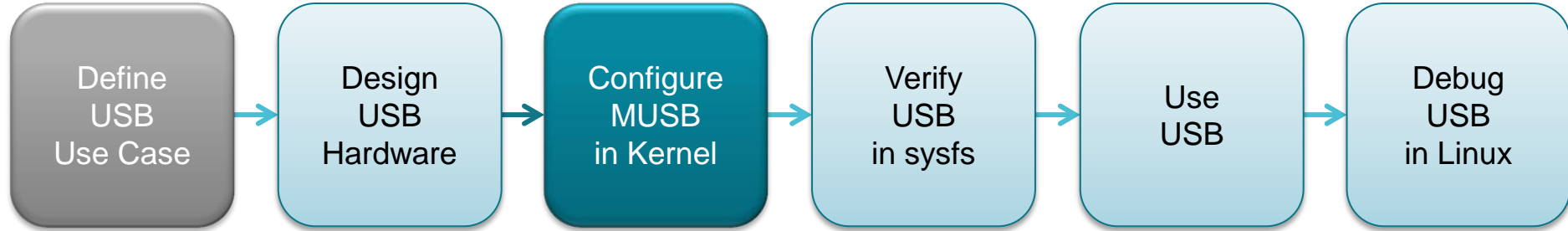


USB System Design in Sitara Devices Using Linux

[Part 2]: Configure MUSB in Linux Kernel

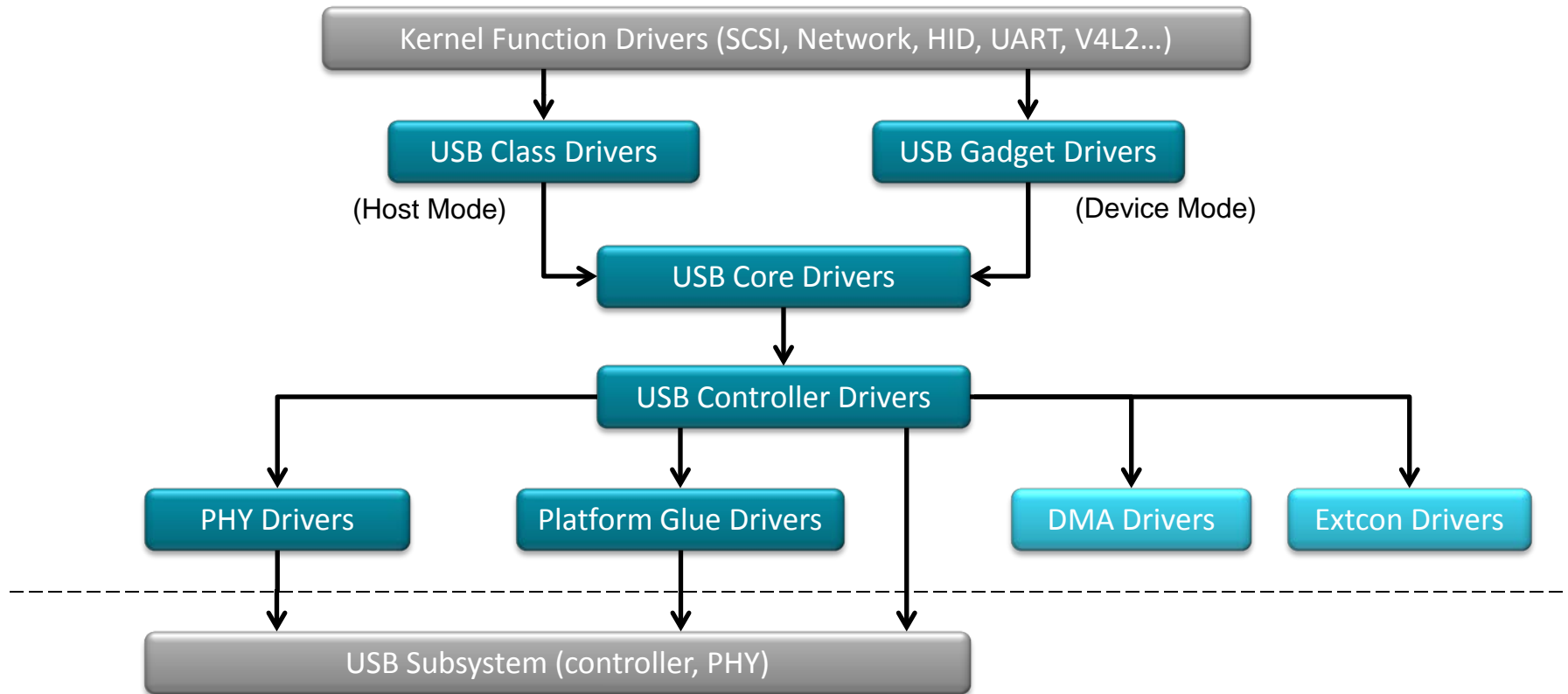
Bin Liu (EP, Processors)

