

Intel® System Debugger 2018 for System Debug Installation Guide and Release Notes

Installation Guide and Release Notes for Windows* host

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1 Introduction

This Intel® System Debugger 2018 release provides a Windows* 7, 8 or 10 hosted cross-debug solution for software developers to debug kernel sources and dynamically loaded drivers and kernel modules on devices based on the Intel® architecture. It does so using one of the supported JTAG target probes listed under the System Requirements.

Beyond the JTAG communication device the debugger also offers convenient and in-depth access to underlying hardware properties through a powerful graphical user interface (GUI). This makes it an ideal assistant for initial platform bring-up, firmware, BIOS, OS and device driver debugging. A set of features providing in-depth access to the development platform complete the offering for system developers:

- Execution trace support using LBR (last branch record), RTIT (real-time instruction tracing and Intel® PT (Intel® Processor Trace) for identifying incorrect execution paths or memory accesses
- Support for UEFI firmware debug via JTAG as well as EDKII (EFI Development Kit) debug agent
- Graphical representation of the page translation table with full access of the descriptor tables
- Flashing Support available upon request

These debugger capabilities minimize the time it takes to isolate and correct platform and system level problems.

This document provides system requirements, installation instructions, issues and limitations, and legal information.

Note:

Intel® System Debugger is available with Intel® System Studio. The Intel® System Studio without JTAG distributions are clearly labeled as such. To find out more about the installation and purchase options, please go to <https://software.intel.com/en-us/intel-system-studio/try-buy> .

1.1 Technical Support and Documentation

The default installation directory of the Intel® System Studio including the Intel® System Debugger, in the following also called <INSTALLDIR>, is

```
For Linux Target: C:\IntelSWTools\system_studio_2018
```

For Windows Target: C:\Program Files (x86)\IntelSWTools

This installation directory can be specified by the user with a 'Custom' installation. The product however is being installed in a fixed directory structure below <INSTALLDIR>.

All documentation about the Intel® System Debugger 2018 and its components can be found under

<INSTALLDIR>\documentation_2018\en\debugger\system_studio_2018\system_debugger\

An overview document with getting started information about all components included in the Intel® System Debugger (system debug, system trace and WinDbg extension) is located at:

<INSTALLDIR>\documentation_2018\en\debugger\system_studio_2018\overview.html

If you did not register your debugger during installation, please do so at the [Intel® Software Development Products Registration Center](#). Registration entitles you to free technical support, product updates and upgrades for the duration of the support term.

To submit issues related to this product please visit the [Online Service Center](#) webpage and submit issues under the product **Intel(R) System Studio**.

Additionally you may submit questions and browse issues in the [Intel® System Studio User Forum](#).

For information about how to find Technical Support, product documentation and samples, please visit <http://software.intel.com/en-us/intel-system-studio>.

Note: If your distributor provides technical support for this product, please contact them for support rather than Intel.

1.2 Product Contents

- Intel® System Debugger 2018 for System Debug and System Trace
- Eclipse* 4.6 Neon, Eclipse* CDT and additional debug extensions
- Intel® Dfx Abstraction Layer (Intel® DAL) v1.9.9400
- Open IPC Debug Library v1.17029
- Intel® ITP XDP3 Driver 2.0.3.0
- Intel® DCI Driver 1.7.0.0

2 What's New in Intel® System Debugger 2018 Update 1

No changes.

3 System Requirements

If you have any doubts about installation requirements, please check the [Prerequisites Guide](#)

3.1 Host Software Requirements

1. Microsoft* Windows* 7, 8 and 10 64bit.
2. 64bit Java runtime environment (JRE) 1.7 or newer to use the Eclipse* framework. In a web browser, access www.java.com , and download and install JRE 1.7 or higher. Ensure that the Java runtime environment is 64 bit. (Go to <http://www.java.com/en/download/manual.jsp> and select “Windows Offline (64-bit)”).

64-bit host system:

3. Microsoft .NET Framework 4 (dotNetFx40_Full_x86_x64.exe)
4. Microsoft .NET Framework 3.5 SP1 runtime (pre-installed by default on Microsoft* Windows* 7)
5. Microsoft Visual C++ 2008 Redistributable Package version 9.0.30729 (vcredist9_x86_x64.exe)
6. Microsoft Visual C++ 2010 SP1 Redistributable Package version 10.0.30319 (vcredist10_x86_x64.exe)
7. Microsoft Visual C++ 2012 Redistributable Package version 11.0.61030 (vcredist_x64.exe)

Microsoft* Visual Studio* redistributables will be installed automatically if they are not found on the system.

3.2 Target Software Requirements

The target platform should be based on one of the following environments:

- Bare metal, BIOS, firmware environment
- Yocto Project* 1.4 – 1.6 on
 - Intel® Atom™ Processor Z5xx, E6xx, E3xxx, C2xxx
 - 4th Gen or newer Intel® Core™ Processor
- Android* 4.0.x -4.4.x on
 - Intel® Atom™ Processor Z2400, Z2500, Z2700, Z3680, Z37xx
 - 4th Gen Intel® Core™ U-Processor Line

- Wind River* Linux* 4, 5, 6 on
 - Intel® Atom™ Processor Z5xx, E6xx, E3xxx, C2xxx
 - 4th Gen Intel® Core™ Processors
- Tizen* IVI 2.x, 3.x on
 - Intel® Atom™ Processor E3xxx

3.3 Host Hardware Requirements

- Second generation Intel® Core™ i5 processor or Intel® Core™ i7 processor.
- 2GB RAM
- 10GB free disk space for all product features and all architectures
- USB 2.0 host interface

