Troubleshooting Ignite-UX Installation Booting

hp

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Abstract

Ignite-UX for HP-UX addresses the need for system administrators to perform operating system installations, deployment, and recovery, often on a large scale. It provides the means for creating and reusing standard operating system configurations. Additionally, Ignite-UX delivers the ability to archive operating system configurations, and to use these archives to replicate systems, with the added benefit of speeding up the process. Ignite-UX also permits various customizations, and is capable of both interactive and unattended operating modes.

Executive summary

The necessity to debug problems encountered by the specific secondary loader (SSL) or bootstrap program may occur. This white paper is intended to provide additional information to augment the *hpux*(1M) and *hpux.efi*(1M) documentation and aid you in advanced troubleshooting of secondary loader problems.

It is important to understand how Ignite-UX boots a system in preparation for installing HP-UX, which differs from the normal system boot process. The first section of this paper discusses the installation booting process for PA-RISC and Intel® Itanium®-based systems. The second section presents troubleshooting techniques to assist you in resolving secondary loader issues.

Section I: Installation and recovery booting processes

This section provides a high-level outline of the system booting process that occurs prior to installation or recovery of the HP-UX operating system using Ignite-UX.

PA-RISC systems:

<u>Booting from a CD or DVD</u>

System booting from a CD or DVD is as follows:

1. The command to boot from the CD or DVD is entered at the boot console.

   Please consult the documentation appropriate to the system for information on how to boot from CD/DVD.

2. The firmware reads the LIF from the boot device and copies the ISL from the location on the device designated by the ISL LIF entry.

3. ISL is invoked.

   It is assumed that you did not answer **y** when asked, "Do you want to interact with IPL?" The booting process is different if you answer **y**, since ISL does not read and automatically execute the AUTO file.

4. ISL reads the AUTO file from the LIF on the boot device.

   For installation media, the typical contents of the AUTO file are hpux (;0):INSTALL, while for a normal system boot the contents are hpux (;0)/stand/vmunix. ISL completes the (;0) information read from the AUTO file to include the full device information.

5. ISL reads the secondary loader and invokes it with the options described in the previous step.

   The secondary loader, hpux, reads the file name part of the boot command. The ':' (colon) in the boot command means that the kernel is to be read from the LIF on the boot device, whereas in a normal boot command the file name starts with '/' (forward slash) to indicate it is to be read from a filesystem.

   Note:
   ISL may also alter the name of the installation kernel to prepend a W if the PDC indicates that the system can only run a 64-bit kernel. The translation to add a "W" was new at HP-UX 11.0.

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6. The secondary loader loads the installation kernel and invokes it.

   By its name the kernel knows that it has been loaded as INSTALL (or one of the [W|V|I]INSTALL kernels), so it must act as an installation kernel. Early in the boot process it has to load the corresponding [W|V|I]INSTALLFS filesystem into a RAM disk.

   The installation filesystem is very limited in size, approximately 8MB for PA-RISC systems.

7. The kernel loads the installation filesystem from the LIF into the RAM disk.

The kernel loads the installation filesystem by executing calls to the secondary loader to load the filesystem. Since the kernel has not initialized the input/output (I/O) subsystem, it has no ability to access a disk device to read from the installation media.

8. The kernel starts `init`[1] from the installation filesystem that was just loaded.

9. Lastly, `init` starts the installation or recovery process.

Booting from a CD or DVD with HP-UX 11i v2 and greater

The Ignite-UX C.6.0.x version, which supports HP-UX 11i v2 (B.11.23) and greater, contains installation kernels specific to each supported release of the operating system. In order to select the correct kernel for your client at network installation time, the bootloader was enhanced to understand additional `AUTO` file syntax.

This additional syntax causes `hpux` to prompt you for the target HP-UX release for the client, for example B.11.23, and then it retrieves the installation kernel appropriate for that release. The default prompts and other options of the additional `AUTO` file syntax can be modified using the `auto_adm` command introduced in the Ignite-UX C.6.0.x version. For more information, refer to `auto_adm(4)`.

Booting from a tape

The only difference between booting from media and tape is that the tape is a serial device so it requires rewinding and forwarding to access different parts of the tape to locate the files the LIF points to on the tape.

Booting from a LAN

System booting from a LAN is as follows:

1. The command to boot from the LAN is entered at the BCH prompt.

   The IP Address of the server to boot from is optional, and if given, only responses from that server are accepted.

2. The client performs a `bootp` broadcast in an attempt to find an Ignite-UX server. The `bootp` broadcasts do **not** go outside of the local LAN segment. If the Ignite-UX server is on a different LAN segment and there is no local boot helper, the system fails to boot

3. The Ignite-UX server provides a `bootp` response to the client.

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[1] The `init` process that is started from the installation filesystem is **not** the same as the `/sbin/init` process used by HP-UX, rather it is Ignite-UX code.

If the `install` option was given to the BCH to boot from the LAN, the `bootp` protocol is still used. However, the User Datagram Protocol (UDP) ports used are 1067/1068 instead of the standard 67/68. These custom ports for installation allow you to install PA-RISC HP-UX systems without any interference from other systems. Only the Ignite-UX daemon `instl_bootd` is set to listen on these ports for `bootp` traffic, so only `instl_bootd` responds. All of the necessary client boot information is provided in the `bootp` response.

The response from `instl_bootd` returns `/opt/ignite/boot/boot_lif` as the boot file.

4. The client retrieves the boot file from the Ignite-UX server using firmware implemented `tftp`, and then extracts the ISL.

5. The ISL on the client reads the `AUTO` file from the boot LIF.

6. The secondary loader reads from the boot LIF and is started with the information read from the `AUTO` file.

   At this point, both ISL and the secondary loader are set to read from the LAN device. Using a / (forward slash) in the file name when designating a LAN device causes `tftp` to access a file, or if a disk is designated to read from a filesystem.

