

# Intel<sup>®</sup> Boot Agent

*User's Guide*

# Where to go for more information

## Readme Files

For more information about installation topics and product errata, see the readme text files. To view the files, open the README.TXT file with any text editor.

## Online Services

You can use the Internet to download software updates, troubleshooting tips, installation notes, and more. Online services are on the World Wide Web at:

**<http://support.intel.com>**

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Intel Corporation, 5200 N.E. Elam Young Parkway, Hillsboro, OR 97124-6497

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# Introduction

The Intel Boot Agent is a software product that allows a personal computer client to boot using a boot image that resides on a remote server. The features offered by this product are:

- Compliant with the Wired for Management Baseline 2.0 (WfM 2.0) specification.
- Incorporates the software defined in the Pre-boot eXecution Environment version 2.0 (PXE 2.0) specification.
- Incorporates support for Remote Program Load (RPL) runtime and loader software.
- Compatible with earlier boot agent environments that used BOOTP (Bootstrap Protocol).
- Includes all necessary image files, loading software and utilities, documentation, and a blank flash ROM device.

## Product Contents

The retail version of the Boot Agent ships in a single box with the following contents:

- A Quick Start Guide that describes how to install the Boot Agent into a typical personal computer client system. More detailed instructions are included in the User's Guide.
- A blank 64KB flash ROM device. This is a 32-pin device that installs in the ROM socket on a network adapter.

**NOTE:** If used, the flash ROM device must first be installed in the ROM socket of the client system adapter. Client systems that have a remote boot enabled LAN On Motherboard (LOM) or a preinstalled flash device on the adapter will not use this blank flash ROM device.

- A diskette containing the image files, loading software and utilities, and documentation.

The Boot Agent might also be included as an add-in product that ships with an Intel® PRO/100+ Management Adapter or an Intel PRO/100+ Server Adapter.

## Diskette Contents

The diskette shipped with the Boot Agent product contains files and directories for the product software, appropriate utility and application software, and product documentation files. Refer to the README.TXT at the root level of the diskette for a list of the files and directories on the diskette.

## Supported Environments

The Boot Agent resides in two environments:

- The client environment
- The server environment

### Client Environment

The client environment is defined by the operating system used by your PC. Client environments that have been tested with the Boot Agent include:

- DOS 5.0 or higher
- Windows\* 95
- Windows 98
- Windows NT\* 3.51
- Windows NT 4.0

The computer system into which the Boot Agent is being loaded might also be a server that needs to remote boot from its own server (i.e., one of a network of servers that remote boot from a central server). In this case, the server is a client with respect to the Boot Agent.

### Server Environment

The server environment is defined by the network operating system used by your server. Server environments that have been tested with the Boot Agent include:

- Windows NT 4.0
- Novell NetWare\* 3.11
- Novell NetWare 3.12
- Novell NetWare 3.2
- Novell NetWare 4.11
- Novell NetWare 5.0
- OS/2\*

# Client Computer Setup

Before you can install the Boot Agent you must make sure that the client computer is set up. In general, this means ensuring that a compatible network adapter is installed and that the Boot Agent software can be loaded. The following sections guide you through the setup process.

- *Setup for a Known Configuration*
- *Determining the Client Computer Configuration*
- *Installing the Flash ROM Device*

## Setup for a Known Configuration

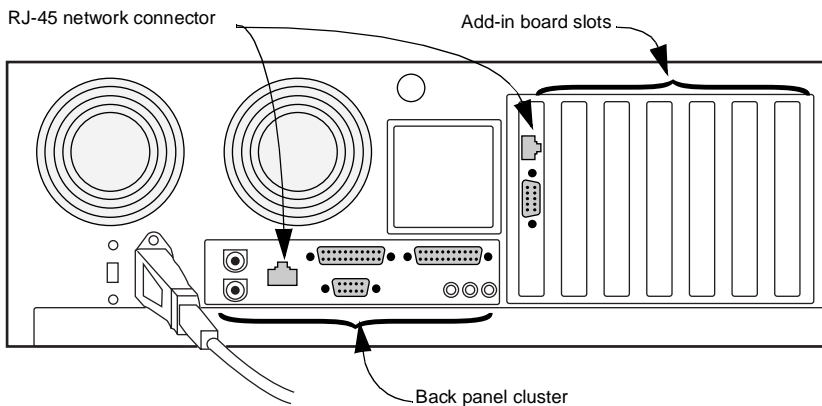
If you already know the hardware configuration of the target client computer, you can proceed directly to the proper setup section as indicated in the following list:

