

# BIOS Boot Specification

Compaq Computer Corporation  
Phoenix Technologies Ltd.  
Intel Corporation

intel.


*Phoenix*

**COMPAQ**

## Booting Today

- ◆ **Only Supports Fixed and Floppy Disks**
  - **Very Simple**
  - **Very Limited**
    - ⇒ Choose From the First Floppy or First Hard Drive
- ◆ **Additional Devices**
  - **Hook INT 19**
  - **Hook INT 13**
- ◆ **Failure Conditions are Platform and Card Specific**

## Current Boot Issues

- ◆ **Systems Are Now Booting From Several Sources, Not Just "A:" or "C:"**
  - CD-ROM 
  - PCMCIA
  - LAN
- ◆ **Plug and Play Does Not Effectively Address Boot Device Selection**
  - **The PnP BIOS Spec Does Not Address the Subject of \$PnP OP-ROM Selection**
  - **The PnP BIOS Spec Really Allows Only One INT 13 Hooker to Be Executed**

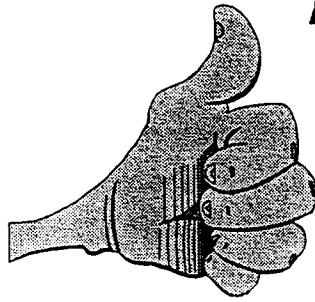


## Current Boot Issues (Continued)

- ◆ **There is Nothing in PCI to Tell the BIOS About Boot Capability**
- ◆ **No Industry Specifications**
  - **Allocating memory to an OP-ROM**
  - **Choosing a Boot Device**
  - **PCI and PnP**
  - **Multiple O/S Compatibility**
  - **BIOS/OP-ROM Failure Behavior**



## Enter the BIOS Boot Specification (BBS)



**Microsoft**  
**COMPAQ**  
**intel.**

*Phoenix*

## BBS Overview

- ◆ Provides a Method for Ordering Boot Devices
- ◆ Provides a Method for Ordering OP-ROMs Which Hook INT 13
- ◆ Provides Support for Legacy Devices

## **BBS Overview Boot Devices**

- ◆ **Builds on the PnP Specification**
  - **Requires a PnP Header**
  - **Device May Be Boot Entry Vector (BEV)**
  - **Or, Device May Be BIOS Aware IPL Device (BAID)**
- ◆ **Provides Specifications for OP-ROM Vendors**
  - **Requires a PnP Header in PCI OP-ROMs**
  - **Provides Formatting Requirements for the Product ID String**

## **BBS Overview INT 13 Hookers**

- ◆ **Provides a Method for Ordering OP-ROMs Which Hook INT 13**
  - **Requires PnP Header**
  - **Device Must be Boot Connection Vector (BCV)**
- ◆ **Defines How \$PnP OP-ROM Headers Apply to Booting**
- ◆ **Allows for BIOS Level Product Differentiation.**

## BBS Overview Legacy Cards


- ◆ **Allows Legacy Devices to be Installed in Any Order**
- ◆ **PCI Cards w/o the PnP Header are Treated as Legacy Devices**
- ◆ **Provides a Runtime Interface for Managing Boot Devices**
  - **Extends the PnP Interface by Using PnP Function Numbers**
    - ⇒ Numbers 60-6F are now Reserved for BBS
  - **32 Bit Protect Mode Capable**

## Initial Program Load (IPL) Devices


- ◆ **Requirement for IPL Devices**
  - ***Must invoke INT 18 if O/S fails to boot***
    - ⇒ PnP Spec Defines the Operating Environment on INT 18 Invocation
  - **Legacy Cards Which Hook INT 19 Will Short Circuit the BBS Process**
- ◆ **IPL Table**
  - ***Contains an Entry for Each BAID/BEV Device***
  - **Format is Specified for Runtime Interface**
  - **Internal Format is Implementation Specific**



