

BIOS Issues for OpenHCI

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Agenda

- ◆ **Introduction**
- ◆ **Initial Chip Configuration**
- ◆ **Adapter Cards**
- ◆ **System Requirements**
- ◆ **BIOS Boot (x86)**
- ◆ **Legacy DOS Support**

Introduction

◆ **Why BIOS?**

- **Required for boot**
- **Required for initial configuration**
- **Desirable for legacy DOS support**



Initial Chip Configuration From a Motherboard Perspective



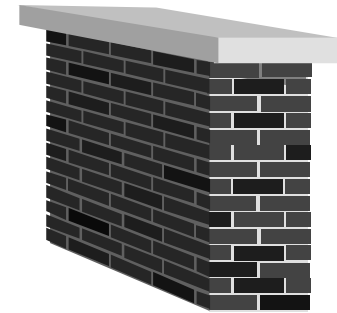
GUID Requirements

- ◆ **Each 1394 controller must have a unique GUID/EUI-64**
- ◆ **The GUID must be set before an OS is launched**
- ◆ **The GUID must be stored in an area which the user can't flash**
 - **BIOS upgrades could erase the GUID**
 - **BIOS upgrades could propagate non-unique GUID's**

Storage Options

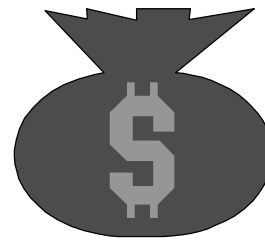
◆ **Boot Block**

- **Not always available**
- **Can not be corrupted by the user**
- **Requires a custom Boot Block for each motherboard**



◆ **Alternative ROM storage**

- **1394 Serial ROM**
- **Added cost**
- **Better security**
- **Can also be used to store other system specific information**



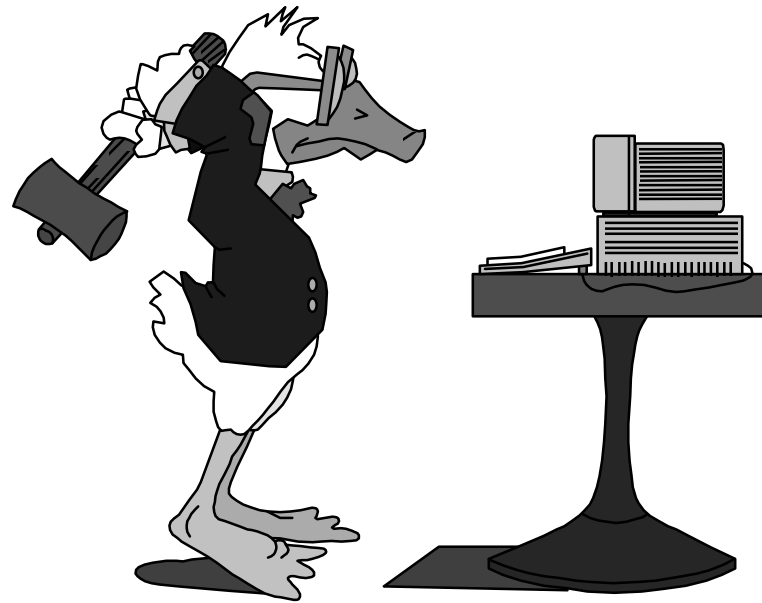
Initialization Sequence

- ◆ **BASIC initialization**
 - **Configure bus specific registers**
 - **Store the GUID/EUI-64**
 - **Setup initial DBDMA script**
 - **Enable the GRU (Async Receive Enable)**
 - **Store a pointer to Config ROM**
- ◆ **Enable the Link**
 - **All required registers must be initialized before the Link is enabled**

Initialization Sequence After Link Enable

- ◆ **Requests for config ROM information are processed by the chip without host intervention**
 - **The host CPU need not have IRQ's enabled**
 - **The host CPU need not respond to any device**
 - **The host CPU need not respond to unsolicited requests in the GRU**

Adapter Cards



Requirements

- ◆ **Very similar to motherboard requirements**
- ◆ **Must use serial ROM initialization**
 - **Ensures that correct GUID/EUI-64 is always stored**
 - **Prevents tampering**
- ◆ **Serial ROM should not be removable**
 - **User pops the Serial ROM and BIOS off the card**
 - **Uses device driver which can load anything**

Bootability

- ◆ **Requires and option ROM**
 - **May be socketed**
 - **Does NOT load the GUID/EUI-64, this is a function of the serial ROM**
 - **Option ROM is not required if bootability is not important**
- ◆ **For x86 this option ROM provides INT 13 services**

System Requirements



System Resource Summary

- ◆ **1 IRQ**
- ◆ **1k PCI register space**
- ◆ **1K 1394 register space not required**
- ◆ **Config ROM from 24 bytes min to 1k**
- ◆ **.5k GRU (RAM)**

