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## Overview

### TotalView by Perforce

#### HPE High Performance Computing Software: Perforce TotalView for HPC

TotalView for HPC is a scalable and intuitive debugger for parallel applications written in C, C++, and Fortran that simplifies and shortens the process of developing, debugging and optimizing complex applications. Purpose-built for multicore and parallel computing, TotalView for HPC delivers a set of tools providing unprecedented control over processes and thread execution, along with deep visibility into program states and data.

#### TotalView for HPC includes the following tools to make debugging as easy as possible:

- Data visualization: visibility into program data and variables
- Type transformation: transform your custom data structures into a simpler form for debugging
- Advanced memory debugging: dynamic memory debugging features
- Evaluation points: evaluate expressions to go beyond simply looking at data values
- TVScript: unattended batch debugging
- Reverse debugging: record and replay, debugging race conditions and deadlocks in Linux® applications
- Remote display: connect from a Linux and Windows system

#### TotalView supports the following key technologies:

- Laptops to supercomputers: laptops, workstations, servers, departmental clusters, and supercomputers
- C and C++: comprehensive support for templates and standard template libraries
- Fortran: includes concepts such as common blocks and modules
- Multiprocess with MPI: support for 20 different MPI implementations
- Multithreaded processes: Debugging multithreaded applications with pthreads, OpenMP TBB
- Xeon Phi: support for debugging Intel Xeon Phi
- OpenPOWER Linux PowerLE: support for debugging on the OpenPOWER Little-Endian platform
- Accelerator support: debug programs that use CUDA or OpenACC to leverage NVIDIA GPUs
- ARM64 support
- Mixed language Python – C/C++ support

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## What's New

- Record testing through scripting, helping with continuous integration workflow in a giving a debuggable reproduction of testing:
    - Minimizes time needed to reproduce failures
    - Allows developers to focus on fixing actual bugs in program
    - Based on proven ReplyEngine and TVScript technologies
    - Includes added benefits like reverse debugging
  - New functionality added to the user interface for mixed language debugging with Python and C/C++:
    - Enables viewing of a fully integrated call stack across language barriers
    - Examine data passed between the layers
    - Automatic detection of Python code
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## Standard Features

### Distribution Media and Software Documentation

TotalView for HPC is available for download. Upon order delivery, customers will receive an entitlement certificate, which includes a URL to the Perforce licensing portal. Customers will need to visit the specified URL and enter their entitlement ID to download TotalView for HPC and complete their support setup.

Customers may also download user guides and other documentation at <https://totalview.io/support>

### Sessions Manager

TotalView for HPC includes a Sessions Manager, a graphical user interface (GUI) to manage debugging sessions. Users leverage the manager to load a new program, to attach to a program, or to debug a core file. The manager keeps track of debugging sessions and enables users to save, edit or delete any previous session. Users can duplicate a session and then edit its configuration to test programs in a variety of ways.

### Interface

TotalView for HPC provides an easy-to-use graphical user interface (GUI) and a command line interface (CLI). The GUI and CLI are well integrated, allowing users to use them together. Users may launch the CLI from the GUI and invoke CLI commands that display data in the GUI. Users also have the option to use each interface separately.

- The GUI is an easy and quick way to access most of the TotalView for HPC features, allowing users to dive into almost any object for more information. Such objects include variables, functions, breakpoints, or processes. Data is graphically displayed so users can easily analyze problems in array data, memory data, call tree graph, or a message queue graph.
- The CLI provides an extensive set of commands to enter into a command window. These commands are embedded in a version of the Tcl command interpreter. Users can enter any Tcl statements from any version of Tcl into a CLI window, or make use of TotalView-specific debugging commands. These additional commands are native to Tcl so users can leverage Tcl to manipulate their programs. The end result is using the CLI to create custom commands or perform any kind of repetitive operation.

### Stepping and Breakpoints

In TotalView for HPC, breakpoints are a type of action point. TotalView for HPC has four different breakpoints:

- A breakpoint stops execution of processes and threads that reach it.
- An eval point executes a code fragment when it is reached.
- A barrier point synchronizes a set of threads or processes at a location.
- A watchpoint monitors a location in memory and stops execution when it changes.