   In a default Ignite-UX installation, the `AUTO` file read by a system booting via the network should contain `hpux (;0)/boot/INSTALL`. Due to way that NFS diskless was originally designed, the secondary loader translates the kernel path by taking the path of the boot file, `/opt/ignite/boot/boot_lif`, and removing the last two path elements, leaving `/opt/ignite`, and then by appending the name from the `AUTO` file, resulting in `/opt/ignite/boot/[W|V|I]INSTALL`[2]. This design allows the kernels to be in client-specific directories without needing each LIF volume to have a different `AUTO` file.

7. The secondary loader loads the `INSTALL` kernel and executes it.

8. The `INSTALL` kernel loads the RAM filesystem, `INSTALLFS`.

   The kernel loads the installation filesystem by making calls back into secondary loader to load the filesystem. At this stage, the kernel cannot read anything from the Ignite-UX server. The kernel does not have any initialized LAN interfaces from which the installation filesystem can be read.

   The kernel starts `init`[3] from the installation filesystem just loaded. The `init` process then starts the installation or recovery process.

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[2] As of Ignite-UX version C.6.0.x, all installation kernels are located in release-specific directories so the boot kernel for an 11.11 PA-RISC system is `/boot/Rel_B.11.11/INSTALL` not `/boot/INSTALL`.

[3] The `init` process that is started from the installation filesystem is **not** the same as the `/sbin/init` process used by HP-UX.

Figure 1 illustrates the process of booting from the network by PA-RISC systems:

Figure 1

Client   Server

```
boot lan install – bootp query on
```
→
→ response on 1068 from
```
boot lan – bootp query on port
```
→
→ response on 68 from
```
tftp
```
→ ISL
```
tftp
```
→ AUTO (`hpux (;0)/boot/INSTALL`)
```
tftp
```
→ HPUX
```
tftp
```
→ `/opt/ignite/boot/INSTALL`

kernel runs – callback to PDC to get install filesystem
```
tftp
```
→ `INSTALLFS` into RAM filesystem

Kernel completes initialization and then starts `/sbin/init`

inetd

→ 1067 –

→ 67 –
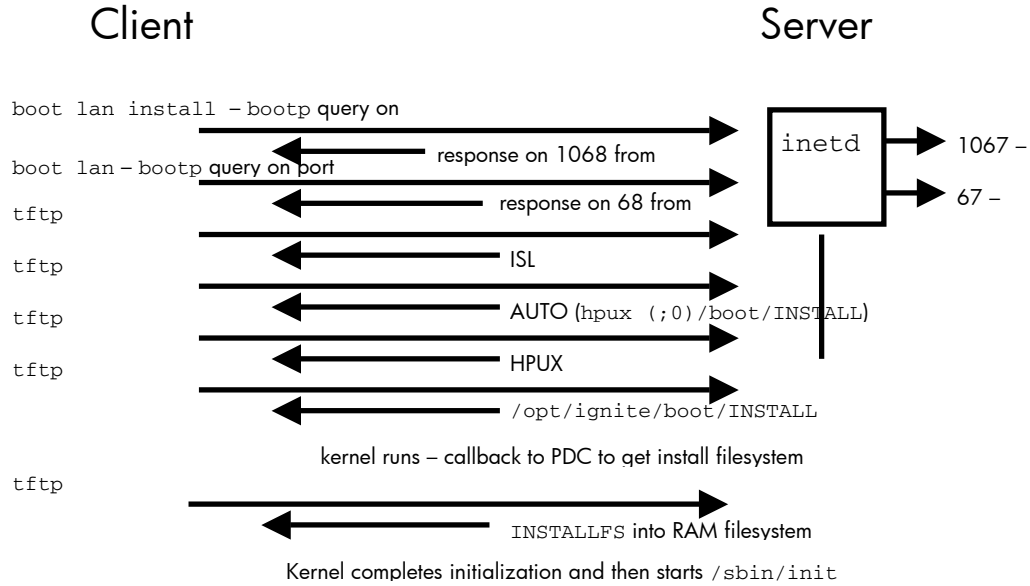
Note:
The method that very old PA-RISC systems used to boot over the network, Remote Maintenance Protocol (RMP) via `rbootd(1m)`, is not discussed in this white paper.

Booting from a PA-RISC virtual partition

This example is illustrated with an rp8400 system that has been split into three Virtual Partitions (vPars). The virtual partition, `host1`, has already been installed with the vPars software and the vPars monitor is running. The remaining two virtual partitions have been configured but not installed.
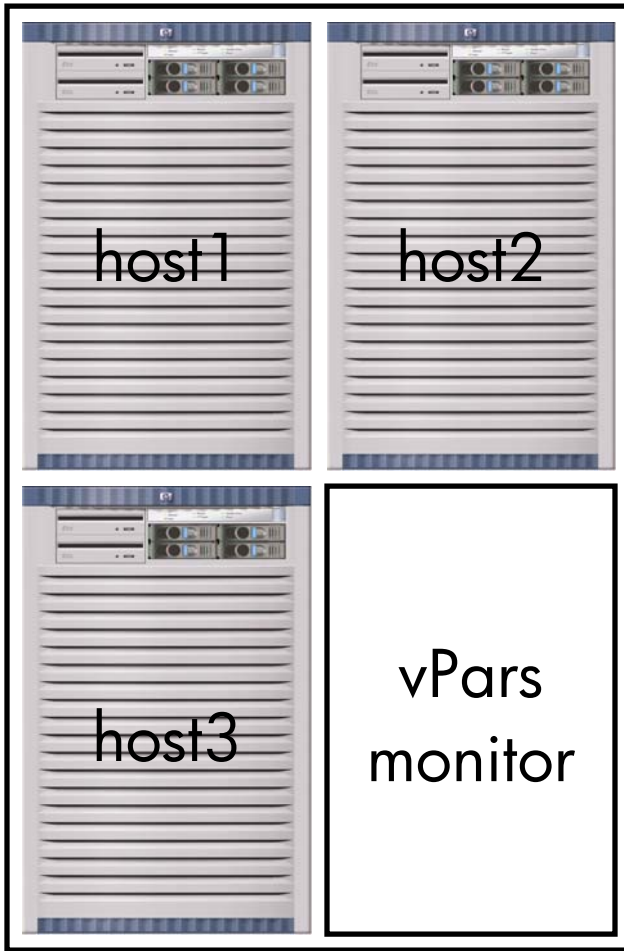
The virtual partition host1 has Ignite-UX installed previously and has depots that contain the HP-UX B.11.11 OE, the vPars software, and enablement patches. The required Ignite-UX configuration is complete.

