Open-Source Firmware Status on Ampere® Platforms

Arjun Khare, Sr. Principal Software Engineer
Ampere®
Get to Know Ampere®!

• Ampere is a passionate, experienced team committed to building the next generation ARM64 server processors targeted for the cloud and edge. Founded and led by Renee J. James, previously from Intel.

• Headquartered in Santa Clara with offices around the world: Portland, Raleigh, Bangalore, Ho Chi Minh City, Taipei and Shanghai

• Key Dates
  – October 2017: Ampere founded.
  – November 2018: Introduced Ampere® eMAG®: 16nm, Arm v8.0, 32-core 3.3GHz server processor
Ampere Mt. Jade Platform

- 2P/2U reference platform for Altra
- https://amperecomputing.com/altra/#jade
Ampere’s Support for Open-Source Firmware

• Ampere is committed to supporting open source in the firmware ecosystem.
  – Enable open-source FW on Ampere platforms
  – Active engagement with the community

• Firmware Projects
  – TianoCore/EDK2 & LinuxBoot
  – OpenBMC
  – OpenOCD
  – OCP/OSF Efforts

• Ampere’s GitHub:  https://github.com/AmpereComputing
TianoCore/EDK2

• Support for Altra on Mt. Jade
  – Currently forking TianoCore/EDK2 to Ampere’s GitHub
  – Monthly release cadence, latest release is v1.03.100
  – Upstream to main repo in progress. v1 reviewed, v2 to be submitted. Targeting completion by end of March.

• Beginning support for Ampere Altra Max in March 2021
LinuxBoot

• What is LinuxBoot
  – https://www.linuxboot.org/
  – *LinuxBoot is a firmware for modern servers that replaces specific firmware functionality like the UEFI DXE phase with a Linux kernel and runtime. Improves boot reliability and boot time.*
  – Old idea, but somewhat new in servers.

• Ampere’s Support
  – Ampere EDK2 GitHub has a build option enabling LinuxBoot, which replaces the BDS shell with LinuxBoot & u-root UI.
  – Will be working to integrate LinuxBoot into EDK2 upstream.
  – LinuxBoot executable built directly from the GitHub repo (https://github.com/linuxboot/mainboards/tree/master/ampere/jade)
OpenBMC

- Support for Mt. Jade
  - [https://github.com/ampere-openbmc](https://github.com/ampere-openbmc)
  - openbmc/meta-ampere: Ampere’s implementation for Mt. Jade
  - linux: Linux kernel changes (including Ampere’s SM Pro MFD drivers and Ampere’s bmc-ssif driver)
  - ssifbridge: Ampere’s SSIF Bridge implementation
  - Monthly release cadence, latest release is v1.03.100

- Upstreaming status
  - Base meta-ampere and ssifbridge upstreamed
  - Additional code under meta-ampere continues to be upstreamed over time
  - SM Pro MFD drivers to be upstreamed for review Feb 2021
  - ssif-bmc driver to be upstreamed for review Feb 2021
OpenOCD

- OpenOCD is a free software on-chip debugging, in-system programming and boundary-scan test tool for various ARM, MIPS and RISC-V systems. [http://openocd.org/](http://openocd.org/)

Ampere Contributions for ARM 64-Bit
- ARMv8 system register access
- Improved instruction step support (OpenOCD ‘aarch64 steponly on’ option)
- ADlv6 DAP including Class 9 ROM Table large physical addressing 64-bit AXI access
- Watchpoints (Co-developed with Mellanox)

Ampere Contributions for Altra & Mt. Jade
- OpenBMC/OpenOCD BMC Remote Debug of target server system
- SMpro (AArch32), PMpro (AArch32) & ARMv8 (AArch64) DAPs
- Ampere eMAG, Altra and Altra Max OpenOCD board and target configuration files
- Ampere Altra Life-Cycle-State (LCS) support

- Code is slowly merging upstream, but otherwise available on Ampere’s GitHub
  - [https://github.com/AmpereComputing/ampere-openocd](https://github.com/AmpereComputing/ampere-openocd)
OCP/OSF Efforts

• The OCP Open System Firmware project’s purpose is to allow platform owners to “own their firmware”. One of the central compliance requirements is that firmware be open-source (code) or freely redistributable (binaries).

• Ampere will be working towards certifying our Mt. Jade firmware to be OCP/OSF compliant in the next few months. Much of the stack is already open-source and Ampere is working to make the relevant binaries publicly redistributable.

• At the end of this process, the firmware components for Mt. Jade will be available from OCP’s website.

• Link: https://www.opencompute.org/projects/open-system-firmware
## Ampere Open-Source Firmware Links

<table>
<thead>
<tr>
<th>Component</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDK2</td>
<td><a href="https://github.com/AmpereComputing/edk2">https://github.com/AmpereComputing/edk2</a></td>
</tr>
<tr>
<td></td>
<td><a href="https://github.com/AmpereComputing/edk2-platforms">https://github.com/AmpereComputing/edk2-platforms</a></td>
</tr>
<tr>
<td></td>
<td><a href="https://github.com/AmpereComputing/edk2-ampere-tools">https://github.com/AmpereComputing/edk2-ampere-tools</a></td>
</tr>
<tr>
<td></td>
<td><a href="https://github.com/AmpereComputing/edk2-non-osi">https://github.com/AmpereComputing/edk2-non-osi</a></td>
</tr>
<tr>
<td>OpenBMC</td>
<td><a href="https://github.com/ampere-openbmc">https://github.com/ampere-openbmc</a></td>
</tr>
<tr>
<td>OpenOCD</td>
<td><a href="https://github.com/AmpereComputing/ampere-openocd">https://github.com/AmpereComputing/ampere-openocd</a></td>
</tr>
<tr>
<td>LinuxBoot</td>
<td><a href="https://github.com/linuxboot/mainboards/tree/master/ampere/jade">https://github.com/linuxboot/mainboards/tree/master/ampere/jade</a></td>
</tr>
</tbody>
</table>
All data and information contained in or disclosed by this document are for informational purposes only and are subject to change. This document may contain technical inaccuracies, omissions and typographical errors, and Ampere Computing LLC, and its affiliates (“Ampere”), is under no obligation to update or otherwise correct this information. Ampere makes no representations or warranties of any kind, including express or implied guarantees of noninfringement, merchantability or fitness for a particular purpose, regarding the information contained in this document and assumes no liability of any kind. Ampere is not responsible for any errors or omissions in this information or for the results obtained from the use of this information. All information in this presentation is provided “as is”, with no guarantee of completeness, accuracy, or timeliness.

This document is not an offer or a binding commitment by Ampere. Use of the products and services contemplated herein requires the subsequent negotiation and execution of a definitive agreement or is subject to Ampere’s Terms and Conditions for the Sale of Goods.

This document is not to be used, copied, or reproduced in its entirety, or presented to others without the express written permission of Ampere.

The technical data contained herein may be subject to U.S. and international export, re-export, or transfer laws, including “deemed export” laws. Use of these materials contrary to U.S. and international law is strictly prohibited.

© 2021 Ampere Computing LLC. All rights reserved. Ampere, Ampere Computing, Altra and the Ampere logo are all trademarks of Ampere Computing LLC or its affiliates. Other product names used in this publication are for identification purposes only and may be trademarks of their respective companies.
Thank You