OPERATING SYSTEMS SEMINAR REPORT

System Management BIOS

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1 SMBIOS: AN INTRODUCTION

SMBIOS is an acronym for System Management BIOS. It is a standard by DMTF (Distributed Management Task Force),for the data structures used and the access methods for the BIOS information stored while booting. The information which BIOS has is in unstructured form, and would make no sense to a human.SMBIOS forms a part of the BIOS implementation.This part of BIOS i.e. SMBIOS will put the BIOS information table in the structure specified according to the SMBIOS standard and places it in the part of secondary memory.

2 WHY SMBIOS?

To understand the need for DMTF to standardize the information structure of BIOS, we first need to understand what basically DMTF does.The Distributed Management Task Force (DMTF) is an industry organization involved in the development, adoption, and interoperability of management standards and initiatives for enterprise and Internet environments. The aim is the exchange of management information in a platform-independent and technology-neutral way, streamlining integration and reducing costs by enabling end-to-end multi-vendor interoperability in management systems.[?]It was founded in 1992, and it is aimed towards the development, maintenance and promotion of systems management standards for enterprise IT environments.Thus, main aim of SMBIOS is to provide the information about the system vendors, by extending the BIOS information to the upper levels.
Here, system vendors means the Original Equipment Manufacturers.OEM Lisencing is one of the uses of SMBIOS.OEM Lisencing is the way Microsoft finds out if the windows version

is retailed or OEM Lisenced.It is like signature authentication on the firmware level.Thus, SMBIOS will put all the information that is in the BIOS to the upper levels in a structured way.

3 General Overview: How Computer works

When a Computer is switched on, we see the first screen to be loading either a GRUB or an Operating System.We know that, both the Grub as well as the Operating system are softwares and not electronics, that gets on as soon as the power is applied. So,one can wonder what happens in the hardware, to trigger on the OPerating system, as well as the other hardware peripherals attached to computer.

One can say that Computer is an empty carcass without an Operating System or a firmware installed in it.The MotherBoard of the computer has a firmware installed on it with certain amount of flash memory to it.This Firmware is know an BIOS -Basic Input and Output System. When a Computer is initially switched on, the BIOS chip gets powered first.This chip then performs the initial hardware testing for electrical faults.This test is known as Power-On-Self-Test(POST).The main reasons for powering the computer in stages is to check if the underlying hardware is up to mark and no faults have occurred, because if these faults are discovered after the total power up, up-to the operating System, then some serious damage will occur in terms of the loss of information and resulting other hardware complications.For what it does,BIOS crudely can be called as a comparator unit, where it has some information stored in memory about the hardware specifications and hardware options, which while booting, it will compare with the current specifications. If there is some error in the checking, the booting will terminate abruptly, thus saving the other hardware.One might hear beeping sounds when such abrupt termination occurs while booting.The number of such beeps in series determine the reason for termination.After this, if the checking is successful, the BIOS loads the bootloader, which is a small program stored on the flash memory on the hardware. This bootloader, does the job of loading the grub, which will inturn load the operating system from secondary memory.Thus, BIOS provides an additional layer for the abstraction for the hardware [**?**]

One can manually log into the BIOS and change the hardware settings. The figure 3.1 shows the options that BIOS provides for the hardware settings

4 How to access SMBIOS information?

Different Operating System will have different methods to handle SMBIOS data structure.In windows operatng system, we have command line command called WMIC, which uses WMI-Windows Management instrumentation.WMI is the Microsoft implementation of Web-Based Enterprise Management (WBEM), which is an industry initiative to develop a standard technology for accessing management information in an enterprise environment.So, if in a command prompt, one types ’wmic bios’, all the information about the BIOS of that machine will be

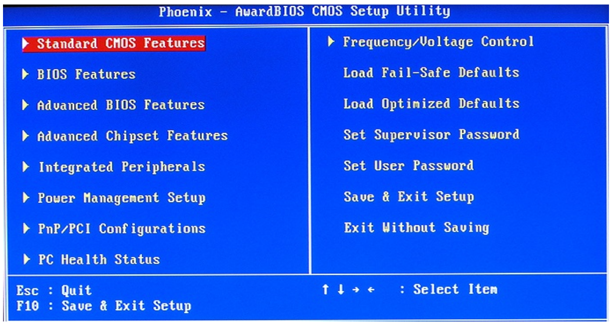

Figure 3.1: BIOS Environment

displayed. Similarly, for linux, we have dmidecode command to see the SMBIOS information.Appendix A shows outputs of some of the commands in dmidecode and wmic.

