Intel Boot Agent 4.1
Stepping Document

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Intel Platform Networking Group
LAN Access Division

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Version Number	Introduction Method	Incremental Changes
4.1.13	OEM & Web release	• PXE 2.1 build 83 (since 4.0.18) • Corrected cosmetic problem in TFTP that would erase the current line o screen. *(Base code change)* • Corrected a problem with continuous retry on some platforms *(Option R Loader code change)*
4.1.11	OEM Release (LOM only)	• Link stability problems on some tablet systems. Added additional initializ code to drivers to detect problematic system and stabilize link detection generation. *(UNDI change)* • Spanning tree detection algorithm could fail under certain conditions. Modified spanning tree detection algorithm to be more robust by detecti normal traffic sooner and allowing the full DHCP timeout interval to expir before declaring an error. *(Base Code and RPL change)* • Some BIOS vendors need a single flash image that could be used with r device IDs without having to change the device ID in the PCI image hea Removed the code that verified the flash image PCI header device ID ag the device ID of the adapter being initialized. *(Option ROM loader code change)* • PXE applications could not use UDP calls to accept multicast packets. Updated udpread() so that unknown multicast addresses not filtered out unless an MTFTP transfer is in process. *(Base Code change)*
4.1.10	OEM & Web release	• Implemented an extended DHCP timeout if the driver does not detect ar received packets (at all) during the normal 16-second timeout. This is s for systems that are plugged into spanning tree switches, the DHCP wai longer than the spanning tree cycle and the base code will be able to fir DHCP server even if it has to wait a long time. On a normal network with broadcast traffic, the DHCP timeout is the normal length. *(Base Code ch* • Small change made to the base code to conform to the spec when the P server refers the agent to another server to perform the TFTP of the bo file. *(Base Code change)*
4.1.09	OEM & Web release	• Modified the EEPROM timing code to eliminate a non-standard port acc On some non-standard systems, replacing the 82559 LOM with an 8255 results in a system hang during EEPROM access. *(UNDI change)* • Under a precise set of circumstances, UDP read requests would sometir drop a valid packet, causing a timeout. Code now performs UDP packe validation checks in the correct order. *(Base Code change)* • In certain older systems, the F10 BIOS setup key would not work after updating the boot agent. Modified the keyboard handling code to pres keystrokes if the Boot Agent setup menu is not being requested. *(UNDI change)*
4.1.08	OEM & Web release	• Restored support for multiple ICHx device IDs without changing the devi the flash header (code was in 4.0.22, but was inadvertently removed in *(UNDI change)* • Added code to save and restore the BP register when updating the EEP to fix an issue with one specific BIOS. *(UNDI change)*
4.1.06	OEM & Web release	• Additional validation checks added to Microsoft Simple Boot Flag checki code to ensure the ACPI tables are valid before being used. *(UNDI cha* • Minor GUID display formatting improvement *(UNDI change)*
4.1.05	Limited Release	• Improved handling of fragmented UDP packets. Under certain circumsta with previous code releases, Windows 2000 RIS could fail to complete w connected at 10Mbps. *(Base Code change)* • DHCP timeouts have been increased to cope with non-optimized networ *(Base Code change)* • Boot Agent now has better handling of referrals between PXE servers. *(*

