

Overview

Arm High Performance Computing Tools

Arm High Performance Computing tools deliver market leading tools for debugging, profiling and optimization of software on any HPC platform, including x86 based platforms. Arm also offers a software development environment to support high performance applications for Armv8-A hardware and achieving optimum efficiency with a specially tuned studio of everything developers need from compilers and libraries to parallel debugger and profilers.

Arm Forge Ultimate

Arm Forge Ultimate brings everything software engineers need to build reliable and optimized code that creates the right results on multiple high performance computing (HPC) architectures. The suite allows users to debug, profile and tune for optimal performance—on everything from single threads to complex parallel HPC and scientific codes with MPI (message passing interface) OpenMP, threads, or NVIDIA CUDA. Arm Forge Ultimate supports debugging and profiling for codes using the latest compilers and C++ 11 standards, to Intel and 64-bit Arm hardware.

Arm Forge Professional brings together Arm DDT and Arm MAP into a single intuitive interface to provide the ideal package for software development and optimization:

- **Arm DDT** is the No. 1 debugger in research, industry and academia for software engineers and scientists developing C++, C, or Fortran parallel and threaded applications on CPUs, GPUs, Intel, and Arm. Arm DDT is a powerful tool for automatic detection of memory bugs. Different detection and insightful data view offer easy way to understand and fix problems.
- **Arm MAP** is a profiler helping to find bottlenecks in computation, communication, synchronization or I/O. Its high-speed, accurate low-overhead measurement and visual scalability tackle even the most challenging performance issues. Whether at one process or 10,000, Arm MAP is designed to work out-of-the-box with no need for instrumentation and no danger of creating large, unmanageable data files. Software engineers developing parallel and threaded applications on CPUs, GPUs, Intel and Arm rely on Arm MAP's insight into optimization.

Arm Allinea Studio, HPC Professional & Essential Edition

Arm Allinea Studio provides tools designed to get applications ready-to-run with optimal performance on Armv8-A systems. The Studio offers everything needed to create, migrate and innovate serial and parallel codes within an Arm-based Linux, Fortran or MPI system.

What is in Arm Allinea Studio:

C/C++ Compiler - LLVM based commercial compiler with support for C++14 standard and tuned for server and HPC workloads on a wide range of Arm-based platforms.

Fortran Compiler - Commercial fortran compiler, provided by Arm, with support for Fortran 2003 and prior standards, to meet the needs of the scientific and HPC communities on the Arm architecture.

Performance Libraries - Commercial 64-bit Armv8-A math libraries for optimal serial and parallel performance.

Forge - A integrated suite for debugging, profiling and optimization that supports the latest Armv8-A architecture.

Performance Reports - Analyze application performance on the latest Armv8-A architecture.



Standard Features

Usage Scenarios	
Requirement	Recommended Solution
Require only compiler and libraries.	Arm Allinea Studio - Essential edition, as it provides compiler and libraries.
Require limited debug and profile support in addition to compilers and libraries.	Arm Allinea Studio - HPC Professional edition, as it provides Forge and Performance reports that can be used for HPC applications with upto 64 MPI processes running on 4 or less nodes.
Require debug and profile support for applications with more than 64 MPI processes and/or running more than 4 cluster nodes, in addition to compiler and libraries.	Buy separate licenses for Arm Allinea Studio - Arm Forge Ultimate. 1. Arm Allinea Studio - Essential edition for compilers and libraries. 2. Arm Forge Ultimate for debug and profiling support.



Service and Support

HPE Pointnext - Service and Support

Get the most from your HPE Products. Get the expertise you need at every step of your IT journey with **HPE Pointnext Services**. We help you lower your risks and overall costs using automation and methodologies that have been tested and refined by HPE experts through thousands of deployments globally. HPE Pointnext **Advisory Services** focus on your business outcomes and goals, partnering with you to design your transformation and build a roadmap tuned to your unique challenges. Our **Professional** and **Operational Services** can be leveraged to speed up time-to-production, boost performance and accelerate your business. HPE Pointnext specializes in flawless and on-time implementation, on-budget execution, and creative configurations that get the most out of software and hardware alike.