5 DataStructure of SMBIOS

SMBIOS data is a simple table of entries. Each entry is called a structure.There is no fixed number of structures. In other words, the number of structures in the table can vary.All structures are placed one after another and are packed closely; there is no padding data between two consecutive structures.Each structure size is a multiple of byte length. The SMBIOS table is not bit packed; this makes it simple to navigate.Each structure has a mandatory part called a structure header that has a fixed length.Each structure is identified by a type.Some structures are mandatory.Some structure types will and should occur only once. Some structure types can occur more than once.Each structure has a formatted section containing, at a minimum, the header.A structure could have an unformatted section. The unformatted section could contain proprietary information, OEM specific data, or it could contain string data.Some of the entries in the SMBIOS table are:
BIOS Information (Type 0)
System Information (Type 1)
System Enclosure (Type 3)
Processor Information (Type 4)
Cache Information (Type 7)
System Slots (Type 9)
Physical Memory Array (Type 16)
Memory Device (Type 17)
Memory Array Mapped Address (Type 19)
System Boot Information (Type 32)

6 Comparision between version 2.8.0 and 3.0.0 for Processor Information

As any standardized stndard, SMBIOS have different versions. The latest one is SMBIOS 3.0. With each version some new addition and optimization for the data structure is done.For Example, comparing the specification documents for version 2.8.0 and 3.0.0, for the processor information is :
Processor Information (Type 4) :
extend core, core enabled and thread count ranges
add new socket type Intel LGA1150
add new socket type Intel BGA1168
add processor family names
add new Intel socket types BGA1234 and BGA1364

References

[1] http://www.bcot1.com/bios1.html

[2] http://en.wikipedia.org/wiki/BIOS

[3] http://wiki.osdev.org/System_Management_BIOS

[4] http://wiki.osdev.org/System_Management_BIOS

[5] http://en.wikipedia.org/wiki/System_Management_BIOS

[6] http://en.wikipedia.org/wiki/Original_equipment_manufacturer

[7] http://en.wikipedia.org/wiki/Original_equipment_manufacturer

[8] http://en.wikipedia.org/wiki/Booting

[9] http://www.service-architecture.com/articles/xml/distributed_management_task_force_dmtf.html

