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Workstation firmware delivery methods.

What system firmware does and when it does it

System firmware is the set of code that usually resides in EEPROM on a system processor board. The purpose of the code is to test the system hardware, initialize any required hardware operating parameters, and prepares the system for control by the operating system. It begins to execute as soon as the power to the hardware is turned on.

A brief description of the flow of firmware executing will illustrate firmware's role on the system hardware. The code will initially select a master CPU in case of multiple CPUs called the monarch. The monarch CPU tests and initialize its CPU parameters. The monarch informs the other processors, the slaves, when they can initialize their CPU parameters. The monarch CPU is then in charge of initializing the rest of the system resources and initialize PDH (processor dependent hardware), scratch RAM, and NVRAM . The boot sequence then proceeds to initialize and test enough of the built-in core I/O to output early chassis codes or indicators of progress out of the serial UART. This includes the I/O controller, the system bus bridge controllers, and the core I/O buses.

The firmware then proceeds to initialize, test, and configure the memory controller. It identifies all installed DIMMs, test them, and setup the final memory configuration.

The firmware will next discovers and initializes all PCI devices. It proceeds to provide each I/O device with the amount of requested memory or I/O space.

The workstation code then selects and initializes a serial or graphical console . Then it proceeds to select a boot device and prepares to hand control over to the booting OS.

This entire turn on sequence can be monitored through the LCD display of current HP workstations. It identifies the current test being ran, the FRU that the test is on, and the state of the machine. If there is any failure, the test will halt and display the failing test and the suspect FRU.

Since firmware does initialize and configure hardware parameters for CPU's, I/O controllers, and memory controllers, it is a convenient way to adjust and fix unforeseen hardware problems. Problems that have been fixed with firmware include support of new memory, adjustment of memory refresh rates, PCI reset timings, support of new I/O devices, address bus problems, new hardware tests, adjusting fan speeds. The fixes are released at irregular intervals. Firmware is being used more frequently to address hardware problems and enhance features since more hardware is controlled by more code all the time. Indeed firmware exists on many devices now ranging from I/O cards, disks, even memory. So it becomes important to be keep current on firmware revisions. The

rest of this discussion goes over the various ways to implement firmware updates, how to get the updates, and when it might be appropriate to use each method.

The HP patch hub.

The website to get individual firmware patches is HP IT resource website at http://home.itrc.hp.com. The firmware patches are now available as either bootable LIF images or as OS system patches. Look under the individual patch link. The bootable LIF images are kept as firmware CPU patches using names like PF_XXXXX. The OS versions are PHSS_XXXXX type patches under the hp-ux. Search for CPU firmware.

The tried and true tape update method.

This has been the normal method used in the firmware patches delivered for years on HP's patch hub. It requires getting the proper PF_XXXXX patch from the HP IT resource website. It is best used when you have a few workstations to update that have DAT tapes built in. You can also walk a SCSI DAT tape around to each workstation. Updating the firmware will require user intervention to answer the question of whether you want to continue or not after it compares the versions of firmware installed and the version available for updating. This file has been shar'ed into a binary LIF format as well as text file with instructions for creating the bootable tape with the firmware images on it.

Alternately, you can copy the LIF volume to a bootable disk drive. HP DAT tapes are the only tapes that have been tested and work with this process.

* * * * * * * * CREATING THE FIRMWARE UPDATE TAPE * * * * * * * *

Step 1. Verify the checksum of the file ".frm" using
the "sum" command. Results of the command should be
equal to the "sum" value as documented in the header
of this document.

Step 2. Use the "dd" command to copy the file "CBCJ0049.frm"
to tape, as follows:

```
dd if=CBCJ0049.frm of=/dev/rmt/0m bs=2k
                   ^^^^^^^^^^^
              (device path dependent)
```

NOTE: Blocksize (bs) must be = 2k

* * * * * * * IDENTIFY CURRENT VERSION OF FIRMWARE * * * * * * *

Prior to performing the firmware update, verify the current

version of your firmware, using the following steps:

Step 1. Re-boot your system and do the following:

A. Interrupt the boot process and from the BOOT ADMIN prompt, type <information> and press [return].

B. Identify your firmware revision. The last 2 digits in the patch name indicate the revision. In this case, 4.9 is the revision. If the revision on your system is equal to or higher than 4.9, do not proceed with the update.

* * * * * * * * * * FIRMWARE UPDATE PROCEDURE * * * * * * * * * *

Step 1: Install the tape you have just created into your tape drive.

Step 2. Shutdown your system via the power switch and power back on, or execute the reboot command resetting your system.

