

Centre for Wireless Communications

CWC



Finnish Software Radio Programme

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Introduction

- Software defined radio research started 1997 at CWC.
 - Funded by Finnish Defence Forces Technical Research Centre.
- At the same time the development of a new communication waveform and a new national positioning system for the Finnish Navy was started.
- In order to achieve improved protection against EW adaptive antennas can be utilized.

- At 2002 waveform, navigation and adaptive antenna research/development projects were combined and a decision was taken that they are the first ones to be implemented in the Finnish SDR Demonstrator.
- The demonstrator development was awarded to Elektrobit, Ltd. March 2003 and estimated delivery of the demonstrator is February 2006.

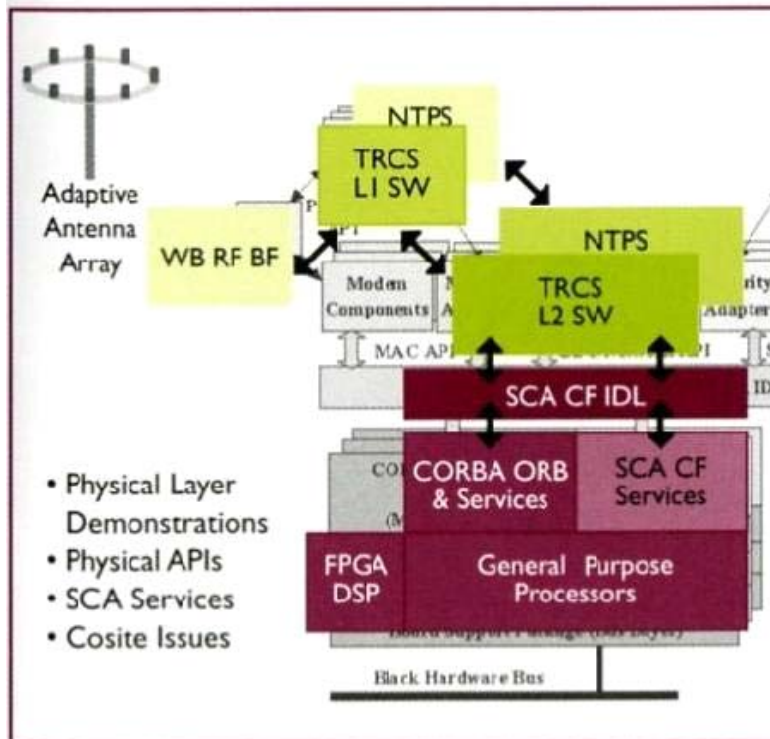
Finnish Software Radio Demonstrator

- The Finnish Software Defined Radio Demonstrator project is a national technology demonstration required before full-scale SDR system development and acquisitions can be started.
 - In order to ensure that both technical and cost risks are understood and are at acceptable levels prior to decision-making and acquisition.
- The demonstrator project focuses on the following four key technologies:
 - New national wideband waveforms
 - SCA based software architectures
 - COTS based hardware architectures
 - Smart antenna in SDR.

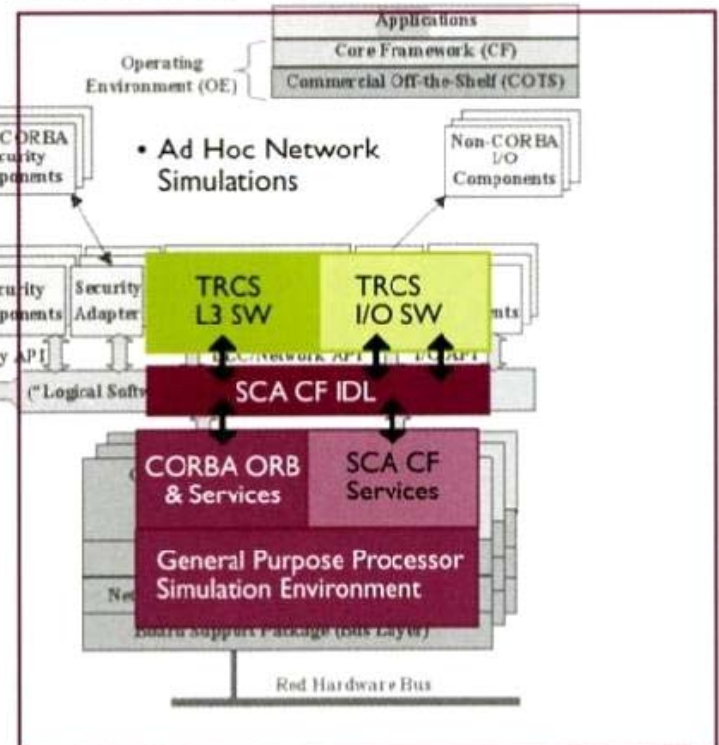
- Two wideband waveforms, Adaptive Wideband Networking Waveform (AWNW) and National Tactical Positioning Waveform (NTPW) as well as SDR architecture, are implemented in the demonstrator project.
 - Developed in the research programs carried out by the University of Oulu.
- The implementation and demonstration of the AWWN waveform is divided into two separate testing platforms.
 - The physical and link layers are implemented, verified and validated on the SDR platform.
 - The network layer protocols are implemented and simulated in a simulating environment developed in the project.

