Nicolas Pitre

Senior Software Engineer — Embedded, Linux & Zephyr Systems

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PROFILE

Embedded and real-time systems engineer with three decades of low-level experience across bootloaders, firmware, device drivers, and OS kernels. A long-standing Linux kernel contributor and a core architect of 64-bit and Arm support in the Zephyr OS project. I work close to the metal — CPU architecture, memory management, context switching, performance — turning hard, constrained problems into clean, upstreamed solutions.

CORE EXPERTISE

Systems	OS kernels · bootloaders · firmware · device drivers · real-time · memory management
Languages	C (expert) · ARM & RISC-V assembly (expert) · C++, Rust, Python, Perl, shell
Arch	Arm (v4–v9, AArch64, SVE2, PAC/BTI) · RISC-V (32/64) · SoC bring-up
Domains	Linux & Zephyr kernel internals · SMP · MMU & demand paging · edge AI / NPUs
Protocols	TCP/IP · SSH/SSL/VPN · Ethernet · RS-232/I3C/SPI · JTAG · wireless · audio codecs
Open Source	25+ years of upstream development, maintainership, licensing & community
Roots	*hand-coding 6502 assembly on a Commodore 64 by age 13*

PROFESSIONAL EXPERIENCE

BayLibre SAS baylibre.com 2019 – present

Senior Software Engineer

BayLibre is an engineering firm specializing in Linux, Zephyr OS and open-source development, training and consulting. Selected accomplishments — over 650 Zephyr contributions to date:

- Made Zephyr **64-bit capable** from the ground up, then led the **AArch64** and **RISC-V 64** architecture ports — the foundational work behind Zephyr on application-class processors (blog: *When 32 bits isn't enough*).
- Added **ARMv9-A** support to Zephyr, including **SVE2** vector extensions and **PAC/BTI** (Pointer Authentication & Branch Target Identification) for hardware-enforced control-flow integrity.
- Implemented **demand paging** for the AArch64 architecture, including a generic LRU page-eviction algorithm.
- Rewrote the RISC-V **exception and syscall** entry path — a mega-simplification that cut the code roughly in half and sped userspace system calls by ~11× (77,000 → 7,000 cycles).
- Wrote the Zephyr **Synopsys DesignWare MAC** Ethernet driver — the project's first zero-copy Ethernet driver.
- Authored the Linux mainline **MIPI I3C Host Controller Interface** driver.
- Ported **ExecuTorch** to Zephyr to run on-device ML inference on the Arm **Ethos-U85** NPU.
- Optimized **Nordic nRF54** firmware for a consumer product — efficient real-time acquisition and low-latency wireless transmission of sensor data.
- Further kernel work: smart FPU context switching for AArch64 and RISC-V, RISC-V PMP support, the ARM64 MMU, and a wide range of upstream fixes.

Linaro Ltd. www.linaro.org 2010 – 2019

Senior Software Architect (Office of the CTO)

Linaro is a collaborative engineering organization advancing open-source software — the Linux kernel, GCC, power management and multimedia — across the Arm ecosystem.

- Designed and implemented the Linux In-Kernel Switcher (IKS) for Arm big.LITTLE.
- Tackled Linux power-management challenges at the intersection of the task scheduler, CPU frequency scaling and idle states.
- Explored making Linux usable on very small systems, upstreaming contributions such as XIP support for the CramFS filesystem.
- Investigated neural-network inference frameworks for efficient AI on Arm platforms.
- Contributed a broad range of additional patches to the Linux kernel.

Marvell Technology Group Ltd. www.marvell.com 2007 – 2010
Producer of storage, communications and consumer semiconductors, including Arm-based SoCs and wireless microcontrollers.

- Added initial mainline Linux support for the **Orion**, **Kirkwood** and **MV78xx0** SoC families.
- Completed Linux kprobes and created HighMem support for ARM32.
- Contributed Feroceon/Dragonite core support, direct NAND reflashing and semihosting to OpenOCD.
- On the Marvell 8688 Wi-Fi thermostat: rewrote the SPI-flash bootloader with bit-banging for a ~20× boot speed-up, plus a fail-safe over-the-air firmware update mechanism.

MontaVista Software, Inc. www.mvista.com 2000 – 2007
A leading provider of embedded Linux across many processor architectures.

- Created and maintained the initial Linux support for the Intel **XScale** architecture and the **PXA2xx** processor family.
- Implemented XIP and the kernel side of NPTL for Arm.
- Added kernel support for version 2 of the Arm ABI, including a mixed-ABI compatibility module; improved the SMC91x Ethernet driver with DMA.

VIPSwitch, Inc. 1999 – 2000
Developer of video/voice/data Ethernet switches and QoS IP networks.

- Ported Linux to the StrongARM-based VIPCI router board; zero-copy optimizations for a Sangoma WAN driver, and a configurable Intel NOR flash arrangement.

VisuAide, Inc. (now HumanWare) www.humanware.com 1995 – 1999
R&D of adaptive technologies for blind and visually impaired people.

- **Victor** (1997–1999): principal software architect for the first-generation Victor digital talking-book reader (StrongARM SA1100 + Linux), from design to shipping product — an architecture reused across a decade of Victor Reader generations.
- **MagNum** (1995–1996): real-time speech recorder/organizer on a TI TMS320C52 DSP, storing compressed voice on 1.44 MB floppy disks — managing that storage in real time was itself a challenge under tight resource limits.

SELECTED OPEN-SOURCE CONTRIBUTIONS

The Git Version Control System git-scm.com
Influential early contributor — most notably delta-compression heuristics and object-storage access performance, plus an Arm assembly SHA-1 implementation.

Pure-assembly soft-float routines for Arm
Hand-coded floating-point support merged into GCC (2003), *"significantly smaller and faster than the existing C-based implementation"* — an initial version already 8–25× faster, with further gains a year later.

Fixed-point audio codecs (Ogg Vorbis / Tremor, MP3 / MAD)
Released the first free fixed-point Ogg Vorbis decoder to run in real time on StrongARM, later driving major performance work in Tremor earlier, the first open-source fixed-point MP3 decoder, with Arm optimizations contributed to MAD.

Accessibility: BRLTTY, Cicero TTS, Talking Multimeter
Co-author of BRLTTY (maintainer 1997–2001), Linux console access via braille displays. Author of Cicero, a French text-to-speech engine whose rules seeded the French voice in eSpeak. Interrupt-driven software RS-232 sampler — reconstructing the data from the timing of GPIO transitions — for a talking multimeter.

PUBLICATIONS

- When 32 bits isn't enough — Porting Zephyr to RISC-V 64 · BayLibre, 2019
- *Shrinking the kernel* series — garbage collection, optimization, with an axe, with a hammer · LWN.net, 2017–2018
- The Road to Energy-Aware Scheduling · Linaro, 2015
- Teaching the scheduler about power management · LWN.net, 2014
- Linux support for Arm big.LITTLE · LWN.net, 2012
- Profiled in *An Inspiration from the Linux World* · The New Stack, 2017

EDUCATION & EARLY ACTIVITIES

École Polytechnique de Montréal www.polymtl.ca/en 1991 – 1995
B.Eng., Computer Engineering (Systems & Telecomputing)

- Director of the COMiC microcomputer committee (1994–95); co-founder and project leader of **The STEP Project**, a student-run multi-user Solaris/UNIX server providing internet services and shell accounts to the student body.

INTERESTS

Judo (black belt, 2013) · strength training · kayaking · hiking · alpine skiing · reading.