- No network adapter is installed in the computer. Perform these steps:
  - a) Install a compatible network adapter. The adapter documentation gives installation instructions. (Compatible adapters include the Intel PRO/100+ Management adapter and the Intel PRO/100+ Server adapter. There are hardwired flash ROM devices already installed in these adapters.)
  - b) If the adapter has an empty flash ROM socket, install the supplied 64 KB flash ROM device. Refer to “Installing the Flash ROM Device” on page 5 for installation instructions.
- A network adapter is installed, but no flash ROM device is installed (or the installed flash ROM is smaller than 64 KB). Perform these steps:
  - a) Remove the adapter. The adapter documentation gives removal/installation instructions.
  - b) Install the supplied 64 KB flash ROM device. Refer to “Installing the Flash ROM Device” on page 5 for installation instructions.
  - c) Reinstall the adapter. The adapter documentation gives removal/installation instructions.
- The client computer motherboard has a compatible LAN on motherboard (LOM) solution. Perform these steps:
  - a) Follow the motherboard manufacturer’s update instructions to install the BIOS code that incorporates the Boot Agent software.
  - b) Alternatively, it is possible that the motherboard has a ROM socket that will accept the supplied 64 KB flash ROM device. Refer to “Installing the Flash ROM Device” on page 5 for installation instructions on the supplied 64 KB flash ROM device. Contact the motherboard manufacturer to get the code that must be loaded into the flash ROM in this case.

## Determining the Client Computer Configuration

If you are unsure of the hardware configuration of the target client computer, you can determine it without removing the computer cover. Perform the following steps:

1. Examine the back panel of the computer to determine if there is an adapter already installed. The following figure shows the back panel of a typical computer, and indicates the areas you should examine.



2. As shown in the figure, the network connector is an RJ-45 connector. If there is a network connector only in the back panel cluster, it is possible that the computer motherboard has a compatible LAN on motherboard (LOM) solution. Contact the motherboard manufacturer and, if it is compatible, perform the following steps:
  - a) Follow the motherboard manufacturer's update instructions to install the BIOS code that incorporates the Boot Agent software.
  - b) Alternatively, it is possible that the motherboard has a ROM socket that will accept the supplied 64 KB flash ROM device. Refer to "Installing the Flash ROM Device" on page 5 for instructions.
  - c) Contact the motherboard manufacturer to get the code that must be loaded into the flash ROM.
3. If there is no network connector at the back of your computer, you must install an adapter as well as the flash ROM device. Refer to the installation procedures for the adapter for any setup requirements, then follow the procedures in "Installing the Flash ROM Device" on page 5 before installing the adapter.
4. If there is a network connector in the one of the add-in board slots, there might be a compatible network adapter already installed in the computer. Perform the following steps:
  - a) Boot your computer to DOS (a DOS Command Prompt window will

not work).

- b) Insert the Boot Agent diskette in your computer's floppy drive, then type `A:\fboot` followed by the Enter key.
- c) If there is no flash ROM device installed, you will get the following type of message:

NIC	Network Address	PWA Number	Flash Memory	Size	Valid
====	=====	=====	=====	=====	=====
1	xxxx00000000	xxxxxxx-xxx	No Flash	0	No

**NOTE:** If the flash ROM device installed in the adapter ROM socket is not large enough (64KB or larger), `fboot` returns a message stating that the flash is too small, and does not allow you to proceed.

5. At this time, (assuming there is a large enough flash device installed) enter (y)es, and `fboot` will write the new Boot Agent image to the flash ROM device.
6. If there is no flash device installed, or if the installed flash device is too small, refer to "Installing the Flash ROM Device" on page 5 for instructions.

## Installing the Flash ROM Device

If there is already an adapter installed in your computer, complete all of the steps in the section. If you are installing a new adapter, skip steps 2 and 3.

1. Turn off and unplug your computer. Then, remove its cover.

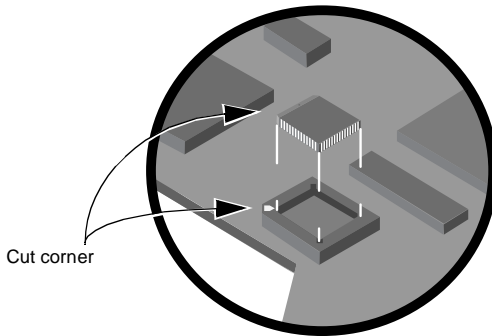


Turn off and unplug the computer before removing the computer cover. Failure to do so could endanger you and might damage the adapter or computer. Observe appropriate ESD precautions when working with components, adapters, and the computer.

