Università degli Studi di Sassari IDEA Lab

FRANCESCA PALUMBO AND LUCA PULINA

uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI

3rd Italian Workshop on Embedded Systems (IWES 2018)
September 13-14, 2018 – Siena, Italy

Università degli Studi di Sassari

Established in 1562, UniSS is more than 450 years old.

13,000 students and around 700 scholars. 50+ institutional courses, including 2 international degrees and a wide range of post-graduate activities (PhD courses, advanced training programmes and international exchange projects).

Third medium-sized university by the Italian Censis University Ranking 2015-2016 for services, infrastructure and internationalization.

In 2017 UniSS has obtained the highest co-financing among all the Italian universities for the Erasmus Traineeship program.

Intelligent system DEsign and Application (IDEA) Lab - Fundations

Modern digital devices (*real-time* and *ad-hoc*) are pervasive (*98%* of computers are *embedded*) and may present *sensing and actuating* capabilities.

system-of-systems
system
device
Decision — Interactions
Info — cyber — Action — human
physical
Physical State

NIST CPS PWG Framework Release 1.0

	Safety	Security	Certif.	Distrib.	HMI	Seamless	MPSoC	Energy
Automotive	x	x	x	x	x	x	x	
Aerospace	x	x	x	x	x		x	x
Healthcare	x	x	x	x	x	x	x	x
Consumer					x	x	x	
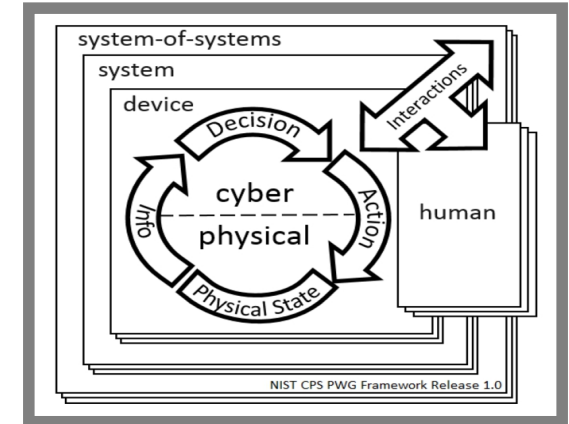
IDEA MISSION

Optimally implement *complex/demanding* systems, managing *numerous/conflicting* requirements

IDEA Lab – Expertise

➢ CAD for

  ➢ Reconfigurable system design;

  ➢ Requirements analysis and verification.

➢ Digital Systems Design

  ➢ Low Power System (Multi-Frequency, Clock/Power-Gating);

  ➢ Coarse Grained Reconfigurable Accelerators;

  ➢ Approximate Computing.

➢ AI & Formal Methods

  ➢ Formal Verification;

  ➢ Automated Reasoning;
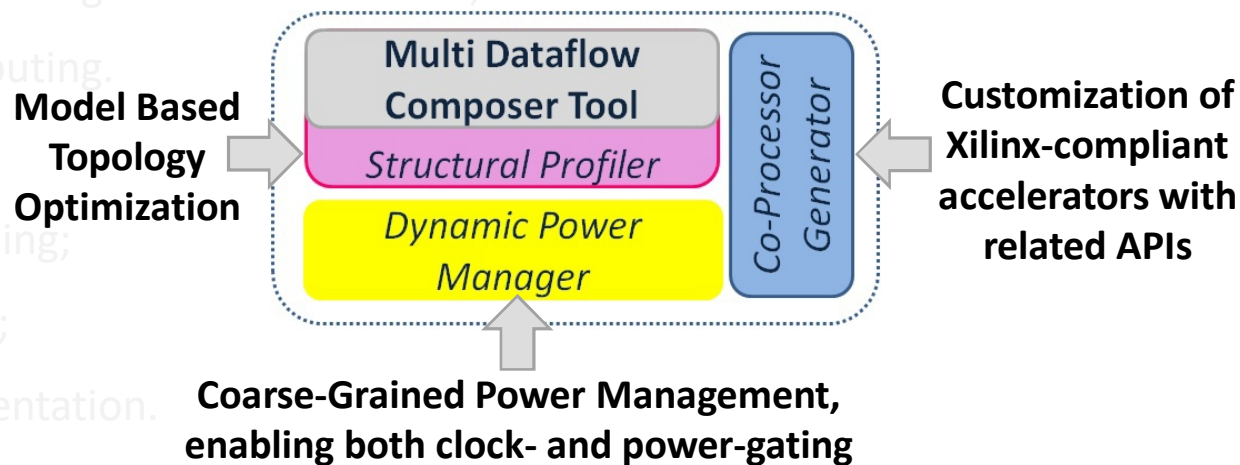
  ➢ Knowledge Representation.