You execute the `vparboot` command to start one of the other virtual partitions so that you can begin the operating system installation using Ignite-UX with the following command:

`vparboot -p host2 –I WINSTALL`[4]

The `–I` option of `vparboot(1M)` by default obtains files from `/opt/ignite/boot` if no path is specified.

In addition, the `–I` option allows a host name or IP address with the kernel. When used in this way, the `vparboot` command will `tftp` the installation kernel and filesystem from the remote Ignite-UX server to the local vPars partition, and then the installation kernel is passed to the vPars monitor.

`vparboot -p host2 –I \`
`10.0.0.5,WINSTALL`

The monitor uses the installation kernel and filesystem to boot the vPar[5]. The monitor puts the `WINSTALL` and `WINSTALLFS` into the memory owned by the partition that is booting and then starts the partition running.

This boot process is completely different from the way that a PA-RISC system would normally boot.

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[4] As of Ignite-UX version C.6.0.x, the `vparboot` command will not know about the new locations of installation kernels within the Ignite-UX product. You must give the full path to the installation kernel if you are using vPars and Ignite-UX version C.6.0.x or later. For example, HP-UX 11i v1 (B.11.11) requires `/opt/ignite/boot/Rel_B.11.11/WINSTALL` and HP-UX 11i v2 (B.11.23) requires `/opt/ignite/boot/Rel_B.11.23/WINSTALL`.

[5] This description indicates that if there are no partitions running (just the monitor), it is not possible to use a network-based Ignite-UX server from just the monitor prompt since the monitor is not capable of communicating over the network.
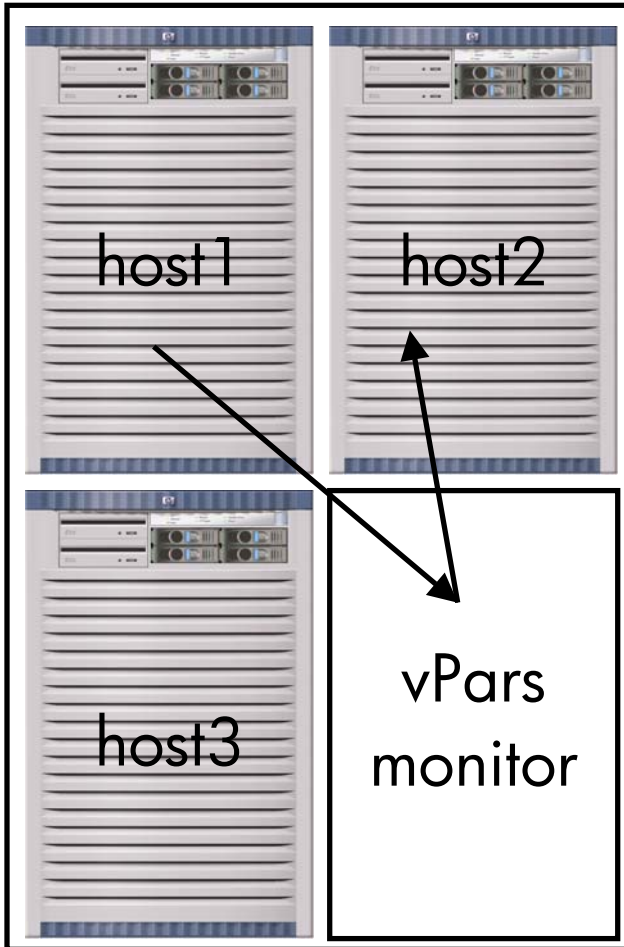
The vPars boot process is as follows:

1. The `vparboot` command locates the installation kernel and filesystem.
2. The `vparboot` command transfers the installation kernel and filesystem to the vPars monitor.
3. The monitor places them into the memory that is used by the host being started.
4. The kernel in the virtual partition is started.

Once the vPar host2 has started and is running the kernel in the installation filesystem, it must be able to contact the Ignite-UX server.

This is accomplished either by the client contacting a DHCP server to obtain an IP address, or by entering the information on the client console designating the IP address and Ignite-UX server to use (and possibly a default route).

To advance the booting process, the client must be connected via the network to the Ignite-UX server.

If the booting partition cannot contact the Ignite-UX server because there is no network connectivity, the installation cannot succeed.

Remember that being able to boot a virtual partition from an Ignite-UX server does not mean there is network connectivity between the two systems, so consider the following:

- When you choose a network interface on the booting vPars system, it **must** have network connectivity to the Ignite-UX server.
- If you experience problems, troubleshoot the connectivity issue as a network problem.

Itanium®-based systems:

Booting from a CD/DVD

System booting from a CD/DVD is as follows:

1. Enter the commands to boot from an appropriate DVD or use the boot manager menu (if configured).

   Please consult the documentation appropriate to the system for information on how to use the EFI or how to configure the boot manager menu.