	release for ICHx and 8255x designs	• TFTP fix for small minority of PXE/DHCP servers supplying non-null term boot file names – TFTP transfers would fail in this case. This issue is fix 4.0.22. Issue can be avoided with earlier Boot agent versions by supply non-zero bootfile size option tag (DHCP option 13) *(Base Code change,* • Updated TCO workaround for a specific OEM platform hang *(UNDI char*
4.00.19	Web release for ICHx and 8255x designs	• PXE 2.1 build 83 • Changes to PXE base code and UNDI driver initialization to allow the ag pass the BIS test suite. *(UNDI and Base Code change)* • Added code to assume that a LOM image is always in a PnP/BBS-comp BIOS. *(UNDI change)* • Changed UNDI driver to correctly get the PCI device ID when deciding if needs to do the TCO workaround. *(UNDI change)*
4.00.18	OEM Release for ICH3 designs	• PXE 2.1 build 83 (IAL base code bootp changes included) • Added multiple device ID support in PCI checking functions. *(UNDI char* • Fixed UNDI driver bug in the Clear Statistics routine that could corrupt m *(UNDI change)* • Changed BBS detection code to only validate the PnP check structure a not call the optional runtime routines. Changed non-BBS code path to le the BEV vector in place unless "Legacy Mode" is selected in EEPROM. *change)* • Corrected invalid PnP header checksum *(UNDI change)* • Removed redundant device checking and BAR swapping code that is n any more. *(UNDI change)* • Optimized the diagnostic display functions to be smaller and added mor information to the screen. *(UNDI change)*
4.00.17	Web release	• PXE 2.1 build 83 (base code changes not including bootp enhancement • Fix for 82559 and 82550 PXE and Modem co-existence (BAR swapping) *change)* • Resolves 82559 & 82550 TCO interface interactions (doubled number c transmit/receive buffers) *(UNDI and Base Code change)* • All LOM images rebuilt – 4.0.12 LOM images had build problems
4.00.14/12	Web release/new adapters	• PXE 2.1build 78 to build 82 • Now distributed in Split-ROM and Monolithic versions • 16 bit IA64 support *(UNDI change)* • Setup screen delay 8 seconds replaced with 0 second option (MS Miller requirement) *(UNDI change)* • Support for dumb terminals which lack 'F8' key – 'M' (for menu) can be instead to obtain the PXE server list. *(Base Code change)*
3.00.05	OEM specific release	• Bug fix - In one OEM BIOS, the DS register is left at F000 on entry to the option ROM. The option ROM attempts to increment a memory location an instruction that uses DS without first initializing DS. Since F000:xxxx protected, this write was forwarded out to the firmware hub. This puts th into an indeterminate state that prevents POST from completing (hang). Dependent on code alignment in different builds, this bug may or may n apparent in a given system. *(UNDI change)*
3.00.04	Web release for ICH2 LOM only	• Bug fix – Windows 2000 Professional install from a Remote OS Installati Server (RIS) would fail to complete on ICH2 based systems This fix only affects ICH2 platforms - no change required for 8255x base implementations. (PXE 2.1build 78) *(UNDI change)*
3.00.03	Web release/ new adapters	• PXE 2.1build 71 to build 78 • Added support for 82550 and 82562 LAN interfaces *(UNDI change)* • Added hooks for new version of PROSet (Allows configuration via PROS Intel (R) PRO/100 Driver release 4.0) *(UNDI change)* • Added feature to detect if Quick Boot is enabled versus diagnostics. *(U change)*

		Windows NT4.0. - On-Line help text is available at bottom of screen.
2.6	Web Release	• The PCI Data Structure's Revision ID changed from 1 to 0 (incorrectly incremented by IAL in build 71). *(UNDI change)* • Changes to use the stack instead of Alloc/Free Memory, as fixes made i 2.2 have now been included in Build 71. *(UNDI change)*
2.5	Internal only	• Expansion Rom, Address decode enable/disable – With Modem enable Flash was not Chip selected. Included a software work around to set th Expansion ROM offset 30h bit0 before Flash copy and restore to the or value after the copy. Additional check to include BAR2 when required. *(UNDI change)* • To print carriage return at the end of Ctrl-S message. *(UNDI change)*
2.4	Internal only	• PXE 2.1build 71 and RPL version 2.71
2.3	Internal only	• Added code to save old INT 13 vector in the INT 18 vector. This makes RPL correctly with older BIOSes. (UNDI change)
2.2	Adapter ECO	• Added code to use the Base memory to read the EEPROM instead of BIOS (UNDI change) • Added menu option to allow user to select the Power Mgmt. method. (i.e. AC APM. Selecting APM causes the initialization code to set the Enable_PME r to be set if the WOL bit of the EEPROM is set. This allows PME# signal to b for waking a PCI 2.2 system running a non-ACPI OS instead of the 3 pin cab set to ACPI, bootrom code does nothing, and the ACPI OS controls Enable_ register). (UNDI change) • Made modification in the code to hide only the 'Ctrl+S for setup' message. (release masked both initialization message and setup message) (UNDI chan
2.1	Web release	• PXE 2.1build 67 and RPL 2.71
2.0	Initial release	• PXE 2.1build 65 and RPL version 2.71

