

2nd System-on-Chip Workshop

7-11 June, CERN

Closing Remarks

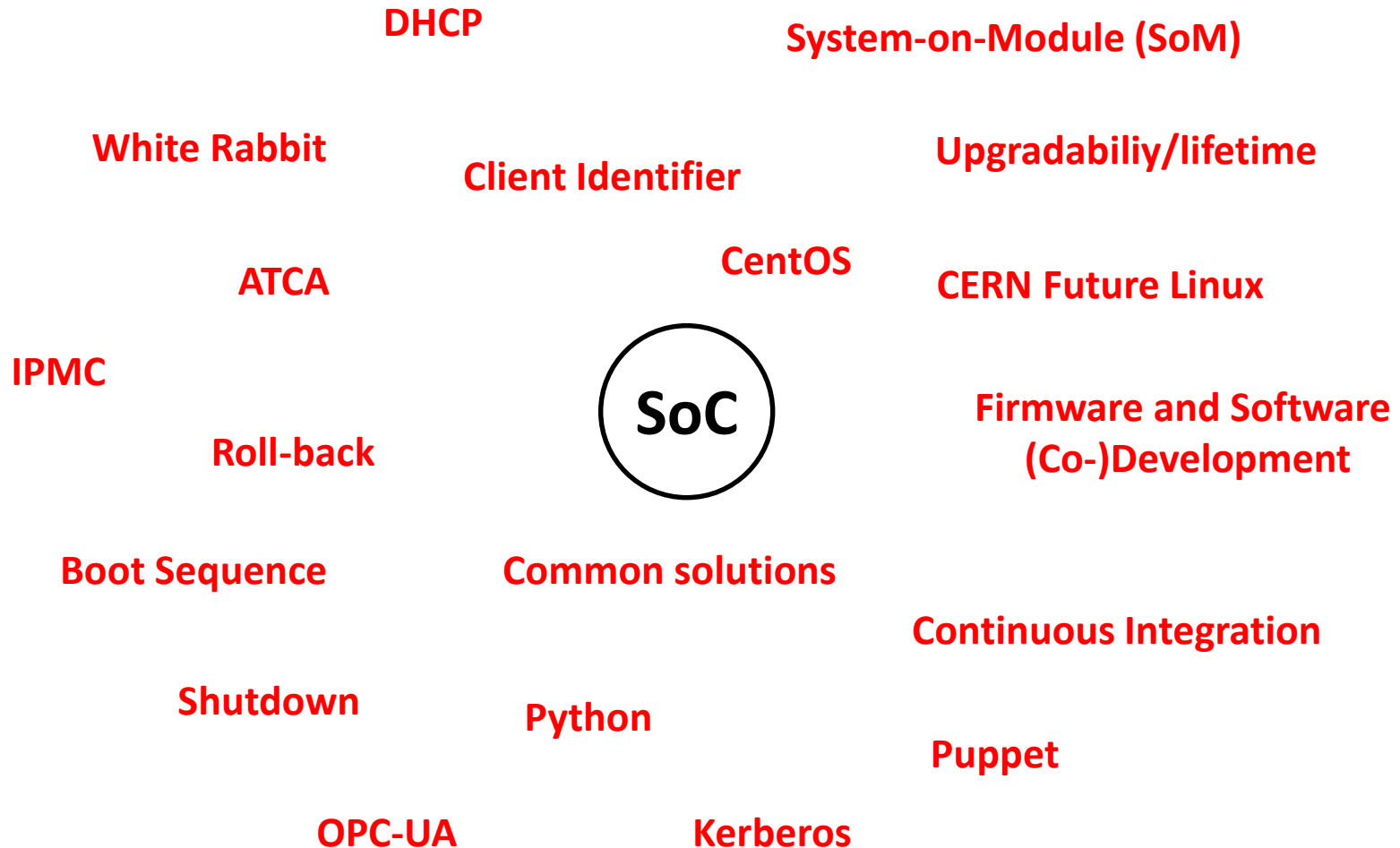
Summary - Workshop

2nd Workshop on System-on-Chip:

Across LHC experiments, Accelerator&Technology Sector, and Radioprotection

- 125 registrations
- Meeting fully virtual: zoom + mattermost
- Usually 40..70 participants connected to any session, with peaks at 90
- 6 vendor presentations:
Avnet/Silica: Xilinx and MicroChip, Intel/Altera, Enclustra, Trenz, Nalu Scientific ... *special thanks!*
- 3 overview talks: ATLAS, CMS, Accelerator&Technology Sector
- 14 presentations of different uses of SoC:
CMS, ATLAS, and Radiation Protection
- 3 tutorials/demos: CI/CD for firmware, reliable booting, CI for software
- 4 presentations on system-oriented aspects + discussion

Key Words (Selection)



Summary – Use of SoC

A lot of interest in System-on-Chips:

Across experiments, accelerators, and radiation protection

Wide range of uses: interactive access, hardware/slow control, run/operational control, trigger, readout, monitoring, etc.

SoCs are very powerful, flexible devices with a lot of potential

A prediction for ATLAS and CMS foresees about 1500 SoCs in phase 2 each

System aspects:

- **How to organise SoCs into manageable systems?**
- **How to provide secure connection to the technical control network?**
- **How to provide long-term maintenance and support?**

⇒ *“Overcoming the challenges will most likely rely on commonality across systems.”*

Summary - Hardware

On the hardware side:

- **Actually all systems are using the same hardware families:**
Xilinx Zynq7000 and Zynq Ultrascale+ MPSoC
⇒ Support for 32-bit OS in case of Zynq7000?
- **Many (all?) systems are moving towards a System-on-Module in order to overcome the problem of hardware obsolescence.**
- **There are a number of different SoM being used:**
Avnet, Enclustra, Trenz, Custom SoM, Xilinx Kria, ...

Summary – Software (1)

On the software side:

- **Operating system:**

- There was a large agreement to use CentOS across many projects
- This agreement has been challenged by the change of strategy by CentOS: CentOS 7 support ends JUN-2024, CentOS 8 support ends DEC-2021, and is replaced by CS8 (CentOS Stream 8), which is supported until AUG-2024
- Support for aarch64 is available from CERN-IT for CS8.
- Linux Future Committee was set up at CERN to follow up. Necessity of support for ARM is recognised.
- What about the kernel?

- **User application software:**

- Better understanding of eco system: cross, native, qemu, ...
use depends on build environment: petalinux, Yocto, CMake with toolchain, etc.
- Generally: there could be more exchange of software between the projects, but software is often tied into an experiment/project-specific framework ...
- Plans for fallback solution, if SoC software becomes unmaintainable in the long-term, e.g. ATLAS SoC-DAQI

Summary – Software (2)

For system administration:

- **Network:**

- Organisation: number of SoCs, architecture of network, naming scheme shelf/board/SoC, etc. ⇒ *proposals for CMS & ATLAS are being put together*
- Could imply communication SoC – IPMC: Client Identifier for “geographic” information; DHCP to work with Client Identifier ⇒ *a mechanism is available*

- **Booting:**

- Strategy to boot as little as possible from local SoC resources, and as much as possible from network in order to maximise flexibility, e.g. all SoC can have same FSBL and U-Boot, all specific images are loaded from network ⇒ many elements available
- Reliable booting sequence with fall-back solution, i.e. fail-safe remote control of large system ⇒ a scheme was presented during tutorial session

⇒ *Many elements in hand, need to put them together to build a framework for centrally managed and maintained, security-certified SoCs in the experiments*

Outlook

How to continue from here:

- Interest group: system-on-chip@cern.ch, [SystemOnChip \(Mattermost\)](#)
 - Continue with regular meetings:
<https://indico.cern.ch/category/11883>
 - Use twiki page to exchange information/documents:
<https://twiki.cern.ch/twiki/bin/view/SystemOnChip/WebHome>
 - Use gitlab for sharing software:
<https://gitlab.cern.ch/soc>
- SoC organising committee, SoC-Workshop-Organisers@cern.ch :
 - Follow up with CERN-IT on Linux
 - Follow up with CMS&ATLAS SysAdmin on system aspects
 - Anything else we can do to facilitate sharing, e.g. common test environments, common software?
- Next SoC workshop in 1 to 2 years from now?

Thanks

- **To all presenters for the presentations and tutorials!**
- **To the conveners, in particular, to Wainer for convening the last session, and to the minute takers.**
- **To CERN-IT for support of Indico and Zoom, in particular J. Cassar, J. Coloigner, H. Ilhan, A. Monnich ...**
- **To all of you for the interesting discussions!**

Have a good weekend!