IDEA Lab – Expertise

➢ CAD for

   ➢ Reconfigurable system design;

Multi-Dataflow Composer (MDC) tool
automatically derive energy efficient coarse-grained reconfigurable accelerators starting
from high level dataflow-based functional specifications.
http://sites.unica.it/rpct/

➢ Coarse Grained Reconfigurable Accelerators;

➢ Approximate Computing.

➢ System Verification

   ➢ Automated Reasoning;

   ➢ Formal Verification;

   ➢ Knowledge Representation.

Model Based Topology Optimization

Multi Dataflow Composer Tool
Structural Profiler
Dynamic Power Manager
Co-Processor Generator

Customization of Xilinx-compliant accelerators with related APIs

Coarse-Grained Power Management, enabling both clock- and power-gating

IDEA Lab – Expertise

Coarse-Grained Reconfigurable Approaches + Functional Approximate Computing
Approximate computing, in conjunction with hardware reconfiguration, guarantees a tunable interpolation system offering an energy versus quality trade-off to further reduce energy.

Sau, C. et al. (2017) " Challenging the Best HEVC Fractional Pixel FPGA Interpolators With Reconfigurable and Multi-frequency Approximate Computing", IEEE ESL
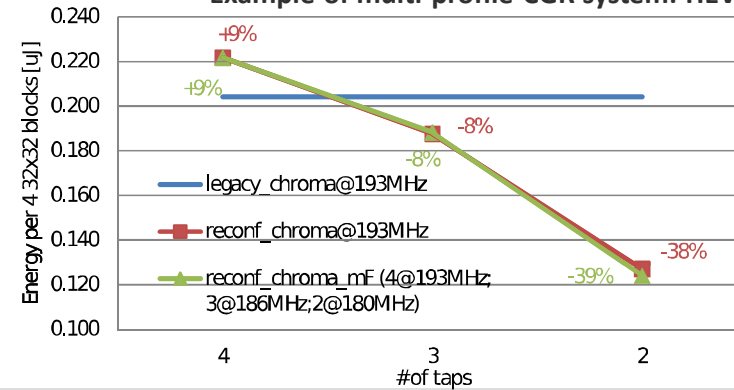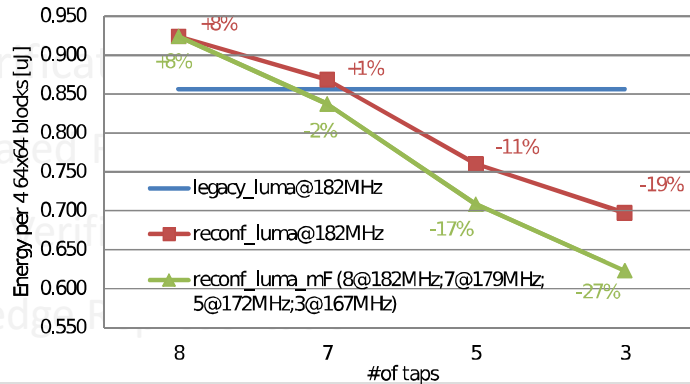
➢ Digital Systems Design

   ➢ Low Power System (Multi-Frequency, Clock/Power-Gating);

   ➢ Coarse Grained Reconfigurable Accelerators;

   ➢ Approximate Computing.

