System On Chip
embedded Systems
and cOnneCted things

GdR SOC²

http://www.gdr-soc.cnrs.fr/

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The GdR in action

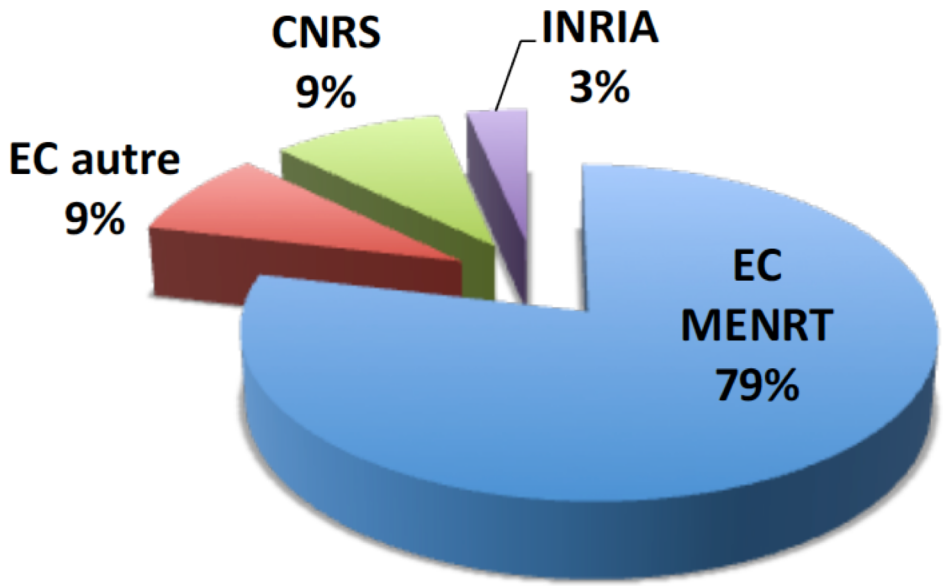
- A CNRS GdR*'s missions
  - bring a research community together
  - act as CNRS contact point for a **field of research**

- GdR SOC²'s specificities
  - high percentage of academic staff, several small teams
  - strong interaction with industry
  - at the intersection of 3 National University Council sections and two CNRS institutes

* GdR = research network

The GdR in action

- Unite
  - 56 research labs
  - >600 permanent staff

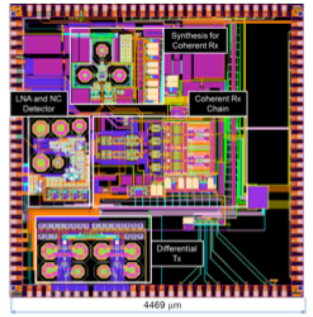


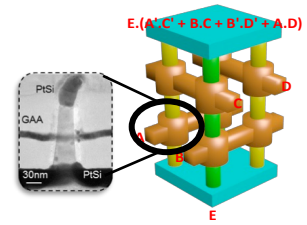
The GdR in action

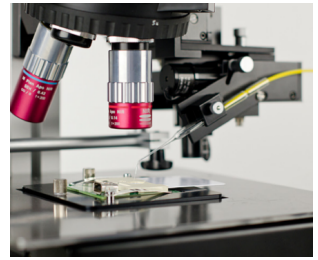
- Drive
  - 15 research theme days per year,
  - barcamps,
  - Co-organized research seminars (with IEEE-CAS, IRT Saint-Exupéry, Pole AerospaceValley)
  - Support 2 short-term research schools
  - National Research Days Montpellier, 19-21 June 2019 (next one 23-25 June 2020 in Rennes)
  - Research theme of the year

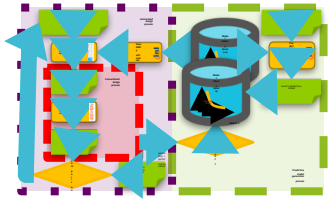
The GdR in action

- Organize
  - 3 thematic topics
    - Embedded high-performance computing
    - Cyberphysical frontiers and interfaces
    - System security and integrity
  - 3 cross-thematic topics
    - Smart devices
    - Future technologies
    - Methods and tools
  - To be announced : AI





