Zsolt István **Associate Professor at ITU Copenhagen**

Contact

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Research Profile

My research interests lie in the intersection of distributed systems, databases and specialized hardware. I explore and combine ideas from these areas in order to overcome the compute/data gap that modern data centers face.

Education

Ph.D., Computer Science 2013 – 2018
Systems Group, ETH Zürich, Switzerland
Advisor: Prof. Gustavo Alonso

M.Sc., Computer Science (Distributed Systems) 2011 – 2013
ETH Zürich, Switzerland

B.Sc., Computer Science 2007 – 2011
UTCN Cluj-Napoca, Romania

Professional Experience

IT University, Copenhagen, DK October 2020 – Present
Associate Professor in Computer Science

IMDEA Software Institute, Madrid, ES September 2018 – September 2020
Assistant Research Professor
Working in the area of distributed systems and hardware acceleration for data processing.

IBM Research, Rüschlikon, CH May 2018 – July 2018
Visiting Researcher
Topic: Exploring software and hardware acceleration opportunities for Blockchains.

Microsoft Research, Redmond, WA June 2014 – August 2014
Research Intern
Supervisor: Ken Eguro
Topic: Adding support for B-tree indexes and a local cache to the FPGA in Cipherbase.

Xilinx Labs, Dublin, Ireland September 2012 – March 2013
Research Intern (Master Thesis)
Supervisor: Michaela Blott
Topic: Design of a hash table for an FPGA-based key-value store.

INRIA, Sophia-Antipolis, France July 2011 – August 2011
Research Intern (OASIS Group)
Supervisors: Ludovic Henrio and Fabrice Huet
Topic: Annotation-based automatic parallelization of Active Objects in ProActive.

INRIA, Sophia-Antipolis, France June 2010 – August 2010
Research Intern (OASIS Group)
Supervisor: Denis Caromel
Topic: Parallel programming and scheduling for multicores in the ProActive Framework

Awards and Scholarships

- **Juan de la Cierva Formación 2018**, Spanish Science Foundation (funding part of my salary with EUR 25.000 for 2 years, awarded in 2019)
- **ACM EuroSys Roger Needham PhD Award 2019 – Honorable Mention**
- **ETH Zürich Medal for Doctoral Dissertations of 2018** (Awarded in 2019)
- ETH Zürich Excellence Scholarship for Master's Studies 2011-2013

Project Funding

Novo Nordisk Fonden Start Package Grant for Associate Professor. Starting 2021.

Earlier funding:
ACCORD: Accelerated Ordering Service for Distributed Ledgers. *Marie Curie Individual Fellowship 2018. Ref: EU Project 842956.* Principal investigator: Z. István. Mentor: M. Hermenegildo.

BOSCO: Fundamentos para el desarrollo, analisis y comprension de los blockchains y los contratos inteligentes.*Spanish National Research Grant, Ref.: PGC2018-102210-B-I00.* Principal investigators: C. Sanchez, P. Ganty

BLOQUES-CM: Intelligent Contracts and Scalable Blockchains and Insurance through Verification and Analysis. *Community of Madrid Research Grant. Ref.: P2018/TCS-4339.* Coordinator: J. Caballero; Members: UCM, UPM and IMDEA Software.

Conference Publications

Specialize in Moderation – Building Application-aware Storage Services using FPGAs in the Datacenter. L. Kuhring, E. Garcia, Z. István. *11th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage'19), 2019.*

Design Patterns for Code Reuse in HLS Packet Processing Pipelines.
H. Eran, L. Zeno, Z. István, M. Silberstein. *27th IEEE Int'l Symposium on Field-Programmable Custom Computing Machines (FCCM'19), 2019.*

A Flexible K-Means Operator for Hybrid Databases.
Z. He, D. Sidler, Z. István, G. Alonso. *International Conference on Field Programmable Logic and Applications (FPL), 2018.*

Providing Multi-tenant Services with FPGAs: Case Study on a Key-Value Store. Z. István, G. Alonso, A. Singla. *International Conference on Field Programmable Logic and Applications (FPL), 2018.*

Accelerating Pattern Matching Queries in Hybrid CPU-FPGA Architectures.
D. Sidler, Z. István, M. Ewaida, G. Alonso. *ACM SIGMOD/PODS Conference (SIGMOD'17), 2017.*

Caribou: Intelligent Distributed Storage. Z. István, D. Sidler, G. Alonso. *Proceedings of VLDB Endowment, Volume 10, No. 11 (VLDB'17), 2017.*

Low-Latency TCP/IP Stack for Data Center Applications.
D. Sidler, Z. István, G. Alonso. *26th Int'l Conference on Field Programmable Logic and Applications (FPL'16), 2016.*

Runtime Parameterizable Regular Expression Operators for Databases.
Z. István, D. Sidler, G. Alonso. *24th IEEE Int'l Symposium on Field-Programmable Custom Computing Machines (FCCM'16), 2016*