3.4 Target Hardware Requirements

- Intel® In-Target Probe eXtended Debug Port
- JTAG Device
 - Intel® ITP-XDP3
- One of the following target platforms:
 - Intel® development kit based on the Intel® Atom™ Processor E6xx
 - Intel® development kit based on Intel® Atom™ Processor Z36xx, Z37xx - 2 cores (Baytrail / MinnowBoard MAX)
 - Intel® development kit based on Intel® Atom™ Processor C2xxx
 - Intel® development kit based on Intel® Atom™ Processor Z24xx, Z25xx, Z27xx
 - Intel® development kit based on Intel® Atom™ Processor E38xx, Z3680, Z37xx
 - Intel® Atom™ x7 Z8700 & x5 Z8500/X8400 processor series (Cherry Trail)
 - Intel® development kit based on 4th, 5th, 6th and 7th generation Intel® Core™ and Intel® Xeon™ Processor
 - Intel® development kit based on 5th generation Intel® Core™ M Processor

Note: Please find more details about debugger startup support for specific JTAG probe and target CPU/Platform combinations under section *5.1 Starting the Debugger*

3.5 Ordering Connection Device for Intel® System Debugger

3.5.1 Intel® ITP-XDP3

To order the Intel® ITP-XDP3 device, please

1. Go to <https://designintools.intel.com/>, select the Debug Tools product category and add ITP-XDP BR3 to your cart.
2. or contact the Hibbert Group* at Intelvtg@hibbertgroup.com and request the VTG order form.

We will also gladly assist with the ordering process. If you have any questions please submit an issue in the Intel® System Studio product of Online Service Center <https://supporttickets.intel.com> or send an email to IntelSystemStudio@intel.com.

3.5.2 Intel® SVT Closed Chassis Adapter

To order the Intel® SVT Closed Chassis Adapter (CCA) device, please

Go to <https://designintools.intel.com/>, select the Debug Tools product category and select the Intel® SVT Closed Chassis Adapter. https://designintools.intel.com/product_p/itpxdpsvt.htm

For assistance with the ordering process or if you have any questions please submit an issue in the Intel® System Studio product of Online Service Center <https://supporttickets.intel.com> or send an email to IntelSystemStudio@intel.com.

3.5.3 Intel® DCI USB Native Debug Class

To order the Intel® DCI USB Native Debug Class (DbC) device, please go to the websites

- A-to-A 1.0 meter: https://designintools.intel.com/product_p/itpdciamam1m.htm
- A-to-A 1.5 meter: https://designintools.intel.com/product_p/itpdciamam2m.htm
- A-to-C 1.0 meter:
<https://designintools.intel.com/ProductDetails.asp?ProductCode=ITPDCIAMCM1M>
- C-to-C 1.0 meter: https://designintools.intel.com/product_p/itpdcic2cd2u1m.htm

4 Installation

4.1 Note on Microsoft* Visual Studio generated UEFI debug

The debugger is dependent on a shared library provided by Microsoft* for access to debug information generated with the Microsoft* compiler. In some cases this library will not be correctly registered on the host system, which will lead to an error message when trying to load symbols for modules (e.g. EFI modules) that are compiled using the Microsoft* toolchain. The user can resolve this issue by manually registering the correct library using an administrator command prompt.

From a command line window go to:

```
C:\Program Files (x86)\Common Files\microsoft shared\VC
```

Run:

```
regsvr32 msdia90.dll
```

if the msdia90.dll file is not found there, reinstall the Microsoft* Visual C++ 2008 Redistributable Package after downloading it from Microsoft's website

4.2 Product Installation (Online Installer)

The Intel® System Debugger 2018 on Windows* host component of the Intel® System Studio 2018 is available as part of a downloadable online installer. If you only intend to install the Intel® System Debugger you can thus reduce the package size that is downloaded for the actual install. Using the online installer requires to be connected to the internet and that https protocol based component downloads are permitted by your firewall.

Double-click on the executable file (system_studio_2018.0.xxx_online.exe) to begin installation. And follow the installer guidance.

The default installation directory is <INSTALLDIR>

4.3 Product Installation (Full Product)

The Intel® System Debugger 2018 on Windows* is part of the Intel® System Studio 2018 downloadable installer. Double-click on the executable file (system_studio_2018.0.xxx.exe) to begin installation and follow the on-screen instructions.

If you have any doubts about installation requirements, please check the [Prerequisites Guide](#)

The default installation directory is <INSTALLDIR>

4.4 Installing Intel® XDP3 JTAG Probe

The Intel® ITP-XDP3 driver is automatically installed as part of the Intel® System Debugger installation process.

4.5 Uninstalling the Product

Run setup.bat file present in <INSTALLDIR> directory and follow steps in order to uninstall the product.

To also uninstall the Intel® ITP-XDP3 driver please select

- Windows Driver Package – Intel Corporation ... ITP_ON_USB as well.

5 Intel® System Debugger Usage Notes

5.1 Starting the Debugger

Intel® System Debugger is now integrated into Intel® System Studio IDE and is recommended to be started through this IDE. However, in case of issues with this new way of starting the debugger, the older way of starting the debugger (through startup scripts) can also be used. Both are explained below.

5.1.1 Through Intel® System Studio IDE

To start the Intel® System Debugger, go to <INSTALLDIR> and run `iss_ide_eclipse-launcher.bat` that opens Intel® System Studio IDE. In the menu, click on Intel System Studio > System Debugger > Launch System Debugger

For details on how to start a debugging session, please refer to [Getting Started with the Intel® System Debugger 2018 - System Debug](#).

