Running ACS on Arm's Neoverse Reference Design Platforms

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Contents

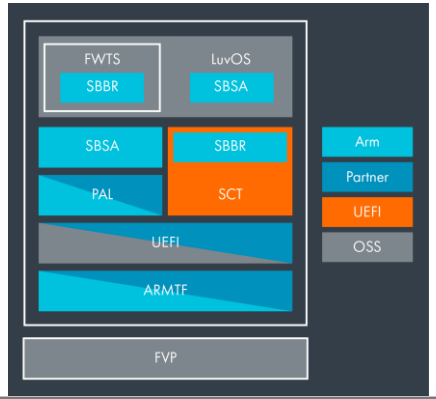
- What is ServerReady & why is it required?
- Overview of ACS, SBSA & SBBR test suites.
- Getting ACS test suite.
- Running ACS SBSA & SBBR test suites on Neoverse Reference Design.

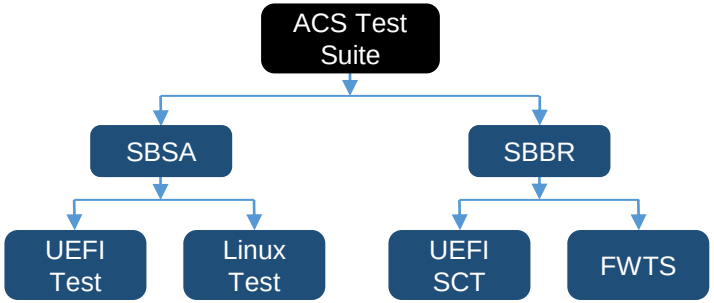
Introduction to ServerReady

- Compliance program, put around standard approach to ARM server.
- Provides a solution for servers that “just works”.
- Has a set of requirement for hardware & firmware.
  - Server Base System Architecture (SBSA): Defines hardware requirements.
  - Server Base Boot Requirements (SBBR): Defines firmware requirements.
- Certifies a platform is good to run with standard OS.

Architectural Compliance Suite (ACS)

- Arm have the ServerReady specification, and this spec have a set of requirements.
- ACS is a set of tests around each one of these requirement.
- Objective is to provide a seamless out of the box experience with booting standard OS.





- ServerReady requirement can be classified as:
  - Hardware requirement
  - Firmware requirement
- Covered in ACS with:
  - SBSA tests
  - SBBR tests

Server Base System Architecture (SBSA)

- SBSA v6 specification: https://developer.arm.com/documentation/den0029/latest?_ga=2.2681840.1567254736.1582536887-1048184626.1580228297
- Define hardware requirement
- Classify hardware into different level.
  - Level 3 – Level 6
- Tests for
  - CPU properties
  - System Components (GIC, IOMMU, WatchDog & Timers)
  - PCIe Integration
- UEFI shell SBSA tests
- OS SBSA tests

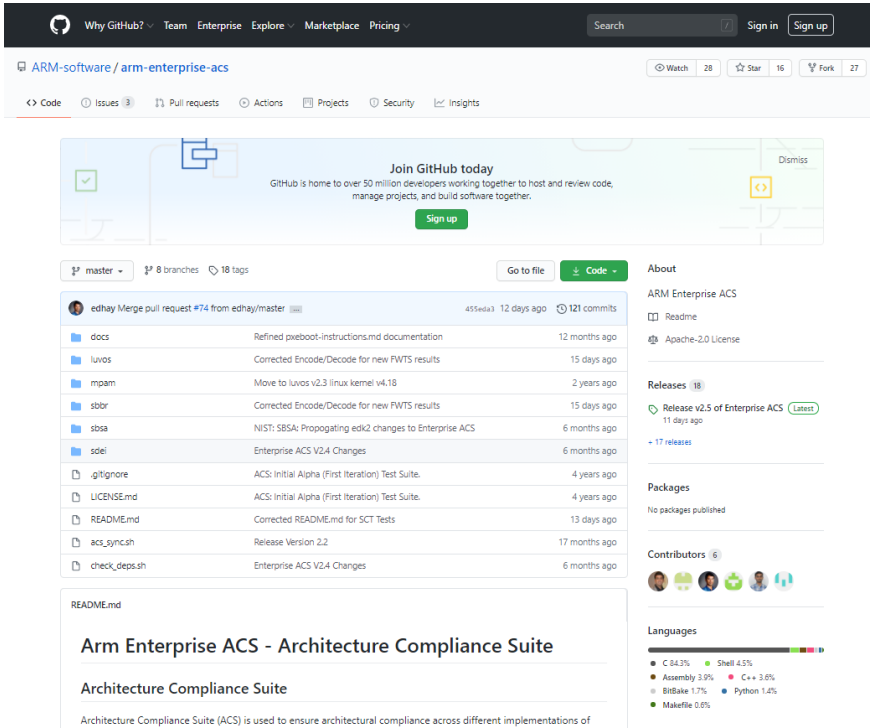
SBSA Level	PE 'A' profile	SMMU	GIC
3	v8.0	v2/v3	v3.0
4	v8.3	v3.0	v3.0
5	v8.4	v3.2	v3.0
6	v8.5	v3.2	v3.0

