Prem **Mallappa**

Software Architect • System & Embedded Software

Bengaluru, India

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Seasoned Software Architect with extensive expertise in designing and developing high-performance embedded systems, system software, Linux kernel drivers, and virtualization technologies. Proficient in a wide range of programming and scripting languages, with a proven track record of delivering robust, scalable solutions in complex technical environments.

A highly analytical and collaborative team player, recognized for strong problem-solving abilities, logical thinking, and a passion for mastering emerging technologies. Committed to driving innovation and excellence through clean architecture, optimized code, and best-in-class engineering practices.

Experience

AMD Ltd.

Bengaluru, India

Principal Engineer

Feb. 2018 -- Present

- AMD Math Library: Optimizing exponential/power/logarithmic/trigonometric functions for latest AMD processors
- Improved performance of exp() and log() by 30% using look-up-table, Estrin's method polynomial, and fast integer conversion
- AMD Cryptographic Primitives Library: Optimizing AES/SHA/PKCS functions with AVX2 and AESNI/SHANI instruction sets
- Developed dynamic dispatcher using cpuid instruction for runtime algorithm selection
- Achieved 3x performance improvement in CFB-based parallel decrypting

Broadcom Ltd.

Bengaluru, India

Principal Engineer

Jan. 2014 -- Oct. 2016

- Designed and developed initial software support for Broadcom Vulcan, a multicore-multithreaded ARMv8 64-bit processor
- Handled SMMUv3 (IOMMU) related issues and software stack implementation
- Developed SMMUv3 emulation model for QEMU which was merged into mainline codebase
- Implemented Command queue, STE/CD parsing, pagetable walk, and Stage1/Stage2 virtualization support

Cavium India Pvt. Ltd.

Bengaluru, India

Tech Lead

May. 2011 -- Dec. 2013

- Worked on Cavium's Octeon III (MIPS64) series of processors
- Fixed major bug in KEXEC and developed MIPS port of Kexec and Kdump (patches merged upstream)
- Developed baremetal core-file generating software with host-based daemon for GDB debugging
- Designed and developed CavHv hypervisor for MIPS64 with experimental hardware virtualization

ARM Ltd.

Bengaluru, India

Sr. Development Engineer

Aug. 2005 -- Jun. 2009

- Responsible for OS porting to latest ARM cores including ARM1176JZFS, TrustZone and Cortex-A8
- Developed touch-screen driver for Symbian OS and automated testing using Python scripts
- Designed interrupt latency measurement driver for TrustZone secure world overhead analysis
- Ported L4Ka::pistachio microkernel to ARM for virtualization experiments

Sasken Communications Pvt Ltd.

Bengaluru, India

Sr. Software Engineer

Aug. 2004 -- Aug. 2005

- Module owner for EFS (Extended File System) developed for VxWorks, used in UMTS/BTS
- Developed reset-proof filesystem with wear-leveling and minimal data-loss features
- Implemented flat file tree structure optimized for Flash devices with limited read/write cycles

Global Edge Software Ltd.

Bengaluru, India

Software Engineer

Jun. 2003 -- Aug. 2004

- Designed and developed SDIO driver for Linux on Intel StrongARM boards
- Developed fast SDIO driver supporting 4-bit mode for Marvell 802.11g WiFi chipset
- Achieved maximum throughput for WiFi communication via SDIO interface

Short Stints

VSPL Ltd.

Bengaluru, India

Software Architect

Nov. 2016 -- Jan. 2018

Cisco Ltd.

Bengaluru, India

Software Engineer

Oct. 2010 -- Apr. 2011

B-Labs, London UK

Bengaluru, India

Sr. Engineer - Contractor

Nov. 2009 -- Sep. 2010

Harman International

Bengaluru, India

Engineer

Jul. 2009 -- Nov. 2009

Open Source Contributions

QEMU

2014-2016

- SMMUv3 (IOMMU) emulation support for ARMv8
- Designed and implemented SMMUv3 model merged into mainline
- Added support for Stage1, Stage2, and nested virtualization
- Implemented command queue processing and page table walk