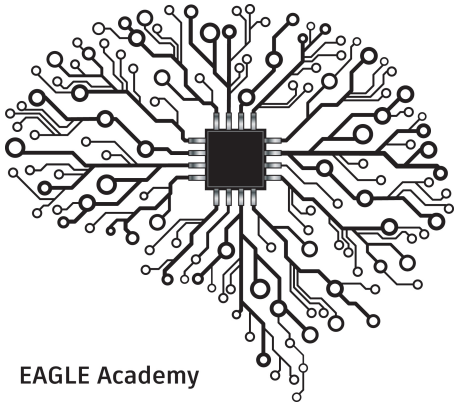




Crédit photos : laboratoires Hubert curien, IMS, INL, IM2NP

SOC² and AI

- Foundations and technologies
  - neuroinspired (spiking, STDP)
  - non-volatile memories
  - analog implementation etc.
- Applications and architectures:
  - hardware accelerators for inference
    - IoT / CPS, vision, wearables, edge computing
  - software techniques (compression etc.)
  - dynamic control of systems
- Methods and tools
  - CAD & AI: the tools of tomorrow
- AI and security
  - attacks, reverse engineering etc.



SOC² and RISC-V

- Expectations of the industry in term of modern architecture for critical embedded systems and how could RISC-V-based systems fullfil these requirements.
- Design RISC-V-based architectures for (critical) embedded systems.
- Modeling and formal verification of RISC-V-based architectures.
- Design and tools for RISC-V

A GdR in its ecosystem
Partner Companies club

- Represent industrial partners
  - advice on topics, proposals for research theme days
- Services for industrial partners
  - database of contacts, research lab survey, training and course survey
  - access to research theme days
  - access to lab software tools (if IP protected)
  - dissemination of messages or offers (internship, thesis …)
  - standard CNRS convention
- Financial aspects
  - SME contributions, large groups
  - free access for startups

GDR SOC²

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Join us

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Embedded high-performance computing

- Towards ultra-high performance and ultra-low power embedded systems
  - hardware and software optimization
  - alternative computing approaches
  - technology integration
- Safe and predictable massively parallel embedded computing
  - programming models and compilation techniques
  - allocation and scheduling
  - operating safety

Cyberphysical frontiers and interfaces

- Integrate energy-efficient intelligence into sensors
  - optimize the sensor and the interface
  - efficient RF transmission
  - adapt the node to the application
  - compress data locally
- Optimize communication with the heart of the system
  - interoperable RF communications
  - secure communications
- High-level multi-domain modeling

System security and integrity

- Adapt security methodologies
  - to future technologies (3D integration, nanoelectronics, ultra low-power, mixed-signal …)
  - to high levels of abstraction for the seamless insertion of developed methods (formal verification, security, fault tolerance, …) into design flows
  - to scale in terms of complexity, integration density, software and hardware fusion, and system heterogeneity

Smart devices

- Scale up networks of smart devices and dataflow
- Architectures and operating modes
- Applications:
  - traffic improvement, road safety, continuity of service
  - deploying increasing numbers of *in vivo* smart devices
  - pain reduction
  - ubiquity - smart territory, industry 4.0
  - ethical, social issues

Future technologies

- Functions
  - computing (nanowires, nanotubes, SET …)
  - memory (MRAM, ReRAM, FeRAM …)
  - interconnect and communication (nanophotonics, spin, THz, visible-range optics …)
- To improve
  - SoC energy efficiency, evolution of computing architectures
  - memory integation density
  - communication data rate
- New computing paradigms (bio-inspired, approximate, stochastic …)

Methods and tools

- Hardware / software co-design of parallel many-core architectures
- Holistic analog / digital-software approach, modeling and multi-physics simulation
- Modeling for fault tolerance and resilience
- Adapt methods to new technologies and new computing paradigms

Topic structure