Common Display Framework

Tomorrow's Linux Kernel Display Architecture

Embedded Linux Conference Europe 2013
Edinburgh

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a long
long time
ago

source: http://commons.wikimedia.org/wiki/File:Danaides_Waterhouse_1903.jpg

display
(skip?)

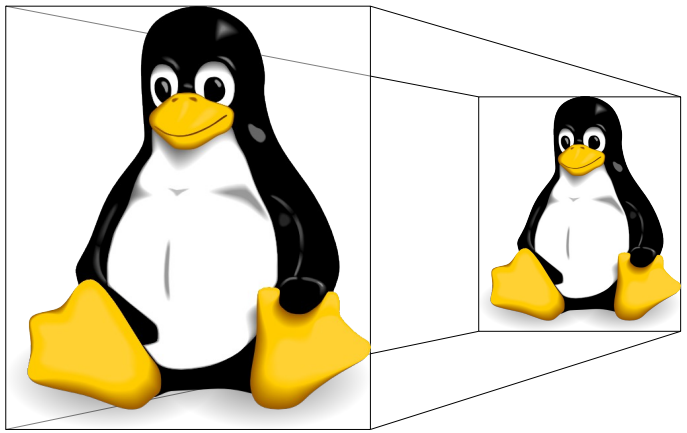
Frame Buffer

Display – Scanout

CRTC

Composition

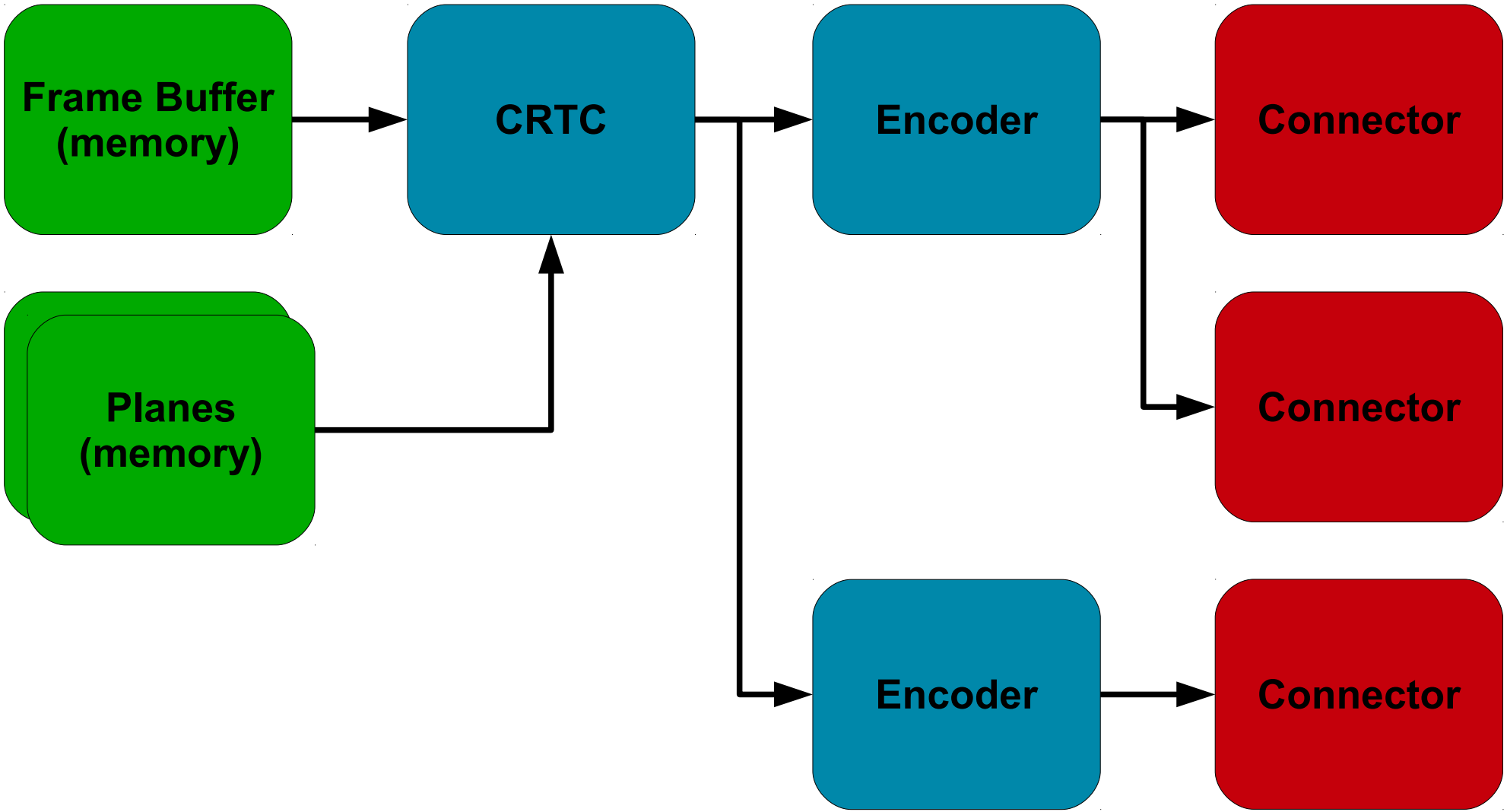
Plane(s)



