

ARM Tools for HPC

ARM

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ARM User Group, SCI16
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ARM HPC Tools team

The mission:

Enable the software ecosystem for large-scale ARM systems.

Current team of 30, from an initial team of 9 in July 2014

Based in Manchester, UK.

Research Compilers

New compiler technology to support and evaluate next-generation ARM architecture.

ARM Performance Libraries

Commercially-supported BLAS, LAPACK and FFT routines optimized for ARM-compatible microarchitectures.

Userspace Performance Tools

New commercial tools to deliver actionable performance improvement advice to software developers.

Open Source HPC

Identification of issues in ARM builds of open-source packages and the upstreaming of fixes.

Commercial HPC products simplify the ecosystem

- Supported
 - ARM support channels help our users to:
 - Deploy and use our tools.
 - Develop and tune for the ARM architecture itself.
- Integrated
 - Tested together.
 - Easy to install.
 - Tightly coupled workflows to maximise productivity.
- Performant
 - At least better than the default OS options.
 - Aim for best-of-breed performance.

Extending our HPC portfolio in 2016

Adding breadth to address the needs of our partners



ARM Performance Libraries

AVAILABLE NOW

ARM C/C++ Compiler

DECEMBER 2016

ARM Code Advisor

BETA DECEMBER 2016

Adding depth with support for next-generation ARM HPC architectures with Scalable Vector Extensions



ARM SVE Performance Libraries

DECEMBER 2016

ARM SVE C/C++ Compiler

DECEMBER 2016

ARM Instruction Emulator

DECEMBER 2016

ARM Performance Libraries

Optimized BLAS, LAPACK and FFT

Commercial 64-bit ARMv8 math libraries

- Commonly used low-level math routines - BLAS, LAPACK and FFT.
- Validated with NAG's test suite, a de-facto standard.

Best-in-class performance with commercial support

- Tuned by ARM for Cortex-A72, Cortex-A57 and Cortex-A53.
- Maintained and Supported by ARM for a wide range of ARM-based SoCs.
- Regular benchmarking against open source alternatives.

Silicon partners can provide tuned micro-kernels for their SoCs

- Partners can collaborate directly working with our source-code and test suite.
- Alternatively they can contribute through open source route.



Performance on par
with best-in-class math libraries



Commercially Supported
by ARM



Validated with
NAG test suite

ARM Performance Libraries

Version 2.0: Improving performance and interoperability

BLAS

- Enhanced parallelism for BLAS level 1.
- Hand-tuned kernels for BLAS level 3.

