

### 7th Int. Workshop Applications in Electronics Pervading Industry, Environment & Society APPLEPIES 2019

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# Round Table: Trend in Italy on EuroHPC & the European Processor Initiative



### FRAMEWORK PARTNERSHIP AGREEMENT IN EUROPEAN LOW-POWER MICROPROCESSOR TECHNOLOGIES

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# **EUROPEAN PROCESSOR INITIATIVE**

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## EUROPEAN PROCESSOR INITIATIVE

- High Performance General Purpose Processor for HPC
- High-performance RISC-V based accelerator
- Computing platform for edge and autonomous cars
- Will also target the AI, Big Data and other markets in order to be economically sustainable

# Overall objective Develop a complete EU designed high-end microprocessor, protecting our continent from embargos and external data control



### **EPI: 27 PARTNERS FROM 10 EU COUNTRIES**



# **ROADMAP & TECHNOLOGY**





### **GPP AND COMMON ARCHITECTURE**







### **EPAC - RISC-V ACCELERATOR**



- EPAC TITAN = EPI Accelerator
- VPU Vector Processing Unit (plan of record)
- STX Stencil/Tensor accelerator (PoR)

**EPAC** 

# FROM IPRTOPRODUCTSFROM EPITOSIPEARL

- SIPEARL is
  - Incorporated in EU (France)
  - the industrial and business 'hand' of EPI
  - the Fabless company
- licence of IPs from the partners
- develop own IPs around it
- licence the missing components from the market
- Raise in equity the missing budget (~100M€)
- generate revenue from both the HPC, IA, server and eHPC markets
- integrate, market, support & sell the chip
- work on the next generations





# CONCLUSION



### European Processor Initiative

## WE NEED YOU!

- EPI needs your help
- EPI will be successful through collaborations
- EPI will be successful through partnership
- EPI needs your expertise
- Key areas of collaboration / partnership
  - Development tools
  - Libraries
  - Applications

- DG-CNECT & EUROHPC want to see more collaboration between EPI and RIA calls
- Contact us!







**UNIBO DEI EEES laboratory** research excellence is on HW and SW co-design of energy-efficient computing system.

The <u>HPC</u> team's research focuses on methods and tools for monitoring and power management of large-scale computing systems

The <u>Compilers & Runtime</u> team's research focuses on the programming support for heterogenous computing systems

The <u>Digital Design</u> team's research focuses on the design of cutting edge computing architectures and their silicon implementation based on the parallel-ultra-low power (PULP) open-source hardware platform

The *Edge AI* team's research focuses on the development of AI-enabled IoT and smart sensors systems and applications

### **UNIBO contribution to EPI**

- UNIBO activities focus on the design of the HW and SW power management subsystem of the EPI processors.
- UNIBO activities focus on the design of the HW and programming support for offloading and supporting computation on the EPI specialized accelerators.



CINECA

Private consortium under public control:

- 67 universities
- 9 public research entities
- 3 university hospitals
- MIUR

### **Main activities**

- Supercomputing for research
- IT Support to MIUR
- IT Support to universities
- Technology transfer



# Our numbers: 100M€ turnover 21th in the TOP500 800 employees in BO, MI, Roma, NA



# CINECA CONTRIBUTION TO EPI

- We are involved in HW/SW **co-design**, **benchmarking** and **validation** to:
- select prominent HPC applications (impact is key) to setup a reference application ecosystem;
- establish a co-design loop between HPC software community, tooling and hardware design teams (e.g.: best match between HW/SW technical constraints and the application requirements - address trade-offs between usability and performance);
- carry out the usual HPC business:
  - make sure that code bases will be ready to run efficiently on the EPI platform (time-to-solution/energy-to-solution);
  - produce performance **projections** for **full systems**.