Agenda

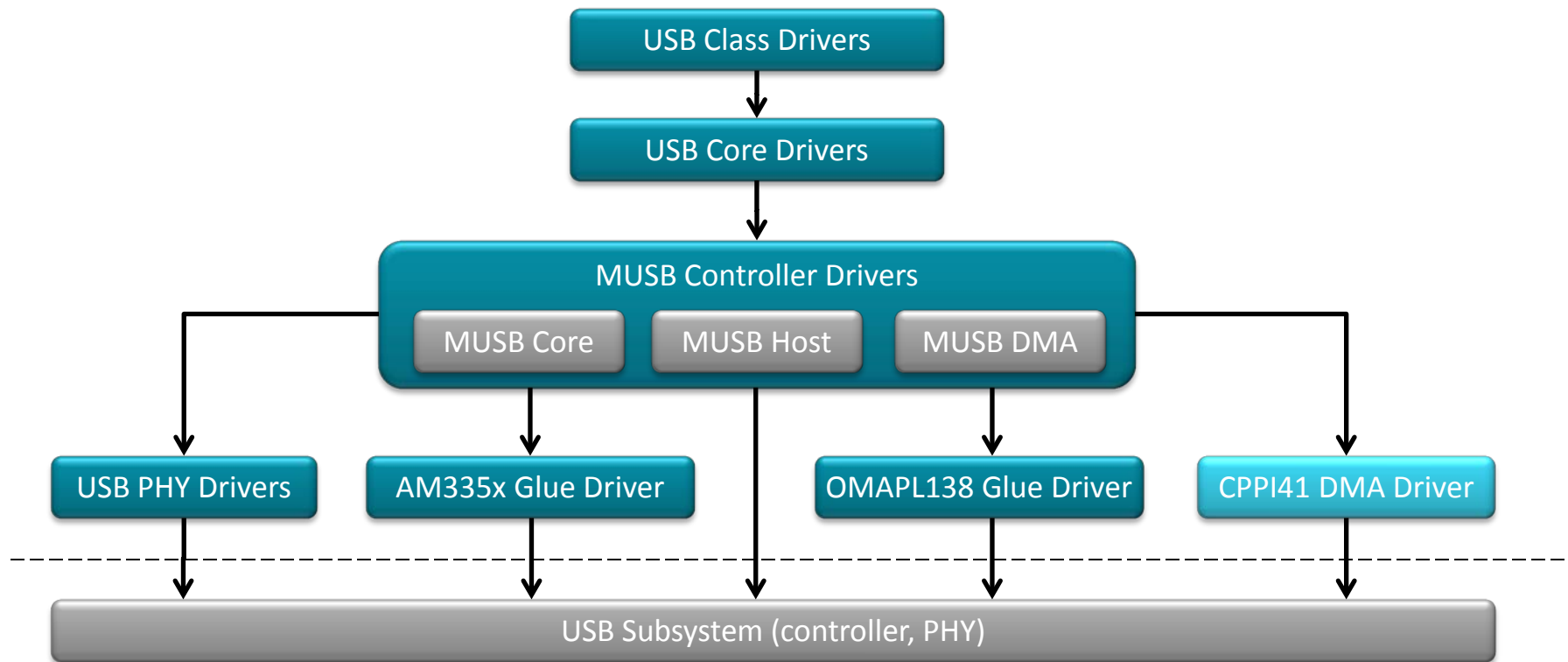


- Overview of Kernel USB stack
- MUSB driver structure
- MUSB kernel config options
- MUSB device tree binding