Consume IT on your terms

HPE GreenLake brings the cloud experience directly to your apps and data wherever they are—the edge, colocations, or your data center. It delivers cloud services for on-premises IT infrastructure specifically tailored to your most demanding workloads. With a pay-per-use, scalable, point-and-click self-service experience that is managed for you, HPE GreenLake accelerates digital transformation in a distributed, edge-to-cloud world.

- Get faster time to market
- Save on TCO, align costs to business
- Scale quickly, meet unpredictable demand
- Simplify IT operations across your data centers and clouds

Managed services to run your IT operations

HPE GreenLake Management Services provides services that monitor, operate, and optimize your infrastructure and applications, delivered consistently and globally to give you unified control and let you focus on innovation.

Recommended Services

HPE Pointnext Tech Care.

HPE Pointnext Tech Care is the new operational service experience for HPE products. Tech Care goes beyond traditional support by providing access to product specific experts, an AI driven digital experience, and general technical guidance to not only reduce risk but constantly search for ways to do things better. HPE Pointnext Tech Care has been reimagined from the ground up to support a customer-centric, AI driven, and digitally enabled customer experience to move your business forward. HPE Pointnext Tech Care is available in three response levels. Basic, which provides 9x5 business hour availability and a 2 hour response time. Essential which provides a 15 minute response time 24x7 for most enterprise level customers, and Critical which includes a 6 hour repair commitment where available and outage management response for severity 1 incidents.

<https://www.hpe.com/services/techcare>

HPE Pointnext Complete Care

HPE Pointnext Complete Care is a modular, edge-to-cloud IT environment service that provides a holistic approach to optimizing your entire IT environment and achieving agreed upon IT outcomes and business goals through a personalized and customer-centric experience. All delivered by an assigned team of HPE Pointnext Services experts. HPE Pointnext Complete Care provides:

- A complete coverage approach -- edge to cloud
- An assigned HPE team
- Modular and fully personalized engagement
- Enhanced Incident Management experience with priority access
- Digitally enabled and AI driven customer experience

<https://www.hpe.com/services/completecure>



Configuration Information

Arm Forge Ultimate

Commercial Licenses (For all usage other than in degree granting academic institutions)

ARM Forge Ultimate 32 Processes 1 Architecture Commercial 1-year LTU

Q5U73A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

ARM Forge Ultimate 64 Processes 1 Architecture Commercial 1-year LTU

Q5U75A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

ARM Forge Ultimate 256 Processes 1 Architecture Commercial 1-year LTU

Q1Z87A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

ARM Forge Ultimate 1024 Processes 1 Architecture Commercial 1-year LTU

Q5U71A

Notes:

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- Includes one (1) year of support from Arm.
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Educational Licenses (For usage in degree granting academic institutions)

ARM Forge Ultimate 32 Processes 1 Architecture Education 1-year LTU

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- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

ARM Forge Ultimate 64 Processes 1 Architecture Education 1-year LTU

Q5U81A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

ARM Forge Ultimate 256 Processes 1 Architecture Education 1-year LTU

Q1Z97A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.



Configuration Information

ARM Forge Ultimate 1024 Processes 1 Architecture Education 1-year LTU

Q5U77A

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Arm DDT

Commercial Licenses (For all usage other than in degree granting academic institutions)

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ARM DDT 64 Processes 1 Architecture Commercial 1-year LTU

R7L73AAI

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

R7L74AAI

ARM DDT 256 Processes 1 Architecture Commercial 1-year LTU

Notes:

- This is a floating commercial license. The number of processes can be shared across multiple users. Please order one (1) license per solution or base system.
- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

R7L75AAI

ARM DDT 1024 Processes 1 Architecture Commercial 1-year LTU

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- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Educational Licenses (For usage in degree granting academic institutions)

ARM DDT 64 Processes 1 Architecture Educational 1-year LTU

R7L76AAI

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ARM DDT 256 Processes 1 Architecture Educational 1-year LTU

R7L77AAI

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ARM DDT 1024Processes 1 Architecture Educational 1-year LTU

R7L78AAI

Notes:

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- Includes one (1) year of support from Arm.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.