# EXASCALE: THE NEW SPACE RACE (AND AI THE NEW COLD WAR)?



European Processor

epi

Initiative

### CINECA EXASCALE ROADMAP AND EUROHPC







### LEONARDO SUPERCOMPUTER @ BOLOGNA SCIENCE PARK





# **E4** Computer Engineering

Since 2002, E4 Computer Engineering has been innovating and actively encouraging the adoption of new computing and storage technologies. Because new ideas are so important, we invest heavily in research and hence in our future. Thanks to our comprehensive range of hardware, software and services, we are able to offer our customers complete solutions for their most demanding workloads in: HPC, Big-Data, AI, Deep Learning, Data Analytics, Cognitive Computing and for any challenging Storage and Computing requirements.







# **E4** Computer Engineering



Silver Level <u>https://openpowerfoundation.org/</u> Cosimo Gianfreda IBMCHAMPION



Member of CERN openlab https://openlab.cern/



Member of the Steering Board http://www.etp4hpc.eu



Member of the OEHI (Open Edge and HPC Initiative) <u>http://www.open-edge-hpc-</u> <u>initiative.org/</u>



Member of the Consortium http://european-processorinitiative.com



Member of the MaX Center of Excellence <u>http://www.max-centre.eu/</u>

OpenVFOAM® Partnership Programme



Member of HiPEAC https://www.hipeac.net/







European Processor

Initiative

# The value of EPI for the industry

- Technological leadership in a key sector
  - Create a European ecosystem for microelectronics:
    - Engineers, IP's, foundries, technologies
  - Create a European ecosystem for exascale-class applications
- Create an Italian ecosystem of expertise & knowledge
  - We have to retain our talents
- Drive the completeness of the Italian and European industry
  - Our industrial system faces a worldwide competition





### **STMicroelectronics** is a key player in the Server & Data Center Power Management arena and brings innovation by:

- Developing new ICs/IPs to support the advanced power management features of the newest CPU, DDR and ASIC chipset ensuring best in class fast load transient response, high precision voltage positioning and accurate telemetry;
- Enabling new Architecture & Applications to achieve higher conversion efficiency and density required by the modern power Server and Data Center services.

### STMicroelectronics contribution to EPI

- ST activities focus on the development of a new generation of power conversion ICs dedicated to 48V power architecture in order to significantly reduce the total cost of ownership in ultra-high-efficiency HPC based on EPI processor;
- ST enables also the development of the advanced power management for the EPI processor which is based on the adoption of STMicroelectronics Power Management ICs.

# ST 48V SERVER & DATA CENTER POWER MANAGEMENT

Powering Server & Modern Data Center via the highest efficiency & density solutions



Complete solutions for Direct or Dual Stage CPU / DDR / ASIC power management in 48V ecosystem



1° Stage (IBC\*)



2° Stage (12V input)



AI accelerators (Posits) DNN & ML and crypto benchmarking on ARM 64b On-chip TRNG & CSPRNG Crypto accelerators for hashing, symmetric key and public key crypto Vertical chain for Secure OTA update of FW/SW Safety & security of the MCU – HPC monitoring link

# Crypto Accelerators & on-chip TRNG/CSPRNG





### TRNG (FiRo/GaRo oscillator based) & CSPRNG

Crypto accelerators, up to 300 Gbps real-time encryption/decryption in 7 nm (needed to exploit HBM) Configurable AES 126b/256b keys with 9 chipper modes Configurable SHA2/SHA3 up to 512b hash functions ECC-based public key crypto accelerators (ECDH, ECSIE, ECDSA,..)

**Open SSL Benchmarks on multi-core 64b ARM** X 3 order of magnitude gain thanks to crypto accelerators



Crypto accelerator ad-hoc policies integrated on-chip Keys storage and management Crypto configuration ad-hoc policy



# V2X channel security & 5G on EPI

**V2X** 



**V2X** 

Secure channels

Embedded

HPC

Over the Air SW/FW Update - Vertical chain Post-quantum resistant App SW (attributed based) eLinux OS coexisting with RTOS *Hypervisor* **EPI HW with crypto accelerators** 



5G resource control & adaptive allocation spectrum, beam-forming/steering, channels, power, goodput (modulation, coding,...)







# OPEN DISCUSSION Trend in Italy on EuroHPC & the European Processor Initiative



### Round Table:

**Trend in Italy on EuroHPC & the European Processor Initiative** 

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