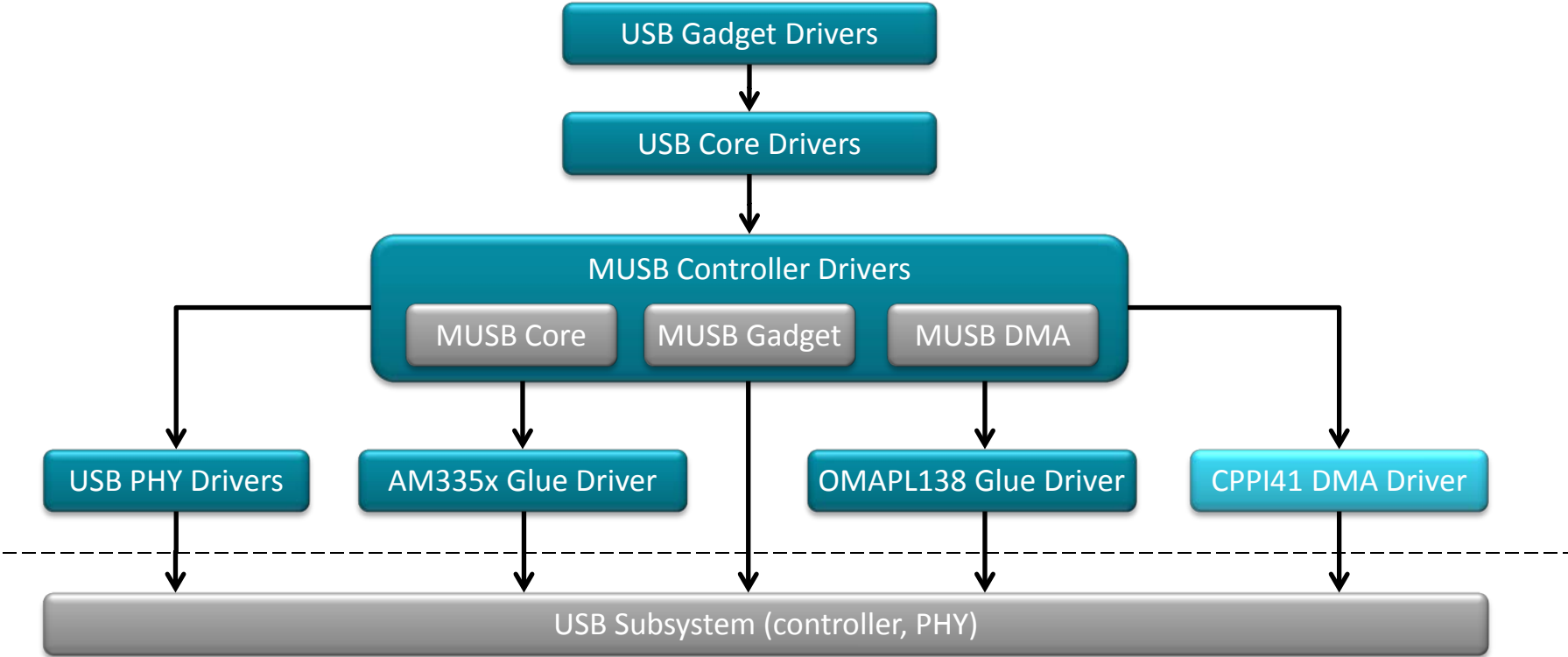
Kernel USB stack



MUSB host mode driver structure



MUSB device mode driver structure



MUSB kernel config options

- USB Class
- USB Gadget
- USB Core
- MUSB Controller
- MUSB Glue
- USB PHY
- CPPI41 DMA (optional)

USB class driver kernel config

- USB device classes:
 - Identifies the functionality of a USB device
 - For example: UAC (Audio), MSC (Mass Storage)
 - Each class has an ID defined by USB-IF
- Kernel config options for USB classes are not in a centralized place; Under each kernel function module
- Kernel defconfig has all/most class options enabled:
 - `tisdk_am335x-evm_defconfig`
 - `tisdk_omap1138-lcdk_defconfig`