Consensus in a Box: Inexpensive Coordination in Hardware
Z. István, D. Sidler, G. Alonso, M. Vukolic. *13th USENIX Symposium on Networked Systems Design and Implementation (NSDI '16), 2016.*

Histograms as a Side Effect of Data Movement for Big Data.
Z. István, L. Woods, G. Alonso. *ACM SIGMOD/PODS Conference (SIGMOD'14), 2014.*

Ibex – An Intelligent Storage Engine with Support for Advanced SQL Off-loading.
L. Woods, Z. István, G. Alonso. *Proceedings of VLDB Endowment, Volume 7, No. 11 (VLDB'14), 2014.*

A Flexible Hash Table Design For 10Gbps Key-value Stores on FPGAs.
Z. István, G. Alonso, M. Blott, K. Vissers. *23rd Int'l Conference on Field Programmable Logic and Applications (FPL'13), 2013.*

Achieving 10Gbps Line-rate Key-value Stores with FPGAs.
M. Blott, K. Karras, L. Liu, K. Vissers, Z. István, J. Bar. *5th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud'13), 2013.*

Multi-threaded Active Objects. L. Henrio, F. Huet, Z. István. *15th Int'l Conference on Coordination models and Languages (COORDINATION), 2013.*

Journal Publications

doppioDB 1.0: Machine Learning inside a Relational Engine. G. Alonso, Z. István, K. Kara, M. Owaida, D. Sidler. *IEEE Data Engineering Bulletin June 2019.*

The Glass Half Full: Using Programmable Hardware Accelerators in Analytics. Z. István. *IEEE Data Engineering Bulletin March 2019.*

Active Pages 20 Years Later: Active Storage for the Cloud.
Z. István, D. Sidler, G. Alonso. *IEEE Internet Computing July/Aug 2018.*

A Hash Table for Line Rate Data Processing. Z. István, G. Alonso, M. Blott, K. Vissers. *ACM Transactions on Reconfigurable Technology and Systems (TRETS), 03/2015.*

Books

FPGA-Accelerated Analytics: From Single Nodes to Clusters Z. István, K. Kara, D. Sidler. *Now Publishers, 2020 (also as a journal: Foundations and Trends in Databases, Vol. 9, No. 2)*

Short Papers, Position Papers

Let's Add Transactions to FPGA-based Key-Value Stores!. Z. István. *The 16th Workshop on Data Management on New Hardware (DAMON) at SIGMOD'20.*

Acceleration Opportunities for BFT Consensus in Datacenter-like Environments. M. Bravo, Z. István, M.K. Sit. *The 10th Workshop on Systems for Post-Moore Architectures (SPMA) at EuroSys'20.*

Something New Under The Sun: Thoughts on Optimizing the Performance of Blockchains. Z. István. *The 9th Workshop on Systems for Multi-core and Heterogeneous Architectures (SFMA) at EuroSys'19.*

StreamChain: Do Blockchains Need Blocks?
Z. István, A. Sorniotti, M. Vukolic. *2nd Workshop on Scalable and Resilient Infrastructures for Distributed Ledgers (SERIAL) at Middleware'18.*

Adapting Active Objects to Multicore Architectures. L. Henrio, F. Huet, Z. István, G. Sebestyen. *Int'l Symposium on Parallel and Distributed Computing (ISPDC), 2011.*

Posters and Demos

I Can't Believe It's Not (Only) Software! Bionic Distributed Storage for Parquet Files. L. Kuhring, Z. István. *Demo for VLDB'19, FPL,19*

Enzian: a Research Computer for Datacenter and Rackscale Computing.
D. Cock, R. Achermann, M. Owaida, Z. Istvan, T. Grosser, Z. Wang, G. Alonso, T. Roscoe, D. Sidler, A. Turowski. *Poster at EuroSys'18.*

Caribou: A Platform for Building Smart Storage
Z. István, D. Sidler, G. Alonso. *Poster at EuroSys'17.*

doppioDB: A Hardware Accelerated Database
D. Sidler, M. Ewaida, Z. István, K. Kara, G. Alonso. *Demo for SIGMOD'17 and FPL'17.*

Specialized Microservers for the Data Center
Z. István, D. Sidler, G. Alonso. *Demo for FPL'15. Poster at EuroSys'15.*

Hybrid FPGA-accelerated SQL Query Processing
L. Woods, Z. István, G. Alonso. *Demo for FPL'13.*

Patents

Systems and Methods for Providing Distributed Tree Traversal Using Hardware-Based Processing. K. Eguro, Z. István, A. Arasu, R. Ramamurthy, K. Shriraghav.
US 20160147779 A1, Patent application filed 11/26/2014

Teaching Experience

Teaching at **UPM Madrid**

Building Data Processing Systems with FPGAs	Spring 2019
Performance Analysis and Modeling of Software Systems	Fall 2018, Fall 2019

Teaching Assistant at **ETH Zürich**

Advanced Systems Lab	Fall 2013, Fall 2014, Fall 2015, Fall 2016, Fall 2017
Data Modeling and Databases	Spring 2016, Spring 2017
Programmieren und Problemlösen	Spring 2014, Spring 2015

