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Case Study: Alternatives for SMM Usage in Intel Platforms

Spring 2019 UEFI Plugfest
April 8-12, 2019
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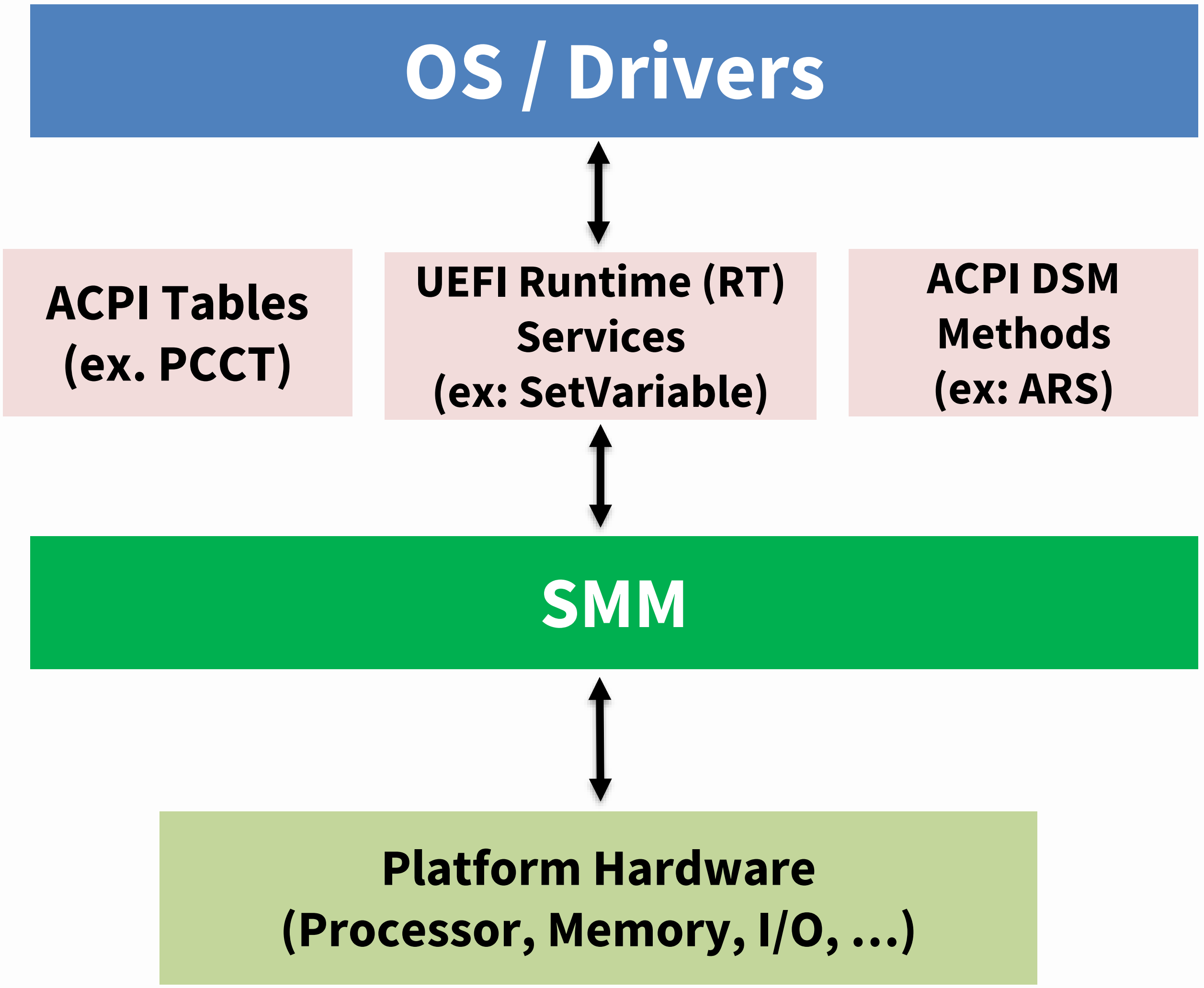
Agenda