Configuration Information

Arm Allinea Studio

Commercial Licenses (For all usage other than in degree granting academic institutions)

ARM Allinea Studio 64 Processes 1 Architecture Commercial 1yr Support E-LTU

Q9M78AAE

Notes:

- This is a floating commercial license.
- This provides C/C++/Fortran compilers and libraries and starter licenses for debug and profiling. Order additional Arm Forge Professional SKUs for debugging and profiling applications with more than 64 MPI processes and/or more than 4 cluster nodes.
- The number of processes (64) cannot be shared across multiple users when using Forge and Performance Reports.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Arm Allinea Studio Essentials Commercial 1yr Support E-LTU

Q9S35AAE

Notes:

- This is a floating commercial license.
- This provides C/C++/Fortran compilers and libraries.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Educational Licenses (For usage in degree granting academic institutions)

ARM Allinea Studio 64 Processes 1 Architecture Education 1yr Support E-LTU

Q9M79AAE

Notes:

- This is a floating license for educational degree granting entities.
- This provides C/C++/Fortran compilers and libraries and starter licenses for debug and profiling. Order additional Arm Forge Professional SKUs for debugging and profiling applications with more than 64 MPI processes and/or more than 4 cluster nodes.
- The number of processes (64) cannot be shared across multiple users when using Forge and Performance Reports.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Arm Allinea Studio Essentials Education 1yr Support E-LTU

Q9S36AAE

Notes:

- This is a floating license for educational degree granting entities.
- This provides C/C++/Fortran compilers and libraries.
- This is an annual subscription license. Please note the software will stop working when the subscription term ends.

Distribution

Media and Software Documentation

Arm Forge Professional and Arm Allinea Studio are available for download. Customers will receive an entitlement certificate via physical shipment. The entitlement certificate must be redeemed online in order to obtain a license key, to download the software, and to register for support.

Customers may also download user guides and other documentation at

<https://developer.arm.com/products/software-development-tools/hpc/documentation>



Technical Specifications

Arm Forge Ultimate

Installation

Arm DDT, an industry-leading parallel debugger, and Arm MAP, a low-overhead line-level profiler for MPI and OpenMP are now part of one common environment: Arm Forge.

One installation provides everything needed to debug, fix, and profile programs at any scale, limited only by the license. This simplifies installation and maintenance overhead, as well as provides one common, familiar interface for all development tools, making it easy to move between them while working on a piece of code. Users may start Arm Forge with ddt or map and can easily switch to the other tool with a single click while working.

Remote Clients

Arm Forge has native remote clients for Windows, Mac OS X and Linux that can connect via SSH to any server or cluster using an existing login process. Users can then run, debug, profile, edit and compile files directly on the remote machine. The native remote client experience is superior to X forwarding or VNC-based solutions.

Arm Forge Ultimate- Technical Features at a Glance

Features	Arm Forge Ultimate
Scalable debugging	✓
Scalable profiling	✓
Memory debugging	✓
CPU, MPI and I/O profiling	✓
Native remote client	✓
Version control integration	✓
CPU hardware counters ¹	✓
Full GPU profiling and debugging	✓
Energy performance metrics	✓
Custom metrics API	✓

Notes: ¹ Support for both PAPI and the Linux Performance interface available

Arm DDT

Arm DDT is a powerful, easy-to-use graphical debugger capable of debugging a wide variety of scenarios found in modern development environments. With Arm DDT, it is possible to debug:

- Single process and multi-threaded software
- OpenMP
- Parallel MPI software
- Heterogeneous software, such as that written to use GPUs
- Hybrid codes mixing paradigms such as MPI + OpenMP, or MPI + CUDA
- Multi-process software of any form, including client-server applications

Arm DDT is designed to make teams more productive. It includes static analysis that highlights potential problems in the source code, integrated memory debugging that can catch reads and writes outside of array bounds, integration with MPI message queues and much more. It provides a complete solution for finding and fixing problems whether on a single thread or hundreds of thousands of threads.



