L3.14.28_1.0.0_GA
OTT Box Porting Notes

i.MX FAE August 2015
Agenda

• Source Codes Changes
  ➢ U-boot
  ➢ Linux Kernel
  ➢ Device Tree

• Yocto Project Modification

• Image Building Instructions

• QA
Source Codes Changes

• Here we focus on below source codes
  ➢ U-boot
  ➢ Linux Kernel
  ➢ Device Tree

• The modified source codes please refer to below files for more details.

  L3.14.28_1.0.0_ga_150805_ottbox_addon.zip
u-boot
What’s new in u-boot-2014.04

- Devices Tree Support

- board definitions are in the boards.cfg

Snatch:

Active arm armv7 mx6 freescale mx6sabresd
mx6qsabresd
mx6sabresd:IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg,MX6Q,DEFAULT_FDT_FILE="imx6q-sabresd.dtb",DDR_MB=1024,SYS_USE_SPINOR
What’s new in u-boot-2014.04 – DCD

- The DCD is pointed by IMX_CONFIG

<table>
<thead>
<tr>
<th>Active arm</th>
<th>armv7</th>
<th>mx6</th>
<th>freescale</th>
<th>mx6sabresd</th>
<th>mx6qsabresd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

mx6sabresd: IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg,
MX6Q,DEFAULT_FDT_FILE="imx6q-sabresd.dtb",DDR_MB=1024,SYS_USE_SPINOR

This change makes the DDR configuration in the IMX_CONFIG file

Note: u-boot 2009.08 DDR configuration is in the flash_header.S

Ex: board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg
    board/freescale/mx6qsabreauto/mx6q.cfg
What’s new in u-boot-2014.04 – DCD (Cont.)

- The DCD is taken care by the mkimage

```
# tools/mkimage.c
145 int
146 main (int argc, char **argv)
147 {
148     int ifd = -1;
149     struct stat sbuf;
150     char *ptr;
151     int retval = 0;
152     struct image_type_params *tparams = NULL;
153
154     /* Init Freescale PBL Boot image generation/list support */
155     init_pbl_image_type();
156     /* Init Kirkwood Boot image generation/list support */
157     init_kwb_image_type();
158     /* Init Freescale imx Boot image generation/list support */
159     init_imx_image_type();
160     /* Init FIT image generation/list support */
```

```
# tools/imximage.c
35 /*
36 * Supported commands for configuration file
37 */
38 static table_entry_t imximage_cmds[] = {
39         {CMD_BOOT_FROM,         "BOOT_FROM",
"boot command", },
40         {CMD_DATA,
"Reg Write Data", },
41         {CMD_IMAGE_VERSION,
"IMAGE_VERSION",        "image version", },
42         {CMD_PLUGIN,            "PLUGIN",
"file plugin_addr", },
43         {CMD_SECURE_BOOT,
"SECURE_BOOT",          "secure boot enable", },
44         {-1,                    
"",                       
"",                       
},
45 }
46
```

```
# board/freescale/mx6ottbox/mx6qottbox _4x_mt41j128.cfg

DATA 4, 0x020e056c, 0x00000030
DATA 4, 0x020e0578, 0x00000030
```
What’s new in u-boot-2014.04 – Compile Flag

• The compile flag could be passed from boards.cfg

Any FLAG in the boards.cfg will become compile flag, which is prefixed with CONFIG_ in the u-boot C files

<table>
<thead>
<tr>
<th>Active</th>
<th>arm</th>
<th>armv7</th>
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<th>freescale</th>
<th>mx6sabresd</th>
<th>mx6qsabresd</th>
<th>mx6sabresd:IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg, MX6Q,DEFAULT_FDT_FILE=&quot;imx6q-sabresd.dtb&quot;,DDR_MB=1024,SYS_USE_SPINOR</th>
</tr>
</thead>
</table>

The DDR_MB will become CONFIG_DDR_MB flag.
The SYS_USE_SPINOR will become CONFIG_SYS_USE_SPINOR flag.
What’s new in u-boot-2014.04 – LDO Bypass

- LDO passby in u-boot: it is moved from linux kernel to u-boot
  A flag `fsl,ldo-bypass` in device tree will tell u-boot to do ldo bypass to ldo enable

```
arch/arm/boot/dts /imx6qdl-sabresd.dtsi

&gpc {
    fsl,cpu_pupscr_sw2iso = <0xf>;
    fsl,cpu_pupscr_sw = <0xf>;
    fsl,cpu_pdnsr_iso2sw = <0x1>;
    fsl,cpu_pdnsr_iso = <0x1>;
    fsl,ldo-bypass = <1>; /* use ldo-bypass, u-boot will check it and configure */
    fsl,wdog-reset = <2>; /* watchdog select of reset source */
    pu-supply = <&pu_dummy>; /* ldo-bypass: use pu_dummy if VDDSOC share with VDDPU */
};
```

```
arch/arm/imx-common/cpu.c +200

void arch_preboot_os(void)
{
    #if defined(CONFIG_LDO_BYPASS_CHECK)
        ldo_mode_set(check_ldo_bypass());
    #endif
    #if defined(CONFIG_VIDEO_IPUV3)
        /* disable video before launching O/S */
        ipuv3_fb_shutdown();
    #endif
}
```

```
arch/arm/cpu/armv7/mx6/soc.c +838

int check_ldo_bypass(void)
{
    node = fdt_node_offset_by_compatible(gd->fdt_blob, -1, "fsl,imx6q-gpc");
    .......... 
    ldo_mode = fdt_getprop(gd->fdt_blob, node, "fsl,ldo-bypass", NULL);
    .......... 
}
```
What’s new in u-boot-2014.04 – LDO Bypass (Cont.)

- set_anatop_bypass called for ldo bypass in u-boot

```c
#define CONFIG_LDO_BYPASS_CHECK
void ldo_mode_set(int ldo_bypass)
{
    /* switch to ldo_bypass mode, boot on 800Mhz */
    if (ldo_bypass) {
        .................
        .................
        .................
        prep_anatop_bypass();
        (void)set_anatop_bypass(2);
        finish_anatop_bypass();
        printf("switch to ldo_bypass mode!\n");
    }
}
#endif
#endif
```
What’s new in u-boot-2014.04 – LDO Bypass (Cont.)

