



A Complete Overview of Reference Design and Solutions Using i.MX 6 Applications Processors

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Agenda

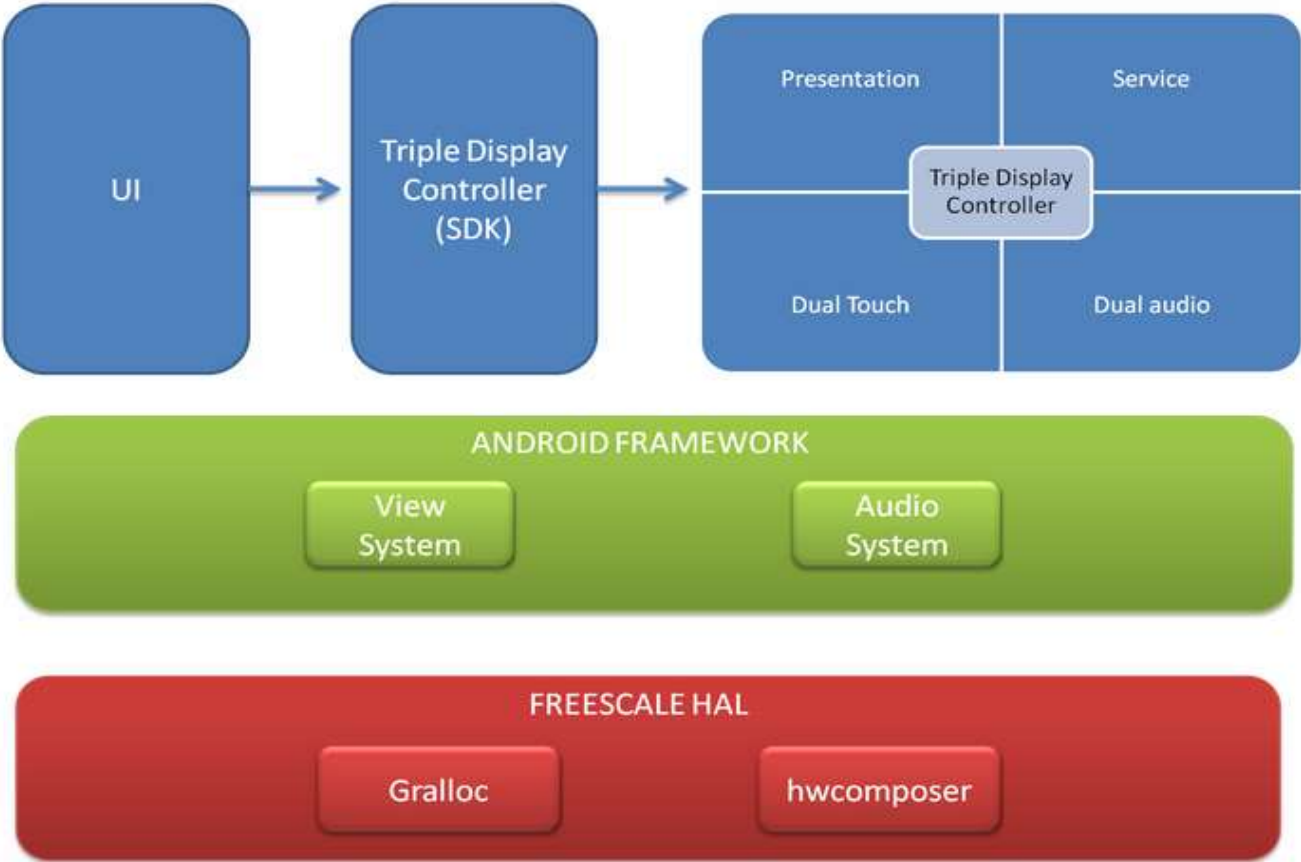
- Overview and Purpose
- i.MX Reference Solutions Overview
 - Human Machine Interface(HMI)
 - Advanced Driver Assistance Systems(ADAS)
 - eReader
 - ThinClient
 - Extended Solutions
- Q&A



Human Machine Interface - Android Triple Display

Android Triple-Display

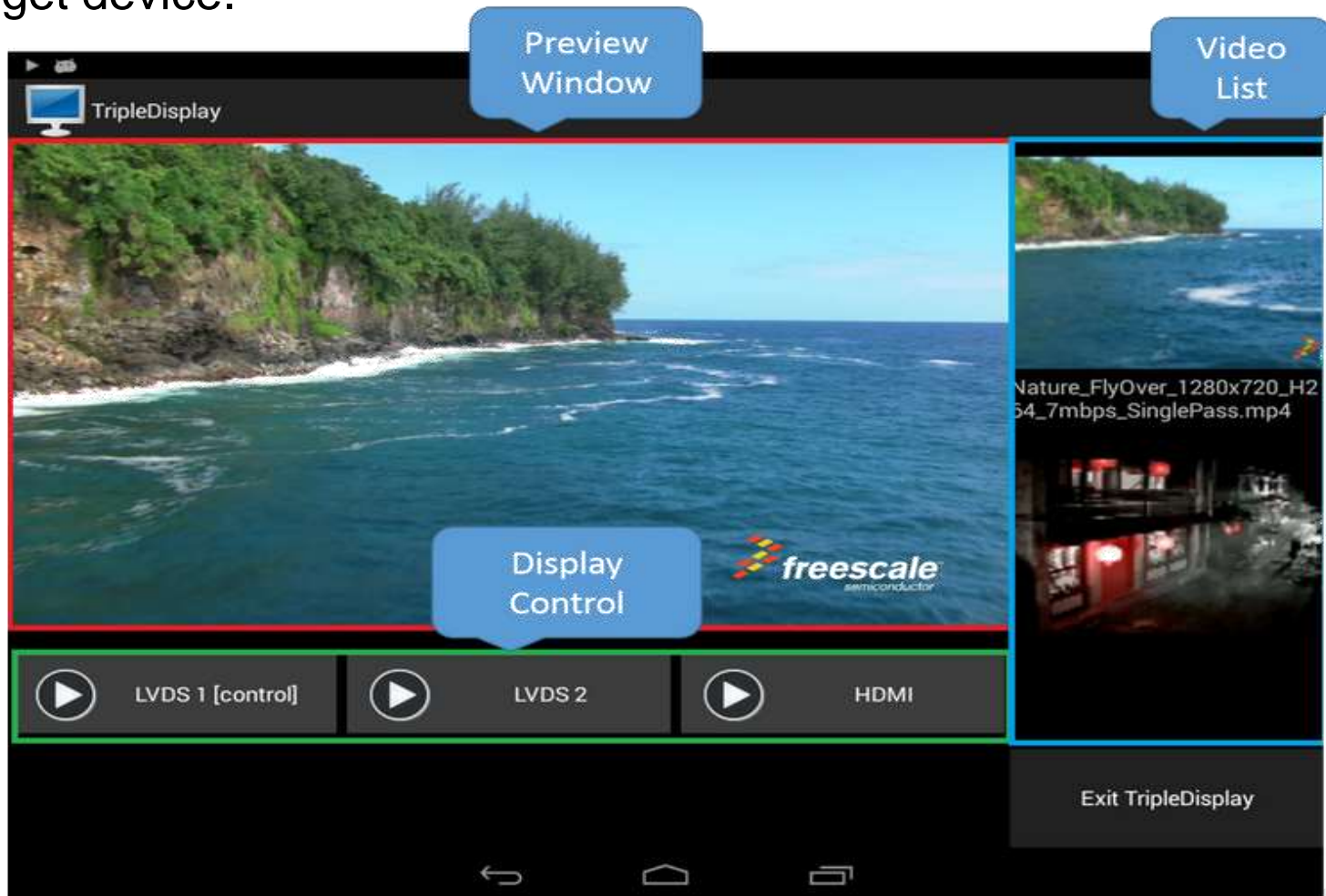
- Freescale Triple display solution is to provide a SDK for showing different images/video on three display devices.