- Problem Summary
- OS View of SMM
- Categories of SMM Handlers
- What about a Driver-based model
- Platform Runtime Mechanism
- Case Study: Using PRM for Correctable Error Handling
- Call to action

Problem Summary

- System Management Mode (SMM) issues to address
  - Degrades performance & quality of service (QoS)
    - SMM latency increases with core count
    - Firmware-based reliability of service (RAS) features
  - SMM model adds complexity to firmware
    - Multi-core asynchronous events, no concept of interrupt priority or reentrancy, race conditions, handler code, …
  - Security concerns due to higher SMM privilege level

OS View of SMM



OS / Drivers

ACPI Tables
(ex. PCCT)

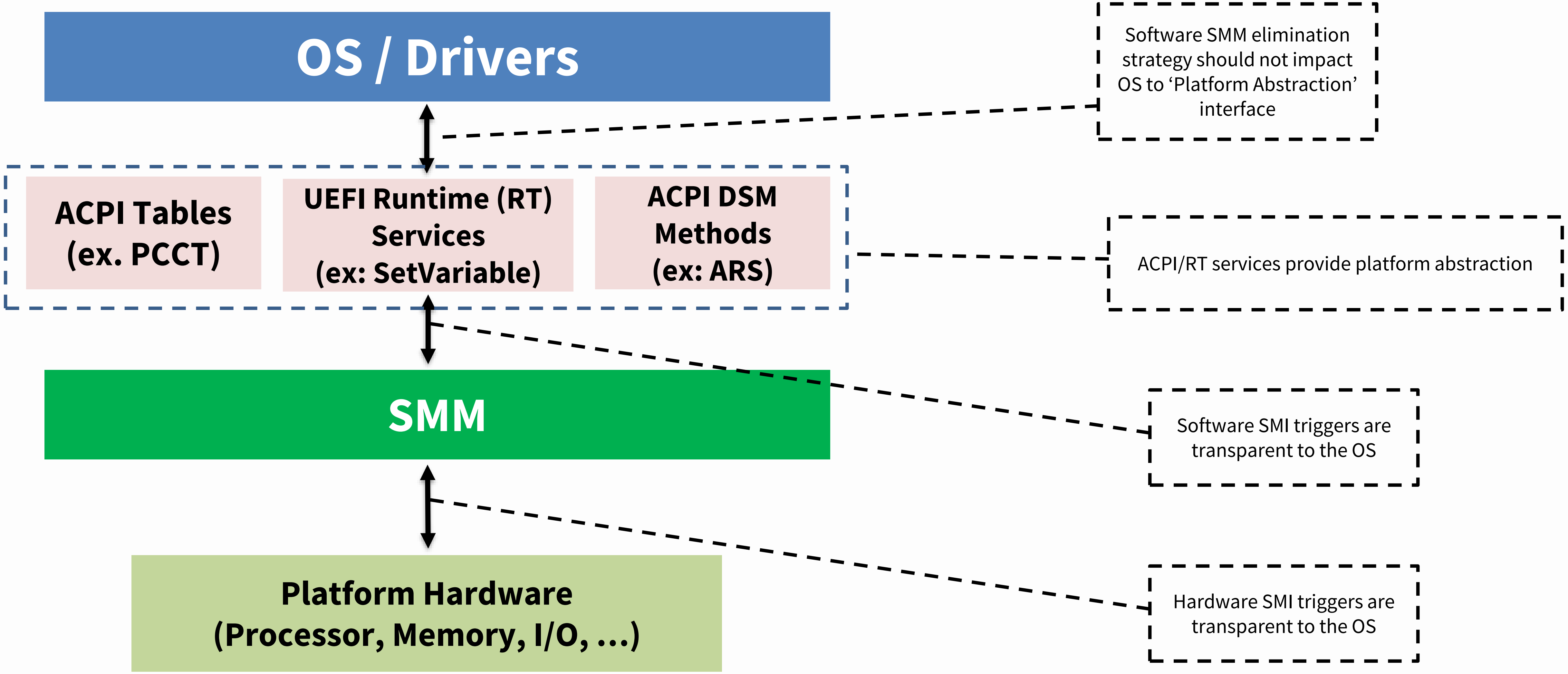
UEFI Runtime (RT)
Services
(ex: SetVariable)