- Set the DCDC1 and DCDC2 voltage to ldo bypass voltage

**OTTBOX:**
- wolfson DCDC1 --- vdd_arm
- DCDC2 --- vdd_soc

Set the voltage to the ldo bypass voltage before switch to ldo bypass mode

<table>
<thead>
<tr>
<th>Run mode: LDO bypassed</th>
<th>VDD_ARM_IN</th>
<th>1.225</th>
<th>—</th>
<th>1.3</th>
<th>V</th>
<th>LDO bypassed for operation up to 852 MHz or 996 MHz (depending on the device speed grade).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDD_ARM23_IN</td>
<td>1.125</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
<td>LDO bypassed for operation up to 792 MHz.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.925</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
<td>LDO bypassed for operation up to 396 MHz.</td>
</tr>
<tr>
<td></td>
<td>VDD_SOC_IN</td>
<td>1.225</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
<td>264 MHz &lt; VPU ≤ 352 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.156</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
<td>VPU ≤ 264 MHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standby/DSM Mode</th>
<th>VDD_ARM_IN</th>
<th>0.9</th>
<th>—</th>
<th>1.3</th>
<th>V</th>
<th>See Table 10, &quot;Stop Mode Current and Power Consumption,&quot; on page 25.</th>
</tr>
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<td>VDD_ARM23_IN</td>
<td>0.9</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
Changes for OTTBox – IOMUX, PMIC I2C Function Mapping

- IOMUX changes for nand, emmc, sdcard and i2c
  - nand --- iomux_v3_cfg_t gpmi_pads[]
  - emmc --- iomux_v3_cfg_t const usdhc2_pads[]
  - sdcard --- iomux_v3_cfg_t const usdhc3_pads[]
  - i2c --- struct i2c_pads_info i2c_pad_info1

- Wolfson 16bit i2c function mapping

```c
static unsigned short wm831x_reg_read(uchar chip, unsigned short reg)
{
    unsigned short val = 0;
    i2c_read(chip, (unsigned int)reg, 2, (uchar *)&val, 2);
    val = uswap_16(val);        return val;
}
```

Note: int i2c_read(uchar chip, uint addr, int alen, uchar *buf, int len)

```c
int wm831x_reg_write(uchar chip, unsigned short reg, unsigned short val)
{
    val = uswap_16(val);
    return i2c_write(chip, (unsigned int)reg, 2, (uchar *)&val, 2);
}
```

Note: int i2c_write(uchar chip, uint addr, int alen, uchar *buf, int len)
Changes for OTTBox – MMC Index Fixed

- U-boot environment variable: `root=/dev/mmcblk2p2` in `include\configs\mx6ottbox_common.h`,

```
#define CONFIG_EXTRA_ENV_SETTINGS \
...
"bootargs=console=" CONFIG_CONSOLE_DEV ",115200
video=mxcfbo:dev=hdmi,1920x1080M@60,if=RGB24 " \
"root=/dev/mmcblk2p2 rootwait " \
Make above changes to align with below settings in device tree:
arch\arm\boot\dts\imx6qdl.dtsi
aliases {
...
mmc0 = &usdhc1;
mmc1 = &usdhc2;
\textbf{mmc2 = &usdhc3;}:
mmc3 = &usdhc4;
```
Add new files in u-boot source codes

```
├── board
│   └── freescale
│       └── mx6ottbox
│           ├── Makefile
│           ├── mx6dlottbox_4x_mt41j128.cfg  # board configuration (ex: DCD for DDR)
│           ├── mx6ottbox.c  # board c code
│           └── mx6qottbox_4x_mt41j128.cfg  # board configuration (ex: DCD for DDR)
│       └── plugin.S
│   └── mx6sabresd
│       ├── Makefile
│       └── boards.cfg
│           └── add mx6qottbox, mx6dlottbox ...
│       └── include
│           └── configs
│               ├── mx6ottbox_common.h  # ottbox common include
│               ├── mx6ottbox.h  # ottbox board include
│               ├── mx6sabresd_common.h  # sabresd common include
│               └── mx6sabresd.h  # ottbox board include
```

OTTBox porting is based on `mx6sabresd` with corresponding configuration and the DCD is configured base on DDR stress test result.
Linux Kernel
What’s New in L3.14.28

- Device Tree
- Configuration Based on arm core version

  imx_v4_v5_defconfig
  imx_v7_defconfig
  imx_v7_mfg_defconfig
Major changes in kernel for OTTBox

- Disable the Touch Screen
  -> Device Drivers
    -> Input device support
      -> Touchscreens

- Add Micrel KSZ886X Switch KSZ8081 fixup
  arch/arm/mach-imx/mach-imx6q.c

```
static int ksz8081rn_phy_fixup(struct phy_device *dev)
{
    dev->dev_flags |= MICREL_PHY_50MHZ_CLK;
}

static void __init imxq_enet_phy_init(void)
{
    if (IS_BUILTIN(CONFIG_PHYLIB)) {
        ..............
        phy_register_fixup_for_uid(PHY_ID_KSZ8081, MICREL_PHY_ID_MASK,
                                   ksz8081rn_phy_fixup);
        ..............
    }
}
```
Major changes in kernel for OTTBox (cont.)

- Add configuration symbol for DCDC ldo bypass with cpu frequency scaling

Configuration:

CPU Power Management  --->
   CPU Frequency scaling  --->
      ARM CPU frequency scaling drivers  --->
         [*] Freescale i.MX6 cpufreq support DCDC with ldo-bypass

Source code changes:

drivers/cpufreq/imx6q-cpufreq.c

#if !defined(CONFIG_ARM_IMX6_CPUFREQ_DCDC_LDOBYPASS)
   /* scaling up? scale voltage before frequency */
   if (freqs.new > freqs.old) {

............
Add WIFI support for OTTBox

• add wifi support for REALTEK RTL8723AS.
  L3.14.28_1.0.0_GA doesn’t support wifi module rtl8723as (SDIO) on OTTBox board.

• copy the driver source codes from KK4.4.3 kernel source codes
drivers/net/wireless/rtlwifi/rtl8723as

• modify Kconfig and Makefile in the directory add below:
in Kconfig
config RTL8723AS
  tristate "Realtek RTL8723as Wireless Network Adapter"
depends on RTLWIFI
  ---help---
  This is the driver for Realtek RTL8723as sdio wireless network adapters

in Makefile
obj-$(CONFIGRTL8723AS) += rtl8723as/
Add WIFI support for OTTBox (cont.)

- configuration:

ARCH=arm make menuconfig

device drivers --->
   network device support --->
      wireless LAN --->
<*> Realtek RTL8723as Wireless Network Adapter
Device Tree
How to build the Device Tree

dts file name ABC.dts

Build command line
ARCH=arm make CROSS_COMPILE=arm-poky-linux-gnueabi- ABC.dtb

Example:
To build
arch/arm/boot/dts/imx6q-sabresd.dts

ARCH=arm make CROSS_COMPILE=arm-poky-linux-gnueabi- imx6q-sabresd.dtb
The Device Tree Compiler (DTC)

The device tree compiler is located in the scripts/dtc.

The `dtc` compiles the dts file to dtb: DTS $\rightarrow$ DTC $\rightarrow$ DTB

The following is the DTB format:

```
struct boot_param_header
    (alignment gap) (*)
memory reserve map
    (alignment gap) (*)
device-tree structure
    (alignment gap) (*)
device-tree strings
```
What is Device tree

Device Tree is a matching mechanism outside of the linux kernel replacing old matching mechanism.