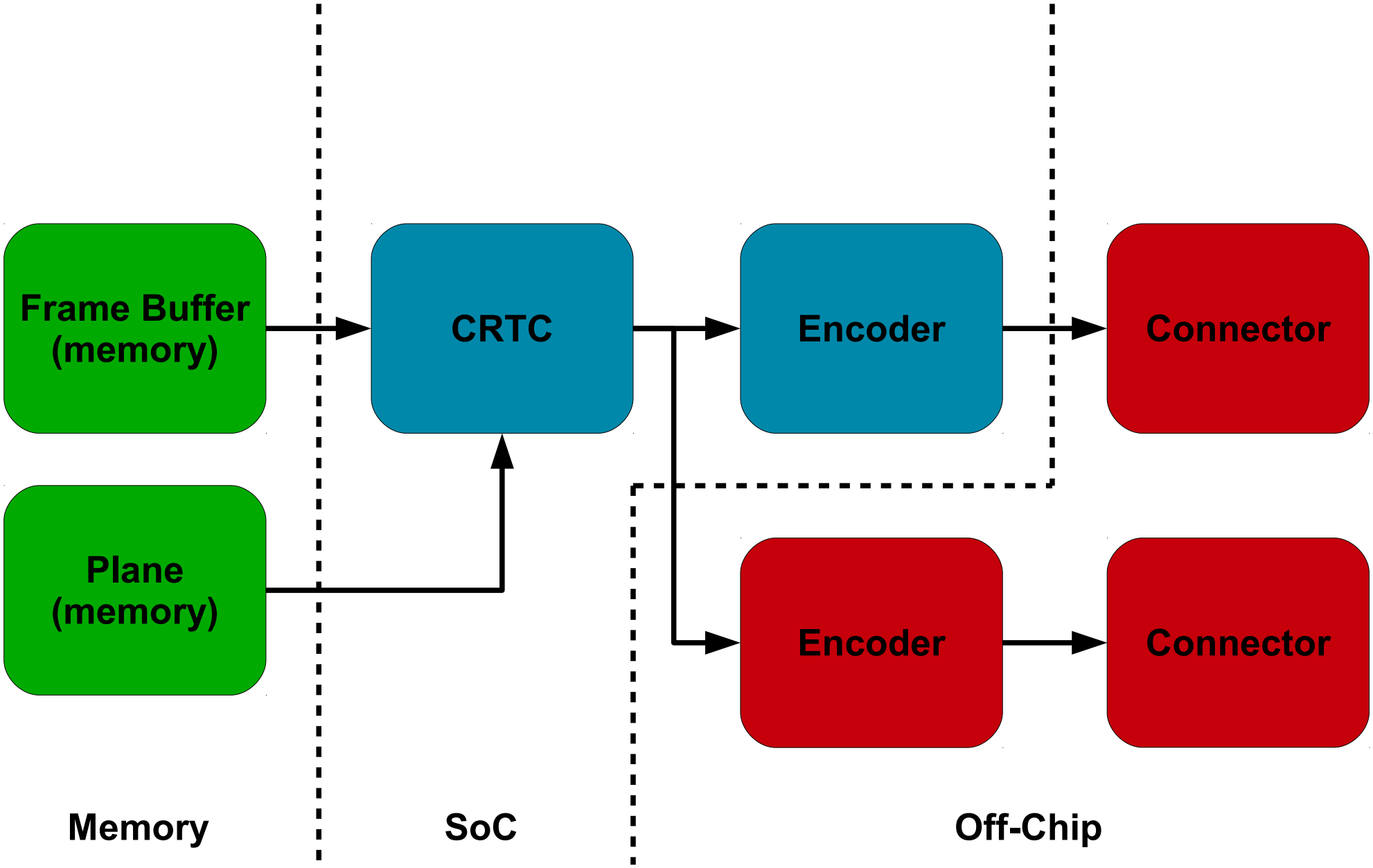
IDEAS ON BOARD

Display – Composition

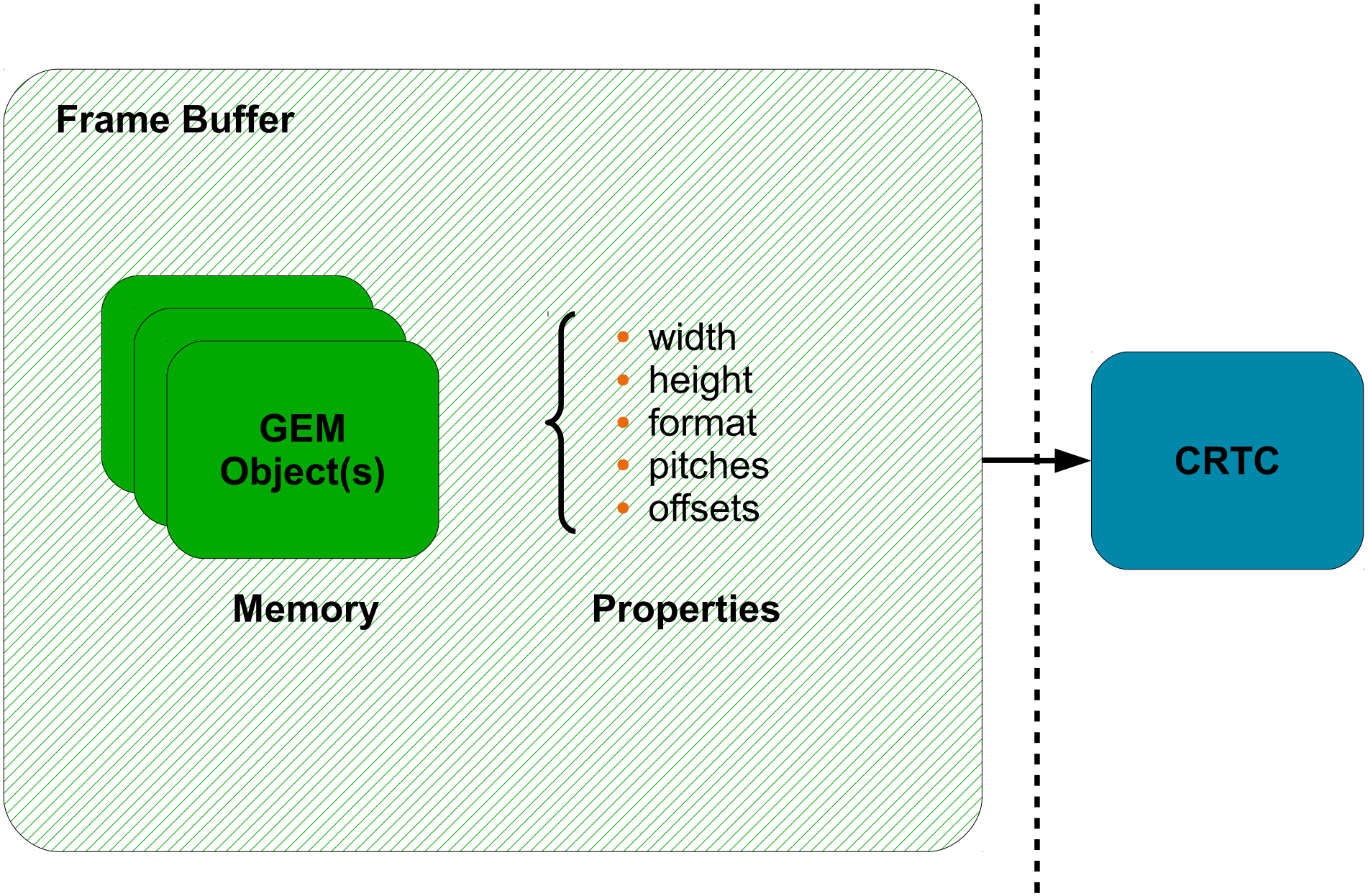
KMS



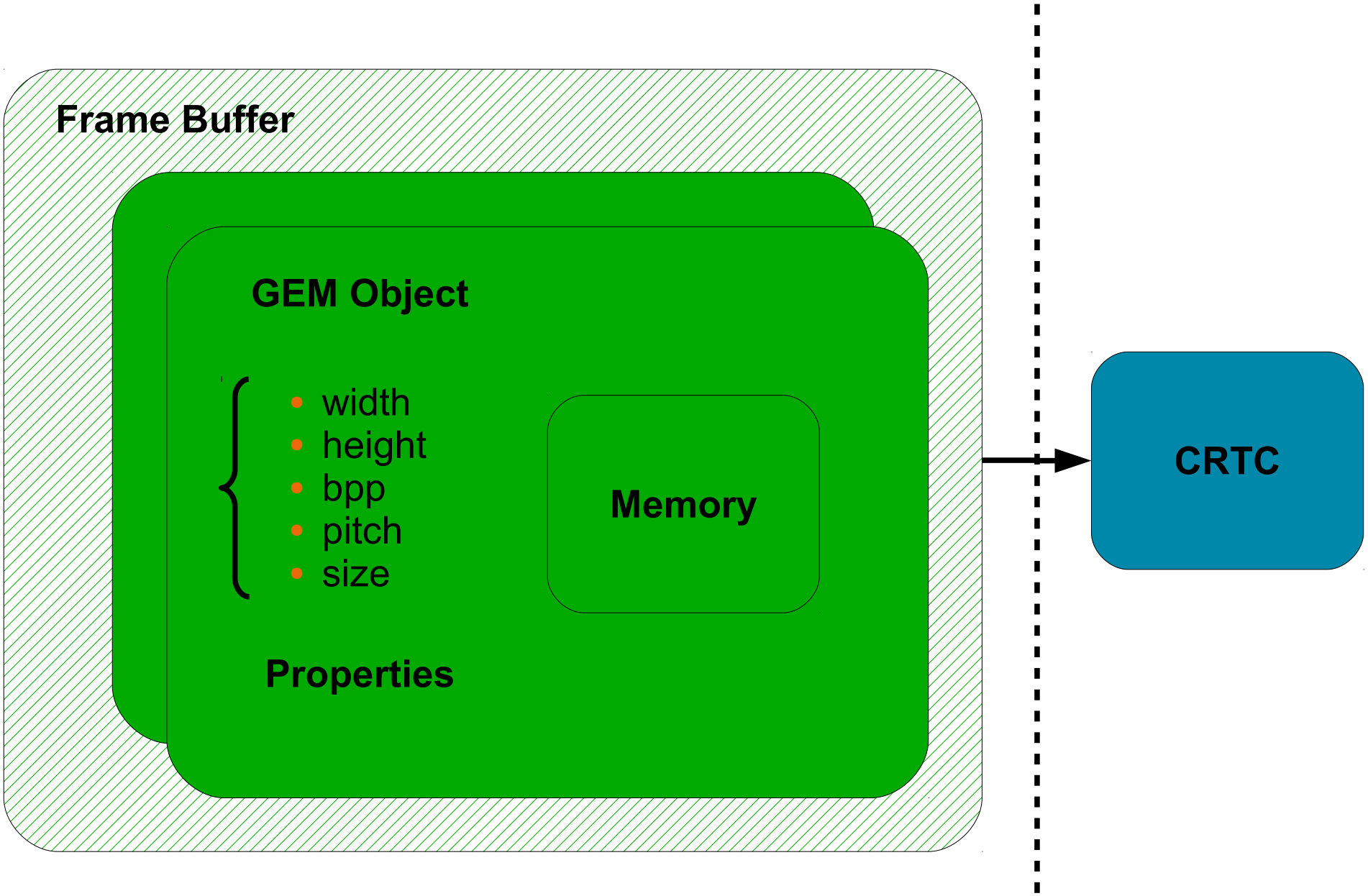
KMS – Device Model



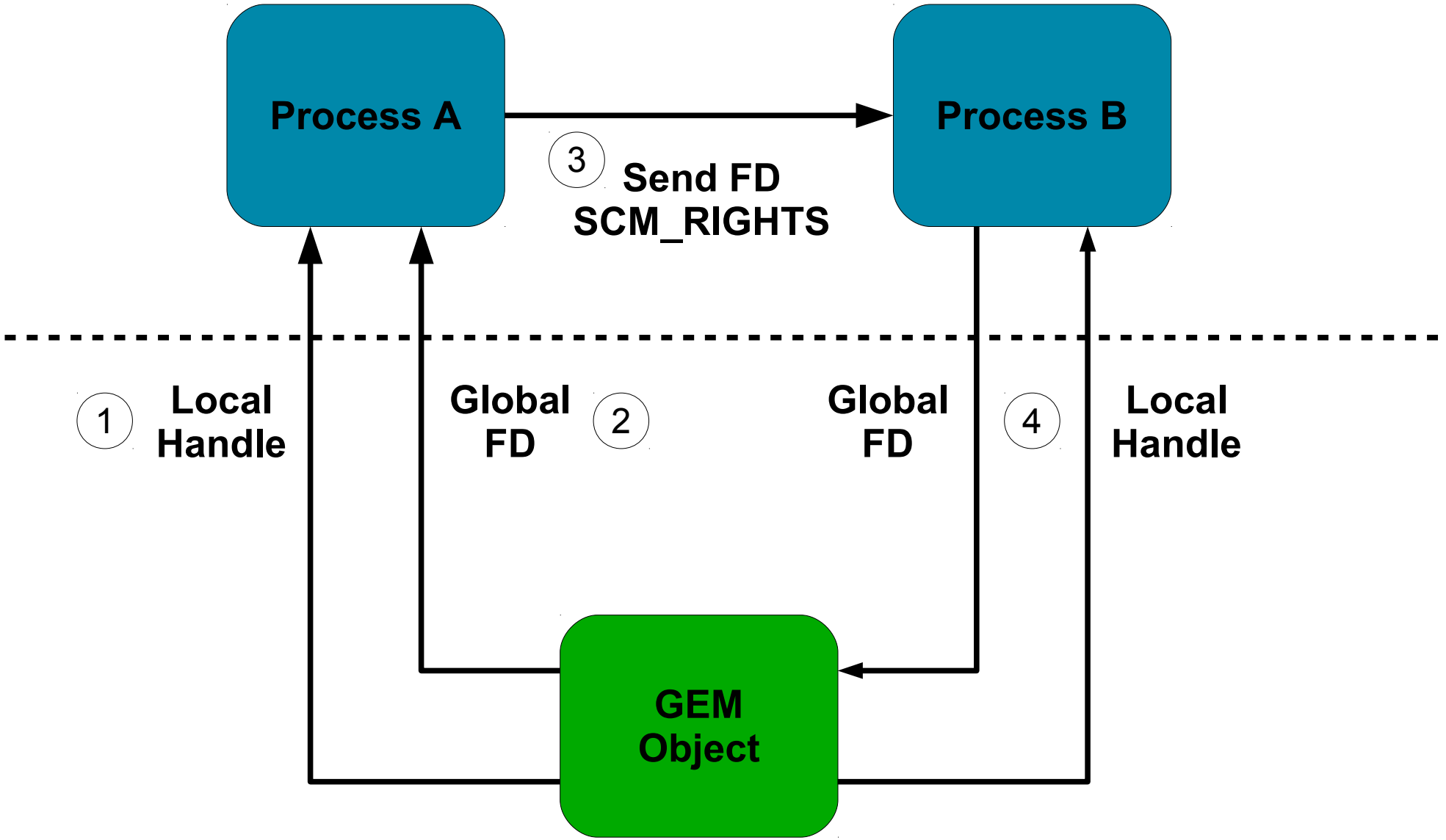
KMS – Device Model



KMS – Frame Buffer

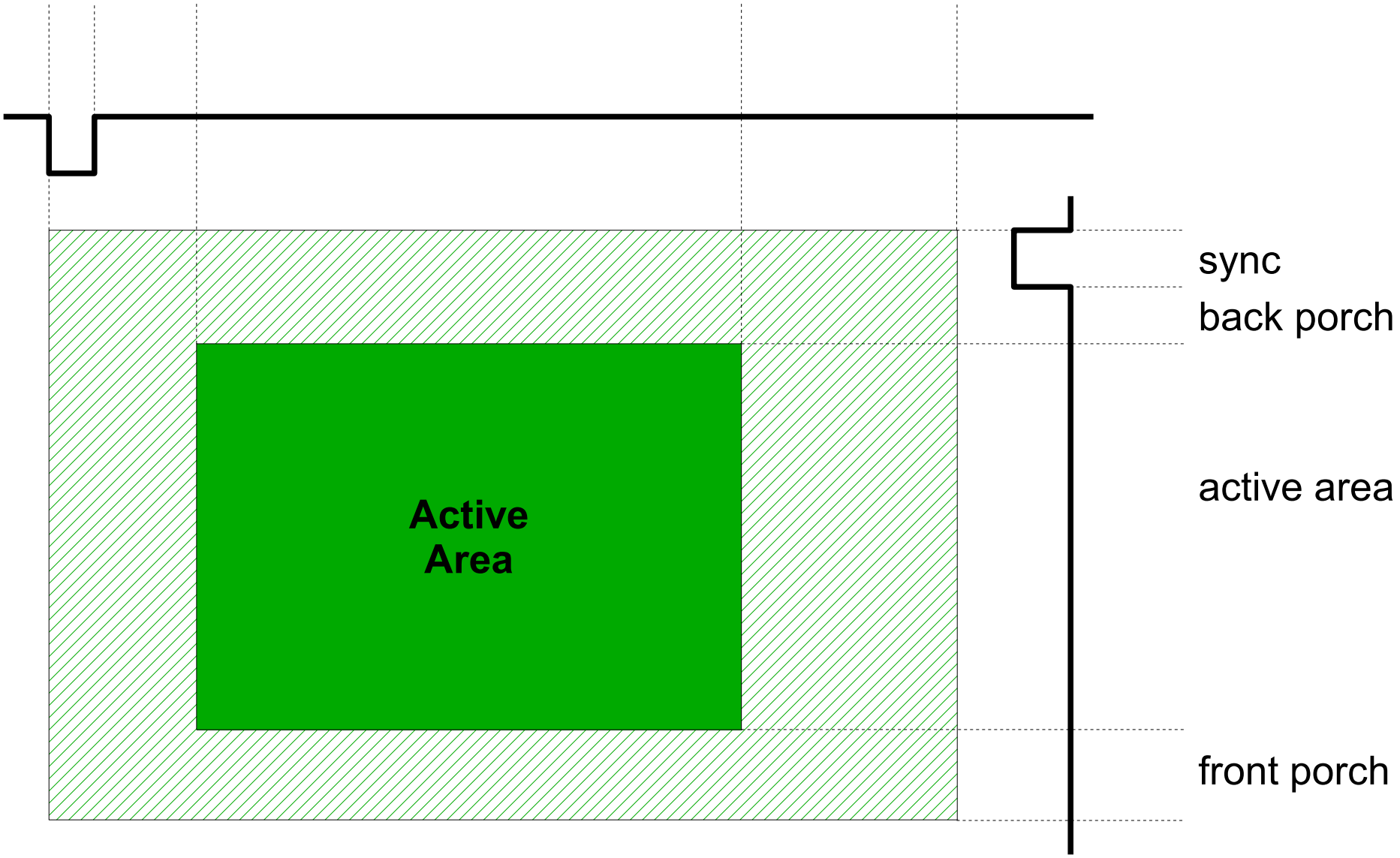


DRM/KMS – GEM Object

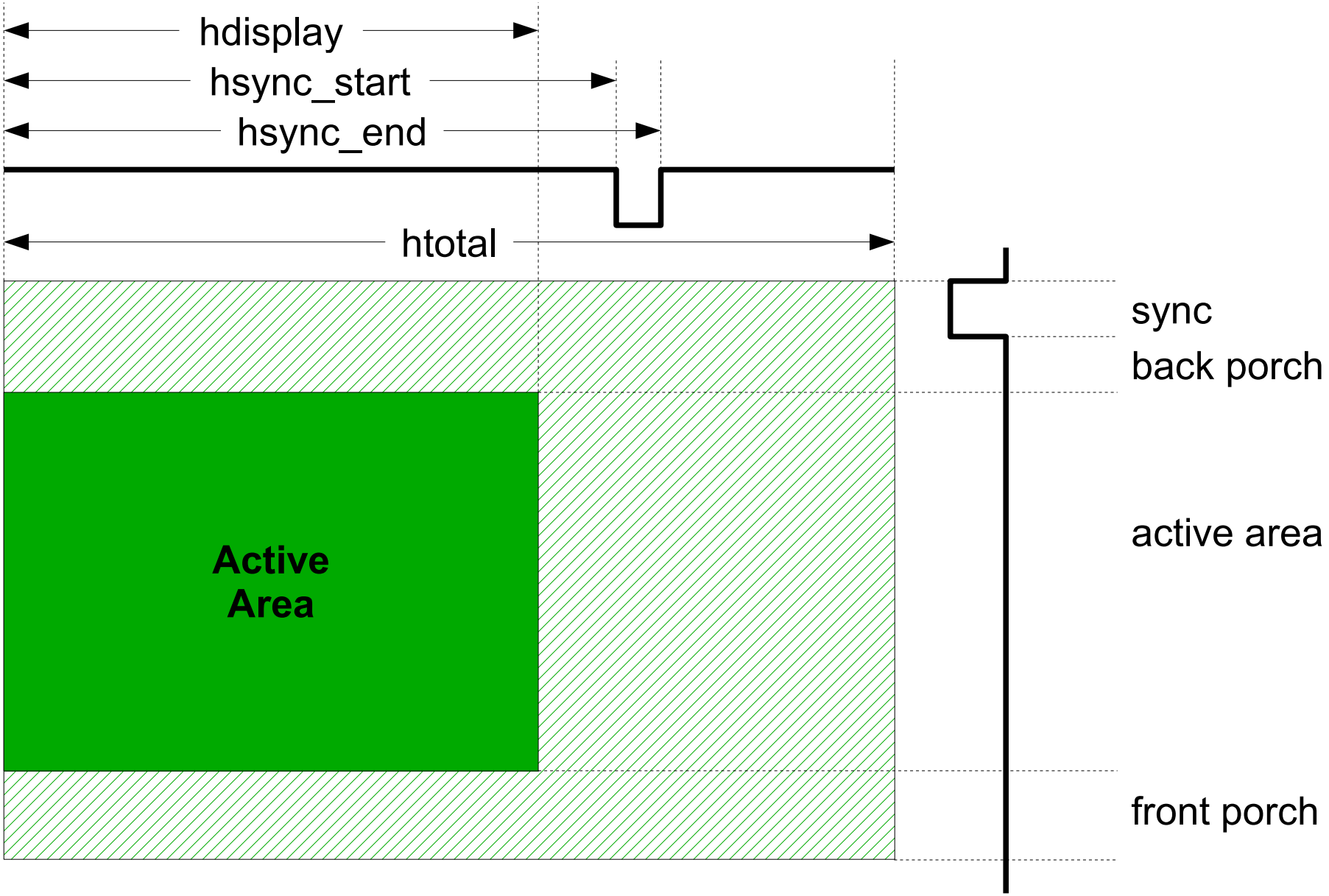


IDEAS ON BOARD

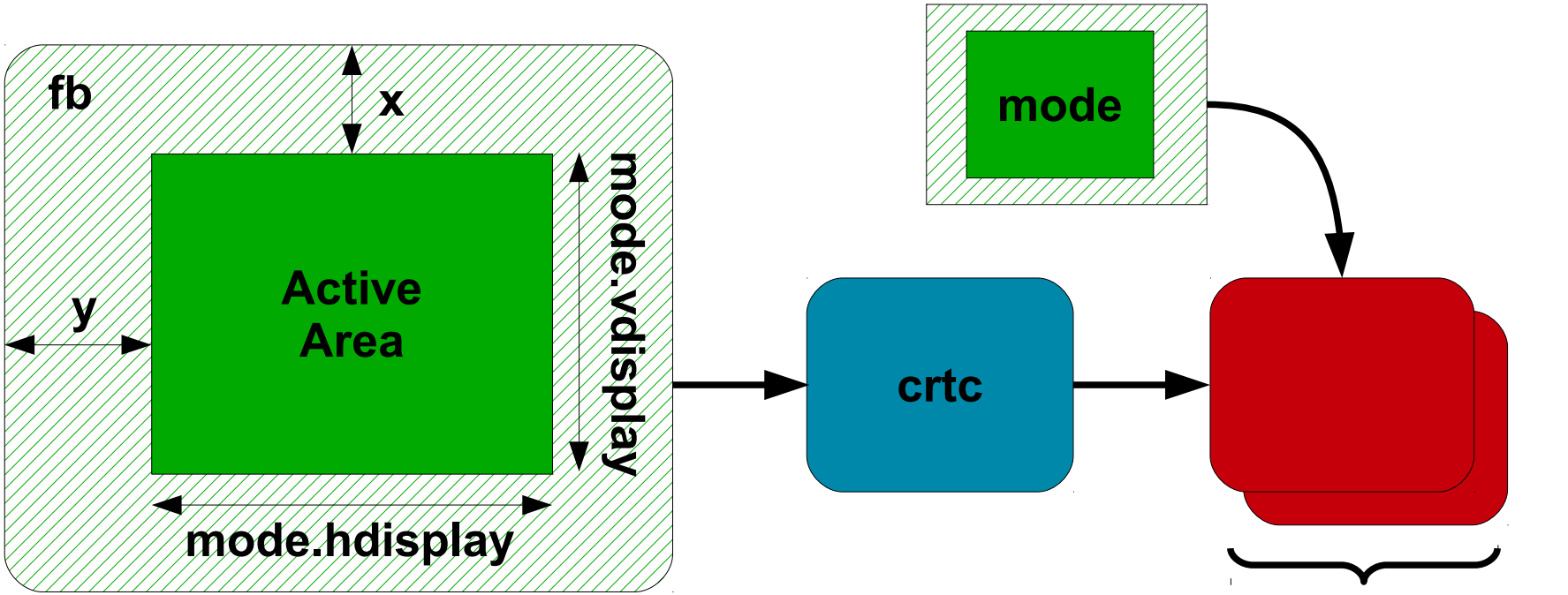
DRM – Handles



KMS – Modes (1/2)