- **System Debugger Demo Application**

Allows basic debugging of a little demo application running under Simics

- **System Debugger for Intel Atom processor**

Allows the user to debug Intel Atom Processors/Platforms using the Intel® ITP-XDP3 device with support of:

- Intel Atom Processor Z36xx, Z37xx - 2 cores (Baytrail / MinnowBoard MAX)
- Intel Atom Processor C2xxx (Avoton)
- Intel Atom Processor E6xx (Tunnel Creek)
- Intel Atom Processor E6xx (Tunnel Creek) – overlay
- Intel Atom Processor x5-Z8xxx, x7-Z8700 (Cherry Trail)
- Intel Atom Processor E3805, E382x, Z3680 - 2 cores (Valleyview)
- Intel Atom Processor E384x, Z37xx - 4 cores (Valleyview)

With using the Intel® ITP-XDP3 (MOFD) and Intel® ITP-XDP3B (MOFD) JTAG probes the following processors are supported:

- Intel Atom Processor Z35xx (Anniedale/Moorefield)

Allows the user to debug Intel Atom Processors/Platforms using Intel(R) DCI USB 3.x Debug Class with support of:

- Intel Atom Processors N4200, N3350, x7-E3950, x5-39xx (Apollo Lake)
- Intel Atom Processor C3xxx (Denverton)

- **System Debugger for Intel Core processor**

Allows the user to debug Intel Core Processors/Platforms using the Intel® ITP-XDP3 device with support of:

- 4th Gen Intel Core Processors (Haswell)
- 4th Gen Intel Core U-Processor Line (Haswell ULT)
- 5th Gen Intel Core Processor (Broadwell)
- 6th Gen Intel Core Processor (Skylake)
- 7th Gen Intel Core Processor (Kaby Lake)

Allows the user to debug Intel Core Processors/Platforms using the Intel® SVT Closed Chassis Adapter (DCI-OOB) device with support of:

- 6th Gen Intel Core Processor (Skylake)
- 7th Gen Intel Core processor (Kaby Lake) / Intel 100 Series chipset (SunrisePoint PCH-H)
- 7th Gen Intel Core processor (Kaby Lake) / Intel 200 Series chipset (Kaby Lake PCH-H)

Allows the user to debug Intel Core Processors/Platforms using Intel(R) DCI USB 3.x Debug Class with support of:

- 7th Gen Intel Core processor (Kaby Lake) / Intel 100 Series chipset (SunrisePoint PCH-H)
- 7th Gen Intel Core processor (Kaby Lake) / Intel 200 Series chipset (Kaby Lake PCH-H)

- **System Debugger for Other processors**

Allows the user to debug following Processors/Platforms using Intel(R) DCI USB 3.x Debug Class with support of

- Intel Xeon Scalable Processor (Skylake-SP) / Intel C620 Series Chipset (Lewisburg)

- **System Debugger UEFI Agent**

Allows the user to debug UEFI BIOS over serial connection. See Agent Based UEFI Debugging for more details.

5.1.2 Using startup scripts in installation directory

Alternatively to invoking the debugger from Intel® System Studio IDE, you can also run xdb.bat batch startup script from the following installation directory:

<INSTALLDIR>\system_debugger_2018\system_debug\

5.2 Handling of Target Access Issues

Please ensure that the target system is running a recent firmware version allowing JTAG debugging. If a “no threads found” error message appears, and applying the restart recipe (see below) doesn’t help the situation, please contact customer support for that specific platform.

If target access issues occur, please apply the following recipe for a complete reset of all the components that take part in JTAG debugging, in this order:

1. Close the debugger.
2. Unplug **both** the USB and power connectors from the XDP3 probe **at the same time**, so no cable is connected to the XDP3 probe anymore.
3. Using the task manager, kill the process MasterFrame.HostApplication.exe
4. Power off the target system.
5. Plug the USB and power connectors back into the XDP3 probe.
6. Power on the target system.
7. Start the debugger.

5.3 Troubleshooting Target Stability issues

5.3.1 Considerations

The Intel® System Debugger requires a great deal of data to construct a full source-level view of the target state. For a simple operation such as step, there can be tens to hundreds of individual accesses to target state. In the case where one of these accesses crashes the target, it can be difficult to identify the exact root cause.

5.3.2 Techniques for isolating causes

1. Close as many GUI panels as possible

Each panel in the debugger (e.g., the registers panel, MSR panel, etc.) is self-updating. If many panels are open, then there are many target accesses. Closing panels is one way to isolate which functional group is causing the problem.

2. Use the TCI_LOG flag to turn on API logging

The debugger can log all transactions made to the communication backend. Although this information is primarily intended for developers, it may also be useful for identifying root causes of stability issues. Enable logging by setting the environment variable `TCI_LOG=1`.

For example, you can edit the startup script to include the command

```
set TCI_LOG=1.
```

On request from you Intel support team you may additionally include the command

```
set ENGINE_LOG=1, which will however slow down debugger startup considerably to provide very detailed logs.
```

This technique causes a log file to be created in the folder

`C:\users\\.sysdbg_2018`, where `<name>` is the user login.

5.4 OS Awareness / Kernel Module Debugging

The Linux* OS awareness pulldown menu allows visibility of all currently active kernel threads. It also provides the ability to view a list of all currently loaded kernel modules with status information and memory location of initialization methods and cleanup methods. Setting whether to stop the target and commence debugging a kernel module on module load, initialization or cleanup/exit allows to start debugging a kernel module and loading its symbolic information. You can then set your breakpoints at the function entry points of the kernel module you want to debug, release the target using the `run` command and trigger an event that will cause the breakpoint to be hit to start your actual debug session.