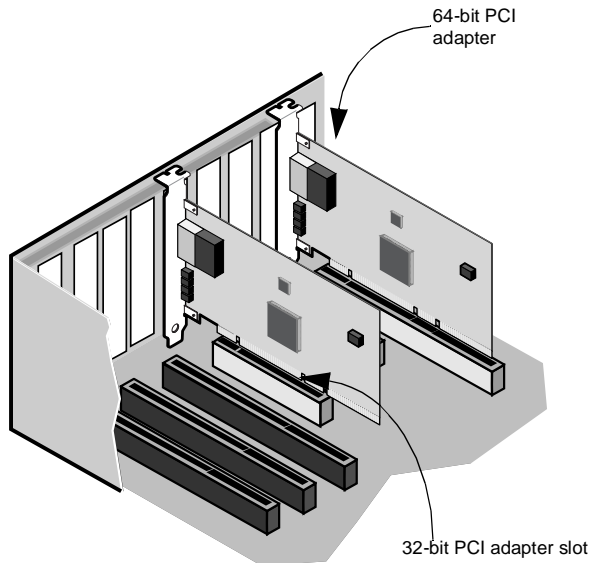
2. Identify the adapter and the adapter slot in which it is installed, then remove the adapter bracket screw.
3. Remove the adapter and move it to an ESD-safe work area. The following



figure shows how to install the flash ROM device in the socket.



4. Refer to the figure and install the supplied flash ROM device in the socket of the adapter. Note the location of the cut corner of the flash ROM device and the corresponding cutout in the socket. There is only one correct orientation for the flash ROM device.
5. Reinstall the adapter in the slot from which it was removed. If you are installing the adapter for the first time, follow the adapter installation instructions and install it in an appropriate PCI expansion slot (refer to the following figure).



6. Push the adapter into the slot until the adapter is firmly seated. Then, secure the adapter bracket with a screw.
7. Replace the computer cover and plug in the power cord.
8. Turn the power on. The computer BIOS automatically assigns resources to

a PCI adapter. If you get a configuration error, see the troubleshooting instructions in the adapter installation guide.

# Installing Boot Agent Software

At this point, there should be an adapter with a flash ROM device installed in your computer, or your computer uses a motherboard with remote boot enabled LOM (LAN on motherboard) technology.

If your computer uses LOM, the Boot Agent software might need to be installed as part of a motherboard BIOS code upgrade. Contact your computer or motherboard manufacturer to upgrade your motherboard BIOS code.

If your computer uses an adapter, perform the following steps:

1. Using a DOS system disk, boot your computer to a DOS prompt.



The next several steps require that your computer be booted *only* to DOS. These steps cannot be performed from a DOS Command Prompt window or using a DOS task within Windows.

2. Insert the diskette with the Boot Agent software into your computer floppy disk drive. Assuming drive A: is your floppy drive, type:

```
A:> \fboot 
```

The following type of message is returned, assuming both the adapter and the flash ROM device are properly installed.

```
[FBOOT ver 2.2] - Intel PCI NIC BOOT FLASH Update Utility  
Copyright (C), 1995 - 1999 Intel Corporation
```

NIC	Network Address	PWA Number	FLASH Memory	Size	Valid
===	=====	=====	=====	====	=====
1	00A0C9A4230B	689661-003	SST 29LE512	64	Yes

```
Select NIC to update or ESC to exit:
```

3. Enter the number corresponding to your adapter, then press the Enter key.
4. The next question requiring a response is:

```
Select Option (U)pdate or (R)estore:
```

An update (U) response results in the `fboot` utility updating the flash ROM device with the current version of Boot Agent software. A restore (R) response will cause the `fboot` utility to write a previously stored flash image file onto the flash ROM device.

5. The final question posed by the `fboot` utility is:

```
Create Restore Image (Y)es or (N)o:
```

Type Y (yes) to create a flash image file and load it with the current (not updated) image of the flash ROM device. Type N (no) to cause `fboot` to proceed without first saving a copy of the current flash image.

After approximately one minute the `fboot` utility finishes writing the flash image and exits to the DOS prompt.

# Server System Setup

**NOTE:** When the Boot Agent software is installed as an upgrade for an earlier version boot ROM, the network and associated server-side software might already exist. Contact your system administrator to determine if any server system setup is necessary.

The Boot Agent software is installed in an adapter flash ROM device that is itself installed in a client computer system. In order for the Boot Agent software to perform its intended job, there must be a server set up on the same network as the client computer. That server must recognize and respond to the PXE or RPL protocols that are used by the Boot Agent software.