NOTE: PXE code changes from build 67 to build 83 were made by Intel Architecture Labs. Please refer to release notes for details on the following pages.

Intel Boot Agent Setup Menu Changes

Version 4.0 & 4.1

```
                              Version 4.0.XX

Network Boot Protocol:             PXE (RPL)

Boot Order:                        Try network first, then local drives
                                   (Try local drives first, then network)
                                   (Try network only)
                                   (Try local drives only)

Show Setup Prompt:                 Enabled (Disabled)

Setup Menu Wait Time:              0 seconds (2, 3, 5 seconds)

Legacy OS Wakeup Support:          Disabled (Enabled)


                        Online help displays here
```

(note - some versions of IBA 4.0 & 4.1 may not include built-in setup screen. For these versions, or if 0 seconds delay makes the setup screen difficult to access, use PROSet in Windows or IBACFG.EXE, a separate DOS utility)

Version 3.0.03

```
                              Version 3.0.03

Network Boot Protocol:             PXE (RPL)

Boot Order:                        Try network first, then local drives
                                   (Try local drives first, then network)
                                   (Try network only)
                                   (Try local drives only)

Show Setup Prompt:                 Enabled (Disabled)

Setup Menu Wait Time:              2 seconds (3, 5, 8 seconds)

Legacy OS Wakeup Support:          Disabled (Enabled)


                        Online help displays here
```

PXE base code Release Notes
PXE Boot ROM
PXE PDK Release Date, PXE PDK Version number, Wired for Management Baseline Version

11/7/2000 V3.0 bld 083 Wfm V2.0

Boot ROM - PXE - 2.1(Build 083) Code Changes

BaseCode

- bootp.c – Added DHCP options 40 (NIS domain name) & 41 (NIS server) to the DHCP option request list to make remote booting Linux w/ NFS a little easier.
- bootp.c – Copy TFTP bootfile name to temp buffer and pad the bootfile with a NULL character.
- bstrap.c – Call UDP read API during boot prompt and boot menu processing so system management traffic will be processed.
- bstrap.c – Accept <F8> and <M> for remote boot menu processing because dumb terminals do not have <F8> keys.
- et_calls.c – Delay and retransmit if an out of resources error is returned by the UNDI.

6/21/2000 V3.0 bld 082 WfM V2.0

Boot ROM - PXE - 2.1(Build 082) Code Changes

Runtime Loader

- The expansion ROM BAR in the PCI configuration space is no longer used to locate the PXE runtime image, only the FLASH BAR (BAR 2) is used.
- All ROM images included in the IAL PDK now display an unsupported development version message when booting. The ROM images included in this PDK cannot be used in released product as described in the PDK license. (This does not apply to Intel Boot Agent which is distributed with a click to agree license from http://developer.intel.com).
- Exit/Status codes returned from Start BaseCode API are no longer checked. When control is returned the Stop BaseCode API is issued. If a keep code or an error is returned, the BaseCode will not be unloaded. This fixes a bug where the PXE split ROM would hang when returning to the system BIOS if there were no DHCP or proxyDHCP servers.

BaseCode

- The vendor-information (option 43) was being ignored if the class-identifier (option 60) was either not present or came after the vendor-information. The BaseCode now accepts any vendor-information that has any valid PXE vendor options, whether or not there is a class-identifier.
- The requested DHCP options in the DHCP discover packet were incorrect. The router option (tag 3) was requested twice and the time offset option (tag 2) was not requested. This has been fixed.
- The timer in the NIC shutdown code was replaced due to reports of hanging during shutdown. The new code reads the 8254 timer registers instead of the tick counter in the BIOS data segment.

