Ruslan Bukin

William Gates Building, 15 JJ Thomson Ave,
Cambridge, CB3 0FD, UK
+447522084566
br@bsdpad.com

Professional Experience

Since Sep 2014 Senior Research Software Engineer **Computer Laboratory, University of Cambridge, UK**

CHERI team

- I ported the **FreeBSD Operating System** to the **RISC-V** Instruction Set Architecture (ISA). From zero to a complete working system. The port includes kernel debugger support, symmetric multiprocessing, DTrace support, a set of device drivers. The port covers support for FPGA implementations (RocketChip), simulators and emulators (Spike, QEMU) and the real hardware (HiFive Unleashed board, HiFive Premier P550). Initial work was done in 6 months.
- I ported the **FreeBSD's bhyve hypervisor** to the **RISC-V ISA**. This includes FreeBSD and Linux multiprocessor guests.
- I developed support for **ARM System MMU v3.2** and formed **generic IOMMU framework** in the FreeBSD. This is about 1 year of work.
- I developed **Intel Software Guard Extensions (SGX)** support for FreeBSD. Intel SGX allows to manage isolated compartments "Enclaves" in user VA space. I wrote the SGX kernel driver and ported Intel Linux SGX SDK to FreeBSD. The SGX driver includes an optional linux ioctl compatibility layer.
- I developed the base FreeBSD support for the **ARM Morello Board** – the joint project **ARM Ltd**/Cambridge University. I wrote **Panfrost GPU** kernel driver for the ARM Mali Midgard/Bifrost GPUs. I wrote Mali D32 Display Processors drivers and ARM Komeda DRM parts. I wrote the Cadence I2C controller driver.
- I developed FreeBSD base support for the **ARM Neoverse N1** – a new server-class architecture (a Cortex successor) from ARM Ltd. I've developed Generic ECAM PCI-e driver.
- I developed a new real-time operating system **MDEPX** (Machdep X) from scratch. This is used in research.
- I developed the new **Hardware Tracing Framework (HWT)** for FreeBSD.
- I developed FreeBSD OS support for U.S. Government Furnished Equipment (GFE) RISC-V cores synthesized on an FPGA; developed device drivers for Xilinx Ethernet controller, Xilinx DMA engine.
- Brought up FreeBSD OS support to Intel Stratix 10, Intel Arria 10, Intel Cyclone V FPGA/ARM SoCs, including support and drivers for programming FPGA.
- Developed support for **ARM Coresight** hardware tracing technology to FreeBSD.
- I added support for ARMv7,v8 and CHERI CPUs to HWPMC (counters) framework.
- I added support for ARMv8, RISC-V to DTrace comprehensive dynamic tracing framework.
- I brought up support for some ARM and RISC-V system-on-chips including Altera SOCFPGA, Qualcomm MSM8916, lowRISC, Codasip SoC covering minimal support required.
- I wrote various device drivers for FreeBSD including Virtio MMIO bus, Synopsys DesignWare MMC controller, Synopsys DesignWare 3504-0 Universal 10/100/1000 Ethernet MAC, Generic ARM PCI controller, Cadence Quad SPI Flash controller, ARM Generic Timer, Xilinx AXI Quad SPI controller.

May 2022 – Feb 2025 Engineer **Capabilities Limited** (part time)

- I implemented memory-safety for userspace drivers and rendering: memory-safe kernel DRM, memory-safe kernel Panfrost GPU drivers, memory-safe Wayland window server, memory-safe KDE, memory-safe **mesa3d**

- I added CHERI support to **ARM Trusted-Firmware (TF-A)**. This includes BL2, BL31 bootloaders (BL1 is running in SRAM – no cheri tag controller – skipped)
- Attempt to add CHERI support to industry-standard **UEFI** (TianoCore EDKII), 30% done, stalled due to weak pointer provenance in UEFI.

Technical Skills

Languages	C, Assembly, BSD/GNU Make, Python, Shell
Technologies	Intel SGX, Intel PT, ARM Coresight, ARM TrustZone, ARM TF-A, ARM SCMI, ARM PSCI, ARM System MMU.
Instruction Sets	RISC-V, ARM Thumb, Aarch64
Operating Systems	FreeBSD, Linux, mdepx real-time OS
CAD	Cadence Orcad/Allegro, Solidworks

Links

https://github.com/freebsd/freebsd

https://github.com/machdep/mdepx

Personal blog

https://t.me/machinedependent

Publications

Panfrost Kernel Driver	https://freebsdfoundation.org/wp-content/uploads/2021/08/The-Panfrost-Driver.pdf
Defending DMA with CHERI Capabilities	https://dl.acm.org/doi/pdf/10.1145/3458903.3458910

Education

2002 – 2008 **BSc, Computer Science**,
Peoples' Friendship University of Russia, Moscow, Russia.

Personal

Nationality	**Russian, British**.
Marital status	**Single**.

Languages

First Language	**Russian**
Fluent	**English**