

Firmware Flexibility using Intel® Firmware Support Package

A decorative graphic consisting of several horizontal blue lines of varying lengths, with small circles at the ends, resembling a circuit board or data bus.

Vincent Zimmer – Senior Principal Engineer, Intel Corporation

Agenda

- Overview of the Intel® Firmware Support Package (Intel® FSP) to encapsulate Intel® silicon initialization
- Scaling platform initialization with the Intel FSP and open source Intel® Architecture (IA) firmware ecosystems
- Details on building an open source IA platform with Intel FSP
- Full openness
- Summary and next steps

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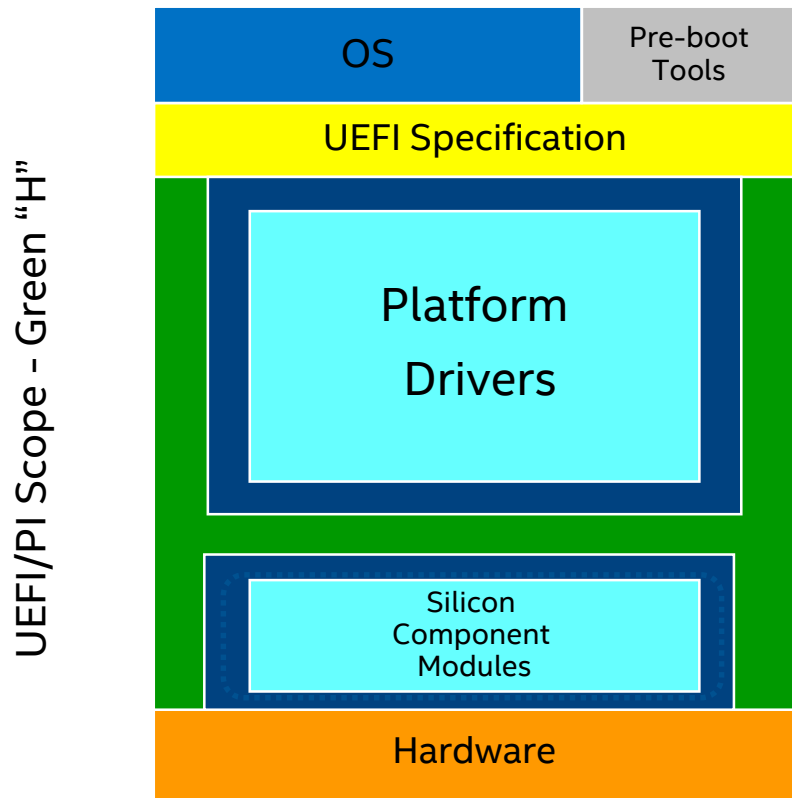
The Intel® Firmware Support Package (Intel® FSP)

Intel® Firmware Support Package (Intel® FSP) components

- CPU, memory controller, and chipset initialization functions as a binary package
- Provides silicon initialization ingredients
- Plugs into existing firmware frameworks
- Integration guide, includes API documentation

Intel FSP is currently available for the many Intel® hardware-producing divisions

From IDF 2013 Applying Intel® Firmware Support Package to Open Source EDK II



■ PEI/DXE PI Foundation

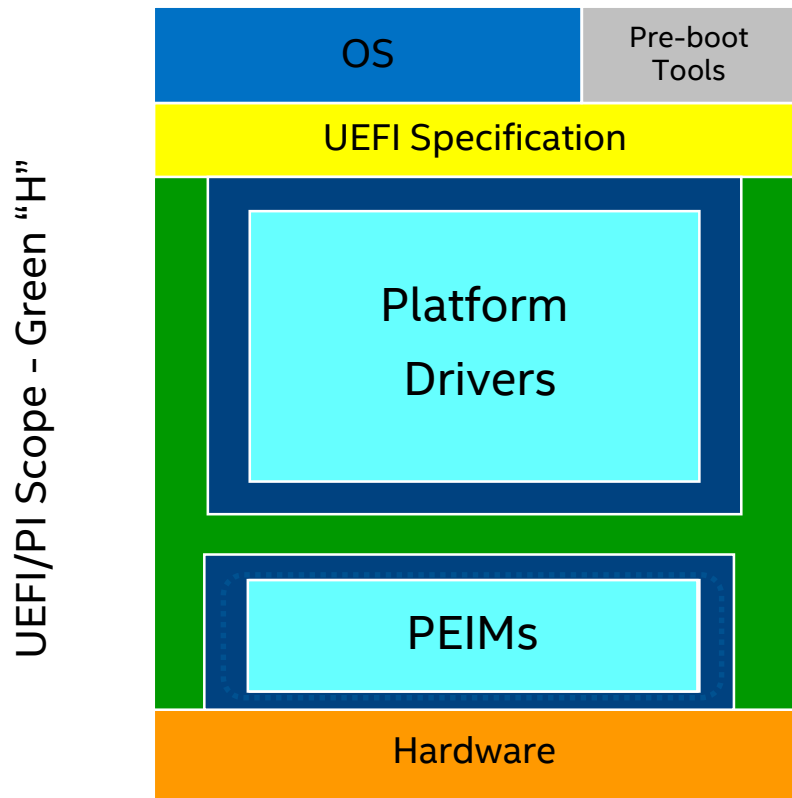
■ Modular Components

EDK II provides the framework ("Green H")