Early UNDI

- No changes.

UNDI

- Interrupts are now disabled when reading the 8254 timer. No bugs were reported against this, it is just precautionary.

(Builds 80 and 81 were internal-only builds. One change was made, and then backed out.)

4/27/2000 V3.0 bld 079 V2.0

Boot ROM - PXE - 2.1(Build 079) Code Changes

Runtime Loader

- Scan for split BaseCode ROM could hang when checking for BaseCode ROM signature. The check address is now validated before checking the signature.

BaseCode

- Request packet. This was not causing any known issues, it was just not following the DHCP RFC.
- A DHCP Decline packet is now being sent if the client cannot get a response from the proxyDHCP service on port 4011. This happens when a DHCP Offer packet is sent with 'PXEClient' and the proxyDHCP service is not installed or not working properly. Also, the client now displays the message "PXE-E55: proxyDHCP service did not reply to request on port 4011."
- The size of the PXE client ARP cache has been increased from 2 entries, to 4. This is done so the client will not ARP every packet when the DHCP, proxyDHCP and TFTP services are all on different servers.
- The TFTP source port number would change to the last UDP write source port number + 1. This has been fixed.
- If the client receives proxyDHCP offers and does not receive DHCP or BOOTP offers it now displays this message: PXE-E52: proxyDHCP offers were received. No DHCP offers were received.
- Top half of EAX was being destroyed during NIC interrupts. All registers are now saved & restored during interrupt handling.
- UDP & TFTP APIs now ignore the gateway IP address parameter if the station, gateway and destination/server IP addresses are all on the same subnet.
- The client no longer does a TFTP get file size if the file size option is returned in the bootserver reply.
- The client now uses the BIOS tick counter instead of the hardware timer to count seconds. This is done because some clients are using different hardware timer speeds.

Early UNDI
- No changes.

UNDI
- Top half of EAX was not being preserved during UNDI API calls. All registers are now saved & restored. API call status is returned in AX only.

01/21/00, V3.0 build 078, V2.0
Boot ROM - PXE - 2.1(Build 078) Code Changes

ROM Init
- Support for spoofing Int 15h, AX=E801h (Get memory size for >64M configurations) service has been removed. This service does not need to be spoofed because it does not report memory below 1M which is where the PXE runtime image is located. The spoofing code in earlier PXE ROM versions was not implemented correctly and caused some Linux implementations to only recognize the first 24M of memory.

Runtime Loader
- No changes.

Base-Code
- The seconds field in the DHCP packet was not being byte swapped.
- TFTP Read File was returning PXENV_STATUS_FAILURE for all TFTP errors that occurred. TFTP Read File has been changed to return TFTP error status codes to the calling program.
- Changed menu selection bar from direct video memory writes to video BIOS write string calls (Int 10h, AH=13h). This was done so the menu selection bar could be redirected to COM: ports.
- Added code to parse the client IP, BOOTP server IP and subnet mask when a BOOTP server is used.
- Removed code that checked for the DHCP message type (option 53) in the unicast proxyDHCP reply. The ROM was only accepting packets with a message type of DHCPACK (5).
- Added minimum length check to BIS SMBIOS structure check.
- SIADDR field in DHCP/BOOTP packet is used for TFTP server IP address if it is not 0.0.0.0.

Early UNDI
- No changes.

UNDI
- Changed the UNDI state check at the beginning of the Set Station Address API so that it would only operate when the UNDI was initialized and fail when the UNDI was opened.

BIOS information (Type 0) table that did not also support the BBS runtime functions, the PXE NIC ROM would set the default bootstrap to Int 18h instead of BBS. This has been fixed. Also, if SMBIOS v2.3 or later is supported the BBS runtime functions are no longer checked by the ROM. In these BIOSes the BBS support flag must be implemented in the BIOS information (Type 0) table.