Technical Specifications

Arm DDT supports all of the compiled languages that are found in mainstream and high-performance computing, including:

- C, C++, and all derivatives of Fortran, including Fortran 90
- Limited support for Python (CPython 2.7)
- Parallel languages/ models including MPI, UPC and Fortran 2008 co-arrays
- GPU languages such as HMPP, OpenMP accelerators, CUDA and CUDA Fortran

While many users choose Arm DDT for desktop development or for debugging on small departmental parallel machines, it is also scalable and fast to beyond Petascale, and is depended upon to debug hundreds of thousands of processes simultaneously.

Arm MAP

Arm MAP is a parallel profiler that identifies which lines of code took the most time and why, without requiring careful configuration or prior experience with profiling tools. Arm MAP features:

- Support for MPI, OpenMP and single-threaded programs
- Small data files; all data is aggregated on the cluster and only a few megabytes written to disk, regardless of the size or duration of the run
- Syntax-highlighted source code with performance annotations, allowing users to collapse blocks of code and functions, or drill down to the performance of a single line
- Just 5 percent application slowdown even with thousands of MPI processes
- Both interactive and batch modes for gathering profile data
- A rich set of zero-configuration metrics, showing memory usage, floating-point calculations and MPI usage across processes, including:
 - The percentage of vectorized instructions, including AVX extensions, used in each part of the code
 - The amount of time spent in memory operations varies over time and processes
 - Click and drag to zoom into specific regions of computation and explore them in detail
 - A display that enlightens users than drown them in data; everything is visually scalable, using aggregation across processes and cores to deliver an immediate overview that highlights regions of imbalance in the code

Operating System Compatibility

Arm Forge Professional is operational on Red Hat Enterprise Linux (RHEL) 5, 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; and Ubuntu 12.04 and 14.04.

Message Passing Interface (MPI) Compatibility

Arm Forge Professional is compatible with the following message passing interface (MPI) libraries:

- Intel MPI
- MPICH
- MVAPICH
- Open MPI
- Platform MPI
- **HPE Performance Software - Message Passing Interface**



Technical Specifications

Compiler Compatibility

Arm Forge Professional is compatible with the following compilers:

- GNU 4.3.2 and above
- Intel 13 and above
- PGI 13.10 and above
- Arm Compiler 18.0 and above

Hardware Compatibility

Arm Forge Professional is supported on the following Gen9 and Gen10 HPE systems:

- HPE Apollo systems, including Apollo 2000, 6000 and 6500
- HPE SGI 8600 system
- HPE Apollo pc40, Apollo sx40 and Apollo kl20 systems
- HPE ProLiant servers, including the DL server line
- HPE Apollo 70

For more information, please contact your Hewlett Packard Enterprise sales representative.

Arm Allinea Studio

Installation

Detailed description on how to install Arm Allinea Studio are available on Arm website

<https://developer.arm.com/products/software-development-tools/hpc/downloads>.

Arm Allinea Studio can be downloaded by selecting these 3 options on the Arm website:

- Arm Compiler
- Arm Forge (additional Arm Forge Professional licences can be purchased to debug and profile codes that are running on more than 4 cluster nodes and/or with greater than 64 processes)
Arm Performance Reports (only for systems up to 4 cluster nodes)

Features Component

C/C++ Compiler

Arm C/C++ Compiler is an enhanced commercial compiler that meets the needs for scientific computing, HPC and enterprise on Arm architecture offering:

