



Hotplug DRM pipeline components on non-discoverable video busses

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Corrections, suggestions, contributions and translations are welcome!





Luca Ceresoli

- ▶ Embedded Linux engineer at Bootlin
 - Embedded Linux **expertise**
 - **Development**, consulting and training
 - Strong open-source focus
- ▶ Linux kernel device driver developer
- ▶ Bootloaders, Buildroot and Yocto integration
- ▶ Open-source contributor
- ▶ Living in **Bergamo**, Italy

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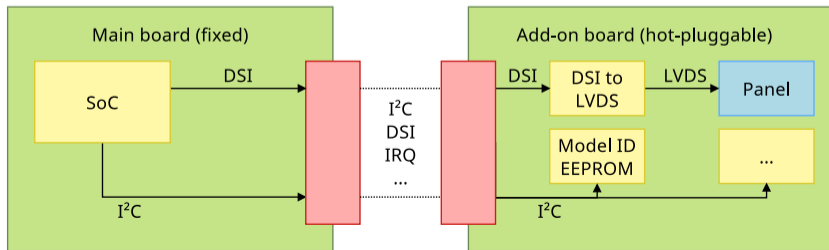


Context



Goal

- ▶ A healthcare product, advanced hardware prototype, to be launched in 2025
- ▶ Classic ARM64 embedded system, using device tree
 - Works standalone with basic features
- ▶ Has a connector for an add-on to extend features
 - Proprietary connector
 - Hot-pluggable by user at any moment
 - Connector uses non-discoverable busses (I2C, MIPI DSI, interrupts)
 - DSI-to-LVDS bridge on the add-on





- ▶ Device tree + Adding HW = **device tree overlays**
 - Discussion next Friday
 - “Runtime hotplug on non-discoverable busses with device tree overlays”
 - <https://lpc.events/event/18/contributions/1696/>
- ▶ v4: <https://lore.kernel.org/all/20240917-hotplug-drm-bridge-v4-0-bc4df6e61be6@bootlin.com/>



Proposed approach: the hotplug bridge

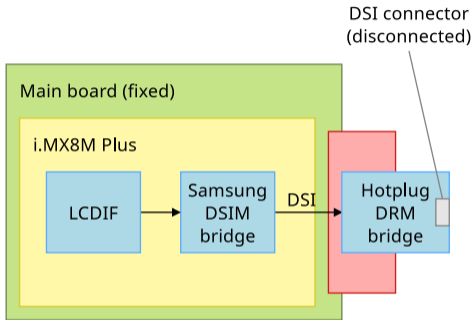


The hotplug bridge

- ▶ Main issue with DRM: pipeline is assumed to be immutable (except panel/display after DRM connector)
- ▶ Card needed to be always present
- ▶ Idea: add a decoupling **“hotplug bridge”**



The hotplug bridge



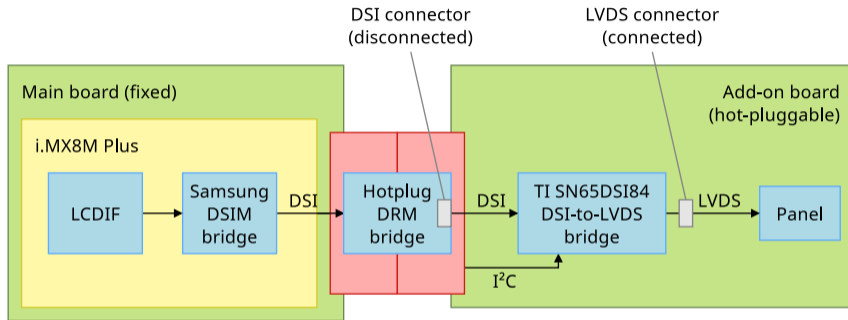
```
# modetest -c | grep -i '^[a-z0-9]'
```

```
Connectors:
```

id	encoder	status	name	size (mm)	modes	encoders
38	0	disconnected	DSI-1	0x0	0	37



The hotplug bridge



```
# modetest -c | grep -i '^[a-z0-9]'
```

```
Connectors:
```

id	encoder	status	name	size (mm)	modes	encoders
38	0	disconnected	DSI-1	0x0	0	37
39	0	connected	LVDS-1	344x194	1	37



The hotplug bridge

- ▶ The hotplug bridge is not a chip, it just “represents” the physical connector
- ▶ Fully decouples fixed and removable sections
- ▶ Existing bridge drivers work unmodified
 - Not aware of hotplug
- ▶ Self-contained, only small additions to DRM core ([patch 2](#), [patch 3](#))
- ▶ DRM card always available



Current status

- ▶ [patch 4](#) adds the `hotplug-drm-bridge` driver
- ▶ Ongoing discussion after [Sima's review of v2](#)
 - Many changes requested



Work in progress

- ▶ Added dynamic LVDS DRM connector [v3]
 - Added/removed on hot(un)plug, like DP MST
- ▶ No DRM bridge notifiers [small step in v4]
 - Added `bridge_event_notify()` to `struct drm_bridge_funcs` (patch 2)
- ▶ Working on other aspects



Open issues

- ▶ Clarifications needed
- ▶ What should be moved to the DRM / bridge core?
- ▶ Should the hotplug bridge exist (as a `struct drm_bridge`)?
 - If not, how to keep the card existing when there is no add-on?
 - Bridges don't expect next bridge to disappear
- ▶ Lifetime, recounting, ownership issues
 - DRM bridges have no lifetime management or recounting
 - Let removable bridges be “owned” by the dynamic DRM connector to reuse its ones
 - Need to add recounting to bridges anyway?
- ▶ Bridge removal during atomic updates

Questions? Suggestions? Comments?

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