LUND UNIVERSITY

Welcome to the

Lund Circuit Design Workshop 2011

SoS
System Design on Silicon

Welcome and Introduction

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Lund University, Sweden

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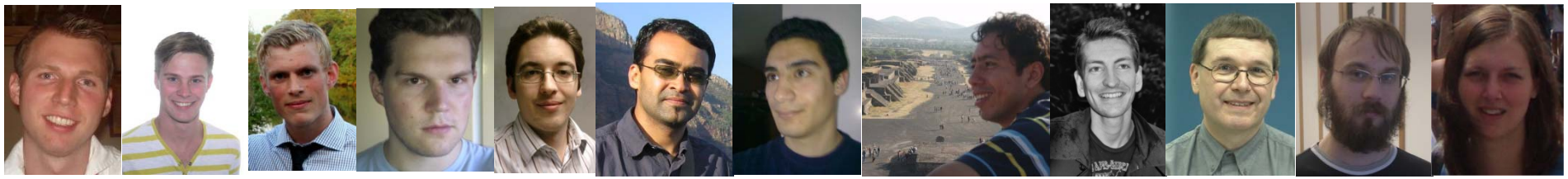
Welcome to two exiting days

- A Lund University perspective by senior researchers and PhD students



Welcome to two exiting days

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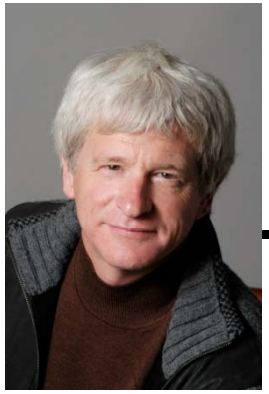


Invited speakers from academia:

- Bram Nauta, University of Twente
- Jan Rabaey, UC Berkeley

Welcome to two exiting days

- A Lund University perspective by senior researchers and PhD students
- Invited speakers from academia:
  - Bram Nauta, University of Twente
  - Jan Rabaey, UC Berkeley

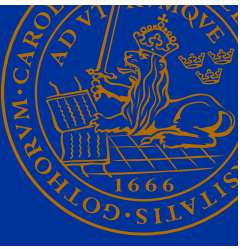
- An industrial perspective:
  - Matthias Passlack, TSMC

  - Baudouin Martineau, STMicroelektronics
  - Thomas Olsson, Ericsson Research

Welcome to two exiting days

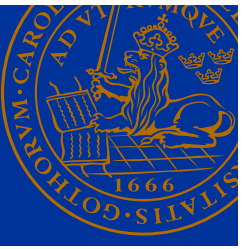
- A Lund University perspective by senior researchers and PhD students
- Invited speakers from academia:
  - Bram Nauta, University of Twente
  - Jan Rabaey, UC Berkeley
- An industrial perspective:
  - Dag T. Wisland, Novelda AS
  - Lars Risbo, TI Denmark
  - Sami Vilhonen, ST Ericsson Finland
- Social activities including: The Dinner

Some Logistics!



- Today's program is at Grand Hotel including Lunch.
- Dinner in the Main Building of Lund University.
- Tomorrows programs is at the Faculty of Engineering, Lund University.

Some Logistics!



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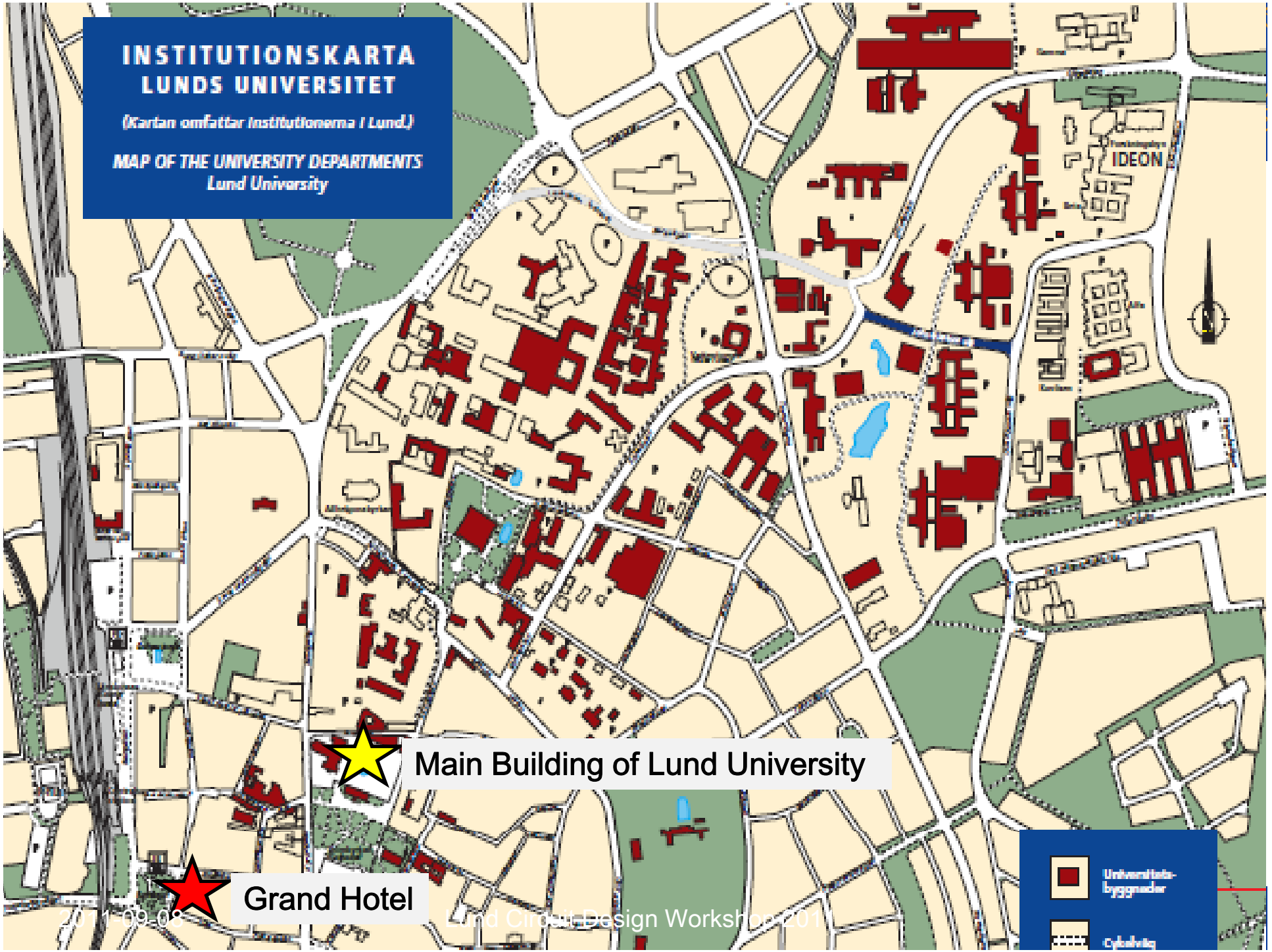
Dinner : Main Building of Lund University