ACPI DSM
Methods
(ex: ARS)

SMM

Platform Hardware
(Processor, Memory, I/O, …)

OS View of SMM


OS / Drivers
ACPI Tables (ex. PCCT)
UEFI Runtime (RT) Services (ex: SetVariable)
ACPI DSM Methods (ex: ARS)
SMM
Platform Hardware (Processor, Memory, I/O, …)

Software SMM elimination strategy should not impact OS to ‘Platform Abstraction’ interface

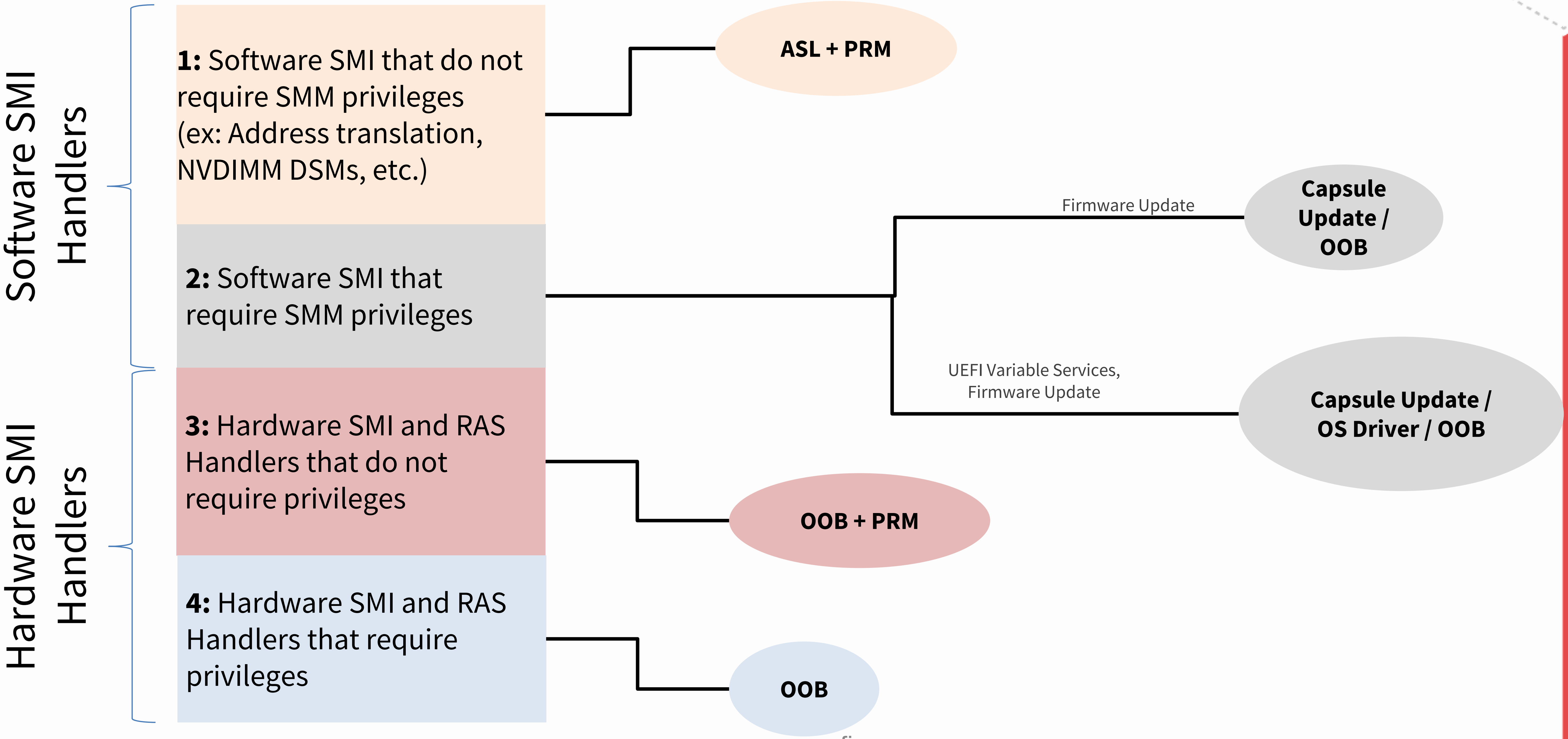
ACPI/RT services provide platform abstraction