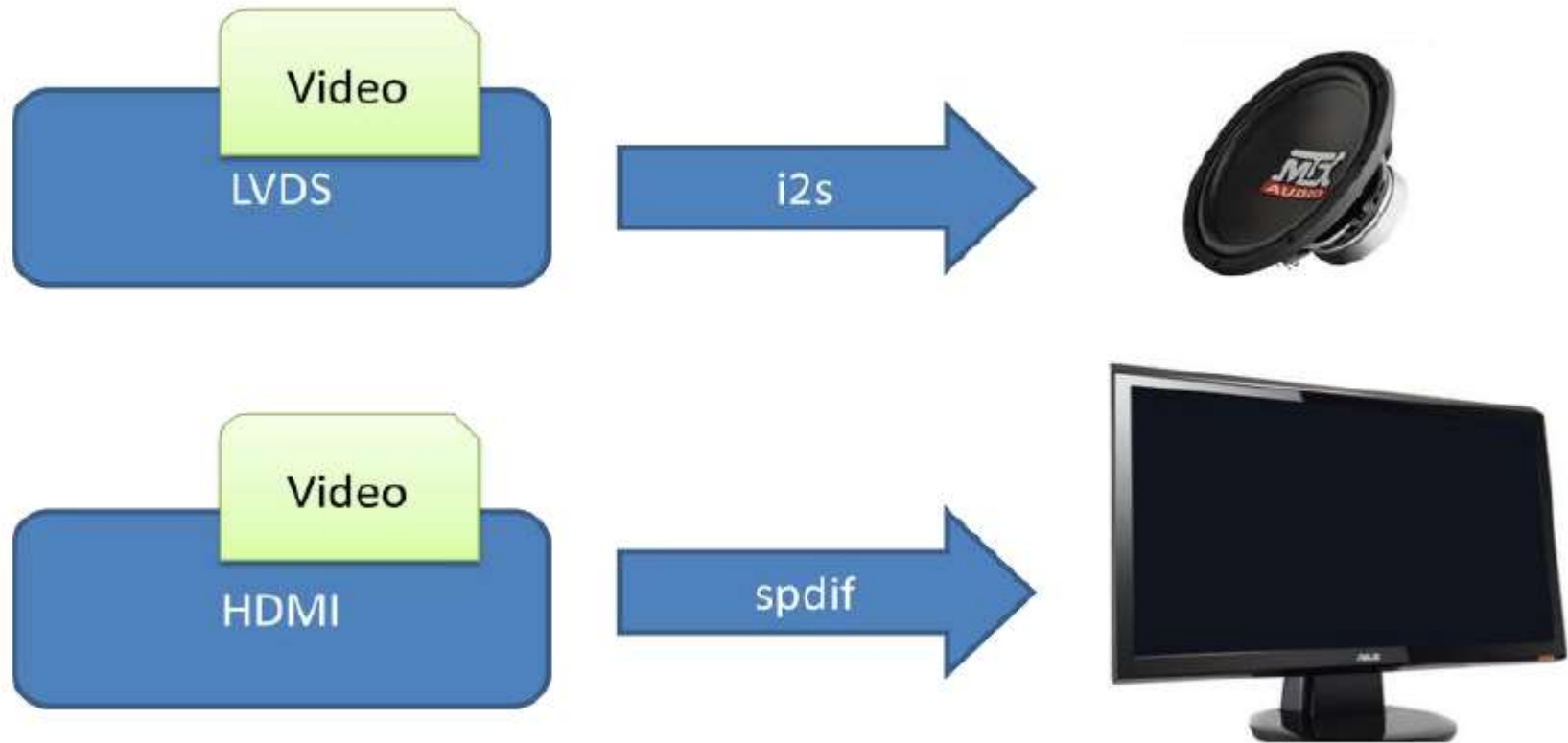
Triple Display Structure

Android Triple-Display

- The user can play different video by clicking control button for specifying the target device.