Server Base Boot Requirements (SBBR)

- SBBR v1.2 specification: https://developer.arm.com/documentation/den0044/latest?_ga=2.259187914.1567254736.1582536887-1048184626.1580228297
- Define firmware requirements
- Tests for
  - UEFI (UEFI SCT)
  - ACPI (FWTS)
  - SMBIOS (FWTS)
- UEFI shell SBBR test / UEFI-SCT (Self Certification Test)
- OS SBBR test / FWTS (Firmware Test Suite)

Getting ACS Test Suite

- Hosted in GitHub and are open source (Apachev2).
  https://github.com/ARM-software/arm-enterprise-acs
- Sync the code using ‘acs_sync.sh’
- Build the suite from source by running ‘luvos/scripts/build.sh’ to generate LUV disk image.
  https://github.com/ARM-software/arm-enterprise-acs#acs-build-steps



ACS Disk Format

- ACS test suite build generate LUV disk image ‘luv-live-image-gpt.img’
- Two Partitions
  - First Partition - for storing test logs
  - Second Partition - contains bootable & test binaries
- Boot the device with ACS disk visible to UEFI BDS stage

```
Disk luv-live-image-gpt.img: 272 MiB, 285212672 bytes, 557056 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 4A13C35F-F8EB-4AF5-BC12-2D225E770A37

Device                     Start    End Sectors  Size Type
luv-live-image-gpt.img1     2048 264191  262144  128M Microsoft basic data
luv-live-image-gpt.img2   264192 555007  290816  142M Microsoft basic data
```

luv-live-image-gpt.img disk format

Running SBBR

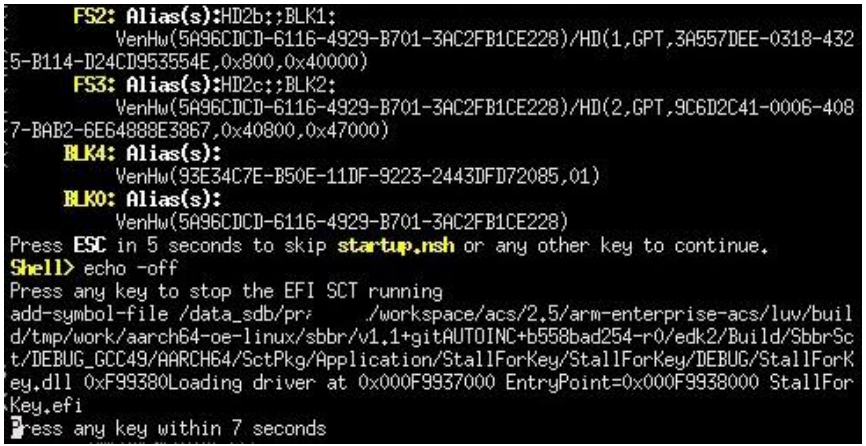
UEFI-SCT (built on top of UEFI-SCT Framework)

- Boot the system
- Choose ‘sbbr/sbsa’ from GRUB.
- UEFI startup script launch SCT test automatically.
- To run manually from UEFI shell:
  1. After GRUB, Press ‘Esc’ to get UEFI shell
  2. Run ‘InstallAARCH64.efi’, Install SCT to FS2
     ```
     FS3:\EFI\BOOT\sbbr> InstallAARCH64.efi
     ```
  3. Run UEFI-SCT test:
     ```
     FS2:\SCT> SCT.efi -a -v
     ```

Running FWTS tests

- Boot the system
- Form GRUB choose ‘luv’
- FWTS tests and OS context SBSA tests are run automatically on LuvOS.

