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UEFI Porting Techniques on ARM SoCs

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Agenda

- Introduction
- Power-on Process
- Boot to OS
- Porting Guidelines
- Summary

Introduction

U-Boot vs UEFI

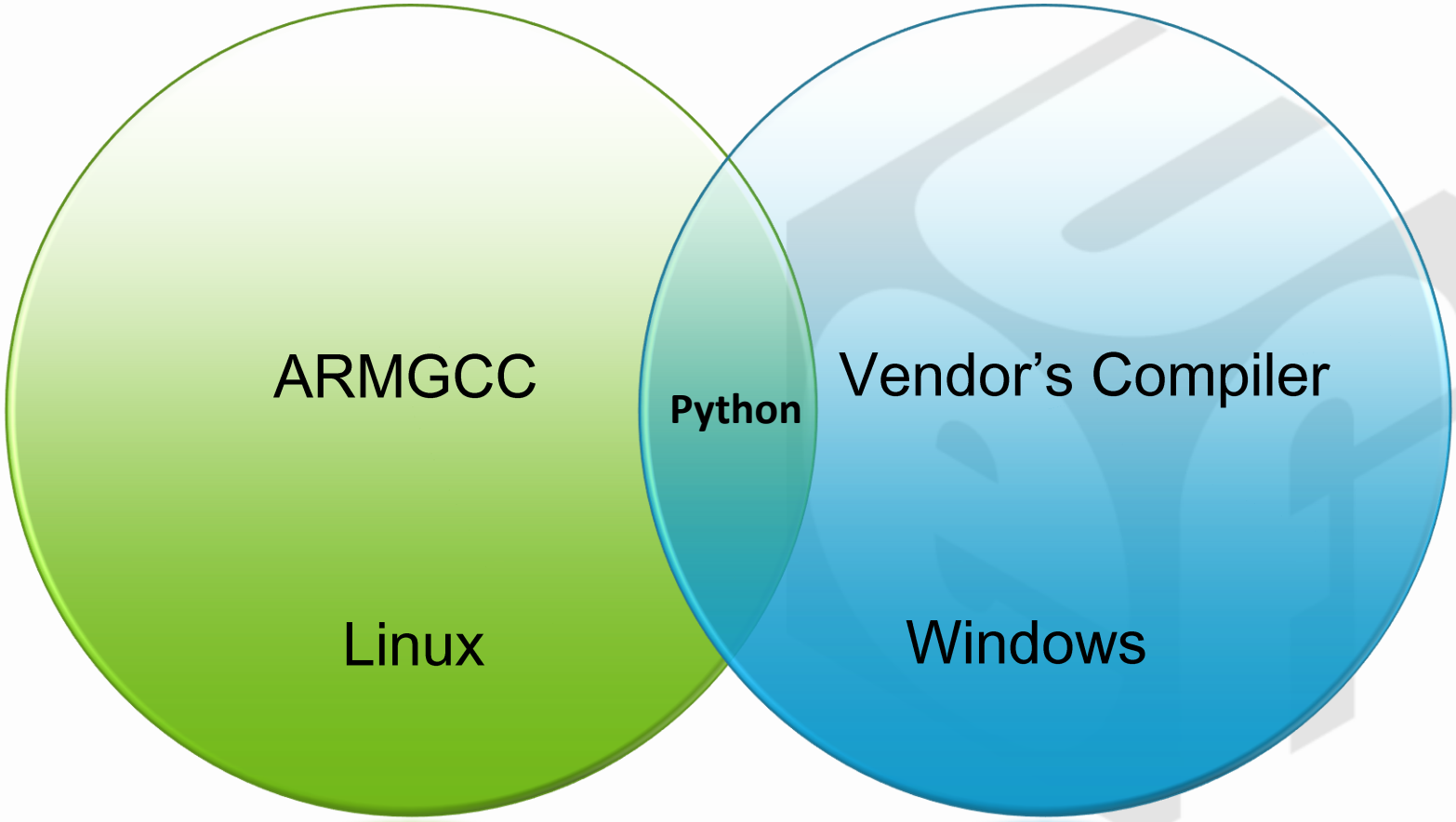
U-Boot

1. Performs platform initialization
2. Sets the boot arguments
3. Passes control to the kernel image

UEFI/Aptio

1. Contains U-Boot base features
2. Cross-platform build environment
3. Modular design
4. Compatible with existing x86 module

