



OS managed Devicetree overlays through UKI add-ons

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Topics

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- Requirements
- Proposed Solution
- Arduino UNO Q secure-boot PoC

The Problem

- ARM SBCs use Devicetree to describe the SoC + peripherals
- SBCs can have a number of extension-boards attached
- Each of these possible boards needs a DT overlay to work
- Loading overlays from userspace has been rejected by the kernel community

Requirements

- The user needs to be able to easily select which DT overlays to load
- The overlays need to be loaded by the boot-stack before starting the kernel
- A standardized solution which is not tied to a specific boot loader or SoC
- Must support EFI secure boot with everything signed

Proposed Solution

- Boot using an UKI with the kernel, initramfs and base DTB
- Have 1 UKI add-on per DT overlay
- Pre-built + sign the UKI + add-ons outside the system
- Simple userspace tool to configure which extension-boards are attached
- This tool writes out a `/etc/kernel/devicetree-overlays`
- A new `/lib/kernel/install.d` script parsing `/etc/kernel/devicetree-overlays` which copies the matching UKI add-ons into the add-ons dir

Arduino UNO Q secure-boot PoC (WIP)

- Replace u-boot with u-boot with EFI secure boot enabled:
<https://stetsed.xyz/posts/arduino-uno-q-custom-firmware/>
- DT overlay support for systemd-boot (but not yet systemd-stub):
<https://github.com/systemd/systemd/pull/43241>
- UNO Q base DTB + overlays for media-carrier, cameras and displays:
<https://github.com/arduino/linux-qcom/commit/7c70850495>

Arduino UNO Q BLS conf with overlays

options	root=UUID=c48ab2f0-e34d-47ec-ac1f-ce52371e661f
linux	/.../linux
initrd	/.../initrd.img-7.0.14+
devicetree	/.../qrb2210-arduino-imola-base.dtb
devicetree-overlay	/.../qrb2210-arduino-imola-video_sound-usbc.dtbo
devicetree-overlay	/.../qrb2210-arduino-imola-carrier-media.dtbo
devicetree-overlay	/.../qrb2210-arduino-imola-carrier-media-camera-imx219-csi0-4lanes.dtbo
devicetree-overlay	/.../qrb2210-arduino-imola-carrier-media-camera-imx219-csi1-4lanes.dtbo

Arduino UNO Q secure-boot PoC todo

- Modify systemd uki-stub with support for applying DT overlays
- Simple userspace tool to configure which extension-boards are attached, writing `/etc/kernel/devicetree-overlays`
- A new `/lib/kernel/install.d` script parsing `/etc/kernel/devicetree-overlays`

Thank you !

Děkuji !

Merci !

Dank je wel !

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