Software SMI triggers are transparent to the OS

Hardware SMI triggers are transparent to the OS

Categories of SMM Handler

Current Model



Software SMI Handlers

1: Software SMI that do not require SMM privileges (ex: Address translation, NVDIMM DSMs, etc.)

2: Software SMI that require SMM privileges

Hardware SMI Handlers

3: Hardware SMI and RAS Handlers that do not require privileges

4: Hardware SMI and RAS Handlers that require privileges

ASL + PRM
Firmware Update
Capsule Update / OOB
UEFI Variable Services, Firmware Update
Capsule Update / OS Driver / OOB
OOB + PRM
OOB

What about a Driver-based Model?

- Do not want platform knowledge in OS driver
- Requires intimate platform/silicon knowledge (ex: Address Translation for RAS)
- Variance between platform implementation / generation

Examples of Driver-based Issues

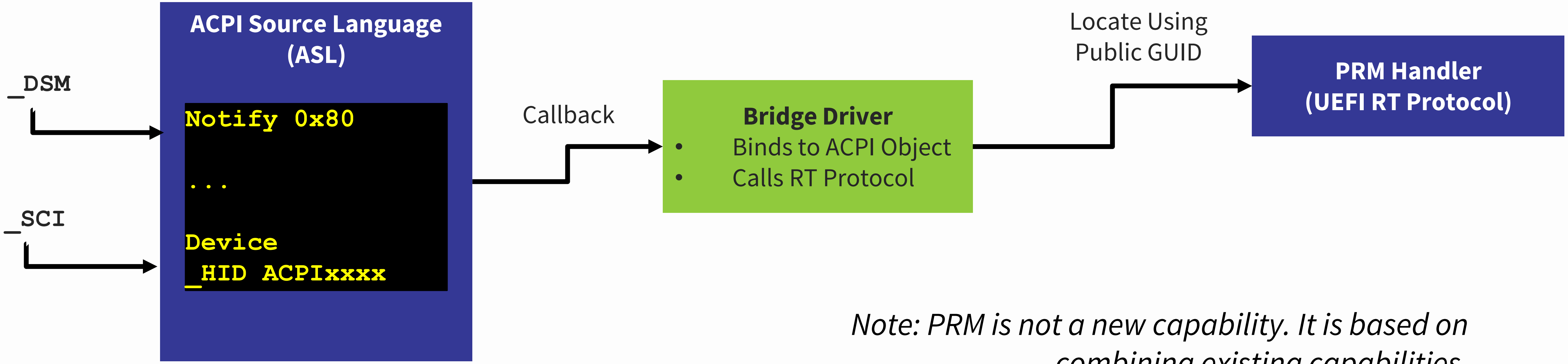
- PSHED Plug-in: Not a viable deployment model due to ACPI abstraction, which uses SMI for complex tasks.

- Address Translation: Originally pushed to EDAC drivers. OS vendors prefer ACPI to keep driver generic. ACPI relies SMM to handle complex algorithms.

- NVDIMM Drivers: Uses ACPI to keep NVDIMM drivers generic. Relies on ACPI (again) which (still) uses SMM to handle complex tasks (this is a trend).

