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Case Study: Alternatives for SMM Usage in Intel Platforms

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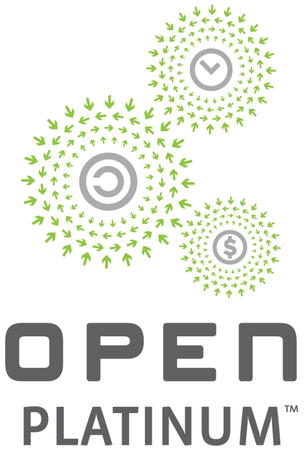

Problem Summary

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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

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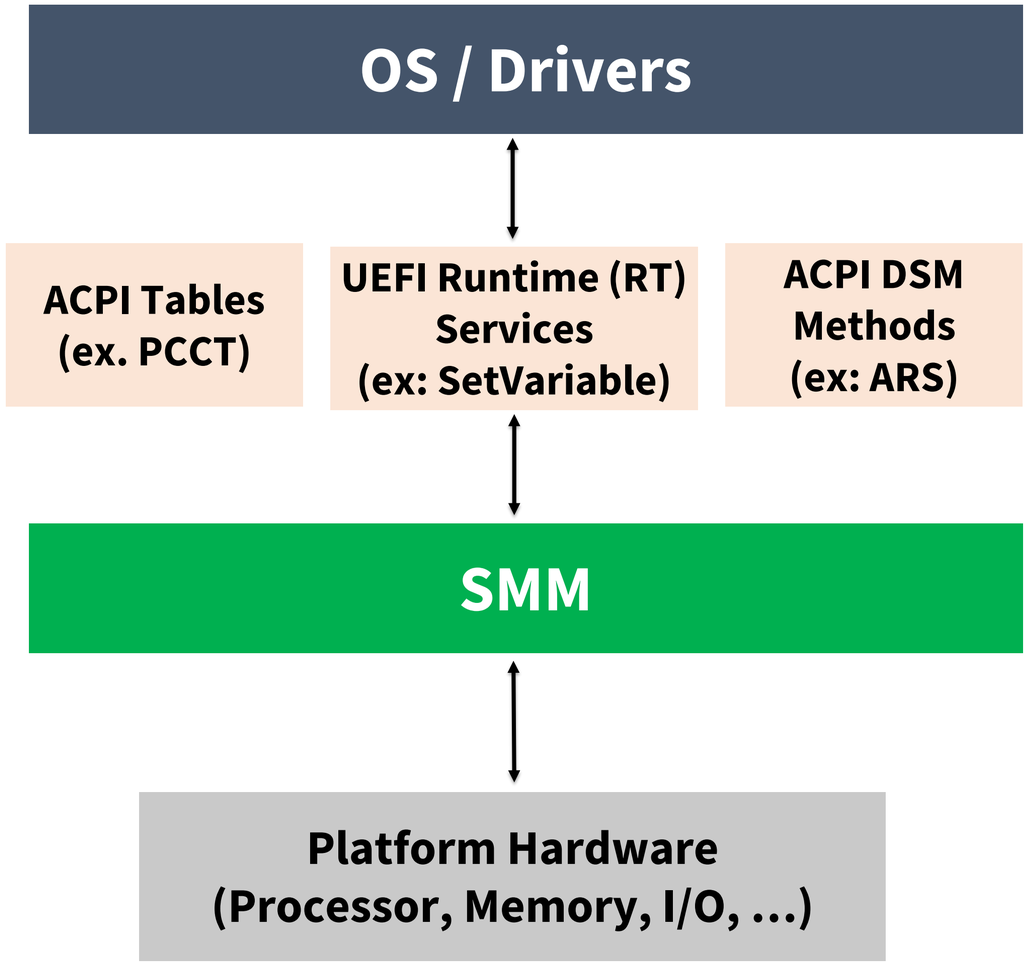
OS View of SMM