➢ System Verifica

   ➢ Automated

   ➢ Formal

   ➢ Knowledge
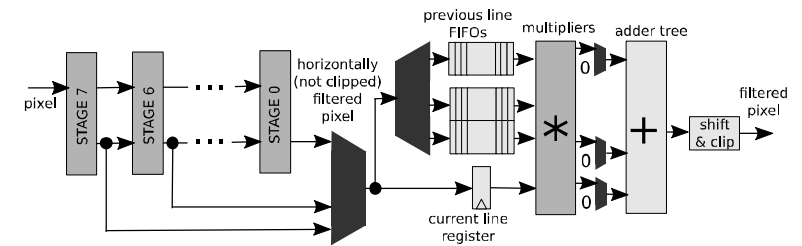
Example of multi-profile CGR system: HEVC interpolator

IDEA Lab – Expertise

AI & Formal Methods

Cyber-Physical System → System Model
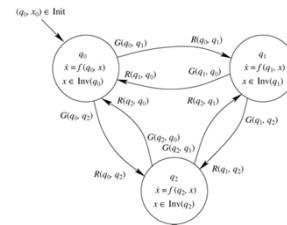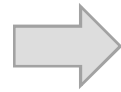
Requirements Goals → Logic formalization

OK!

NO!

IDEA Lab - People

Luca Pulina
Associate Professor

Francesca Palumbo
Assistant Professor

The more the merrier!