hdisplay
hsync_start
hsync_end
htotal
Active Area
sync
back porch
active area
front porch

KMS – Modes (2/2)

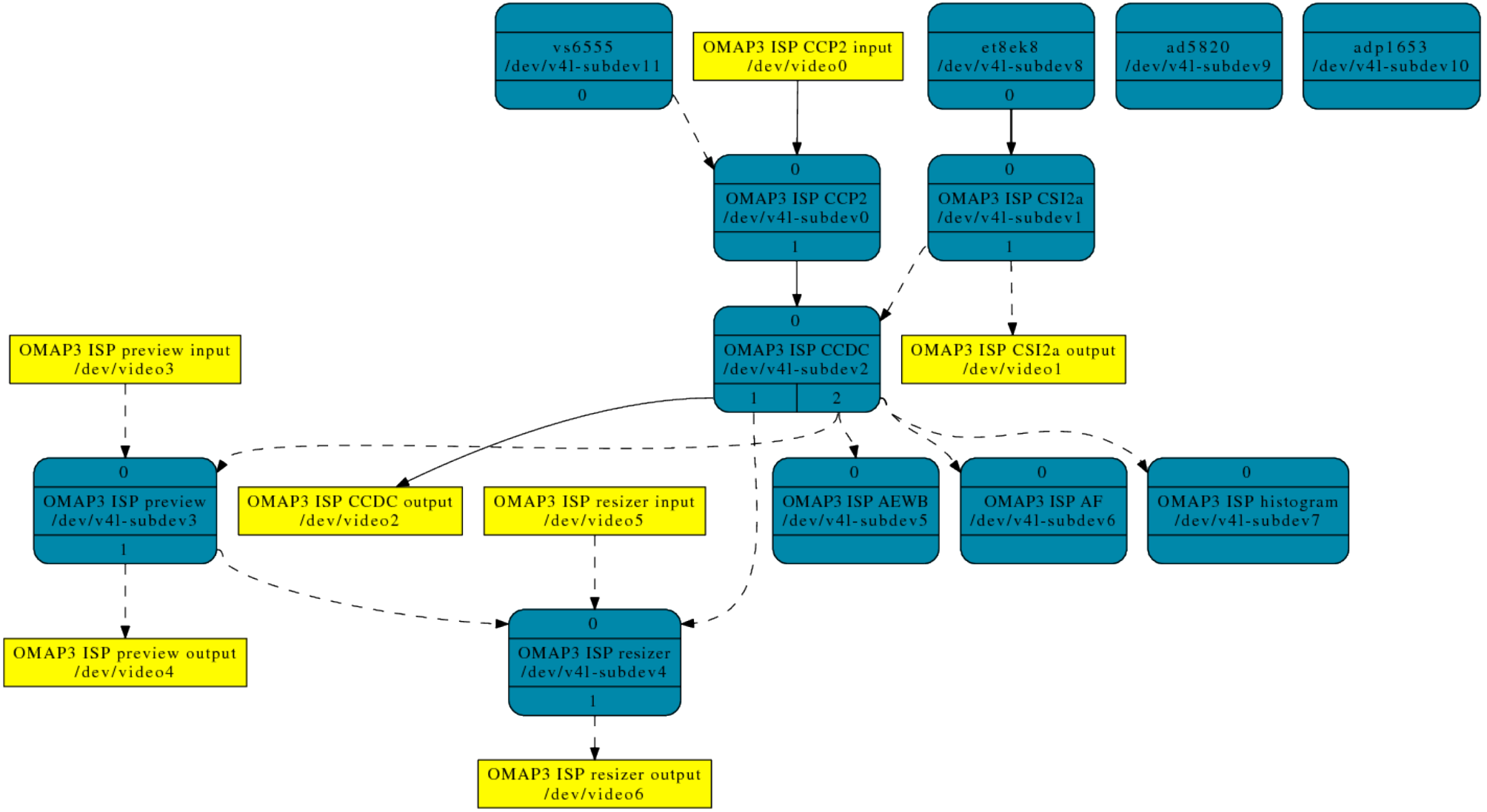



```
struct drm_mode_set {
    struct drm_framebuffer *fb;
    struct drm_crtc *crtc;
    struct drm_display_mode *mode;
    uint32_t x;
    uint32_t y;
    struct drm_connector **connectors;
    size_t num_connectors;
};
```


KMS – Mode Setting

media controller

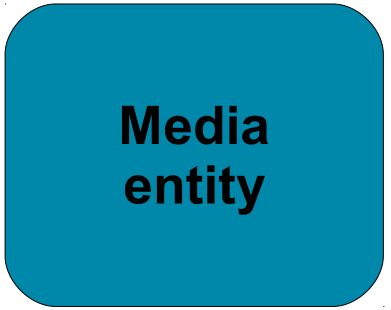
(skip?)