Platform Runtime Mechanism (PRM)

- Mechanism to invoke native code from ACPI
- Uses ASL as a landing point for runtime events
- ASL will invoke PRM if required (“ASL Assist”)



_DSM

_SCI

ACPI Source Language (ASL)

```
Notify 0x80

...

Device
_HID ACPIxxxx
```

Callback

Bridge Driver

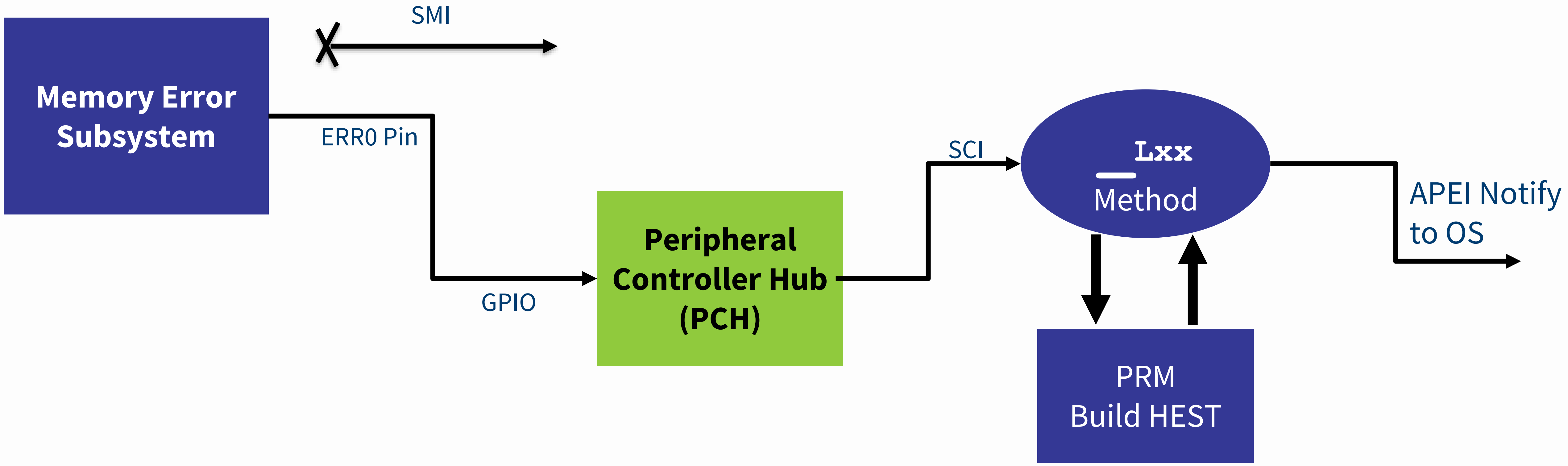
- Binds to ACPI Object
- Calls RT Protocol