- 4 second delay to keep initialization error messages on the screen long enough to read was always being run in LOM images. Speeds up LOM image boots 4 seconds.

Runtime Loader

- If a monolithic PXE ROM was set to use the BaseCode built into the BIOS and the BIOS did not have a built in BaseCode, error message "PXE-EC1: BaseCode not found" was being displayed. This message is no longer displayed in monolithic ROMs because they always have a BaseCode.

Base-Code

- No changes.

Early UNDI

- No changes.

UNDI

- No changes.

10/29/99, V3.0 build 074, V2.0

Boot ROM - PXE - 2.1(Build 074) Code Changes

ROM Init

- There are now four LOM images (e100_m.bbs, e100_s.bbs, e100_m.i18 and e100_s.i18). The old LOM images (e100_m.lom and e100_s.lom) have been removed. Which LOM image to use depends on the system BIOS. If BBS is supported use the e100_?.bbs images. If BBS is not supported, use the e100_?.i18 images.
- Initialization menu and delays have been removed from the PXE LOM images.

Runtime Loader

- No changes.

Base-Code

- DMI BIOSes w/o GUIDs were displaying a bogus GUID on the screen and sending a bogus GUID in the DHCP discover packet. GUIDs are now properly detected in all DMI and SM BIOSes.
- DHCP code would retry DHCP discover if the first DHCP offer packets received did not have a class identifier of 'PXEClient'. Now any DHCP offer that has 'PXEClient' or a bootfile will be accepted.
- Clear screen has been removed from remote boot prompt/menu display. The screen used to be cleared if the menu reached the bottom of the screen.
- Address of !PXE structure is now placed on the CPU stack, as defined by the PXE 2.1 specification. It was being placed in the DX:AX (seg:off) register pair.

Early UNDI

- No changes.

UNDI

- PXENV_STOP_UNDI now works only if PXENV_START_UNDI has been called. PXENV_STOP_UNDI was not checking the state of the UNDI and was always returning success, even if the UNDI was not started. If PXENV_STOP_UNDI was called before PXENV_START_UNDI, the Int 1Ah vector would have been corrupted.

8/27/99, V3.0 build 072, V2.0

Boot ROM - PXE - 2.1(Build 072) Code Changes

ROM Init

- PCI data structure revision changed from 0x01 to 0x00 to match PCI specification.

Runtime Loader

- Size of free base memory reported in 40:13h is used to determine if there is enough free base memory. ROM no longer scans for a block of zero filled base memory.

Base-Code

- Address of !PXE structure is passed on the stack to NBP, instead of address of PXENV+ structure, to

- PXE-E7A: Client could not locate a secure boot server" is displayed if client does not get security information when BIS is enabled.
- PXE-E7B: Missing MTFTP server IP address" is displayed if there is no PXE discovery information and the DHCP SIADDR field is 0.0.0.0.
- The client network interface identifier tag (DHCP option 94) and the UNDI version stored in the class identifier tag (option 60) "PXEClient:Arch:00000:UNDI:002001" were hard coded. These are now read from the version field in the UNDI ROM ID structure.
- UNDIclose was not being called after an error is returned by TFTPopen, TFTPreadfile, TFTPgetfilesize or UDPopen. This caused all calls to any of these APIs to fail after the first error.
- The DHCP SIADDR field is used as the MTFTP server IP address if there is no discovery information available in the DHCP packet and there is no Proxy packet. If the SIADDR field is 0.0.0.0, the DHCP server IP address is used.

Early UNDI
- No changes.

UNDI
- When PXENV_UNDI_TRANSMIT returned a status code of OUT_OF_RESOURCES, the exit code is now PXENV_EXIT_FAILURE, instead of PXENV_EXIT_SUCCESS.
- When a base-code API is issued after base-code is unloaded, a status/exit code pair of PXENV_STATUS_UNDI_INVALID_FUNCTION/PXENV_EXIT_FAILURE is returned, instead of PXENV_STATUS_SUCCESS/PXENV_STATUS_UNDI_INVALID_FUNCTION.