Architecture of the demonstrator

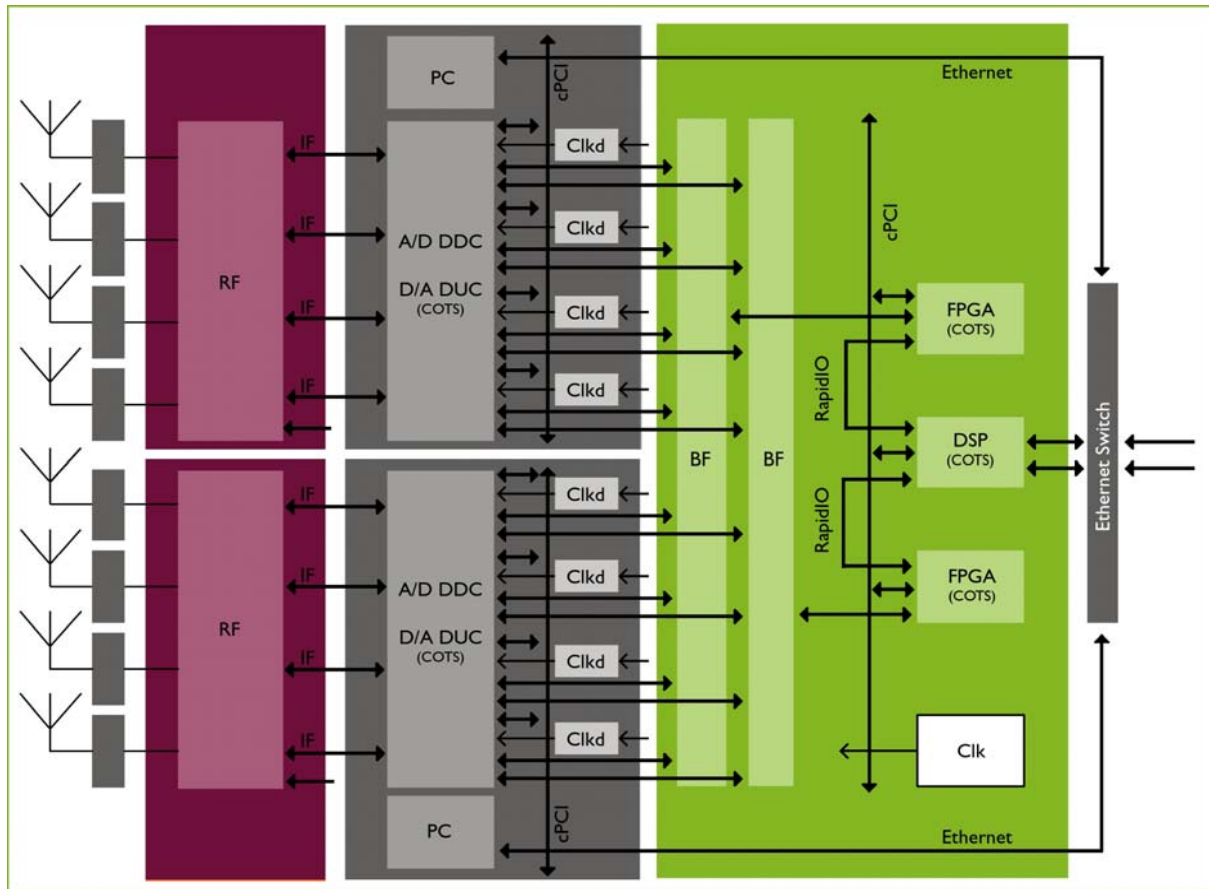
1. LPI/LPD/AJ Modulation Demonstrator



2. Network Simulator



- SCA version 2.2 is used as a baseline for the software architecture of the SDR demonstrator.
- The demonstrator is maximally based on Commercial Off-The-Shelf (COTS) components and subsystems in order to minimize development risks and shorten the development cycle.
 - The SDR-3000 subsystem of Spectrum Signal Processing, Inc, is evaluated as a baseband processing engine in the demonstrator.
 - A/D interface is based on the wideband ADC boards of Nallatech Ltd.



