Open Software Updates for IoT

Phil Wise
Remember IE6?

Microsoft had a platform monopoly in the 90’s

Remember how terrible IE6 was?

A 2020’s Google monopoly won’t be any better
Platforms are not the answer

Many platform wannabees, much $

All based on vendor lock-in

Instead want tools that solve problems
Mission: OTA

Me = OTA

I care about Software Updates

Every device needs one

Not currently a solved problem
RPM / DEB?

Just use rpm or dpkg?

+ Easy
- Unsafe during power-off
- Dependency Resolution

```
sudo apt-get update & sudo apt-get dist-upgrade
```

This results in the following error(s):

```
The following packages have unmet dependencies:
  lsb-base : Breaks: upstart (< 1.12.1-0ubuntu8)
          : Breaks: upstart:1386 (< 1.12.1-0ubuntu8)
  Plymouth : Depends: initramfs-tools but it is not going to be installed
          : Recommends: Plymouth-theme-ubuntu-text but it is not going to be installed
  Plymouth-theme : Depends: initramfs-tools (>= 0.92ubuntu63) but it is not going to be installed
      : Depends: util-linux (> 2.15-rc2)
E: Error, pkgProblemResolver::Resolve generated breaks, this may be caused by held pa```
Dual Bank

+ Safe
- Partition flash during manufacture
- R/O root not trivial
- Hard to reuse/share
OSTree

“It’s like git for a filesystem”

OSTree
- Like git for a filesystem
- Commits are a rootfs
- 1 flash partition
- Multiple systems (chroots)
- From Colin Walters / Gnome
  Continuous
OSTree

“It’s like git for a filesystem”

OSTree

- Incremental fetches (like git pull)
- Hardlink identical files
- Not actually git: Extended Attributes for selinux/smack
OSTree basics

mmcblk0p1
  MLO
  u-boot.bin
  uEnv.txt

mmcblk0p2
  /boot/loader/uEnv.txt
  /ostree/repo/objects/…
  /ostree/deploy/myos/a3c83…/
    /usr/bin/bash
    /usr/bin/echo
  /ostree/deploy/myos/29ff9…/
    /usr/bin/bash
    /usr/bin/echo

Multiple deployment sysroots
  Rootfs #1
  Rootfs #2

1 physical sysroot
OSTree Hard link trees

Files shared using hard links:

/etc/…
/usr/bin/bash

/bash

Files shared using hard links:

/etc/…
/usr/bin/bash

/bash

Files shared using hard links:

/etc/…
/usr/bin/bash

/bash
Inside userspace

As a userland application, looks like a normal Linux root:

/usr/bin   - Read only, gets updates
/var       - R/W storage for user data
/var/home  - Home directories
/etc       - Magically 3-way merged
/sysroot/  - Physical filesystem root
U-Boot > Kernel
> OSTree initrd >
/sbin/init

Boot Process

- Bootloader picks deployment
- Boot kernel
- initrd chroots to correct deployment
Update Process

Updates run in background

1. Download objects
2. Deploy into new chroot
3. Flip active deployment in bootloader
4. Wait for reboot
Update Server

Internet

OSTree

Update Client

Server-side component

OSTree handles mechanics

But still need to:

- Serve Updates
- Choose who gets what version
- Provision new devices
Update Server Options

Already have server/client for updates?
=> Just shell out to ‘ostree’ tool

Otherwise rvi_sota_server and rvi_sota_client
=> Both OSS (MPL2)
=> Scala server, runs in Docker

ATS Garage SaaS
=> 20 devices free
Integration - meta-updater

meta-updater

Seamless integration into Yocto build
Build rootfs as an OSTree commit
Initial bootable flash image
Pushing OSTree commits to server (incrementally)

meta-updater-<board>

Bootloader integration for specific hardware
Today: Qemu, Rasberry Pi, Minnowboard Max/Turbot
Future Plans

Support more boards out-of-the-box
Super-fast incremental rootfs creation
Boot watchdog/rollback
Links

OSTree: https://github.com/ostreedev/ostree

Meta-updater: https://github.com/advancedtelematic/meta-updater

Quickstart with meta-updater and Raspberry Pi:
https://github.com/advancedtelematic/garage-quickstart-rpi
Questions?

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OSTree basics: sysroot

```
/boot/
    /loader/uEnv.txt

/ostree
    /deploy/os/deploy/da3045...
    /deploy/os/deploy/4eda05...
    /deploy/os/var
    /ostree/repo/objects/4eda...4.commit
    /ostree/repo/objects/c4b5...5.dirtree
    /ostree/repo/objects/805d...a.file
    /ostree/repo/objects/7d11...0.file
```

```
bootargs=ostree=/ostree/deploy/
os/deploy/4eda...4/
```

Deployment sysroot
```
/bin -> /usr/bin
/lib -> /usr/lib
/var
/usr
/lib
/libostree-1.so.1
```