2. The EFI reads the CD or DVD media to determine if it is an El Torito format CD or DVD (Itanium®-based systems can only boot from El Torito format CD or DVD media).

3. Invoke the bootloader from command line or use the boot manager menu to start the installation process.

   The bootloader on the CD or DVD is invoked from the EFI shell by changing partitions to the EFI partition for the CD or DVD, and then entering `install`. If no other boot devices are found before the CD or DVD is found, the EFI automatically boots via the `/STARTUP.NSH` EFI script on the CD or DVD. If you change EFI partitions to the CD or DVD, the `STARTUP.NSH` EFI script should automatically start the boot process.

4. The bootloader, `install.efi`, reads the `AUTO` file from the LIF. It is possible to interact with the bootloader.

   The Itanium®-based installation media used to install HP-UX contains a LIF, just as with PA-RISC media. However, the EFI does nothing with this LIF because its purpose is just to allow common code to be used to install HP-UX on PA-RISC and Itanium®-based systems. The `AUTO` file contains `boot :IINSTALL`; the : (colon) designates that the installation kernel `IINSTALL` is read from the LIF on the boot device. Only the installation bootloader reads LIF files; the EFI does not.

5. The bootloader executes the contents of the `AUTO` file; however, both the installation kernel (`IINSTALL`) and installation filesystem (`IINSTALLFS`) are loaded by the bootloader at the same time before the execution of the kernel starts.

   Additional tasks are not available with the Itanium®-based systems bootloader as with the secondary bootloader on PA-RISC because the state of EFI is undefined once the operating system starts running. The bootloader must load the installation kernel and filesystem before passing control to the kernel. The bootloader passes the location of the loaded installation filesystem to the kernel and then the kernel completes its initialization.

6. The installation continues at this stage with the kernel running `init`[6] from the installation filesystem loaded by the bootloader.

Booting from a tape

Itanium®-based systems currently cannot boot from tape. However, Ignite-UX provides tape recovery support via a method called Tape Recovery with No Tape Boot Support or Dual-Media Recovery. This method requires that a tape drive be connected to the client, that you boot the client from the HP-UX installation media, and that you choose options to continue installation or recovery from tape. For more information, refer to the "Tape Recovery with No Tape Boot Support" section of the *Ignite-UX Administration Guide* at:

http://www.docs.hp.com/hpux/os/11iv2/

Booting from a LAN

System booting from a LAN is as follows:

1. At the EFI boot manager menu, select a LAN device to boot from, or use the `lanboot` command at the EFI shell prompt.

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[6] The `init` process that is started from the installation filesystem is ***not*** the same as the `/sbin/init` process used by HP-UX.

Please consult the documentation appropriate to the system for information on how to use EFI or how to configure the boot manager menu.

2. The firmware sends a DHCP request with an Itanium®-based `class-id` set.

    The DHCP server on HP-UX 11i v2 (B.11.23) replies to Itanium®-based PXE boot requests, if configured appropriately.

    For more information regarding how to configure DHCP on an HP-UX B.11.23 system to respond correctly to Itanium®-based PXE DHCP requests, refer to the *Ignite-UX Administration Guide*.

    If a DHCP PXE response to a PXE boot request includes a `class-id`, it will attempt to contact a PXE proxy server on the responding host. HP-UX does not currently provide a PXE proxy server; so a DHCP PXE response including a `class-id` will cause a network boot to fail. HP-UX releases prior to HP-UX 11.23 do not have the appropriate option to allow you to configure DHCP to not include a `class-id` in the DHCP PXE response. On HP-UX 11.23, the `ncid` keyword prevents the `class-id` from being included in the PXE response. Other keywords were also added at HP-UX 11.23 to make configuring DHCP for booting Itanium®-based systems easier.

3. The DHCP response directs the system to download `/opt/ignite/boot/nbp.efi` ("nbp" means "network bootstrap program") to continue booting.

4. After the `nbp.efi` process is downloaded and executed, it downloads and executes the bootloader, `hpux.efi`.

5. The bootloader downloads the `AUTO` file, `/opt/ignite/boot/AUTO`.

    The contents of the `AUTO` file control the operation of the bootloader and usually contain the `boot IINSTALL` command.

6. The bootloader downloads the installation kernel, `IINSTALL`, and the installation filesystem, `IINSTALLFS`, and executes the kernel.

    Itanium®-based systems cannot ask their bootloader to perform additional tasks (like the secondary bootloader does on PA-RISC). Because of this the bootloader must load the installation kernel and the installation filesystem before passing control to the kernel. The bootloader tells the kernel where it loaded the installation filesystem. This is different from how PA-RISC booting works.

7. The kernel completes its initialization. The installation continues with the kernel running `init` from the installation filesystem loaded by the bootloader.

Section II: Troubleshooting the secondary loader

Debugging PA-RISC booting problems:

Errors booting PA-RISC systems without virtual partitions

It is likely that at some point errors will appear when booting a PA-RISC system (without Virtual Partitions) that are similar to the following errors, though the actual errors vary across systems (the amount of information provided varies and you may or may not see a hex dump).

```
ENTRY_INIT
Status = -7
Failed to initialize
```

The status value helps you isolate and correct the problem.