USB gadget driver kernel config

Options are all located under

Device Drivers -->

USB support -->

USB Gadget Support

```
.config - Linux/arm 4.9.69 Kernel Configuration
> Device Drivers > USB support > USB Gadget Support
                                USB Gadget Support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
+-----+
|  [*] USB Gadget Support                                     |
|  [*]   Debugging messages (DEVELOPMENT)                  |
|  [ ]   Verbose debugging Messages (DEVELOPMENT)          |
|  [*]   Debugging information files (DEVELOPMENT)         |
|  [*]   Debugging information files in debugfs (DEVELOPMENT) |
|  (2)   Maximum VBUS Power usage (2-500 mA)                |
|  (2)   Number of storage pipeline buffers                 |
|         USB Peripheral Controller --->                   |
|  <M>   USB functions configurable through configs         |
|  [*]   Generic serial bulk in/out                        |
|  [*]   Abstract Control Model (CDC ACM)                   |
|  [*]   Object Exchange Model (CDC OBEX)                   |
|  [*]   Network Control Model (CDC NCM)                    |
|  [*]   Ethernet Control Model (CDC ECM)                   |
|  [*]   Ethernet Control Model (CDC ECM) subset           |
|  [*]   RNDIS                                              |
|  +-----+ v(+)+                                         |
|  +-----+ <Select> <Exit> <Help> <Save> <Load> +-----+ |
+-----+
```


USB core kernel config

Config Option Symbol:

CONFIG_USB_SUPPORT

CONFIG_USB

```
.config - Linux/arm 4.9.69 Kernel Configuration
> Device Drivers > USB support -----
                                USB support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
-----
|
| --- USB support
| [*] Support for Host-side USB
| [*] USB announce new devices
|   *** Miscellaneous USB options ***
| [*] Enable USB persist by default
| [ ] Dynamic USB minor allocation
| [ ] OTG support
| [ ] Rely on OTG and EH Targeted Peripherals List
| [ ] Disable external hubs
| < > USB port LED trigger
| <M> USB Monitor
| < > Support WUSB Cable Based Association (CBA)
|   *** USB Host Controller Drivers ***
| < > Cypress C67x00 HCD support
| <M> xHCI HCD (USB 3.0) support
| -M- Generic xHCI driver for a platform device
|
+ v(+)
```

<Select> < Exit > < Help > < Save > < Load >

OMAPL-138 MUSB glue kernel config

Config Option Symbol:

CONFIG_USB_MUSB_DA8XX

```
.config - Linux/arm 4.9.69 Kernel Configuration
> Device Drivers > USB support
                                USB support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
+-----^(-)-----+
| <M>  Inventra Highspeed Dual Role Controller (TI, ADI, AW, ...)
|      USB Mode Selection (Dual Role mode) --->
|      *** Platform Glue Layer ***
|      <M>  DA8xx/OMAP-L1x
|      *** USB DMA mode ***
|      [ ]  Disable DMA (always use PIO)
|      [*]  TI CPPI 4.1
|      <M>  DesignWare USB3 DRD Core Support
|          DWC3 Mode Selection (Dual Role mode) --->
|          *** Platform Glue Driver Support ***
|      < >  DesignWare USB2 DRD Core Support
|      < >  ChipIdea Highspeed Dual Role Controller
|      < >  NXP ISP 1760/1761 support
|          *** USB port drivers ***
|      <M>  USB Serial Converter support --->
|          *** USB Miscellaneous drivers ***
+-----v(+)-+
|
| <Select> < Exit > < Help > < Save > < Load >
+-----+-----+

```


CPPI41 DMA MUSB kernel config

Config Option Symbol:

CONFIG_USB_TI_CPPI41_DMA

```
.config - Linux/arm 4.9.69 Kernel Configuration
> Device Drivers > USB support -----
                                USB support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
+-----^(-)-----+
| <M>   Invenra Highspeed Dual Role Controller (TI, ADI, AW, ...)
|       USB Mode Selection (Dual Role mode) --->
|       *** Platform Glue Layer ***
| <M>   TUSB6010
| <M>   OMAP2430 and onwards
| <M>   AM35x
| <M>   TI DSPS platforms
|       *** MUSB DMA mode ***
| [ ]   Disable DMA (always use PIO)
| [ ]   Invenra
| [*]  TI CPPI 4.1
| [ ]   TUSB 6010
| <M>   DesignWare USB3 DRD Core Support
|       DWC3 Mode Selection (Dual Role mode) --->
|       *** Platform Glue Driver Support ***
| <M>   Texas Instruments OMAP5 and similar Platforms
+-----v(+)-----+
| <Select> < Exit > < Help > < Save > < Load >
```


PIO mode MUSB kernel config

Config Option Symbol:

CONFIG_MUSB_PIO_ONLY

```
.config - Linux/arm 4.9.69 Kernel Configuration
> Device Drivers > USB support -----
                                USB support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
+-----^(-)-----+
| <M>  Inventra Highspeed Dual Role Controller (TI, ADI, AW, ...)
|      MUSB Mode Selection (Dual Role mode) --->
|      *** Platform Glue Layer ***
| <M>  TUSB6010
| <M>  OMAP2430 and onwards
| <M>  AM35x
| <M>  TI DSPS platforms
|      *** MUSB DMA mode ***
| [*]  Disable DMA (always use PIO)
| <M>  DesignWare USB3 DRD Core Support
|      DWC3 Mode Selection (Dual Role mode) --->
|      *** Platform Glue Driver Support ***
| <M>  Texas Instruments OMAP5 and similar Platforms
| <M>  Generic OF Simple Glue Layer
| < >  DesignWare USB2 DRD Core Support
| < >  ChipIdea Highspeed Dual Role Controller
+-----v(+)-----+
| <Select>  < Exit >  < Help >  < Save >  < Load >
+-----+-----+
```

Kernel defconfig

Kernel defconfig which has USB config options enabled:

	AM335x	OMAPL-138
Processor SDK Kernel	tisdk_am335x-evm_defconfig	tisdk_omapl138-lcdk_defconfig
Community Kernel	omap2plus_defconfig	davinci_all_defconfig

* Use the defconfig as the base of the config, then fine tune for your project.

AM335x MUSB device tree binding

- USB-related DT nodes are defined in *am33xx.dtsi*
 - *am33xx.dtsi*: AM335x SoC DT definition
- USB node **status** property:
 - In *am33xx.dtsi*, default is set to “**disabled**”.
 - Set to “**okay**” in board DT file to enable the node.
- USB port **dr_mode** property:
 - In *am33xx.dtsi*, default is set to “**otg**” (dual-role).
 - Override it in the board DT file for non-OTG mode:
 - Host-only mode: **dr_mode = “host”**
 - Device-only mode: **dr_mode = “peripheral”**

am335x-bone-common.dtsi:

```
&usb {
    status = "okay";
};
&usb_ctrl_mod {
    status = "okay";
};
&usb0_phy {
    status = "okay";
};
&usb1_phy {
    status = "okay";
};
&usb0 {
    status = "okay";
    dr_mode = "peripheral";
};
&usb1 {
    status = "okay";
    dr_mode = "host";
};
&cppi41dma {
    status = "okay";
};
```

OMAP-L138 MUSB device tree binding

- USB-related DT nodes are defined in *da850.dtsi*
 - *da850.dtsi*: OMAP-L138 SoC DT definition
- USB node **status** property:
 - In *da850.dtsi*, default is set to “**disabled**”.
 - Exception: **cppi41dma** default is set to “**okay**” already
 - Set to “**okay**” in board DT file to enable the node
- USB port **dr_mode** property:
 - In *da850.dtsi*, default is set to “**otg**” (dual-role).
 - Override it in the board DT file for non-OTG mode:
 - Host-only mode: **dr_mode** = “**host**”
 - Device-only mode: **dr_mode** = “**peripheral**”

Da850-1cdk.dts:

```
&usb_phy {
    status = "okay";
};

&usb0 {
    status = "okay";
};
```

MUSB in fullspeed-only config

- MUSB works in high-speed by default.
- How to limit MUSB to full-speed only?
- Configure it in board DT file:
maximum-speed = "full-speed"
- The two MUSB modules can work on different maximum-speed independently.

```
&usb0 {  
    status = "okay";  
    dr_mode = "peripheral";  
    maximum-speed = "full-speed";  
};  
  
&usb1 {  
    status = "okay";  
    dr_mode = "host";  
    maximum-speed = "full-speed";  
};
```

For more information

- MUSB Linux Driver Configuration:
http://processors.wiki.ti.com/index.php/MUSB_Linux_Driver_Configuration
- AM335x MUSB Linux Porting Guide
http://processors.wiki.ti.com/index.php/MUSB_Linux_Porting_Guide
- AM335x MUSB DT Bindings Kernel Documentation
<https://www.kernel.org/doc/Documentation/devicetree/bindings/usb/am33xx-usb.txt>
- OMAPL-138 MUSB DT Bindings Kernel Documentation
<https://www.kernel.org/doc/Documentation/devicetree/bindings/usb/da8xx-usb.txt>
- USB Generic DT Bindings Kernel Documentation
<https://www.kernel.org/doc/Documentation/devicetree/bindings/usb/generic.txt>
- For questions about this training, refer to the E2E Community Forums at
<http://e2e.ti.com>



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