Running UEFI-SCT (Automatically on Boot)



- Pressing any key will skip SCT test & continue with remaining ACS test cases

Running UEFI-SCT (Manually from UEFI Shell)

1

2

```
Press ESC in 5 seconds to skip startup.nsh or any other key to continue.
Shell> fs3:
FS3:\> cd EFI\BOOT\sbbr
FS3:\EFI\BOOT\sbbr\> ls
Directory of: FS3:\EFI\BOOT\sbbr\
09/01/2020  06:17 <DIR>          4,096  .
09/01/2020  06:17 <DIR>          4,096  ..
09/01/2020  06:17               53,248  InstallAARCH64.efi
09/01/2020  06:17                1,423  sbbr.nsh
09/01/2020  06:17                  818  SbbrSctStartup.nsh
09/01/2020  06:17 <DIR>          4,096  AARCH64
09/01/2020  06:17                1,505  SctStartup.nsh
          4 File(s)     56,994 bytes
          3 Dir(s)
FS3:\EFI\BOOT\sbbr\> InstallAARCH64.efi
```

3

```
        MemoryMapped(0xB,0xE0000000,0xE01FFFFF)
    FS0: Alias(s):F0:
        Fv(89CC2AB6-B847-475F-93E2-819603C3D15A)
    FS4: Alias(s):F3::BLK3:
        VenHw(93E34C7E-B50E-11DF-9223-2443DFD72085,00)
    FS2: Alias(s):HD2b::BLK1:
        VenHw(5A96CDCD-6116-4929-B701-3AC2FB1CE228)/HD(1,GPT,3A557DEE-0318-4325-B114-D24CD953554E,0x800,0x40000)
    FS3: Alias(s):HD2c::BLK2:
        VenHw(5A96CDCD-6116-4929-B701-3AC2FB1CE228)/HD(2,GPT,9C6D2C41-0006-4087-BAB2-6E64888E3867,0x40800,0x47000)
   BLK4: Alias(s):
        VenHw(93E34C7E-B50E-11DF-9223-2443DFD72085,01)
   BLK0: Alias(s):
        VenHw(5A96CDCD-6116-4929-B701-3AC2FB1CE228)
Error: Image at 000F79A0000 start failed: Not Found
remove-symbol-file /work/git/edk2/Build/Shell/RELEASE_GCC5/AARCH64/ShellPkg/Application/Shell/Shell/DEBUG/Shell.dll 0xF79A0240
  1: FS1: (Free Space: 0 MB)
  2: FS2: (Free Space: 123 MB)
  3: FS3: (Free Space: 2 MB)
  4: FS4: (Free Space: 63 MB)
  Space Required: 100 MB
Input index of destination FS, 'q' to exit:2
```

4

```
FS3:\EFI\BOOT\sbbr\> fs2:
FS2:\> cd SCT
FS2:\SCT\> SCT.efi -a -v
```

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Running FWTS


```
   Welcome to Linux UEFI Validation Distribution 2.3

   Running tests...
cat: /sys/class/dmi/id/product_uuid: No such file or directory
Running tests...
Running efivarfs-test ...
[    4.340000] [-] INFO
Running fwts ...
[    4.410000] [-] Arm
Running kernel-efi-warnings ...
[    5.630000] [-] kernel-efi-warnings
[    5.640000]  [+] EFI_illegal_accesses_test... passed
[    5.640000]  [+] !!!Kernel_FW_BUG... 1 failures
[    5.660000]  [+] !!Kernel_FW_WARN... 1 failures
[    5.670000]  [+] Kernel_FW_INFO... passed
[    5.680000]  [+] Kernel_MEM_ATTR_TYPE... passed
[    5.690000]  [+] Kernel_MEM_ATTR_ATTR... passed
[    5.700000]  [+] Kernel_MEM_ATTR_ALGN... passed
[    5.710000]  [+] Kernel_MEM_ATTR_OVLP... passed
[    5.710000]  [+] Kernel_MEM_ATTR_TYMA... passed
[    5.720000]  [+] Kernel_MEM_ATTR_MISS... passed
[    5.730000]  [+] Kernel_MCE... skipped
```

Running SBSA

UEFI Test

- Choose ‘sbbr/sbsa’ from GRUB.
- UEFI startup script launch tests automatically.
- Run manually from UEFI shell:
  1. After GRUB, Press ‘Esc’ to get UEFI shell
  2. Run ‘sbsa.nsh’, to start the test and to save result from console.
     ```
     FS2:>FS3:\EFI\BOOT\sbsa\sbsa.nsh
     ```
  3. Applicable only for first time when the image is executed to install the SCT tests.
  4. To run test just with console logs (not save in file), run the ‘Sbsa.efi’.
     ```
     FS3:\EFI\BOOT\sbsa\> Sbsa.efi
     ```

Linux Test

- Choose ‘sbbr/sbsa’ from GRUB.
- Boot Linux and run ‘sbsa’ from commandline once boot is complete.