The following sections describe the actions you should take in order to set up various types of servers to work with the Boot Agent. If you have questions concerning the setup of your server system, contact the manufacturer of your server hardware or your server operating system vendor for assistance. The following sections provide pointers to server setup instructions:

- *PXE Setup on a Windows NT Server*
- *Linux\* Server Setup*
- *Other Server Setup Information*

## PXE Setup on a Windows NT Server

The Intel Pre-boot eXecution Environment (PXE) Product Development Kit (PDK) is designed mainly to test adapters and boot ROMs in a test environment that includes a server that is set up for PXE. The instructions for the PDK describe how to set up a Windows NT server in a normal network environment. Refer to the following Web site for the PXE PDK instructions and other files related to setting up a WfM-compliant server:

*<http://developer.intel.com/ial/wfm/tools/pxe/>*

## PXE Setup on a Linux Server

The Intel Pre-boot eXecution Environment (PXE) Product Development Kit (PDK) is designed mainly to test adapters and boot ROMs in a test environment that includes a server that is set up for PXE. The instructions for the PDK describe how to set up a Linux server in a normal network environment. Refer to the following Web site for the PXE PDK instructions and other files related to setting up a WfM-compliant server:

*<http://developer.intel.com/ial/wfm/tools/pxe/>*

## Linux\* Server Setup

Servers using the Linux operating system can be set up to support a number of different client-side operating systems and remote boot protocols. Since Linux and all related utilities follow Open Source Software (OSS) guidelines, customizing the environment to meet individual network requirements is straightforward. The document at the following Web site provides detailed information on setting up a Linux server to operate with a remote boot agent such as the Boot Agent:

*<http://cuiwww.unige.ch/info/pc/remote-boot/>*

## Other Server Setup Information

Various hardware and software manufacturers support remote boot technology, the Wired for Management (WfM) specifications, and the PXE/RPL/BOOTP protocols at some level. The following Web sites provide useful information on setting up a server to operate in a remote boot environment:

- *<http://www.microsoft.com/>*  
Microsoft produces operating systems that are used by both client and server systems in a remote boot environment. Search this site for technical information and commercial products applying to WfM systems, PXE and RPL environments, and remote booting.
- *<http://www.sco.com/>*  
SCO produces SCO Unix, an operating system used on many servers. Search this site for technical information and commercial products related to remote boot servers.
- *<http://www.bootix.de/>*  
Bootix Technology GmbH produces software for boot management solutions. The available products include a large range of special-purpose tools concentrating on LAN and WAN technology for large internal networks. Search this site for remote boot products supporting BOOTP, RPL, and PXE protocols on a range of client and server types.
- *<http://www.weird-solutions.com/>*  
Weird Solutions produces client and server support software for Windows NT or Windows 98 computers. Search this site for support software products supporting BOOTP, TFTP, and DHCP services on computers based on Windows NT or Windows 98.

- <http://www.sun.com/>  
<http://java.sun.com>  
Sun produces both hardware and software that can be used in either a client or a server application. Search these sites for technical information and commercial products applying to WfM systems, PXE and RPL environments, and remote booting.
- <http://samba.org/samba/>  
The Samba organization produces and supports software that runs on UNIX servers and clients. The software available through Samba complies with GNU Public License requirements. Search this site for information on implementing remote booting on UNIX servers.
- <http://www.novell.com/>  
Novell produces network operating systems and related support software. Search this site for technical information and commercial products applying to WfM systems, PXE and RPL environments, and remote booting.
- <http://www.ibm.com/>  
IBM produces both hardware and software that can be used in either a client or a server application. Search this site for technical information and commercial products applying to WfM systems, PXE and RPL environments, and remote booting.
- <http://www.compaq.com/>  
Compaq produces hardware that might be used in either a client or a server application. Search this site for technical information and commercial products applying to WfM systems, PXE and RPL environments, and remote booting.

# Operating Procedures

Once installed, the Boot Agent software requires no operator intervention unless you need to interrupt the normal boot sequence of your computer. The following sections describe operating procedures that apply to the Boot Agent:

- *Normal Boot Sequence*
- *Interrupting the Boot Sequence*
  - *Diverting to the Motherboard BIOS Setup*
  - *Diverting to the Boot Agent Setup Menu*

## Normal Boot Sequence

The normal boot sequence is as follows:

1. A boot event occurs. A boot event is one of the following:
  - Computer power on
  - Computer hard reset
  - Soft reset (Ctrl+Alt+Del)
  - Operating system or application-initiated system restart
2. The computer goes to a clear screen, then begins its Power On Self Test (POST) sequence.
3. During and shortly after POST the user can press a key or combination of keys to interrupt the boot process and force the computer into the BIOS Setup program. A short message is often (but not always) displayed during this time to indicate what key(s) to press in order to go to BIOS Setup.
4. Next, assuming the Boot Agent software has been properly loaded, a short message is usually (but not always) displayed indicating you can press Ctrl+S to go to the Boot Agent setup screen. Unless it has been disabled as part of its own Setup, this message displays for from two to eight seconds.
5. Assuming the Ctrl+S sequence is not pressed, the computer next goes to the network server and gets the boot code/script that has been set up for this computer.
6. Once the boot code has been followed, the computer is ready for normal operation.