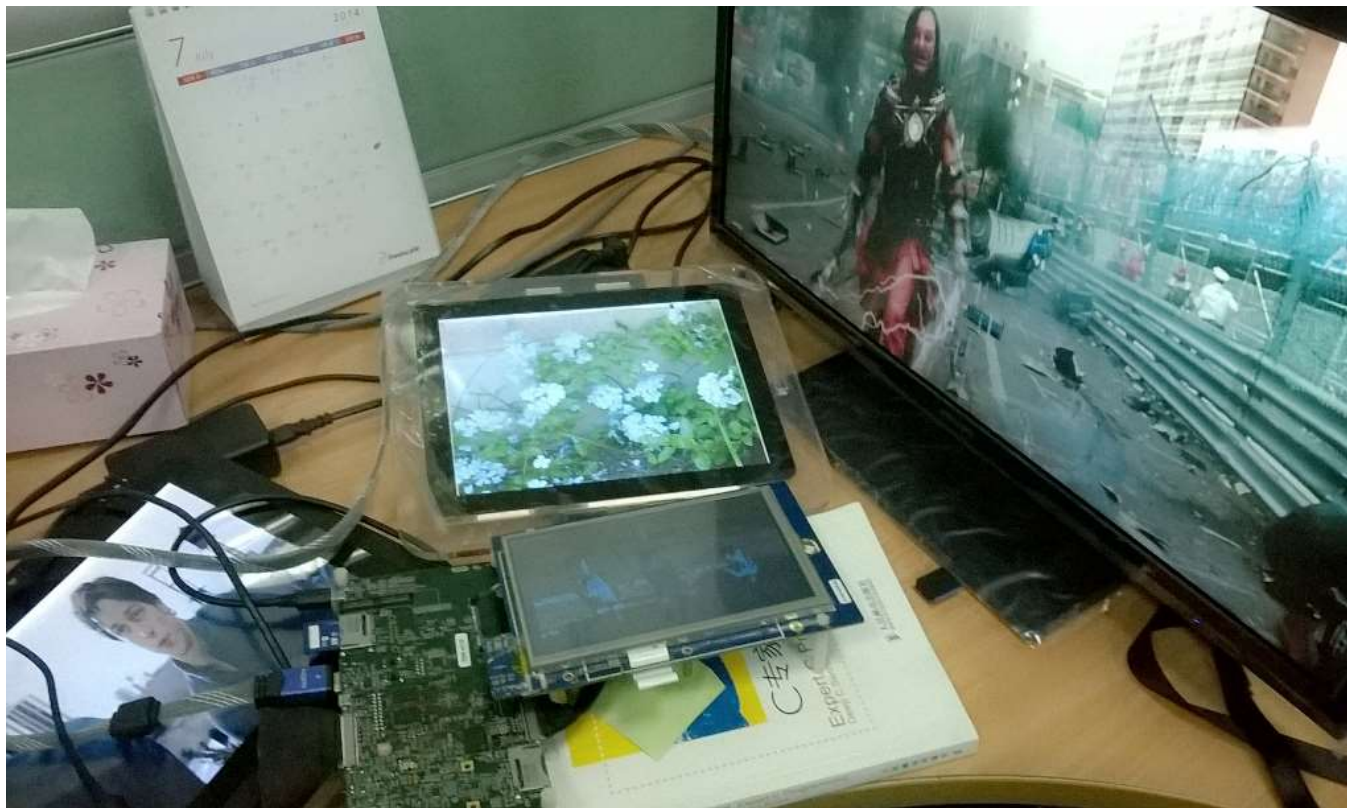
Dual Touch & Dual Audio



Human Machine Interface - Linux Multiple Display

Linux Multiple Display

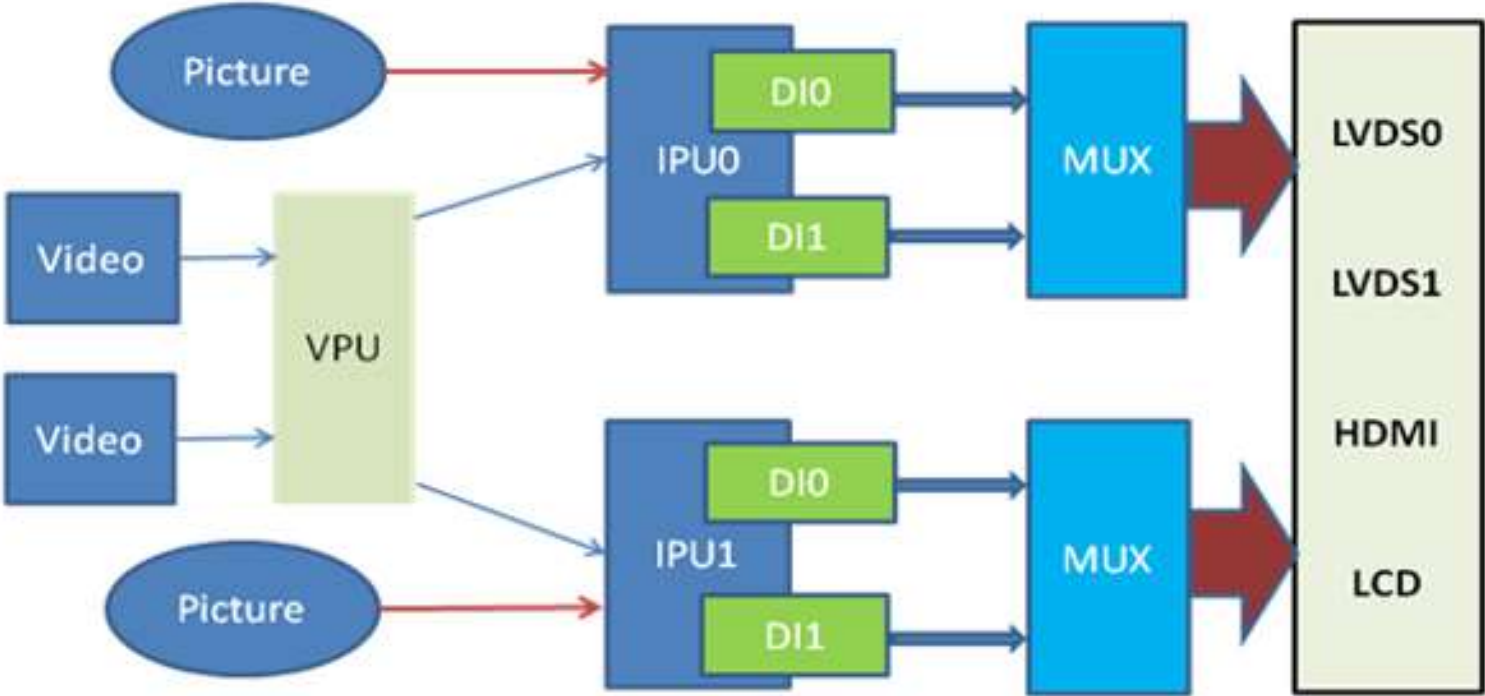
- Freescale Multi display solution is to put different images/video on four display devices at the same time.



