gaZ: group of Computer Architecture
University of Zaragoza

RED2018-102384-T

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Grupo de Investigación en Arquitectura de Computadores (gaZ) Universidad Zaragoza

Instituto Universitario de Investigación de Ingeniería de Aragón Universidad Zaragoza

Universidad Zaragoza

Mission

Research and train researchers in heterogeneous systems and CMPs and their memory hierarchies, *focusing on general purpose computing, hard real-time or important applications such as DNA sequencing, machine learning or on-board satellite processing.* ***Diverse teams are smarter.*** *So gaZ promotes activities to close the gender gap in all its activities, from dissemination to research.*

Vision

Contribute to the design of low-power, high-performance, and reliable processors and accelerators in a open hardware environment, *considering* different markets, such as intelligent IOT sensors, supercomputers, mobile devices and data center servers

Group Profile

Research

- **On-chip Multicore Cache Hierarchy:** **p**refetching ,replacement, STTRAM
- **Heterogeneous Systems** (cpu+gpu+fpga): load-balancing runtimes, accelerators
- **Real-Time systems:** static estimation of WCET, temperature-aware scheduling
- **Reliable Systems:** permanent, transient, and aging-induced fault tolerance
- **Application Acceleration**
- **Embedded Systems & IoT**

Training/Teaching

- **Digital Design**
- **Computer architecture & organization**
- **Operating Systems & Virtualization**
- **Networks & System administration**
- **Heterogeneous Systems**
- **RT Embedded Systems & IoT**
- **Data Centers**

Innovation

- Application optimization
- Accelerator design
- Citizen science, dissemination of embedded systems & IoT

Recent / Ongoing Results

Research

- **Architecture and Programming of High-Performance, Low-Power Scalable Computers** (TIN2016-76635-C2-1-R)
  - Joint Project with Universidad de Cantabria (2017-20)
  - New Project under evaluation
- Gobierno de Aragon **reference research group**: T58_17R
- **TRAFAIR (2017-EU-IA-0167),** Understanding Traffic Flow to improve Air quality, Connecting Europe Facility (CEF)

AGENCIA ESTATAL DE INVESTIGACIÓN

GOBIERNO DE ARAGON Departamento de Ciencia, Tecnología y Universidad

Training/Teaching

- **Computer, Telecommunication, and Industrial Engineering undergraduate and graduate programs** (including Degree and Master Final Projects)
- **PhD program with mention towards excellence**
- Several educational papers on **how to teach energy and power in computers**
- **Collaborations with other teaching areas:** building bridges across the abstraction levels of a computer system:
  - Exposing **Abstraction-Level Interactions** with a Parallel Ray Tracer. Workshop on Computer Architecture Education, 2019

Innovation

- **FCT-18-13586 - Make It Special** embedded systems to assist people with disabilities
- **FPGA accelerators for Machine Learning** improve the accuracy of the forecast system of *Puertos del Estado*
- **Accelerating DNA sequencing** for Intel KNL processors
- **Sending IoT into the atmosphere**
- **High-Performance, Low-Power Computer Vision for Virtual Reality** (with Eonite Inc. Palo Alto, CA, USA)

Group positioning & Perspectives in front of Open-Hw & RISC-V

R+D+i+T

- **The RISC-V open Hw/Sw**
  - **Enables collaboration and can foster our regional markets**
  - **Is a clear educational path for Computer Architecture and Operating Systems in the undergraduate and master studies**
- **IA accelerators and virtualization for RISC-V cores and related application developments**
- **Low power RISC-V cores for IoT with non-volatile cache memories**
- **Use RISC-V as innovator driver-thread for universities and collaborative training strategies for all education levels**

Global Remarks

"If many organizations design processors using the same ISA,
the greater competition may drive even quicker innovation.
The goal is to provide processors for chips that cost from a few cents to $100."

J. Hennessy & D. Patterson – "A New Golden Age for Computer Architecture" CACM Feb. 2019