Transitioning the Plug-In Industry from Legacy to UEFI: Real World Cases and Call to Action

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EFIS005
Agenda

- Plug-Ins! Past, Present, and Future
- UEFI is Making BIOS Plug-Ins Possible!
- Real World Examples
- Taking Plug-Ins to the Next Level
- Call to Action
Plug-Ins: Added Value for PCs

Plug-Ins are added value for PCs installed by either:

- The OEM
- The End User

What plug-ins do we use today?
For MP3 players, it’s earphones, power supplies, etc.
For PDAs/smart phones, it’s app store software
For PCs, plug-ins extend functionality too
Plug-Ins: Added Value for PCs

- **OEM Plug-Ins:**
  - Likely to exist in source code form
  - Require technical integration into the BIOS in some way (source, adaptation, etc.)
  - Integrated as part of system test

- **User Plug-Ins:**
  - Need seamless binary installation
  - Lots of issues (security, storage, configuration, compatibility, etc.)
  - Must just work without any “system test” on the user’s part
Plug-Ins: Added Value for PCs

• In the early days, plug-ins made hardware operational—ROM BIOS extensions (OpROMs)
• Today’s add value is less about new hardware options, and more about other things:
  • Virus/Malware Protection
  • Enterprise Management
  • OS Installation
  • Geo-Fencing
  • Instant-On environments
  • Diagnostics
Plug-Ins Past and Present

Today’s computing is trending towards enclosed systems with limited hardware expansion

1981-1989
Expansion via hardware plug-ins (i.e. LAN, Modem, Graphics)

1990-1999
Expansion via standards (USB, PCI)
Early Notebooks with limited expansion
Connectivity: Network, Internet

2000-2009
Accelerated Transition to Mobility
(Notebooks, Netbooks, PDAs, etc.)
Limited Expansion: Closed Systems

Today’s computing is trending towards enclosed systems with limited hardware expansion.
Plug-Ins: Near Future

What forces are driving plug-ins now?

- **2010**: UEFI Notebooks: SW Door Opens
  - 2008-2009: Steady growth in UEFI adoption
  - 2010*: Broad adoption of UEFI: ~>50% notebooks shipped

- **2012**: Form Factor Mobile UEFI Adoption
  - i.e. PDAs, Mobile Phones, MP3 players, etc.

* Source, UEFI Forum
** Source, Phoenix Technologies
Plug-Ins: Longer-Term Future

What forces are driving plug-ins later?

• 2015*: The Cloud: Unlimited storage and services

• 2015*: The Grid: Unlimited computing power

• 2020*: Shift from “press this to cause the device to do that” to peer interaction with the device

* Source, Phoenix Technologies
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UEFI is Making Plug-Ins Possible!

- Focus on Mobile Devices

- All new systems shipping with some form of UEFI

- Phoenix creating UEFI solutions for all new silicon solutions

- Green H: Formal packaging of executable entities, run-order, flow control
  - Does away with hooking and patching
## Green H/UEFI Transforms Plug-Ins

### Legacy vs. UEFI

<table>
<thead>
<tr>
<th>Category</th>
<th>Legacy</th>
<th>UEFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Allocation</td>
<td>- BDA Editing</td>
<td>✓ Allocate Pages</td>
</tr>
<tr>
<td></td>
<td>- INT 15h</td>
<td>✓ Allocate Memory</td>
</tr>
<tr>
<td>I/O to Screen</td>
<td>- INT 10h/INT 16h</td>
<td>✓ ConIn/ConOut handles</td>
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<tr>
<td></td>
<td>- Painting video memory</td>
<td></td>
</tr>
<tr>
<td>Hotkeys</td>
<td>- Hook INT 09h, INT 08h, INT 1ch</td>
<td>✓ Hotkey protocols</td>
</tr>
<tr>
<td></td>
<td>- None</td>
<td>✓ Well Defined Protocols</td>
</tr>
<tr>
<td>Security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configuration</td>
<td>- ^S to enter special setup program in ROM</td>
<td>✓ Human Interface (HII) Protocols</td>
</tr>
<tr>
<td>Packaging</td>
<td>- ROM extension on PC card</td>
<td>✓ UEFI DXE Driver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ UEFI Application</td>
</tr>
</tbody>
</table>

UEFI offers Standard services & Interfaces vs. ad-hoc legacy implementation
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Real World Example-Phoenix FailSafe™

• Deployed on legacy BIOS and UEFI systems
• Deployed on Phoenix SecureCore™ /Legacy
• Deployed on Phoenix SecureCore Tiano™
• Deployed on other IBV offerings!
Case Study #1: FailSafe™ – What is it?