6/28/99, V3.0 build 071, V2.0
Boot ROM - PXE - 2.1(Build 071) Code Changes

ROM Init
- Added code to increase exit timeout when an error message is being displayed from 2-3 seconds to 5-6 seconds so initialization error messages can be read.
- Only accept ' Y' or ' N' to the "display initialization messages" question in the bootstrap selection menu. Before this any key except ' Y' was treated as an ' N' .
- Relocated code that was clearing the "Hold both shift keys" message so it only runs when initialization messages are displayed. This is so the ROM will not display any characters during option ROM initialization (scan) unless initialization messages are displayed.
- Branch past code to clear initialization messages when initialization messages are not being displayed. Fixes flashing/clearing screen seen in some systems when booting.

Runtime Loader
- The LOM version of PXE was shrinking the ROM image in upper memory when POST Memory Manager is not present in the BIOS. This caused the ROM to fail with a PXE-EC8 message on boot. This has been fixed. POST Memory Manager is still required by the Wired for Management 2.1specification for LOM implementations.

Base-Code
- DHCP IP address being displayed during the remote boot was not correct when booting through Linux software routers. The address being displayed was the router IP address and not the DHCP server IP address. This has been corrected.
- The TFTP APIs will exit early (not retry) if an error response is received from the TFTP server. The client used to retry, and get the same error again and again, until the retry timeout occurred.
- TFTP error messages sent by the TFTP server are no longer displayed when the TFTP APIs are used by NBPs. The NBPs are now responsible for displaying their own TFTP error messages.
- Possible NULL pointer usage removed in DHCP option parsing code. "if (o->ovrload & 0x??) … " statements changed to "if (o->ovrload && (o->ovrload & 0x??) … ".
- UDP read failed was re-assembling fragmented packets. The checksum in the first packet was being corrupted by the following fragments. This has been fixed.

Early UNDI
- The LOM early UNDI loader would not work unless the option ROM was initialized by the BIOS, the call to the loader would return with the error code: 0xC8 (The !PXE structure could not be found). This has been fixed.

UNDI

- Added code to increase exit timeout when an error message is being displayed from 2-3 seconds to 5-6 seconds so initialization error messages can be read.
- Only accept ' Y' or ' N' to the "display initialization messages" question in the bootstrap selection menu. Before this any key except ' Y' was treated as an ' N' .
- Relocated code that was clearing the "Hold both shift keys" message so it only runs when initialization messages are displayed. This is so the ROM will not display any characters during option ROM initialization (scan) unless initialization messages are displayed.

Runtime Loader
- No changes.

Base-Code
- Added code to delay 5-6 seconds when an error message is displayed before returning control to the BIOS so runtime error messages can be read.

UNDI
- No changes.

2/8/99, V3.0 build 067, V2.0
Boot ROM - PXE - 2.1(Build 067) Code Changes

- A ' Break' statement was deleted from the DHCP module. This caused all DHCP/BOOTP packets without ' PXEClient' but with a bootfile to be ignored by the client.
- Removed last six references to PXENV+ structure. The API entry point routines were taking the UNDI data segment and Base-Code code segment from the PXENV+ structure. These are now coming from the !PXE structure.
- Removed ' beta' designator from version number.

1/15/99, V3.0 Beta-4, V2.0
Boot ROM - PXE - 2.1beta-4, (Build 065) Code Changes

- ' DHCP Broadcast Reply' bit is now being set when doing broadcast discovery for boot servers. Not setting this bit caused discovery replies from the boot server to get dropped across some software routers.
- Client no longer ignores BINL responses from NT5 Intellimirror. The new DHCP code was ignoring these BINL responses because they did not have any of the PXE/DHCP vendor options (tag 43).
- Added code to check for PXE discovery tags when running on a secure (BIS enabled) client. ROM will not boot if PXE discovery tags are not found in the cached DHCP or Proxy packets on a secure client.