Intel® Firmware Support Package (Intel® FSP) provides low level of silicon initialization



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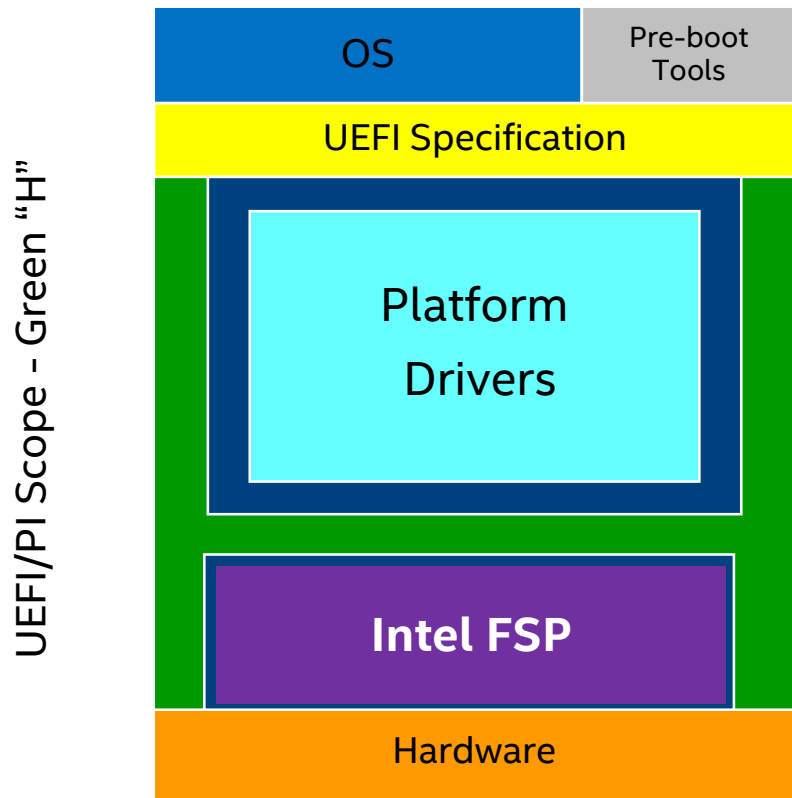
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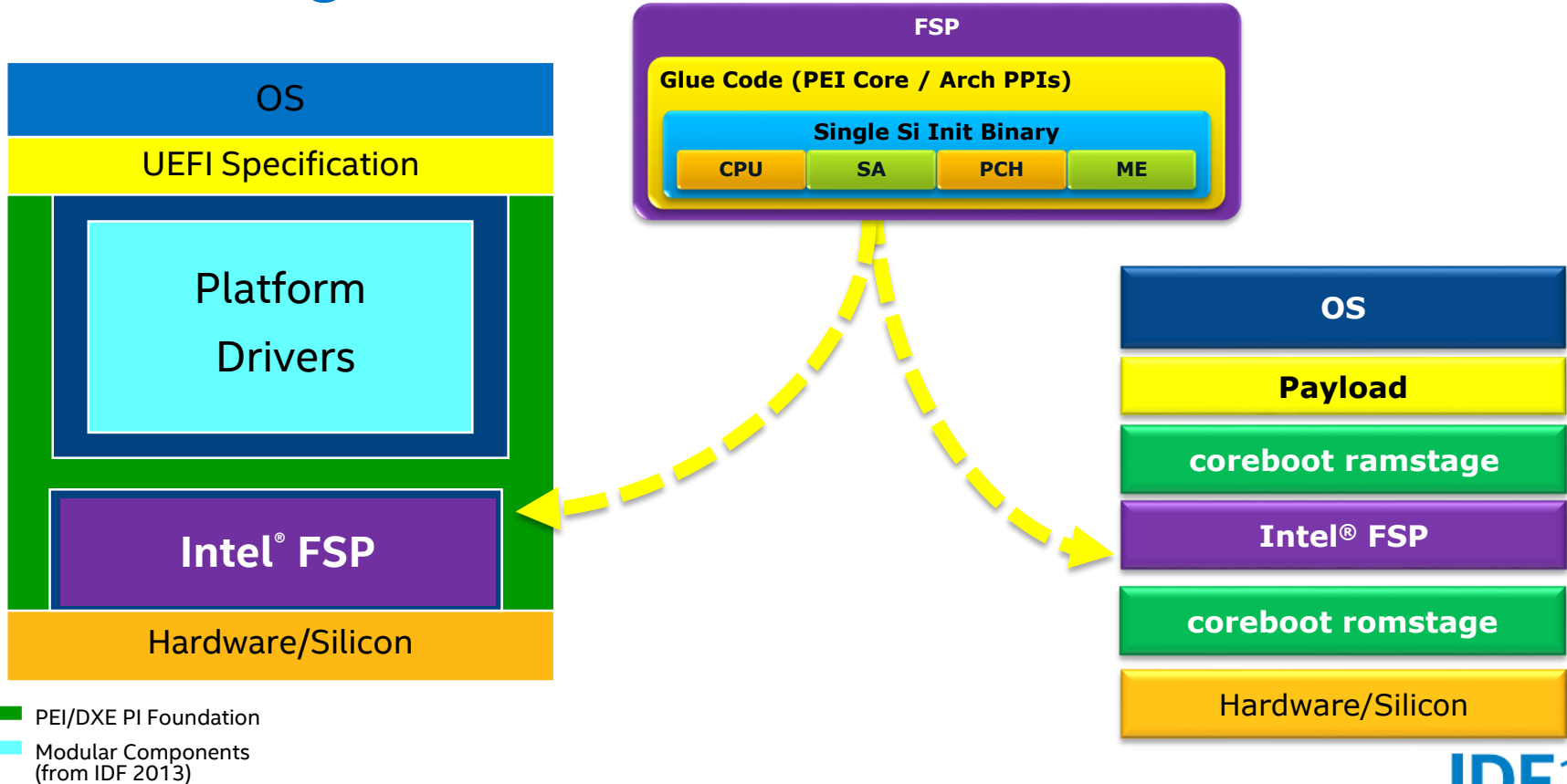
■ Modular Components

