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About This Document

This manual describes how to get started using the HP-UX 11i v3 Driver Development Kit. The document printing date and part number indicate the document's current edition. The printing date will change when a new edition is printed. Minor changes may be made at reprint without changing the printing date. The document part number will change when extensive changes are made.

You can find the latest version of the HP-UX 11i v3 Driver Development Kit (DDK) documents online at:

http://www.hp.com/go/hpux_ddk

NOTE: This book contains many examples of C programs to help design device drivers. Because of page width restrictions, some long lines of code exceed the space available and break in unintended places. Please treat these "broken" lines as one line. We recommend that you use the sample files included with this manual when possible, rather than retyping the examples.

Intended Audience

This document is intended for system administrators and developers responsible for porting or writing drivers. Developers are expected to:

• Have experience writing programs in the C language.
• Have working knowledge of the basic concepts of writing a driver.
• Understand the functionality of the hardware for which the driver is being written.
• Understand the HP-UX System Administration Tasks manual and performed system administration.
• Have working knowledge of the virtual memory, I/O, and file system areas in the HP-UX and/or UNIX.

This document is not a tutorial.

Publishing History

Table 1 Publishing History Details

<table>
<thead>
<tr>
<th>Document Manufacturing Part Number</th>
<th>Operating Systems Supported</th>
<th>Supported Product Versions</th>
<th>Publication Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5991-4189</td>
<td>11i v2</td>
<td></td>
<td>September 2004</td>
</tr>
<tr>
<td>5991-7946</td>
<td>11i v3</td>
<td></td>
<td>February 2007</td>
</tr>
</tbody>
</table>

What's in This Document

The HP-UX 11i v3 Driver Development Kit (DDK) Getting Started Guide is divided into several sections, and each contains information on prerequisites and necessary skills.

Typographical Conventions

This document uses the following conventions.

Book Title The title of a book. On the web and on the Instant Information CD, it may be a hot link to the book itself.

KeyCap The name of a keyboard key. Note that Return and Enter both refer to the same key.

Emphasis Text that is emphasized.
**Bold** Text that is strongly emphasized.

**Bold** The defined use of an important word or phrase.

**ComputerOut** Text displayed by the computer.

**UserInput** Commands and other text that you type.

**Variable** The name of a variable that you may replace in a command or function or information in a display that represents several possible values.

... The preceding element may be repeated an arbitrary number of times.

| Separates items in a list of choices.

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**HP-UX Release Name and Release Identifier**

Each HP-UX 11i release has an associated release name and release identifier. The `uname(1)` command with the `-r` option returns the release identifier. The following table shows the releases available for HP-UX 11i:

**Table 2 HP-UX 11i Releases**

<table>
<thead>
<tr>
<th>Release Identifier</th>
<th>Release Name</th>
<th>Supported Processor Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.11.11</td>
<td>HP-UX 11i v1</td>
<td>PA-RISC</td>
</tr>
<tr>
<td>B.11.20</td>
<td>HP-UX 11i v1.5</td>
<td>Intel® Itanium®</td>
</tr>
<tr>
<td>B.11.22</td>
<td>HP-UX 11i v1.6</td>
<td>Intel® Itanium®</td>
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<td>B.11.23</td>
<td>HP-UX 11i v2</td>
<td>PA-RISC and Intel® Itanium®</td>
</tr>
<tr>
<td>B.11.31</td>
<td>HP-UX 11i v3 February 2007</td>
<td>PA-RISC and Intel® Itanium®</td>
</tr>
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Send comments to: [hphp.support@hp.com](mailto:hphp.support@hp.com)

Include the document title and manufacturing part number with your comments.

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**Support and Compatibility Disclaimers**

Because drivers function at the level of the kernel, Hewlett-Packard Company (HP) reminds you of the following:

- Adding your own driver to HP-UX requires relinking the driver into HP-UX. With each new release, plan on recompiling your driver in order to reinstall it into the new HP-UX kernel. Many header files do not change. However, drivers typically use some header files that could change across releases; you can have some system dependencies.

