

# Sharadh Rajaraman

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## Experience

### PetaGene Ltd

Cambridge, United Kingdom

Software and Test Engineer (C++11, AWS SDK, GNU Autotools, CMake, POSIX)

Aug 2023 – Present

- Added options to compile codebase with Clang and link-time optimisation (LTO) to reduce binary size by 20% and improve performance by 10%.
- Migrated entire 500 KLOC codebase from Linux-only to macOS and Windows.
- Led build tools transition from GNU Autotools and shell script to vcpkg and CMake, thus reducing build and CI run times by a factor of 10, enhancing developer productivity and enabling IDE usage.
- Implemented graphical front-end for codebase in C# using Avalonia UI framework to simplify cross-platform bring-up.

### National University of Singapore (NUS) School of Computing (SoC)

Singapore

Undergraduate Teaching Assistant

Aug 2020 – Nov 2022

- CS1101S Programming Methodology, CS2100 Computer Organisation, CS3241 Computer Graphics, CS4247 Real-time Rendering.
- Conducted weekly tutorials and recitations, prepared materials and videos for students, and marked assignments.
- Set up auto-grading harness for computer graphics assignments to automate marking by comparing framebuffers and pixel errors.

### Government Technology Agency, Singapore (GovTech)

Singapore

Embedded Software Engineering Intern (Sensors and IoT Division: C/C++, CMake, STM32)

May 2022 – Aug 2022

- Implemented a C++ wrapper over Linux Serial Peripheral Interface (SPI) syscall interface. Reduced wheel-reinvention, and improved linkage for other projects using C++.
- Implemented firmware on an STM32 microcontroller in C++ to emulate a Trusted Platform Module (TPM) over I<sup>2</sup>C for Raspberry Pi (rPi). Improved security on the rPi, and saved costs on purpose-built TPMs.

## Skills

**Languages** C++, C#, Python, Java,  $\LaTeX$ , GLSL/HLSL, F#, TypeScript, PowerShell

**Frameworks & Tools** OpenGL, DirectX, Vulkan, OpenMP, CUDA

## Projects and Open-Source

### vulkan.cppm (Merge request)

C++20 module for Vulkan-Hpp (C++, CMake)

- Modified a code generator to output a C++20 module interface file for the Vulkan-Hpp wrapper library.
- Exported C macros and function-like macros as `constexpr` variables and functions, thus improving type safety and performance.
- Tested with Clang on Linux and MSVC on Windows.

### Oat Compiler

Compiler for [Oat language](#) (OCaml, Menhir)

- Front-end outputs a subset of LLVM IR; back-end compiles IR to a subset of x86\_64 assembly.
- Includes compile-time type-checking and optimisations e.g. constant folding, dead-code elimination, and register allocation with graph colouring.

### cache-sim (Repository)

Quad-core cache-coherence simulator (C++20, CMake)

- Implements MESI, MOESI, and Dragon cache-coherence protocols.
- Correctly simulates cache-coherence behaviour of a real quad-core CPU, is configurable (cache size, associativity), and outputs statistics in .csv format.

### Static Program Analyser

Lexer and parser for a C-like toy language (C++17)

- Lexer implemented with `std::regex` state machine; parser is recursive-descent.
- Inserts information such as variable declarations, function calls, and control flow into a database about a given program written in the toy language.

## Education

### National University of Singapore

Singapore

Bachelor of Computing (Honours) in Computer Science; 2nd Major in Physics

Aug 2018 – May 2023

- Computer science: parallel computing; real-time computer graphics; operating systems; compiler design.
- Physics: astrophysics; quantum mechanics; solid-state physics.

## Extracurriculars

### Indian classical music

Carnatic vocal, violin

Sept 2003 – Present

- Completed diploma in Carnatic vocal music in 2012 and violin in 2013
- Performed solo in Singapore, Chennai, and Melbourne since 2010
- Conducted workshops and classes on Carnatic music theory and practice for beginners

### NUS Astronomical Society (NUSAS)

Singapore

Honorary General Secretary, AstroHead

Sept 2018 – Aug 2022

- Organised outreach events and pavement/sidewalk astronomy with public libraries and schools
- Assisted in 2019 Boxing Day solar eclipse event, managed ~5 telescopes, and introduced public to basic astronomy
- Prepared and delivered talks on topics in astronomy to club members