Step 3. When the display reads "Searching for a system to boot" press [escape]. At the BOOT ADMIN prompt, type <search> and press [enter] or [return] to identify the tape device path.

Step 4. Boot from the appropriate boot path. (You must boot from the device that contains the firmware update tape.)

NOTE: This process is automatic and requires no interaction until directed to do so. Please do not Interrupt the process.

NOTE: The load process will take about 2 minutes.

Step 5. A warning message will be issued, followed by "Continue ([y]/n)? Enter <y> and press [enter] or [return] if you wish to continue. Be sure the image on the tape is a newer version than that on your system before proceeding.

NOTE: INTERRUPTING THE PROCESS WHILE IT IS UPDATING THE EEPROMs WILL CAUSE YOUR SYSTEM TO BE INOPERATIVE AND LEAVE THE EEPROMS IN A UNUSABLE STATE.

```
NOTE:    In about 30 seconds the firmware should have been
  updated. The system should automatically reset.  If it
  displays a failure message or doesn't reset, the update has
  failed. Attempt to run the update again from Step 2.  If it
  still fails, or you cannot get to the boot admin prompt,
  call your HP Service Representative.

After the system resets itself, the system will continue the
normal boot process from the default primary path.

            * * * * * *  END OF UPDATE  * * * * * *
```

The system will continue the normal boot process from the default primary path.

* * * * * END OF UPDATE * * * * * *

The bootp method.

The bootp method is useful to deliver the firmware over a network to a number of workstations on the same subnet. This saves walking a DAT drive around and connecting and disconnecting to a large number of machines. The bootp server remains online while all the clients will be offline. The bootp server will have to have the MAC address of each client in the bootptab file. So it is worth doing if you expect to update the same machines at later times.

Updating the HP9000 Series 700 CPU firmware over the network requires the machine to updated to boot over the lan off a HPUX machine setup as a boot server. There are three basic processes or steps to updating S700 machines over the same lan or subnet.

Step 1: Setup a HPUX machine as the boot server.
Step 2: Setup the boot server machine to have the right firmware file in the right directory and recognize the client machines.
Step 3: Boot the client machine off the boot server and answer the questions asked by UPDATER.

SETTING UP THE BOOT SERVER:

Login as super user and run SAM to turn on the bootp protocol service. At the SAM menu, select the NETWORK/COMMUNICATIONS section. Go to the Network services menu and enable the Bootp services. It is now a boot server.

SETUP THE BOOT SERVER WITH FIRMWARE AND TO RECOGNIZE THE CLIENTS:

1) Edit the bootptab file on the boot server at /etc/bootptab and add an entry similar to the following example at the end of the file:

```
"setup5:\
        hn:\
        vm=rfc1048:\
        ip=15.11.160.195:\
        ht=ether:\
        ha=0800090bf3d0:\
        bf=CC180027.FRM"
```

In this example, "setup5" is the client system name, ip sets up the ip address of the client machine, ha sets up the hardware address or lan id of the client machine, and bf sets up the name of the firmware file. In HPUX 10.X, the default directory where the firmware file should be in at /home/tftpdir. It can also be setup with the complete path. The bootptab file contains other examples and explanations of the codes such as bf in the comments.

2) In this example, the firmware files can be downloaded from HP's supportline webserver at http://us-support.external.hp.com or http://europe-support.external.hp.com for Europe. The file can then be copied to /home/tftpdir/CC180027.FRM.

Use the example as a template for as many clients as needs to be updated.

BOOT THE CLIENT OFF THE LAN AND UPDATE THE FIRMWARE:

Shutdown the client and at the BCH prompt, type "sea lan" to search the lan for a boot server. Once it returns with a choice such as "PO lan 15.1.160.93", it has found the boot server. If it does not find the boot server, it could be on a different lan or incorrectly setup.

Then proceed to "boot P0" and answer no to interact with IPL. If it fails with a -7 error, the firmware file wasn't in the path the bootp service directed it to. Check the server's /etc/bootptab file for path and correct spelling of the file.

If everything is OK, it will find the image files, perform some checksum checks, firmware revision, and ask if you want to update or not over the original firmware. Answer yes and it will proceed and then reset the machine to finish the process.

The ignite method

Utilizing Ignite-UX to do firmware updates over the network.

This method is similar to the bootp method. But it does not require a complete list of MAC or lan addresses. It is useful when you already have a ignite server setup and are updating a set of changing workstations such as at a reseller or company staging area. The LIF volume is the same and the FWUPDATE utility is still used. So there is user interaction at each client workstation.