## Interrupting the Boot Sequence

There will likely be instances where it is necessary to deviate from a normal boot sequence. The following instances are typical reasons for a deviation:

- You need to access the BIOS Setup menus for some reason. One reason related to the Boot Agent would be to add, delete, or change the boot order of the “Network” choice in the “Boot Order” menu.
- You need to access the Boot Agent setup menu to change one or more of the parameters associated with it.
- You want to force this computer to boot through a floppy, the hard disk, or a CD-ROM instead of through the network.

## Diverting to the Motherboard BIOS Setup

The key combination required to put your computer into the BIOS Setup menu is defined by the motherboard and BIOS manufacturer. For Intel motherboards you must press the F2 key while or shortly after the POST executes. A message “Entering Setup” displays if you are successful.

While in the BIOS Setup menu, one of the available options might allow selection and ordering of the boot devices. A computer not connected to a network would typically have first, second, and third boot devices of floppy, hard disk, and CD-ROM respectively. When setting a computer up for remote boot, the boot sequence might change to network, floppy, hard disk, and CD-ROM respectively.

**NOTE:** It is not always necessary to set “Network” as the first boot device. The adapter and/or Boot Agent software might take over the boot process after POST and force a Network boot. Not setting “Network” as the first boot device, however, might later cause interrupt arbitration problems between the adapter and another boot device.



## Diverting to the Boot Agent Setup Menu

After POST completes, press Ctrl+S to go to the Boot Agent setup program. If you don't press Ctrl+S in time, the computer will proceed with the boot.

Once you enter the Boot Agent setup program, you can mainly adjust the boot process. If you want to boot from a floppy, for example, perform the following steps:

1. Reboot the computer (power-on, reset, or soft reset).
2. Load a boot floppy into the computer floppy disk drive.
3. After POST finishes, press Ctrl+S as soon as you see the following message:

```
Press Ctrl+S to enter into the Setup Program..
```

4. Using the down arrow and space keys, select the `Default Boot:` option and change it to `Local`.
5. Using the down arrow and space keys, select the `Local Boot:` option and change it to `Enable`.
6. Press the F4 key to save this configuration and exit the setup program.
7. The boot will now continue using the boot sequence identified in the motherboard BIOS setup menu instead of performing the remote boot.

Assuming the first boot device in the motherboard BIOS setup menu is the floppy drive, your computer will now finish booting using the boot floppy you loaded at the start.

In order to go back to booting using the Boot Agent, return to the Boot Agent setup program. Restore the `Default Boot:` option to `Network` and the `Local Boot:` option to `Disable`.

# Reference Information

The topics in this section give detailed information on syntax and options. The following sections give detailed descriptions of the programs and utilities that are part of the Boot Agent:

- *Boot Agent Setup Program*
- *fboot Utility*
- *futil Utility*

## Boot Agent Setup Program

The Boot Agent setup program is similar to the motherboard BIOS setup program in that it can be entered only during a short window after the start of each boot sequence. After completing POST, the computer displays at least the first line of the following message:

```
Initializing Intel Boot Agent Version 2.2  
Press Ctrl+S to enter into the Setup Program..
```

While this message is displayed, and before any subsequent message, you can press Ctrl+S to enter the Setup Program. You have a two- to eight-second window in which to press Ctrl+S. If you miss this opportunity, you will need to reboot the computer to again have the opportunity.

**NOTE:** If the setup message has been disabled (Setup Message: Disable), you will not be prompted to press Ctrl+S, even though you can still enter setup using this key combination.

Once you enter the Setup Program, you are presented with the following menu options:

Boot Protocol:	PXE (RPL)
PnP/BEV Boot:	Disable (Enable)
Default Boot:	Network (Local)
Local Boot:	Disable (Enable)
Prompt Time:	2 (3, 5, 8)
Setup Message:	Disable (Enable)
Power Mgmt:	ACPI (APM)

In the above menu depiction, the default options are shown first and remaining options are listed in parenthesis following the default. The meaning of each of these setup options is as follows:

#### Boot Protocol:

This option is the protocol that the Boot Agent uses when performing the remote boot operation. By default, the Pre-boot eXecution Environment (PXE) protocol is used with the Remote Program Load (RPL) protocol as the only option. If the PXE option is selected and the computer times out prior to boot, the following message is returned:

```
Loading the Boot image failed  
Press Ctrl+T to try again
```

If the RPL option is selected, the computer cannot time out during the boot sequence. In this case, the computer hangs until it is reset or rebooted by the user.

#### PnP/BEV Boot:

This option selects whether the computer boots using the Boot Agent image (PnP/BEV Boot: Disable), or using the motherboard BIOS Setup options (PnP/BEV Boot: Enable). Select “Enable” if you want to boot using the sequence defined in the motherboard BIOS Setup menu. This option effectively bypasses the boot agent software. Leaving the default “Disable” option selected allows booting with the Boot Agent image.

