Building a Datacenter with ARM Devices

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ABSTRACT

The ARM CPU is becoming more prevalent as devices are shrinking and become embedded in everything from medical devices to toasters. However, Linux for ARM is still in the very early stages of release, with many different issues, challenges, and shortcomings. In order to test what level of service commodity ARM devices have, I decided to build a small data center with these devices. This included building services commonly found in large businesses, such as LDAP, DNS, and certain web applications such as Roundcube, webmail, and GlusterFS. I have been sold so far, and the device has even made it on board the ISS as part of public research projects.

METHODS

Physical
- Build a fully operational environment out of commodity ARM devices using SRS, Development Boards, or other ARM-based systems.
- Have dedicated hard drives and power systems for mass storage, including multiple drives for GlusterFS operation, and an Archive disk for backups and newly-used storage.
- Build a case for all of these devices that will protect them from dust and water.
- Have devices hooked up to UPSs for power security.

Software
- Find a single operating system that will support all of the devices used in this experiment.
- Set up the device in a similar way to a full datacenter, with services including LDAP, GlusterFS, and DNS.
- Document any issues with the operating system(s) used.

DEVICE USED

<table>
<thead>
<tr>
<th>Name</th>
<th>CPU</th>
<th>RAM</th>
<th>Device Type</th>
<th>IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana Pi M1</td>
<td>Allwinner A20</td>
<td>1 GB</td>
<td>Primary DNS</td>
<td>172.08.0.10</td>
</tr>
<tr>
<td>Cubieboard 3</td>
<td>Allwinner A20</td>
<td>2 GB</td>
<td>Secondary DNS</td>
<td>172.08.0.11</td>
</tr>
<tr>
<td>Raspberry Pi 2</td>
<td>Broadcom BCM2835</td>
<td>1 GB</td>
<td>Cold Storage</td>
<td>172.08.0.15</td>
</tr>
<tr>
<td>Neo Pi Neo</td>
<td>Exynos 8120</td>
<td>4 GB</td>
<td>OpenVPS and SSH</td>
<td>172.08.0.24</td>
</tr>
<tr>
<td>Odroid XU4</td>
<td>Samsung Exynos 5422</td>
<td>2 GB</td>
<td>U-Boot</td>
<td>172.08.0.25</td>
</tr>
<tr>
<td>Orange Pi One</td>
<td>Allwinner A31</td>
<td>1 GB</td>
<td>U-Boot</td>
<td>172.08.0.26</td>
</tr>
<tr>
<td>Pi2C2B</td>
<td>Allwinner A64</td>
<td>2 GB</td>
<td>U-Boot</td>
<td>172.08.0.28</td>
</tr>
</tbody>
</table>

OPERATING SYSTEMS

Raspberry Pi
- Raspberry, the operating system developed by the Raspberry Pi foundation, is a well-established operating system.

Everything Else
- Raspberry is for Raspberry only, so an alternative operating system was needed.
- Several options were available, including CentOS, Debian, Armbian, Yocto, and Gentoo.
- Armbian was chosen because it was compatible with all of the available devices.

STORAGE SETUP

GlusterFS
- In order to maintain a high level of availability across all of the web services, a central storage system must be built.
- All of the web servers would mount the GlusterFS volume using NFS, then synchronize their information across all of the web servers.
- The GlusterFS volume would hold the directories for ownCloud, DRPD, Hadoop, and so on, and in Armbian and Raspberry they are.
- GlusterFS would be one of several TR HD High-Drive connected to the Banana Pi M1 over SASA.
- Power for the hard drives comes from an external computer power supply.

Cold Storage
- The Cubieboard 3 has an extra PCB that can handle the power required by a 2.5" external hard drive, along with a SASA port.
- This will hold backups, unused files, and logs, but unnecessary items such as logs.

THE CASE

Custom Environments
- Designed in QCAD and can be used on hardboard by Ponder.
- Design was originally only for the Raspberry Pi, Orange Pi One, Ubuntu (Quick), PINE64, and Cold Chocolate.

Each device can be on a tray which can slide in and out at will
- Cable management and cooling are on the back for easy access.
- Designed to be solid and not collapse under its own weight.

Design Flaws
- There was supposed to be a front door for blocking the light, but instead it blocked the individual trays from sliding out.
- When the rear door was closed, it puts pressure on the hinges, eventually breaking them.
- Cooling was insufficient to the point where the Cubieboard 3 kept shutting off due to thermal issues.

CONCLUSION SO FAR

- Most of the devices are capable of running applications that include high availability and services, but none would be maintained for long-term operation.
- The Ubiquiti NanoPi ODROID XU3 is the most likely candidates for our next datacenter, due to its high reliability, RAM, and onboard CPU cores.
- The ARM Linux runs as an inefficient test for the lack of datacenter operation.

REFERENCES

- Armbian - https://www.armbian.com
- Cubieboard - http://cubieboard.org/
- Orange Pi - http://www.uboot.org
- PINE64 - https://www.pine64.org
- Ubuntu - http://www.ubuntu.com

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CURRENT RESULTS

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- Operating Systems
- Storage
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Hardware
- Cubieboard - http://cubieboard.org/
- Orange Pi - http://www.uboot.org
- PINE64 - https://www.pine64.org
- Ubuntu - http://www.ubuntu.com
- Armbian - https://www.armbian.com
- Ponder - https://www.ponderu.com

Issue
- No video output devices
- Power connector is a USB-barrel instead of a microUSB device
- microSD cards need tweezers for extraction
- Wireless module doesn’t work

Device
- Raspberry Pi One
- Orange Pi One
- Raspberry Pi 3

SOFTWARE

- Armbian
- Raspbian
- Gentoo
- Ubuntu

OPERATING SYSTEMS

- Raspbian
- GlusterFS
- Debian
- Ubuntu

SOFTWARE SETUP

- Cold Storage
- Cold Storage
- Storage

PRODUCTS

- Orange Pi One
- Raspberry Pi 2
- Raspberry Pi 3
- Raspberry Pi Zero

BIOGRAPHY

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