Config ROM

- ◆ **Motherboard BIOS**
 - **Will normally reside in BIOS shadow area**
 - **Possibly copied from flash**
 - **BIOS Shadow is respected by most memory managers**
 - **May also reside in UMB space**
 - **Must be write protected**
- ◆ **Adapter BIOS**
 - **Config ROM will be in the Option ROM or corresponding shadow region**

Config ROM (Cont)

- ◆ **Minimum size is 24 bytes (6 quadlets), includes:**
 - **Header**
 - **Bus Info Block (resides in host controller)**
 - **Empty Root Directory**
- ◆ **Can grow larger by expanding the root directory**

Config ROM Pitfalls

- ◆ **Extended BIOS Data Area (XBDA)**
 - **If the system is booting from 1394**
 - **Config ROM must not be located here**
 - **Memory Managers such as EMM386, QEMM, and 386MAX by default relocate XBDA to UMB, or the bottom of DOS**
 - **1394 Register pointers get lost**
 - **Once the OS is loaded device drivers can provide a new config ROM**

GRU

- ◆ **Prior to OS load, at least .5k of XBDA must be assigned to GRU**
- ◆ **At runtime (during boot) the BIOS must ...**
 - **Check the pointer to the GRU for validity**
 - **At some point a memory manager may move XBDA**
 - **The Physical XBDA start address must be calculated if the system is in v86**
 - **If the GRU pointer is invalid a valid pointer must be provided**

BIOS Boot Specification (x86)



intel®

COMPAQ

Phoenix®

Overview

- ◆ **Provides a method for ordering boot devices**
- ◆ **Provides a method for ordering adapter ROMs which hook INT 13**
- ◆ **Provides support for legacy devices**

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 adapter ROM vendors**
 - **Requires a \$PnP header in PCI adapter ROMs**
 - **Provides formatting requirements for the product ID string**

INT 13 Hookers

- ◆ **Provides a method for ordering adapter ROMs which hook INT 13**
 - **Requires \$PnP header**
 - **Device must be Boot Connection Vector (BCV)**
- ◆ **Defines how \$PnP adapter ROM headers apply to booting**
- ◆ **Allows for BIOS level product differentiation**

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**

In Short

BBS Provides the Following:

- ◆ **A structured way for adapter ROMs to gain access to system resources such as INT 13**
- ◆ **A structured way for the BIOS to enumerate boot devices before an OS is launched**
- ◆ **A structured way for the system to re-boot with a different boot device under program control**

For More Information

- ◆ **BIOS Boot Specification v1.01**
 - **Can be downloaded from**
WWW.PTLTD.COM/TECHS/SPECS.HTML
 - **Contact Scott Townsend at**
Scott_Townsend@PTLTD.COM for more
information

Legacy DOS Support x86



INT 13 Support

- ◆ **Legacy DOS support is used by PC's to boot OS's**
- ◆ **Legacy INT 13 is required for DOS 6.22 and below**
 - All addressing is CHS based
- ◆ **DOS '95, Win NT and Win '95 can use INT 13 Extensions**
 - Extensions are LBA based
 - See EDD BIOS Specification, a PC '97 requirement for a description of these extensions
- ◆ **A CHS geometry must be derived for DOS 6.22 and below**

INT 13 Support (Cont)

- ◆ **INT 13 is single threaded**
 - **The BIOS does not respond to random requests**
 - **The BIOS responds to a boot device only after that device has been enumerated and a command has been issued**
 - **In effect, the BIOS acts as the root**
- ◆ **Hot Swapping is not supported**
 - **Drives are enumerated by the OS at boot**
 - **Device driver is needed for hot plugging**

Receive GRU

- ◆ **1394 Receive GRU must be supported**
 - **Motherboard BIOS will place this in Extended BIOS Data Area**
 - **Option ROM BIOS may place this information elsewhere**
 - **Minimum 4k is required**
 - **Unexpected messages will be dumped from the GRU**
 - **The BIOS only responds to devices it enumerates**

DMA

- ◆ **DOS provides virtual addresses**
- ◆ **BIOS is normally OS independent**
- ◆ **BIOS Data Area (BDA) has a flag which indicates when virtual memory services are available**
 - **OS/2, Win NT, Win '95, WFW, Himem.SYS, EMM386, QEMM, 386MAX and others**
 - **Some OS's do not.**
 - **These OS's will not be 1394 bootable**

DMA (Cont)

- ◆ **If the INT 13 services detect v86**
 - **User buffer is converted to a page table**
 - **This table is stored in Extended BDA**
 - **The page table is used in all media access commands to the 1394 device**
- ◆ **If INT 13 services do not detect v86**
 - **The user buffer address is used directly**
 - **Extended BDA is not required**

Any Questions?