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Intel® Firmware Support Package (Intel® FSP) provides low level of silicon initialization

Applying “Produced” Intel® Firmware Support Package (FSP) to “Consuming” IA firmware

UEFI/PI Scope - Green “H” w/ EDK2



Intel® FSP Producer

- Examples of binary instances on <http://www.intel.com/fsp> with integration guides
- This includes hardware initialization code that is EFI Developer Kit II (EDK II)-based PEI Modules (PEIM's)
- Modules are encapsulated as a UEFI PI firmware volume w/ extra header
- Configure w/Vital Product Data (VPD)-style Platform Configuration Data (PCD) externalized from the modules
- Resultant output state reported via UEFI Platform Initialization (PI) Hand Off Block (HOB)
- Present 1.0 specification at [FSP 1.0 External Architecture Specification \(EAS\)](#)

The Source for the Intel® FSP Producer Code

- CPU and chipset-specific code for PEIM's inside of the Intel FSP can be open or closed, added to...
- PEI core and infrastructure code at <https://svn.code.sf.net/p/edk2/code/trunk/edk2/MdePkg> and <https://svn.code.sf.net/p/edk2/code/trunk/edk2/MdeModulePkg>
- And the code to create the Intel FSP interfaces can be found at <https://svn.code.sf.net/p/edk2/code/trunk/edk2/IntelFspPkg/>

Intel FSP can encapsulate IP protected initialization code PRODUCED by Intel business units

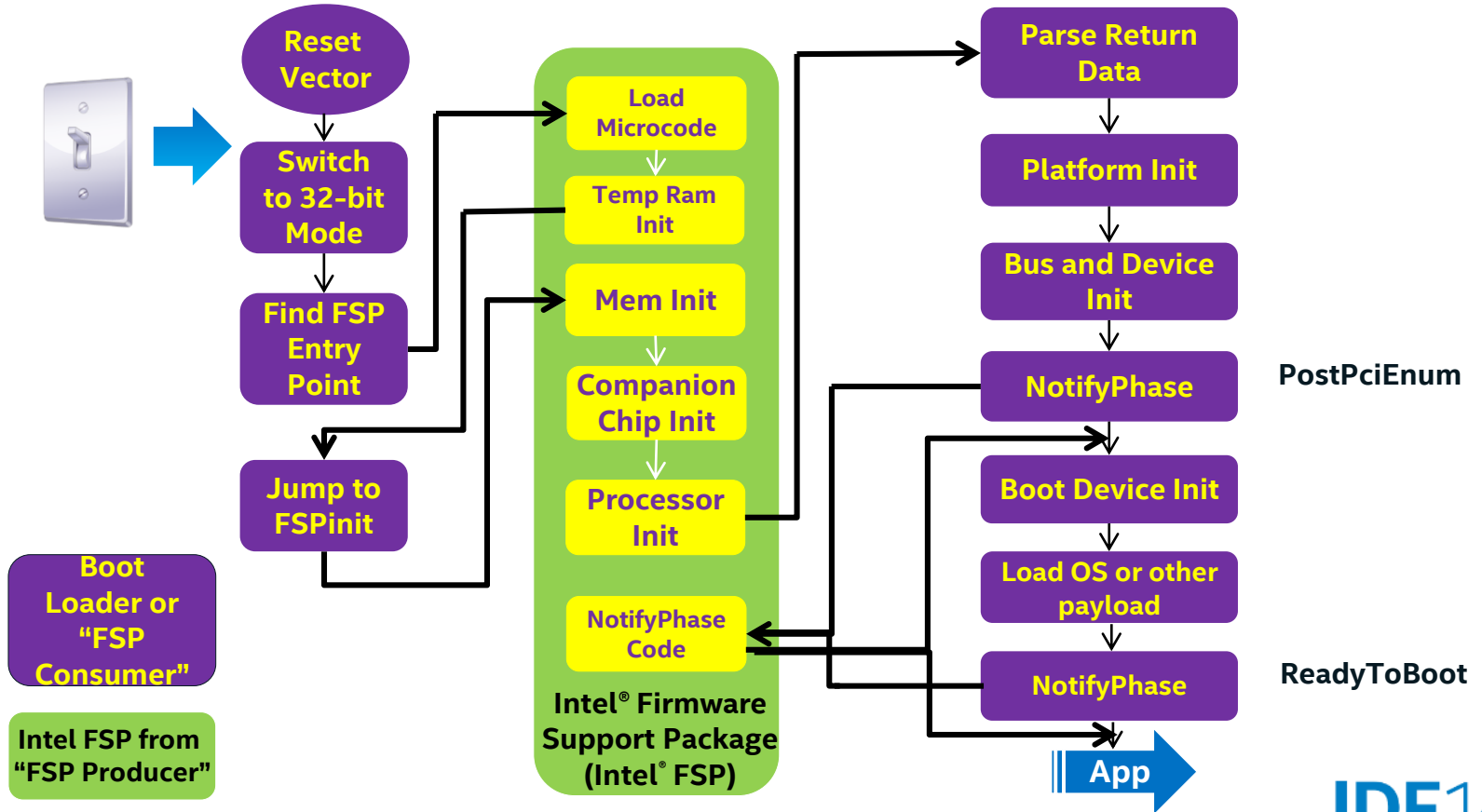
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Intel® FSP Consumer