## Initial Program Load (IPL) Devices

- ◆ **BIOS Aware IPL Devices**
  - **Floppy (INT 13, DL=00h)**
  - **Hard Drive (INT 13, DL=80h)**
  - **Any other device with Motherboard BIOS support**
    - ⇒ ATAPI CD-ROM 
    - ⇒ PCMCIA Devices
    - ⇒ USB Devices

## Initial Program Load (IPL) Devices

- ◆ **Devices With \$PnP Headers**
    - **Must Follow the Present PnP Spec, and one of the following fields must be supported**
      - ⇒ **Boot Entry Vector (BEV)**
      - ⇒ **Boot Connection Vector (BCV)**
    - **BEV Devices Typically are LAN Cards**
    - **BCV Devices Typically are SCSI Cards**
  - ◆ **Product Name String**
    - ***This is a Required Field***
      - ⇒ **Must be NULL Terminated (ASCIIZ)**
      - ⇒ **Significant to 32 Characters**
- 

## Initial Program Load (IPL) Devices



- ◆ **Legacy IPL Devices**
  - **Do Not Contain PnP OP-ROM Headers**
  - **Behavior May be Outside the Scope of BIOS Control**
  - **Should Hook INT 13 to Install Drive Support**
  - **If they Hook INT 18/19, Failures Can Occur**

## Initial Program Load (IPL) Devices

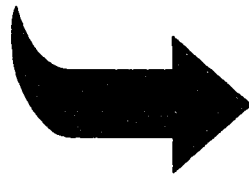
- ◆ **Identifying IPL Devices**
  - **BAIDs are automatically added to the IPL Table by the BIOS**
  - **BEVs are Added to the IPL Table following the System ROM Scan**
    - ⇒ **Must have a \$PnP Header**
  - **PCI Devices without a \$PnP Header are Treated as Legacy Devices**
    - ⇒ **Risk NOT being Presented to the User**
    - ⇒ **Presentation of these Devices is Implementation Specific**

## Boot Priority

- ◆ **Attempted Booting Order**
  - **First Invocation of INT 19 will Attempt to boot the Highest Priority Device**
  - **Device Failures Should Invoke INT 18 to Try Lower Priority Items**
- ◆ **Maintaining the Boot Priority**
  - **Must be Stored in Non-Volatile Memory**
    - ⇒ CMOS, ESCD, ETC...

## Boot Priority

- ◆ **Must Not Change Until *one* of the Following Events Occur**
  - **System Configuration Changes**
  - **User Requests a Change**
- ◆ **Sample IPL Table**



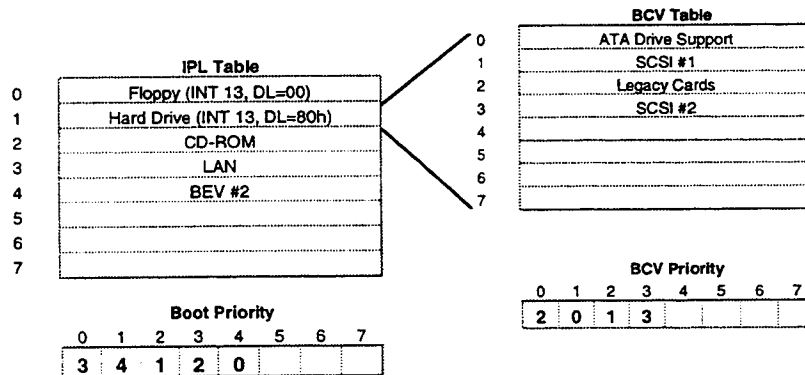
IPL Table	
0	Floppy (INT 13, DL=00)
1	Hard Drive (INT 13, DL=80h)
2	CD-ROM
3	LAN
4	BEV #2
5	
6	
7	