- HP provides support services for HP products, including HP-UX. Products, including drivers, from non-HP parties receive no support other than the support of those parts of a driver that rely on the documented behavior of supported HP products.

- If you encounter difficulties during the development and test phases of writing a driver, HP may provide assistance in isolating problems to determine if:
  - HP hardware is not at fault, and
  - HP software (firmware) is not at fault by removing user-written kernel drivers.

- When HP hardware, software, and firmware are not at fault, seek help from the third party from whom you obtained software or hardware.
1 Components

Documentation is provided as part of the HP-UX 11i v3 Driver Development Kit (DDK).

Documents

- **HP-UX 11i v3 Driver Development Guide (DDG)**
  
  This document contains detailed information on the HP-UX 11i v3 Driver Development Environment (DDE) for I/O subsystems, driver stacks, cookbook approaches on writing a particular class of driver, and implementing high availability features in a driver. Specific components of the DDG include the following:
  
  - **Generic Driver Chapters**
    
    For generic driver development information refer to DDG Chapters 1 thru 9, and chapters 20 thru 22. These chapters provide detailed information on many HP-UX driver development topics, including but not limited to HP-UX IO subsystem features, compiling, building and loading drivers, and adding high availability features to your driver.
  
  - **Mass Storage Driver Chapters**
    
    For mass storage driver development information refer to DDG Chapters 17 thru 19. These chapters contain detailed information on HP-UX Mass storage architecture and on writing a mass storage interface driver.
  
  - **Network Driver Chapters**
    
    For networking driver development information refer to DDG Chapters 10 thru 16. These chapters contain detailed information on HP-UX LAN architecture, writing a native DLPI LAN driver, and writing an HP-DLPI based LAN driver. These chapters also discuss making your LAN driver function with the `nwmgr` command and the System Management Homepage (SMH) NIC GUI.
  
  - **Driver Packaging Specific**
    
    Refer to DDG Chapter 23, "Creating a Software Depot." This chapter contains detailed information on creating a software depot.
  
  - **Kernel Registry Services**
    
    Refer to DDG Chapter 7 to learn how to use Kernel Registry Services to manage persistent attributes in device drivers.

- **HP-UX 11i v3 Driver Development Reference Guide (DDR)**
  
  This document contains reference pages in manpage format for various services the DDE offers. These include:
  
  - **Kernel Services**
    
    Reference pages for all the services and data structures that are kernel specific.
  
  - **WSIO Services**
    
    Reference pages for all of the services and data structures that are WSIO driver specific. Starting with HP–UX 11i v3, many new GIO KPIs are also exported.
— **Network Services**
Reference pages for all the services and data structures that are network driver specific. In addition to these, see Kernel and WSIO services.

— **SCSI Services**
Reference pages for all the services and data structures that are mass storage specific. In addition to these, see Kernel and WSIO services.

• **White Papers**
White papers to be used in conjunction with the DDG and the DDR provide information targeting a specific problem or enhancement. A partial list follows:
  — KWDB User Guide
  — STREAMS Programming Guide
  — Network Driver Migration Guide
  — IOI Migration Guide

• **FAQ**
FAQs are a set of commonly asked HP-UX driver development questions to be used in conjunction with the DDG and DDR for the targeted OS release. The questions addressed here span across all topics like HP-UX DDE, driver compiling issues, building and installing, mass storage, and network stacks.

**Sample Drivers**
Sample drivers in HP-UX 11i v3 DDK provide C program sources for functional drivers. They also include supplemental README files, driver installation notes, and Makefiles. These include a set of sample drivers that are specific to:

• **Mass Storage**
The *qlisp* pSCSI HBA driver is provided as a mass storage specific sample driver. This driver includes driver sources, Makefiles, build scripts, and README files for pSCSI HBA sample driver.