Server requirements:
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1) machine type: any HP9000
2) OS: HP-UX 10.01 or higher
3) Minimum system resources: 32MB RAM, 22MB free disk space

Process:
---

1) Load software
swinstall onto a local subnet machine the following minimum Ignite-UX filesets:

Ignite-UX.BOOT-SERVICES
Ignite-UX.BOOT-KERNEL
Ignite-UX.MGMT-TOOLS

2) Add free IP addresses to /etc/opt/ignite/instl_boottab
These IP addresses are used during the update and are returned to the free
list when the target machine reboots. One IP is required for every simultaneous
install that you plan to do. eg. 10 systems at a time needs 10 IP's

3) Obtain firmware image and put into a file

from HP ftp or web site the lif is already in a file

```
mv <downloaded file> /opt/ignite/boot/firmware_lif
```

from tape

```
dd if=/dev/rmt/0m of=/opt/ignite/boot/firmware_lif bs=2k
```

4) Move lif into place

```
cd /opt/ignite/boot
cp boot_lif boot_lif.install
cp firmware_lif boot_lif
```

5) On client:
  boot lan.<server IP> install
  interact with firmware loader

6) Remove Ignite-UX when done
  swremove Ignite-UX.BOOT-SERVICES Ignite-UX.BOOT-KERNEL
Ignite-UX.MGMT-TOOLS
  rm -rf /var/opt/ignite /opt/ignite /etc/opt/ignite

  OR

  Put regular boot_lif back into place
  cd /opt/ignite/boot
  mv boot_lif.install boot_lif
  rm firmware_lif

==========
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Cautions, possible errors, limitations
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Cautions:

 If using an Ignite-UX server that also serves OS installs, be sure that
Only the machines needing the firmware boot from the server while the
firmware lif is in place.

 Be sure that machines loading the firmware are the correct processor
type for the firmware being loaded.

 Be sure that the IP address in /etc/opt/ignite/instl_boottab won't cause
collisions on your subnet, ie. they aren't being used by active machines on
your subnet.

Trouble-shooting:

 If 'boot lan.<server IP> install' returns to boot rom menu without loading the
firmware then no IP's were available

 Message in /var/adm/syslog/syslog.log on the server:
<date> <time> <hostname> instl_bootd[1230]: instl_bootd: No available IP
address found in: /etc/opt/ignite/instl_boottab

 If 'boot lan.<server IP> install' returns "invalid device" then you have an

older s700 that has a different syntax for network boot. Use
'boot lan.<server lla>' instead, note the omission of the 'install'
word.

If you do use the 'install' word with the older boot rom you'll end up at
the 'ISL>' prompt. From here type 'reset' and try again.

If older s700's (735, 750, 755 ,720) won't boot off of server, check
That rbootd is running on the server. If the server's active lan isn't 10BT
(ie. it_is_ FDDI, 100BT, 100VG, or token) then rbootd won't run and you won't
be able to do these older systems from that server.

Limitations:

The 'boot lan.<server IP> install' method won't work across gateways
Unless your routing hardware can be configured to forward UDP packets.
The number of simultaneous firmware updates is limited to the number of
free IP addresses in /etc/opt/ignite/instl_boottab .

Only s700's , D-class s800, and K-class s800 support network booting.

The CD method

The CD method takes the same LIF volume that we have been using and places it onto a bootable CD. CD's can be used with more confidence over tape. DAT tapes can be rendered dirty or worn and be unreadable if it is old. The CD is also bootable off a SCSI CD or a ATAPI CD and is easily transported.

I have not been able to use PC software to create a HP-UX bootable CD. Rather than trying extensively to make it work and burning up CDR's, I went used the following method running from HP-UX.

To create a bootable CD for updating firmware for HP-UX workstations, you
will need the following:

1) A HPUX workstation running HP-UX 10.20.
2) A SE SCSI CDR drive capable of at least 2X CD write capabilities.
3) CDR media such as HP's C4423 media.
4) TAMS (Test and Measurement System) CD Writer software Rev 3.01 or greater
   regular $650

TAMS can be reached at:

TAMS 6020-8000 CD WRITER Software.

Test & Measurement Systems Inc.
750 14th Street SW
Loveland CO 80537
Phone (970) 669 6553
Fax (970) 669 3090
http://www.tamsinc.com/6020SW.htm

Begin by attaching the CDR writer to a available id on the SE SCSI bus and then booting HPUX up.

As it boots, HPUX will run insf and create the device files for the CDR writer.

Log in as super user.