IDEAS ON BOARD

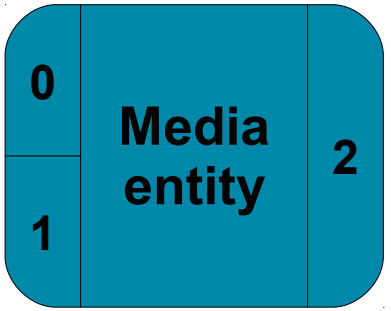
Media Controller – Model

```
struct media_entity
{
    u32 id;
    const char *name;
    u32 type;
    u32 revision;
    unsigned long flags;
    u32 group_id;
    ...
};
```



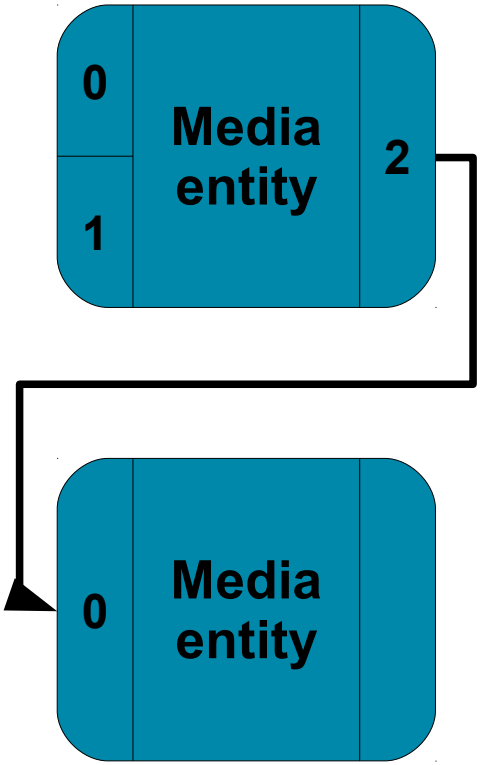
Media Controller – Entity

```
struct media_entity
{
    ...
    u16 num_pads;
    struct media_pad *pads;
    ...
};

struct media_pad
{
    u16 index;
    unsigned long flags;
};
```



Media Controller – Pads

```
struct media_entity
{
    ...
    u16 num_links;
    struct media_link *links;
    ...
};

struct media_entity_link
{
    struct media_pad *source;
    struct media_pad *sink;
    unsigned long flags;
};
```



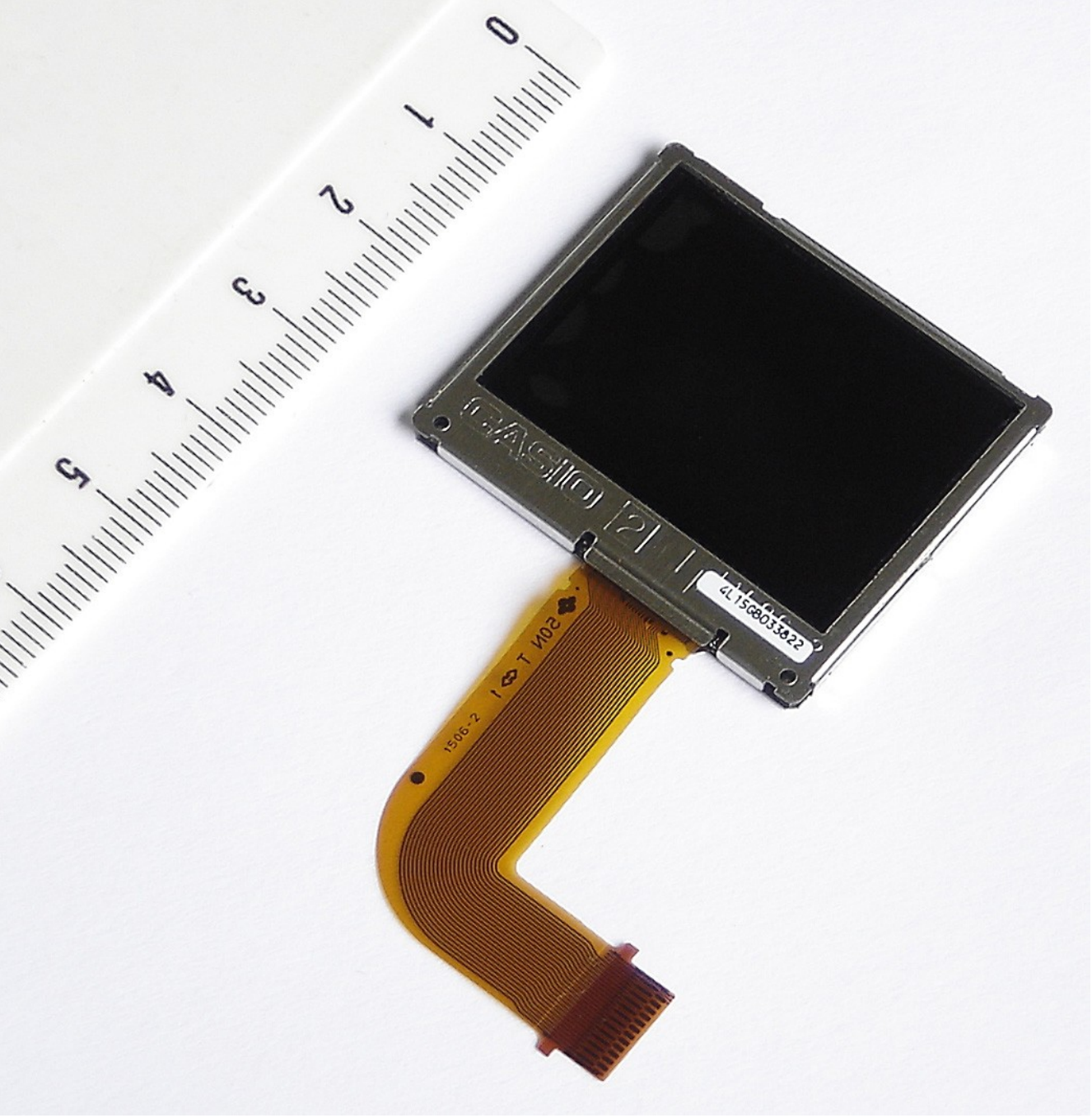
Media Controller – Links

problems

(round 1)

```
/*
 * Skeleton device tree; the bare minimum needed to boot;
 * just include and add a compatible value. The bootloader
 * will typically populate the memory node.
 */

/ {
        #address-cells = <1>;
        #size-cells = <1>;
        chosen { };
        aliases { };
        memory { device_type = "memory"; reg = <0 0>; };
};
```

Problems – DT Bindings



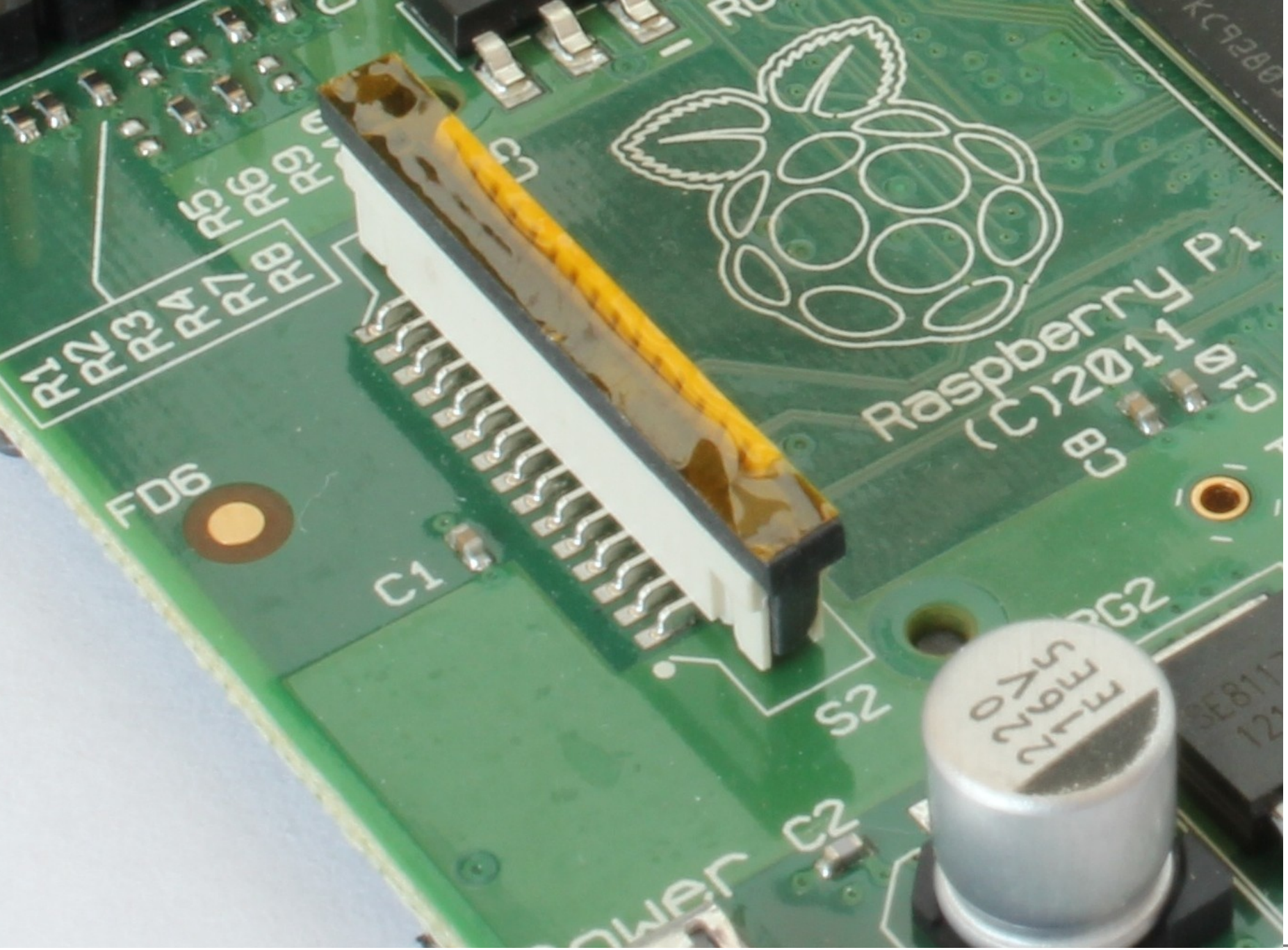
source:
http://en.wikipedia.org/wiki/File:Casio_LCD_screen_for_digital_camera.jpg

IDEAS ON BOARD

Problems – Panel Drivers

KMS
FBDEV

Problems – Sharing



source:
http://en.wikipedia.org/wiki/File:RaspberryPi_Display_Serial_Interface.jpg

IDEAS ON BOARD

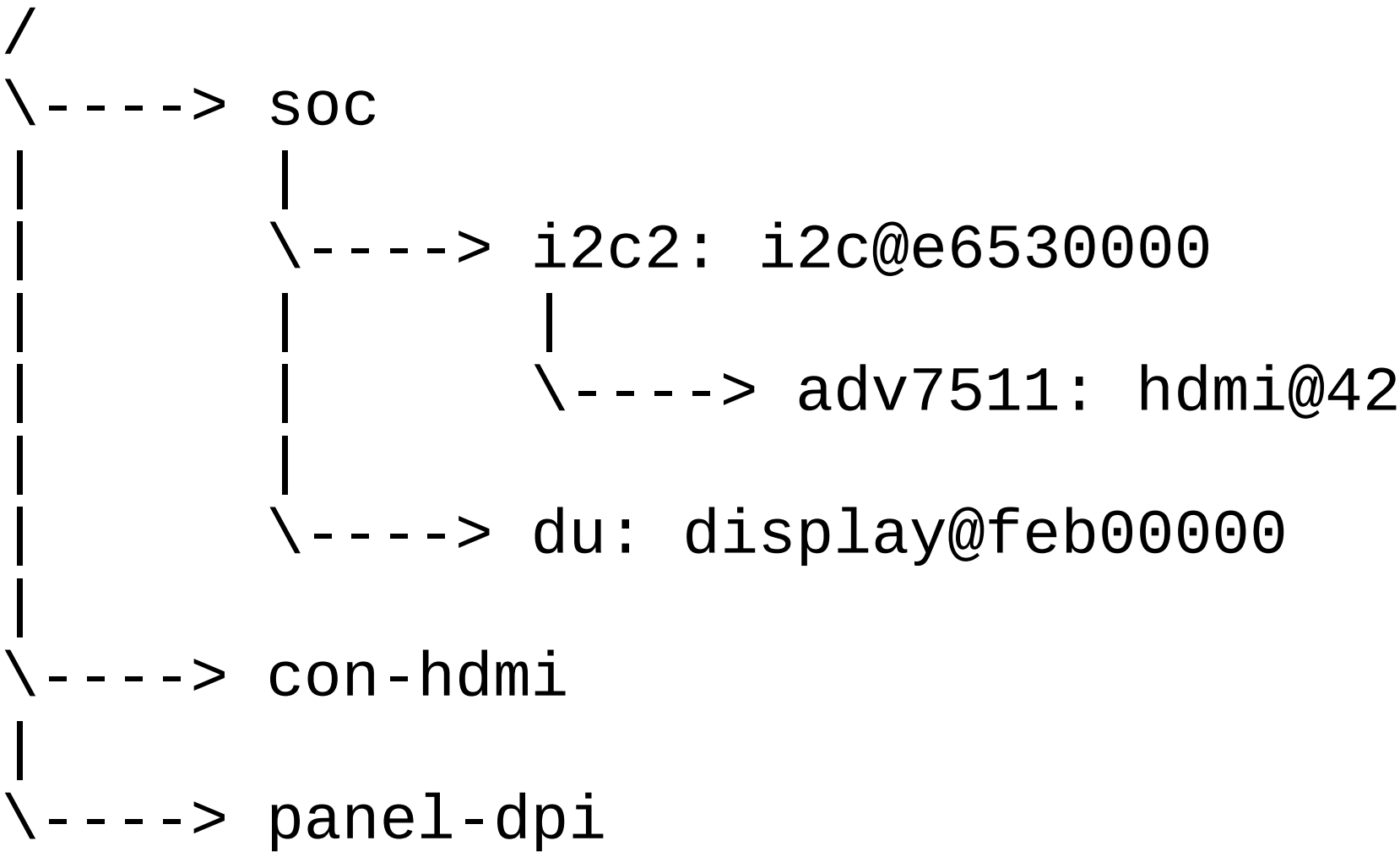
Problems – MIPI DPI/DSI

(round 2)

