SBSA Reference Platform in QEMU: status update

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SBSA Reference Platform?

Virtual machine in QEMU with only emulated components:

- AArch64 cpu (up to 512 cores)
- GIC version 3
- AHCI controller on system bus
- XHCI controller on system bus
- CD-ROM and hard disc on AHCI bus
- E1000e Ethernet card on PCIe bus
- Bochs display adapter on PCIe bus
- A generic SBSA watchdog device

FOSS firmware

We use two firmware components:

- Trusted Firmware
- Tianocore EDK2

Operating system gets EFI services and ACPI tables.

What we did in 2023/24 (hardware)

- Moved to Neoverse-N1 (v8.2) as default cpu core
- Enabled use of Neoverse-V1 (v8.4) and Neoverse-N2 (v9.0) cpu cores
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- Added GIC ITS support (allows for complex PCIe setup)
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- Moved from legacy VGA card to Bochs display card on PCIe bus
- Moved from EHCI (usb 2.0) to XHCI (usb 3) controller
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- Added non-secure EL2 virtual timer

What we did in 2023/24 (firmware)

- Made use of platform versioning
- Added Secure Monitor Calls (SMC) between firmware components
  - This allowed us to drop DeviceTree support from EDK2
- Merged handling of QEMU targets (virt, sbsa-ref) in TF-A
- Same set of cpu features enabled for both targets
  - Some components are board specific
- Enabled support for all cpu cores emulated by QEMU and their features
- Enabled NVME support

Platform versioning?

- Simple way of checking which virtual hardware version we have
- Not linked to QEMU version or SBSA specification
- Currently at 0.3
- Reasons for changing value
  - Firmware information changes
  - Virtual hardware changes
- Used in firmware to handle hardware changes
  - EHCI -> XHCI change in 0.3
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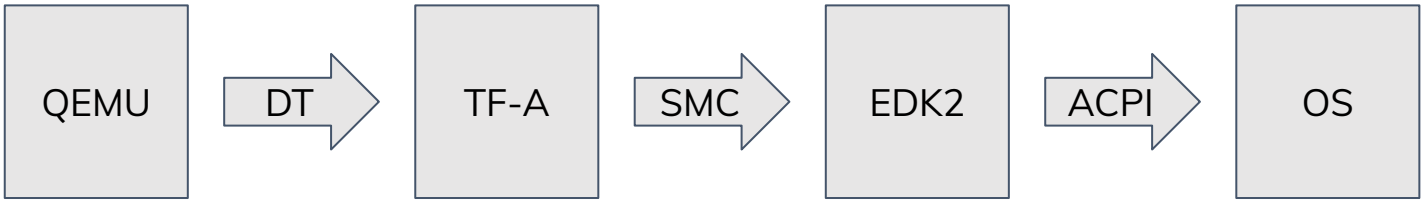
Hardware -> Firmware -> OS interface



DeviceTree or ACPI?

- QEMU gives us hardware information in minimalistic DeviceTree
- TF-A parses DT and provides information via SMC
- EDK2 uses data from SMC and provides ACPI tables
- OS uses data from ACPI

SystemReady SR compliance

BSA ACS:

- 54 / 82 tests
- 73 / 82 tests when PCI Express card is added behind pcie-root-port

SBSA ACS:

- 5 / 6 for level 3
- 10 / 12 for level 4

No failures in both testsuites, skipped tests instead.

Future plans

- Multiple PCI Express buses on NUMA system
- CXL support
- TPM support (so far no OS requires it)
- System Control Processor emulation

Questions?

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Thank you