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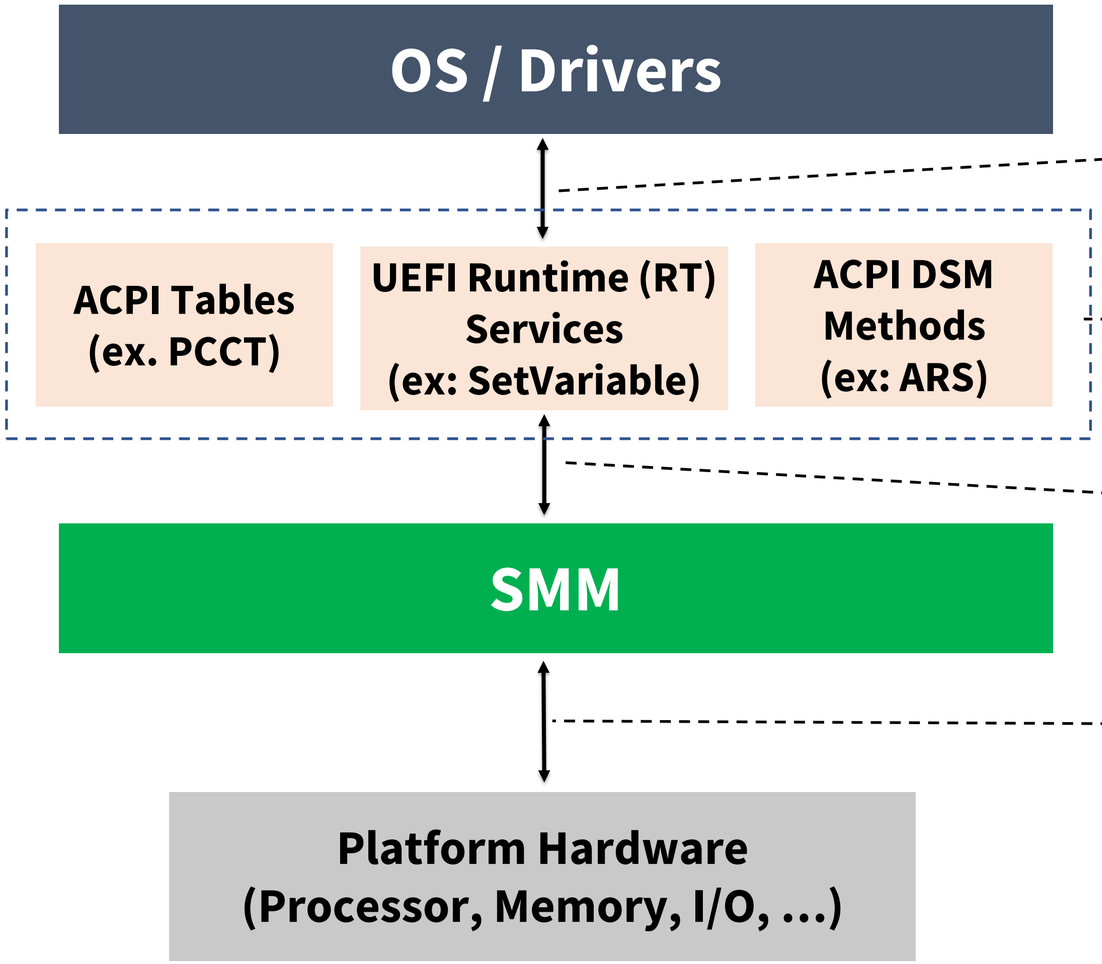
OS View of SMM



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

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Categories of SMM Handler

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Current Model

Software SMI Handlers

Hardware SMI Handlers

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

2: Software SMI that require SMM privileges

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

UEFI Variable Services, Firmware Update

Capsule Update + OS Driver

OOB + PRM

OOB

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What about a Driver-based Model?

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

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Examples of Driver-based Issues

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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).