Users can set action points in their program by selecting the boxed line numbers in the Source Code pane of a process window. A boxed line number indicates that the line generates executable code. Once the breakpoint is set on the line, an icon will appear. Selecting the icon clears the breakpoint.

When a program reaches a breakpoint, it stops. Users can resume or control program execution in any of the following ways:

- Use the single-step commands
- Use the set program counter command to resume program execution at a specific source line, machine instruction, or absolute hexadecimal value.
- Set breakpoints at lines the user chooses, and let the program execute to the breakpoint.
- Set conditional breakpoints that cause a program to stop after it evaluates a condition that the user defines.

### Data Display and Visualization

TotalView for HPC provides comprehensive and flexible tools for developers to explore large and complex data sets. The TotalView for HPC data window supports browsing through complex structures and arrays. Powerful slicing and filtering helps developers manage arrays of thousands or even millions of elements. Key features include:

- Data watchpoints provide answers to questions about how data is changing.
- Built-in graphical visualization displays a quick view of complex numerical data.
- Type transformations, especially C++ View, help display data in a meaningful way.



## Standard Features

### Tools for Multi-threaded and Parallel Applications

TotalView for HPC is designed to debug multi-process, multi-threaded programs, with a rich feature set to support finegrained control over individual or multiple threads and processes. This level of control makes it possible to quickly resolve problems like deadlocks or race conditions in a complex program that spawns thousands of processes and threads across a broad network of servers.

When a program creates processes and threads, TotalView for HPC can automatically bring them under its control, whether they are local or remote. If the processes are already running, TotalView for HPC can acquire them as well, avoiding the need to run multiple debuggers.

TotalView for HPC places a server on each remote processor at the time of launch, then communicates with the main TotalView process. This debugging architecture gives users a central location from which they can manage and examine all aspects of their program.

### Batch and Automated Debugging

Users can set up unattended batch debugging sessions using the TotalView for HPC scripting tool, TVScript. First, the user defines a series of events that may occur within the target program. TVScript loads the program under its control, sets breakpoints as necessary, and runs the program. At each program stop, TVScript logs the data for review when the job has completed.

Users can also execute message passing interface (MPI) programs using TVScript. While batch debugging of large-scale MPI applications through TVScript has long been a powerful tool, TVScript is fully certified to handle 1024 process jobs, 2048 threads per process, or more than two million running operations.

### Debugging on a Remote Host

Using the Remote Display Client, users can easily set up and operate a TotalView debug session that is running on another system. A licensed copy of TotalView must be installed on the remote machine; however, the customer does not need an additional license to run the client.

The client also supports submission of jobs to batch queuing systems, such as **Altair PBS Professional®** and Load Leveler.

Using the TotalView Server, users can debug programs located on remote machines. Debugging a remote process is similar to debugging a native process, although performance depends on the load on the remote host and network latency. TotalView runs and accesses the process tvdsr on the remote machine.

### CUDA Debugger

The TotalView for HPC CUDA debugger is an integrated debugging tool capable of simultaneously debugging CUDA code running on the host system and the NVIDIA® GPU. CUDA support is an extension to the standard version of TotalView, and is capable of debugging 64-bit CUDA programs. Debugging 32-bit CUDA programs is currently not supported.

Supported features include:

- Debug a CUDA application running directly on GPU hardware
- Set breakpoints, pause execution, and single step in GPU code
- View GPU variables in PX registers, and in local, parameter, global, or shared memory
- Access runtime variables, such as threadIdx, blockIdx, and blockDim
- Debug multiple GPU devices per process
- Support for the CUDA MemoryChecker
- Debug remote, distributed and clustered systems
- All host debugging features are supported, except ReplyEngine



## Standard Features

### Memory Debugging

TotalView for HPC includes a fully integrated version of the MemoryScape product for debugging memory issues. MemoryScape can monitor how the program uses malloc() and free() and related functions.

MemoryScape is also available as a standalone product.

### Reverse Debugging

ReplayEngine records all program activities as it executes within TotalView for HPC. After recording information, users can move forward and backward by function, line or instruction. They can examine data and state in the past, as if it were a live process. Using ReplayEngine eliminates the cycle of starting and restarting common in debugging and greatly helps in finding hard-to-produce bugs.