Build Environment Requirements



Supported Framework

- Code Name
  - CortexA8
  - CortexA9
  - CortexA15
  - …
- Instruction Set
  - Arm V7
  - Arm 9
  - …

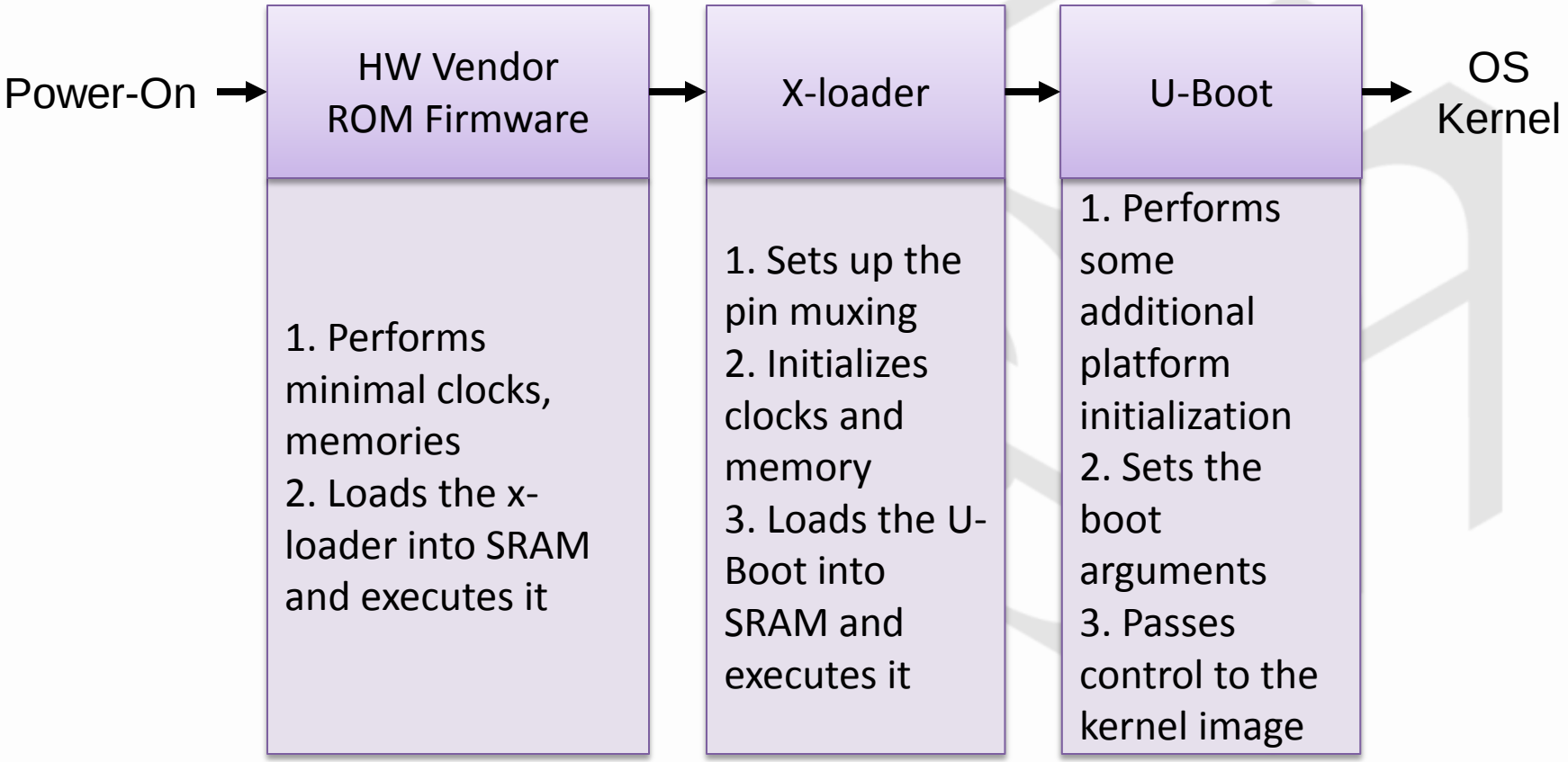
Power-on Process

Power-on Process

- There are two cases of booting UEFI on ARM:
  - UEFI as the final stage
    - Some vendor supplied firmware does initialization and then gives control to a process that provides a basic UEFI layer to provide UEFI boot.
  - UEFI from power-on
    - UEFI is the only firmware image does the entire boot process from the first instruction executed after power-on to the start of the operating system on your platform