- Consumer Firmware can be bootloaders from board support packages, traditional BIOS, UEFI/PI based EDK II firmware, or other embedded software solutions
- Firmware to absorb, integrate, or ‘consume’ the Intel FSP binary
- Consistent consumer code in the open source Intel® Architecture firmware up streams
- Enables fully open work-flow of using Intel FSP and open source IA firmware code

Intel® FSP Boot Flow



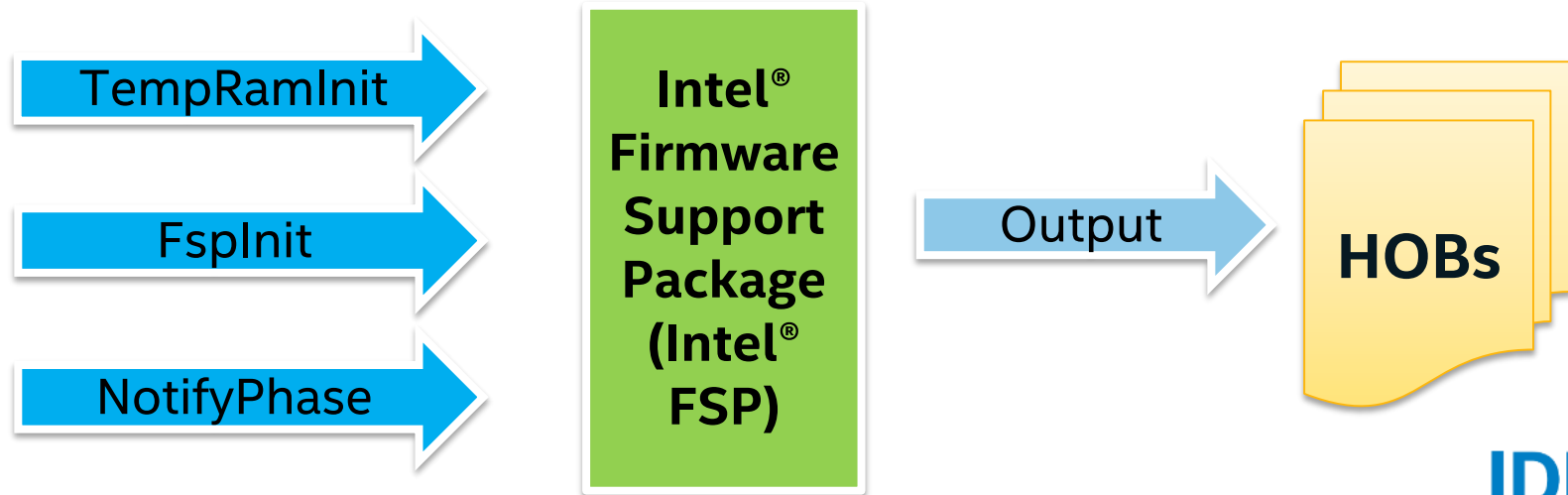
Intel® FSP External Interfaces

APIs published by the Intel FSP Producer and invoked by the Consumer

- **TempRamInit** - Enables cache for using as temporary memory and code caching
- **FspInit** - Performs the processor and companion chipset initialization
- **NotifyPhase** - Hooks for certain phase during the platform initialization

Intel FSP Producer/binary creates the UEFI PI Hand-off Blocks (Vol 3 of the UEFI PI spec)