Linux Kernel

2011-2016

- MIPS Kexec/Kdump port and IOMMU subsystem
- Developed MIPS64 port of Kexec and Kdump (merged upstream)
- Fixed critical bugs in KEXEC for Cavium Octeon platforms
- Contributed to IOMMU/SMMUv3 driver development

GLIBC

2018-2020

- Performance optimizations for AMD processors
- Fixed memcpy behaviour on AMD processors
- Optimized string functions for x86_64 architecture
- Performance improvements for memory operations

AMD LibM

2018-Present

- Open source math library for AMD processors
- Core contributor to open sourcing AMD Math Library
- Optimized transcendental functions (exp, log, pow, trig)
- Implemented SIMD/FMA optimizations for vector operations

Skills

Programming Languages	C, Assembly (x86, ARM, MIPS), Rust, Python, C++, Go, Shell, Haskell
Libraries & Frameworks	GoogleTest, GoogleBench, Hugo, Qt
Operating Systems	Linux, FreeBSD, QNX, VxWorks, Symbian
Architecture & Platforms	x86/x86_64, ARM (ARMv6, ARMv7, ARMv8), MIPS64, PowerPC
Virtualization & Hypervisors	QEMU, KVM, Xen, Custom Hypervisors, TrustZone
Development Tools	Git, Make, CMake, ARM Development Tools, Keil, Macraigor, RealView Trace/JTAG, Docker, Wordpress
Specialized Skills	Linux Kernel Development, Device Drivers, IOMMU/SMMUv3, Embedded Systems, System Software, Performance Optimization, SIMD/FMA Instructions, Cryptography (AES, SHA), Filesystem Development

Education

M.Tech (Computer Science) — *BITS Pilani*
Pilani, Rajasthan, India — *2016*

B.E (Computer Science) — *Visvesvaraya Technological University (VTU)*
AIT, Karnataka, India — *2002*

Awards

Q3 2018	**Spotlight**, Helping Emulation team find design bug in data fabric	*AMD*
Q2 2019	**Spotlight**, Optimization of exp() and improving performance by 30%	*AMD*
Q2 2019	**Director Spotlight**, Supporting Arden Ubuntu emulation boot, fixing initramfs delayed mount	*AMD*
Q4 2020	**Spotlight**, Providing important patches to GLIBC to fix memcpy behaviour on AMD, open sourcing AMD LibM	*AMD*
Q3 2021	**Spotlight**, Delivering Cryptography PoC (CFB based parallel decrypting), increases performance by 3x	*AMD*

Publications

Example Publication Title

2024

- *Authors:* Author Name, Co-Author Name
- *Venue:* Conference/Journal Name
- Brief description of the publication

Projects

AMD Ltd.

2018 – Present *Bengaluru, India*

Principal Engineer

AMD Pensando SmartNIC

Jun. 2025 – Present

Summary: Initiated as a proof-of-concept for an ISV experiencing performance issues with AES-CFB on AMD-Milan servers. Evolved into a comprehensive cryptographic primitives library.

Languages: C, ASM, P4, C++
Tools: Make, Git, P4, Qemu, Xen
Tech: SmartNIC, Storage

Contributions:

- Designed and developed parallel AES-CFB decryption algorithm achieving 3x performance improvement
- Implemented cryptographic primitives library utilizing both AVX2 and AESNI/SHANI instruction sets
- Developed dynamic dispatcher for runtime selection of most efficient algorithm
- Created OpenSSL provider to enable seamless interoperability

AMD Cryptography Library

Jan. 2022 – Jun. 2025

Summary: Initiated as a proof-of-concept for an ISV experiencing performance issues with AES-CFB on AMD-Milan servers. Evolved into a comprehensive cryptographic primitives library.

Languages: C++
Tools: Git, OpenSSL
Tech: AES, SHA2, AVX2, AESNI, SHANI

Contributions:

- Designed and developed parallel AES-CFB decryption algorithm achieving 3x performance improvement
- Implemented cryptographic primitives library utilizing both AVX2 and AESNI/SHANI instruction sets
- Developed dynamic dispatcher for runtime selection of most efficient algorithm
- Created OpenSSL provider to enable seamless interoperability

AMD Math Library

Feb. 2018 – Dec. 2021

Summary: AMD Floating Point Math Library is a high-performance software library primarily written in Assembly (x86_64) to leverage SIMD and FMA instructions. Led architectural modernization and algorithmic improvements to enhance performance and maintainability.