Boot Priority							
0	1	2	3	4	5	6	7
3	4	1	2	0			



## Boot Connection Vectors

- ◆ **The Hard Drive BAID/IPL Device**
  - **Represents INT 13 Device 80**



## Boot Connection Vectors

- ◆ **BCV Devices are Expected to Perform the Following Functions**
  - **Place Themselves at the Head of the INT 13 Chain**
  - **Use 40h:75h to Determine If They are the Boot Device**
  - **Use 40h:75h to Determine the Starting Drive Number for all new Drives Added to the System**
  - **Increment 40h:75h to Reflect the Number of Drives in the System**
  - **Leave INT 13 Untouched If *NO* Devices are Present**

## Boot Connection Vectors

- ◆ **Specify the *Call* order of INT 13 Hookers**
  - **Specify OP-ROM Order, NOT Drive Order**
  - **Allow Legacy Controllers Such as SCSI to Install *Before* the Conventional ATA Interface**
    - ⇒ Does Not Allow Automatic Identification of Legacy Cards to the User
  - **Requires that the *Product ID String* and the *BCV Elements of the PnP Header* be present**
    - ⇒ Provides the BIOS with a way of Identifying the Adapter to the User

## Boot Connection Vectors

- ◆ **The Following Device Classes Can Hook INT 13**
  - **BIOS ATA Support**
  - **PnP Cards w/BCV Support**
    - ⇒ Includes PCI Cards with PnP Headers
  - **Legacy Cards with Option ROMs**
- ◆ **Installation Ordering**
  - ***All BCV Devices are Installed Prior to Invoking INT 19***
  - **Ordering is Controlled in the Same Fashion as IPL Devices**

## Motherboard Power On Self Test (P.O.S.T.)

- ◆ **The Following Device Classes are Initialized During POST**
  - **BAIDs**
    - ⇒ All BIOS Aware IPL Devices Must be Initialized Prior to the Initial INT 19 Call
  - **PnP Boot Devices**
    - ⇒ All BEV and BCV devices will be Initialized Prior to the Initial INT 19 Call
    - ⇒ Only one Device Will Boot. All Other Devices Must Handle the Condition Where they are Initialized but do not Boot

## P.O.S.T.

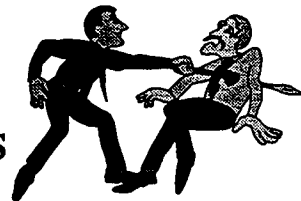
- ◆ **\$PnP Option ROM Initialization**
  - **PnP Devices Must Return Control to the BIOS After They Initialize**
    - ⇒ A PnP OP-ROM Which Does not Return is not BBS Compatible
  - **OP-ROM Initialization Occurs From the Lowest to the Highest Memory Address**
  - **\$PnP OP-ROMs Which Hook Vectors During Initialization Violate the PnP Specification and are *not* BBS Compatible**

## P.O.S.T.

- ◆ **IPL and BCV Priority**
  - **Must be Validated**
    - ⇒ **If there is a Discrepancy Between the Devices and the Priorities, Then Error Recovery Must be Performed**
- ◆ **INT 13 Device Controller Installation**
  - **All BCVs Must be Installed Prior to Calling INT 19**
  - **Any BCV Which Does not Have INT 13 Devices to Install *Must* Exit without Changing the System**

## P.O.S.T.

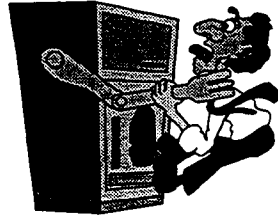
- ◆ **The PnP Disconnect Vector**
  - **Unimplemented Today**
  - **Will Never be Invoked by BBS**
  - ***Must be Null***
- ◆ **Legacy ROM Scan**
  - **Ignores ALL OP-ROMs Which Have a PnP Header**
  - **Scan is From Low to High (C0000h-EFFFFh)**



## P.O.S.T.

### ◆ On-Board ATA Support

- All ATA Devices Must be Initialized Prior to Installing the Devices in the BCV Table
- ATA Devices are Installed at the Point Selected by the User



## P.O.S.T.

### ◆ INT 19

- BAID Devices Boot from Internal Addresses
- BEV Devices Boot from Addresses Stored in the \$PnP Expansion Header
- Hard Drive (C:) BAID is the INT 13 Device Controller that Installs as Drive 80h
- *OS Load Failures Must Result in an INT 18 Call*
- Display the IPL Table if no Bootable Devices were Found?