LAPACK

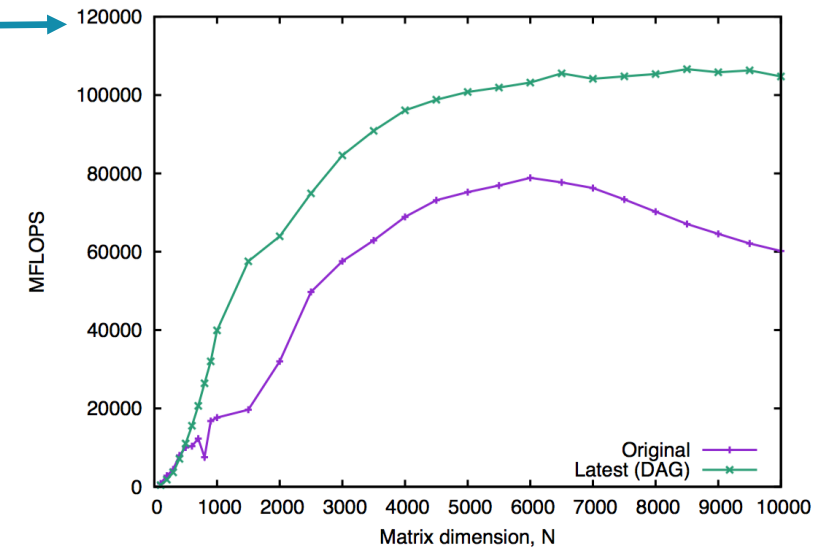
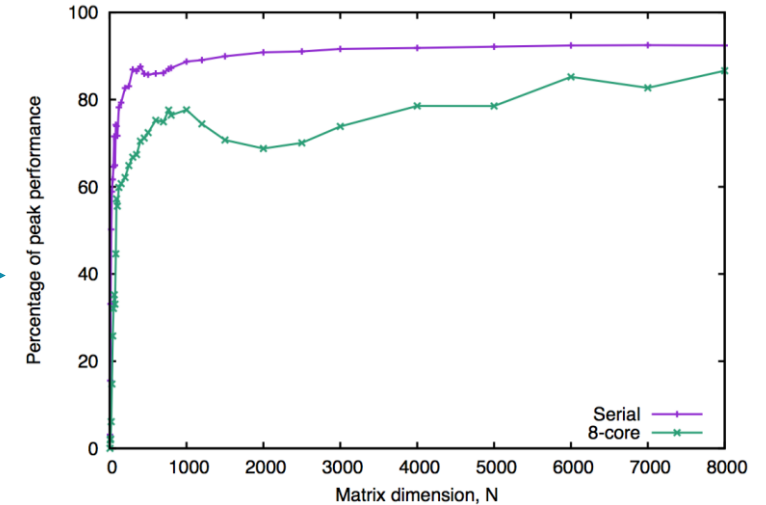
- Added PLASMA-style Directed Acyclic Graphs for better parallelism.

FFTW Interface

- Support for FFTW-compatible basic and advanced DFT interfaces.

Scalable Vector Extensions

- Libraries built with SVE-capable compilers.
- Hand-written DGEMM and SGEMM kernels.



ARM C/C++ Compiler

Commercially supported C/C++ compiler for Linux user-space HPC applications

LLVM-based

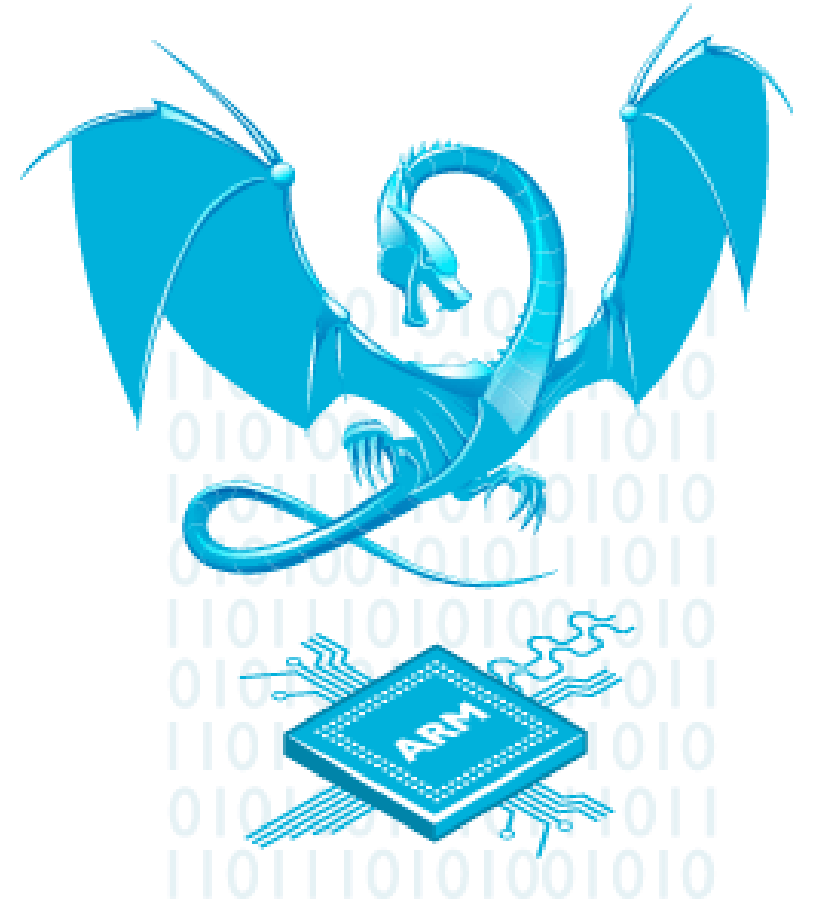
- ARM-on-ARM compiler
- For application development (not bare-metal/embedded like ARM Compiler 6).