[10] http://www.servicetechspecs.com/organization

[11] http://en.wikipedia.org/wiki/Original_equipment_manufacturer

7 Appendix

Appendix contains the output to some of the wmic and dmidecode commands.

```
>>wmic  process get name, workingsetsize

Name                    WorkingSetSize

System Idle Process       24576

System                  323584

smss.exe                 1245184

csrss.exe               4878336

wininit.exe              4775936

csrss.exe               73203712

services.exe              10346496

lsass.exe               14897152

lsm.exe                 4538368

winlogon.exe              7733248

svchost.exe              10338304

scproxysrv.exe            3325952

ScSecSvc.exe              7917568

svchost.exe              10833920

svchost.exe              25456640

svchost.exe              139898880

svchost.exe              21872640

svchost.exe              47435776

svchost.exe              20889600

wlanext.exe              6135808

conhost.exe              2916352

spoolsv.exe              13336576

svchost.exe              14880768

BDSSVC.EXE                25657344

EMLPROXY.EXE               60739584

SAPISSVC.EXE              227328000

OPSSVC.EXE               10330112

QUHLPSVC.EXE               9121792
```

```
>>dmidecode bios

# dmidecode 2.11

SMBIOS 2.7 present.

45 structures occupying 2246 bytes.

Table at 0x000EBAE0.


Handle 0xDA00, DMI type 218, 251 bytes

OEM-specific Type

        Header and Data:

                DA FB 00 DA B2 00 0D 5F 0F 37 40 7D 00 00 00 00

                00 7E 00 01 00 00 00 75 01 01 80 01 00 76 01 02

                80 01 00 2D 01 03 80 01 00 2E 01 04 80 00 00 4F

                02 05 80 01 00 50 02 06 80 00 00 81 01 07 80 00

                00 82 01 07 80 01 00 83 01 08 80 00 00 84 01 08

                80 01 00 85 01 09 80 00 00 86 01 09 80 01 00 58

                02 0B 80 00 00 57 02 0B 80 01 00 9C 00 02 00 01

                00 9B 00 02 00 00 00 8A 01 03 00 01 00 89 01 03

                00 00 00 7F 01 04 00 00 00 80 01 04 00 01 00 53

                01 05 00 00 00 52 01 05 00 01 00 7B 01 06 00 00

                00 7C 01 06 00 01 00 94 01 07 00 00 00 93 01 07

                00 01 00 7D 00 08 00 00 00 2D 00 09 00 01 00 2E

                00 09 00 00 00 6E 00 0A 00 00 00 95 00 0B 00 01

                00 96 00 0B 00 00 00 2F 02 0C 00 01 00 30 02 0C

                00 00 00 4B 01 0D 00 01 00 4A 01 0D 00 00 00 EA

                00 0E 00 01 00 FF FF 00 00 00 00


Handle 0xDA01, DMI type 218, 59 bytes

OEM-specific Type

        Header and Data:
```

```
		DA 3B 01 DA B2 00 0D 5F 0F 37 40 EB 00 0E 00 00
		00 37 01 0F 00 00 00 38 01 0F 00 01 00 2E 02 07
		80 01 00 2D 02 08 80 01 00 4F 03 09 80 01 00 50
		03 0A 80 01 00 FF FF 00 00 00 00

Handle 0x0000, DMI type 0, 24 bytes
BIOS Information
	Vendor: Dell Inc.
	Version: A00
	Release Date: 05/25/2012
	Address: 0xF0000
	Runtime Size: 64 kB
	ROM Size: 2048 kB
	Characteristics:
		MCA is supported
		PCI is supported
		BIOS is upgradeable
		BIOS shadowing is allowed
		ESCD support is available
		Boot from CD is supported
		Selectable boot is supported
		BIOS ROM is socketed
		EDD is supported
		5.25"/1.2 MB floppy services are supported (int 13h)
		3.5"/720 kB floppy services are supported (int 13h)
		3.5"/2.88 MB floppy services are supported (int 13h)
		Print screen service is supported (int 5h)
		8042 keyboard services are supported (int 9h)
		Serial services are supported (int 14h)
		Printer services are supported (int 17h)
		CGA/mono video services are supported (int 10h)
		ACPI is supported
		USB legacy is supported
		ATAPI Zip drive boot is supported
		BIOS boot specification is supported
		Targeted content distribution is supported
		UEFI is supported
	BIOS Revision: 0.0
	Firmware Revision: 0.0

Handle 0x002E, DMI type 13, 22 bytes
BIOS Language Information
	Language Description Format: Long
	Installable Languages: 1
		en|US|iso8859-1
	Currently Installed Language: en|US|iso8859-1

Handle 0x002D, DMI type 131, 64 bytes
OEM-specific Type
	Header and Data:
		83 40 2D 00 31 00 00 00 00 00 00 00 00 00 00 00
		F8 00 5D 1E 00 00 00 00 01 00 00 00 00 00 08 00
		A1 05 04 00 00 00 00 00 C8 00 FF FF 00 00 00 00
		00 00 00 00 26 00 00 00 76 50 72 6F 00 00 00 00

Handle 0x0001, DMI type 1, 27 bytes
System Information
	Manufacturer: Dell Inc.
	Product Name: Vostro 2520
	Version: Not Specified
	Serial Number: JQDTLV1
	UUID: 4C4C4544-0051-4410-8054-CAC04F4C5631
```