#### Default Boot:

This option selects either “Network” or “Local” as the default boot path. If “Network” is selected, the boot agent software attempts to boot over the network. If “Local” is selected, the computer attempts booting using the BIOS boot sequence. Unless the next option (Local Boot) is also set to “Enabled”, however, the boot agent software still attempts to boot over the network.

#### Local Boot:

This option (along with the Default Boot option) determines whether the computer attempts booting using the BIOS boot sequence, or using the boot agent software. If this option is set to “Enabled”, the computer boots using the BIOS boot sequence regardless of any other option setting. When the default “Disable” setting is used, the computer can only be booted locally using the PnP/BEV Boot option.

#### Prompt Time:

This option determines how long the computer waits after the following message is displayed:

```
Initializing Intel Boot Agent Version 2.2
```

```
Press Ctrl+S to enter into the Setup Program..
```

Note that only the first line of the above message shows if the Setup Message option is set to Disable. The default Prompt Time of 2 seconds allows you two seconds to press the Ctrl+S key combination so you can enter the Boot Agent Setup Program. The other options are 3, 5, or 8 seconds. If you do not press Ctrl+S within the option time, the only way to enter the setup program is by rebooting the computer.

#### Setup Message:

This option determines whether or not the following message is displayed at boot:

```
Press Ctrl+S to enter into the Setup Program..
```

This message displays for the two-to eight-second period defined by the Prompt Time option. If the Setup Message is set to Disable, the only message displayed is:

```
Initializing Boot Agent Version 2.2
```

However, you will still be able to enter Ctrl-S to enter the setup program at that time.

#### Power Management:

The selections are ACPI and APM. ACPI should work in most computers. The APM selection will pre-enable the Wake-on-LAN function of the adapter. Set this selection to APM if one of the following apply;

1. You are having difficulty with remote wake up in computers that are compliant to the PCI 2.2 specification, you are not using the 3-pin header cable and are running an OS that is not ACPI (Advanced Control and Power Interface) aware.
2. You are running an ACPI aware OS (such as Windows 98) on a non-ACPI computer and the link light goes out when you shut down the system, disabling Wake-on-LAN.

## fboot Utility

The `fboot` utility is the default interactive method that most users follow to install or upgrade the Boot Agent software. In order to use this utility, you must have an adapter (along with a 64KB flash ROM device) installed in your computer. The computer next must be booted to a DOS prompt.

**NOTE:** If the flash ROM device installed in the adapter ROM socket is already programmed (not blank), you can still use `fboot`, but it might be more difficult to first boot your computer to a DOS prompt. If necessary, disable the network boot and boot to a system disk loaded in the floppy drive.

Load the Boot Agent diskette in the floppy drive, then enter:

```
A:\> fboot 
```

The following response is returned, assuming both the adapter and the flash ROM device are properly installed.

```
[FBOOT ver 2.12] - Intel PCI NIC BOOT FLASH Update Utility
Intel Boot Agent 2.2
Copyright (C), 1995 - 1999 Intel Corporation

NIC Network Address PWA Number FLASH Memory Size Valid
=== =====
1 00A0C9A4230B 689661-003 SST 29LE512 64 Yes
```

Select NIC to update or ESC to exit:

If more than one adapter is installed in your system, you will need to enter the number corresponding to your adapter. Normally, however, just press “1” and the Enter key to continue. The next question requiring a response is:

```
Select Option (U)pdate or (R)estore:
```

An update (U) response results in the `fboot` utility updating the flash ROM device with the current version of Boot Agent software. A restore (R) response causes the `fboot` utility to write a previously stored flash image file onto the flash ROM device.

**NOTE:** The flash image file used as the result of a Restore selection must have previously been written to the same location as the `fboot` utility due to a prior `fboot` or `futil` utility operation. This file will have some automatically generated file name with a `.FLS` extension.

If you select an update (U) response, you will next be asked to respond to this final question:

```
Create Restore Image (Y)es or (N)o:
```

A yes (Y) response creates a flash image file and loads it with the current image of the flash ROM device. A no (N) response causes `fboot` to proceed without first saving a copy of the current flash image.

**NOTE:** If there is already a flash image file in the `fbboot` directory, it must first be deleted if you want to save a new version of the flash ROM device image. The `fbboot` utility will not overwrite this file.

Once you have answered the two (or three) questions posed by the `fbboot` utility, it creates the flash image file (if appropriate), then writes the current version of the Boot Agent image to the flash ROM device. The Boot Agent image is imbedded in the `fbboot` utility itself.