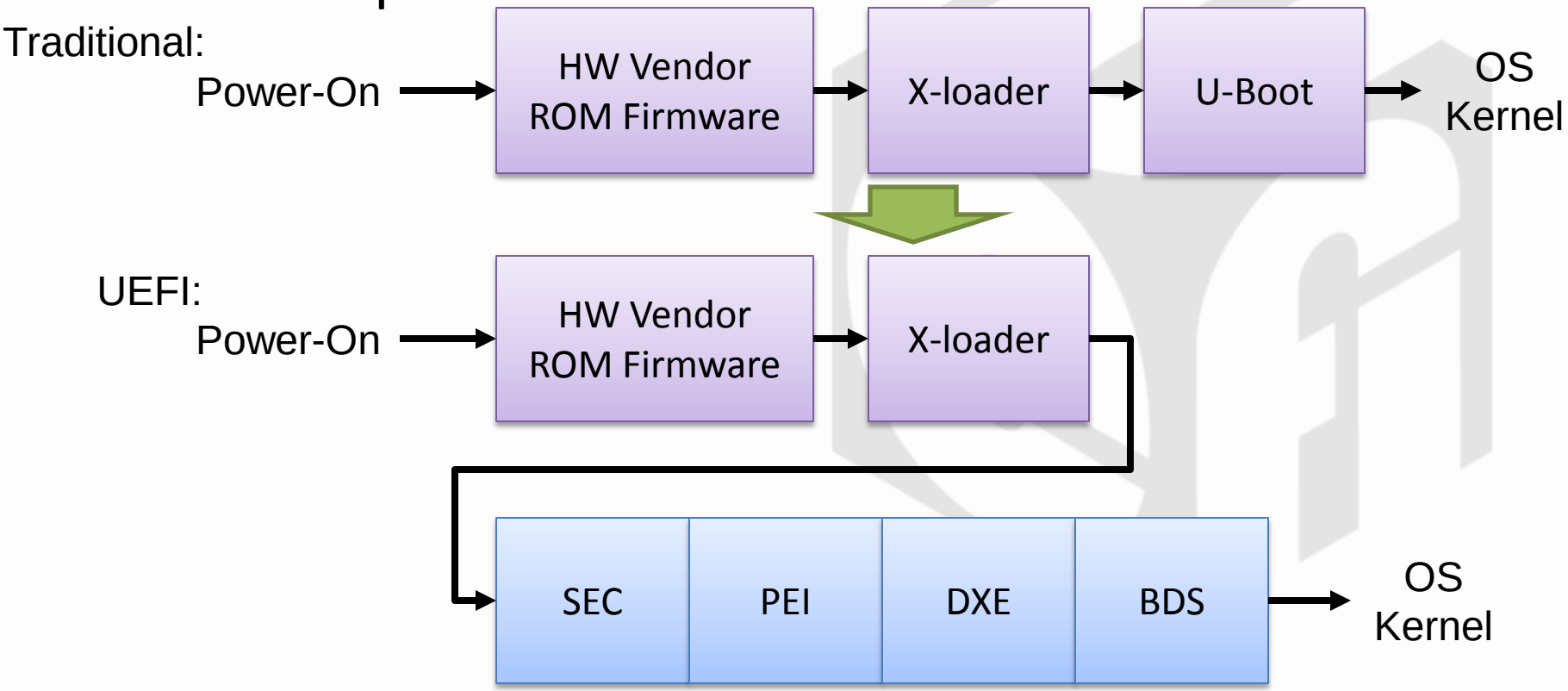
Power-on Process

- Example : TI OMAP Series



Power-on Process

- UEFI as the final stage power-on flow:
  - Example : TI OMAP Series

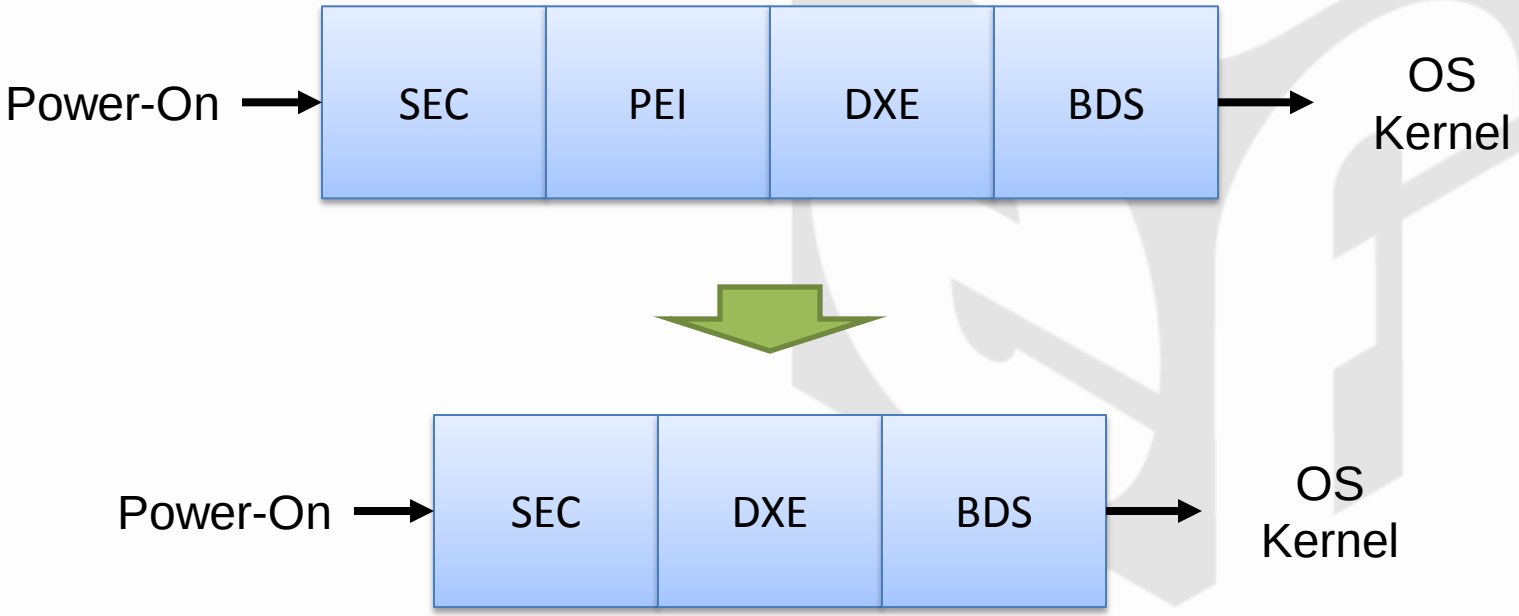


Power-on Process

- UEFI power-on flow:
  - Follows traditional UEFI boot sequence through SEC through BDS
    - for more info please visit the website. www.uefi.org
  - Does same initialization of the platform throughout the phases
    - Such as: clock, memory and cpu initialization