Old matching: driver/base

Driver:
Drivers\mfd\ pfuze-core.c
static const struct i2c_device_id pfuze_device_id[] =
 {
    "pfuze100", 0,
 },
};

enum pfuze_id {
    PFUZE_ID_PFUZE100,
    PFUZE_ID_INVALID,
};
static const char *pfuze_chipname[] = {
    [PFUZE_ID_PFUZE100] = "pfuze100",
};

Board init:
arch\arm\mach-mx6\ board-mx6q_sabresd.c
mx6q_sabresd_init_pfuze100

arch\arm\mach-mx6\mx6q_sabresd_pmic_pfuze100.c
static struct i2c_board_info __initdata pfuze100_i2c_device = {
    I2C_BOARD_INFO(PFUZE100_I2C_DEVICE_NAME, PFUZE100_I2C_ADDR),
    .platform_data = &pfuze100_plat,
};

int __init mx6q_sabresd_init_pfuze100(u32 int_gpio)
{
    pfuze100_i2c_device.irq = gpio_to_irq(int_gpio); /*update INT gpio */
    return i2c_register_board_info(1, &pfuze100_i2c_device, 1);
}
What is Device tree (cont.)

Device Tree matching:  driver/of

Driver:

drivers\regulator\pfuze100-regulator.c

static const struct of_device_id pfuze_dt_ids[] = {
    { .compatible = "fsl,pfuze100" },
    {},
};

static struct i2c_driver pfuze_driver = {
    .id_table = pfuze_device_id,
    .driver = {
        .name = "pfuze100-regulator",
        .owner = THIS_MODULE,
        .of_match_table = pfuze_dt_ids,
    },
    .probe = pfuze100_regulator_probe,
    .remove = pfuze100_regulator_remove,
};

Device Tree:

arch/arm/boot/dts/imx6qdl-sabresd.dtsi

&i2c2 {
    ...... 
    ...... 
    pmic: pfuze100@08 {
        compatible = "fsl,pfuze100";
        reg = <0x08>;
    }
}
Platform Matching Vs. Device Tree Matching Example

L3.0.35_410
board-mx6q_sabresd.c

```c
796 static struct i2c_board_info mxc_i2c0_board_info[]
    __initdata = {
797     { I2C_BOARD_INFO("wm89***", 0x1a),
799     },
800     { I2C_BOARD_INFO("ov564x", 0x3c),
802     .platform_data = (void *)&camera_data,
803     },
804     { I2C_BOARD_INFO("mma8451", 0x1c),
806     .platform_data = (void *)&mma8451_position,
807     },
808 );
809
1816   i2c_register_board_info(0, mxc_i2c0_board_info,
1817       ARRAY_SIZE(mxc_i2c0_board_info));
```

Note: In Old kernel the i2c index is **Zero** Base (i2c0, i2c1, i2c2)

L3.14.28_1.0.0_ga
imx6qdl-sabresd.dtsi

```dts
317 &i2c1 {
318   clock-frequency = <100000>;
319   pinctrl-names = "default";
320   pinctrl-0 = <&pinctrl_i2c1_2>;
321   status = "okay";
322   codec: wm8962@1a {
323     compatible = "wlfs,wm8962";
324     reg = <0x1a>;
325   }
326   ov564x: ov564x@3c {
327     compatible = "ovti,ov564x";
328     reg = <0x3c>;
329   }
330   mma8451@1c {
331     compatible = "fsl,mma8451";
332     reg = <0x1c>;
333   }
334 }
```

Note: In device tree, the i2c index is **One** Base (i2c1, i2c2, i2c3)
Bindings

All the devices supported by devices have the binding document in the following directory.

Any device NOT in the bindings could not be supported by the devices tree matching.
But still can use platform matching(old way) but ugly code

Documentation/devicetree/bindings

Snatch:

Documentation/devicetree/bindings/net/fsl-fec.txt

* Freescale Fast Ethernet Controller (FEC)
  Required properties:
  - compatible : Should be "fsl,<soc>-fec"
  - reg : Address and length of the register set for the device
  - interrupts : Should contain fec interrupt
  Optional properties:
  - local-mac-address : 6 bytes, mac address
  - phy-reset-gpios : Should specify the gpio for phy reset
  - phy-reset-duration : Reset duration in milliseconds. Should present only if property "phy-reset-gpios" is available. Missing the property will have the duration be 1 millisecond. Numbers greater than 1000 are invalid and 1 millisecond will be used instead.

Example:

ethernet@83fec000 { compatible = "fsl,imx51-fec", "fsl,imx27-fec";
  reg = <0x83fec000 0x4000>;
  interrupts = <87>;
  phy-mode = "mii";
  phy-reset-gpios = <&gpio2 14 0>; /* GPIO2_14 */
  local-mac-address = [00 04 9F 01 1B B9];
Device Tree Dependency

After making dtb, below files will be generated in arch/arm/boot/dts/ directory:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>imx6q-sabresd.dtb</td>
<td>Device tree file</td>
</tr>
<tr>
<td>.imx6q-sabresd.dtb.cmd</td>
<td>Command file for generating dtb</td>
</tr>
<tr>
<td>.imx6q-sabresd.dtb.d.dtc.tmp</td>
<td>Temporary file for dmcrypt</td>
</tr>
<tr>
<td>.imx6q-sabresd.dtb.d.pre.tmp</td>
<td>Pre-processed file for dmcrypt</td>
</tr>
<tr>
<td>.imx6q-sabresd.dtb.dts.tmp</td>
<td>Pre-processed file for dmcrypt</td>
</tr>
</tbody>
</table>

In the file .imx6q-sabresd.dtb.cmd we could get the device tree dependency:

```plaintext
deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \ 
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \ 
    ----arch/arm/boot/dts/imx6q-pinfunc.h \ 
    ----arch/arm/boot/dts/imx6qdl.dtsi \ 
    ........arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \ 
    ........arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \ 
    ........arch/arm/boot/dts/skeleton.dtsi \ 
    arch/arm/boot/dts/imx6qdl-sabresd.dtsi \ 
    ....arch/arm/boot/dts/include/dt-bindings/input/input.h \ 
```
Device Tree Dependency (cont.)

deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \ 
  arch/arm/boot/dts/imx6q.dtsi \ 
  ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \ 
  ----arch/arm/boot/dts/imx6q-pinfunc.h \ 
  ----arch/arm/boot/dts/imx6qdl.dtsi \ 
  ------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \ 
  ------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \ 
  ------arch/arm/boot/dts/skeleton.dtsi \ 
  arch/arm/boot/dts/imx6qdl-sabresd.dtsi \ 
  ----arch/arm/boot/dts/include/dt-bindings/input/input.h \ 

