

Suren A. Chilingaryan, PhD

Systems Software Architect | Scientific Instrumentation & Heterogeneous Systems

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20 years of experience designing and delivering distributed, data-intensive systems for large-scale scientific instrumentation. Architected systems spanning hardware interfaces, low-latency data paths, heterogeneous computing, data management, and cloud-native orchestration, combining architectural breadth with deep systems and performance expertise. Lead multidisciplinary development, bridge scientific experiments with HPC centres, and take research prototypes into long-lived production systems.

KEY COMPETENCES

Leadership	Team building, cross-team coordination, presentations & publications
Project Management	Technical & financial planning, proposals & funding, partnerships
Architecture	Distributed & heterogeneous systems, data-intensive scientific systems, high-bandwidth DAQ, data-driven control, data organization & lifecycle
Performance	Parallel & approximate algorithms, performance modeling, code optimization
Platforms	Kubernetes/OpenShift, distributed storage, SQL/TSDB/array databases
Key Technologies	C/C++, Linux/POSIX/IPC, CUDA/OpenCL, NUMA, PCIe/DMA, RDMA

SELECTED PROJECTS

Since 2026	Distributed Data Architecture for Interactive 3D/4D Tomography Repositories
›	Co-authored proposal; PI / work-package lead for data reduction and organization
›	Project targets a data lifecycle spanning data-generation facilities, HPC centres & users
›	Exploring compression, caching, and abstractions to enable interactive data access
›	Co-designing DAG tomography framework; evaluating NVIDIA Graphs/Holoscan
Since 2018	KATRIN-as-a-Service (KaaS) platform for distributed data acquisition systems
›	Initiated platform, secured funding, built team of 4, and led production rollout
›	Coordinated integration across Canonical, KIT HPC, electronics & experiment teams
›	KaaS integrates data from fast detectors and thousands of monitoring sensors
›	Led development of containerized AF_XDP data-acquisition framework
›	Cut costs by adapting legacy software for distributed ops and integrating HPC resources
2017 – 2022	Uncovering & Exploiting GPU Architectural Features
›	Identified performance imbalances and hidden parallelism in NVIDIA and AMD GPUs
›	Developed method exploiting intra-SM parallelism on NVIDIA (up to 30% speed-up)
›	Accelerated tomography 4–6× through architecture-aware resource balancing
›	Published paper "Reviewing GPU architectures to build efficient back projection..."
2016 – 2017	GPU-based L1 Trigger for CERN CMS using GPUDirect (6 μs latency budget)
2011 – 2017	Coordinated software work-package and led algorithm parallelization in a project
	"Ultrafast tomography with online monitoring and image-based control"

EMPLOYMENT

Since 2020	Scientific Systems Architect at KIT: End-to-end systems for data-intensive instrumentation, from detectors to processing & data organization
2013 – 2020	Data Processing and Performance Engineer at KIT: high-performance instrumentation for large-scale scientific experiments
2007 – 2012	Postdoctoral Researcher at KIT: data management & software optimization
2001 – 2007	Software Engineer & Researcher at Yerevan Physics Institute and Forschungszentrum Karlsruhe: DAQ middleware and control systems

PERSONAL DATA

Nationality	Armenian, German Residence Permit (Niederlassungserlaubnis)
Languages	English, Armenian, Russian

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

PROJECTS

2012 – 2017	Remote-DMA based Data Acquisition Platform ➤ Developed a driver platform for fast prototyping of PCIe-based electronics with a modular (user-space) DMA engine (up to 12 GB/s) and scripting/debugging support ➤ Implemented drivers for in-house electronics, e.g. camera (<i>in use at KIT and Desy</i>) ➤ Used RDMA and GPUDirect/DirectGMA to intercommunicate detectors with GPUs ➤ Led 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
2010 – 2017	Coordinated student exchange program with Tomsk Polytechnic University
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, 10-100x speed-up ➤ Developed parallel algorithms for μPIV (micro-particle velocimetry) ➤ Leveraged the PowerXCell 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 acquisition and slow control ➤ Stabilized a slow control system of the KATRIN experiment (<i>in use</i>) ➤ Built a distributed data acquisition system for ASEC particle detector network (<i>in use</i>) ➤ Developed Linux drivers and control software for AI-accelerator

TECHNICAL BACKGROUND

Programming	C/C++, POSIX/IPC, OpenMP/NPTL, NUMA, SIMD, CUDA/OpenCL
System Program.	Linux & Kernel Internals, PCIe Drivers, DMA/GPUDirect/DirectGMA
Networking	Ethernet/InfiniBand, EPICS, Sockets/MPI/0MQ, RDMA (RoCE), LibVMA
Software Analysis	gdb, perf/operf, nvvp/nvprof, vtune, valgrind, systap, tcpdump
Data Management	Brokers, Databases (SQL/TSDB/Array/InMem), XML, Web Development
Orchestration	Ansible, Kubernetes/OpenShift, OCI/Docker, LibVirt/KVM, Ceph/GlusterFS