You do not need to select kernel modules that are already loaded, but can add additional kernel module names to the list of kernel modules that are monitored and have the debugger stop at load, initialization or cleanup just as it would with the kernel modules that are already populated in the OS awareness pulldown menu as they were loaded during the Linux* OS boot process.

To debug kernel modules the following steps additional to selecting or adding a kernel module in the module list are necessary.

In a debugger script or in the debugger console window enter the following commands:

```
SET DIRECTORY "<kernel module path>"
```

This path setting is necessary to enable the automatic source and symbol info mapping upon kernel module load as described above.

To use this feature for runtime loaded kernel module debugging you will need to have the kernel module `xdbntf.ko` running and installed on the target device. The folder

<INSTALLDIR>\system_debugger_2018\system_debug\kernel-modules\xdbntf contains code to generate a Linux* kernel module that enables kernel module debugging with the Intel® System Debugger.

For generation simply transfer these files to your target system and invoke make. This will generate the kernel object **xdbntf.ko**.

To enable module debugging this object has to be loaded prior to starting the debugger via the command **insmod xdbntf.ko**. After finishing the debug session, the module can be unloaded with **rmmod xdbntf**.

5.5 Troubleshooting Simics Simulated Target

5.5.1 Connection fails with error message: “E-2201 TCP/IP Socket initialization or connection failed: Connection to host localhost:9123 failed, please verify server is running, and that the address and port are correct”

The error indicates that the Intel® System Debugger could not connect to the Simics software. This can be caused by:

1. There is a local firewall running which permits TCP accesses to localhost:9123
2. The license for Simics is expired. Either update to the latest version of Intel® System Debugger or contact technical support.

6 Issues and Limitations

6.1 Symbol offset issue with GCC compiled firmware

When debugging GCC compiled firmware the automatic symbol load feature loads the symbols to the wrong offset. Symbols need to be reloaded to the correct offset manually:

Command “efi loadthis” shows the path to loaded symbol file.

Example:

```
> efi loadthis
```

```
INFO: Searching backwards from 0x0000000077AC7000 to 0x00000000779C7000 for PE/COFF header (semantics=MEM align=0x00001000 range=0x00100000)
```

```
INFO: Found PE/COFF module at 0x0000000077AC7000 - 0x0000000077AD72A0 Entrypoint: 0x0000000077AC72AF (size: 66208 bytes)
```

INFO: Successfully loaded debug symbols found at offset 0x0000000077AC6FC0 instead of 0x0000000077AC7000:

C:\uefi_64_gcc\Build\Vlv2TbltDevicePkg\DEBUG_GCC46\X64\Vlv2TbltDevicePkg\SmBiosMiscDxe\SmBiosMiscDxe\DEBUG\MiscSubclass.debug

Use eval command to get the module entry point address.

Example:

```
> eval _ModuleEntryPoint  
  
_ModuleEntryPoint [ at address 0x0000000077AC728F ] : type procedure is not evaluatable  
[ \_MODULEENTRYPOINT ]
```

NOTE! The default module entry point function name may change from module to module. Check the module code to find the correct entry point function name.

If evaluated entry point doesn't match the one shown by efi loadthis command, the symbols need to be reloaded to an adjusted address.

Reload the module symbol file with the correct offset:

```
LOAD /NOLOAD /OFFSET = <offset> OF <filename>
```

Where <filename> is the path to the module symbol file from efi loadthis command result print.

Where <offset> is original load address + (original entry point address - evaluated entry point address)

Example: To get the adjustment subtract evaluated address from the original entry point address:
 $0x0000000077AC72AF - 0x0000000077AC728F = 0x20$. Add the adjustment to the original module load address = $0x0000000077AC6FC0 + 0x20$

6.2 Intel® Atom™ Processor Z35xx Support Limitations

- IO breakpoints are not working
- Reset break is currently not supported
- No power management support due to hardware limitations. Ensure that all OS power management is disabled, including low power C-states, and sleep states (S0iX and S3)
- Only supported on Windows* host
- The target needs to have the the eXtended Debug Port enabled (unlocked).

6.3 Intel® Atom™ Processor Z3xxx and E3xxx specific issues

6.3.1 Platform power management policy may limit debugger control of the target:

The platform power-management policy may include power management of the CPUs, this may limit availability of debugger features when the threads are in a low-power state. Examples include:

6.3.2 Launching the debugger when the target is off or in a low-power state may cause unexpected behavior

The debugger needs to see all threads when connecting to the target in order to correctly initialize both the debugger state, and the debug resources in the target. The Debugger will report the number and type of threads observed during initialization (e.g. "INFO: Connected to Processor type: <name> (4 threads)") the user should confirm that this matches the expected configuration. Resetting the target (with the debugger running) should clear the issue and cause all expected threads to show up in the hardware threads window.

6.3.3 Hardware Threads window may show no threads/partial threads/disabled threads

Hardware Threads window may show no threads/partial threads/disabled threads due to the CPUs appearing/disappearing from the JTAG scanchain, and/or showing up in the JTAG scanchain as "disabled". This condition should only happen when the target is in "run" state, when halted (e.g. from hitting a breakpoint) the debugger should correctly show all threads. ***if the debugger halts and all threads are not shown*** then the debugger is in an incoherent state and you may need to restart your debug session.

6.3.4 User-initiated Halt may occasionally return errors, especially if the target is in a low-power state.

Errors include "E-2201: Target has no active threads, this operation is not permitted." and "E-2201: Target did not halt execution."

This condition occurs when the debugger attempts to halt the target, but the CPUs are asleep and therefore unresponsive to debugger commands. Workaround: manually bring the CPUs out of sleep (e.g. by fiddling with the tablet) ***or*** try repeatedly to halt via the debugger, after 2-3 tries the target typically wakes up.

