Suren A. Chilingaryan, PhD

Data Processing and Performance Expert | Lead of Cloud Computing

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I do research in high-performance and heterogeneous computing and apply my expertise to architect online systems for scientific instrumentation. With deep knowledge across computer science and IT technology, I can grasp complex systems as a whole and pay attention to the performance of critical components. Currently, I lead an effort to adopt cloud technologies for data acquisition and control systems.

Areas of expertise

High performance computing
Distributed data acquisition and control systems
Performance analysis and software optimization techniques
Parallel algorithms and parallel hardware architectures
Low-latency communication in heterogeneous systems
Cloud-based data management and visualization

Technical skills

Programming	C/C++, IPC, TCP/IP, CUDA/OpenCL, SSE/AltiVec, OpenMP/NPTL
System Programming	POSIX, Linux Internals, PCI Drivers, DMA, GPUDirect/DirectGMA
Networking	Ethernet/Infiniband, Sockets/MPI/0MQ, RDMA (ROCe), LibVMA
Software Analysis	gdb, perf/operf, nvvp/nvprof, vtune, valgrind, systap, tcpdump
Scientific Computing	MATLAB, Python/SciPy, ROOT, BLAS/LAPACK
Data Management	Brokers, Databases (SQL/NOSQL), XML & Co, Web Development
Orchestration	Ansible, OpenShift, Docker, LibVirt/KVM, Infiniband, GlusterFS

Employment

Since 2020	**Leader of CloudDAQ project** at Karlsruhe Institute of Technology: Research on cloud technologies for control and data acquisition applications
2013 – 2020	**Data processing and performance expert** at KIT: high-performance instrumentation for large-scale scientific experiments
2007 – 2012	**Postdoctoral researcher** at KIT: data management & software optimization
2005 – 2007	**Software engineer** at Yerevan Physics Institute: data acquisition systems
2002 – 2005	**Associate researcher** at Forschungszentrum Karlsruhe
2001 – 2002	**Software engineer** at Yerevan Physics Institute

Education

July 2006	PhD in Computer Engineering “Data Exchange Solution for Distributed Data Acquisition Systems and its application for Cosmic Ray Monitor Networks”, National Academy of Science, Armenia
1996 – 2001	MSc in Mathematics “Data Processing using Neural Networks”, Moscow State University, Russia

Personal data

Nationality	Armenian, Russian Federation, residence permit in Germany
Languages	English, Armenian, Russian

Projects

Ongoing — **Cloud technologies for heterogeneous control systems**
- Responisble for operation of the Kaas platform
- Prepare the KATRIN infrastructure for new high-speed detectors

2018 – 2020 — **Katrin-as-a-Service Cloud Platform**
- Proposed, built, and maintain the KaaS cloud platform for the KATRIN experiment
- Coordinated migration of the KATRIN services to the KaaS platform
- Made a distributed and scalable version of the ADEI data management system
- Supervised development of online monitoring framework for the ADEI ecosystem

2017 – 2020 — **Research of undocumented aspects in GPU architectures**
- Investigated performance imbalances and hidden parallelism in GPU architectures
- Developed method to exploit intra-SM parallelism (up to 30% speed-up)
- Evaluated methods of approximate computing for tomography (quality vs. speed-up)
- Applied these techniques to speed-up tomographic reconstruction by extra 4-6 times via performance modeling and rebalancing of hardware usage [s11554-019-00883-w]

2010 – 2018 — **Coordinated student exchange program with Tomsk Polytechnic University**

2012 – 2017 — **Data Acquisition Platform for UFO ecosystem**
- Developed a driver platform for fast prototyping of PCIe-based electronics with a modular (user-space) DMA engine (up to 12 GB/s) and scirpting/debugging support
- Implemented drivers for in-house electronics, e.g. camera (*in use at KIT and Desy*)
- Used RDMA and GPUDirect/DirectGMA to intercommunicate detectors with GPUs
- Participated in a case study on applications of GPUs for CMS track trigger, decision on acceptance of a track candidate was made within 6 μs (data transfer + analysis)
- GPUs allowed to utilize a more precise algorithm than was possible with classic designs

2015 – 2016 — **Cloud platform for collaborative analysis of tomographic data**
- Led development of web-visualization for large and time-resolved volumes

2011 – 2015 — **UFO: Ultrafast tomography with online monitoring and image-based control**
- Proposed a scalable architecture for pipelined processing of image streams
- Coordinated software development with a team in KIT and 3 Russian universities
- Supervised development of fast reconstruction algorithms (up to 6 GB/s per node)
- Supervised development of regularized reconstruction methods to compensate low SNR and/or undersampling in case of high-speed tomography
- Since 2016, the developed system is installed at the KIT synchrotron and enables both high-speed (5 volumes/second) and high-throughput (1000 samples/week) operation

2011 – 2014 — **ADEI: Advanced Data Extraction Infrastructure**
- Helped to secure funding and initiated collaboration between KIT and YerPhI
- Supervised a cross-university team of researchers and engineers
- Developed a platform for exploration and analysis of time-series in terascale archives
- System is in operation in YerPhI, the SEVAN network, and 7 major facilities at KIT

2009 – 2013 — **Parallel algorithms and software optimization**
- Developed parallel algorithms for μPIV (micro-particle velocimetry)
- Leveraged the PoweXCell architecture for a MRSES feature selection algorithm
- Optimized performance of PyHST (ESRF tomographic framework)
- Implemented a digital image correlation and tracking algorithm for GPUs

2002 – 2008 — **Distributed systems for data acquistion and slow control**
- Stabilized a slow control system of the KATRIN experiment for production use *(in use)*
- Built a distributed data acquisition system for ASEC particle detector networks *(in use)*
- Developed drivers for PCI neuro-accelerator and evaluated it for control applications