## futil Utility

The `futil` utility provides you direct control over the processes associated with backing up, erasing, and writing the Boot Agent software on the flash ROM device installed on the adapter. This utility must be invoked from a DOS environment. It cannot be invoked from a DOS Command Prompt window of a Windows environment. The command syntax for `futil` is:

```
futil [-nic={1..8}] [filename] [[-v]erify filename] [[-d]ump] [[-e]rase]
      [-bootenable] [-bootdisable] [[-h]elp]
```

Where:

- `futil` is the command itself. If no options or variables are specified when the command is entered, the Help screen is displayed.
- `-nic={1..8}` defines the adapter (NIC) on which the operation of THIS command will be performed. This option only has meaning when there is more than one adapter in the system. By default, operations are performed on all adapters in the system, and this option is necessary to restrict them to a single adapter.
- filename* writes the flash ROM device with the flash image located at *filename*. The *filename* option defines the full path and file name of the flash ROM boot image file. When the path is not included, the utility assumes the image file is in the same directory as the `futil.exe` file. If there is more than one adapter in the system this option should be used with the `-nic` option to restrict its effect to a single adapter instead of all adapters in the system.
- `[-v]erify filename` verifies the current contents of the flash ROM device against the flash image file at the *filename* location. This option can be abbreviated. If there is more than one adapter in the system this option should be used with the `-nic` option to restrict its effect to a single adapter instead of all adapters in the system.
- `[-d]ump` writes the current contents of the flash ROM device in the adapter to an image file. The image file will have an automatically generated filename and a `.FLS` extension. It will be located in the same directory as the `futil` utility. If there is more than one adapter in the system this option should be used with the `-nic` option to restrict its effect to a single adapter instead of all adapters in the system.
- `[-e]rase` clears (erases) the current contents of the flash ROM device in the adapter. If there is more than one adapter in the sys-

tem this option should be used with the `-nic` option to restrict its effect to a single adapter instead of all adapters in the system.

`-bootenable` enables remote booting of a flash ROM device that was previously disabled using the `-bootdisable` option. The computer must next be power cycled (reset) before this option can take effect.

`-bootdisable` disables remote booting of the flash ROM device that contains the Boot Agent remote booting software. The computer must next be power cycled (reset) before this option can take effect.

`[-h]elp` displays the Help information for the `futil` command. If no options or variables are specified when the `futil` command is entered, the Help screen is also displayed.

The `futil` utility is normally used by a more experienced user who needs more precise control over the flash ROM update process than that provided by the `fboot` utility. The following options are available when using the `futil` utility:

- Operations can be performed on a specific adapter, or on all adapters in the system.
- Any flash image file can be used to update the flash ROM device in a specified adapter.
- The flash ROM content can be verified against any specified flash image file content.
- The flash ROM content of any identified adapter can be dumped to an image file.
- The flash ROM content of any identified adapter (or all adapters in the system) can be erased.

Any of the above options can be performed, in any sequence, on one or all adapters in a system using the `futil` utility.



# Troubleshooting Procedures

The following list of problems and associated solutions covers a representative set of problems that you might encounter while using the Boot Agent.

If you are experiencing a problem that is not listed in this section, contact Intel Customer Support either by telephone or over the World Wide Web. Phone numbers and Web sites are listed at the back of this manual.

## ***“Media test failure, check cable”***

When an error message like this is returned, it means the adapter did not detect a viable network connection. Look at the RJ-45 network connector at the back of your computer and verify that a network cable is plugged in. Refer to “Determining the Client Computer Configuration” on page 4 for help in identifying the network connector.

If the network cable is correctly installed at the rear of your computer, it is possible that it is not connected to a server, or that the server has not been set up correctly yet. Make sure your computer is properly set up and connected to the network server before trying to set up the Boot Agent.

## ***Flash device wrong size***

The full version of Boot Agent software cannot be loaded into a flash ROM device smaller than 64K bytes. If a 32K byte or smaller flash ROM device is detected in the adapter, the Boot Agent software will return the “Flash device wrong size” message. Assuming the device is socketed, remove the “too small” device and install the blank 64K byte flash ROM device included as part of the Boot Agent product. See “Installing the Flash ROM Device” on page 5.

## ***Cannot change boot order***

If you are accustomed to redefining your computer’s boot order using the motherboard BIOS setup program, the default settings of the Boot Agent setup program can override that setup. In order to change the boot sequence, you must first override the Boot Agent setup program defaults. See “Interrupting the Boot Sequence” on page 13.

## ***When using RPL protocol, the boot does not proceed normally***

Operation of the Boot Agent under the RPL protocol might be erratic for several specific configurations. Contact Customer Support.

### ***There are configuration/operation problems with the boot process***

For some specific configurations and operating conditions, the boot process does not proceed as expected. Contact Customer Support.