Running SBSA UEFI test (Automatically on boot)


```
Press ESC in 5 seconds to skip startup.nsh or any other key to continue.
Shell> echo -off
Press any key to stop the EFI SCT running
add-symbol-file /data_sdb/pr    ''./workspace/acs/2.5/arm-enterprise-acs/luv/buil
d/tmp/work/aarch64-oe-linux/sbbr/v1.1+gitAUTOINC+b558bad254-r0/edk2/Build/SbbrSc
t/DEBUG_GCC49/AARCH64/SctPkg/Application/StallForKey/StallForKey/DEBUG/StallForK
ey.dll 0xF99180Loading driver at 0x000F9917000 EntryPoint=0x000F9918000 StallFor
Key.efi
remove-symbol-file /data_sdb/pr     ./workspace/acs/2.5/arm-enterprise-acs/luv/b
uild/tmp/work/aarch64-oe-linux/sbbr/v1.1+gitAUTOINC+b558bad254-r0/edk2/Build/Sbb
rSct/DEBUG_GCC49/AARCH64/SctPkg/Application/StallForKey/StallForKey/DEBUG/StallF
orKey.dll 0xF99add-symbol-file /data_sdb/pramad01/workspace/acs/2.5/arm-enterpri
se-acs/luv/build/tmp/work/aarch64-oe-linux/sbsa/1.0+gitAUTOINC+d6c2198725-r0/edk
2/Build/Shell/DEBUG_GCC49/AARCH64/AppPkg/Applications/sbsa-acs/uefi_app/SbsaAvsN
Loading driver at 0x000F78FD000 EntryPoint=0x000F78FE000 Sbsa.efi


 SBSA Architecture Compliance Suite
    Version 2.5

 Starting tests for level  4 (Print level is  3)
```

Running SBSA UEFI test (Manually from UEFI Shell)


```
Press ESC in 5 seconds to skip startup.nsh or any other key to continue.
Shell> fs2:
FS2:\> FS3:EFI\BOOT\sbsa\sbsa.nsh
FS2:\> echo -off
add-symbol-file /data_sdb/pr   ../workspace/acs/2.5/arm-enterprise-acs/luv/buil
d/tmp/work/aarch64-oe-linux/sbsa/1.0+gitAUTOINC+d6c2198725-r0/edk2/Build/Shell/D
EBUG_GCC49/AARCH64/AppPkg/Applications/sbsa-acs/uefi_app/SbsaAvsNist/DEBUG/Sbsa.
Loading driver at 0x000F78FD000 EntryPoint=0x000F78FE000 Sbsa.efi


 SBSA Architecture Compliance Suite
    Version 2.5

 Starting tests for level  4 (Print level is  3)
```

Run the test with console logs, and save the same into log file

Run the test only with console logs

```
Shell> fs3:
FS3:\> cd EFI\BOOT\sbsa
FS3:\EFI\BOOT\sbsa\> Sbsa.efi
```

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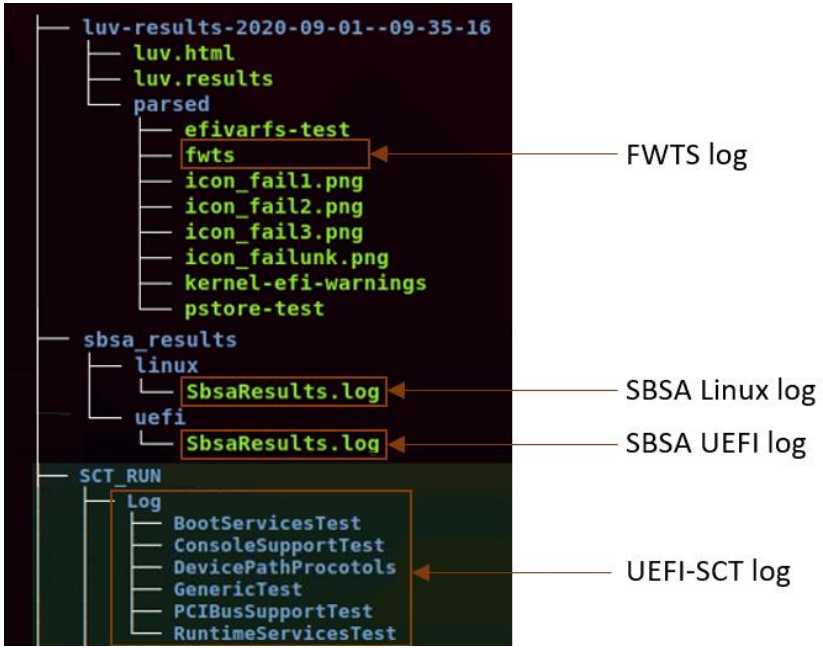
Analyzing Result