Table 1 defines some of the errors that you may encounter:

Table 1

Status Value	Description
-3	Cannot complete call without error – An error of unknown type prevented the call from completing correctly.
-4	Unrecoverable hardware error – An unrecoverable hardware error has occurred between the processor PDC and IODC on the target controller or device.
-5	Unrecoverable data error - ENTRY_INIT encountered an error while transferring data to/from the target controller or device.
-6	Illegal device address – The device address supplied to ENTRY_INIT is invalid; it could never be a valid device address.
-7	Nonexistent device - The device address specified is a valid device address. However, it points to either a device that is not installed and/or not responding.
-8	Module/device not ready - The module or device is not ready to be initialized or tested. A module may not be ready because it is still performing its self-test after reset or power-on.
-9	Cannot locate a console device or boot device - The search could not locate a console device or boot device on the module.
-10	Invalid argument.
-13	Protocol error - A protocol violation was encountered on the module-device connection while transferring data to or from the device, for example, a SCSI protocol error.
-14	Invalid or uninitialized SCSI parms in NVRAM – When initializing a SCSI module, either the SCSI parameters in the system NVRAM or module NVRAM were not initialized, or they did not agree.

Examples:

- A value of -7 for the ENTRY_INIT error can mean different things for different devices. For a LAN device it could mean that nothing responded to its boot request. For a disk device, it could mean that the device does not exist (for example, the device path is incorrect).

- A value of -8 for the ENTRY_INIT error could mean that the disk you are attempting to boot from has not spun up yet, the tape is still loading, or the CD-ROM may have only just been inserted into a drive and is in the process of becoming ready.

Debug level logging

There are times when you encounter errors when using Ignite-UX when you may be asked by HP Support to enable debug level logging within Ignite-UX to gather more detailed information to help with troubleshooting.

The following steps enable debug level logging during an installation or recovery session:

1. Boot the system from the media and answer **y** when queried if you wish to interact with the IPL.

2. At the ISL prompt, enter the appropriate command from Table 2 for the media you used to boot:

Table 2

Boot Media	Command
CD or DVD and tape	`hpux -i3 (;0):INSTALL`
Network before Ignite-UX C.6.0.x	`hpux -i3 (;0)/boot/INSTALL`
Network after Ignite-UX C.6.0.x	`hpux -i3 (;0)/boot/Rel_B.xx.yy/INSTALL`

Other older PA-RISC systems may require different syntax (for example the V series) so consult the operational documentation for the system for specifics regarding how to boot and provide flags to the bootloader.

There are times when you may experience bootloader problems like the loading of a kernel or installation filesystem. At these times, HP Support may ask you to enter a loader option from Table 3 or Table 4 appropriate for the operating system release and media you used to boot from, on systems running HP-UX 11i v1 (B.11.11) and greater:

Table 3, HP-UX 11i v1 (B.11.11) and above

Boot Media	Command
CD or DVD and tape	`hpux -D0xfffff -B0xfffff (;0):INSTALL`
Network before Ignite-UX C.6.0.x	`hpux -D0xfffff -B0xfffff (;0)/boot/INSTALL`
Network after Ignite-UX C.6.0.x	`hpux -D0xfffff -B0xfffff (;0)/boot/Rel_B.<xx.yy>/INSTALL`

Table 4, HP-UX 11.0 (B.11.00)

Boot Media	Command
CD or DVD and tape	`hpux -D0xfffff (;0):INSTALL`
Network before Ignite-UX C.6.0.x	`hpux -D0xfffff (;0)/boot/INSTALL`
Network after Ignite-UX C.6.0.x	`hpux -D0xfffff (;0)/boot/Rel_B.xx.yy/INSTALL`

Setting debug level logging causes the system to print information about the instructions that the secondary loader is executing. Typically this information is useful only to HP Support. Enable these loader debug options only when requested to do so by HP Support.

Setting debug level logging on Itanium®-based systems

There are times when you encounter errors when using Ignite-UX when you may be asked by HP Support to enable debug level logging within Ignite-UX to gather more detailed information to help with troubleshooting.

The following steps enable debug level logging during an installation or recovery session:

1. At the EFI shell, choose one of the following options:

- If you have configured an option to boot from the CD or DVD drive, select that option. The system starts to boot automatically.

- Otherwise, quit to the EFI shell, and then change your EFI partition to the CD drive containing the installation media. If the system does not automatically boot, type **startup** and then press **Enter**.

2. Interrupt the boot sequence at the message `Press Any Key to interrupt Autoboot` by pressing a key.

```
fs0:\> startup
…
HP-UX Bootloader for IA64 Revision 1.713
Press Any Key to interrupt Autoboot
AUTO ==> boot :IINSTALL
Seconds left till autoboot -   7
type 'help' for help
HPUX>
```

3. At the HPUX> prompt, enter **boot :IINSTALL –i3** so that the bootloader loads the kernel and installation filesystem into memory, and then passes control to the kernel.

Debug messages start to appear once the kernel has started the `init` process.

Additional debug level logging for both PA-RISC and Itanium®-based systems

The information in this section is applicable to PA-RISC and Itanium®-based systems.

In addition to booting with the `-i3` flag (how you do this depends on the type of system you are using), you can enable debug level logging during an installation or recovery before the Ignite-UX Graphical User Interface (GUI)[7] program starts.

On the screen that provides the option to **Install HP-UX**, select **Advanced Options**. In the screen that appears, scroll down to debug level and press **Enter** to select **level 3**. The same amount of detail is provided for levels 3, 4 and 5. This action starts debug level logging exactly as it would from boot except that debug messages will appear once you have continued with the installation or recovery (that is, selected **Install HP-UX** from the main menu) instead of when `init` starts.

If you are experiencing problems during initial device discovery (for example, some hardware is not found), you must enable debug level logging from boot time. For more information, see Debugging PA-RISC booting problems: or Setting debug level logging on Itanium®-based systems.

You may choose to enable debug level logging during an installation or recovery to avoid filling the RAM filesystem to capacity when debug level logging is enabled from boot (it is more likely to happen the more hardware you have attached to a system). A full RAM filesystem can cause an installation or recovery session to fail if the RAM filesystem fills before the Ignite-UX GUI starts and causes cosmetic issues with the GUI. However, it should not cause recovery problems after the GUI is invoked.