---

imx6q-sabresd.dts

<table>
<thead>
<tr>
<th>imx6qdl-sabresd.dtsi</th>
<th>imx6q.dtsi</th>
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<tbody>
<tr>
<td>input.h</td>
<td></td>
</tr>
<tr>
<td>gpio.h</td>
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</tr>
<tr>
<td>imx6qdl.dtsi</td>
<td></td>
</tr>
<tr>
<td>skeleton.dtsi</td>
<td></td>
</tr>
<tr>
<td>imx6q-pinfunc.h</td>
<td></td>
</tr>
<tr>
<td>irq.h</td>
<td></td>
</tr>
</tbody>
</table>

board level

chip level

head file
OTTBox Device Tree Dependency (compare with SabreSD)

```
<table>
<thead>
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<th>imx6q-sabresd.dts</th>
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```

```
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</tr>
<tr>
<td>imx6q-pinfunc.h</td>
</tr>
<tr>
<td>irq.h</td>
</tr>
</tbody>
</table>

```

board level  chip level  head file
Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6q-sabresd

arch/arm/boot/dts/.imx6q-sabresd.dtb.cmd:

deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
  arch/arm/boot/dts/imx6q.dtsi \ 
  ----arch/arm/boot/dts/imx6q-pinfucn.h \ 
  ----arch/arm/boot/dts/imx6qdl.dtsi \ 
  --------arch/arm/boot/dts/skeleton.dtsi \ 
  -------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \ 
  arch/arm/boot/dts/imx6qdl-sabresd.dtsi \ 

- imx6q-sabresd.dts
- imx6qdl-sabresd.dtsi
- imx6q.dtsi
- imx6qdl.dtsi
- gpio.h
- skeleton.dtsi
- imx6q-pinfucn.h
Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6dl-sabresd

arch/arm/boot/dts/.imx6dl-sabresd.dtb.cmd:

deps_arch/arm/boot/dts/imx6dl-sabresd.dtb := \n  arch/arm/boot/dts/imx6dl.dtsi \n  ----arch/arm/boot/dts/imx6dl-pinfunc.h \n  ----arch/arm/boot/dts/imx6qdl.dtsi \n  ------arch/arm/boot/dts/skeleton.dtsi \n  --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \n  arch/arm/boot/dts/imx6qdl-sabresd.dtsi \n  arch/arm/boot/dts/imx6dl-sabresd-common.dtsi \n
---

```
import DeviceTree
import imx6dl-dtsi
import imx6dl
import imx6qdl-dtsi
import skeleton-dtsi
import gpio
import gpio.h
import arch/arm/boot/dts/imx6qdl-sabresd.dtsi
import arch/arm/boot/dts/imx6dl-sabresd-common.dtsi
```

---

```
import gpio
import gpio.h
import skeleton-dtsi
```
Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6q-sabreauto

arch/arm/boot/dts/.imx6q-sabreauto.dtb.cmd:

deps_arch/arm/boot/dts/imx6q-sabreauto.dtb := \
  arch/arm/boot/dts/imx6q.dtsi \
  ----arch/arm/boot/dts/imx6q-pinfunc.h \
  ----arch/arm/boot/dts/imx6qdl.dtsi \
  --------arch/arm/boot/dts/skeleton.dtsi \
  --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
  arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \

Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6dl-sabreauto

```
arch/arm/boot/dts/.imx6dl-sabreauto.dtb.cmd:

deps_arch/arm/boot/dts/imx6dl-sabreauto.dtb := \
arch/arm/boot/dts/imx6dl.dtsi \
----arch/arm/boot/dts/imx6dl-pinfunc.h \
----arch/arm/boot/dts/imx6qdl.dtsi \
-------arch/arm/boot/dts/skeleton.dtsi \
-------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \\
```

![Device Tree Diagram]
L3.14.28_1.0.0 for mx6q-sabresd

arch/arm/boot/dts/.imx6q-sabresd.dtb.cmd:

defs_arch/arm/boot/dts/dts/imx6q-sabresd.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
    ----arch/arm/boot/dts/imx6q-pinfunc.h \
    ----arch/arm/boot/dts/imx6qdl.dtsi \
    -------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
    -------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
    -------arch/arm/boot/dts/skeleton.dtsi \
    arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/input/input.h \

<table>
<thead>
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</tr>
<tr>
<td>skeleton.dtsi</td>
</tr>
</tbody>
</table>
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6dl-sabresd

arch/arm/boot/dts/.imx6dl-sabresd.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6dl-sabresd.dtb := \ 
arch/arm/boot/dts/imx6dl.dtsi \ 
----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \ 
----arch/arm/boot/dts/imx6dl-pinfunc.h \ 
----arch/arm/boot/dts/imx6qdl.dtsi \ 
-------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \ 
-------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \ 
-------arch/arm/boot/dts/skeleton.dtsi \ 
arch/arm/boot/dts/imx6qdl-sabresd.dtsi \ 
----arch/arm/boot/dts/include/dt-bindings/input/input.h 
```
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6q-sabreauto

arch/arm/boot/dts/.imx6q-sabreauto.dtb.cmd:

deps_arch/arm/boot/dts/imx6q-sabreauto.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
    ----arch/arm/boot/dts/imx6q-pinfunc.h \
    ----arch/arm/boot/dts/imx6qdl.dtsi \
    --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
    --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
    --------arch/arm/boot/dts/skeleton.dtsi \
    arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/input/input.h \

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</tr>
<tr>
<td></td>
<td>imx6q-pinfunc.h</td>
<td>irq.h</td>
</tr>
</tbody>
</table>
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6dl-sabreauto

arch/arm/boot/dts/.imx6dl-sabreauto.dtb.cmd:

deps_arch/arm/boot/dts/imx6dl-sabreauto.dtb := \ 
  arch/arm/boot/dts/imx6dl.dtsi \ 
  ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \ 
  ----arch/arm/boot/dts/imx6dl-pinfunc.h \ 
  ----arch/arm/boot/dts/imx6qdl.dtsi \ 
  -------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \ 
  -------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \ 
  -------arch/arm/boot/dts/skeleton.dtsi \ 
  arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \ 
  --------arch/arm/boot/dts/include/dt-bindings/input/input.h \ 

<table>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>irq.h</td>
</tr>
</tbody>
</table>
Device Tree Tips

Device Status:

status = "okay"    --- The device with = "okay" will be matched
status = "disabled"    --- The device with = "disabled" will be ignored

usdhc1 is disabled
usdhc1: usdhc@02190000 {
    compatible = "fsl,imx6q-usdhc";
    reg = <0x02190000 0x4000>;
    interrupts = <0 22 0x04>;
    clocks = <&clks 163>, <&clks 163>, <&clks 163>;
    clock-names = "ipg", "ahb", "per";
    bus-width = <4>;
    status = "disabled";
};

usbh1 is enabled
&usbh1 {
    vbus-supply = <&reg_usb_h1_vbus>;
    status = "okay";
}
Device Tree Tips (cont.)

The pinctl is mainly defined in imx6qdl-ottbox.dtsi, only a few defined in imx6q-ottbox.dts or imx6dl-ottbox.dts.