➢ Look for open positions at
http://idea.uniss.it/index.php/open-positions/

Arthur Bit-Monnot
Postdoctoral Researcher

Laura Pandolfo
Postdoctoral Researcher
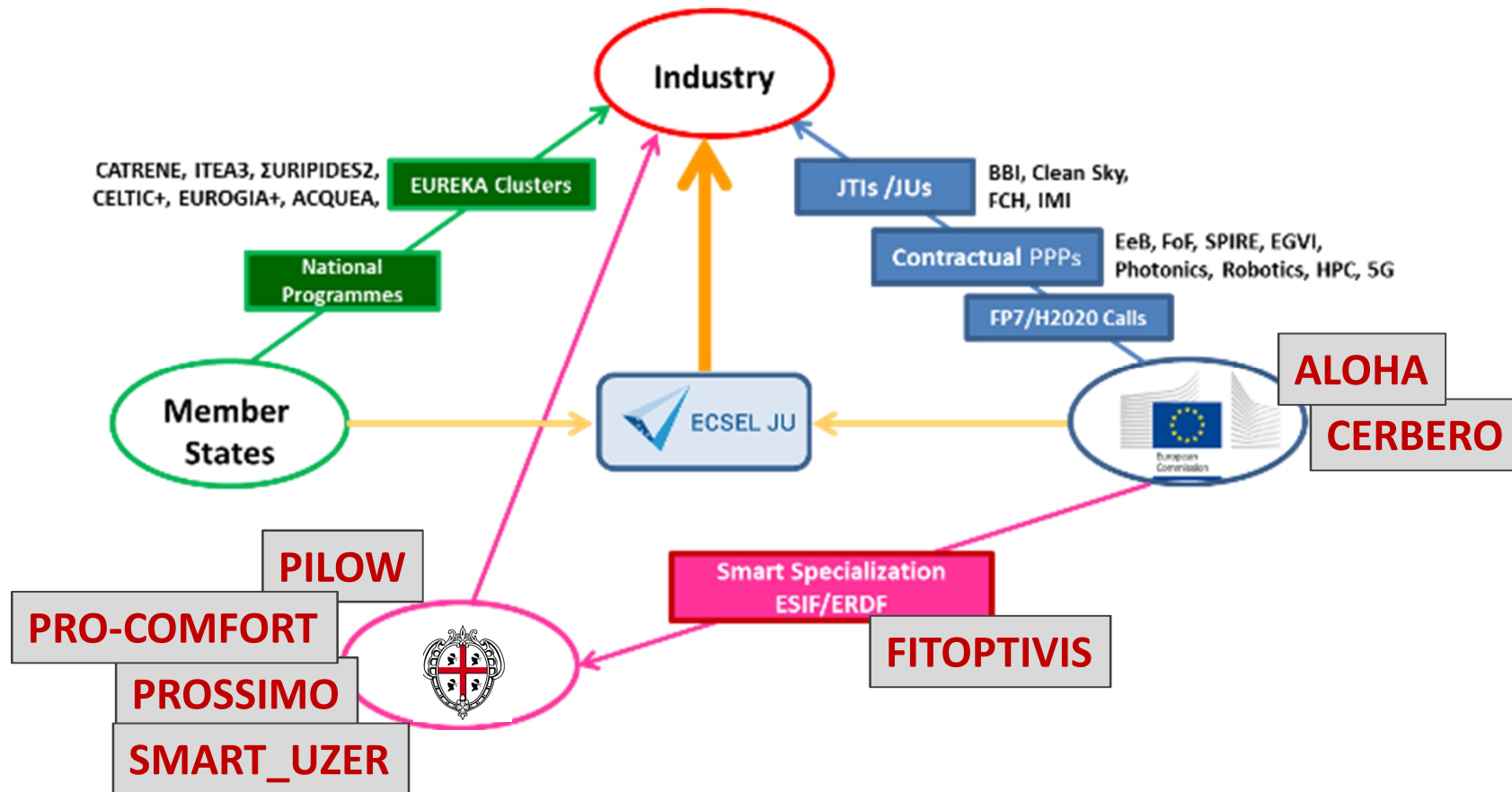

Claudio Rubattu
Researcher Assistant

Simone Vuotto
Researcher Assistant

Monica Marini
Communication and Administration

IDEA Lab - On Going Projects

IDEA Lab - On Going Projects

CERBERO – Cross-layer modEl-based fRamework for multi-oBjective dEsign of Reconfigurable systems in unceRtain hybRid envirOnments
H2020 ICT-01-2016 – Duration: 2017-2020 – Role: Scientific Coordinator – Project Value: 5.383.597 €
Design environment for Cyber Physical Systems

ALOHA – software framework for runtime-Adaptive and secure deep Learning On Heterogeneous Architectures
H2020 ICT-05-2017 –Duration 2018-2021 – Role: Partner – Project Value: 5.976.415 €
Software development tool flow for Deep Learning on heterogeneous low-energy computing platforms

FITOPTIVIS - From the cloud to the edge: smart IntegraTion and OPtimization Technologies for
highly efficient Image and VIdeo processing Systems
H2020-ECSEL-2017 – Duration 2018-2021 – Role: Scientific Coordinator – Project Value: 25.215.007 €
Smart integration of image- and video-processing pipelines for Cyber Physical Systems.

IDEA Lab – On Going Projects

PROSSIMO – Progettazione, sviluppo e ottimizzazione di sistemi intelligenti multi-oggetto
POR FESR Sardegna 2014-2020 2014/2020 – Duration: 2018-2020 – Role: Coordinator
Project Value: 284.396 €
Technology transfer: experimentation of innovative methodologies and tools for designing and verifying Cyber Physical Systems at various stages of the lifecycle.

PILOW – Piattaforma Informatica per la LOgistica via Web
P.O. FESR Sardegna 2007-2013, Regione Sardegna – Duration: 2017-2019 – Role: Scientific Coordinator
Project Value: 726.000 €
Develop and experiment innovative solutions in the logistics field.

PRO-COMFORT - sistema PRoattivo di Ottimizzazione dell'efficienza energetica e del COMFORT negli edifici
P.O. FESR Sardegna 2014-2020, Regione Sardegna– Duration: 2018-2020 - Role: Scientific Partner
Project Value: 399.656 €
Develop and experiment innovative solutions in the energy management field.

SMART_UzER - Sistema ModulARe e proaTtivo per l'ottimizzazione dell'UtiliZzo dell'Energia elettrica in Reti intelligenti
P.O. FESR Sardegna 2014-2020, Regione Sardegna– Duration: 2019-2021 - Role: Scientific Partner
Project Value: 128.303 €
Development of an intelligent system for energy management.

IDEA Lab

Thank you for your attention!

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Web: http://idea.uniss.it