- 1x 1080p HDMI
- 2x 720p LVDS
- 1x WVGA LCD

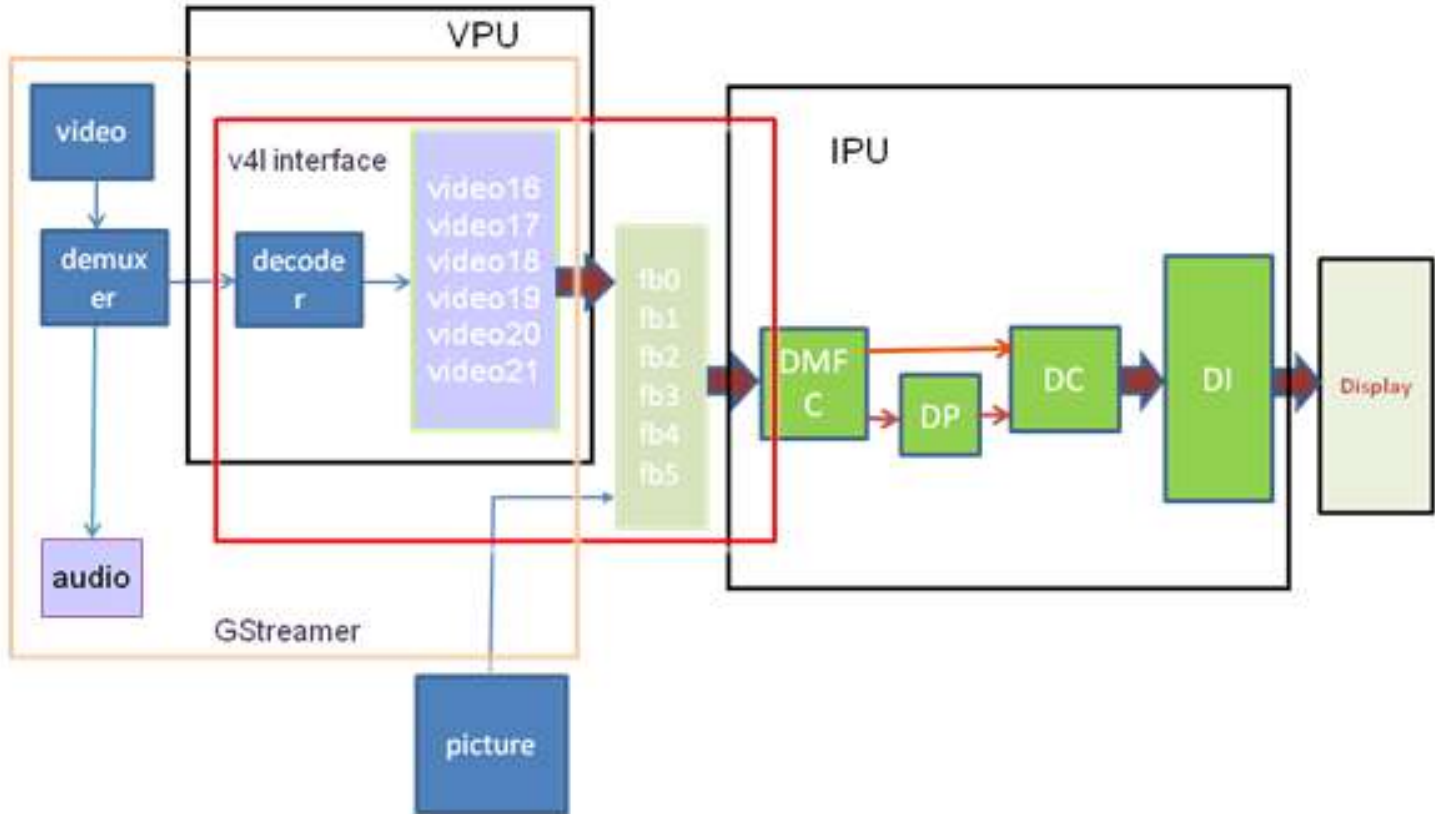
Linux Multiple Display

- Block Diagram of the IPU DI Port for Multiple Display

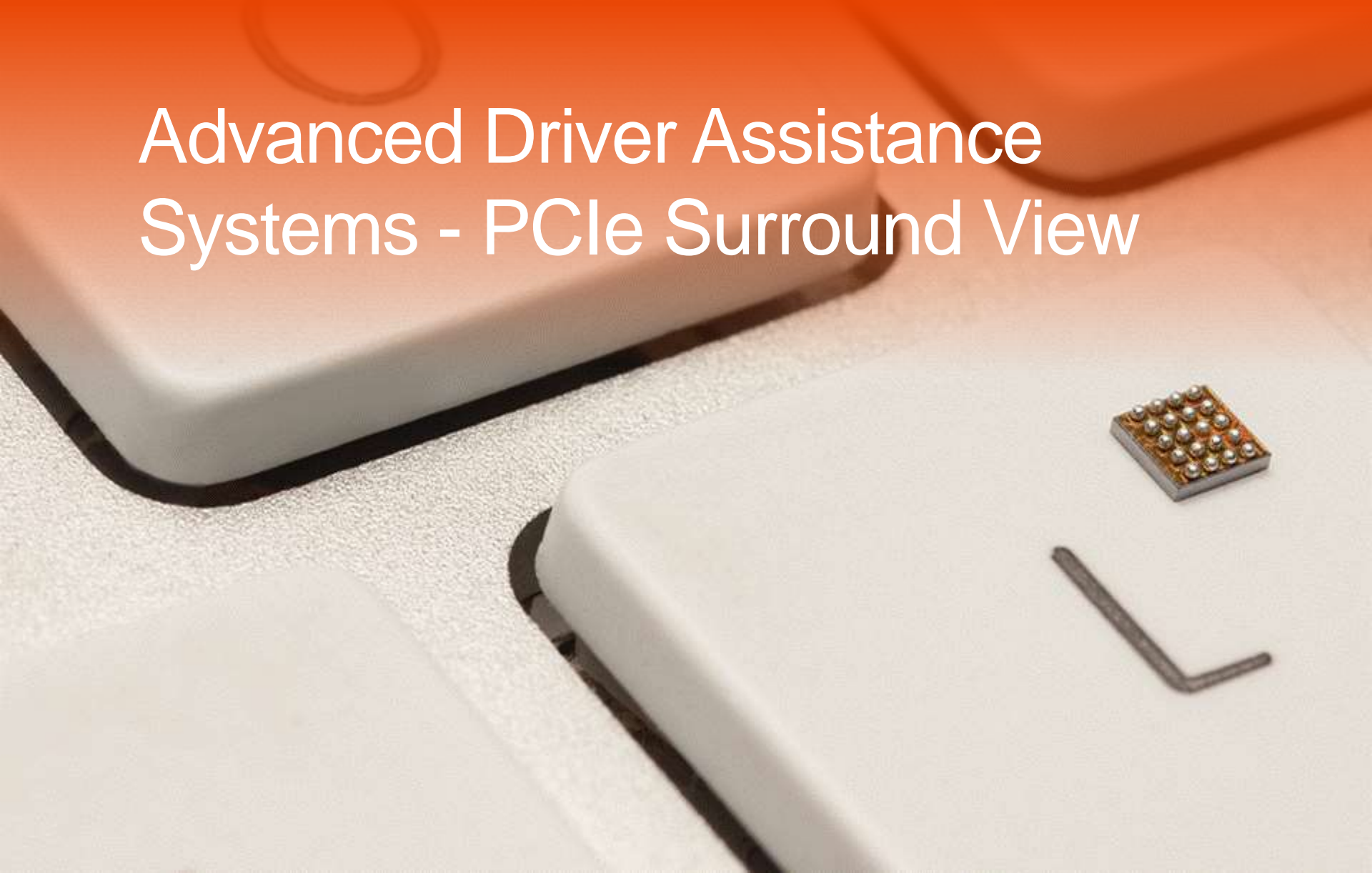