The macros are in the header files:
imx6dl-pinfunc.h  imx6q-pinfunc.h  imx6sl-pinfunc.h

Example:

```
uart1 {
    pinctrl_uart1_1: uart1grp-1 {
        fsl,pins = <
            MX6QDL_PAD_CSI0_DAT10__UART1_TX_DATA 0x1b0b1
            MX6QDL_PAD_CSI0_DAT11__UART1_RX_DATA 0x1b0b1
        >;
    }
}
```

```
&uart1 {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_uart1_1>;
    status = "okay";
}
```

Here:  **MX6QDL_PAD_CSI0_DAT10__UART1_TX_DATA** is function control.
The value **0x1b0b1** is pad settings.
Device Tree Tips (cont.)

The last value of the property will be the final value.
Example:

```
usbh1
```

```
imx6qdl.dtsi
&usbh1 {
  vbus-supply = <&reg_usb_h1_vbus>;
  status = "okay";
}
```

```
imx6qdl-sabresd.dtsi
&usbh1 {
  vbus-supply = <&reg_usb_h1_vbus>;
  status = "Disabled";
}
```

The final value of `status` is **Disabled**
The final value of `vbus-supply` is **reg_usb_h1_vbus**
Device Tree Tips (cont.)

The include will merge the different properties together

```c
imx6qdl.dtsi
usbotg {
    pinctrl_usbotg_1: usbotggrp-1 {
        ....................
    };
    pinctrl_usbotg_2: usbotggrp-2 {
        ....................
    };
};
```

```c
imx6qdl-ottbox.dtsi
&usbotg {
    pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
        ....................
    };
};
```

Compiled DTB:
```
usbotg {
    pinctrl_usbotg_1: usbotggrp-1 {
        ....................
    };
    pinctrl_usbotg_2: usbotggrp-2 {
        ....................
    };
    pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
        ....................
    };
};
```
Device Tree Tips (cont.)

How to check the dts error with so many includings
Once the dts is compiled, the dtb compiler will expand all the includings into one temporary dts file
You can check this file for including issues

Snatch:
/arch/arm/boot/dts/.imx6q-sabresd.dtb.dts.tmp

1836  };  
1837  };  
1838  };  
1839 # 13 "arch/arm/boot/dts/imx6q.dtsi" 2

1840  
1841 / {  
1842  aliases {  
1843   ipu1 = &ipu2;  
1844  };  

..............................................

..............................................

2760  
2761 &vpu {  
2762  pu-supply = <&pu_dummy>;  
2763 };  
2764 # 17 "arch/arm/boot/dts/imx6q-sabresd.dts" 2

2765  
2766 / {  
2767  model = "Freescale i.MX6 Quad SABRE Smart Device Board";  
2768  compatible = "fsl,imx6q-sabresd", "fsl,imx6q";  
2769 };  
2770
The pinctrl conflicts

The linux kernel will print out the pinctrl(iomux) conflicts

Check and correct till no error

imx6q-pinctrl 20e0000.iomuxc: pin MX6Q_PAD_KEY_ROW0 already requested by 21f0000.serial; cannot claim for 2008000.ecspi
imx6q-pinctrl 20e0000.iomuxc: pin-127 (2008000.ecspi) status -22
imx6q-pinctrl 20e0000.iomuxc: could not request pin 127 on device 20e0000.iomuxc
spi_imx 2008000.ecspi: Error applying setting, reverse things back
Major changes in OTTBox – Power

- power vdd_arm and vdd_soc

imx6qdl-ottbox.dtsi:

&cpu0 {
    arm-supply = <&VDD_ARM_DCDC1>;
    soc-supply = <&VDD_SOC_DCDC2>;
};

Note: LDO is bypassed on OTTBox board due to overheat issue. See slide 17 for reference.

imx6qdl-ottbox.dtsi:

VDD_ARM_DCDC1: vddarm_dcdc1 {
    compatible = "regulator-fixed";
    regulator-name = "vddarm_dcdc1";
    enable-active-high;
};

VDD_SOC_DCDC2: vddsoc_dcdc2 {
    compatible = "regulator-fixed";
    regulator-name = "vddsoc_dcdc2";
    enable-active-high;
};
Major changes in OTTBox – UART

- uart
  enable uart 4 and disable all the others

**imx6qdl-ottbox.dtsi:**

```dts
&uart4 {
  pinctrl-names = "default";
  pinctrl-0 = &pinctrl_uart4_1;
  status = "okay";
};
```

**imx6qdl-ottbox.dtsi:**

```dts
pinctrl_uart4: uart4grp {
  fsl,pins = <
    MX6QDL_PAD_KEY_COL0__UART4_TX_DATA 0x1b0b1
    MX6QDL_PAD_KEY_ROW0__UART4_RX_DATA 0x1b0b1
  >;
};
```
Major changes in OTTBox – NAND

- nand flash
- imx6qdl-ottbox.dtsi:

  &gpmi {
    pinctrl-names = "default";
    pinctrl-0 = &pinctrl_gpmi_nand_ottbox_1;
    status = "okay"; /* pin conflict with uart3 */
  };

pinctrl_gpmi_nand_ottbox_1: gpmi-nand-ottbox-1 {
  fsl.pins = <
      MX6QDL_PAD_NANDF_CS0__NAND_CE0_B 0xb0b1
      MX6QDL_PAD_NANDF_CS1__NAND_CE1_B 0xb0b1
      MX6QDL_PAD_NANDF_CS2__NAND_CE2_B 0xb0b1
      MX6QDL_PAD_NANDF_CS3__NAND_CE3_B 0xb0b1
      MX6QDL_PAD_NANDF_CLE__NAND_CLE 0xb0b1
      MX6QDL_PAD_NANDF_ALE__NAND_ALE 0xb0b1
      MX6QDL_PAD_NANDF_WP_B__NAND_WP_B 0xb000
      MX6QDL_PAD_NANDF_RB0__NAND_READY_B 0xb000
      MX6QDL_PAD_NANDF_D0__NAND_DATA0 0xb0b1
      MX6QDL_PAD_NANDF_D1__NAND_DATA01 0xb0b1
      MX6QDL_PAD_NANDF_D2__NAND_DATA02 0xb0b1
      MX6QDL_PAD_NANDF_D3__NAND_DATA03 0xb0b1
      MX6QDL_PAD_NANDF_D4__NAND_DATA04 0xb0b1
      MX6QDL_PAD_NANDF_D5__NAND_DATA05 0xb0b1
      MX6QDL_PAD_NANDF_D6__NAND_DATA06 0xb0b1
      MX6QDL_PAD_NANDF_D7__NAND_DATA07 0xb0b1
  >;
}
Major changes in OTTBox – Micro SD