- Physical platform: Results available at first partition of USB
- FVP: Mount the ‘luv-live-image-gpt.img1’ to get results

Results:

1. SBSA: https://git.linaro.org/landing-teams/working/arm/arm-reference-platforms.git/tree/docs/rdn1edge/acs-results/rdn1edge-sbsa.log
2. FWTS: https://git.linaro.org/landing-teams/working/arm/arm-reference-platforms.git/tree/docs/rdn1edge/acs-results/rdn1edge-fwts.log



Debugging ACS Errors

SBSA

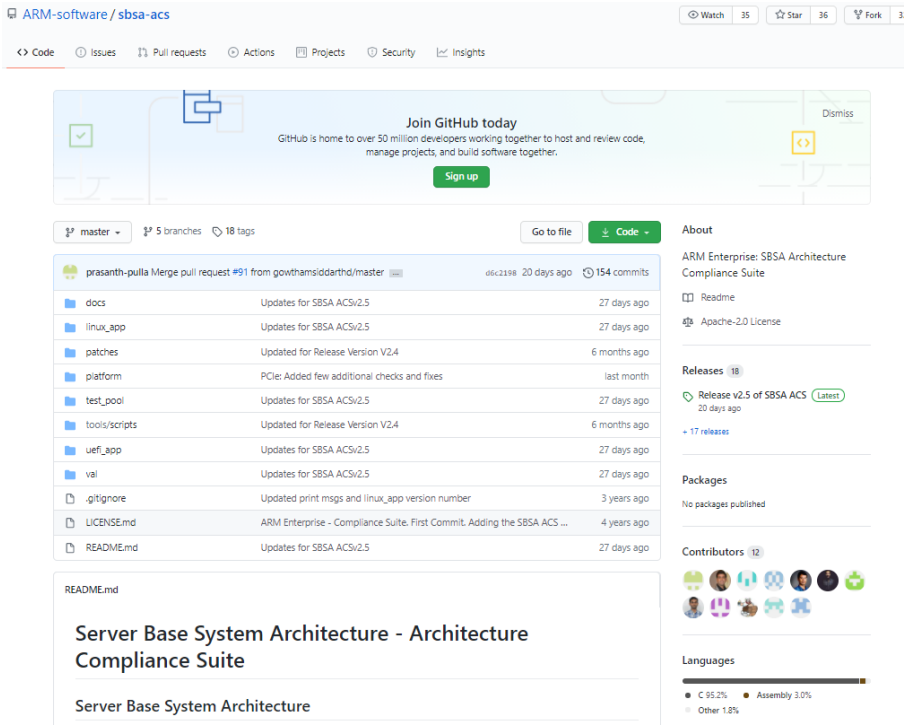
- Figure out Failed/Skipped test cases.
- For UEFI, tests are present in:
  `/path/to/arm-enterprise-acs/luv/build/tmp/work/aarch64-oe-linux/sbsa/1.0+gitAUTOINC+<commit-id>-r0/git/test_pool/`
  - Test 201 : Check Counter Frequency
    `test_pool/timer_wd/test_t001.c`
  - Test 442 : Check Power Management rules
    `test_pool/pcie/test_p042.c`
  - Start from '`payload()`' in '`test_*.c`' to analyze the test case.
- For Linux:
  `meta-luv/recipes-utils/sbsa-acs-app/sbsa-acs-app/`

SBBR

- Figure out Failed/Skipped test cases.
- For SCT:
  `build/tmp/work/aarch64-oe-linux/sbbr/v1.1+gitAUTOINC+b558bad254-r0/git/`
- For FWTS:
  `build/tmp/work/qemuarm64-oe-linux/fwts/V18.02.00+gitAUTOINC+<commit-id>-r0/git/fwts-test/`

Running Custom SBSA Binary

- Clone https://github.com/ARM-software/sbsa-acs to local edk2 source code.
- Compile the Sbsa efi application. Refer here for steps to integrating the app into UEFI build: https://github.com/ARM-software/sbsa-acs#acs-build-steps---uefi-shell-application
- Copy the SBSA efi binary to a disk image.
- Boot the device with this disk accessible to UEFI.
- Run the 'Sbsa.efi' from this disk partition.
- Get test result from console log.



Thank you

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