- Contains basic platform information



Agenda

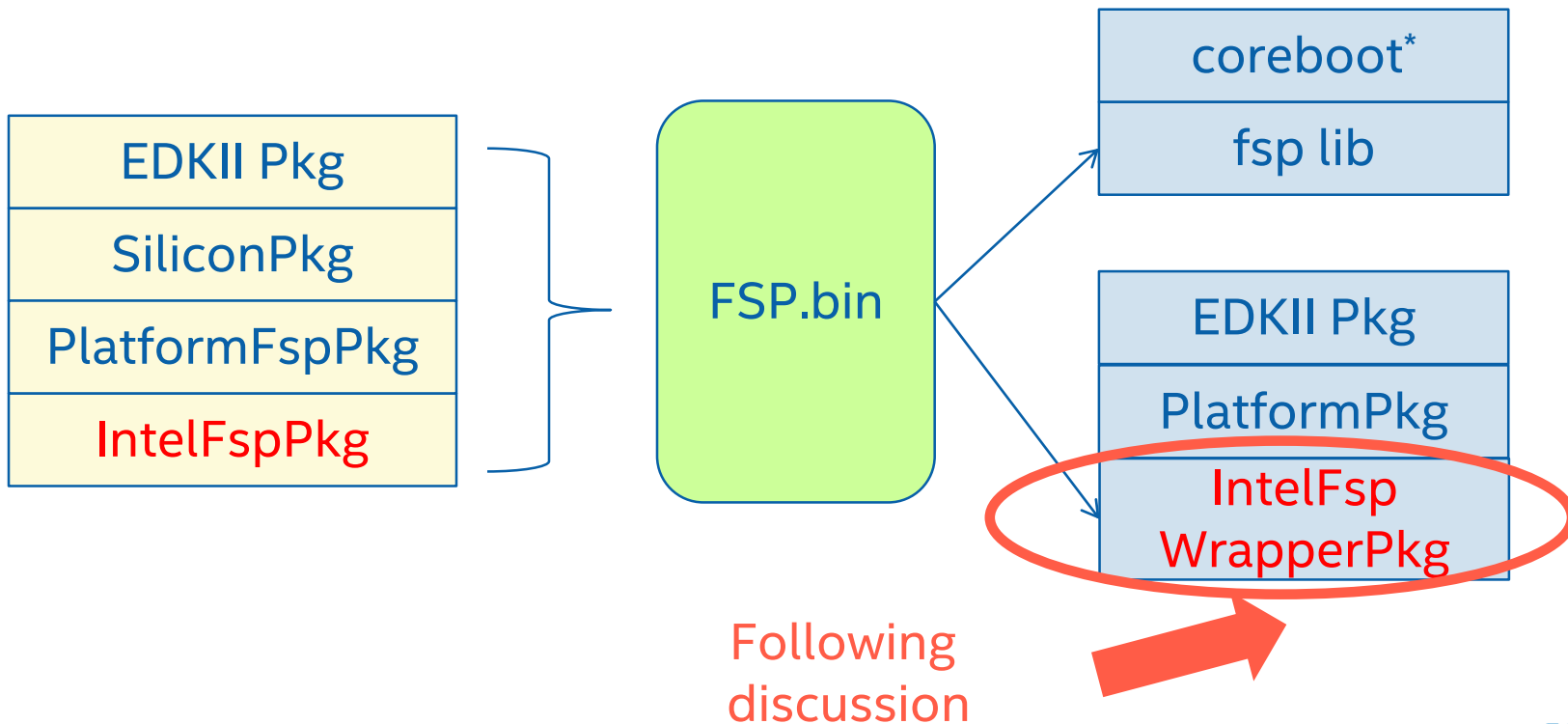
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2 Consumers: EDK II firmware and coreboot*

Functionality	coreboot	UEFI / PI
The reset vector and pre cache-as-ram setup	bootblock	Security Phase (SEC)
Cache as Ram setup, early silicon initialization, memory setup. Covered largely by Intel® Firmware Support Package	romstage	Pre-EFI Initialization (PEI) Create HOBs
Normal device setup and mainboard configuration. Publish SMBIOS/ACPI Tables	ramstage	Early Driver Execution Environment (DXE)
Memory map hand-off	CBMEM	UEFI Memory Map
The OS or application bootloader	payload	DXE BDS and UEFI Drivers