- enable micro SD card (injected card)
- with card detection

```c
imx6qdl-ottbox.dtsi:
&usdhc2 {
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_usdhc2_ottbox_1>;
  no-1-8-v;
  keep-power-in-suspend;
  enable-sdio-wakeup;
  status = "okay";
};
pinctrl_usdhc2_ottbox_1: usdhc2grp-ottbox_1 {
  fsl,pins = <
    MX6QDL_PAD_SD2_CMD__SD2_CMD 0x17059
    MX6QDL_PAD_SD2_CLK__SD2_CLK 0x10059
    MX6QDL_PAD_SD2_DAT0__SD2_DATA0 0x17059
    MX6QDL_PAD_SD2_DAT1__SD2_DATA1 0x17059
    MX6QDL_PAD_SD2_DAT2__SD2_DATA2 0x17059
    MX6QDL_PAD_SD2_DAT3__SD2_DATA3 0x17059
    MX6QDL_PAD_GPIO_4__GPIO1_IO04 0x17059
    MX6QDL_PAD_KEY_ROW1__SD2_VSELECT 0x17059
  >;
};
```
Major changes in OTTBox – USB OTG

- enable usb otg and usb host

**usb otg**

`imx6qdl-ottbox.dtsi:

```dtsi
reg_usb_otg_vbus: usb_otg_vbus {
    compatible = "regulator-fixed";
    regulator-name = "usb_otg_vbus";
    regulator-min-microvolt = <5000000>;
    regulator-max-microvolt = <5000000>;
    gpio = <&gpio4 15 0>;
    enable-active-high;
}
```

```dtsi
&usbotg {
    vbus-supply = <&reg_usb_otg_vbus>;
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_usbotg_ottbox_1>;
    disable-over-current;
    status = "okay";
}
```

```dtsi
pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
    fsl,pins = <
        MX6QDL_PAD_GPIO_1__USB_OTG_ID 0x17059
        MX6QDL_PAD_KEY_ROW4__GPIO4_IO15 0x17059
    >;
}
```

**usb host**

```dtsi
&usbh1 {
    vbus-supply = <&reg_usb_h1_vbus>;
    status = "okay";
}
```

**Diagram**

- **GPIO4_15:**
  - Pad: KEY_ROW4
  - Function: USB_OTG_PWREN

- **USB_OTG_ID:**
  - Pad: GPIO_1

- **USB_OTG_PWREN:**
  - Pad: KEY_ROW4

**Note:**
- The diagram shows the connections and signals between GPIO pins and USB OTG components within the OTTBox system.
Major changes in OTTBox – Ethernet

Schematic: Ethernet
Major changes in OTTBox – Ethernet (cont.)

- enable fec (ethernet)

imx6qdl-ottbox.dtsi:

&fec {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_enet_ottbox_1>;
    phy-mode = "rmii";
    phy-reset-gpios = <&gpio1 23 0>;
    phy-reset-duration = <5>;
    status = "okay";
};

pinctrl_enet_ottbox_1: enetgrp-ottbox_1{
    fsl,pins = <
        MX6QDL_PAD_ENET_MDIO__ENET_MDIO 0x1b0b0
        MX6QDL_PAD_ENET_MDC__ENET_MDC 0x1b0b0
        MX6QDL_PAD_ENET_CRS_DV__ENET_RX_EN 0x1b0b0
        MX6QDL_PAD_ENET_RX_ER__ENET_RX_ER 0x1b0b0
        MX6QDL_PAD_ENET_TX_EN__ENET_TX_EN 0x1b0b0
        MX6QDL_PAD_ENET_RXD0__ENET_RX_DATA0 0x1b0b0
        MX6QDL_PAD_ENET_RXD1__ENET_RX_DATA1 0x1b0b0
        MX6QDL_PAD_ENET_TXD0__ENET_TX_DATA0 0x1b0b0
        MX6QDL_PAD_ENET_TXD1__ENET_TX_DATA1 0x1b0b0
        MX6QDL_PAD_GPIO_16__ENET_REF_CLK 0x4001b0a8
        MX6QDL_PAD_GPIO_16__GPIO7_IO13 0x1b0b0
    >;
};
Major changes in OTTBox – WDOG

- Watchdog1 is used in OTTBox, select is in device tree

imx6qdl-ottbox.dtsi:

```
&gpc {
    /* use ldo-bypass, u-boot will check it and configure */
    fsl,ldo-bypass = <1>;
    fsl,wdog-reset = <1>;
};
```
OTTBox: MX6Q & MX6DL difference

- eMMC on mx6q board layout overlaps with micro SD on mx6dl board
- so settings for them could NOT be placed in imx6qdl-ottbox.dtsi.

**eMMC Storage**

# Option 1

- [Diagram showing eMMC storage]

# Option 2

- [Diagram showing MicroSD socket]

- Layout for 50MHz Performance,
  SD Signals(SD_DATAx, SD_CMD, SD_CLK) Length Equal

- MicroSD Layout should be OverLap with eMMC chip!!!
OTTBox: MX6Q & MX6DL difference – eMMC on MX6Q

- Micro SD for mx6dl board layout overlaps with eMMC for mx6q board: no card detection
- For **eMMC** on **mx6q** board:

    ```
    imx6q-ottbox.dts:
    &usdhc3 {
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_usdhc3>;
        bus-width = <8>;
        non-removable;
        no-1-8-v;
        keep-power-in-suspend;
        status = "okay";
    };

    imx6q-ottbox.dts:
    pinctrl_usdhc3: usdhc3grp { 
        fsl,pins = <
            MX6QDL_PAD_SD3_CMD__SD3_CMD 0x17059
            MX6QDL_PAD_SD3_CLK__SD3_CLK 0x10059
            MX6QDL_PAD_SD3_DAT0__SD3_DATA0 0x17059
            MX6QDL_PAD_SD3_DAT1__SD3_DATA1 0x17059
            MX6QDL_PAD_SD3_DAT2__SD3_DATA2 0x17059
            MX6QDL_PAD_SD3_DAT3__SD3_DATA3 0x17059
            MX6QDL_PAD_SD3_DAT4__SD3_DATA4 0x17059
            MX6QDL_PAD_SD3_DAT5__SD3_DATA5 0x17059
            MX6QDL_PAD_SD3_DAT6__SD3_DATA6 0x17059
            MX6QDL_PAD_SD3_DAT7__SD3_DATA7 0x17059
        >;
    };
    ```
OTTBox: MX6Q & MX6DL difference – Micro SD on MX6DL

- Micro SD for mx6dl board layout overlaps with eMMC for mx6q board: no card detection
- For micro SD card on mx6dl board:

```dts
imx6dl-ottbox.dts:
&usdhc3 {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_usdhc3_2>;
    bus-width = <4>;
    non-removable;
    no-1-8-v;
    keep-power-in-suspend;
    status = "okay";
};

imx6dl-ottbox.dts:
pinctrl_usdhc3_2: usdhc3grp -2{
    fsl,pins = <
        MX6QDL_PAD_SD3_CMD__SD3_CMD 0x17059
        MX6QDL_PAD_SD3_CLK__SD3_CLK 0x10059
        MX6QDL_PAD_SD3_DAT0__SD3_DATA0 0x17059
        MX6QDL_PAD_SD3_DAT1__SD3_DATA1 0x17059
        MX6QDL_PAD_SD3_DAT2__SD3_DATA2 0x17059
        MX6QDL_PAD_SD3_DAT3__SD3_DATA3 0x17059
    >;
};
```
Agenda