Regularly pulls from upstream LLVM, adding:

- SVE support in the assembler, disassembler, intrinsics and autovectorizer.
- Compiler Insights to support ARM Code Advisor.

OpenMP

- Uses latest open-source (now ARM-optimized) LLVM OpenMP runtime.
- Changes pushed back to the community.



ARM Code Advisor (Beta)

Combines static and dynamic information to produce actionable insights

Performance Advice

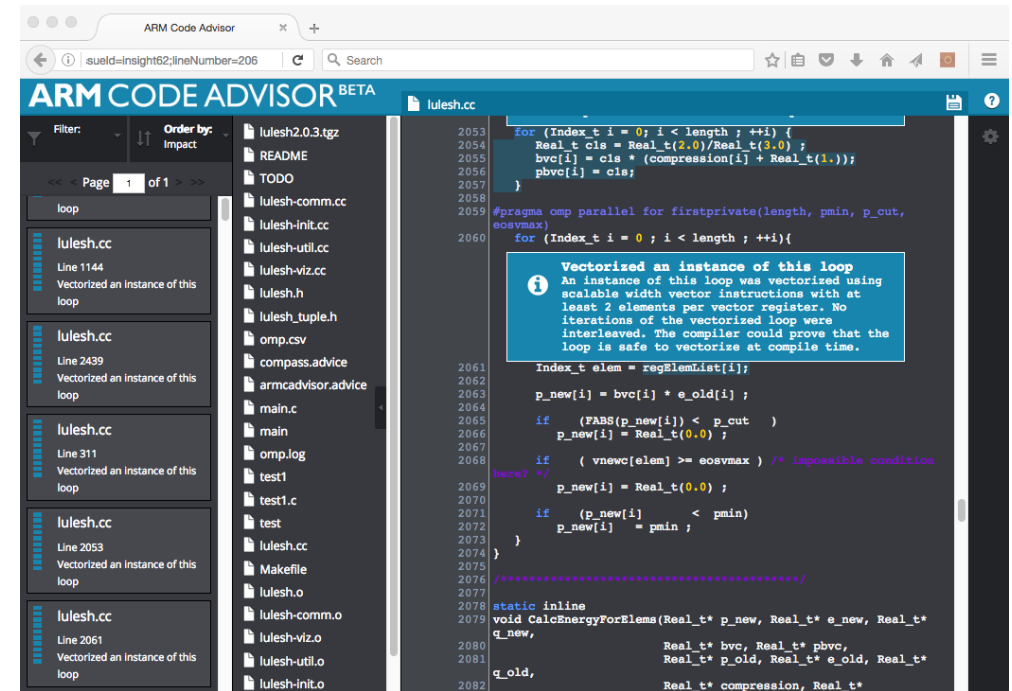
- Compiler vectorization hints.
- Compilation flags advice.
- Fortran subarray warnings.
- OpenMP instrumentation.

Insights from compilation and runtime

- **Compiler Insights** are embedded into the application binary by the ARM Compilers.
- OMPT interface used to instrument OpenMP runtime.