A SaaS offering from Phoenix Technologies that provides the ability to protect, track and remotely manage lost or stolen notebook or netbook.
• Lock laptop at the BIOS level
• BIOS stores critical information
• Cryptography modules in BIOS responsible for authenticating callers
• Uses UEFI SMM architecture to perform all runtime operations
FailSafe Legacy Implementation

- Created as a Phoenix SecureCore feature
- Tightly coupled with SecureCore features
  - Secure BIOS-to-OS communication (CryptOSD)
  - Encrypted data storage (SDM)
  - Cryptographic features (StrongROM)
  - Additional features
    - Hard-disk password support
    - User password collection routines
FailSafe™ – Legacy Porting Challenges

• Option ROM concept dismissed
  – Cannot use platform setup screen
  – No conflict-free mechanism for CMOS access
  – Prone to malware attacks

• Tight integration with 3rd party BIOS
  – Little knowledge of the architecture
  – Need to integrate key SecureCore features/services
  – OS compatibility with SecureCore™
  – SDK for ease of implementation – difficult to generalize
FailSafe™ SDK (Legacy)– Binaries

- SDK created as a proprietary binary solution
- Additional effort required by 3rd party BIOS teams:
  - Six binary modules in flash
  - Memory allocation
    - i.e. E000/F000 and SMM
  - Placement of SDK binaries in specific regions
  - Population of binary headers with environment information
FailSafe™ SDK (Legacy) – Challenges

- SDK solution had large code size driven by:
  - Time to market urgency
  - Lack of familiarity with the code
  - Lack of common services

- Unexpected environment differences:
  - SDK assumed SMM code address at TSEG vs. a flat address

- Conflicting behaviors:
  - FailSafe hard-disk password implementation compatibility with 3rd party BIOS solution
Failsafe™ – UEFI Implementation

• EDK framework as a starting base
• Greater modularity and portability through UEFI services and protocols
  – Boot Services and Runtime Services
    • Readytooboot
    • LegacyBoot,
    • Exitbootservices
  – User Interface
    • Conin()
    • Conout()
  – Wide array of UEFI protocols
    • EFI_CPU_IO_PROTOCOL
    • EFI_SMM_CPU_PROTOCOL
    • EFI_ACPI_SUPPORT_PROTOCOL
    • EFI_LEGACY_BIOS_PROTOCOL
    • Etc.

UEFI significantly improves portability across multiple code bases
Failsafe: UEFI Challenges

• Not all BIOS codebases are compliant with the latest spec
  – Some protocols not yet adopted by everyone
    • EFI_SMM_COMMUNICATION_PROTOCOL
    • EFI_SMM_CPU_PROTOCOL

• Build environments are different, require additional integration effort
  – SDK is released for a EDK style build environment
    • Adding new binaries to build requires “.inf” and “.dxs” files
  – Lack of standardization on global settings/environment variables

➢ Need a standard build environment or means for binary inclusion
➢ Compliance checking and plugfests are a must
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Taking Plug-Ins to the Next Level

• Preparation for transition from OEM “Push” to End User “Pull” in the market

• Solve User-Level problems, not OEM problems
Taking Plug-Ins to the Next Level

• Make Mobile Systems Plug-In Friendly (OEM/ODMs)
  • Need to create concept vehicles

• Make Tools that are Plug-In Friendly (IBVs)
  • Create SDKs for ODMs and OEMs
  Also
  • Create SDKs for Plug-In Makers
  • Development environment that abstracts the complexities of BIOS from the Plug-In makers

i.e., You don’t need Windows 7* source code to create a Windows application.
Taking Plug-Ins to the Next Level

- IBVs to collaborate with UEFI forum and define a path to move to binary distribution (i.e. app store level)

- All IBVs will have their own ideas

- Phoenix is working on:
  - **Installation** – Installer
  - **Discovery** – Defining firmware volume assignments for plug-In storage
  - **Compatibility** – UI form and function
  - **Storage** – Read/Write firmware volume assignments and QoS for data storage
  - **Isolation** – Adding protection around apps for security and reliability
  - **Performance** – One second POST
  - **Power Management** – Best practices for maximizing battery life
  - **Configuration** – Best practices to simplify user experience
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Call To Action

- Plug-Ins are going to take off, as the role of the BIOS/Pre-Boot is standardized and stabilized

- Importance of Plug-Ins will increase
  - Allows for differentiation and expandability in otherwise closed systems

- IBVs, ODMs, OEMs, and SVs will pave the way for plug-In manufacturers to add value:
  - First at the source code level as they sell to OEMs
  - Finally at the binary level as end users install their own plug-ins

Active participation in the UEFI Forum is key to the success of plug-ins
Additional resources on UEFI:

- Visit UEFI Booth #136
- More web based info:
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