### ***Not getting a prompt to go to Boot Agent setup program***

This is actually a feature of the Boot Agent product. As part of the setup program, one of the options allows you to turn off the prompt that says:

```
Press Ctrl+S to enter into the Setup Program..
```

You can still press the Ctrl+S key combination to enter the setup program, but the prompt is not displayed telling you when to do so. Immediately after POST, repeatedly press the Ctrl+S key combination until the Boot Agent setup program starts. While in the setup program, you can restore the prompt message if you want.

### ***My computer does not complete POST***

This problem occurs before the Boot Agent software has even begun operating. There is a software or BIOS problem with your computer. Contact your computer manufacturer's customer support group for help in correcting your problem.

### ***After booting, my computer experiences problems***

After the Boot Agent product has finished its sole task (remote booting), it no longer has any effect on the client computer operation. Any problems you are having with your computer after it completes the boot process are most likely related to another part of the computer.

If you are having problems with the local (client) or network operating system, contact the operating system manufacturer for assistance. If you are having problems with some application program, contact the application manufacturer for assistance. If you are having problems with any of your computer's hardware or with the BIOS, contact your computer system manufacturer for assistance.

# Glossary

The Glossary defines terms, abbreviations, and acronyms that apply directly to the Boot Agent.

API	Application Programming Interface
BEV	BIOS Entry Vector
BIOS	Basic Input Output System
BIS	Boot Integrity Service
BOOTP	Bootstrap Protocol
DHCP	Dynamic Host Configuration Protocol DHCP provides a framework for passing configuration information to hosts on a TCP/IP network. DHCP is based on the Bootstrap Protocol BOOTP, adding the capability of automatic allocation of reusable network addresses and additional configuration options. DHCP captures the behavior of BOOTP relay agents, and DHCP participants can interoperate with BOOTP participants.
ESD	Electro-Static Discharge
FTP	File Transfer Protocol
IP	Internet Protocol
MTFTP	Multicast Trivial File Transfer Protocol
NDIS	Networking Device Interface Specification – A Microsoft low-level device interface specification for network drivers.
NIC	Network Interface Controller (same as adapter)
NLM	Network Loadable Module – An executable file format that is used primarily in Novell NetWare server products.
OASIS	OS-Absent Security/Integrity Services
OS	Operating System
OSS	Open Source Software
PDK	Product Development Kit
PnP/BBS	Plug and Play BIOS Boot Specification
PXE	Pre-boot eXecution Environment
RPL	Remote Program Load
SM BIOS	System Management BIOS

TCP	Transmission Control Protocol – A set of protocols developed to allow cooperating computers to share resources across a network.
TFTP	Trivial File Transfer Protocol – The TFTP is a simple, lock-step file transfer protocol that allows a client to get a file from or put a file onto a remote host.
UDP	User Datagram Protocol – UDP provides a mechanism for data communication that uses less overhead than TCP. It does not ensure that packets arrive in sequence. UDP is used for applications that transmit short bursts of data, need faster network throughput, or do not require verification of delivery at the destination. Applications and protocols using UDP include DNS (Domain name System) and BOOTP.
UNDI	Universal NDIS Device Interface
URL	Uniform Resource Locator
WfM	Wired for Management

# Licensing, Warranty, and Support

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## Returning a defective product

### From North America:

Before returning any product, contact Intel Customer Support and obtain a Return Material Authorization (RMA) number by calling +1 916-377-7000.

If the Customer Support Group verifies that the product is defective, they will have the RMA department issue you an RMA number to place on the outer package of the product. Intel cannot accept any product without an RMA number on the package.

### All other locations:

Return the product to the place of purchase for a refund or replacement.

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## FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION: If the device is changed or modified without permission from Intel, the user may void his or her authority to operate the equipment.

## Canadian Compliance (Industry Canada)

When tested in at least one intended host:

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled "Digital Apparatus", ICES-003 of the Canadian Department of Communications.

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Class B prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadien des Communications.

## Manufacturer Declaration

This certifies that the Intel Boot Agent complies with the EU Directive 89/336/EEC, using the EMC standards EN55022 (Class B) and EN50082-1. This product also meets or exceeds EN 60950 (TUV) requirements. This product has been tested and verified to meet CISPR 22 Class B requirements.

Intel Corporation, Mailstop JF3-446  
Hillsboro, Oregon 97124-6497 USA

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## Web and Internet Sites

- Support: <http://support.intel.com>
- Network Products: <http://www.intel.com/network>
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- FTP Host: [download.intel.com](http://download.intel.com)
- FTP Directory: [/support/etherexpress/](http://support/etherexpress/)

## Customer Support Technicians

*US and Canada: 1-916-377-7000 (7:00 - 17:00 M-F Pacific Time)*

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