SDR Demonstrator structure

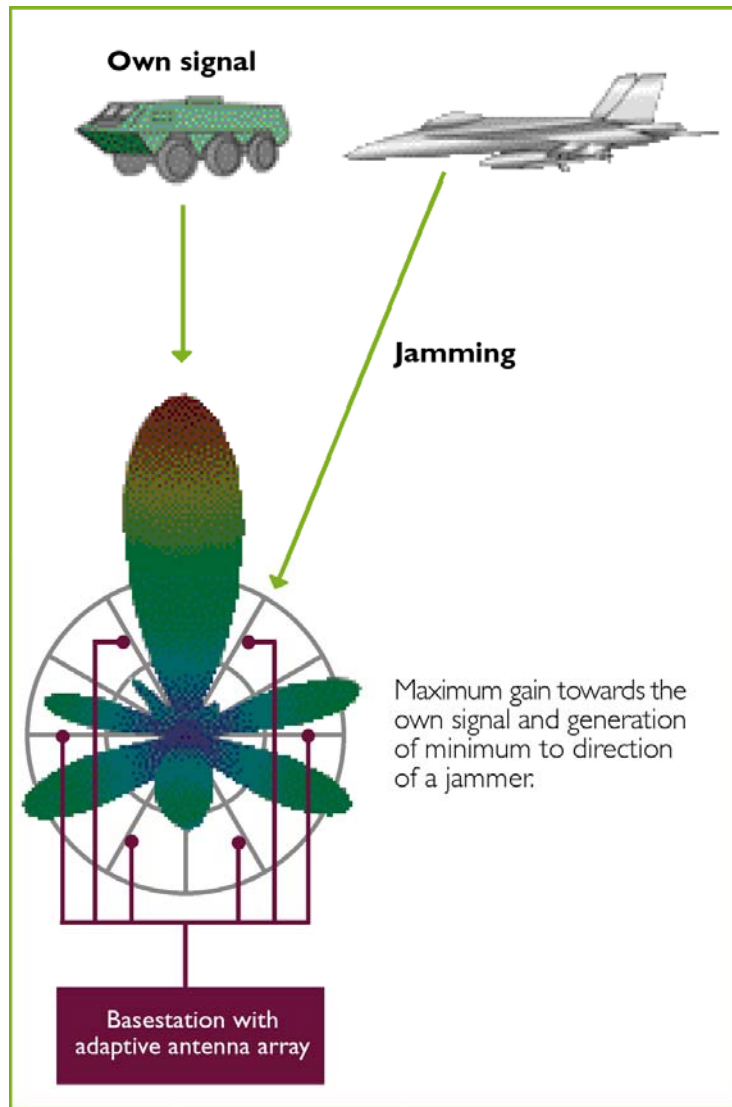
New Tactical Radio Systems

- Tactical Radio Communication System:
 - allows data rates from few bits to megabits per second
 - supports interoperability
 - exploits advanced network operations
 - has different modes of operation and priorities for different communication needs
 - can transport voice, data, still pictures, video and sensor data
 - uses adaptive antennas to enhance LPI/LPD and EP capabilities
 - enables several simultaneous logical connections for dedicated datalink applications, e.g. UAV communications.

- National Tactical Positioning System:
 - decentralized network synchronization
 - new BS can be added to the system easily because it merely synchronizes itself to the network and is ready for use
 - the signal used is a DS/FH signal.
 - navigation and communication systems are separated by hopping codes (FH-CDMA)
 - the communication and navigation systems can share BSs but it is also envisaged that in some situations a simpler navigation BS is required.