6.3.5 Kernel module load configurations may be unreliable

Due to limitations in silicon debug features, kernel module load notifications may not function correctly on Intel® Atom™ Processor Z3xxx and E3xxx based platforms. The following should be observed to work around this:

- **Software breakpoint in the target must be set prior to using xdbntf.** The breakpoint should be in an unused/unreachable code location, it is not necessary that the breakpoint is ever hit, its purpose is to enable the Intel® System Debugger redirection logic in the Silicon, which will allow the kernel module notifications to function correctly.
- **in some cases the notification will only partially work:** this will manifest as a hung system, with the Intel® System Debugger indicating a “running” state. In this case the user should manually halt the target, at which point the debugger will detect the notification, consume it, and resume target execution.

6.4 Intel® Atom™ Processors N4200, N3350, x7-E3950, x5-39xx (Apollo Lake)

6.4.1 Re-connection to the target is not reliably working

Symptom: The connection to the target is sometimes failing if a previous established connection was disconnected. Power cycling of the target usually resolves the issue.

6.4.2 Resuming the target after hitting software breakpoint is not reliably working

Symptom: Executing “run” command doesn’t work reliably after software breakpoint is hit. The way to solve it is to either step after the breakpoint or remove the breakpoint.

6.5 Problems with setting breakpoints for Intel® Processor code-named “Coffee Lake” from disassembly view

Setting breakpoint by double clicking on an instruction in disassembly window may cause an error in DAL and the breakpoint might not be set correctly. Please use “Create Breakpoint” command to set it.

6.6 Other Target-specific issues:

6.6.1 3rd generation Intel® Core™ Processor support only available on request

Intel® System Debugger support for the 3rd generation Intel® Core™ Processor code-named “Ivy Bridge” is currently only available on request. Please contact Intel® System Studio support via <https://premier.intel.com> or IntelSystemStudio@intel.com to request the patch necessary to enable it.

6.6.2 Functional differences of 60-pin vs. 10-pin JTAG

Some platforms do not implement the full 60-pin debug port that is traditionally used on Intel systems, in this case the functionality of the debugger will be limited, especially in the following areas:

- Detection of reset by the debugger
- Initiation of reset by the debugger
- Halting the target at the reset vector

6.6.3 Platform reset policy may inhibit debugger operation

Some platforms implement reset in such a way that the debugger may not be able to gain control of the target immediately after reset. This impacts the debugger operation in the following ways:

- The debugger may not be able to restore breakpoints after reset; the breakpoints may appear “enabled” in the GUI but will not in fact be enabled in the target.
- The debugger will not halt automatically at the reset vector; if the user wishes to debug early in the boot process there will be no way to manually initiate a halt quickly enough.

6.6.4 Platform security policy may inhibit debugger operation

In some platforms the security policy may disable JTAG access to the CPU, this is intended to prevent reverse-engineering. In this case the Intel® System Debugger will successfully connect to the target, however it will not be able to discover any CPUs on the JTAG bus, and will warn the user that no CPUs are available. To resolve this issue please ensure that that platform firmware has enabled access to the CPUs via JTAG, this is typically done by flashing a special “debug” firmware into the target.

Also note that in some cases the CPU or CPU module may have physically disabled JTAG access, especially in production or near-production versions. In this case please work with the platform business unit to obtain JTAG-enabled hardware.

6.6.5 Target power management and platform power policy on tablet systems may inhibit debugger operation

On some tablet designs the platform architecture includes aggressive power-management of the CPU, this will impact debugger operation in that a CPU in a low-power state cannot be accessed via JTAG. This will manifest in a variety of ways:

- Error messages indicating that “no threads are available”

- Error messages indicating that “target could not halt”
- No threads displayed in the hardware threads window

In general these problems will be mitigated by doing one or more of the following:

- Ensure that the CPUs are in an active state when the debugger is first started (e.g. in early boot firmware where no power management is present)
- Ensure that the OS has a workload that will inhibit low power states (e.g. play a video, run animated wallpaper, etc.)
- Disable low-power states in the platform when possible (generally a BIOS setting)

6.6.6 Platform reset implementation may limit debugger-initiated reset:

Debugger-initiated reset is not an industry standard feature, it is implemented using sideband signals on the 60-pin Intel XDP port, and it is subject to the reset implementation on the target system. Some targets may not reset reliably via the debugger’s reset/restart feature, this will typically result in a message such as “WARNING: target did not halt after reset, forcing a halt” being displayed in the debugger console, followed by additional error messages. In this case the user may need to manually initiate a reset on the target via buttons, debug card, etc.

6.6.7 Platform reset implementation may limit ability to halt at reset vector:

Halting the CPU at the reset vector (first instruction fetched) is a CPU/platform dependent feature and may be limited due to target implementation details. The main impact to the user is:

- **inability to debug early platform boot code due to a runaway target.** In this case it may be necessary to build a special firmware with a hard-coded infinite loop early in the boot flow.
- **inability of the debugger to re-apply breakpoints after target reset.** In this case the debugger may show breakpoints as “enabled” in the GUI, but they will not be installed in the target, the user should manually halt the target, disable, re-enable breakpoints to ensure they are applied correctly.

6.6.8 There could be loss in control while doing stepping around reset

On some targets, there could be loss in control while doing stepping around reset.

6.7 Installation related issues

6.7.1 Intel® System Debugger use in conjunction with PVT product

In order to use Intel® System Debugger in conjunction with a PVT product, please update OpenIPC and DAL files inside <INSTALLDIR>/env.d folder.

