Jonas Markussen

Systems Software Engineer

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Experience

Software Architect 2019 —
Senior Software Engineer 2018 — 2019
Dolphin Interconnect Solutions

Working with Dolphin's PCIe-based shared-memory solutions. Gained experience with C programming, PCIe non-transparent bridging, cluster interconnects, RDMA, distributed shared-memory architectures, NVMe, GPU programming, Linux driver development and Linux kernel hacking.

- Contributed to the integration of the SmartIO framework from my PhD into Dolphin's standard product line.
- Created a distributed block device driver for simultaneous sharing of a non-SR-IOV NVMe among multiple hosts in a cluster.

External PhD Student 2018 — 2022
PhD Student 2015 — 2018
Simula Research Laboratory

Was a full-time PhD student until my scholarship ran out, and then completed my PhD on my own time. Worked on a research project in collaboration with Dolphin, with the goal of creating a framework called SmartIO for efficiently sharing I/O resources in a PCIe shared memory cluster.

- Contributed significantly to the design and implementation of SmartIO.
- Implemented Linux KVM hypervisor support for SmartIO using VFIO mediated device drivers for assigning remote physical devices to VMs.
- Identified performance bottlenecks and implemented several optimizations that reduced overheads for individual memory accesses to near-zero (<50 nanoseconds), improving the overall system performance.
- Developed a CUDA/C++ library based on SmartIO using NVMe and GPUDirect, providing zero-copy data transfers and allowing GPUs to initiate reads and writes directly without involving CPUs.
- Published 5 academic papers based my SmartIO work, including one in a flagship journal on distributed computer systems (ACM TOCS).

Software Developer 2014 — 2015
Bridgetech

Worked with real-time analysis of digital video over network. Got experience with working with C++ in an embedded environment, network traffic analysis, video encoding, MPEG streams, and PIM-SM multicasting.

- Contributed to an MPEG transport stream parser for the VB288 content extractor using libpcap for live capturing IPTV (MPEG-DASH).
- Implemented a parser for MPEG-2 and MPEG-4/AVC video streams in order to extract and validate CEA608/708 closed captioning data and provide real-time event notifications.

Software Development Engineer 2013 — 2014
Fotoware

Worked as a back-end web developer on Fotoweb, an web-based image and video archiving system with full-text metadata search and workflows based on metadata tags. Designed REST services from the ground up, and worked with MongoDB, C++ (FastCGI) and Python (Flask).

- Implemented a hierarchical metadata taxonomy tree that supported CRUD operations and assignment to assets of tens of thousands of metadata tags within milliseconds.
- Created a configurable workflow engine allowing users to create custom pipelines and workloads for processing assets based on metadata tags.
- Made a background job scheduler with support for webhooks and asynchronous message-passing as well as bulk file operations.
- Implemented both back-end and front-end for exporting assets to an external CMS and an access management UI for these exports.

Education

PhD, Informatics 2015 — 2022
University of Oslo
& Simula Research Laboratory
Doctoral degree in computer science.

MSc, Informatics 2010 — 2014
University of Oslo
& Simula Research Laboratory
Master's degree in computer science.

BSc, Informatics 2006 — 2010
University of Oslo
Bachelor's degree in computer science.

Part-time Jobs & Internships

Front-end Web Developer 2011 — 2013
Fotoware

Java Programmer 2010 — 2011
Redimi

Teaching Assistant 2009 — 2011
University of Oslo

Skills & Technologies

Software engineering – C, Python, C++, CUDA, JavaScript, Bash, git, CI/CD, PHP, Java.

System architecture – Linux kernel hacking, PCIe device drivers, microcontrollers, embedded systems, virtual machines, memory and resource virtualization, Linux KVM/VFIO, memory architectures, NVMe, GPUDirect.

Cluster computing & HPC – distributed shared-memory applications, RDMA, GPU programming (CUDA), interconnection networks, ultra low-latency networking.

TCP/IP – transport layer protocols, TCP, routing protocols, multicasting, QoS & AQM, traffic engineering & analysis, libpcap, HTTP, REST API design, low-level network programming.

Selected Publications

- J. Markussen. "SmartIO: Device sharing and memory disaggregation in PCIe cluster using non-transparent bridging". *PhD thesis*. 2022.DOI: 10852/97351
- J. Markussen, L.B. Kristiansen, P. Halvorsen, H. Kielland-Gyrud, H.K. Stensland, C. Griwodz. "SmartIO: Zero-overhead Device Sharing through PCIe Networking". *ACM Transactions on Computer Systems (TOCS)*, vol. 38, no. 1–2. 2021.DOI: 10.1145/3462545