INSTITUTIONSKARTA
LUNDS UNIVERSITET
(Kartan omfattar institutionerna i Lund.)
MAP OF THE UNIVERSITY DEPARTMENTS
Lund University
IDEON
Main Building of Lund University
Grand Hotel

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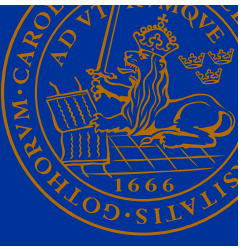

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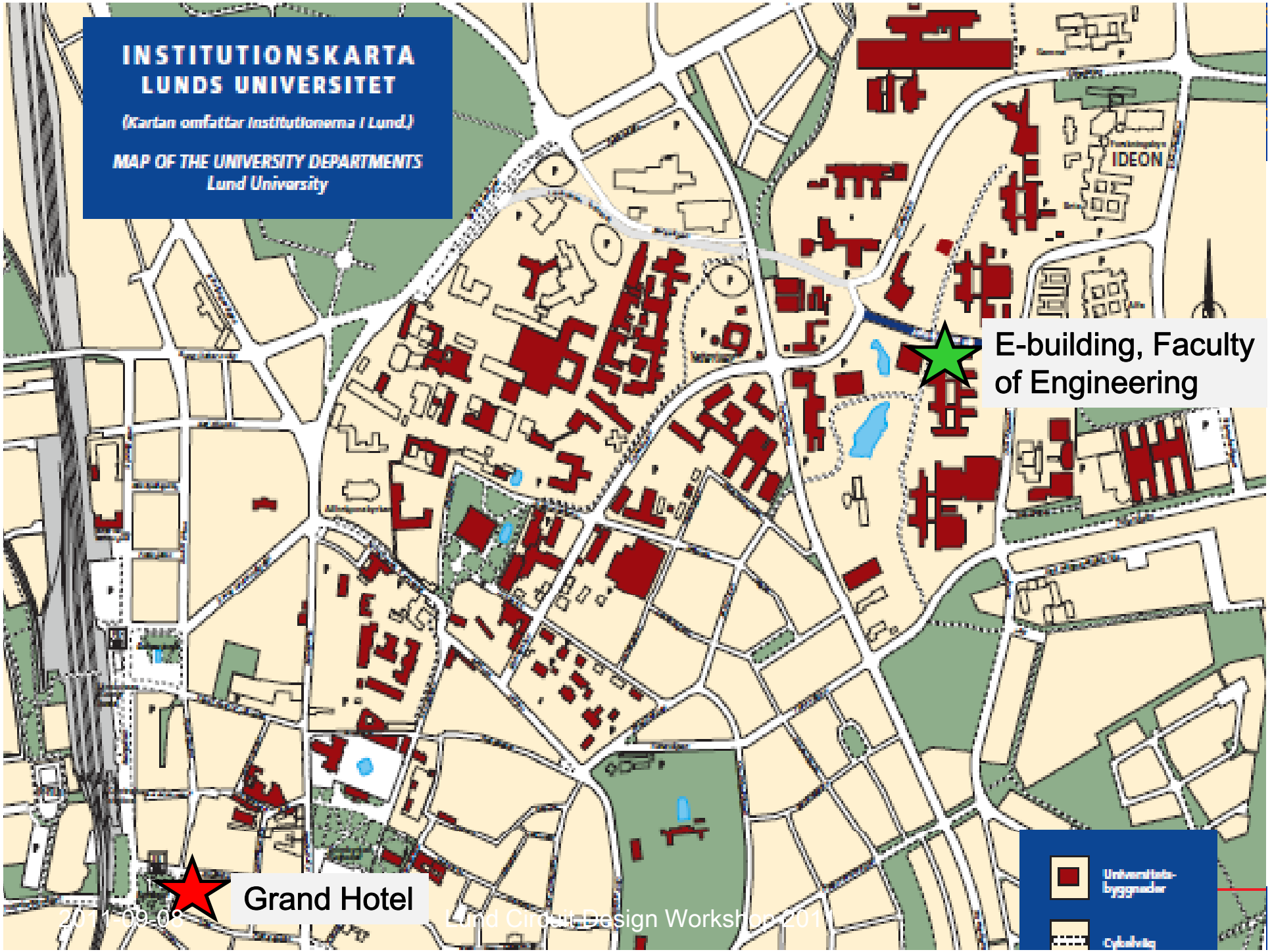
  Approximately 20-25min walk from Grand Hotel.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E-building: faculty of Engineering

The Hosts

ST ERICSSON

VINNOVA

Sony Ericsson

ERICSSON

Industrial Excellence Center in

infineon

cadence

SoS

System Design on Silicon

From VINNOVA´s evaluation 2011: "SoS builds on strong long-term relations with top industry partners in the international arena in the Center's strategic area which is highly relevant to the Swedish economy. The SoS team represents an impressive range of research talent and experience, including many staff with international records of achievement and clearly shows that they can compete on an international level. "

People in SoS

Director: Viktor Öwall, Co-director: Piertro Andreani
Chairman of the Board: Sven Mattisson, Ericsson AB