Troubleshooting early install kernel boot problems on Itanium®-based systems

When you encounter the rare occurrence of a kernel hang or delay during boot on Itanium®-based systems, you can localize where the problem may be occurring. There is a boot loader option `-v` that directs the kernel to print out what is happening in the kernel during its initialization.

The output looks like the following:

```
Init[  0]:0xe0000000015ea1c0:                        - DONE (0x000000000a8b iticks)
Init[  1]:0xe0000000017c4f90:                        - DONE (0x00000000dd2d iticks)
Init[  2]:0xe000000001856240:                        - DONE (0x0000000000b4 iticks)
Init[  3]:0xe000000000557520:                        - DONE (0x000000004c62 iticks)
Init[  4]:0xe000000000b1c8e0:                        - DONE (0x0000000006cf iticks)
Init[  5]:0xe00000000133d0c0:                        - DONE (0x000001faa603 iticks)
Init[  6]:0xe00000000085a750:           unwind_init - DONE (0x000000001e93 iticks)
Init[  7]:0xe0000000016093c0:kwdb_wait_for_consol - DONE (0x000000000181 iticks)
Init[  8]:0xe000000000b14c80:            fpswa_init - DONE (0x000000001915 iticks)
Init[  9]:0xe000000000b0be90:               ex_init - DONE (0x0000000000e9 iticks)
Init[ 10]:0xe000000000af9720:          fw_psm_init - DONE (0x00000000d0a8 iticks)
Init[ 11]:0xe0000000010599d0:      io_memory_config - DONE (0x00001cbf9196 iticks)
```

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[7] The Ignite-UX Graphical User Interface helps you manage multiple, simultaneous installation or recovery sessions using tabs and dialog boxes for task navigation.

```
Init[ 12]:0xe0000000015ea9d0:kwdb_boot_init_lan_s - DONE (0x0000000000f6 iticks)

Init[ 13]:0xe000000000edfaa0:        GetPAinfo - DONE (0x000000010ae4 iticks)

...

Init[105]:0xe0000000005bb6b0:          vasinit - DONE (0x0000000adddc iticks)

Init[106]:0xe0000000005cd160:          preginit - DONE (0x0000000025c9 iticks)

Init[107]:0xe0000000005c1480:          reginit - DONE (0x000000006a1d iticks)

Init[108]:0xe0000000004ed200:    pgcopy_util_init - DONE (0x00000000019c iticks)

Init[109]:0xe000000000ee1780:    pdk_malloc_nomore - DONE (0x000001b5cd82 iticks)

Init[110]:0xe000000000efc620:    vm_pre_main_init - DONE (0x00003e2929ba iticks)

Init[111]:0xe000000000f18ee0:        miscmeminit - DONE (0x000000000232 iticks)

Init[112]:0xe000000000f2b220:        vhpt_init2 - DONE (0x0000003f55a8 iticks)

Init[113]:0xe0000000017a45c0:        treg_copy_trs - DONE (0x00000000cb9a iticks)

Init[114]:0xe0000000008b8d40:          p0init - DONE (0x00000001782d iticks)

Init[115]:0xe00000000081c190:          swmain - Invoked       0xe000000100105040
```

Important:
The format and functions listed may change with patch and HP-UX
revisions, but the information provided will remain generally the same.

The output is dynamic. On the console, you will see:

```
Init[ 11]:0xe0000000010599d0:    io_memory_config - In Progress ...
```

When the function completes, the "In Progress ..." gets erased and replaced with:

```
Init[ 11]:0xe0000000010599d0:    io_memory_config - DONE (0x00001cbf9196 iticks)
```

To enable this output, you should perform the following actions when booting the IINSTALL install
kernel (these instructions assume that you are booting from a CD or DVD):

1. At the EFI shell, choose one of the following options:

- If you have configured an option to boot from the CD or DVD drive, select that option. The system
  starts to boot automatically.

- Otherwise, quit to the EFI shell, and then change your EFI partition to the CD drive containing the
  installation media. If the system does not automatically boot, type **startup** then press **Enter**.

2. Interrupt the boot sequence at the message `Press Any Key to interrupt Autoboot` by
  pressing a key.

```
fs0:\> startup

...

HP-UX Bootloader for IA64 Revision 1.713

Press Any Key to interrupt Autoboot

AUTO ==> boot :IINSTALL
```

```
Seconds left till autoboot - 7

type 'help' for help

HPUX>
```

3. At the `HPUX>` prompt, enter **boot :IINSTALL –v** and then press **Enter** so that the bootloader loads the kernel and installation filesystem into memory, and then passes control to the kernel.

Note that the information about what routines are being called during initialization will appear only on the console of the system.

Network recovery/installation without network boot helpers:

There are several methods for doing this. Note that some methods work only on PA-RISC systems or Itanium®-based systems.

As of Ignite-UX version C.6.2, an example script is provided that can create many types of custom media:

```
/opt/ignite/data/scripts/examples/make_media_install
```

This script can create most of the media mentioned in this section. A future version of this white paper will remove the information presented here currently and replace it with how to achieve the same results with the `make_media_install` script.

Booting from tape (PA-RISC only)

The *make_boot_tape*(1m) command can create a bootable tape containing just enough information to boot a PA-RISC system. However, you must use a combination of an interface card and a tape drive that is bootable. Booting the tape will get the system to the point where it can contact an Ignite-UX server.

Note the `–f` option to `make_boot_tape` which allows you to specify the configuration that will be placed into the LIF on the tape. In this configuration file (which is limited to 8Kb[8]), you need to give information like the IP address of the Ignite-UX server.