• Source Codes Changes
  ➢ U-boot
  ➢ Linux Kernel
  ➢ Device Tree

• Yocto Project Modification

• Image Building Instructions

• QA
Yocto Modification

add a layer (mylayer) for:
1. u-boot and kernel patching
2. support new machines (…)
3. appoint new defconfig file:
   imx_v7_ottbox_defconfig

We could run this command to create our new-add layer under directory sources/

 yocto-layer create mylayer
mylayer directory structure

- glance at the added layer (mylayer) under directory sources/

```
meta-mylayer/
  conf
    layer.conf
    machine
      imx6dlottbox_mmc.conf
      imx6dlottbox_nand.conf
      imx6qottbox_emmc.conf
      imx6qottbox_nand.conf
  recipes-bsp
    linux
      linux-imx
        0001-add-support-for-OTTBox.patch
        linux-imx_%_.bbappend
        linux-imx-mfgtool_%_.bbappend
      u-boot
        u-boot-imx
          0001-add-support-for-OTTBox.patch
          u-boot-imx_%_.bbappend
          u-boot-imx-mfgtool_%_.bbappend
```
**yocto-layer** create mylayer

**yocto-layer** command is activated after we run:

```bash
source fsl-setup-release.sh
```

if all setting use default value, there will no example recipe and no **bbappend**, and the created layer looks like below:

```
meta-mylayer/
│   └── conf
│       └── layer.conf
├── COPYING.MIT
└── README
```
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}" 

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \ 
               ${LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_meta-mylayer = "6"
bb/bbappend file location study

Only bitbake hello6 works!
bb/bbappend file location study (cont.)

./meta-qt5/recipes-qt/examples/qt5everywheredemo_1.0.bb
./meta-qt5/recipes-qt/examples/quitindicators_1.0.1.bb
./meta-qt5/recipes-qt/tufao/tufao_1.2.1.bb
./meta-qt5/recipes-devtools/ninja/ninja-native_1.4.0.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-cfa_3.10.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-wandboard_3.10.17.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-cfa_3.12.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-congatec-rt_3.10.17.bb
./meta-fsl-arm-extra/recipes-bsp/broadcom-nvram-config/bcm4329-nvram-config.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-cubox-i_2013.10.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-timesys_2011.12.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-boundary_git.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-script-boundary_git.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-congatec_2013.04.bb
./meta-fsl-arm-extra/recipes-core/net-persistent-mac/net-persistent-mac.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-feedparser_5.1.3.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-pyparsing_2.0.1.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-psutil_0.6.1.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-pep8_1.4.6.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-cheetah_2.4.4.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-lxml_3.0.2.bb
layer.conf

# We have a conf and classes directory, add to BBPATH
BBPATH .= "::{LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "::{LAYERDIR}/recipes-*/*/*.bb \ 
::{LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^::{LAYERDIR}/" 
BBFILE_PRIORITY_meta-mylayer = "6"

Search bb and bbappend files in the BBFILES directories.
layer.conf

# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb "
  "$LAYERDIR/*.bb "
  "$LAYERDIR/*//*.bb "
  "$LAYERDIR/*//*.bb "
  "$LAYERDIR/recipes-*/*/.*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_meta-mylayer = "6"

Now we could bitbake all hello1 -> hello6.
if we create layer with sample recipe and sample bbappend, the created layer looks like this:

```bash
yocto-layer create mylayer
```
yocto-layer create mylayer (cont.)

example_0.1.bb

# This file was derived from the 'Hello World!' example recipe in the
# Yocto Project Development Manual.
#

DESCRIPTION = "Simple helloworld application"
SECTION = "examples"
LICENSE = "MIT"
LIC_FILES_CHKSUM = "file://$(COMMON_LICENSE_DIR)/MIT;md5=0835ade698e0bcf8506ecda2f7b4f302"
PR = "r0"

SRC_URI = "file://helloworld.c"

S = "${WORKDIR}"

do_compile() {
    ${CC} helloworld.c -o helloworld
}

do_install() {
    install -d ${D}${bindir}
    install -m 0755 helloworld ${D}${bindir}
}
example_0.1.bbappend

FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}-${PV}:

# This .bbappend doesn't yet do anything - replace this text with
# modifications to the example_0.1.bb recipe, or whatever recipe it is
# that you want to modify with this .bbappend (make sure you change
# the recipe name (PN) and version (PV) to match).
#

recipes-example-bbappend
  example-bbappend
    example-0.1
      example.patch
      example_0.1.bbappend
mylayer directory structure

- add a layer (mylayer) under directory sources/

meta-mylayer/
  conf
    layer.conf
  machine
    imx6dlottbox_mmc.conf
    imx6dlottbox_nand.conf
    imx6qottbox_emmc.conf
    imx6qottbox_nand.conf
  recipes-bsp
  linux
    linux-imx
      0001-add-support-for-OTTBox.patch
      linux-imx_%_bbappend
      linux-imx-mfgtool_%_bbappend
    u-boot
      u-boot-imx
        0001-add-support-for-OTTBox.patch
        u-boot-imx_%_bbappend
        u-boot-imx-mfgtool_%_bbappend
1, u-boot and kernel patching

• layer.conf:

```bash
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \n    ${LAYERDIR}/recipes-*/*/*bbappend"

BBFILE_COLLECTIONS += "mylayer"
BBFILE_PATTERN_mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_mylayer = "5"
```

This file is created manually.
1, u-boot and kernel patching (cont.)

- **u-boot-imx_% .bbappend:**
  ```
  FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"]
  SRC_URI += "file://0001-add-support-for-OTTBox.patch"
  ```

- **u-boot-imx-mfgtool_% .bbappend:**
  ```
  FILESEXTRAPATHS_prepend := "${THISDIR}/u-boot-imx:"
  SRC_URI += "file://0001-add-support-for-OTTBox.patch"
  ```

1, u-boot and kernel patching (cont.)
1, u-boot and kernel patching (cont.)

- `linux-imx_%_.bbappend`:
  ```
  FILESEＸTRAPATHS_prepend := "${THISDIR}/${PN}:"
  
  SRC_URI += "file://0001-add-support-for-OTTBox.patch"
  ...
  ```

- If file name is `linux-imx_3.14.28.bbappend`, it also works as the preferred `linux-imx` version is 3.14.28. But suppose we bitbake `linux-imx_3.10.54.bb`, this patch will not be appended.

- We could add more than one patch here.
1, u-boot and kernel patching (cont.)

- `linux-imx_%_bbappend`:
  ```
  FILESEXTRESPATHS_prepend := "${THISDIR}/${PN}:":
  
  SRC_URI += "file://0001-add-support-for-OTTBox.patch"
  ...
  ```

- `linux-imx-mfgtool_%_bbappend`:
  ```
  FILESEXTRESPATHS_prepend := "${THISDIR}/linux-imx:":
  
  SRC_URI += "file://0001-add-support-for-OTTBox.patch"
  ...
  ```
1, u-boot and kernel patching (cont.)