Languages: C, Assembly, Python
Tools: CMake, GCC, AOCC
Tech: x86_64, SIMD, FMA

Contributions:

- Implemented advanced optimization techniques including look-up-tables, Estrin's method polynomial for parallel-FMA, and fast integer conversion
- Achieved 30% performance improvement for scalar operations and approximately 2x improvement for vector operations
- Developed dynamic dispatcher using cpuid instruction for runtime algorithm selection
- Redesigned architecture with cache-aligned and interleaved tables

Sr. Member of Technical Staff

Model0

Feb. 2018 – May. 2021

Summary: Initiated as a proof-of-concept for an ISV experiencing performance issues with AES-CFB on AMD-Milan servers. Evolved into a comprehensive cryptographic primitives library.

Languages: C, ASM, P4, C++
Tools: Make, Git, P4, Qemu, Xen
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Contributions:

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- Created OpenSSL provider to enable seamless interoperability

Broadcom Ltd.

2011 – 2016 *Bengaluru, India*

Principal Engineer

ARM IO Virtualization with SMMUv3

Jan. 2014 – Oct. 2016

Summary: SMMUv3 is ARM's IOMMU implementation for ARMv8 platforms. Developed comprehensive emulation environment and software model to facilitate driver development.

Languages: C
Tools: QEMU, Git
Tech: ARMv8, SMMUv3, IOMMU

Contributions:

- Designed and developed complete SMMUv3 emulation model for QEMU (merged into QEMU mainline)
- Implemented command queue processing, STE and CD parsing mechanisms
- Developed ARMv8/LPAE pagetable walk implementation supporting Stage1, Stage2, and nested translation
- Implemented comprehensive event reporting and interrupt handling mechanisms

SMMUv3 Driver for Vulcan

Jan. 2014 – Oct. 2016

Summary: Vulcan is Broadcom's ground-up ARMv8 processor design featuring up to 32 cores with 4 threads each. The SoC integrates SMMUv3 requiring comprehensive software support.

Languages: C
Tools: Git, Linux Kernel
Tech: ARMv8, SMMUv3, IOMMU

Contributions:

- Designed and developed initial Linux driver for SMMUv3 with minimal feature set
- Collaborated with hardware team to identify and resolve design issues
- Contributed bug fixes and enhancements to ARM's open-source SMMUv3 driver
- Developed comprehensive test suite for validating SMMU functionality

Tech Lead

XLP (MIPS64) SDK Development

May. 2011 – Dec. 2013

Summary: XLP is Broadcom's multicore+multithreaded MIPS64 processor featuring up to 80 execution cores with integrated hardware accelerators for networking.

Languages: C
Tools: Linux Kernel, Git
Tech: MIPS64, RNG, CLK Framework

Contributions:

- Developed RNG (Hardware Random Number Generator) driver for cryptographic applications
- Implemented Clock Framework driver for dynamic frequency management
- Created CPU voltage and frequency scaling driver for power optimization
- Developed CDE (Compression/Decompression Engine) driver

Cavium Networks

2011 – 2013 *Bengaluru, India*

Tech Lead

OCTEON III - Kexec/Kdump

May. 2011 – Dec. 2013

Summary: Kexec enables booting a secondary kernel from running Linux without full system reset. Kdump builds upon Kexec to preserve crashed kernel memory for offline debugging.

Languages: C
Tools: Linux Kernel, GDB
Tech: MIPS64, Kexec, Kdump

Contributions:

- Developed complete MIPS architecture port of Kexec and Kdump
- Debugged and resolved critical issues preventing Kexec functionality
- Submitted two patches to upstream Linux kernel, now part of mainline codebase
- Enabled seamless kernel upgrades without disrupting Hybrid SMP configurations

CavHv Hypervisor

Jan. 2012 – Dec. 2013

Summary: CavHv is an experimental hypervisor for MIPS64 with hardware virtualization support, developed for Octeon-III series chips.