International Advisory Board

- Professor Jan Rabaey, BWRC, UC Berkeley, USA
- Professor Mike Faulkner, Victoria University, Australia
- Professor Qiuting Huang, ETH, Zürich, Switzerland

The Hosts

SoS
System Design on Silicon

WWW

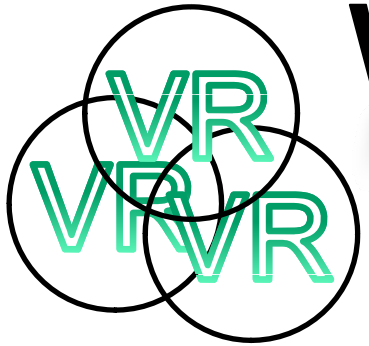
Wireless with Wires

UPD

Wireless Communication for Ultra Portable Devices

Research Grants

New projects:
- DARE
- Distrant
- HiPEC



New this year at the workshop

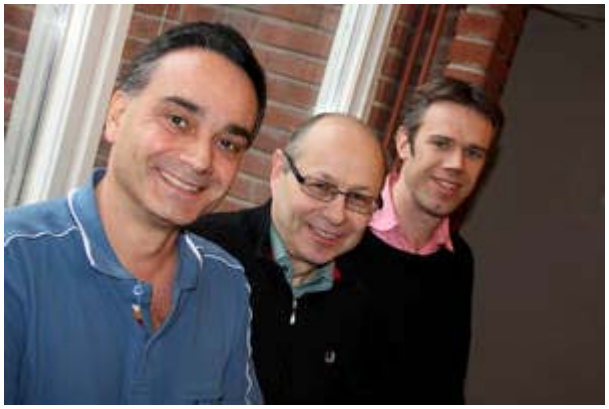
Instead of presenting different research grants we have put together a slide show on

…and one with introductions to tomorrows poster sessions.

Grand Slam at SSF!

We have been very succesful this year and attracted three large SSF Grants:

- DARE – Digitally Assisted Radio Evolution
  PI Pietro Andreani



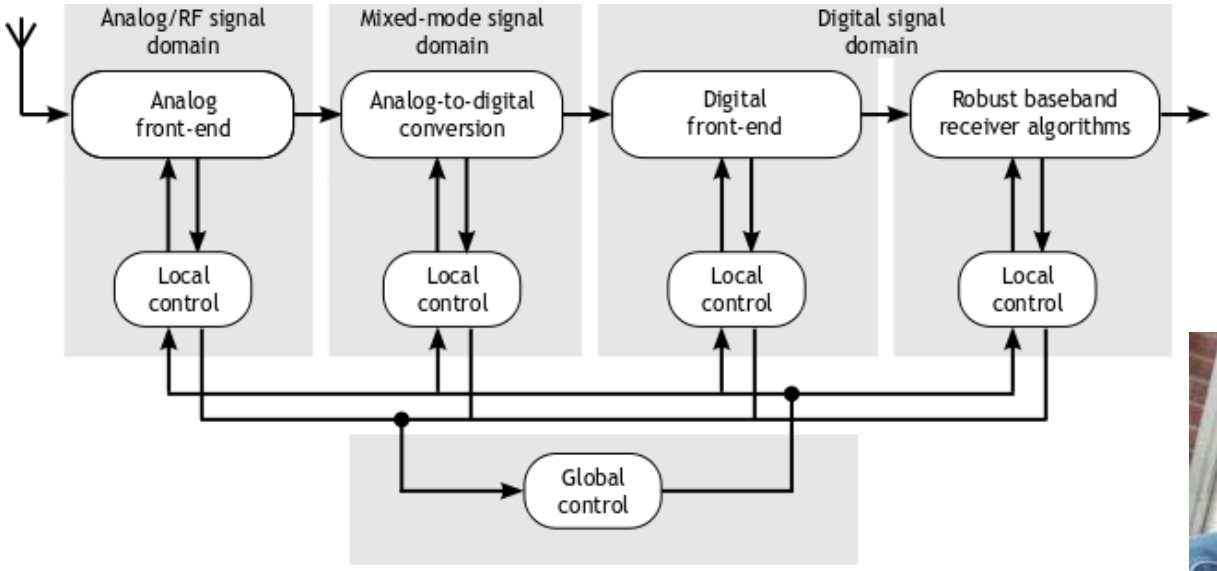
- Distrant - Distributed Antenna Systems
  PI Fredrik Tufvesson

- HiPEC - High Performance Embedded Computing
  PI Kris Kuchcinski

” – Vi bedömer strategiskt relevans och vetenskaplig kvalitet på ansökningarna och där låg Lund bäst till i denna utlysning. ”, Joakim Amorin, SSF

DARE – Digitally Assisted Radio Evolution

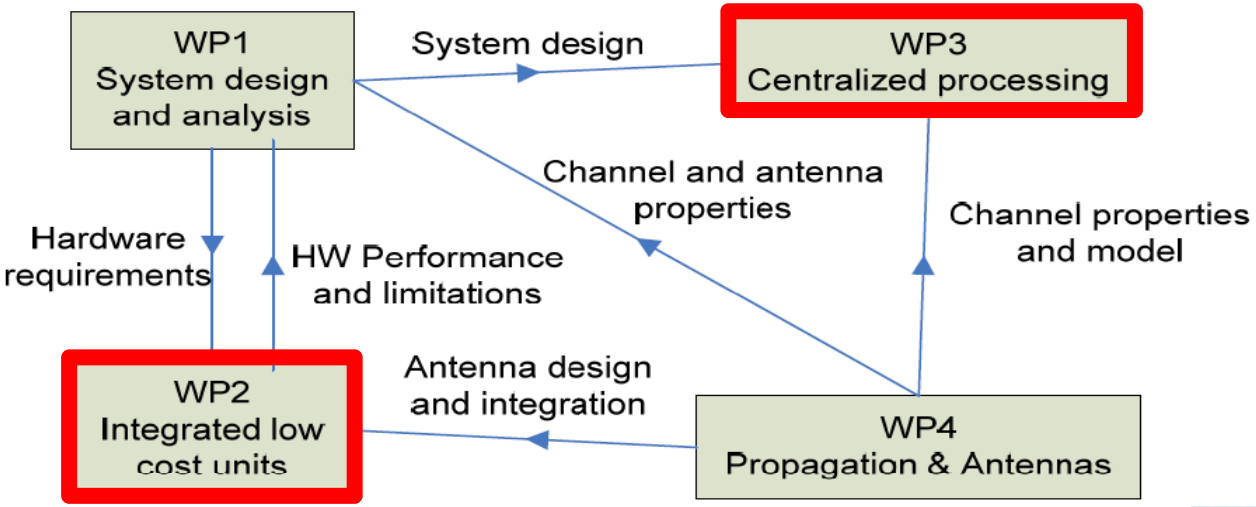
SSF grant, 29 MSEK over 5 years, starts Sept. 2011 with 6 PhD students



