



White Paper

G. Anthony Saladino

Debugger Consultant

Intel Corporation

Debugging on Intel® Platforms



Introduction

This white paper provides a high-level overview of debugging on Intel® processor-based platforms for technical decision makers. It catalogues the relevant debuggers and describes the features and benefits of each with references to additional information.

Overview

The Intel® Compiler enables effective debugging on Intel® platforms, by means of native debuggers, the Intel® Debugger, and selected third-party debuggers. The Intel Debugger works with native compilers, the Intel Compiler, and selected third-party compilers. This range of capabilities provides a great deal of flexibility in mixing and matching development tools to suit various development environments. Intel encourages customers to use the native debuggers on Intel processor-based platforms in cases where those debuggers provide satisfactory debugging functionality. In cases where the native debuggers do not provide satisfactory support on Intel processor-based platforms, Intel recommends that customers use the Intel Debugger.

Servers and Workstations

This section discusses debugging functionality for platforms based on IA-32, Intel® Extended Memory 64 Technology (Intel® EM64T), and Intel® Itanium® 2 processors, running Linux*, Mac, or Windows* operating systems.

Support for Linux*, Mac OS*, and Windows*

The Intel Debugger provides quality debugging features across all supported platforms. Specific details can be found in the Intel® Debugger 9.1 white paper (http://www.intel.com/software/products/compilers/techtopics/Intel_Debugger.pdf).

Support for Linux and Mac OS Only

GDB* (<http://www.gnu.org/software/gdb/gdb.html>), the GNU Project Debugger, allows you to see what is going on ‘inside’ another program while it executes—or what another program was doing at the moment it crashed. GDB can perform four primary functions (plus other functions in support of these) to help you catch bugs in the act:

- Start your program, specifying anything that might affect its behavior.
- Make your program stop on specified conditions.
- Examine what has happened, when your program has stopped.
- Change things in your program, so you can experiment with correcting the effects of one bug and go on to learn about another.

The program being debugged can be written in C, C++, Pascal, Objective-C, or many other languages. Those programs might be executing on the same machine as GDB (native) or on another machine (remote). GDB can run on most popular UNIX and Microsoft Windows variants.

The Etnus TotalView* debugger (<http://www.etnus.com/>) is a powerful, sophisticated, and programmable tool that lets you debug, analyze, and tune the performance of complex serial, multiprocessor, and multi-threaded programs.

Linux-Only Support

Allinea DDT* (Distributed Debugging Tool) (<http://www.allinea.com/index.php?page=48>) is an advanced and comprehensive graphical debugger for scalar, multi-threaded and large-scale parallel applications that are written in C, C++, or Fortran. With a now-famous user interface that wins praise for ease-of-use and capability, it is a good bet for efficient software development.

Mac OS-Only Support

Xcode* 2.0 (<http://www.apple.com/macosx/features/xcode/>)* is a fast way for developers to create Mac OS X* applications and an easy way to take advantage of new Apple technologies. Xcode 2.0 brings together the ease of use of Mac OS X, the power of UNIX, and a mixture of high-performance development technologies.

Xcode works with numerous other tools available with Mac OS X, such as the integrated user interface construction application, compilers such as GCC, javac, and Jikes*, and debuggers such as GDB.

It's a challenge to debug full-screen applications such as games. Where do you put the debug window? With Xcode 2.0's graphical remote debugging, all of Xcode's powerful debugging features, such as data formatters, Fix, and Continue, are available for debugging applications on remote machines. Xcode even helps keep your data secure by using an encrypted connection to the remote debugging session.

Windows-Only Support

The Windbg* (<http://www.microsoft.com/whdc/devtools/debugging/default.msp>) and Microsoft Visual Studio* (<http://msdn.microsoft.com/vstudio/>) Debuggers are two Debugging Tools for Windows to debug drivers, applications, and services on systems running Windows NT 4.0, Windows 2000, Windows XP, Windows Server 2003, and Windows Vista, as well as debugging the operating system itself. Versions of the Debugging Tools for Windows packages are available for 32-bit x86, native Itanium®-based systems, and native x64 platforms.

Embedded Systems

Debugging applications running on platforms based on Embedded IA-32, Intel XScale® microarchitecture-based processors, and Intel® Personal Internet Client Architecture (Intel® PCA) processors are included in this section.

Embedded IA-32

Both GDB (<http://www.gnu.org/software/gdb/gdb.html>) and IDB (http://www.intel.com/software/products/compilers/techtocpics/Intel_Debugger.pdf) (each mentioned previously) support debugging on systems running variants of Linux, via Remote Agent.

The QNX Momentics* IDE (<http://www.qnx.com/download/feature.html?programid=8114>)* provides a comprehensive toolset to build and optimize applications.

The Wind River VxWorks Workbench* IDE (http://www.windriver.com/portal/server.pt?space=Opener&control=OpenObject&cached=true&in_hi_ClassID=512&in_hi_OpenerMode=2&in_hi_ObjectID=397&)* provides an open, unifying framework for use by project teams.

The MontaVista Linux DevRocket* IDE (<http://www.mvista.com/devrocket/>)* provides the tools and functionality you need to develop and deploy system software and applications.

Support for debugging on Windows XP Embedded systems is provided by Windows Embedded Studio* (<http://www.microsoft.com/windows/embedded/xpe/deven.msp>).

Intel XScale® Microarchitecture

For processors based on Intel XScale® microarchitecture, the available toolsets vary by specific processor implementation and application target.

For Intel® I/O processors, GNU cross-development tools and American Arium*, as well as Mentor Graphics' X-Ray Debugger*, are the most common combination. For Intel® IXP network processors, GNU tools and GCC are also the most commonly encountered. Intel provides a range of software development tools for the Intel XScale microarchitecture however, especially for the Intel PCA-based Intel® PXA processors that are found in PDAs, cellular phones, bar code scanners, and other embedded devices.