- Best performance from the C/C++ application on any 64-bit Arm in minimal time
- Built on LLVM for overall compiler infrastructure with clang as C/C++ front end. This allows users to benefit from advances from these projects in addition to specific tuning by Arm for Arm architecture.
- Support for the latest C/C++ standards - C++14 and prior standards
- Support for OpenMP 4.5 (No offloading support)
- Interoperability with Arm Forge and Arm Performance Libraries
- Support and advice from Arm engineers during porting and tuning to achieve maximum performance
- Full support for Scalable Vector Extension (SVE) – highly suitable for HPC

Fortran Compiler

Arm Fortran Compiler is tuned scientific computing and HPC workloads running on 64-bit Arm-based platforms and offers:

- Optimal code utilizing the salient features of the hardware allowing for the best performance out-of-the-box
- Based on two community-driven projects - LLVM for overall compiler infrastructure and Flang for Fortran frontend. This allows users to benefit from advances from these projects in addition to specific tuning by Arm for Arm architecture
- Support for the latest Fortran standards
- Interoperability with Arm Forge and Arm Performance Libraries
- Support and advice from Arm engineers during porting and tuning to achieve maximum performance
- Full support for Scalable Vector Extension (SVE) – highly suitable for HPC



Technical Specifications

Performance Libraries

Arm Performance Libraries are a commercial math library meeting the needs of scientific computing and HPC community on Arm architecture offering:

- Algorithms written to exploit vector engine within the single core and large number of cores within the processor, allowing partners to fully exploit the capabilities available in the hardware.
- Tuning to vendor's micro-architecture for the best out-of-the-box performance
- Validation with the NAG suite, thereby ensuring accurate results when used in scientific computing applications
- Support for:
 - BLAS and LAPACK
 - FFTW with FFTW compatible API
 - Available for GCC and Arm Compiler

Forge

Description as per "Arm Forge Professional" section

Notes:

- Available in HPC Professional Edition, with support for debugging and profiling applications with up to 64 MPI processes and running on 4 or less nodes.
- Additional licences for "Arm Forge Professional" need to be purchased to debug/profile applications with more than 64 MPI processes and/or running on more than 4 nodes.

Performance Reports

Arm Performance Reports are a non-intrusive performance tool for HPC and scientific software. They analyze the applications running on the system to seek inefficiencies and pinpoint exactly where to focus the optimization work.

A report measures overall information about the computation, communication and I/O providing detail for each of these areas, including:

- The time spent in various categories of instruction: memory access, numeric operations, floating point operations
- I/O – time and the effective performance (transfer rate) of read and write operations to storage
- Memory – the mean and peak usage of memory per node
- Communication – MPI time and performance for collective and point-to-point operations
- Threads – the time spent in computation and synchronization, the physical core utilization and system load
- GPUs – the utilization and memory use of NVIDIA CUDA GPUs
- Energy – the energy pack add-on reports energy usage and peak power – for system, CPU and any NVIDIA GPUs

Notes:

- Available in HPC Professional Edition, with support for analyzing applications with up to 64 MPI processes and running on 4 or less nodes.
- Additional licence for "Arm Performance Reports" need to be purchased directly from Arm to analyze applications with more than 64 MPI processes and/or running on more than 4 nodes.

Arm Allinea Studio supports leading Linux distributions including Red Hat 7.2+, SLES 12+ and Ubuntu 16.04+

Arm Allinea Studio is supported on the following HPE system:

- HPE Apollo 80

Support

Support for Arm Forge Ultimate and Arm Allinea Studio is direct-to-vendor. Information about support processes will be provided at the point of providing a license key to Arm.



Summary of Changes

Date	Version History	Action	Description of Change
15-Nov-2021	Version 5	Changed	Service and Support section was updated
01-Feb-2021	Version 4	Changed	Overview, Standard Features, Configuration Information and Technical Specifications sections were updated
16-Nov-2020	Version 3	Changed	Overview and Standard Features sections were updated
5-Feb-2018	Version 2	Updated	Update name and QuickSpecs information throughout the whole document
4-Dec-2017	Version 1	New	New QuickSpecs



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