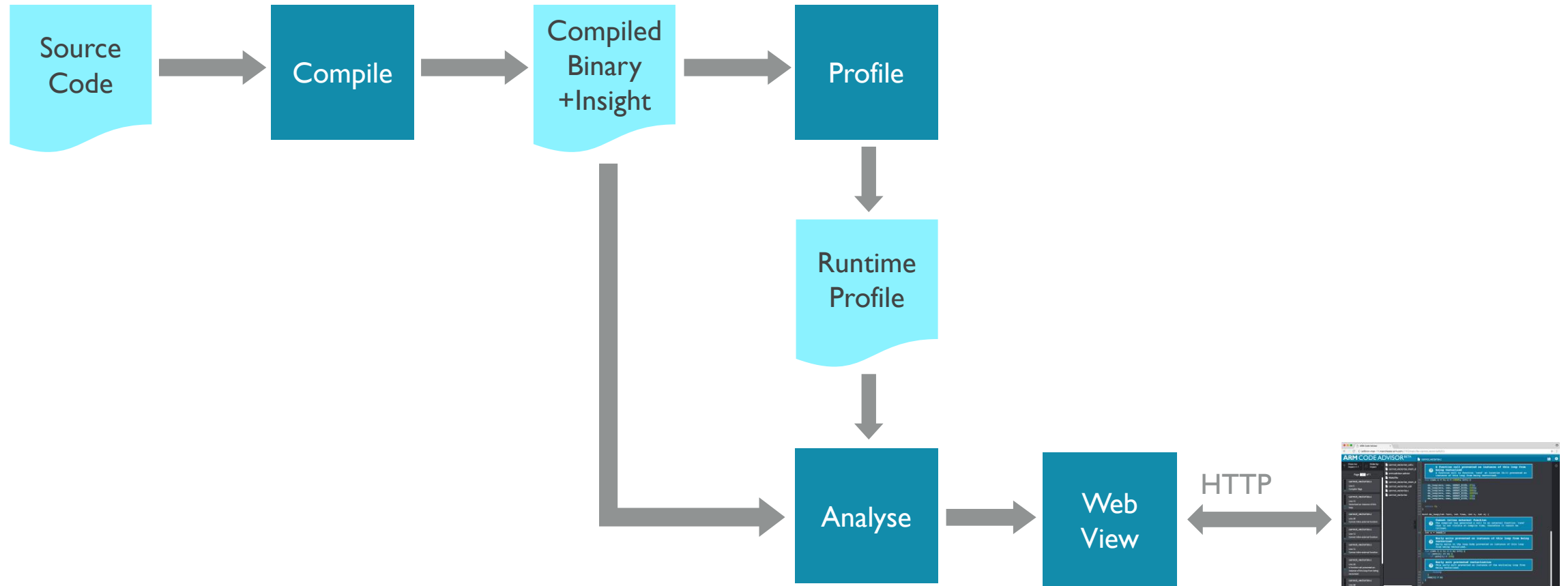
Extensible Architecture

- Users can write plugins to add their own analysis information.
- Data accessible via **web-browser**, **command-line**, and **REST API** to support new user interfaces.



ARM Code Advisor (Beta)