- *Target: LTE – rel. 10*
- Key radio blocks in nm CMOS
- Digital control and adaptation of analog, mixed-signal, and digital blocks
- Improved trade-off between performance and power consumption

Distrant - Distributed Antenna Systems

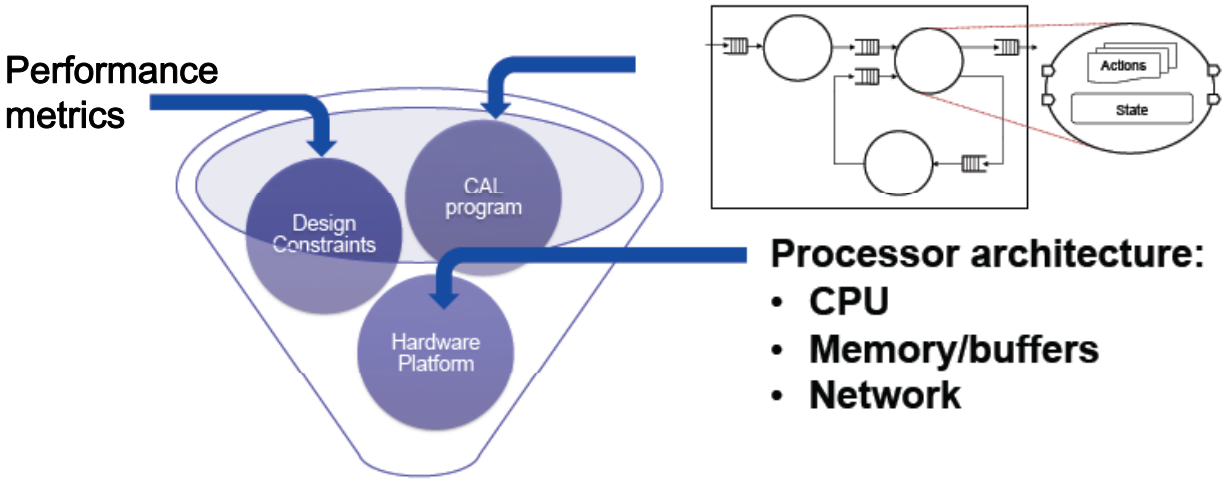
SSF grant, 27.2 MSEK over 5 years, starts Sept. 2011 with 5 PhD students



- *Large antenna arrays (~100) to be grouped together to form large arrays or distributed in the environment as a sparse array .*
- To achieve: increased capacity, improved coverage, reduced energy dissipation

HiPEC - High Performance Embedded Computing

SSF grant, 25.9 MSEK over 5 years, starts Sept. 2011 with 5 PhD students



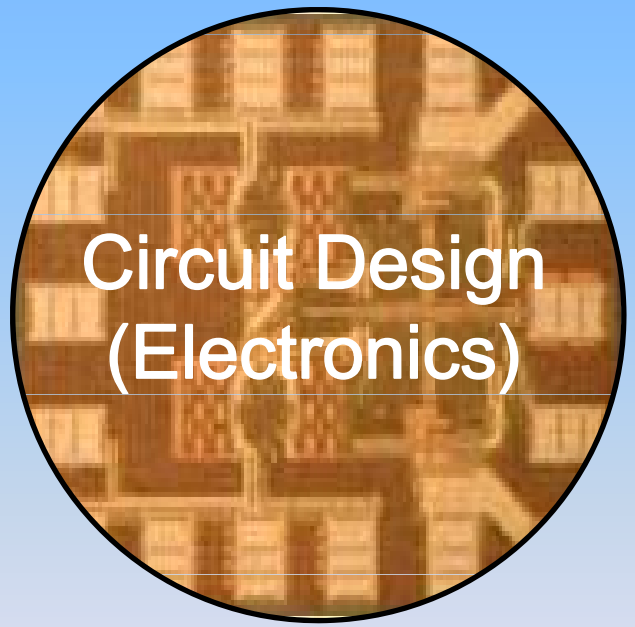
Processor architecture:

- **CPU**
- **Memory/buffers**
- **Network**

Utilizing the Reconfigurable Array developed within SoS

- *Develop reconfigurable embedded execution platform.*
- *Automatic translation, mapping and scheduling based on the CAL dataflow language*

