Abstract

Modern radio communications systems employ a variety of advanced modulation techniques to maximize data throughput while minimizing spectrum use. Software-defined radio ("SDR") systems are becoming increasingly popular as a means to implement numerous, diverse communications standards with a single hardware platform. Hardware-software codesign, a topic which has appeared in the literature for over a decade, is more relevant today than at any time in the past, as "system-on-chip" technologies begin to incorporate reconfigurable logic, allowing for tightly-integrated hardware/software solutions to be developed with ease.

This project implements a critical part of a modern radio communications system: A front-end demodulator unit for receiving data modulated using GMSK ("Gaussian minimum-shift keying") under GSM ("Global System for Mobile Communications") will be developed as an IP core for inclusion in a software-defined radio based on the Xilinx Zynq-7000 system-on-chip. A Linux device driver is developed to allow run-time configuration of the demodulator IP core and stream demodulated data results into the Zynq's ARM-based processing system.

In addition, a Linux kernel module allowing simple zero-copy DMA direct from/to userspace ("ezdma") is also developed as part of the testing/verification process. This module has potential to accelerate the pace of future research and development of Zynq IP cores under Linux, and has been released as open-source under the GNU General Public License.