Typical workflow



ARM Instruction Emulator

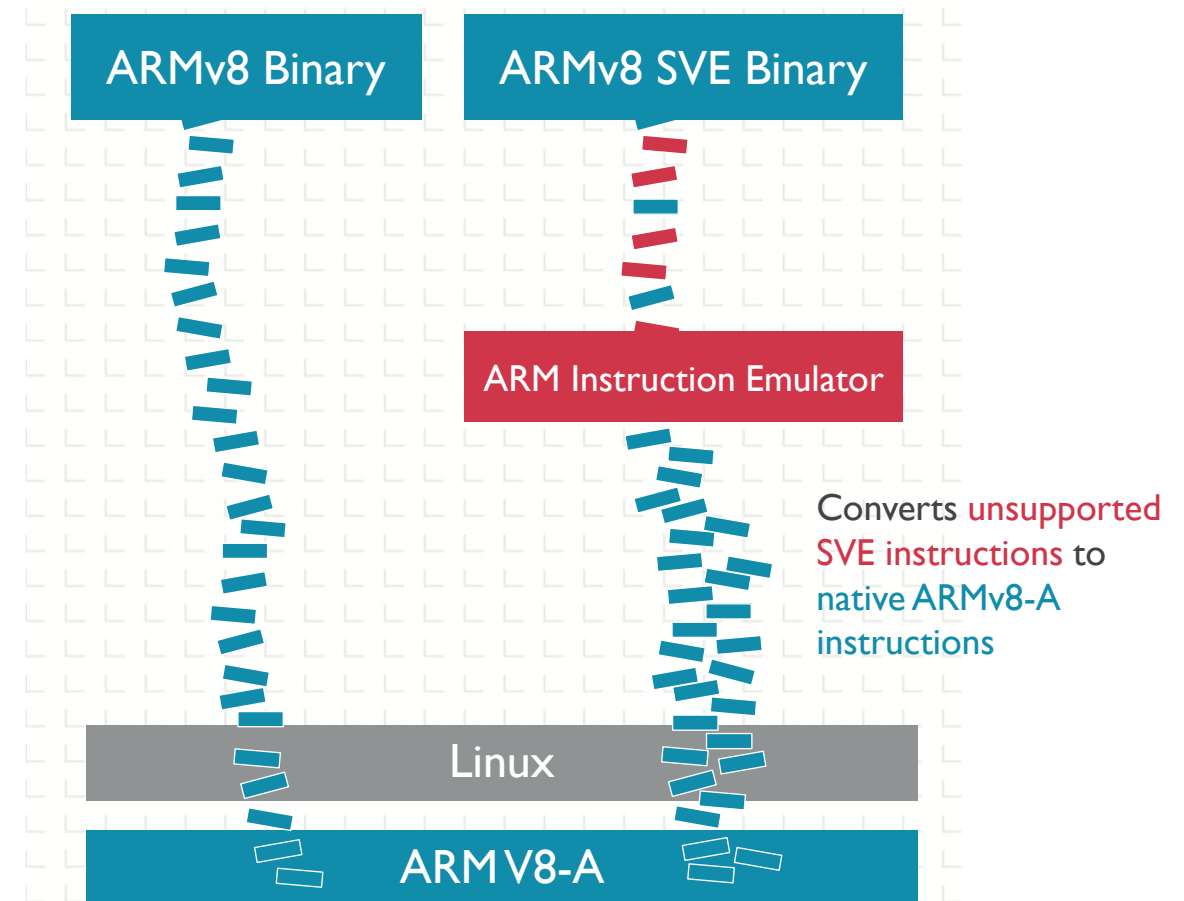
Run SVE binaries at near native speed on existing ARMv8-A hardware

Trap-and-emulate of illegal userspace instructions

- For application development (not bare-metal/embedded like ARM Fast Models).
- Natively supported instructions run at full speed.
- Unsupported instructions are faithfully emulated in software.

Full integration with ARM Code Advisor

- Plugin allows ARM Instruction Emulator to provide hotspot information and other metrics.
- Command-line integration allows ARM Code Advisor workflows to seamlessly integrate with ARM Instruction Emulator.



ARM HPC Products from arm.com/hpc

Supported, Integrated and Performant, available December 2016.

ARM Compiler for HPC

- ARM C/C++ Compiler
- ARM Performance Libraries
- GCC 6.0

ARM SVE Compiler for HPC

- ARM C/C++ SVE Compiler
- ARM SVE Performance Libraries
- GCC 6.0
- ARM Instruction Emulator
- GCC for SVE with LLVM OpenMP

ARM Code Advisor Beta

- ARM Code Advisor
- ARM C/C++ Compiler
- gfortran with LLVM OpenMP for ARM Code Advisor

Looking to 2017...

- Enhance performance across the portfolio, close the gap between LLVM and GCC.
- Extend the portfolio with LLVM Fortran, integrated OpenMPI...
- Deploy these products to our partners, improve our products, and be essential.

Talk to us!

Floor plan as of: 09/06/2016



- Visit arm.com/hpc for further details of the products and Code Advisor Beta.
- Talk to us in the Exhibit hall, booth 4033
- Mail us at hpc@arm.com with your questions.

ARM

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