Booting from CD/DVD (PA-RISC only)

Here we're going to look at how to create a CD-ROM image that can be used to boot PA-RISC systems to the point of contacting an Ignite-UX server.

You should do this on a system with the same version of Ignite-UX as the Ignite-UX server. You need to have only the PA-RISC boot filesets loaded on the system to be able to build the LIF correctly.

---

[8] Ignite-UX takes advantage of the fact that the first 8Kb of filesystems are not used (true for HFS and VxFS filesystems currently) to allow for up to 8Kb of configuration information to be kept in the install filesystem.

```
# make_medialif -m -l ./my_lif
# lifls -l ./my_lif
volume ISL10 data size 648426 directory size 3 03/10/12 14:38:46
filename    type    start   size      implement  created

===========================================================
ISL         -12800  16      306       0          03/10/12 14:38:46
AUTO        -12289  328     1         0          03/10/12 14:38:46
HPUX        -12928  336     848       0          03/10/12 14:38:46
FWWKAR4     BIN     1184    1         0          03/10/12 14:38:46
FWWKAR5     BIN     1192    1         0          03/10/12 14:38:47
FWWKAR6     BIN     1200    1         0          03/10/12 14:38:47
FWWKAR7     BIN     1208    1         0          03/10/12 14:38:47
FWWKAR8     BIN     1216    1         0          03/10/12 14:38:47
INSTALL     -12290  1224    67418     0          03/10/12 14:38:52
INSTALLFS   -12290  68648   35840     0          03/10/12 14:38:54
VINSTALLFS  -12290  68648   35840     0          03/10/12 14:38:54
WINSTALLFS  -12290  68648   35840     0          03/10/12 14:38:54
IINSTALL    -12290  104488  158311    0          03/10/12 14:39:06
VINSTALL    -12290  262800  72971     0          03/10/12 14:39:11
WINSTALL    -12290  335776  79434     0          03/10/12 14:39:17
IINSTALLFS  -12290  415216  88400     0          03/10/12 14:39:23
```

You can see the required files in the output of lifls. All of the install kernels are there (PA-RISC and Itanium®-based) along with all of the install filesystems, the PA-RISC AUTO, ISL, and HPUX files.

You can burn this file directly onto a CDR or DVD and use it to boot PA-RISC systems.

Note that you will need CD-burning software that can write non-ISO images to the target media (for example, cdrecord can do this).

Don't forget you can place configuration information into the INSTALLFS about how to contact the Ignite-UX server before burning to recordable media.

Booting from CD/DVD (PA-RISC and Itanium®-based systems)

The following section requires you to have the mkisofs command available. You can find mkisofs as part of the TechSysConf bundle (which contains the TC-OpenSource and TC-

SysSetup products) on your application media. You can use any other version of mkisofs as long as it supports creating El-Torito media.

Starting with Ignite-UX version C.6.2, the mkisofs and other commands required to create optical media are shipped as part of Ignite-UX. If you use this version or later, you do not need to source mkisofs from elsewhere. If you use the version of mkisofs shipped with Ignite-UX, this will change the path to the commands in the examples that follow.

The TC-OpenSource product contains the following filesets on the 11i Version 1 media (the contents might vary between revisions of HP-UX and Application Media).

```
BASH-RUN          The Bourne-Again Shell

CDRECORD-RUN      CDRecord

EMACS-RUN         GNU Emacs

GMAKE-RUN         GNU make

LESS-RUN          GNU less

OPENSOURCE-AUX    TC-OpenSource auxiliary fileset

TCSH-RUN          tcsh (a superset of C-shell)

VIM-RUN           Vi IMproved

XCDROAST-RUN      X-CD-ROAST
```

To create the media that allows you to boot an Itanium®-based system, we'll use the LIF we created for PA-RISC systems (since it contains the IINSTALL kernel and IINSTALLFS filesystem).

To do this, we need to create a top level directory to lay out our ISO image and copy the LIF into it along with the file /opt/ignite/boot/EFI_CD_image:

```
# mkdir top

# mv my_lif top

# cp /opt/ignite/boot/EFI_CD_image top/EFI_CD_image
```

Next you need to create an ISO image of the top level directory containing those two files with the following command:

```
# cd top

# /opt/mkisofs/bin/mkisofs -no-emul-boot -b EFI_CD_image \

> -eltorito-alt-boot -no-emul-boot -b my_lif -o ../cdfs.out $(pwd)

Size of boot image is 6428 sectors -> No emulation


Size of boot image is 251808 sectors -> No emulation

  7.75% done, estimate finish Sun Oct 12 16:05:07 2003

 15.48% done, estimate finish Sun Oct 12 16:05:14 2003

 23.23% done, estimate finish Sun Oct 12 16:05:12 2003

 30.96% done, estimate finish Sun Oct 12 16:05:14 2003
```

```
   38.71% done, estimate finish Sun Oct 12 16:05:13 2003

   46.44% done, estimate finish Sun Oct 12 16:05:14 2003

   54.19% done, estimate finish Sun Oct 12 16:05:13 2003

   61.91% done, estimate finish Sun Oct 12 16:05:14 2003

   69.66% done, estimate finish Sun Oct 12 16:05:13 2003

   77.39% done, estimate finish Sun Oct 12 16:05:14 2003

   85.14% done, estimate finish Sun Oct 12 16:05:13 2003

   92.87% done, estimate finish Sun Oct 12 16:05:14 2003

 Total translation table size: 2048

 Total rockridge attributes bytes: 0

 …
```

Note that this is the minimum required to create an ISO filesystem that will boot both PA-RISC and Itanium®-based systems.

Also note that more options are required if you wish to place other files in the ISO image since they will appear in 8.3 ISO9660 format using the above options. However, this is not a general guide to creating custom install/recovery media; only enough information is provided to create a CD/DVD that can be used to boot a system to the point of contacting an Ignite-UX server.