bridges
encoders
transmitters
...

```
/*
 * Skeleton device tree; the bare minimum needed to boot;
 * just include and add a compatible value. The bootloader
 * will typically populate the memory node.
 */

/ {
        #address-cells = <1>;
        #size-cells = <1>;
        chosen { };
        aliases { };
        memory { device_type = "memory"; reg = <0 0>; };
};
```

Problems – DT Bindings



Problems – Async Probing

(secret round)

KMS

FBDEV

V4L

Problems – Sharing

KMS

~~FBDEV~~

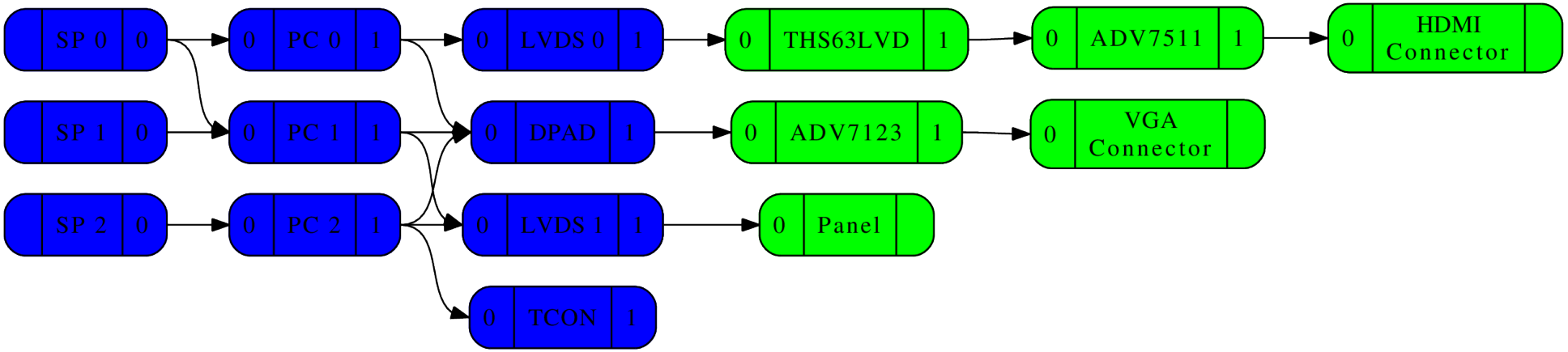
V4L

Problems – Sharing

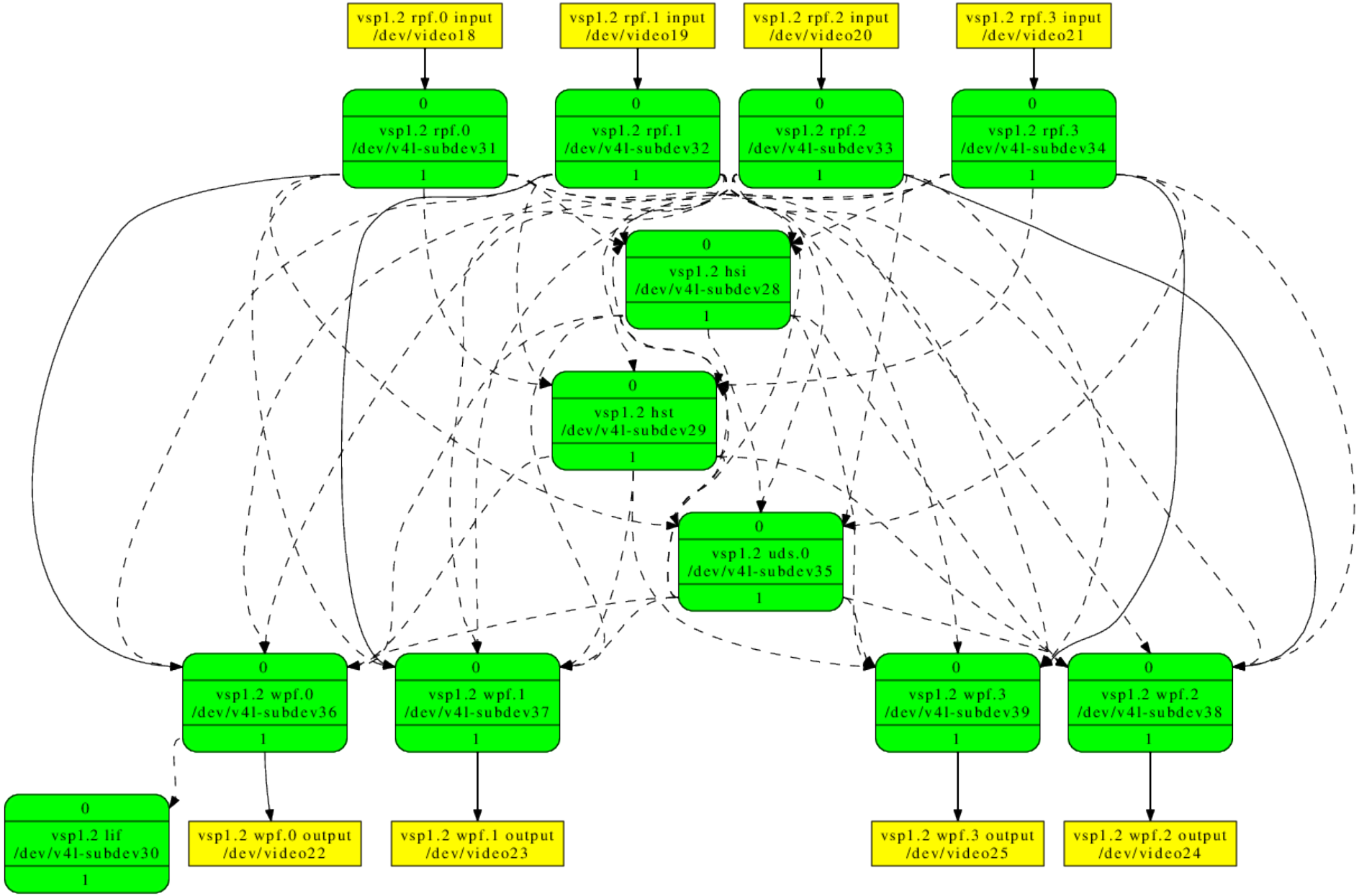
Multiple control busses

Use Cases

(they're real)

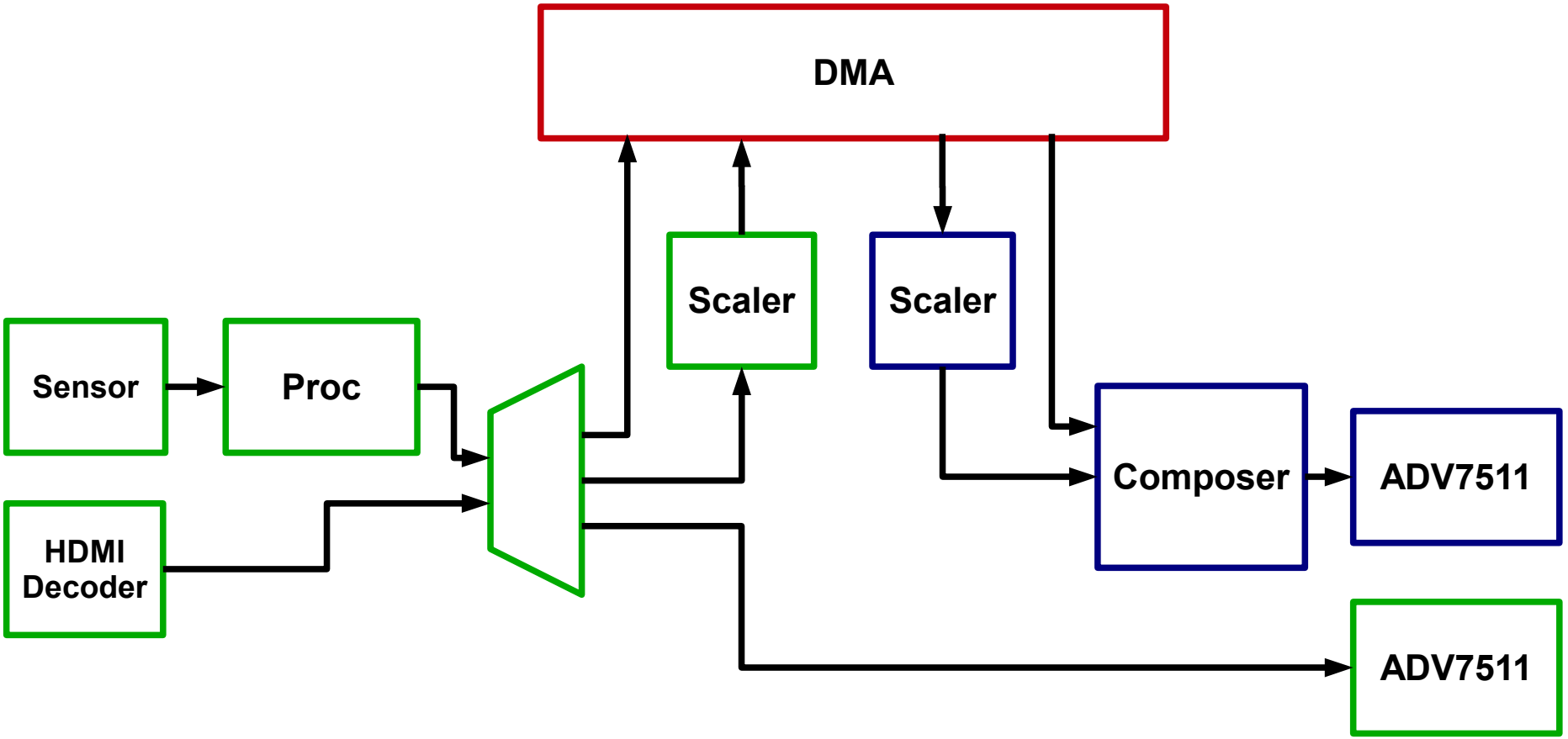

SP 0
0
PC 0
1
LVDS 0
THS63LVD
ADV7511
HDMI Connector
SP 1
PC 1
DPAD
ADV7123
VGA Connector
SP 2
PC 2
LVDS 1
Panel
TCON