Linux Multiple Display

- Data Flow for Frame Buffer



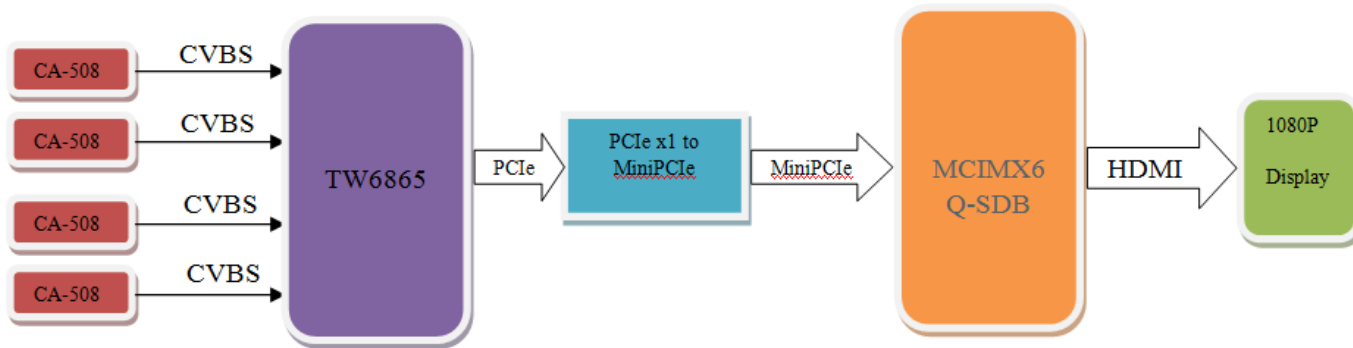
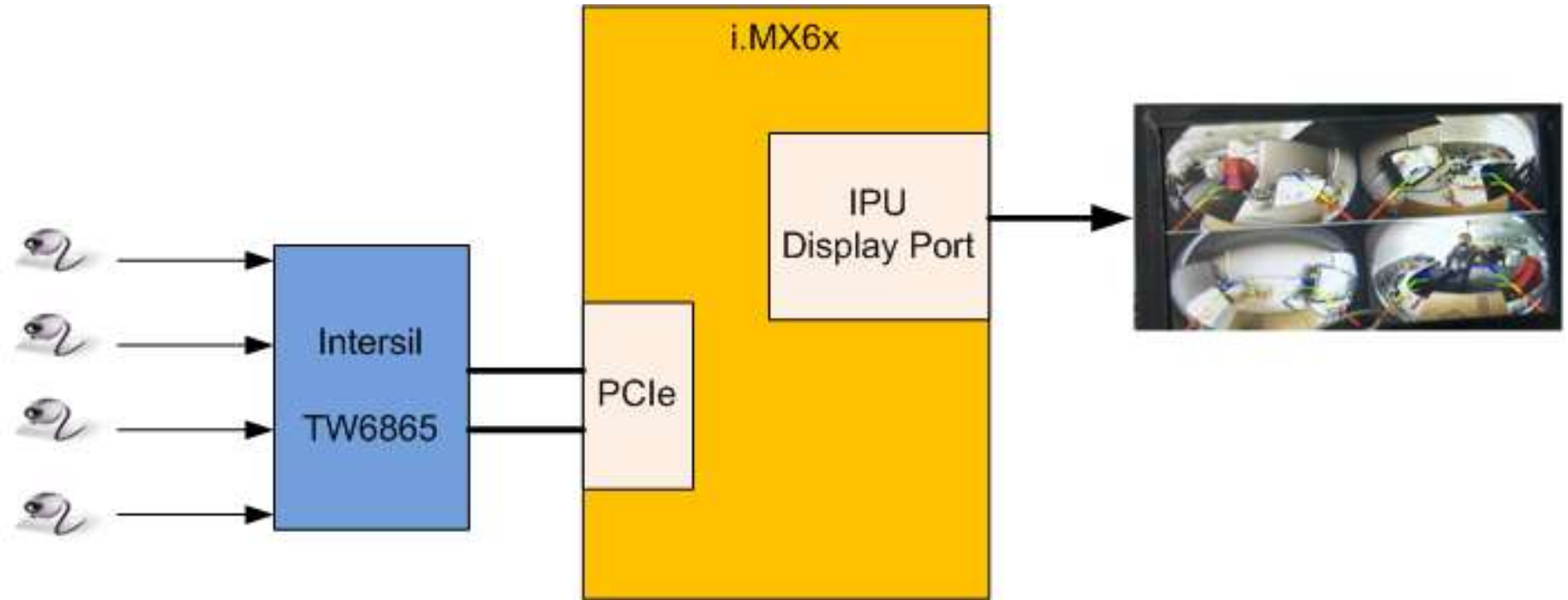
Advanced Driver Assistance Systems - PCIe Surround View



