Software Radio Receiver

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Contents

- **Introduction**
  - Background
  - Objectives
- **Current progress**
- **Future plans**

1. Introduction

- **Background**
  - The rapid development in communications
    - More and more services are available:

    Telephone ⇒internet, mobile phone (2G/2.5G/3G, …)

    TV ⇒ Digital TV, interactive TV, internet, …

    Radio ⇒ digital radio, interactive, …

    GPS, bluetooth, …
    - The trend: everything goes to DIGITAL.
  - The question: what do you want to do?

    Keep buying?

➡ Key-board & display

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Software radio

The same piece of hardware can be used for different applications.

- Multi-mode, and multi-band transceiver;
- The hardware must be re-configurable;
- The software will define the particular application/ functions of the hardware.
- Incorporation of all advanced technology

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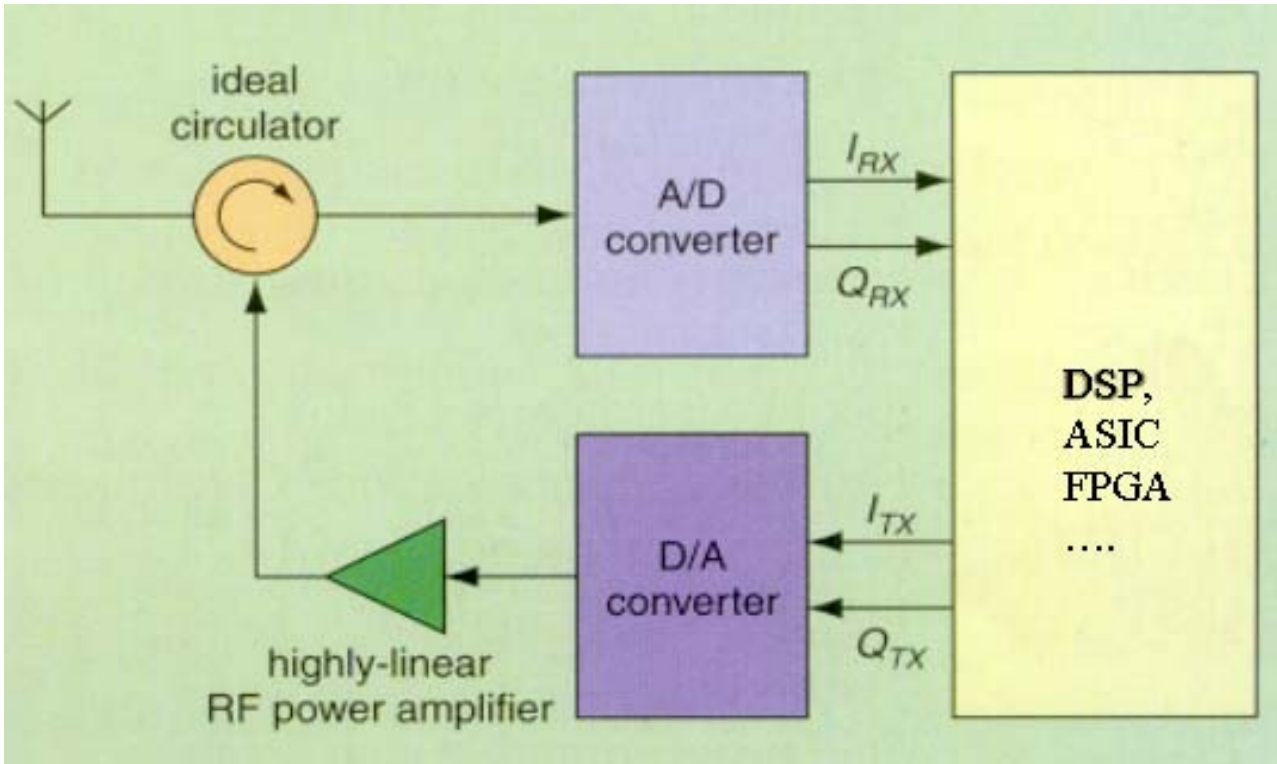
An ideal software radio



Challenges

- Wide-band small antennas
- High speed ADC and DAC
- Wide-band RF devices, RF-front end
- High speed ASIC, DSP, and FPGA
- Efficient algorithm and software
- Low cost

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Broadcasting spectrum

Service	Frequency Band	Channel bandwidth
AM Radio	540 – 1600 kHz	10 kHz
FM Radio	88 – 108 MHz	200 kHz
Digital Radio III	217.5 – 230 MHz	1.536 MHz
UHF TV	470 – 806 MHz	6 MHz
Digital Radio L	1452-1492 MHz	1.536 MHz
Satellite TV	10.95 – 12.75 GHz	about 36 MHz

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The project

- Design and build a prototype software radio that can successfully receive, demodulate/decode two types of signal
    - Standard analogue FM broadcasts.
    - UK Digital Audio Broadcasts (DAB).
- Demonstrate the ability to switch between the two operating modes in software, using the same hardware
- Provide a comparison between the performance of current advanced processing architectures and alternative, re-configurable processing architectures (FPGAs).
- ARM processor will be used as the core of the radio

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The team

- **Liverpool University**:
  - Yi Huang: leader
  - Jason Ralph (FPGA), Waleed Al-Nuaimy (DSP)
  - Yiyuan Xiong: research student
- **ARM**
  - Tom Cronk
  - Martin Evans: industrial supervisor

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2. Current Progress

- Formally Started March 2001 for a period of 3 years.
- The architecture of the system is carefully studied and compared. The design is done.
- Most components are ordered and received.
- Analogue part is constructed and specs are met.
- Three progress meetings: March, July, and Oct.
- Three tech reports are produced.
- Two papers are submitted.

3. Future Plans

- The next phase (12 months) is mainly digital and software development.
- ARM 9E will be used.
- The student would like to work at ARM in Cambridge for a period of time.

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