Install the software by mounting the software CD onto a mount point such as SD_CDROM and running swinstall. Set the depot to local CD and putting the depot path as /opt/CDwriter and install the software.

Get a copy of the correct firmware off the HP patch depot at hp.external.hp.com. In this case, it is PF_CC2X0060.

unshar the patch bundle. In this case, move the firmware file, CC2X0060.FRM to /opt/cdwriter/bin.

Place a piece of blank media into the CDR writer.

Type in the following command:

cdrecord -v -speed=2 -dev="channel #, SCSI id, 0" CC2X0060.FRM

The verbose message example for a CDR burner at channel 1, id 5, subunit 0 will be as below:

cdrecord -v -speed=2 -dev=1,5,0 CC2X0060.FRM

Cdrecord release 1.6a9 Copyright (C) 1995-1998 Jrg Schilling
Cdrecord TAMS changes Copyright (C) 1998- A Neil
Fifo buffer size: 4 MBytes.
scsibus: 1 target: 5 lun: 0
Device type : Removable CD-ROM
Vendor_info : HP CD-Writer 6020 Revision : 1.07
Device seems to be: Philips CDD2600.

```
Using driver for Philips CDD-522 (philips_cdd522).
Driver flags   :
Track 01: data    1 MB
Total size:       1 MB (00:10.01) = 751 sectors
Starting to write CD at speed 2 in write mode for single session.
Waiting for reader process to fill input-buffer ... input-buffer ready.
Starting new track at sector: 0
Track 01:   1 of   1 MB written (fifo 100%).
Track 01: Total bytes read/written: 1533952/1533952 (749 sectors).
Writing  time:   10.916s
Fixating...
Fixating time:  123.316s
cdrecord: fifo had 25 puts and 25 gets.
cdrecord: fifo was 0 times empty and 0 times full, min fill was 100%.
```

You should now have a bootable CD for firmware updates.

The OS patch method

The latest method for delivery of workstation firmware is to use OS system patches with the designation of PHSS_xxxxx for the current series of workstations including the B1000, C3X00's, J5X00's, J6X00's, and the J7000. This should be the preferred method for most administrators since it can be installed as with any other rebootable patch and does not require user intervention to answer any questions. Individual PHSS type patches are available from HP's IT resource center at http://home.itrc.hp.com. Then they are included in HP's Quality Pack bundle for 10.20 and 11.00 at http://software.hp.com. The 11.11 bundle name would be Gold QA bundles. The bundles or patches can be installed using swinstall on the workstation. By setting up a system as a software depot, updates can also be distributed over the network. Just keep in mind that it requires a reboot.

The PHSS patches deliver the equivalent firmware revision to the PF type patches. But since they are OS type patches, they require no user intervention unlike the PF type patch. It is important to remember that the PHSS patches are just a delivery vehicle for the same firmware. They do not interact with any OS drivers or other online functions. The PHSS doc file will list the equivalents names of the PF patches as well as the other OS patches. Currently we deliver the workstation firmware as PHSS patches in 10.,20, 11.00, and 11.11. Since the firmware is the same, it would not require updating when there is a move from one OS rev to another such as from 10.20 to 11.11. The patch process will either catch the install at the OS level or the update process will see that the firmware has already been updated.

The PHSS patch process works by using the software patch install scripts to deliver a modified boot image. The install scripts also check for installation on the proper workstations for that version of firmware. The modified boot image contains a system loader application, a system loader configuration file, and the firmware patch. The firmware patch can be further defined to be comprised of a bootable kernel, the firmware

update logic, and a EEPROM flash program. The bootable kernel contains reboot logic as well. By installing the patch and rebooting, the workstation will boot off the modified boot image on disk and load the firmware patch into RAM. From RAM, it will proceed to execute the firmware update program to check to see if it the right workstation type and the firmware revision in the system's EEPROM.

If the revision is below the level carried by the firmware patch, it will proceed to reflash the EEPROM with the new revision of firmware. The console will display message on what the current EEPROM firmware revision is and what it will proceed to install. The console will also start outputting a series of dots to indicate the reflashing progress. It is very important to note that this process must not be interrupted by a power cycle or anything else. Just as in all the above mentioned methods, a incomplete firmware installation will not allow the complete initialization of the hardware to proceed and result in a workstation that will not function without the EEPROM's being replaced. Once the reflash has finished, the firmware application will proceed to modify the boot image to boot normally thereafter rather than reflash firmware again. The workstation will then reset itself and boot up normally. So this process does not modify the operating environment, but uses the OS patch process to deliver a hardware modifying process.