Research Environment –
from both academic and industrial networks



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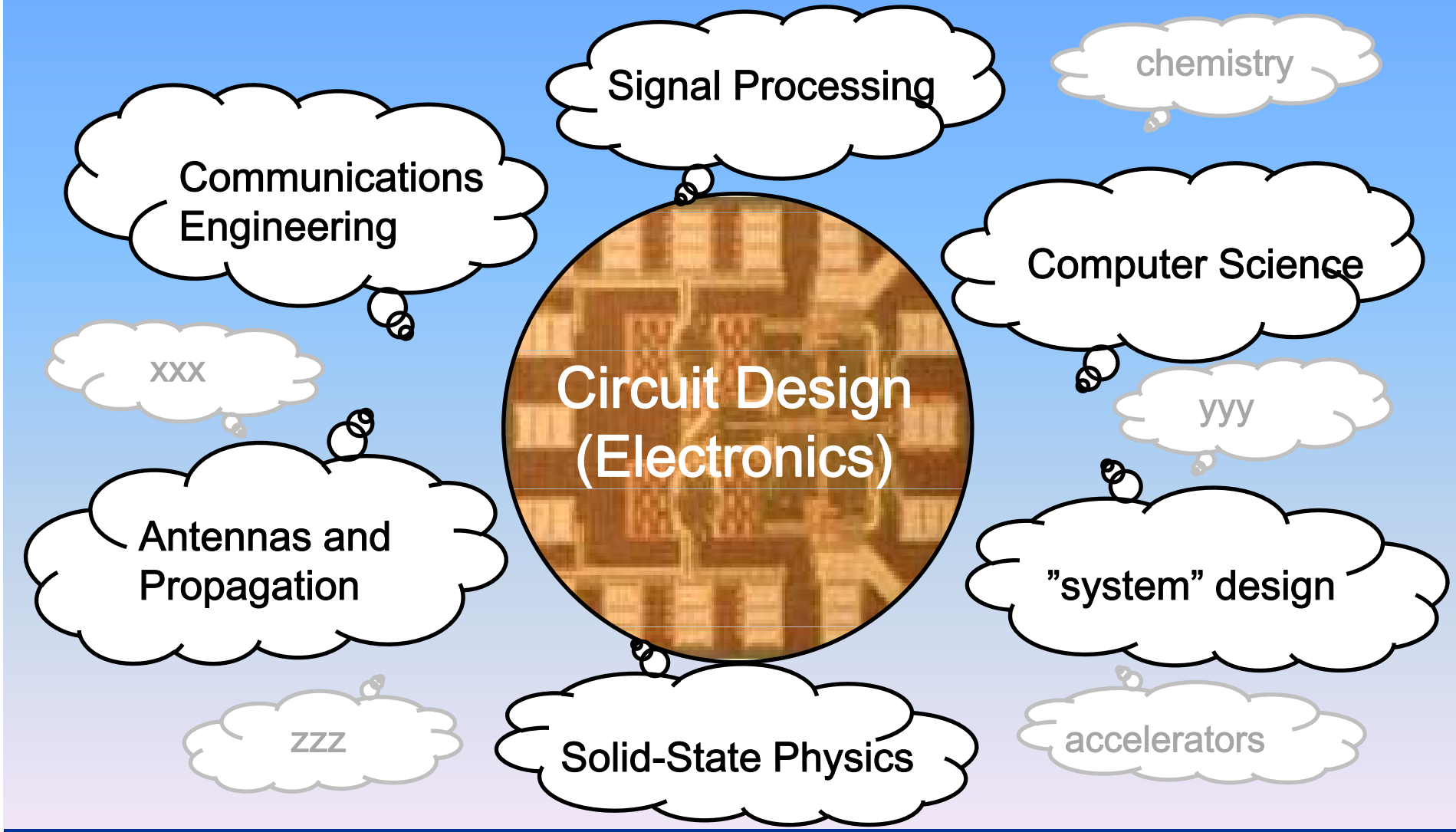

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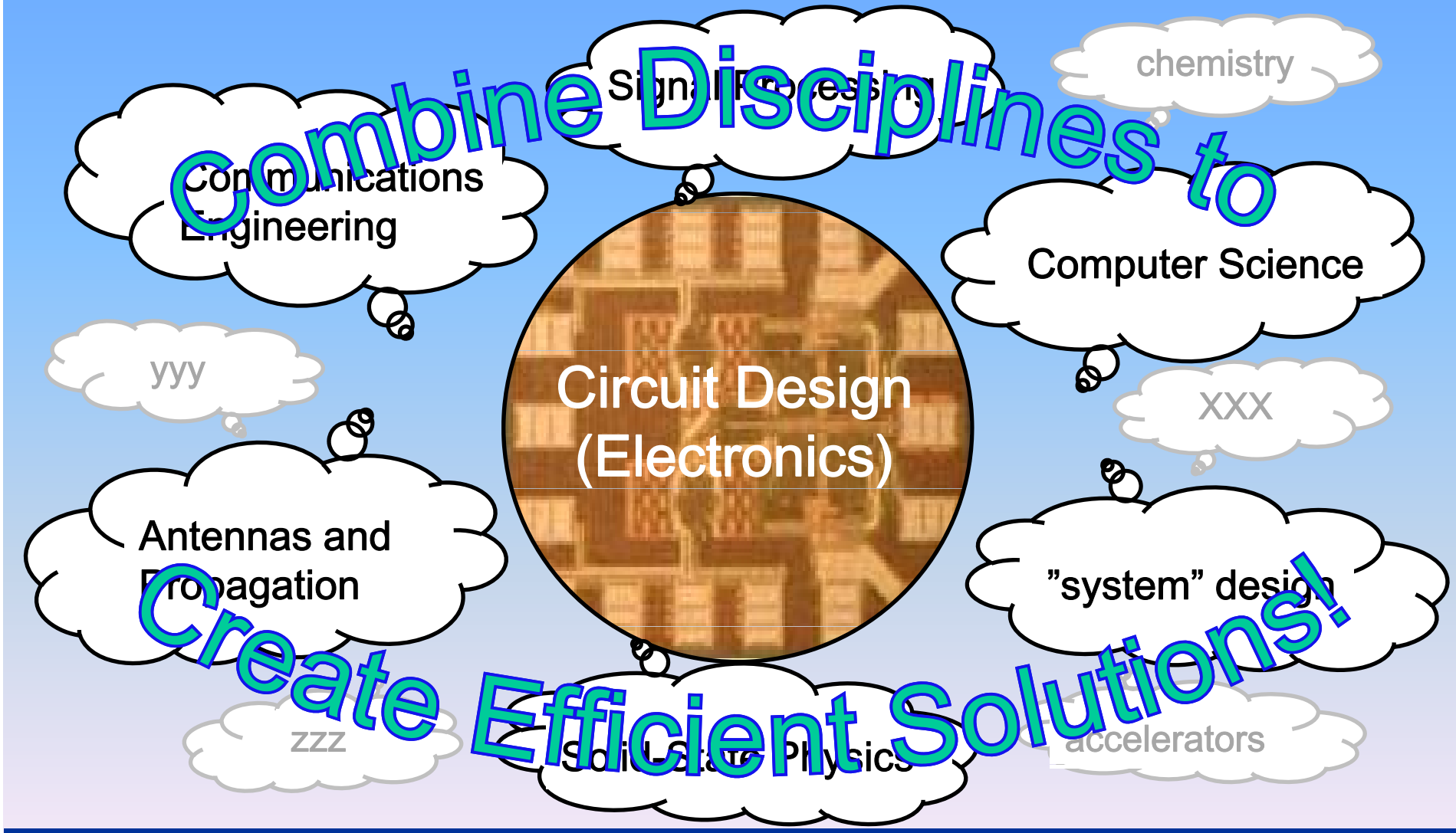
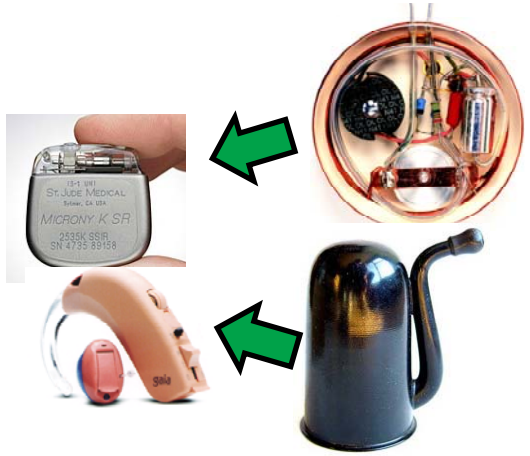


