

# Jonas Markussen

## R&D Software Engineer and PhD



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### SOFTWARE ENGINEERING EXPERIENCE

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

Contributed to the SmartIO framework for high-performance, distributed I/O and resource sharing, in PCIe shared-memory clusters. Gained experience with PCIe, non-transparent bridging, cluster interconnects, RDMA, distributed shared-memory architectures, NVMe, GPU programming, Nvidia GPUDirect, driver development and Linux kernel hacking.

- Contributed to the design, implementation and evaluation of SmartIO.
- Created a distributed device driver for simultaneous sharing of a non-SRIOV NVMe among multiple hosts in a cluster.
- Implemented Linux KVM hypervisor support using VFIO mediated device drivers for assigning remote physical devices to VMs (pass-through).
- Developed a storage framework based on SmartIO and GPUDirect, providing zero-copy raw block access to NVMe's from multiple GPUs in the cluster without involving CPU in the data path.
- Developed various DMA and RDMA cluster benchmarking tools.

**Embedded & Systems Software Developer** 2014 — 2015  
Bridgetech

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

- Contributed to an MPEG transport stream parser for the VB288 content extractor using libpcap for live capturing IPTV.
- 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 (Back-end)** 2013 — 2014  
Fotoware

Worked mainly with FotoWeb, a web-based image and video archiving system with full-text metadata search and workflows based on metadata tags. Gained experience working with Apache2, MongoDB, web caches, designing REST services from the ground up, and creating HTTP endpoints with 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.

### SELECTED PUBLICATIONS

- J. Markussen, L.B. Kristiansen, P. Halvorsen, H. Kielland-Gyrd, H.K. Stensland, C. Griwodz: *SmartIO: Zero-overhead Device Sharing through PCIe Networking*. ACM TOCS (2021). DOI: 10.1145/3462545
- J. Markussen, L.B. Kristiansen, R.J. Borgli, H.K. Stensland, F. Seifert, M. Riegler, C. Griwodz, P. Halvorsen: *Flexible device compositions and dynamic resource sharing in PCIe interconnected clusters using Device Lending*. Cluster Computing (2020). DOI: 10.1007/s10586-019-02988-0
- J. Markussen, L.B. Kristiansen, H.K. Stensland, F. Seifert, C. Griwodz, P. Halvorsen: *Flexible Device Sharing in PCIe Clusters using Device Lending*. ICPP Comp. (2018). DOI: 10.1145/3229710.3229759
- L.B. Kristiansen, J. Markussen, H.K. Stensland, M. Riegler, H. Kohmann, F. Seifert, R. Nordstrøm, C. Griwodz, P. Halvorsen: *Device Lending in PCI Express Networks*. ACM NOSSDAV (2016). DOI: 10.1145/2910642.2910650
- B.R. Opstad, J. Markussen, I. Ahmed, A. Petlund, C. Griwodz, P. Halvorsen: *Latency and fairness trade-off for thin streams using Redundant Data Bundling in TCP*. IEEE LCN (2015). DOI: 10.1109/LCN.2015.7366322

### EDUCATION

**PhD, Informatics** 2015 —  
University of Oslo  
& Simula Research Laboratory  
Doctorate 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.

### OTHER JOB EXPERIENCE

**Front-end Developer** 2011 — 2013  
Fotoware

**Java Programmer** 2010 — 2011  
Redimi

**Teaching Assistant** 2009 — 2011  
University of Oslo

### SKILLS

**System architecture** – Linux kernel hacking, device drivers, ATmega & STM32 microcontrollers, embedded, PCIe, KVM, virtual machines, memory and resource virtualization, memory architectures, non-transparent bridges, NVMe, GPUDirect, x86, ARM.

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

**IP networking** – routing protocols, transport protocols, TCP, multicasting, 802.11 WLAN family, MANETs, QoS, traffic engineering, libpcap, TCP congestion control, traffic analysis, AQMs.

**Web technologies** – HTTP, REST, Ajax, FastCGI, jQuery, SQL, HTML/CSS, MongoDB, Flask, Apache2, nginx, CDNs, web caching.

### PROJECTS

**libnvm** – A software library for developing user-space NVMe drivers and storage applications. Supports GPUDirect, enabling direct data transfer into GPU memory.  
github.com/enfiskutensykkkel/ssd-gpu-dma

**analyseTCP** – Contributed to a TCP traffic analyser that looks at the per-byte latency from sent to received, useful for measuring the performance of time-dependent traffic. Supports using both sender- and receiver-side pcap traces.  
github.com/enfiskutensykkkel/analyseTCP

**EksOS** – a protected mode OS kernel for x86.