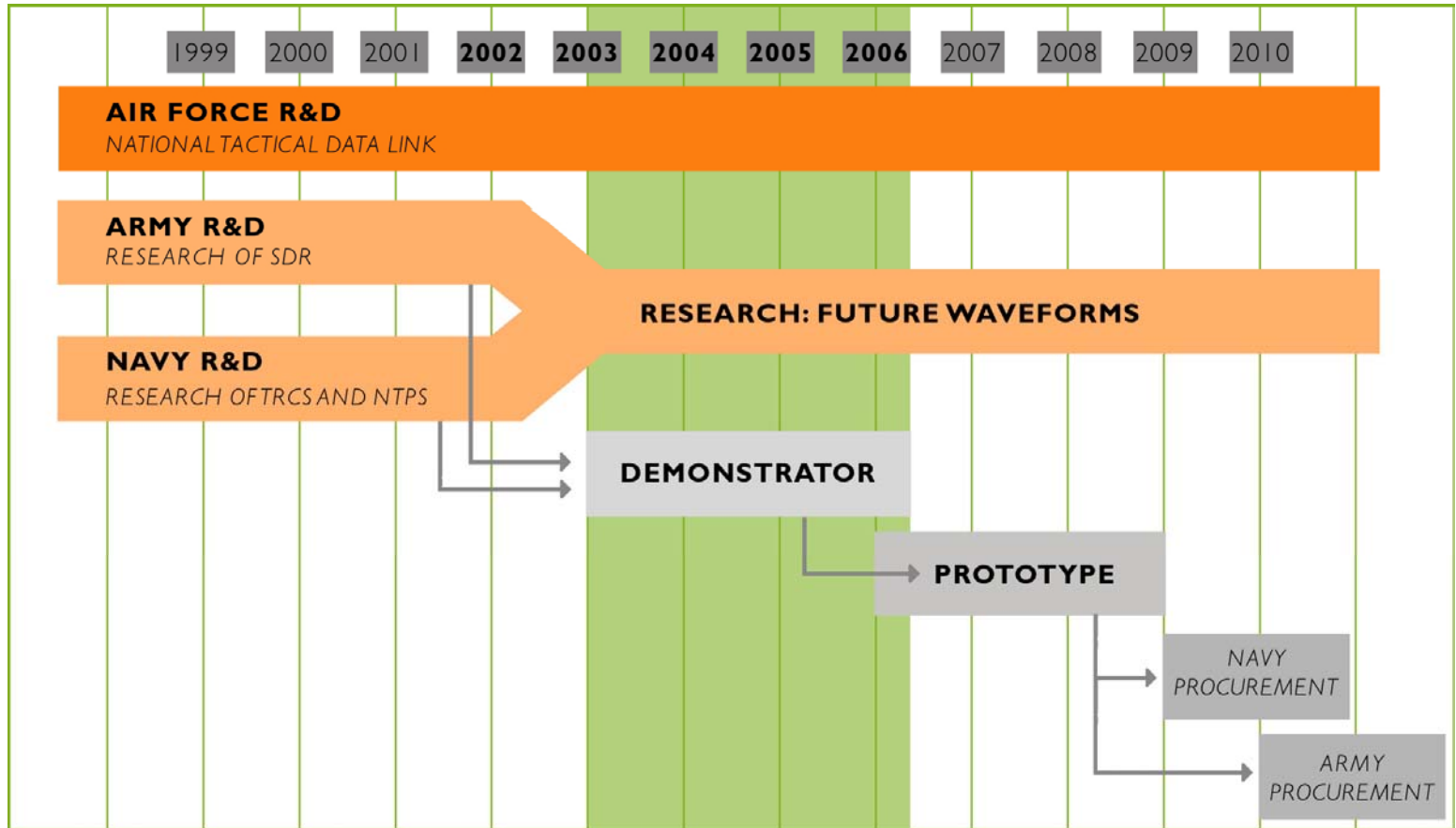
Adaptive antenna system

- Goals:
 - specification of adaptive antenna arrays and algorithms for tactical radio systems of the Finnish Defense Forces
 - to adjust transmitter and receiver antenna patterns in a dynamic way according to the (hostile) signal environment.
- Algorithm research and development by the University of Oulu/CWC
- Equipment and software development by Elektrobit, Ltd and PJMicrowave, Ltd.



Adaptive antenna system

Program Schedule



Conclusion

- A software defined radio platform with an adaptive antenna system is being built.
 - The demonstrator platform will be available in 2006. It can be used in the development of new both military and commercial waveforms (e.g. 4G waveforms).
- Two new adaptive waveforms are under development and will be implemented on the SCA-compatible platform.