Application areas

Main Focus:

Wireless/cellular systems

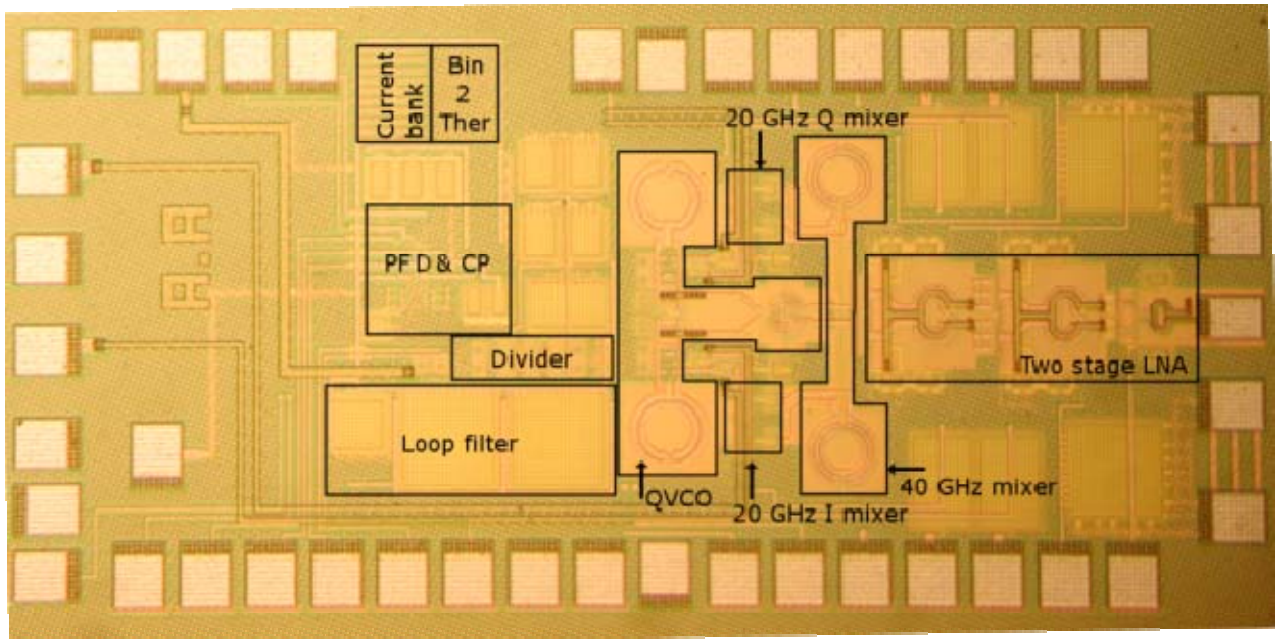


Medical applications, including wireless

…and some research highlights!

mmWave Beamforming circuits

Andreas Axholt defended his PhD thesis September 7!