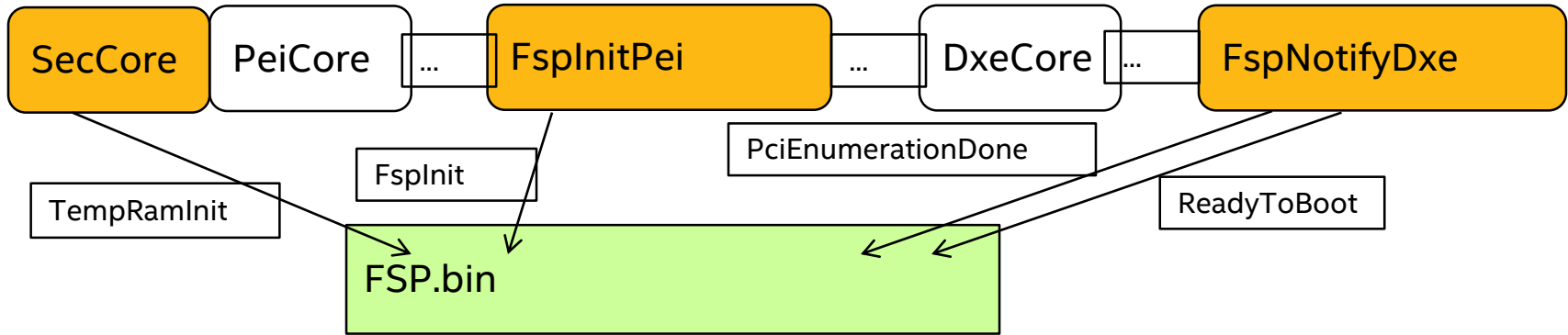


EDK II based Intel® FSP Consumer Details

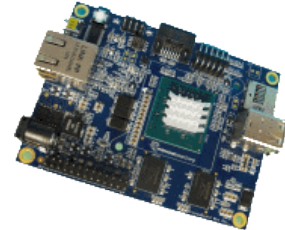


Following
discussion

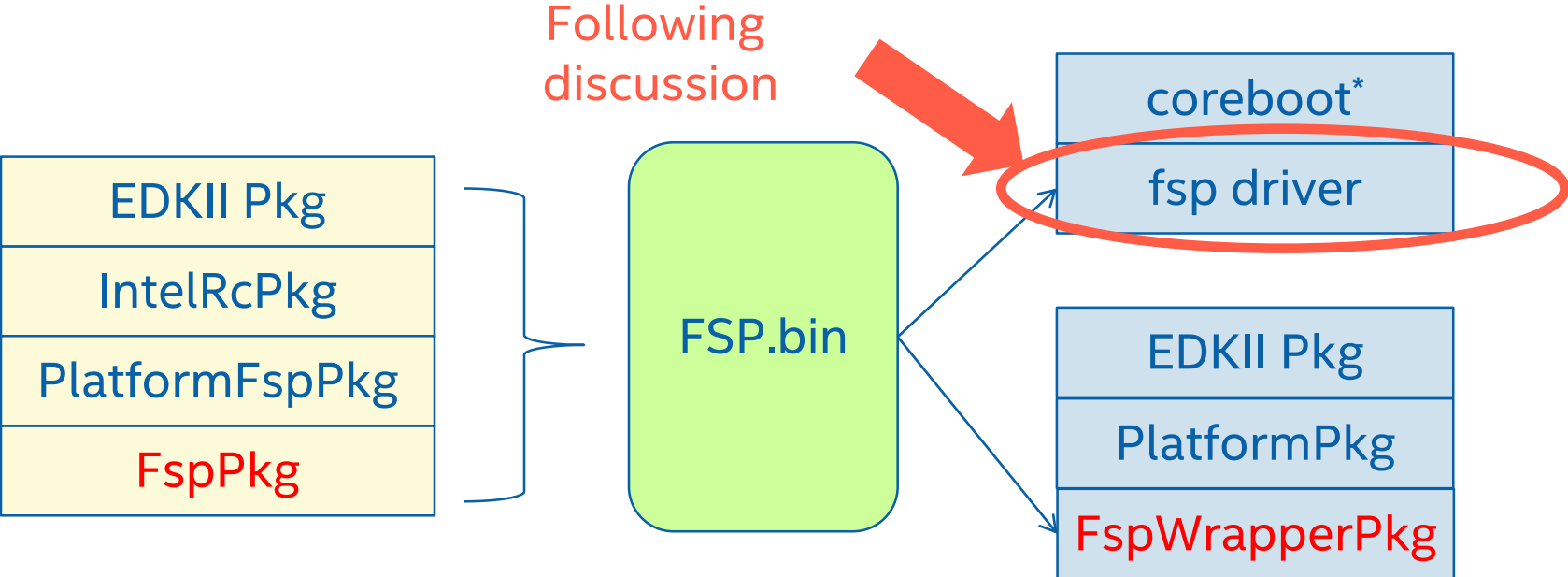
EDK II based Intel® FSP Consumer Flow



- Generic EDK II code, the *FSP Wrapper*
- <https://svn.code.sf.net/p/edk2/code/trunk/edk2/IntelFspWrapperPkg/>
- Allows for integration of Intel® Firmware Support Package binary into EDK II-based platform code
- Some sample platform code at <http://uefidk.com>



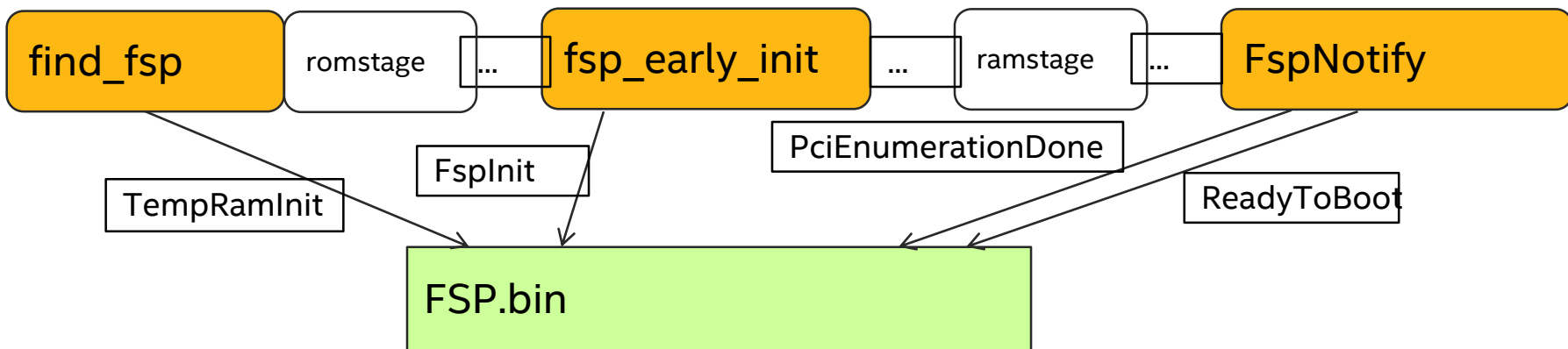
coreboot* based Intel® FSP Consumer Details