Analog D1 Solution for 360° Surround View



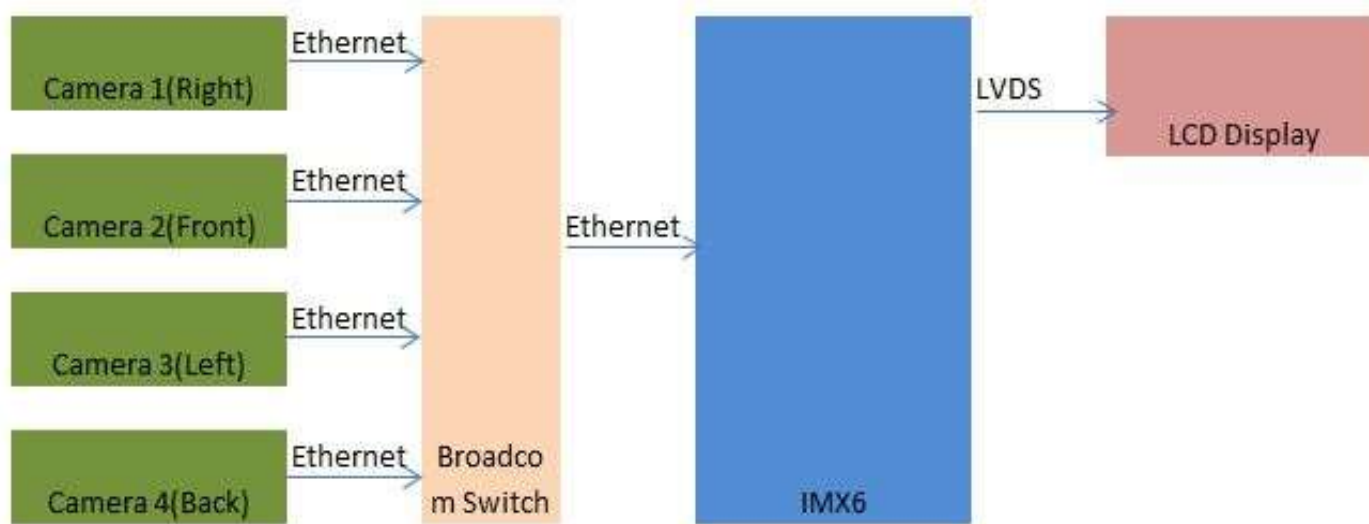
Block Diagram



Advanced Driver Assistance Systems - Ethernet Surround View



Ethernet Surround View



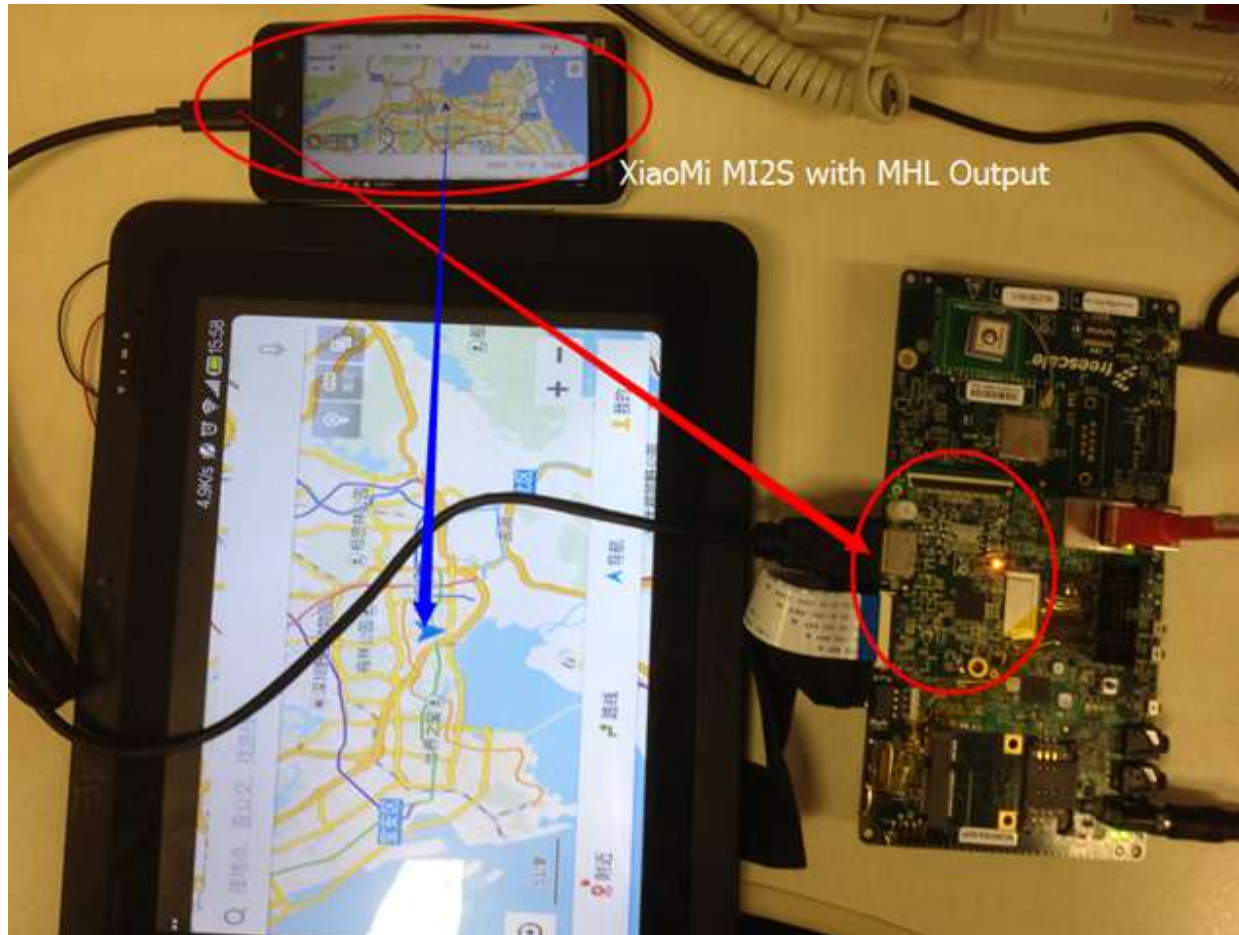
- Based on this implementation, the customer can develop more feasible and specific applications for ADAS, such as Parking Assistance System. And the solution can support up to 4 * 720p HD video Digital IP cameras at the same time.