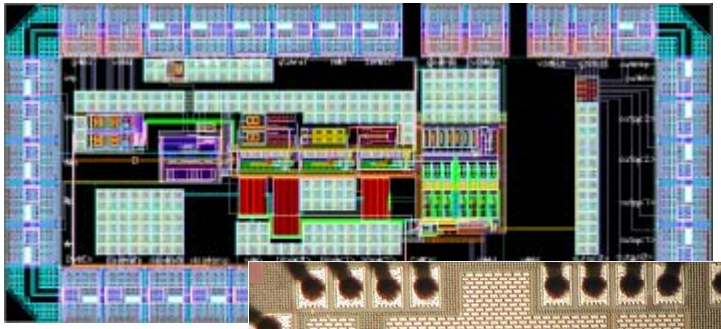


Measured and working

60 GHz, 20 GHz PLL, Transformers, Balun, Mixers, LNAs, QVCO, Binary-to-Thermometer decoder

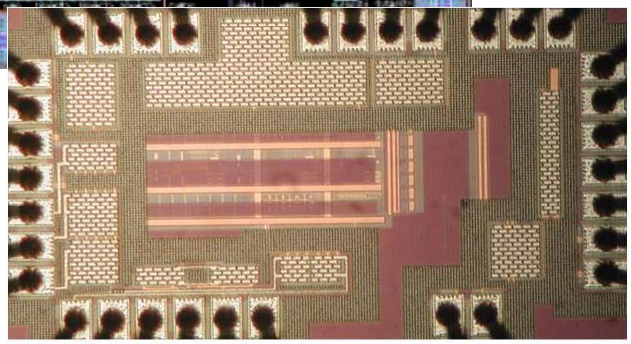
Continuous-Time Δ Σ-ADC

- LTE

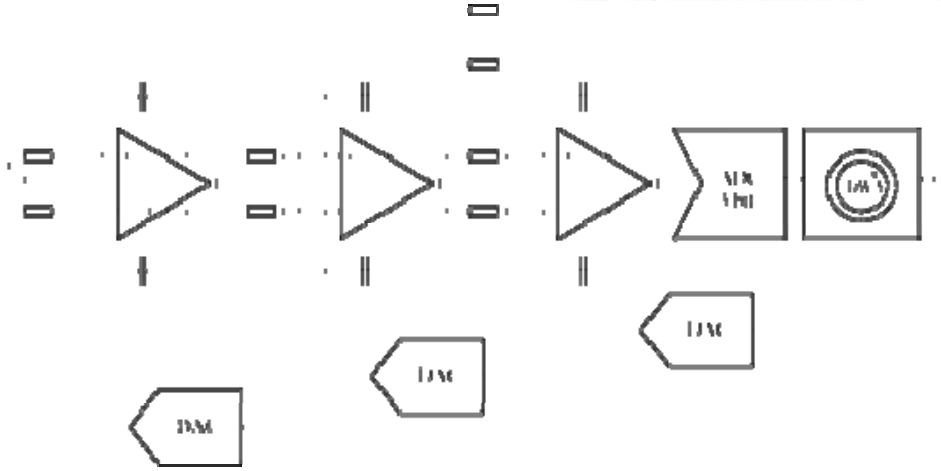


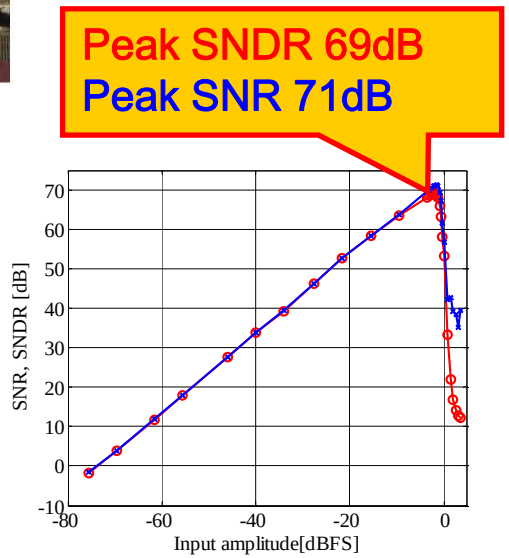
by Mattias Andersson

- Low Power Radios



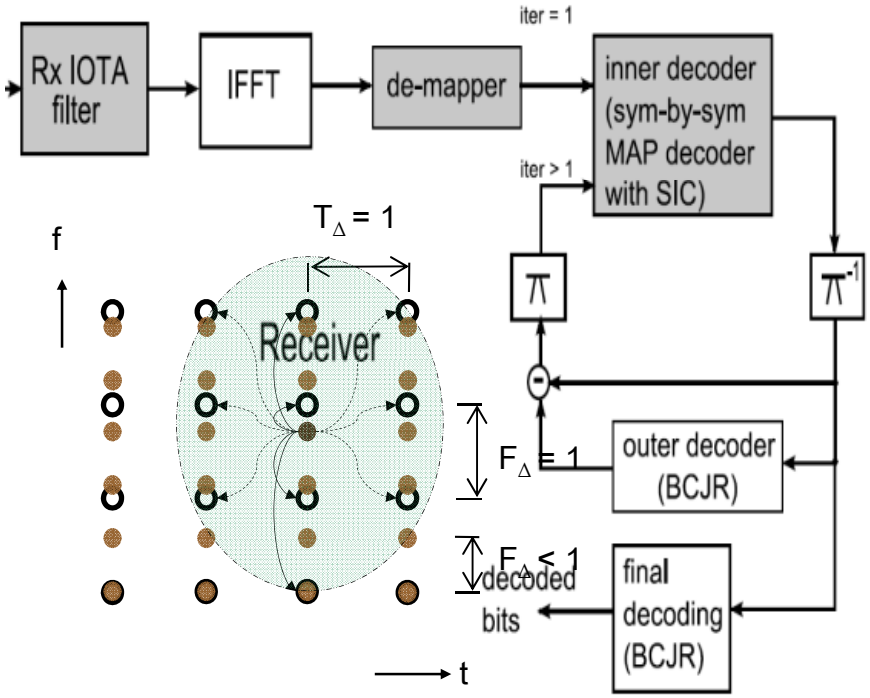
by Dejan Radjen



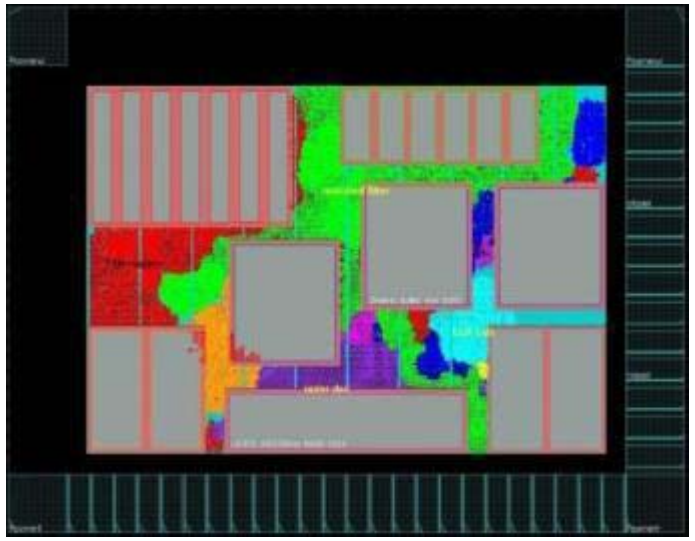


Faster-than-Nyquist (FTN) receiver

FTN iterative receiver



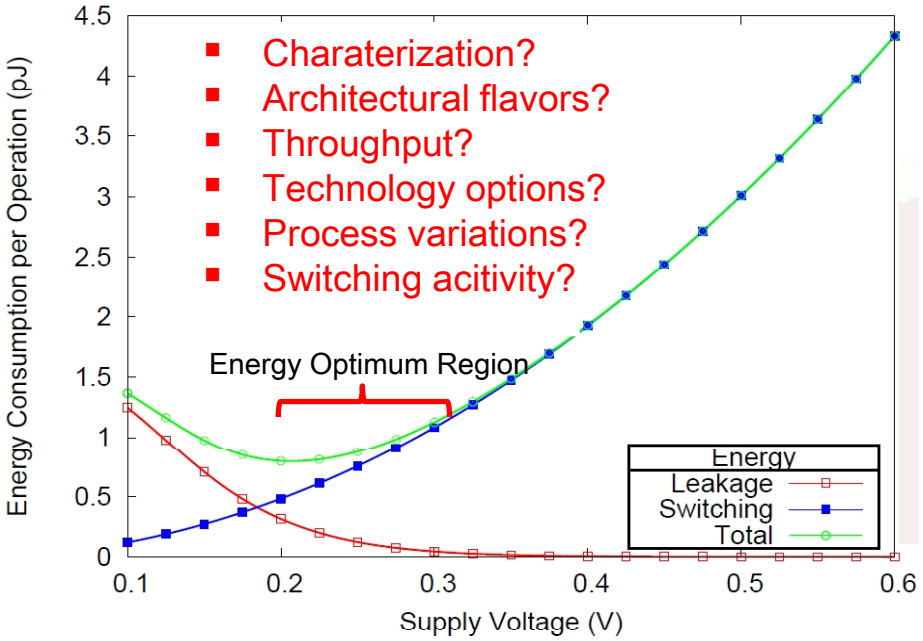
Motivation:
- increased bandwidth efficiency
- is FTN hardware feasible?



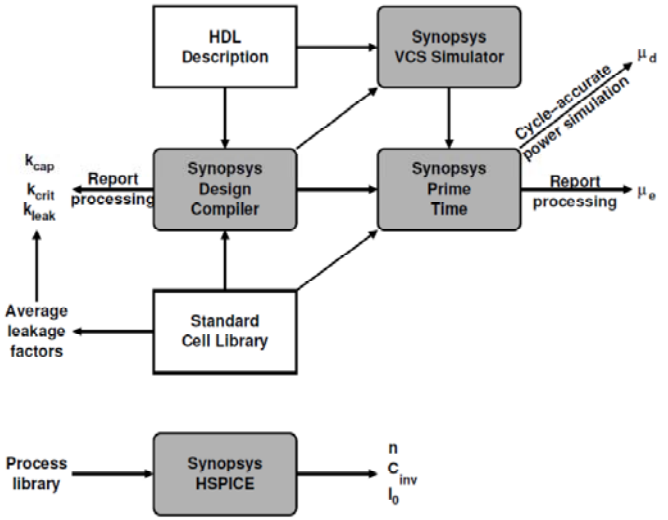
Fabricated in ST65nm CMOS
Measured.
Demo tomorrow.