coreboot* Intel® FSP Consumer Code Details

coreboot* driver	Functionality
<code>find_fsp</code>	Function to find the FSP in memory
<code>fsp_early_init</code>	FSP memory and early device setup function. Called in romstage by the chipset driver
<code>romstage_fsp_rt_buffer_callback</code>	Callback from <code>fsp_early_init</code> for mainboard specific RT buffer customizations (soldered down memory timings, etc.)
<code>FspNotify</code>	There are two notify calls in ramstage. AfterPciEnumeration during device finalize and ReadyToBoot during chip finalize.
<code>save_mrc_data</code>	Called in romstage after <code>fsp_early_init</code> to save the memory configuration to CBMEM
<code>update_mrc_cache</code>	Moves the mrc data from CBMEM to NVRAM in late ramstage

coreboot* based Intel® FSP Consumer Flow



The EDK II and coreboot* open source ecosystems can CONSUME FSP's with the upstreamed FSP wrapper package & driver

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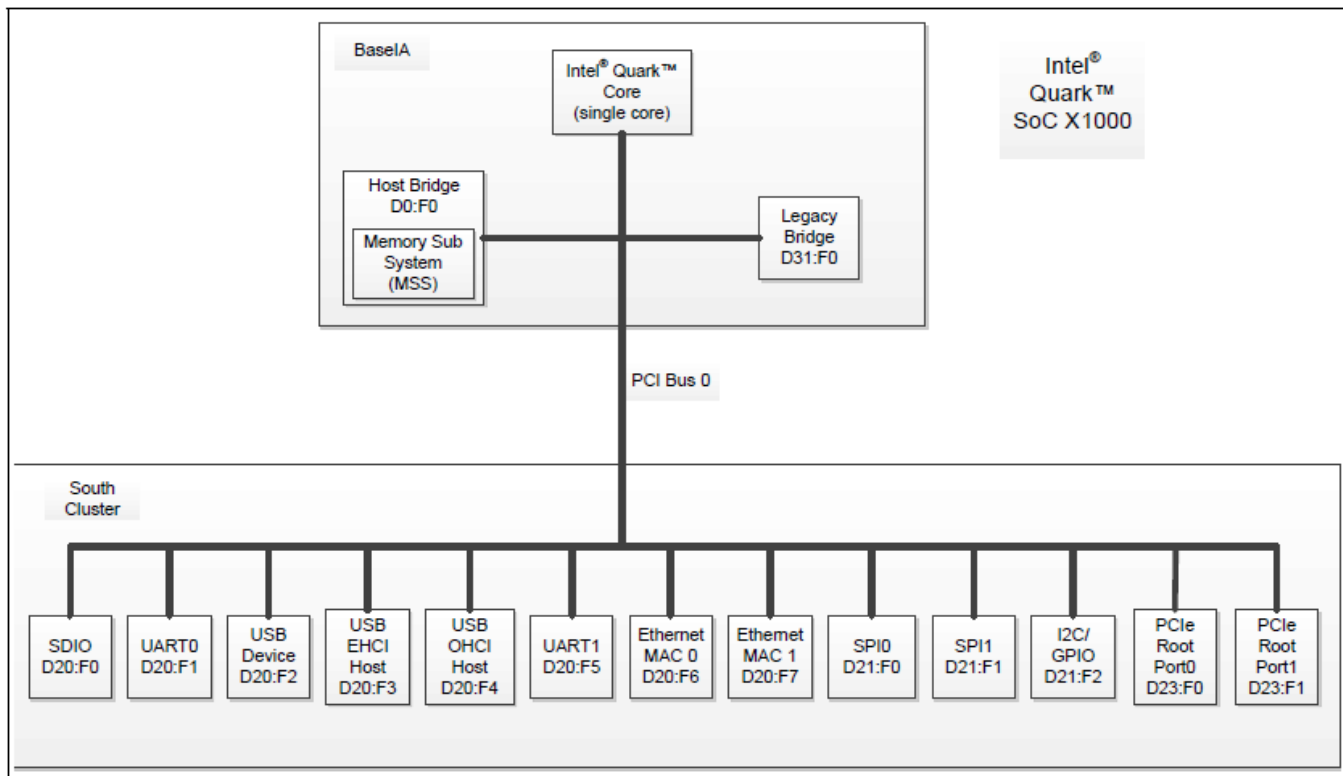
Many Paths for Enabling

- We're moving into a world where it is easier to work with Intel® platforms
- Open platforms, open source
- Intel® Unified Binary Management System (Intel® UBMS)
- Development kits, Reference boards
- There is also a full open source EDK II option
 - See full platform sources for Intel® Quark™ SoC, including a feature rich UEFI build



Intel® Quark™ SoC – Hardware Overview

- 32 bit Intel® Pentium® ISA-class processor
- PCI
- USB
- I2C
- Single core



UEFI for Intel® Quark™ SoC

- First fully open source Intel-based platform
- Builds on Intel® UDK2010 packages like MdePkg, MdeModulePkg w/ a 32-bit build, adding
 - IA32FamilyCpuBasePkg
 - QuarkPlatformPkg
 - QuarkSocPkg
- Standard build is 1 Mbyte image w/full features
 - Capsule update, SMM, S3, PCI, recovery, full UEFI OS support, FAT OS support, UEFI variables