Renesas – DU

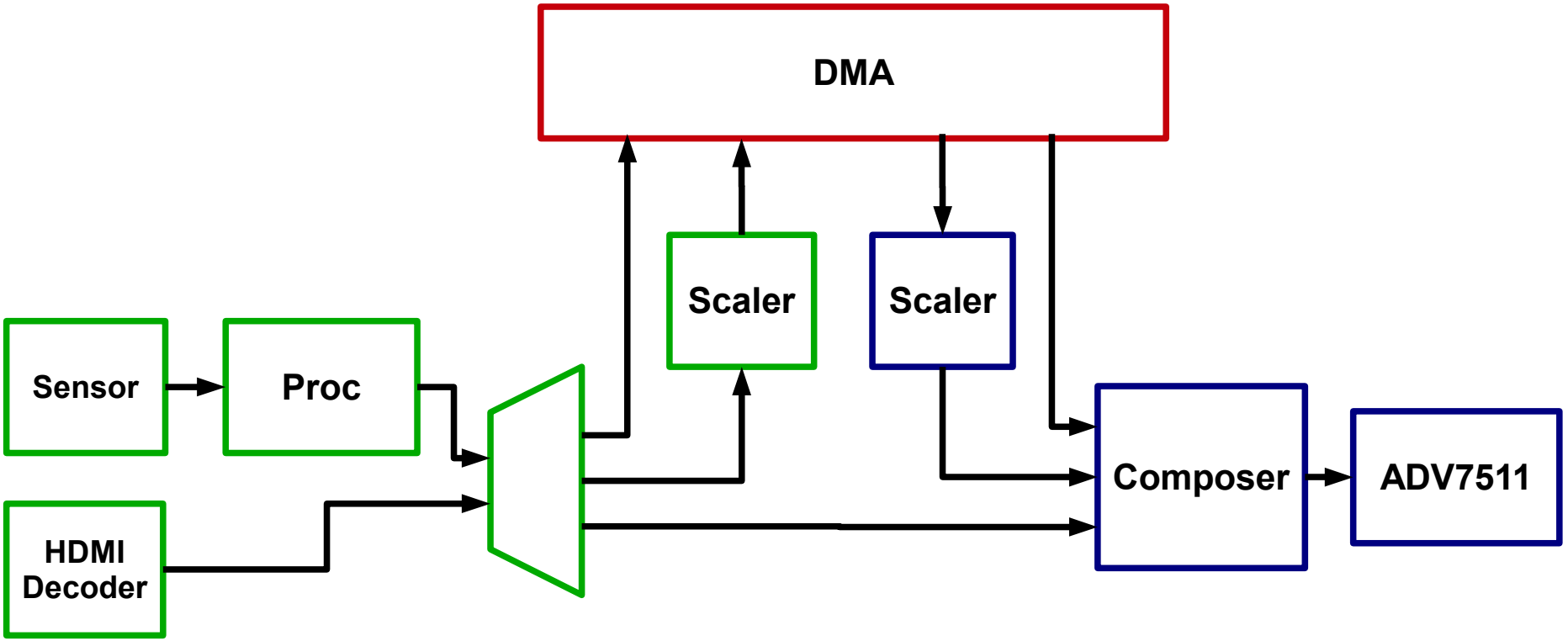


IDEAS ON BOARD

Renesas – VSP1


DMA
Scaler
Scaler
Sensor
Proc
HDMI
Decoder
Composer
ADV7511
ADV7511

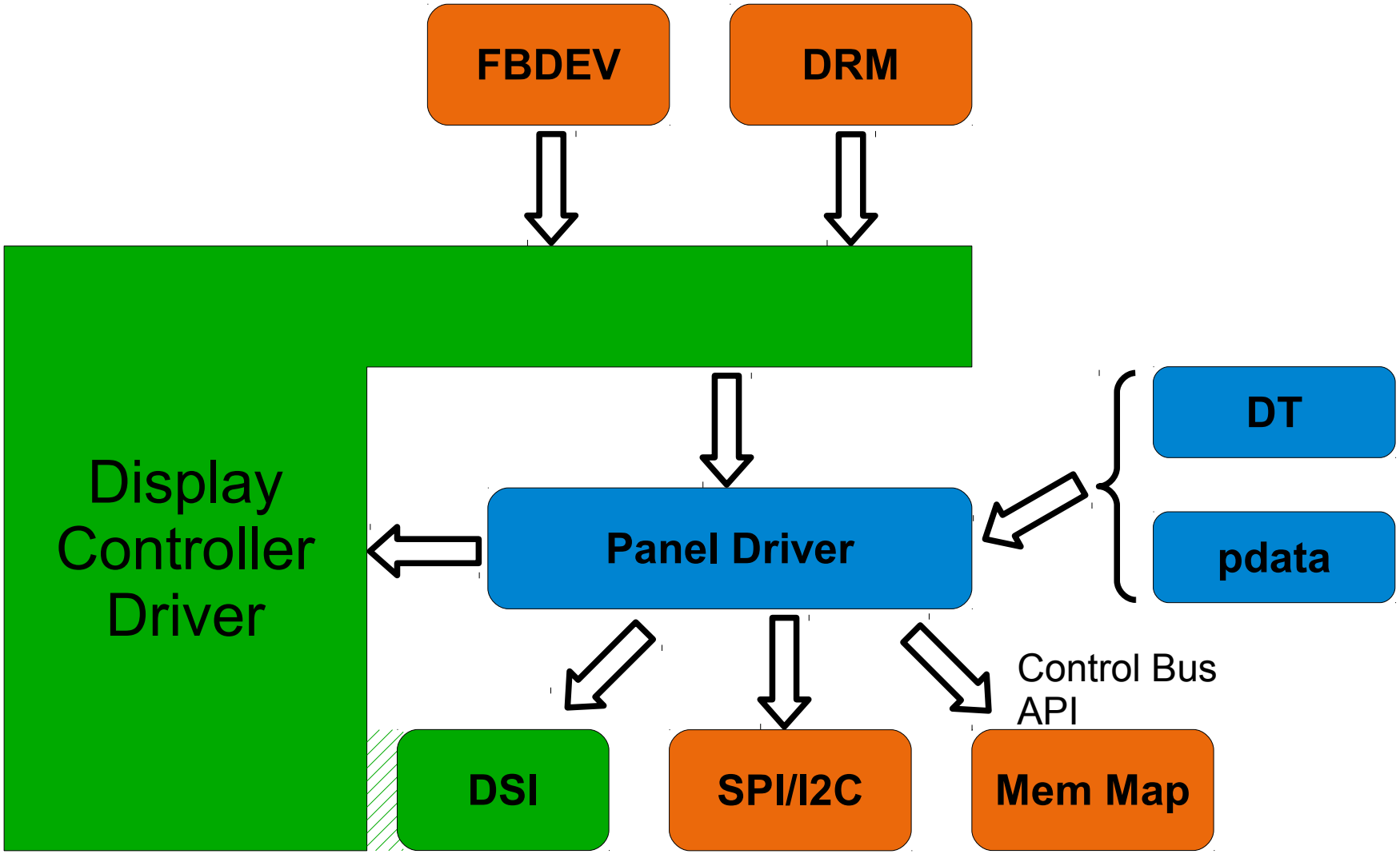
Xilinx – FPGA


DMA
Scaler
Scaler
Sensor
Proc
HDMI
Decoder
Composer
ADV7511

Xilinx – FPGA

CDF

[RFC 0/5] Generic panel framework



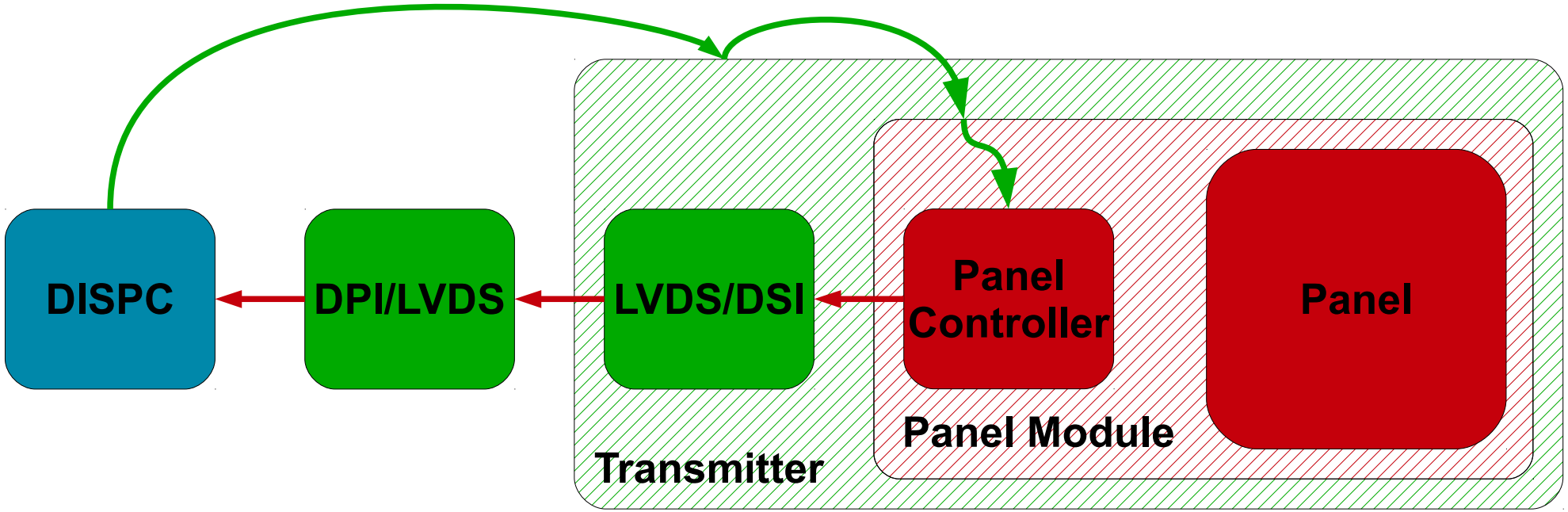
CDF – Integration

[RFC v2 0/5] Common Display Framework

source: http://en.wikipedia.org/wiki/File:Russian-Matroshka2.jpg

IDEAS ON BOARD

CDF – Configuration Model

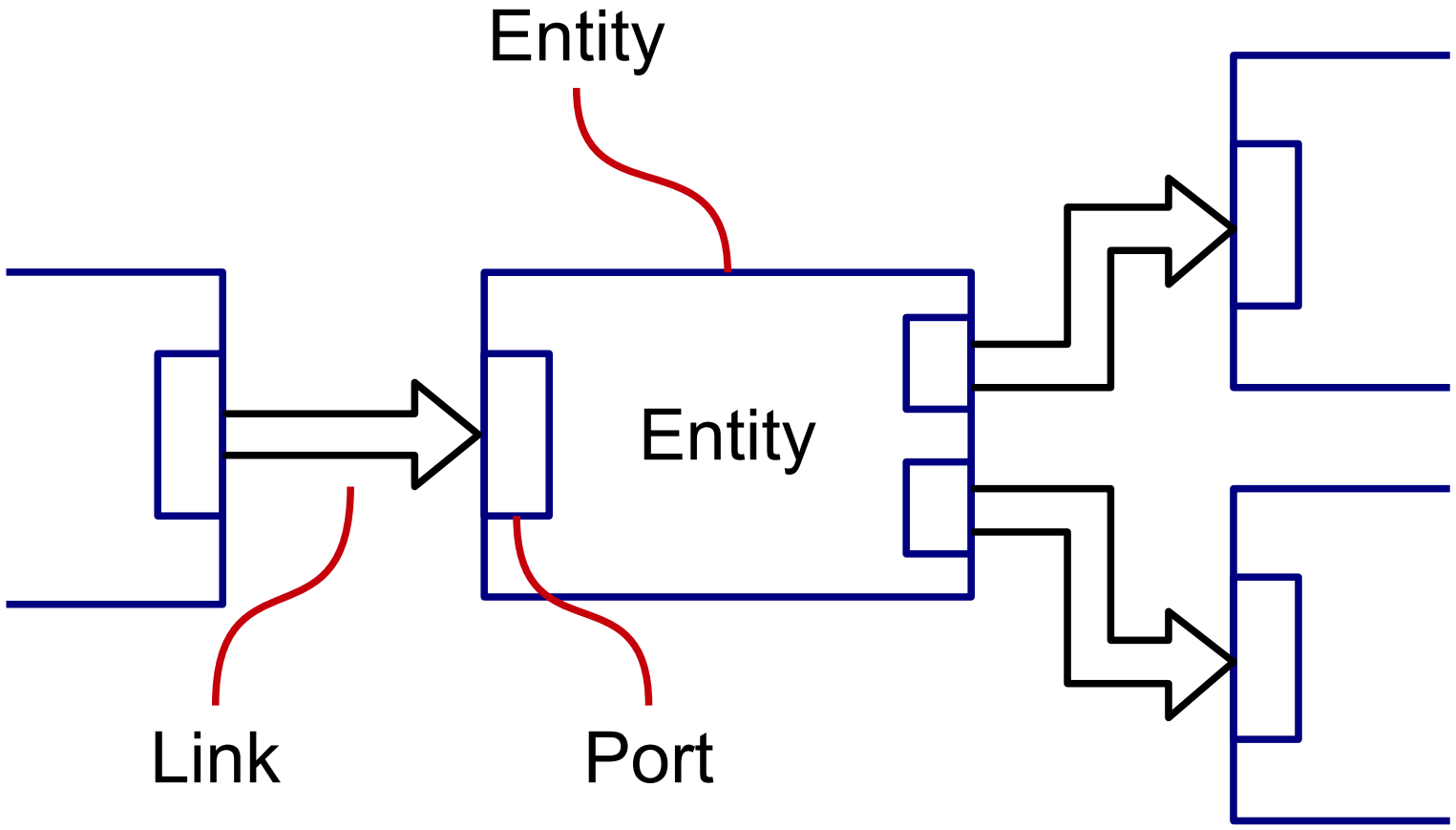


CDF – Configuration Model

- [RFC PATCH 0/4] exynos-drm-hdmi driver to CDF complaint display driver
- [RFC 0/6] Common Display Framework-T
- [RFC PATCH 0/4] Common Display Framework-TF
- [RFC 0/4] Use the Common Display Framework in tegra-drm
- [RFC 00/10] Versatile Express CLCD DVI output support