- add a layer (mylayer) under directory sources/

```plaintext
meta-mylayer/
├── conf
│   └── layer.conf
├── machine
│   ├── imx6dlottbox_mmc.conf
│   │   └── imx6dlottbox_nand.conf
│   ├── imx6qottbox_emmc.conf
│   │   └── imx6qottbox_nand.conf
│   └── recipes-bsp
│       ├── linux
│       │   └── linux-imx
│       │       └── 0001-add-support-for-OTTBox.patch
│       │   │       └── linux-imx_%bbappend
│       │   └── linux-imx-mfgtool_%bbappend
│       └── u-boot
│           └── u-boot-imx
|                   └── 0001-add-support-for-OTTBox.patch
|                       └── u-boot-imx_%bbappend
|                               └── u-boot-imx-mfgtool_%bbappend
```

If in the bbappend file, the dir use ${PN}, the directory name should be same with the bbappend file name prefix. Or, the bitbake process cannot get the patch file.
2, support new machines

- add a layer (mylayer) under directory sources/

\[
\text{meta-mylayer/}
\]

\[
\begin{align*}
\text{conf} & \\
\quad \text{layer.conf} & \\
\quad \text{machine} & \\
\quad \quad \text{imx6dlottbox_mmc.conf} & \\
\quad \quad \text{imx6dlottbox_nand.conf} & \\
\quad \quad \text{imx6qottbox_emmc.conf} & \\
\quad \quad \text{imx6qottbox_nand.conf} & \\
\text{recipes-bsp} & \\
\quad \text{linux} & \\
\quad \quad \text{linux-imx} & \\
\quad \quad \quad \text{0001-add-support-for-OTTBox.patch} & \\
\quad \quad \quad \text{linux-imx \_\_\_\_bbappend} & \\
\quad \quad \quad \text{linux-imx-mfgtool\_\_\_\_bbappend} & \\
\quad \text{u-boot} & \\
\quad \quad \text{u-boot-imx} & \\
\quad \quad \quad \text{0001-add-support-for-OTTBox.patch} & \\
\quad \quad \quad \text{u-boot-imx \_\_\_\_bbappend} & \\
\quad \quad \quad \text{u-boot-imx-mfgtool\_\_\_\_bbappend} & \\
\end{align*}
\]
2, support new machines (cont.)

Imx6qottbox_nand.conf:

... require conf/machine/include/imx6sabresd-common.inc

SOC_FAMILY = "mx6:mx6q"
KERNEL_IMAGETYPE = "zImage"
KERNEL_DEVICETREE = "imx6q-ottbox.dtb"

UBOOT_CONFIG ??= "nand"
UBOOT_CONFIG[nand] = "mx6qottbox_config"
UBOOT_CONFIG[emmc] = "mx6qottbox_emmcrootfs_config"
UBOOT_CONFIG[mfgtool] = "mx6qottbox_config"
3, appoint new defconfig file

• *linux-imx_3.14.28.bb* has defined below function:

```c
... do_configure_prepend() {
    # copy latest defconfig for imx_v7_defconfig to use
    cp ${S}/arch/arm/configs/imx_v7_defconfig ${S}/.config
    cp ${S}/arch/arm/configs/imx_v7_defconfig ${S}/../defconfig
    fi
} 
```

• however, OTTBox use *imx_v7_ottbox_defconfig* instead of *imx_v7_defconfig* due to the specific HW configuration (see next page).
• Why we need new defconfig:

On mx6q sabresd board there is max11801 for touch screen. OTTBox board has no such component. So in the kernel the serial console will keep printing below:

FAIL  max11801_client not initialize

or

max11801_ts 1-0048: FIFO_RD_AUX_MSB read fails

Besides, the release BSP original imx_v7_defconfig has incorporated almost all probably needed drivers, like SCSI, SPI-NOR, digital accelermeter, proximity/opto sensor, ambient light sensor… For PMIC, several vendor’s PMIC drivers including PFUSE100 are built into the kernel. Actually on OTTBox board none of them are used.

So, we reconfigured base on the imx_v7_defconfig for OTTBox board, which is imx_v7_ottbox_defconfig.
3, appoint new defconfig file (cont.)

- in `linux-imx_%.bbappend` add below:

```bash
... 
do_configure_append() {
if [ "${MACHINE}" = "imx6dlottbox" ] || [ "${MACHINE}" = "imx6qottbox" ] ; then
    # copy latest defconfig for imx_v7_ottbox_defconfig to use
    cp ${S}/arch/arm/configs/imx_v7_ottbox_defconfig ${S}/.config
    cp ${S}/arch/arm/configs/imx_v7_ottbox_defconfig ${S}/../defconfig
fi
}
```
3, appoint new defconfig file (cont.)

- Similarly, in `linux-imx-mfgtool_%.bbappend` add:

```c
...  
do_configure_append() {
    if [ "${MACHINE}" = "imx6dlottbox" ] || [ "${MACHINE}" = "imx6qottbox" ] ; then
        # copy latest defconfig for imx_v7_ottbox_defconfig to use
        cp ${S}/arch/arm/configs/imx_v7_ottbox_mfg_defconfig
        ${S}/.config
        cp ${S}/arch/arm/configs/imx_v7_ottbox_mfg_defconfig
        ${S}/../defconfig
    fi
}
```
the last step of adding a layer

After creating the build directory and before bitbaking any image, we need to modify build/conf/bblayer.conf to add below line:

BBLAYERS += "${BSPDIR}/sources/meta-mylayer"
Agenda

• Source Codes Changes
  ➢ U-boot
  ➢ Linux Kernel
  ➢ Device Tree

• Yocto Project Modification

• Image Building Instructions

• QA
1. get Yocto L3.14.28_1.0.0_GA source code, following user's guide
   
   ```
   mkdir ~/fsl-release-bsp
   cd ~/fsl-release-bsp
   git config --global user.name "vmuser"
   git config --global user.email "vmuser@freescale.com"
   git config --list
   repo init -u git://git.freescale.com/imx/fsl-arm-yocto-bsp.git -b imx-3.14.28-1.0.0_ga
   repo sync
   ```

2. apply the addon tarball in directory ~/fsl-release-bsp
   
   ```
   tar xvjf fsl-release-bsp_L3.14.28_1.0.0_GA_addon.tar.bz2
   ```
Image Building Instructions (cont.)

3. configure for different boards of OTTBox
   imx6q, rootfs in emmc:
   
   ```
   MACHINE=imx6qottbox_emmc source fsl-setup-release.sh
   -b build-x11 -e x11
   ```

4. modify build/conf/bblayers.conf, add below line
   
   ```
   BBLAYERS += "${BSPDIR}/sources/meta-mylayer"
   ```

5. bitbake images

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