• **Network**
Native and non-native *enet* and *ielan* drivers are provided as part of network sample drivers. These drivers include driver sources, Makefiles, build scripts, and a README for *ielan* and *enet* sample drivers.

• **Miscellaneous**
This includes three drivers:
  - *iklpn* — Printer class driver
  - *pcishm* — Shared memory access driver
  - *rdisk* — *rdisk* driver
These drivers are provided with emphasis on DLKM and kernel tunable features. Driver sources, README, Makefiles, and build scripts are provided for each of these three drivers.
Build Environment (BE)

The necessary driver build tools and sample Makefiles required to build and install drivers are included. The following items are provided with the BE:

- **Build and install tools**
  These sets of tools are required for driver building and installing. They include `modmeta`, `kmsecgen`, and `modlink`.

- **Sample Makefiles**
  You can use the sample Makefiles to generate your own Makefiles for driver development.

Build and Install Tools

The following tools binaries and manpages are provided as part of BE of the DDK:

- **modmeta**
  Used to compile a `modmeta` file. A `modmeta` file for a module defines the metadata characteristics of that module and adds dynamic loading data to the module.

- **kmsecgen**
  Adds dynamic loading data to the module.

- **modlink**
  Creates a kernel module for a set of component object files.

Sample Makefiles

The following files assist you in building your driver:

- **Makefile**
  Sets the Build Environment for driver building and calls `Makefile.bld`.

- **Makefile.bld**
  Defines build options and builds the driver.

In addition to the previous files, a `stub.m4` macro assembler file for generating auto load stubs and a `modprep` script manpage are also provided.

Development Tools

HP-UX 11i v3 includes performance analysis tools, configuration and administration tools, driver compliance tools, certification tools, and test tools. All tools have either a Usage Guide or manpage with binaries. Some of these tools are listed below:

- **DDICT**
- **KIVT**
- **APITI**
- **Netperf**

System Support

If you encounter difficulties during the development and test phases of writing a driver, HP may provide assistance in isolating problems to determine if:

- HP hardware is not at fault
- HP software (firmware) is not at fault by removing user-written kernel drivers

When HP hardware, software, and firmware are not at fault, seek help from the third party from whom that software or hardware was obtained.
System Requirements

The HP-UX 11i v3 DDK will install on an earlier version of HP-UX, but some of the included binaries may not function on earlier versions of HP-UX, including the HP-UX Kernel Configuration Build tools.

Installation Locations

Document Hierarchy

All the HP-UX 11i v3 DDK documents are installed under the /opt/ddk/11.31/docs directory.

Sample Driver Hierarchy

All the HP-UX 11i v3 DDK sample drivers are installed under the /opt/ddk/11.31/sample-drvs directory.

Build Hierarchy Environment

All the HP-UX 11i v3 DDK build tools are installed under the /opt/ddk/11.31/BE/bin directory. The sample makefiles are copied under the /opt/ddk/11.31/BE/makefile directory. Any included header files are copied to the appropriate directory under the /usr/include directory.

Tool Hierarchy

The SD/UX depot files for all of the tools included with the HP-UX 11i v3 DDK are copied under the /opt/ddk/11.31/tools directory. None of the tools are installed. You must install the individual tools as required. All of the tools include README files with installation instructions. This approach has the advantage that when you uninstall the DDK the individual tools do not get uninstalled. If you want to uninstall a tool that you previously installed, you will need to uninstall it individually and separately from DDK.

Installing the Driver Development Kit (DDK)

To install the DDK on a system do the following:

1. Download the HP-UX 11i v3 DDK SD/UX tape depot from the DDK Website at http://www.hp.com/go/hpux_ddk
2. Copy the downloaded depot to the system you want to install it on.
3. Log on as the "root" user and execute the following command:
   $ swinstall -s <ddk tape depot location> B11_31DDK

   NOTE: Starting with the HP-UX 11.31 DDK, a single SD/UX depot is provided, which contains everything.