Positive Feedback

[RFC v3 00/19] Common Display Framework



CDF – Entity Model

```
struct display_entity {
        struct list_head list;
        struct device *dev;
        struct module *owner;
        struct kref ref;
        void(*release)(struct display_entity *ent);
        char name[32];
        struct media_entity entity;
        const struct display_entity_ops *ops;
        enum display_entity_state state;
        struct display_entity_match *match;
        struct display_entity_notifier *notifier;
};
```

CDF – Entity

```
hdmi_encoder {
    ports {
        #address-cells = <1>;
        #size-cells = <0>;

        port@0 {
            hdmi_input: endpoint@0 {
                remote = <&display_output>;
            };
        };
        port@1 {
            endpoint@0 { ... };
            endpoint@1 { ... };
        };
    };
};
```

CDF – Device Tree

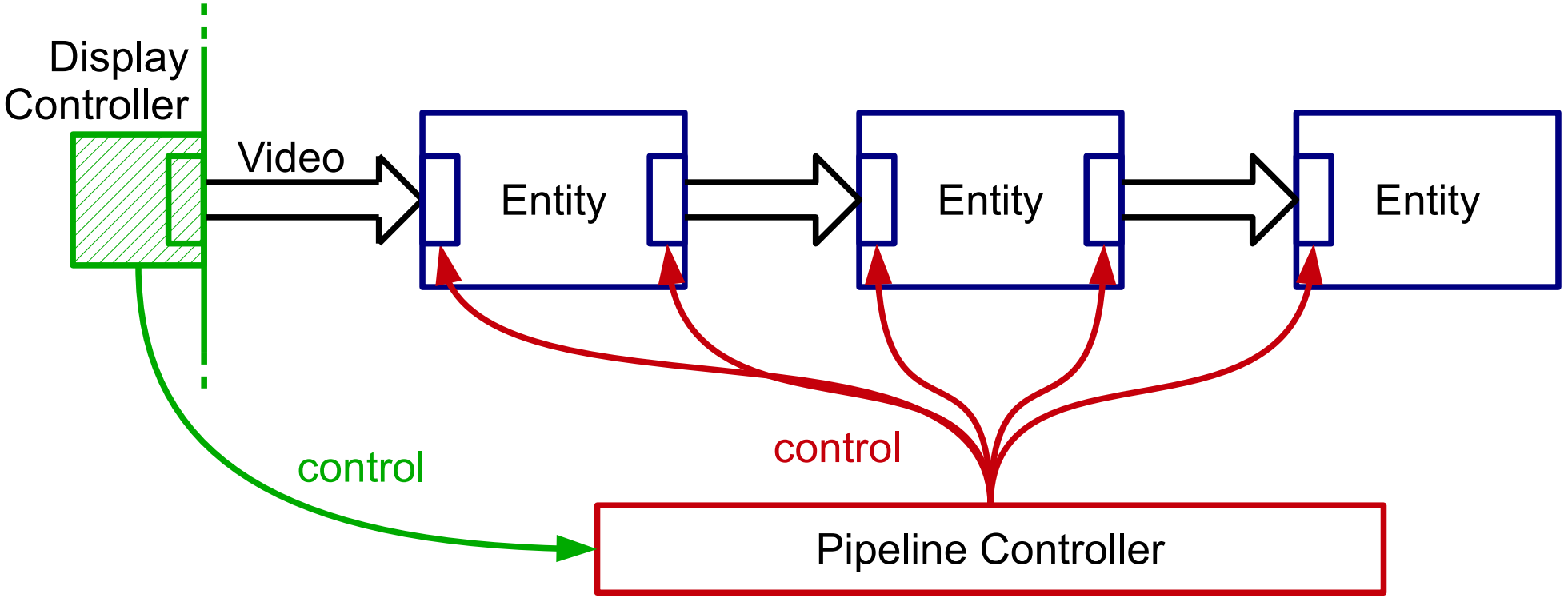
- [RFC PATCH 0/4] CDFv3: MIPI DSI bus implementation

Positive Feedback

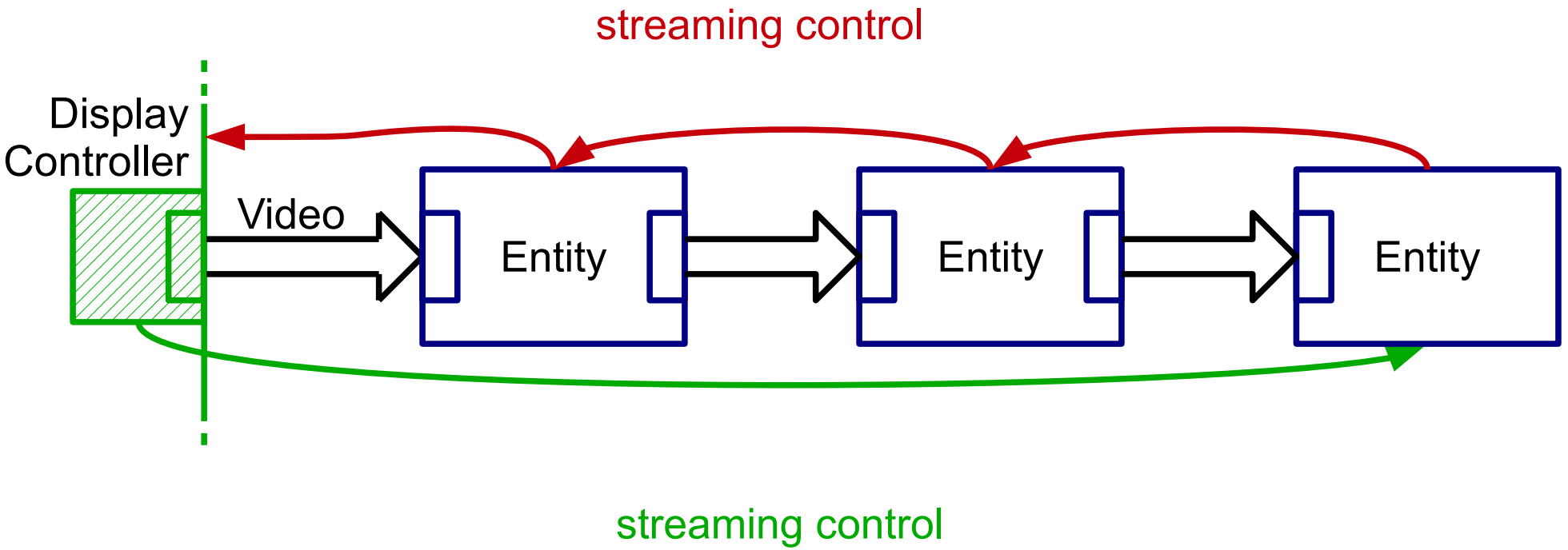
[PATCH v2 0/2] drm: Add drm_bridge and PTN3460 bridge driver

[RFR 0/2] DRM display panel support

[RFC v4]
TBD



CDF – Configuration Model



CDF – Streaming Control

```
struct display_entity_control_ops {
    int (*get_size)(struct display_entity *ent,
                    unsigned int *width,
                    unsigned int *height);
    int (*set_state)(struct display_entity *ent,
                     enum display_entity_state state);
    int (*update)(struct display_entity *ent);

    /* Port operations */
    int (*get_modes)(struct display_entity *entity,
                     unsigned int port,
                     const struct videomode **modes);
    int (*get_params)(struct display_entity *entity,
                      unsigned int port,
    struct display_entity_interface_params *params);
};
```

