OpenAMP Project update
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Agenda

- What is the OpenAMP Project?
- Overall OpenAMP Project update
- OpenAMP-remoteproc working group update
- System Device Tree working group update
- Application Services working group update
- OpenAMP in industry
- How to get involved
- Related Linaro Virtual Connect talks
- Q/A
Acronyms

- AMP: Asymmetric Multi-Processing
- API: Application Programming Interface
- APU: Application Processor Unit
- EL: Execution Level
- FPGA: Field-Programmable Gate Array
- FuSa: Functional Safety
- HCI: Host Controller Interface
- IPC: Inter-Processor Communication
- LAVA: Linaro Automation & Validation Architecture
- MPSoc: Multi-Processing System-on-Chip
- OE: Operating Environment
- OS: Operating System
- PMU: Platform Management Unit
- RPU: Real-Time Processor Unit
- RTOS: Real-Time Operating System
- SEL: Secure Execution Level
- SoC: System-on-Chip
- TEE: Trusted Execution Environment
- TSC: Technical Steering Committee
- TZ: TrustZone
- WG: Working Group
What is the OpenAMP Project?

• What are we trying to solve?
What is the OpenAMP Project?

- Announced at Linaro Connect SAN19
- Vision:
  The OpenAMP Project seeks to standardize the interactions between operating environments in a heterogeneous embedded system through open source solutions for Asymmetric Multi-Processing.
- Structure:
  - Board
  - Technical Steering Committee
  - Working groups
    - OpenAMP-remoteproc working group
    - System Device Tree working group
    - Application Services working group
    - Future: Hypervisor Interfaces working group
Overall OpenAMP Project update

- 10 member companies
- 3 active working groups
- 2x/year release schedule
- Maintainers officially appointed
- Formalizing Governance
  - Roles of Board, TSC, Working groups
  - Issue tracking via GitHub Issues
  - GitHub pull requests for code contributions
  - Coding style chosen
OpenAMP-remoteproc working group update

- Works on original (pre-Linaro Community Project) parts of OpenAMP
  - Lifecycle & messaging: Remoteproc, RPMsg, Virtio, libmetal
  - 2 code bases: Library side, kernel side
- Repositories
- Active work
  - Addressing backlog of pull requests
  - Improving testing through integration with LAVA Continuous Integration
  - Big buffers
  - Submitting outstanding patches to linux-remoteproc mailing list for remoteproc core
- Related session LVC20-308: Remoteproc/RPMSG subsystems update
System Device Tree working group update

● Defines new Device Tree bindings
  ○ Describe Heterogeneous systems
  ○ Configure Execution Domains

● Repositories
  ○ https://github.com/devicetree-org/lopper

● Active work
  ○ Device Tree Evolution: DTE-2
  ○ System DT example with default case
  ○ Alignment between ST pintctrl proposal & Xilinx proposal for bus-firewall configurations
  ○ Remote processor bindings
  ○ Lopper tool published, with a set of reference OpenAMP assist routines

● Related session LVC20-314 System Device Tree update: Bus Firewalls and Lopper
Application Services working group update

- What is needed to build on top of OpenAMP?
  - Using industry standard interfaces (sockets, open/close, read/write, ...)
- Application developer issues that resonated most with members
  - Remote file access
  - Remote console
  - Proxy ports (e.g. proxy debug)
  - Messaging APIs (e.g. sockets)
- Working group (WG) will leverage common OS drivers & API standards where possible
  - RPMsg
  - VirtIO

Linux Services
1. File Systems
2. Network Stacks
3. Console PTYs
4. Remote App Debug
5. IPC

Drivers specified by WG

Remote OS
- Application
- Access to Linux services
OpenAMP in Industry

- **Xilinx**
  - Default AMP solution for Zynq-7000, Zynq UltraScale+ MPSoC, and Versal devices
  - Cortex-A APUs, Cortex-R RPU. Microblaze “soft” processors in programmable logic. Either APU or RPU can act as the master.

- **Mentor Graphics**
  - Core for the Mentor Embedded Multicore Framework and Multicore Framework Cert product offerings.
  - Expands on OpenAMP: Linux as a Remote, Large Buffer, Zero Copy, Proxy support for Ethernet
  - Communication between the safe and non-safe domains in Mixed Safety-Criticality systems

- **TI**
  - Enhancing the Linux kernel implementation of RemoteProc & RPMsg
  - Defining the wire protocol between processors
  - Contributed a limited scope version of remoteproc loader into U-Boot

- **NXP**
  - Low Power Audio use case in I.MX: Use remote proc to start/stop M4 core to do debug. Using rpmsg driver(NXP driver) and remote proc early boot feature.

- **Kalray**
  - Standard message passing solution within homogeneous Manycore architecture on MPPA®3 processor
  - MPPA®3 as accelerator: virtio over PCIe. Within MPPA®3 processor: virtio with shared memory
OpenAMP in Industry (2)

- Zephyr
  - OpenAMP integrated & available
- Nordic Semiconductor
  - Bluetooth Host Controller Interface (HCI) based on OpenAMP in Zephyr
- Linaro
  - Hosting OpenAMP project through Community Projects division
  - Involvement in Zephyr, openamp-rp, LAVA testing
- STMicroelectronics
  - IPC in multicore and multi-SoC STM32 solutions
    - OpenAMP-OpenAMP, Linux RPMsg-OpenAMP
  - OpenAMP library used with baremetal, FreeRTOS, Zephyr
- Wind River
  - To accelerate the ability of developers to create edge compute applications
- Arm
  - Active role in System Device Tree discussion
How to participate

● All are welcome to join the calls for the TSC & working groups!
  ○ Call invitations are sent to the mailing lists

● You can participate!
  ○ Not necessary to be from an OpenAMP Project member company

● Your company can become an OpenAMP Project member
  ○ Not necessary to be a Linaro member company
  ○ Member fees support administration for the project & infrastructure
  ○ OpenAMP Project membership gets the company
    ■ Vote on TSC
    ■ Vote on Board
How to become a member company

- Company representative signs Membership Agreement and Charter
- $2500 annual fee
- Current member companies (alphabetical order):
More information

- **GitHub project**
  - https://github.com/OpenAMP/
  - Also, Lopper lives at devicetree-org: https://github.com/devicetree-org/lopper

- **OpenAMP Wiki**
  - https://github.com/OpenAMP/open-amp/wiki
  - Notes from calls
  - Features being worked on & under consideration

- **Community Project Website**
  - https://www.openampproject.org/

- **Mailing lists**
  - Visit lists.openampproject.org to subscribe
Upcoming related talks

- LVC20-308 Remoteproc/RPMSG subsystems update
  - 4:55pm UTC

- LVC20-314 System Device Tree update: Bus Firewalls and Lopper
  - 6pm UTC
Thank you

Accelerating deployment in the Arm Ecosystem