For Intel IXP network processors, Intel currently only offers support for IXP425 running Microsoft Windows CE and Microsoft Windows Mobile. For Intel® I/O processors (Intel® IOP), full compiler support for all little-endian implementations is available.

Intel® Personal Internet Client Architecture (Intel® PCA)

Discussion of Intel® Personal Client Architecture provides an overview of the common development tools, the complexity of the ecosystem, and the breadth of target operating systems that are supported.

Support for Windows CE and Windows Mobile is as follows:

- eXDI JTAG debugging extensions for Microsoft Platform Builder*
- Debugging extensions (ActiveSync*) for Visual Studio 2005 and Embedded Visual C++ 4.0
- Intel XDB Browser as part of both aforementioned debugging extensions
- Cross build- and debug environment - XP host and CE target

- Intel® C++ Compiler supports Platform Builder, Visual Studio 2005, Embedded Visual C++ 4.0, and Microsoft Adaptation Kits for Windows Mobile
- Platform Builder, Visual Studio 2005, and Embedded Visual C++ 4.0

Support for Palm OS* is provided as follows:

- Kernel 5.0: Palm Universal Debugger*, Palm OS Debugger*, Intel® XDB JTAG Debugger for Palm OS 5.x Kernel debug.
- Kernel 7.0: GDB, Intel® XDB JTAG Debugger with Linux OS awareness plug-in
- Application 5.0: Palm Universal Debugger, Palm OS Debugger
- Application 7.0: GDB, Intel XDB Linux Application Debugger Beta for Kernel 2.6
- Metrowerks CodeWarrior* (<http://www.freescale.com/webapp/sps/site/homepage.jsp?nodeId=012726>)

Support for Nucleus* OS is provided as follows:

- Mentor Graphics X-Ray* (http://www.mentor.com/products/embedded_software/development_tools/xray_debugger/upload/xray.pdf) and Codelab*, XDB JTAG Debugger with Nucleus plug-in

Support for Symbian* OS provided as follows:

- GDB
- Metrowerks CodeWarrior* (<http://www.freescale.com/webapp/sps/site/homepage.jsp?nodeId=012726>)

Unlike in the Intel IXP and Intel I/O processor world for Intel PXA processors, ARM RealView* 2.2 (<http://www.arm.com/products/DevTools/>) is the market-dominating toolset and is used for Palm OS, Nucleus OS, Symbian OS, and bare-metal development.

The Linux world is dominated by MontaVista and open source ARM-Linux development based on GNU tools. The most common GUI interface is QT, provided by Trolltech.

Intel currently has the Intel® C++ Compiler for Linux for Intel XScale microarchitecture in Beta to offer Intel XScale microarchitecture-specific optimizations.

Conclusions

Intel enables effective debugging on its platforms. There are a variety of quality debuggers to choose from that work well with most compilers. This variety provides a great deal of flexibility in mixing and matching development tools to suit any given development environment.

Where to find them

References throughout this white paper give sources to obtain additional information about the featured debuggers, as well as to obtain the debuggers themselves.

Native debuggers are typically provided with the host operating system (or as a component of the compilers or other development tools intended for use on those systems).

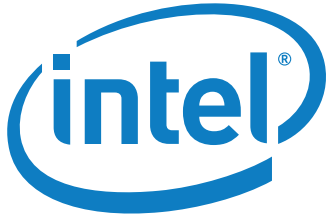
The Intel Debugger is a value-added component of the Intel Compilers. The Intel Compilers can be purchased, or an evaluation copy can be downloaded, from the Intel® Software Development Products Web pages (<http://www.intel.com/software/products/>).

Customers have access to product updates and product support through the following Web pages:

- Intel Support and Downloads: <http://www.intel.com/support/>
- Intel Software Development Products Support: <http://www.intel.com/software/products/support/>
- Intel Software Development Products Self Help: <http://www.intel.com/support/performance/tools/index.htm>
- Intel Developer Services Community discussion forums: <http://softwareforums.intel.com/ids>
- Intel® Premier Support: <http://premier.intel.com/>

References

1. Intel® Debugger white paper: http://www.intel.com/software/products/compilers/techttopics/Intel_Debugger.pdf
2. GNU Project Debugger: <http://www.gnu.org/software/gdb/gdb.html>
3. Etnus TotalView Debugger: <http://www.etnus.com/>
4. Allinea DDT (Distributed Debugging Tools): <http://www.allinea.com>
5. Xcode: <http://www.apple.com/macosx/features/xcode/>
6. Windbg: <http://www.microsoft.com/whdc/devtools/debugging/default.mspx>
7. Microsoft Visual Studio: <http://msdn.microsoft.com/vstudio/>
8. Windows Embedded Studio: <http://www.microsoft.com/windows/embedded/xpe/deven.mspx>
9. Metrowerks CodeWarrior: <http://www.freescale.com/webapp/sps/site/homepage>
10. Mentor Graphics X-Ray: http://www.mentor.com/products/embedded_software/development_tools/xray_debugger/upload/xray.pdf
11. ARM RealView: <http://www.arm.com/products/DevTools/>



For product and purchase information visit:
www.intel.com/software/products

Intel, the Intel logo, Intel. Leap ahead. and Intel. Leap ahead. logo, Pentium, Intel Core, and Itanium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

*Other names and brands may be claimed as the property of others.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. Intel products are not intended for use in medical, life saving, life sustaining applications. Intel may make changes to specifications and product descriptions at any time, without notice.

Copyright © 2006, Intel Corporation. All Rights Reserved.

0505/DXM/ITF/PDF 300348-002