UEFI for Intel® Quark™ SoC

- A modular firmware architecture like UEFI PI and code-base like EDK II allows for scaling the technology
- Fixed function UEFI OS load experiences can scale in size
- Introducing “TinyQuark” open source example
 - 64 kbyte to boot UEFI-aware Yocto* image from SPI NOR flash

Module	Size (K)	%
Generic	34	50%
Silicon	10	14%
Platform	24	36%

```
FU Space Information
EDKII_BOOT_STAGE1_IMAGE1 [99%Full] 65536 total, 65216 used, 320 free
```

Many paths for enabling, including full openness

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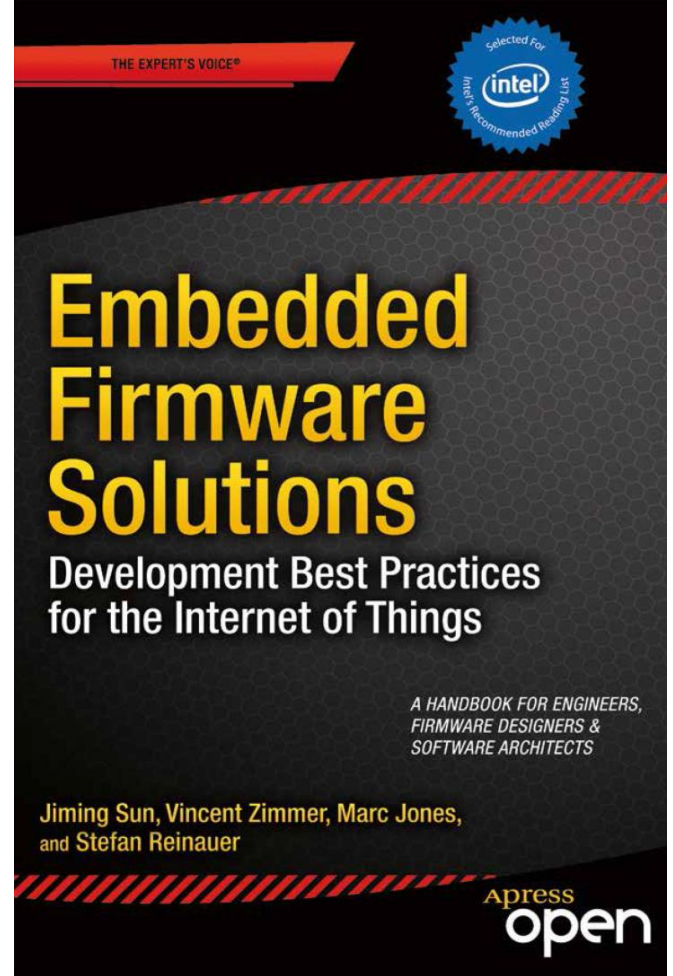
- Intel® Firmware Support Package (Intel® FSP) can encapsulate IP protected initialization code PRODUCED by Intel business units
- The EDK II and coreboot* open source Intel® Architecture (IA) firmware ecosystems can CONSUME FSP's with the upstreamed FSP wrapper package and driver code
- Beyond mixing binary FSP and source, a full open source EDK II experience is possible, as noted by the Intel Quark Firmware

Next Steps

- Start to examine the Intel® Firmware Support Package (Intel® FSP) collection at intel.com/fsp, support code at tianocore.org, and sample projects at uefidk.com
- Provide Intel feedback as Intel FSP 1.0 EAS evolves going forward for new platform topologies [FSP 1.0 External Architecture Specification \(EAS\)](#) and whitepaper at [FSP on EDKII Whitepaper](#)
- Build more platforms with open source platform packages on www.tianocore.org and www.coreboot.org
- Evaluate the first fully-featured platforms on uefidk.com, like Intel® Quark™ SoC <https://communities.intel.com/docs/DOC-22226> and Tiny Quark <https://uefidk.com/content/get-started-intel-galileo-development-board> and whitepaper at [TinyQuark Whitepaper](#)

Additional Sources of Information

- A PDF of this presentation is available from our Technical Session Catalog: www.intel.com/idfsessionsSF. This URL is also printed on the top of Session Agenda Pages in the Pocket Guide.
- More web based info:
www.tianocore.org
www.intel.com/fsp
www.uefidk.com
www.coreboot.org
- More on topics discussed in this presentation:
[see upcoming book](#)
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 - Software and services content
 - Tracking earned coins for the "Surf the Code" game and other prizes
 - Your own 3D avatar with 10 coins... Play the game, share with friends
- Visit the Software & Services Pavilion to earn more coins
 - Talk with Intel experts about your development needs and plans
 - Tinker on your own time with self-run labs, source code, tools
 - Swipe your wristband on the Galileo Scan Stations to get coins
- Play to Win in the Software & Services Pavilion
 - Get 5 coins to play "Surf the Code"... Gift cards for three highest scores!
 - Get 10 coins to get your 3D avatar... And enter daily drawing for tablets and 2-in-1s
 - Get 15 coins for your King Code t-shirt, and increase total game score potential



Don't let the fun stop!
Daily lunch at food trucks

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