Advanced Driver Assistance Systems - HDMI MHL-In



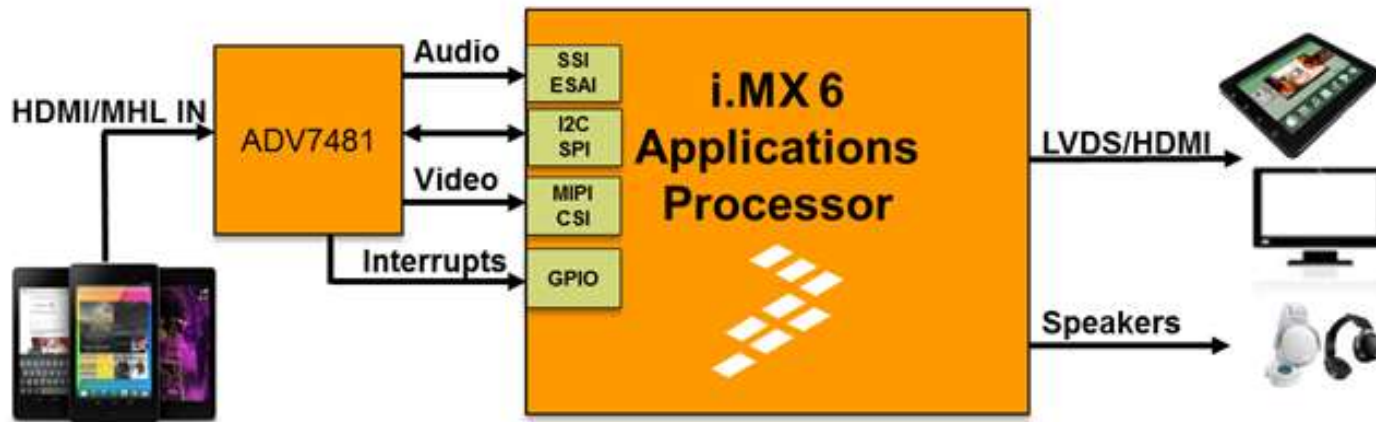
HDMI MHL-In

- This reference design shows how to make a HDMI/MHL output device access to i.MX platform through the ADV7481 which act as a bridge that convert HDMI/MHL signal to MIPI (video) & I2S (audio) signal.



HDMI MHL-In

- The ADV7481 MHL 2.1 capable receiver supports a maximum pixel clock frequency of 75 MHz, allowing resolutions up to 720p/1080i at 60 Hz in 24-bit mode. The ADV7481 HDMI capable receiver supports a maximum pixel clock frequency of 162 MHz, allowing HDTV formats up to 1080p, and display resolutions up to UXGA (1600 × 1200 at 60 Hz). Below is the HDMI/MHL IN system block diagram



Advanced Driver Assistance Systems - Linux Fast Boot

Fast boot For Linux

- Why Need Fast Boot
 - In first ignition reversing, we need see the reverse image in a short time
 - Boot up quickly for a good user experience
- How to Define the Boot Time
 - The booting time we defined here is from the board be powered up to the main application working and main application be showed directly to the end user
 - For example: for the media player purpose board, the booting time count to the first video frame be shown on the screen
- Platform
 - i.MX 6 SABRE SD Board

Solution - Performance Optimizing

- How to Achieve the Target
 - Optimizing the performance in uboot and kernel
 - Remove unnecessary modules at boot time
 - Start main application at the first time after the kernel boot up
- Performance Optimizing
 - U-Boot
 - Enable MMU and L2-Cache
 - Optimizing memset and memcpy function
 - Implement SDMA to accelerate copying data from NOR flash to memory
 - Implement ADMA for uSDHC to improve performance of SD card read
 - Kernel
 - Optimizing `_memcpy_fromio` function

Solution - Remove Unnecessary Modules

- Remove Unnecessary Modules

- U-Boot

- Disable UART output and add quiet parameter to Kernel boot
 - Remove boot up delay
 - Disable I2C, SPI, SPLASH_SCREEN

- Kernel

- Just keep necessary module initialization at mx6_sabresd_board_init:
 - iomux configuration, uart0, vada, ipu, ldb, v4l2, mipi-csi, i2c1, uSDHC1, pwm0, dvfs, mipi camera clock.
 - Try to just keep necessary module and configuration to keep minim size.
 - Build necessary modules from external to Kernel itself.
 - Create ulmage from Image instead of zImage to reduce Kernel self extraction time.
 - Use ext4 file system on SD card to accelerate rootfs mounting.

Solution - Start main application at the first time

- Start main application at the first time after the kernel boots up.
 - Try run main application before the sysinit
 - The necessary preparation of main application will be handled by this application internally.
- See below example for MIPI camera overlay on LVDS screen:

/etc/inittab

::once:/unit_tests/mxc_v4l2_overlay.out -iw 640 -ih 480 -it 0 -il 0 -ow 1024 -oh 768 -ot 0 -ol 0 -r 0 -t -1 -d 0 -fg -fr 30

::once:/etc/rc.d/rcS

::once:/sbin/getty -L ttymxc0 115200 vt100 # GENERIC_SERIAL

Advanced Driver Assistance Systems - Digital Cluster



Digital Cluster

- Virtual cluster demo is built on top of the Linux fastboot demonstration published in the IMXCommunity.
- The boot time is roughly 1.2s. The demonstration is based on L3.0.101_4.1.1 BSP release running on i.MX6QSDP board.