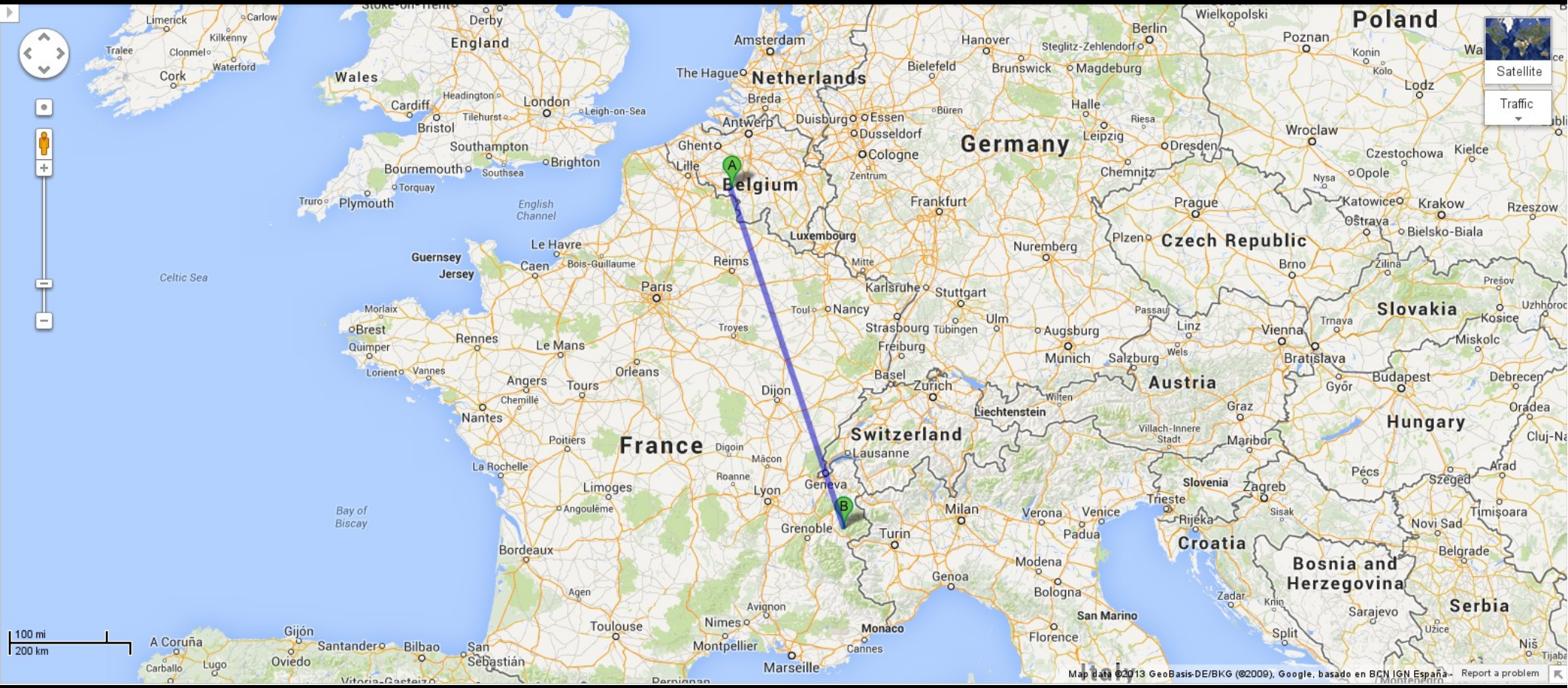
CDF – Control Operations

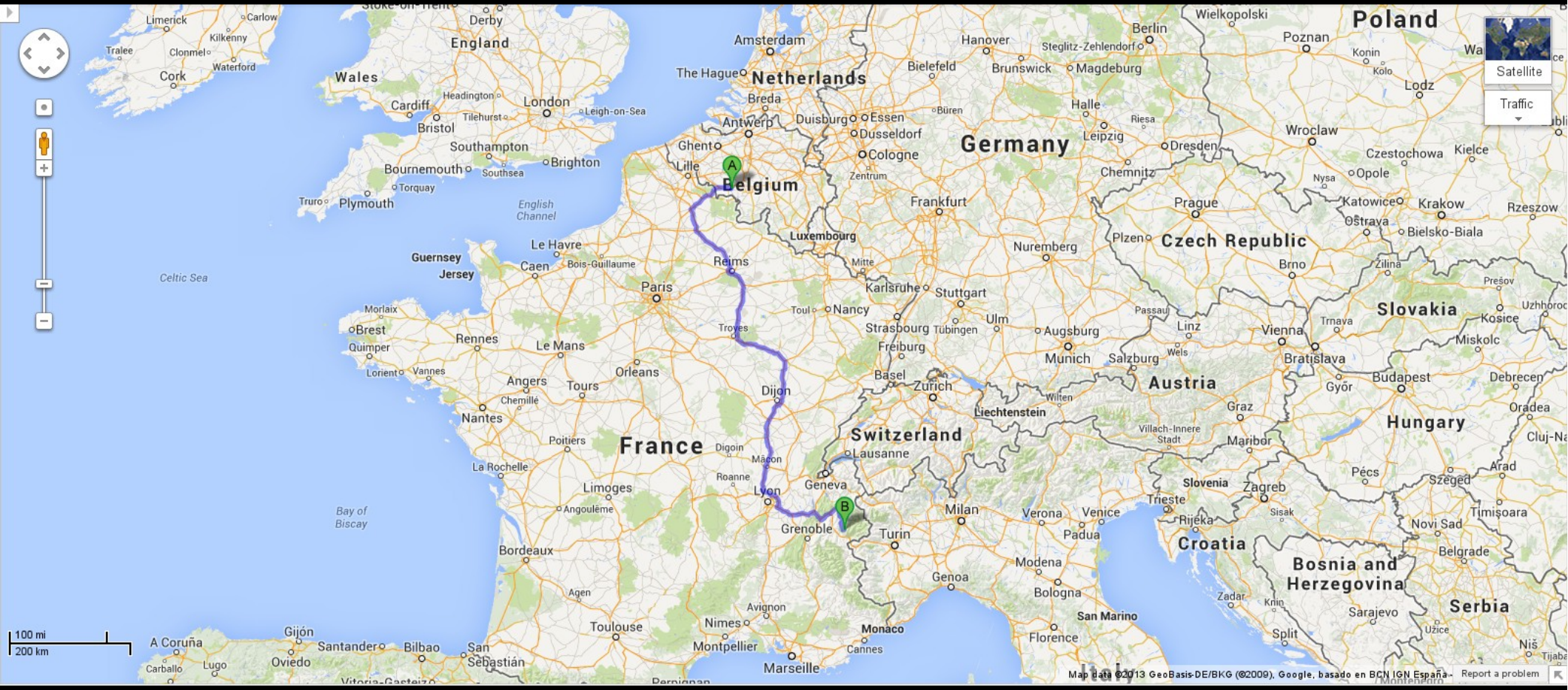
```
struct display_entity_video_ops {
    int (*set_stream)(struct display_entity *ent,
                      unsigned int port,
            enum display_entity_stream_state state);
};
```

CDF – Video Operations

Pushback

Satellite
Traffic
A
B
Poland
Netherlands
Belgium
Germany
Luxembourg
Czech Republic
Slovakia
Austria
Hungary
Switzerland
Liechtenstein
France
Slovenia
Croatia
Bosnia and Herzegovina
Serbia
Monaco
San Marino
England
Wales
Guernsey
Jersey
Celtic Sea
English Channel
Bay of Biscay
Limerick
Carlow
Kilkenny
Tralee
Clonmel
Waterford
Cork
Derby
Cardiff
Bristol
Headington
Tilehurst
London
Leigh-on-Sea
Southampton
Bournemouth
Southsea
Brighton
Torquay
Truro
Plymouth
Amsterdam
The Hague
Breda
Antwerp
Ghent
Lille
Duisburg
Essen
Dusseldorf
Cologne
Zentrum
Bielefeld
Hanover
Brunswick
Magdeburg
Steglitz-Zehlendorf
Berlin
Wielkopolski
Poznan
Konin
Kolo
Lodz
Büren
Halle
Leipzig
Riesa
Dresden
Chemnitz
Wroclaw
Czestochowa
Kielce
Nysa
Opole
Katowice
Krakow
Rzeszow
Ostrava
Bielsko-Biala
Frankfurt
Prague
Plzen
Nuremberg
Brno
Zilina
Presov
Kosice
Uzhhorod
Le Havre
Caen
Bois-Guillaume
Reims
Paris
Mitte
Karlsruhe
Stuttgart
Toul
Nancy
Passau
Linz
Vienna
Trnava
Bratislava
Miskolc
Morlaix
Brest
Quimper
Lorient
Vannes
Rennes
Le Mans
Troyes
Strasbourg
Tübingen
Ulm
Augsburg
Munich
Salzburg
Wels
Freiburg
Basel
Zurich
Wilten
Orleans
Angers
Tours
Chemillé
Nantes
Dijon
Graz
Villach-Innere Stadt
Maribor
Gyor
Budapest
Debrecen
Oradea
Cluj-Na
Poitiers
Digoin
Macon
Lausanne
La Rochelle
Limoges
Roanne
Geneva
Lyon
Angoulême
Grenoble
Turin
Milan
Verona
Venice
Padua
Trieste
Rijeka
Zagreb
Sisak
Pécs
Szeged
Arad
Timisoara
Novi Sad
Belgrade
Bordeaux
Modena
Bologna
Genoa
Agen
Avignon
Toulouse
Nimes
Montpellier
Marseille
Cannes
Florence
Zadar
Knin
Split
Sarajevo
Uzice
Nis
A Coruña
Gijón
Santander
Bilbao
San Sebastián
Carballo
Lugo
Oviedo
Vitoria-Gasteiz
Perpignan
Italy
100 mi
200 km
Map data ©2013 GeoBasis-DE/BKG (©2009), Google, basado en BCN IGN España -
Report a problem


A
B
Belgium
Netherlands
Germany
France
Switzerland
Luxembourg
Poland
Czech Republic
Slovakia
Austria
Hungary
Croatia
Bosnia and Herzegovina
Serbia
Slovenia
Italy
England
Wales
Ireland
Monaco
San Marino
Liechtenstein
Satellite
Traffic
100 mi
200 km
Map data ©2013 GeoBasis-DE/BKG (©2009), Google, basado en BCN IGN España - Report a problem


A
B
Belgium
Netherlands
Germany
France
Switzerland
Luxembourg
Poland
Czech Republic
Slovakia
Austria
Hungary
Croatia
Bosnia and Herzegovina
Serbia
Slovenia
Italy
England
Wales
Ireland
Monaco
San Marino
Liechtenstein
Satellite
Traffic
100 mi
200 km
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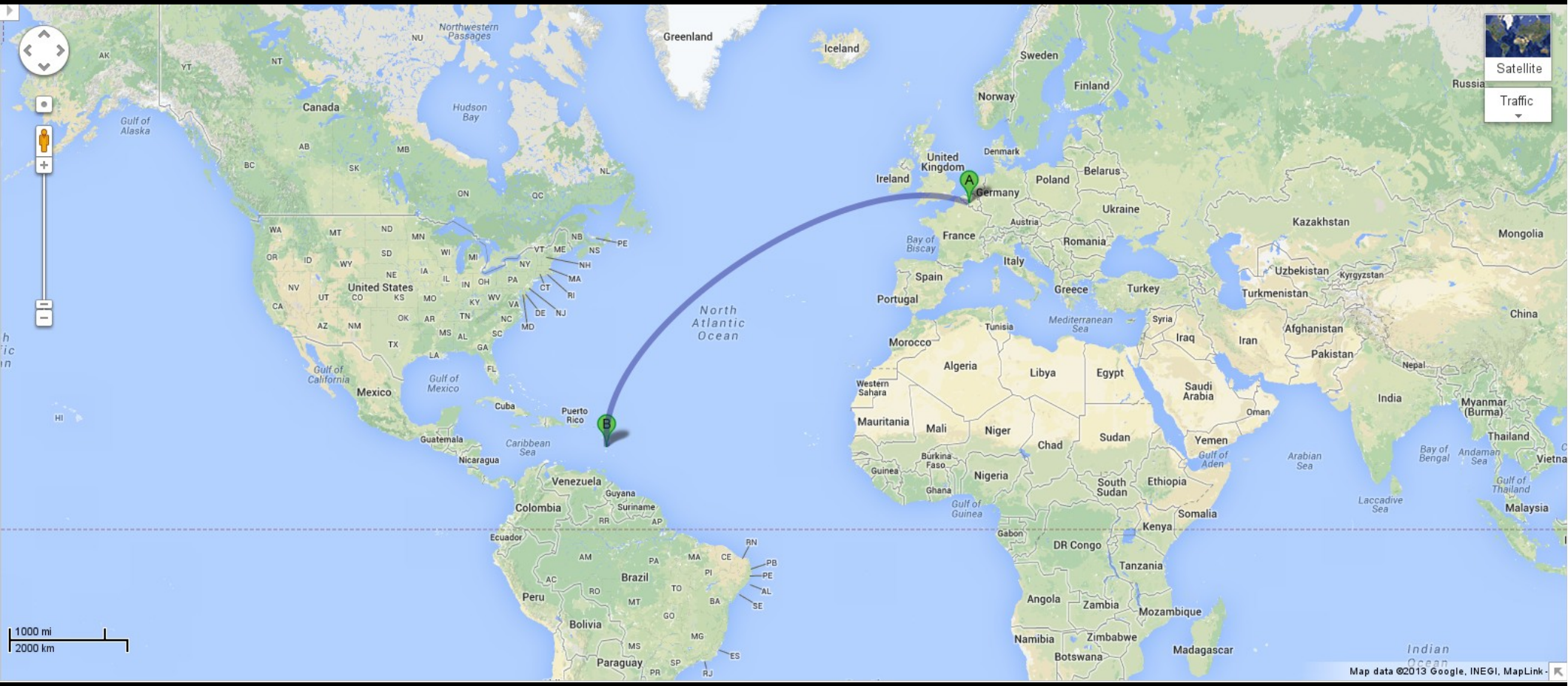
A
B
Satellite
Traffic
North Atlantic Ocean
Greenland
Iceland
Ireland
United Kingdom
Sweden
Finland
Norway
Russia
Denmark
Belarus
Poland
Germany
Ukraine
France
Austria
Romania
Kazakhstan
Mongolia
Italy
Spain
Portugal
Greece
Turkey
Uzbekistan
Kyrgyzstan
Turkmenistan
China
Afghanistan
Pakistan
Iran
Iraq
Syria
Mediterranean Sea
Bay of Biscay
Morocco
Algeria
Tunisia
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Saudi Arabia
Oman
Yemen
India
Nepal
Myanmar (Burma)
Thailand
Vietnam
Malaysia
Gulf of Aden
Arabian Sea
Bay of Bengal
Andaman Sea
Gulf of Thailand
Laccadive Sea
Gulf of Guinea
Burkina Faso
Guinea
Ghana
South Sudan
Ethiopia
Somalia
Kenya
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madagascar
Indian Ocean
Canada
Northwestern Passages
Hudson Bay
Gulf of Alaska
United States
Mexico
Gulf of California
Gulf of Mexico
Cuba
Puerto Rico
Caribbean Sea
Guatemala
Nicaragua
Venezuela
Guyana
Suriname
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
1000 mi
2000 km
Map data ©2013 Google, INEGI, MapLink

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Contact

Thenk ye.