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Platform Runtime Mechanism (PRM)

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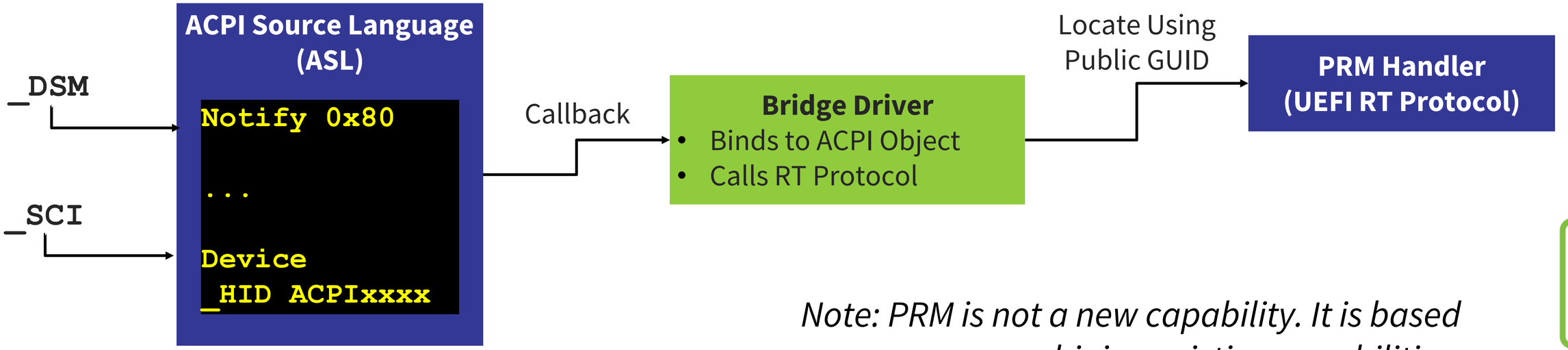
- Mechanism to invoke native code from ACPI
- Uses ASL as a landing point for runtime events
- ASL will invoke PRM if required (“ASL Assist”)



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

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

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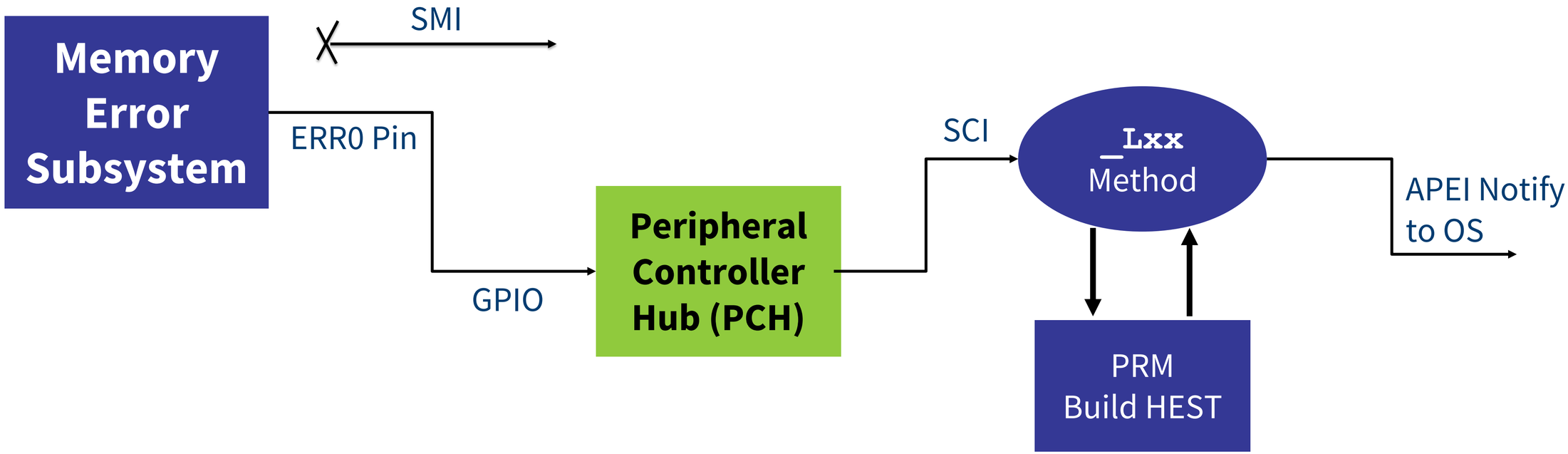
Handling correctable errors (Option 1)