Languages: C
Tools: Compiler Toolchain
Tech: MIPS64, Hypervisor, Virtualization

Contributions:

- Designed and implemented hypervisor based on draft MIPS virtualization specification
- Collaborated with compiler and hardware teams to validate virtualization extensions
- Successfully demonstrated concurrent execution of two Linux kernel instances
- Provided critical feedback for virtualization specification refinement

Cisco Systems

2010 – 2011 *Bengaluru, India*

Software Engineer

Garbage Detector for Linux

Oct. 2010 – Apr. 2011

Summary: Cisco IOS runs both as bare-metal and as Linux application, often executing for months or years before memory leak failures.

Contributions:

- Designed and implemented garbage detection system using custom C runtime
- Developed separate monitoring thread to intercept malloc() and free() calls
- Implemented intrusive mark-and-sweep algorithm
- Enabled proactive memory leak identification in long-running systems

Languages: C
Tools: Glibc, Clearcase
Tech: Memory Management, Mark-Sweep

B-Labs

2009 – 2010 *London, UK (Remote)*

Sr. Engineer - Contractor

CodeZero Hypervisor

Nov. 2009 – Sep. 2010

Summary: CodeZero is a microkernel-based hypervisor for ARM Cortex-A9 running directly on hardware.

Contributions:

- Ported CodeZero hypervisor to ARM Cortex-A9 SMP systems
- Developed optimized fast memcpy implementation for ARM
- Extended QEMU with new device and platform support
- Ported Linux kernel to run under CodeZero hypervisor

Languages: C, ARM Assembly
Tools: Git, QEMU
Tech: ARMv7, ARMv6, SMP

Harman International

2009 – 2009 *Bengaluru, India*

Engineer

QNX BSP for PowerPC

Jul. 2009 – Nov. 2009

Summary: Porting QNX microkernel to Freescale QorIQ P4080 and P2020 PowerPC processors.

Contributions:

- Debugged and resolved P4080 SMP booting issue
- Ported I2C driver to new PowerPC platform
- Developed base drivers including timer and interrupt controller
- Enabled early QNX boot on P2020 and P4080 platforms

Languages: C
Tools: Make, QNX
Tech: PowerPC, P4080, P2020, SMP

ARM Ltd.

2005 – 2009 *Bengaluru, India*

Sr. Development Engineer

OS Support for ARM Cores

Aug. 2005 – Jun. 2009

Summary: Platform team responsible for supporting new ARM cores across multiple operating systems.

Contributions:

- Developed touch-screen driver for Symbian OS with full gesture support
- Created Symbian OS test automation framework using Python
- Designed interrupt latency measurement driver for TrustZone analysis
- Ported L4Ka::pistachio microkernel to ARM

Languages: C, ARM Assembly, Python
Tools: FastModels, SoCDesigner
Tech: ARM1176, Cortex-A8, TrustZone

Sasken Ltd.

2004 – 2005 *Bengaluru, India*

Sr. Software Engineer

EFFS Filesystem

Aug. 2004 – Aug. 2005

Summary: Developed specialized filesystem for UMTS BTS on VxWorks.

Contributions:

- Designed reset-proof filesystem with flat file tree structure
- Developed wear-leveling algorithm for Flash blocks
- Implemented atomic write operations
- Integrated with VxWorks APIs

Languages: C
Tools: VxWorks
Tech: Flash Storage, Wear-Leveling

Global Edge Software

2003 – 2004 *Bengaluru, India*

Software Engineer

Linux SDIO Driver

Jun. 2003 – Aug. 2004

Summary: Developed high-performance SDIO driver for Marvell 802.11g WiFi chipset.

Contributions:

- Designed fast SDIO driver supporting 4-bit mode
- Developed 1-bit SDIO driver for legacy hardware
- Optimized data transfer protocols for maximum throughput
- Implemented robust error handling mechanisms

Languages: C
Tools: Linux Kernel, Make
Tech: ARM, SDIO, WiFi 802.11g