Deepak Dasalukunte to defend PhD thesis December/January.

Digital Circuits in Weak Inversion



High-level Modeling in the Sub-V_T Domain



Applied to a decimation chain filter in the UPD-project

Decimate data from 8-Msamples/s to 0.25-Msamples/s.

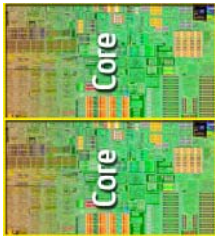
Different throughputs

⇩

Different Architectures

Parallelized by 4

Parallelized by 2



Original

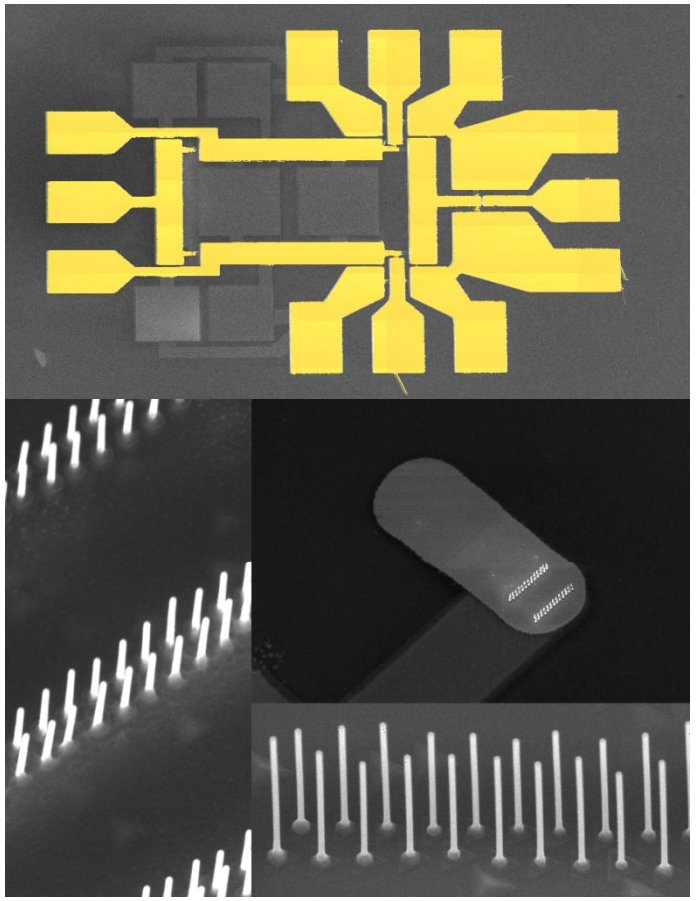
InAs Nanowire Mixer Circuit Integration

Goal

- Integration of InAs NW single balanced differential mixer circuit
- Demonstrating performance advantageous compared to similar Si technology

Results

- Single and Array Vertical NW Transistor Performance
  - g_m - 1 S/mm
  - f_t - 20 GHz
  - f_{max} - 30 GHz



Thank You and Enjoy!