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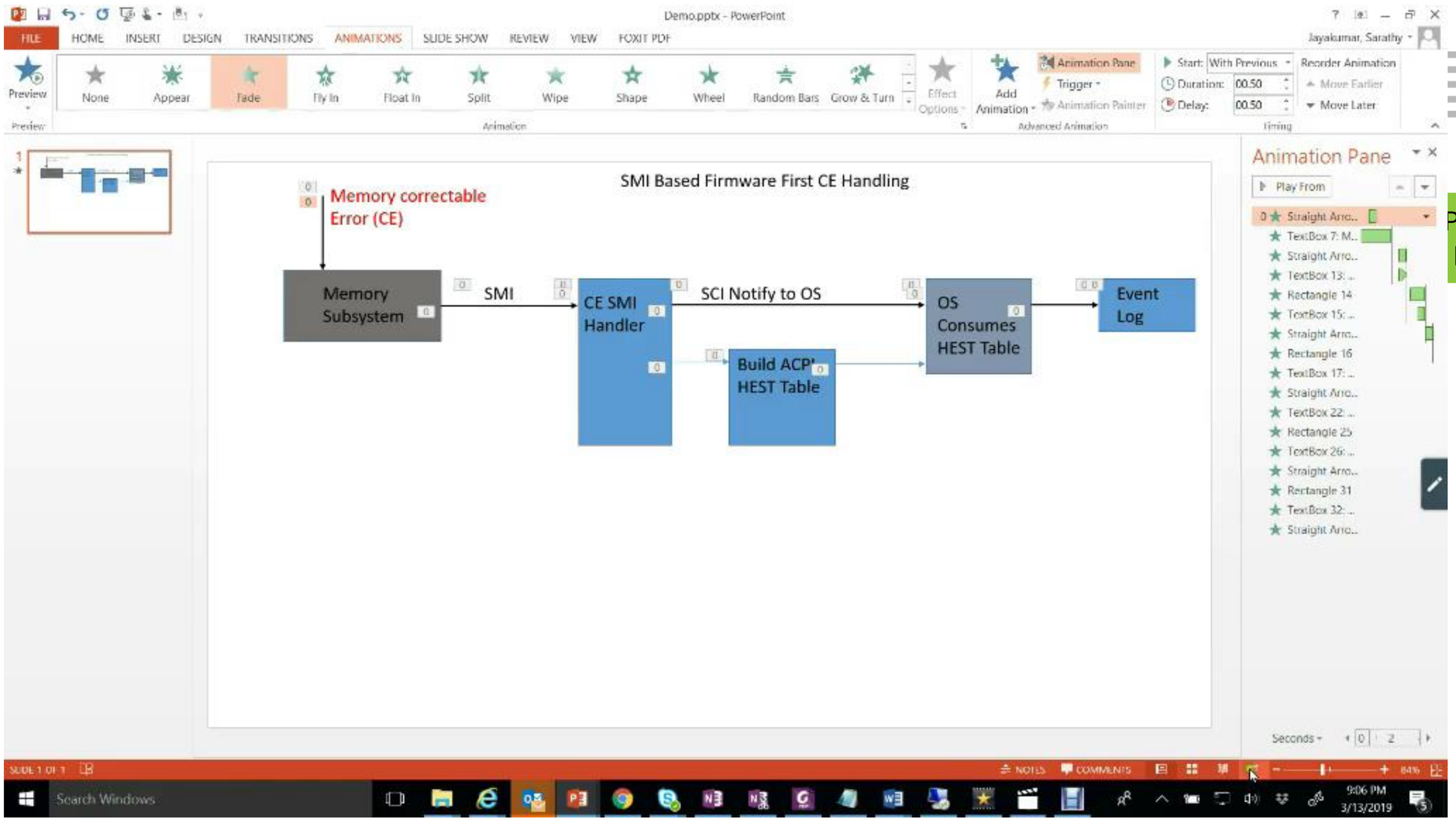

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Call to Action

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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!

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Glossary

PCCT – Platform Communication Channel Table
DSM – Device Specific Methods
ARS – Address Range Scrubbing
OOB – Out Of Band
PRM – Protected 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


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