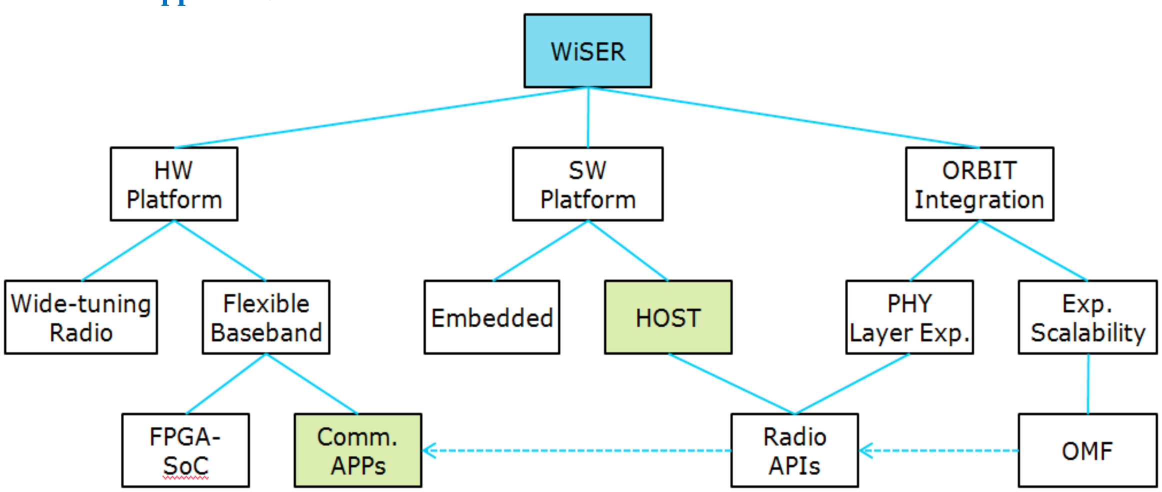

Figure 1: WISER Framework

The overall architecture of the WiSER system is shown in Fig. 1 above which identifies the main components and their building blocks. As shown in the figure, the two main modules to be developed are the hardware (HW) platform and the software (SW) platform both of which will be described further in this report. Integration with the ORBIT control framework provides for easy experimental access to the community with tools such as OMF (ORBIT Management Framework) that is used for experimental control and measurements. Key components corresponding to the block diagram in Fig. 1 are the FPGA code, embedded hardware and software (these are "hardware functions" implemented on the typically resource limited soft-core or hard-core CPU), host software, and coordination functions (necessary for deployment of a large number of potentially heterogeneous sensing devices). The resulting tasks to be carried out for development of the WiSER system are thus: (a) framework architecture expansion, (b) design and implementation, (c) system integration and testing. The project is focused mainly on system-

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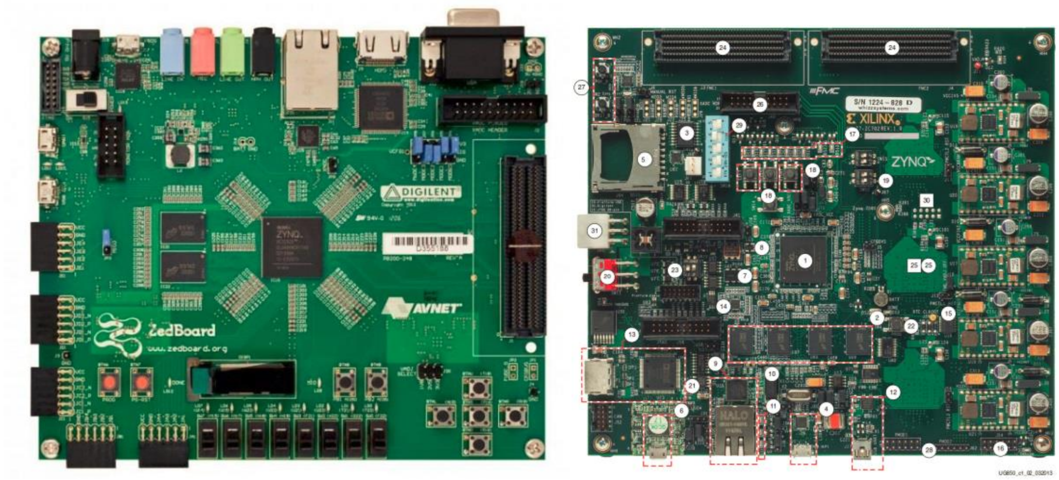

Figure 2: XILINX Zynq Platforms

level architecture development, with a basic implementation that was geared towards system validation and basic hardware testing, as detailed below:

Results to Date and Future Work Plan:

A fully-functional WiSER system running on the USRP N210 and Xilinx Zynq baseband platforms (see Fig 2 below) coupled with an Analog Devices RF front end has been developed and validated during 2013-14. The architecture of the WiSER system makes it possible to decouple application development from platform software, thus reducing programming complexity for experimental end-users. The developed hardware and software components were integrated and validated for an example wideband spectrum sensing application, demonstrating the feasibility and flexibility of the WiSER design. As an independent validation, WiSER-based SDR units were successfully used to support spectrum measurement requirements in the DARPA spectrum challenge conducted on the ORBIT testbed during 2013 and 2014.

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