6.7.2 Sharedinfo.txt not writable

The debugger is dependent on writing to a file called “sharedinfo.txt” which is normally installed at “C:\ProgramData\Intel\DAL\MasterFrame\sharedinfo.txt”. Default security policy on the host system may cause this file to be read-only after Intel® System Studio installation. If this is the case then the user will observe an error message when connecting to the target. To resolve this issue either (a) run the debugger with administrator privileges or (b) change the permissions on this file (and any containing folders) to be writable.

6.7.3 Network access for MasterFrame.HostApplication.exe blocked by Microsoft* Windows* firewall

The debugger utilizes a server process to access the target, this “Masterframe” process will attempt to access the network when initializing, and this access may trigger a warning from the Microsoft* Windows* firewall. This is expected and the user should allow the access for the debugger to function correctly.

6.7.4 MSDIA DLL not registered

The debugger is dependent on a shared library provided by Microsoft* for access to debug information generated with the Microsoft* compiler. In some cases this library will not be correctly registered on the host system, which will lead to an error message when trying to load symbols for modules (e.g. EFI modules) that are compiled using the Microsoft* toolchain. The user can resolve this issue by manually registering the correct library using an administrator command prompt.

From a command line window go to:

```
C:\Program Files (x86)\Common Files\microsoft shared\VC
```

Run:

```
regsvr32 msdia90.dll
```

if the msdia90.dll file is not found there, reinstall the Microsoft* Visual C++ 2008 Redistributable Package after downloading it from Microsoft’s website

6.7.5 XDB Grey unresponsive window

On some hosts the System Debugger may come up with an empty gray unresponsive window. If this is observed then please verify that the Intel Remote Monitor opt-in dialog is not hidden behind the main window. If this dialog is present, clicking to dismiss it will allow the debugger to launch normally.

6.8 General Feature Limitations

6.8.1 Debugging a module on the watchlist

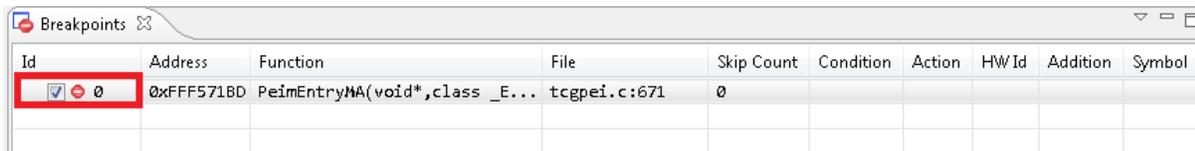
The debugger will stop the target when a module on the watchlist gets loaded. Target will stop at the debug agent code and load the symbols for the module on the watchlist. To debug the module you need to browse to the module source files and set a breakpoint somewhere in the code.

1. Add your module into the watchlist.
2. Wait for the module to get loaded and target to stop.
3. Open the “Source Files” window. The window is visible at the left side of the screen.
4. Browse to module source code and set a breakpoint.
5. Run the target. Execution stops at the breakpoint and you can debug the module.

6.8.2 Using breakpoints

After reset, the breakpoints will get disabled in target even though they look enabled in the GUI. After target stops at a watchlist module load, the breakpoints need to be disabled and re-enabled for them to work.

1. Open the breakpoints window.
2. Disable breakpoint by unchecking the enable box.
3. Re-enable breakpoint by checking the enable box.
4. Run the target.



6.8.3 Support for Intel® Atom™ processor bitfield editor register views

To receive information on how to access bitfield editor chipset register views for Intel® Atom™ Processors, please send an email to EmbeddedDevTools@intel.com for details.

6.8.4 Failure of initial debugger re-connection can lead to debugger hang

In some cases the debugger will hang when re-connecting to the target. This is typically observed when the initial connect attempt has failed (e.g. due to the CPUs or target being powered off). Workaround: always shut down the debugger and re-launch it when re-connecting to the target.

6.8.5 Locals Window updates can be slow

The local window updates may be slow in many cases where it is evaluating many large structs or in scopes with many locals. If the slowness is noticed, it is recommended to close the locals window.

6.8.6 Kernel Threads Window Population Slow

The Linux* OS awareness plug-in for the Intel® System Debugger includes a Kernel Threads Window, that displays all current kernel threads and information about their state. When the Kernel Threads Window is opened it can take several seconds before the actual content is displayed. The initial window content of “No data.” will disappear once kernel thread data is available. This can take up to 20 seconds.

6.8.7 Debugger puts a Windows file system lock on symbol files

Currently when a symbol file is loaded in the debugger a file system lock is placed on this file to prevent other processes from deleting or modifying this file. If this lock is preventing you from recompiling your program, simply use the Unload feature found in the Load Dialog. Unloading a symbol file will release the file system lock and allow you to modify or delete the symbol file without exiting the debugger.

6.8.8 Memory Reads with Uninitialized Memory

If any window other than the memory window is open on uninitialized memory (e.g. Assembly Window), memory read attempts may lead to the target entering an undefined state.

6.8.9 Memory Writes to Uninitialized Memory

Memory writes to uninitialized or read-only memory (this includes setting software breakpoints or accessing memory mapped registers) can lead to a crash of the target or a loss of the target

control. The debugger will not prevent these memory accesses when requested by the user (e.g. changing instructions in the disassembly window).

6.8.10 Flash Writer disables pre-existing Breakpoints

Flashing the BIOS will disable all code breakpoints and data breakpoints you may have had set prior to using the flash writer.