Supervision Experience

Member of PhD committee

Mario Daniel Ruiz Noguera (UAM, Madrid) — Defended: January 2020
Title: On the Exploration of FPGAs and High-Level Synthesis Capabilities on Multi-Gigabit-per-Second Networks

Student Supervision at **IMDEA Software**

BSc Intern: Paula Benedec (UTCN, Romania) — Summer 2020
Topic: Benchmarking permissioned blockchains

PhD Intern: Andrei Tosa (UTCN, Romania) — Summer 2020
Topic: Towards differential privacy on FPGAs

PhD Intern: Mustapha Bouhali (ENP Oran, Algeria) — Spring 2020
Topic: Evaluating Rowhammer risks on modern FPGA boards

Bachelor Thesis: Samuel Garcia (UPM, Madrid) — Spring 2020
Topic: In-network data processing with FPGAs

PhD Intern: Man-Kit Sit (Imperial College, London) — Fall 2019 - Spring 2020
Topic: Acceleration of Blockchains using specialized hardware

BSc Intern: Lukas Stasytis (KTU, Lithuania) — Summer 2019 - Fall 2019
Topic: Acceleration of matrix-multiply operations using HLS

BSc Intern: Claudiu Mihali (UTCN, Romania) — Summer 2019
Topic: Near-data processing in an FPGA-based KVS

Master Thesis: Lucas Kuhring (UPM, Madrid) — Spring 2019
Topic: Optimizing the performance of Hyperledger Fabric

Master Thesis: Srivatsan Lakshmi (UPM, Madrid) — Spring 2019
Topic: Evaluation of blockchains as a replacement for relational databases

BSc Intern: Eva Garcia (UAM, Madrid) — Fall 2018
Topic: Porting a benchmarking suite to Hyperledger Fabric

Student Supervision at **ETH Zürich**

Semester Project: Zhenhao He (co-advised with David Sidler) — Spring 2018
Topic: A flexible K-Means operator for hybrid databases

Bachelor Thesis: Mickey Vanska (co-advised with David Cock) — Spring 2017
Topic: Program Trace Analysis on an FPGA

Bachelor Thesis: Tim Taubner — Spring 2015
Topic: Accelerating statistical methods using an FPGA

Semester Project: Jakub Szymanek — Spring 2014
Topic: Indexes and caching in IBEX

Community Service

Conference/Workshop Organization:
Workshop co-chair for EuroSys'21
Sustainability chair for VLDB'21
Workshop Co-organizer: SFMA'19, SPMA'20 (EuroSys) , SERIAL'19 and '20 (Middleware)
Hackathon Co-organizer: chainrEaction 2020

PC Member:
Database conferences: SIGMOD'21, EDBT'21, EDBT'20
Systems conferences: SRDS'20, HotCloud'20, ASPLOS'20 (light)
FPGA conferences: FCCM'20
Others: EuroSys Doctoral Workshop 2020 and 2019.

Invited Reviewer:
Journals: IEEE TC-CS (04.2020), ACM TACO (02.2019, 06.2017), IEEE TKDE (01.2019, 09.2017)

Selected Invited Talks

About re-imagined architectures and how looking across layers increases efficiency in data-intensive systems:
ITU Copenhagen, Denmark. May 2020 (virtual)

About StreamChain and how to design a Blockchain with sub-millisecond commit times:
ETH Zurich, Switzerland, November 2019

About past and future challenges of analytic database acceleration with FPGAs:
SAP Walldorf, Germany. November 2019
UCM, Madrid, Spain. May 2019
UPM, Madrid, Spain. June 2019

About Multes and providing multi-tenant services with specialized hardware in the cloud:
UAM, Madrid, Spain. October 2018
UPB, Bucharest, Romania. September 2018

About Caribou, an intelligent distributed storage solution:
Technion, Haifa, Israel. November 2018
IMDEA Software Institute, Madrid, Spain. February 2018
KAUST, Thuwal, Saudi Arabia. October 2017
TU Dresden, Germany. July 2017
Swiss Joint Research Center Workshop, MSR, Cambridge, UK. February 2017

About inexpensive coordination (consensus) in hardware:
UTCN Cluj-Napoca, Romania. November 2018 and December 2019
IBM Research Rüschlikon, CH. October 2016
Xilinx Labs, San Jose, CA. March 2016
IBM Research Almaden, San Jose, CA. March 2016

About accelerating string matching queries with hybrid CPU-FPGA multicores:
TU Munich, Germany. June 2020 (virtual)
UTCN Cluj-Napoca, Romania. April 2019 and December 2019
Oracle Labs, Belmont, CA. March 2016

About building specialized microservers:
University of Washington, Seattle, WA. June 2015
Microsoft Research, Redmond, WA. June 2015
Oracle Labs Zürich Kickoff Workshop, Zürich, CH. January 2015

Languages

Hungarian, Romanian, English – Proficient
German, Spanish – Intermediate