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## Operating System

### Compatibility

Perforce TotalView for HPC is operational on:

- Red Hat® Enterprise Linux 6, and 7
- Red Hat Fedora 23, 24 and 25
- Ubuntu 14.04, 15.04, 15.10, and 16.04
- Open SuSE 12 and 13
- SuSE Linux Enterprise Server 11 and 12

### Supported Compilers

Perforce TotalView for HPC supports the following compilers for Linux x86-64 platforms:

- **Intel Parallel Studio XE 15-17**
- GNU 4.3-6.2
- PGI Workstation 11.2-16.1
- Oracle Studio 12
- C and C++: LLVM Clang 3.3 – 3.5
- Fortran: Absoft Pro 16
- Fortran: Lahey Fortran 6.2 - 8

### Supported Message Passing Interface (MPI) Products

Perforce TotalView for HPC supports the following MPI products for Linux x86-64 platforms:

- Argonne MPICH and MPICH2
- GNU SLURM
- Intel MPI
- Open MPI
- OSU MVPICH and MVAPICH2
- **HPE Performance Software – Message Passing Interface**

### Hardware Compatibility

Perforce TotalView for HPC 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
- ARM processor-based Apollo 70 system
- HPE ProLiant servers, including the DL server line

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



Standard Features

Support

Support for Perforce TotalView for HPC is direct-to-vendor. Information about support processes will be provided at the point of providing a license key to Perforce.



Configuration Information

Configurations

TotalView license and support is a token-based approach where each token is tied to an application process. Configurations need to include the total number of concurrent processes needed to run through the software. Once the total number of processes is determined select the corresponding term of license and support: 1 year, 3 years, 4 years and 5 years. If more than 512 concurrent processes is needed reach out to Software Product Management for custom quotes from Perforce.

| Description                                  | SKU      |
|----------------------------------------------|----------|
| TotalView 32 Processes 1-year Support E-LTU  | S2L38AAE |
| TotalView 64 Processes 1-year Support E-LTU  | S2L39AAE |
| TotalView 128 Processes 1-year Support E-LTU | S2L40AAE |
| TotalView 256 Processes 1-year Support E-LTU | S2L41AAE |
| TotalView 512 Processes 1-year Support E-LTU | S2L42AAE |
| TotalView 32 Processes 3-year Support E-LTU  | S2L43AAE |
| TotalView 64 Processes 3-year Support E-LTU  | S2L44AAE |
| TotalView 128 Processes 3-year Support E-LTU | S2L45AAE |
| TotalView 256 Processes 3-year Support E-LTU | S2L46AAE |
| TotalView 512 Processes 3-year Support E-LTU | S2L47AAE |
| TotalView 32 Processes 4-year Support E-LTU  | S2L48AAE |
| TotalView 64 Processes 4-year Support E-LTU  | S2L49AAE |
| TotalView 128 Processes 4-year Support E-LTU | S2L50AAE |
| TotalView 256 Processes 4-year Support E-LTU | S2L51AAE |
| TotalView 512 Processes 4-year Support E-LTU | S2L52AAE |
| TotalView 32 Processes 5-year Support E-LTU  | S2L53AAE |
| TotalView 64 Processes 5-year Support E-LTU  | S2L54AAE |
| TotalView 128 Processes 5-year Support E-LTU | S2L55AAE |
| TotalView 256 Processes 5-year Support E-LTU | S2L56AAE |
| TotalView 512 Processes 5-year Support E-LTU | S2L57AAE |



Summary of Changes

| Date        | Version History | Action  | Description of Change                                |
|-------------|-----------------|---------|------------------------------------------------------|
| 03-Feb-2025 | Version 4       | Changed | New SKUs updated                                     |
| 15-Nov-2021 | Version 3       | Changed | Service and Support section was updated              |
| 16-Nov-2020 | Version 2       | Changed | Overview and Standard Features sections were updated |
| 4-Dec-2017  | Version 1       | Created | Created QuickSpecs for Perforce TotalView Software   |



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