6.8.11 Master Flash Header Read/Write not supported for Intel® Atom™ Processor CE4200

On the Intel® Atom™ Processor CE4200 the Master Flash Header serves as a road map for the contents of flash that are processed by security and host firmware. It contains the location and size of each element in the flash, as well as a list of host firmware images that the security processor will attempt to boot. Currently the flash writer plug-in for the Intel® System Debugger does not support writing or modifying the Master Flash Header.

It is of course possible to use the terminal Master Flash Header commands `mfhlist` `mfhinfo` and `mfhinit` in conjunction with the Intel® System Debugger flash writer plug-in.

`mfhlist` provides the location of the Master Flash Header entries and where the current platform boot configuration expects the various flash images to be put. It's output can be used as a guidance for setting the start address when using the flash writer plug-in.

For NOR Non-Trusted Boot and NAND/eMMC Non-Trusted boot can be configured such that target boot is possible even if no Master Flash Header is present on the platform.

eMMC Trusted Boot does require the presence of a Master Flash Header and requires that the actual memory layout does match its contents.

Please read the Platform User Guide closely for further details on the Master Flash Header and its usage.

7 Change History

Below are features listed for older versions of the Intel® System Debugger 2015 to 2018 Beta releases.

7.1 Intel® System Debugger 2018 Initial Release

7.1.1 New Features

- Added support for targets “8th Gen Intel Core Processor (Kaby Lake R) / Intel 100 Series Chipset (SunrisePoint PCH-H)” and “8th Gen Intel Core Processor (Coffee Lake-S) / Intel Z370 Series Chipset (Kaby Lake PCH-H)”
- Updated Simics to a new version

7.1.2 Bug Fixes

- Intel® Atom™ Processor Z36xx, Z37xx - 2 cores (Baytrail / MinnowBoard MAX) can now be connected with the new connection establishment method

7.2 Intel® System Debugger 2018 Beta

7.2.1 New Features

- Added support for “Intel Atom Processor C3xxx (Denverton)” and “Intel Xeon Scalable Processor (Skylake-SP) / Intel C620 Series chipset (Lewisburg)”
- Intel(R) System Debugger is now integrated into Intel(R) System Studio IDE and can be invoked from within this IDE as well (except for Wind River* Workbench* integration)
 - New connections can now be made from the Intel(R) System Studio IDE as well (see the [“Getting Started with the Intel\(R\) System Debugger 2018 – System Debug”](#) guide for instructions)
- Microsoft* Windows* 10 64-bit is now supported as a Host Operating System
- OpenOCD* support has been discontinued since this release

7.3 Intel® System Debugger 2017 Update 3

7.3.1 New Features

- Providing information to the users about breakpoint re-application after target reset
- Updated Intel® DfX Abstraction Layer (Intel® DAL)
- IO port based reset shows now an information which port writes were executed.
- Improved System Table discovery for LoadDXEModules function.
- The Target Access Module hang detection timeout can now be configured in the options dialog. Especially for server platforms with a large number of threads increasing the timeout helps to identify real target access module hangs.
- Intel® Processor Trace Plugin added support for multiple configuration tables and regions.

7.3.2 Bug Fixes

- Providing an appropriate message if a target access call is taking a long time instead of trying to abort the call
- Fixed crash during usage of the LoadPEIM function if PEI modules were built in release mode.

- IO port based reset does not use to default reset method anymore but do a port based reset.

7.4 Intel® System Debugger 2017 Update 2

7.4.1 New Features

- Added support for 7th Gen Intel Core processor family (Kaby Lake)
- Added the platform breakpoint types: Shutdown Break and Machine Check Break
- For code lines that are mapping to multiple assembly blocks the context menu provides now also the options “Go Here”, “Set Current Location” and “Jump to assembler”.
- Improved the messaging for cases when no additional hardware breakpoints are available.
- Updated Simics
- The context menu in the assembler and source window allows now to set a software or hardware breakpoint explicitly.
- The Script file:
`<INSTALLDIR>\system_debugger_2018\system_debug\scripts\startup.xdb`
was added to allow execution of commands automatically during startup of Intel® System Debugger
- Variables are now marked as `<optimized out>` if not available because of compiler optimizations and as `<currently unavailable>` if they are out of scope.
- UEFI Buttons are loaded automatically. No need to manually execute efi.xdb anymore
- Improved DWARF Version 4 debug information support.

7.4.2 Bug Fixes

- Corrected masking of base addresses in paging structures.
- Added correct handling of Memory Protection Key IDs in paging structures.
- For the BATCH command the option /NOOUT was fixed.
- Complex debug information decoding improved especially for Memory Reference Code (MRC) debugging.
- Setting breakpoints on source lines that map to multiple assembly locations is working now also if the source file is not part of the first symbol file loaded.

7.5 Intel® System Debugger 2017 Update 1

No changes.

7.6 Intel® System Debugger 2017 Initial Release

7.6.1 EFI Script:

New script "EFI.xdb" adds UEFI-specific helper buttons to the user interface to discover PEI/DXE phase debug symbols." In order to use the script, use either of these methods:

- Via the menu of the debugger GUI: Click File -> Execute Command File and point it to the file "efi.xdb" which is contained in the debugger's "scripts" subdirectory.
- Alternatively, on the debugger command line, use this command: BATCH "scripts/efi.xdb"

This will add three new buttons to the debugger's toolbar:

- LoadThis: This will parse memory around the current instruction pointer and load symbolic source information for the currently executing UEFI module.
- LoadPEIMs: This will search the flash firmware volume and load debug information for all the PEI-phase modules.
- LoadDXEModules: This will search DRAM for the system table, and load debug information for all the DXE-phase modules that have been loaded by the target up to this point.

Please note that any of these commands may sometimes lead to the debugger's disassembly window showing "No data". This can be fixed by right clicking into the window and selecting "Reload" from the context menu.