## P.O.S.T.



- ◆ **INT 18 -- Recovery Interrupt**
  - **This Call Performs the Following**
    - ⇒ **Informs the Motherboard BIOS That an IPL Failure has Occurred**
    - ⇒ **Invokes the Next Highest Priority IPL Device**
    - ⇒ **Generates an Error Message?**

## Runtime Function Overview (Optional Interfaces)

- ◆ **Boot Priority Functions**
  - **Installation Check**
  - **Get/Set Boot Priority**
  - **Get IPL/BCV Tables**
- ◆ **Boot First Functions**
  - **Get Boot First**
  - **Set Boot First**

## Runtime Functions (Boot Priority)

- ◆ **Get Version and Installation Check**
  - **If the Installation Check is Present, *all* Remaining Boot Priority Functions Must be Supported**
  - **Must be the *First* Runtime Service Invoked**
  - **Returns Motherboard BIOS Version Number, if a BBS-compliant System is present**

## Runtime Functions (Boot Priority)

- ◆ **Get IPL Device Count**
  - **Returns the Number of Entries in the IPL Device Table**
  - **Should be the Second Call**
- ◆ **Get Boot Priority and IPL Table**
  - **Fills a Buffer Supplied by the Caller**
    - ⇒ **Boot Priority**
    - ⇒ **IPL Table (See Specification for Format)**

## **Runtime Functions (Boot Priority)**

- ◆ **Get IPL Device from Last Boot**
  - **Returns the IPL Table Index that Successfully Booted the System**
- ◆ **Set Boot Priority**
  - **Writes the Caller's Specified Boot Priority into Non-Volatile Memory**

## **Runtime Functions (Boot Priority)**

- ◆ **The Jury is Still Out on the Usefulness of this Interface**





## **Runtime Functions (Boot First)**

- ◆ **These Functions Provide Support for Setting the Device which will Boot on the Next Reset**
- ◆ **Software Equivalent of the Boot Menu**

## **Runtime Functions (Boot First)**

- ◆ **Get Boot First**
  - **Returns the IPL Index of the Boot Device Currently Selected as Boot First**
  - **If this Call is Successful, Set Boot First Must be Supported**
- ◆ **Set Boot First**
  - **Sets the Device Which Will Boot on the Next Journey Through P.O.S.T.**

## **Boot Menu (Optional)**

- ◆ **In BBS's Lust for Defining New System Capabilities an Optional Pop-Up Menu System has Been Defined**
  - **Accessed via a Hot Key During P.O.S.T.**
  - **Allows the User to Select the Boot First Device**
  - **Free's the User From Entering the SETUP Utility for a One-Time Boot Order Change**

## **In Summary**

- ◆ **BBS Provides for Booting from Newer Technology**
- ◆ **BBS Makes Boot Device Ordering Possible**
- ◆ **BBS Clarifies Option ROM Design Based on Plug and Play Specification**
  - **Clearly Defines "Bootable" Devices**
  - **Requires Better, More Consistent Error Recovery**

## Which Benefits...

- ◆ **Users, by Giving Them**
  - **Better Control Over Their Systems**
  - **Consistent Access to *All* Their Bootable Devices**
  - **A Method of Controlling Their Drive Letter Assignments**
    - ⇒ *This is Not 100% Full Control*
    - ⇒ *Actual Control is OS Dependent*



## In Closing

- ◆ **The BIOS Boot Specification is Open to Public Review Until August 25, 1995**
- ◆ **Please Submit Your Comments via E-Mail to**
  - **Scott\_Townsend@PTLTD.COM**
- ◆ **Other Contact Points**
  - **MGlass@Microsoft.COM (Mike Glass)**
  - **KevinW@BanGate.Compaq.COM (Kevin Winert)**
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