Booting from CD/DVD (Itanium®-based systems only)

See the previous section. To remove PA-RISC support, create the LIF on a system that does not have the PA-RISC boot filesets loaded. This will prevent the various PA-RISC install kernels and filesystems, and so forth from being placed into the LIF file.

The *bootsys*(1m) command

The `bootsys` command allows you reinstall or recover an existing HP-UX system on its next reboot. The `bootsys` command does this by copying an install kernel and filesystem to `/stand` on the client from an Ignite-UX server. (This means you must have enough free space on the client to hold a copy of the install kernel and filesystem.) The `bootsys` command then modifies how the system will next boot so it points at the install kernel in `/stand`.

Note that you must have a functional HP-UX system before you can use `bootsys`. If the system is down and is not currently bootable, you will not be able to take advantage of `bootsys` as an installation or recovery method.

Important:
The `bootsys` command does not support Auto-Port Aggregation (APA). If you need to contact an Ignite-UX server through an aggregate link, the aggregate must be broken before running `bootsys`, and a LAN interface must be set up with the IP address information through which you wish to contact the Ignite-UX server.

Please consult the *bootsys*(1m) man page for more information on the `bootsys` command.

<u>Customizing the media</u>

The following are customization ideas for environments where it is not feasible or desirable to boot systems over the network.

If you provide enough information in the install filesystem, you can have individually customized media that can set the IP address and disable DHCP so you do not need to gain an IP address over the network. This would require sets of CDs/DVDs unique to subnets to allow you to boot the CDs/DVDs on systems and not have conflicting IP addresses.

An extension to this would be to add tests to the configuration in the install filesystem to test on MAC addresses of systems on a subnet. This would allow a system to use the IP address that it normally uses (with a default route defined) so that the system could be booted for install or recovery using it's own IP address without having to worry about network booting, `bootp`, DHCP, boot helper setup, and so forth.

Section III: Network boot helpers

The `bootp` protocol query UDP broadcast is not routable (cannot relay or forward). In view of this, Ignite-UX provides you the ability to configure a boot helper. A boot helper is the supported method for accessing an Ignite-UX server when it is located on a different subnet than the client.

By default, an Ignite-UX boot helper does not have enough information to point to the correct server so you must modify the server line in the INSTALLFS that gets downloaded from the boot helper using `instl_adm` as follows:

`instl_adm –d`

```
# instl_adm defaults:
# NOTE: Manual additions between the lines containing "instl_adm
defaults"
#       and "end instl_adm defaults" will not be preserved.
server="10.0.0.2"
netmask[]="255.255.255.0"
route_gateway[0]="10.0.1.1"
route_destination[0]="default"
disable_dhcp=true
# end instl_adm defaults.
```

This INSTALLFS indicates that the Ignite-UX client was somewhere on the class C subnet based upon the netmask 10.0.1.1, and must contact the Ignite-UX server at 10.0.0.2.

If the `server` line in the `INSTALLFS` does not match one of the IP addresses of the system that the Ignite-UX server booted from, you are using a boot helper. The remainder of the network boot process occurs transparently as the IP address the firmware used is immaterial to the kernel.

Once the client systems boots from the boot helper, it sends a DHCP request to attempt to obtain an IP address. If the request does not succeed, Ignite-UX prompts for the IP address information to be entered on the client console.

For more information regarding boot helpers, refer to "Appendix C" of the *Ignite-UX Administration Guide*.

Glossary

BCH Boot Console Handler is the firmware prompt that is available when the system first boots. At the BCH prompt, you can start a system boot and execute other BCH commands.

DHCP Distributed Host Configuration Protocol allows systems to gain IP addresses and other configuration information dynamically.

EFI Extensible Firmware Interface is the firmware interface for Itanium®-based systems.

El Torito A bootable CD or DVD ISO9660 filesystem variant that allows the booting of systems from CD or DVD disks.

HPUX The `hpux` utility is the specific secondary loader program used for bootstrap of the kernel. For more information, refer to *hpux(1M)* or *hpux.efi(1M)*.

ISL Initial System Loader is the program that starts a system boot and loads the secondary loader, `hpux`. This term is used interchangeably with IPL on PA-RISC systems.

IPL Initial Program Load means that a system has begun to boot. This term is used interchangeably with ISL on PA-RISC systems.

LIF Logical Interchange Format is the directory format that contains the information that is needed to boot PA-RISC systems. For more information, refer to *lif(4)* and *lifls(1M)*.

PA-RISC Precision Architecture-Reduced Instruction Set Computer is the name of the CPU architecture used in HP9000 servers and workstations.

PDC The processor-dependent code (firmware) that implements all processor-dependent functionality, including initialization and self-test of the processor. Upon completion, it loads and transfers control to the ISL. Firmware behavior varies somewhat, depending on the hardware architecture.

PXE Pre-eXecution Boot Environment is part of the Wired For Management specifications from the Intel® Corporation and allows a PXE compliant system to boot over the network. All Itanium®-based systems support PXE.

For more Information

The following relevant documents are available online at the HP Technical Documentation Web site at http://www.docs.hp.com/:

Ignite-UX Administration Guide

HP-UX 11.0 Installation and Update Guide

Release Notes for HP-UX 11.0

HP-UX 11i v[1|1.6|2] Installation and Update Guide

HP-UX 11i v[1|1.6|2] Release Notes

Managing Systems and Workgroups: A Guide for HP-UX System Administrators

Some or all of these documents are available on the Instant Information media and in printed form.

Product information regarding Ignite-UX for HP-UX is available at the HP Software Depot at

http://www.docs.hp.com/en/IUX/