7.6.2 System Management Mode (SMM) debug support

Improved the support for SMM debugging (currently only available for Intel® DAL based target connections). See the ["Debugging System Management Mode" chapter](#) in the user documentation for details and usage instructions.

- Special stepping handling for RSM (Return from System Management Mode) instruction: Stepping over the RSM instruction will now use SMM Exit Break (and not have the target freely running).
- SMM Entry Break and SMM Exit Break available to set from the GUI: Use the "Platform" tab in the "Create Breakpoint" dialog. Also these special breaks can be set by commands

SET BREAKPOINT ON “SMM Entry Break” or SET BREAKPOINT ON “SMM Exit Break”, respectively

7.6.3 Single Startup

Single startup, “xdb.bat” and “xdb.sh” are added. This provides a single interface to connect to different targets and platforms. The previous startup scripts are still present in case of issues with the new startup script.

7.7 Intel® System Debugger 2016

- Support for Intel® Atom™ x7 Z8700 & x5 Z8500/X8400 processor series (Cherry Trail)
- Support for 5th Generation (Broadwell) and 6th Generation (Skylake) Intel® Core™ Processor Family
- Platforms that use the Lynx Point PCH are no longer supported and have been removed from the connection dialog.
- The start_xdb_firmware_recovery startup script has been removed. The flash utility from the GUI should be used for flashing instead.
- Support for the Macraigor Systems* usb2Demon* JTAG hardware adapter has been removed.
- Agent based UEFI debugging is now exclusively supported via serial connection.
- Several bug fixes and stability improvements

7.8 Intel® System Debugger 2015 Update 2

- Intel® Atom™ Processor Z35xx code-named “Moorefield” support added
- Additional improvements in support for Intel® Atom™ Processors E38xx, Z37xx, N29xx codenamed “Baytrail”. Now supported exclusively with start_xdb_legacy_products.bat
- Additional improvements in support for Intel® Quark™ SoC. Now supported exclusively with OpenOCD* and start_xdb_gdb_remote.bat
- Improved faster and more reliable symbol information handing
- Intel® System Debugger Options menu settings are remembered between debugger sessions
- Memory evaluations can be saved in hex format
- Update to Intel® Dfx Abstraction Layer version 1504 (1.9.5968)

7.9 Intel® System Debugger 2015 Update 1

- Update to Intel® Dfx Abstraction Layer (Intel® DAL) version 1448
- Yocto Project* 1.7 and Wind River* Linux* 7 support
- Stability Improvements
- Improvements to UEFI Debug functionality

- Improved support for the Intel® Atom™ Processor N29xx, E38xx, Z374x and Z377x code-named “Baytrail”
- Additional communication API for faster interface to Intel® Atom™ Processor N29xx, E38xx, Z374x and Z377x code-named “Baytrail” – Use start_xdb_legacy_products.bat to test the new sAPI
- Improved support for Intel® Quark™ SoC with OpenOCD*
- Debugger User and Reference Guide has been updated to include latest improvements to UEFI
- debug

7.10 Intel® System Debugger 2015 (Initial Release)

7.10.1 General Usage

- Support for Wind River* VxWorks* 7 target OS
 - VxWorks* Task and Kernel Module Viewer
- Support for OpenOCD* and compatible JTAG devices for Intel® Quark™ SoC
- Intel® System Debugger Launch from within Wind River* Workbench*
- Instruction trace window and source level instruction flow visualization improvements
- Required Microsoft* Visual Studio* redistributables are now automatically installed if missing on system.
- PCI-Bus Scan Tool Technology Preview

7.10.2 Target Platform Support

- **Support for platforms based on the processors listed below using the Intel® ITPXDP3 device**
 - Intel® Atom™ Processor C2xxx
 - Intel® Atom™ Processor E38xx, Z3680, Z37xx
 - 3rd generation Intel® Core™ Processor
 - 4th generation Intel® Core™ and Intel® Xeon™ Processor
 - 5th generation Intel® Core™ M Processor
- **Support for Intel® Quark™ SoC using the following OpenOCD* compatible devices**
 - TinCanTools* FLYSWATTER2 http://www.tincantools.com/wiki/Compiling_OpenOCD
 - Olimex* ARM-USB-OCD-H
<https://www.olimex.com/Products/ARM/JTAG/ARM-USB-OCD-H/>
The following pin adapter was used to connect the Intel® System Debugger to the Intel® Quark™ SoC board:
<https://www.olimex.com/Products/ARM/JTAG/ARM-JTAG-20-10/>
- **Support of BIOS flashing for 4th generation Intel® Core™ processor**

- **Support for 3rd generation Intel® Core™ processor target on request via IntelSystemStudio@intel.com**
- **Agent-based debugging of UEFI (EDK2) BIOS**
The Intel® System Debugger now supports non-JTAG based debug of UEFI BIOS, this requires the use of a target-side debug agent. For more information see chapter 8 on [Agent-based UEFI Debugging](#).
- **Extensible Firmware Interface (EFI) Support:**
When the target is booting through an EFI BIOS (PEI or DXE phase of the boot process) which has been built with debug information, the debugger can parse the PE/COFF headers and locate an address in source.

Use the command

```
xdb> efi "loadthis <address>"
```

Providing an address is optional. If no address is passed on the current instruction pointer is used.

In addition the EFI plugin is able to automatically search and find the system table pointer. Once found many of the key aspects of the EFI environment including loaded services and modules can be listed.

```
xdb> efi "showstab"
xdb> efi "showmodules"
```

Please see the output of the

```
xdb> efi "showhelp"
```

command for more details

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