Simplified UEFI Boot

- Not all UEFI phases are essential:
  - PEI phase can be skipped altogether if DRAM initialization is done in the SEC phase



Boot to OS

Boot to OS

- Follow the UEFI Framework
  - Look for supported boot devices
    - There is a FAT32 partition with an EFI directory
    - Inside it there is the BOOT folder that contains a file BootArm.efi(UEFI Boot Loader)
    - You can obtain UEFI Boot Loader by your OS.
  - Load image into memory and executes it
    - Image is verified if the Secure Boot is enabled
  - Pass control to the UEFI Boot Loader
    - The loader does the rest of the OS boot process

Porting Guidelines

Porting Guidelines

- Follow the porting guide released by SoC vendor to do the SoC initialization.
  - Using the porting guide you can create the required UEFI libraries
  - Very similar to x86 porting
- If U-Boot is available, use it as a reference to create the UEFI drivers and interfaces

Follow the steps to set the chip

- Example : Trigger software cold reset
  - Source : TI porting guide

Physical Address	0x4A30 7B00	**Instance**	DEVICE_PRM
Description	Global software cold and warm reset control. This register is auto-cleared. Only write 1 is possible. A read returns 0 only.		
Type	RW		

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RESERVED																														RST_GLOBAL_COLD_software	RST_GLOBAL_WARM_software

Bits	Field Name	Description	Type	Reset
31:2	RESERVED		R	0x0000 0000
1	RST_GLOBAL_COLD_software	Global COLD software reset control. This bit is reset only upon a global cold source of reset. 0x0: Global COLD software reset is cleared. 0x1: Triggers a global COLD software reset. The software must ensure the SDRAM is properly put in sef-refresh mode before applying this reset.	RW	0
0	RST_GLOBAL_WARM_software	Global WARM software reset control. This bit is reset upon any global source of reset (warm and cold). 0x0: Global warm software reset is cleared. 0x1: Triggers a global warm software reset.	RW	0

Follow the steps to set the chip

- Example : Trigger software cold reset
  - Target : UEFI ResetSystem Library

```
EFI_STATUS
LibResetSystem (
   IN EFI_RESET_TYPE ResetType,
   IN EFI_STATUS ResetStatus,
   IN UINTN DataSize,
   IN CHAR16 *ResetData OPTIONAL
   )
{
        :
   MmioOr32 (PRM_RSTCTRL, BIT1);
        :
}
```

Porting Guidelines

- Use the U-boot code
  - Most ARM vendors provide U-Boot code that initializes the following components:
    - cpu, board, serial, dram…etc
  - Using this U-Boot code as a reference, you can develop UEFI code to use these peripherals

Debugging Tips for UEFI on ARM

- Example : Write Debug Messages to Serial
  - Source : U-Boot Serial Code

```
static void do_boot_linux ()
{
        :
    debug ("## Transferring control to Linux … \n");
        :
}
```

Debugging Tips for UEFI on ARM

- Example : Write Debug Messages to Serial
  - Target : UEFI Code

```
EFI_STATUS
SomeFunction (
   …
   )
{
        :
     DEBUG ((EFI_D_INFO, “This is a debug message\n”));
        :
}
```

- The serial debug messages for UEFI should be very familiar to x86 developers

Summary

Summary

- UEFI is a neutral boot firmware capable of booting both EFI and non-EFI compliant Operating Systems
  - Certain OSes like Windows already require UEFI for SecureBoot
- Porting on an ARM chipset is similar to porting an x86 platform
  - There are porting guides and reference code provided by the chip vendors
- ARM platforms can also use common debugging techniques like serial debug messages and JTAG debuggers
- UEFI also allows re-use of all features developed for x86 if it is hardware independent

Questions?

Thanks for attending the UEFI Spring PlugFest 2013

For more information on the Unified EFI Forum and UEFI Specifications, visit http://www.uefi.org

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