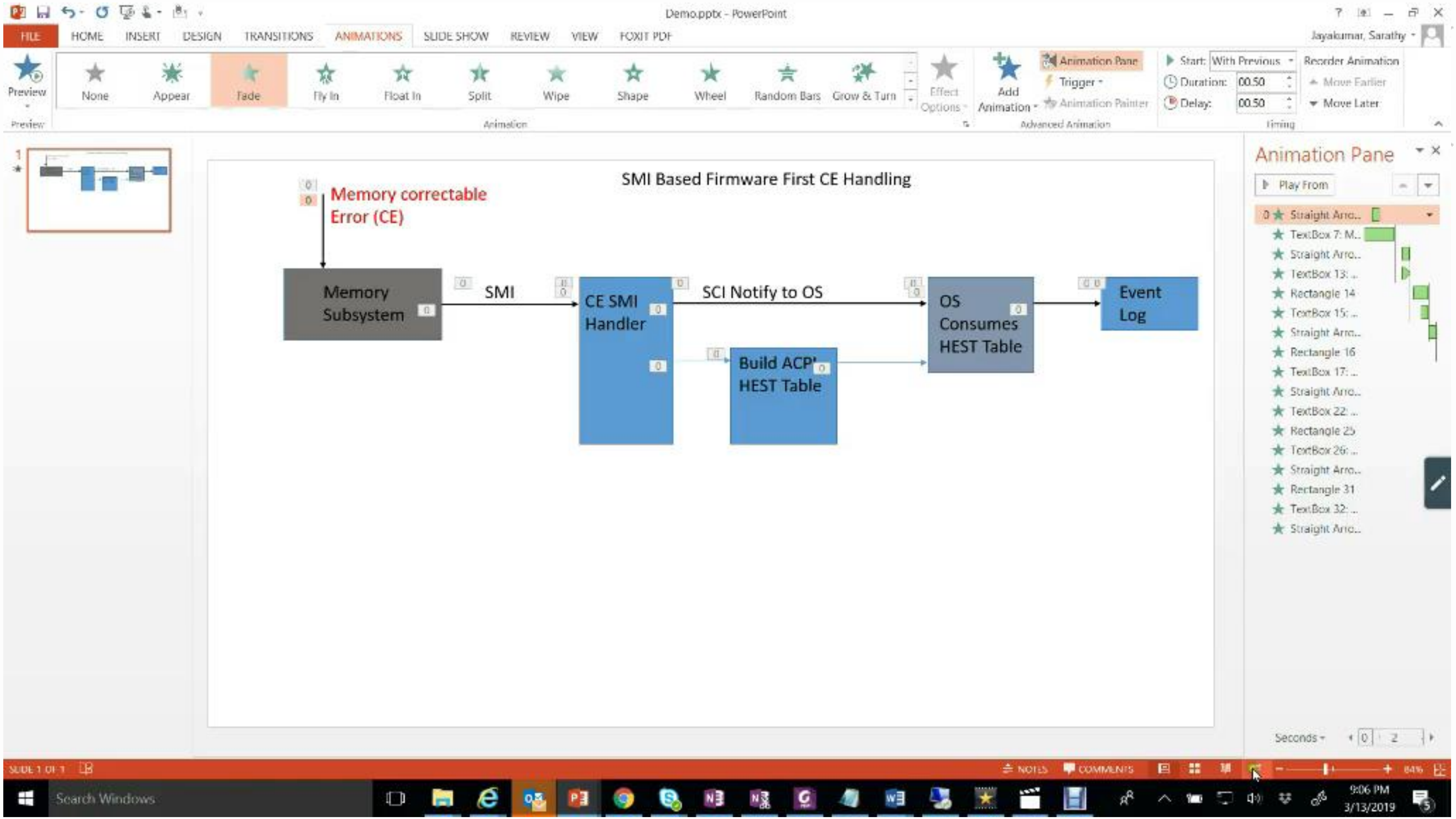
Locate Using Public GUID

PRM Handler (UEFI RT Protocol)

Note: PRM is not a new capability. It is based on combining existing capabilities.

Case Study: Using PRM for Correctable Error (CE) Handling





Demo.pptx - PowerPoint

SMI Based Firmware First CE Handling

Start: With Previous

Duration: 00.50

Delay: 00.50

Animation Pane

Call to Action

- Work together to accelerate SMM reduction.
- Move software SMM Handlers to PRM.

- Bridge driver and sample PRM handler available in GitHub:
- https://github.com/tianocore/edk2-staging/tree/PRMCaseStudy

- Please review & provide feedback!

Glossary

PCCT – Platform Communication Channel Table

DSM – Device Specific Methods

ARS – Address Range Scrubbing

OOB – Out Of Band

PRM – Platform Runtime Mechanism

PSHED – Platform Specific Hardware Error Driver

EDAC – Error Detection And Correction

SCI – System Configuration Interrupt

HEST – Hardware Error Sources Table

APEI – ACPI Platform Error Interfaces

*Other names and brands may be claimed as the property of others

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