eReader - Android Eink

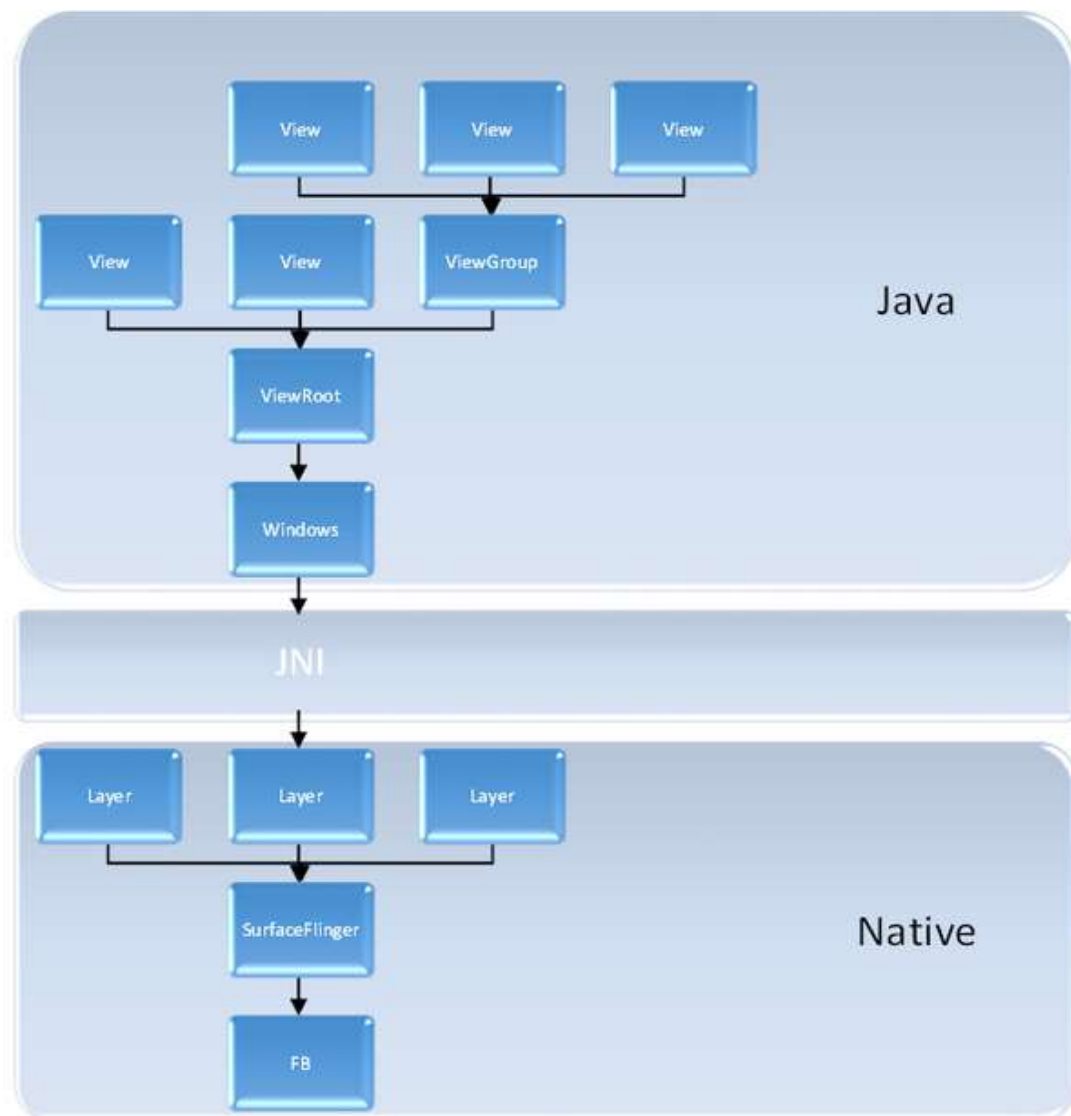


Android KitKat EInk Support

- Android is a common operation system in portable devices including mobile phone and tablet, also a choice for eReader.
- There is a device driver in Linux kernel to support E-Ink feature but it is needed to modify the Android framework so that Android application will not handle any additional update requirement of E-Ink.



Implementation Architecture



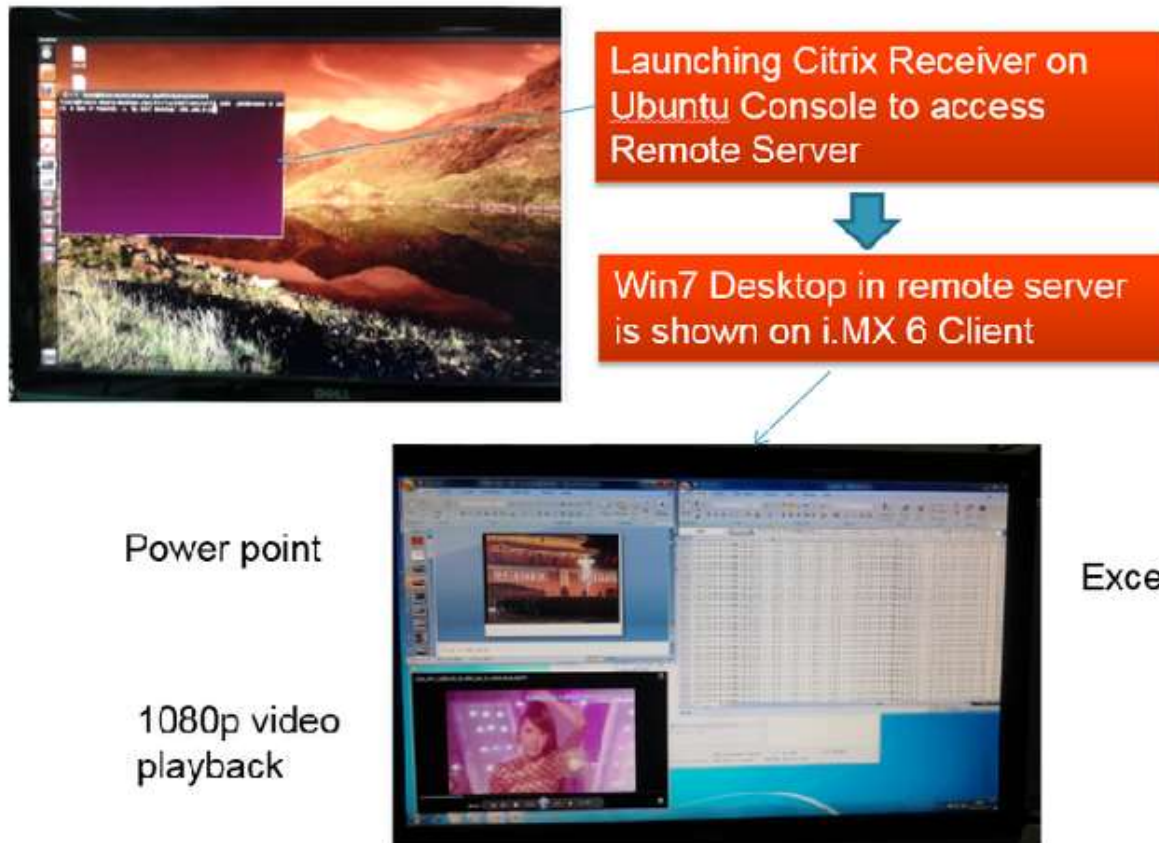
- There are three kinds of graphic update paths in Android framework
 - Update triggered by invalidate
 - Graphic animation
 - OpenGL to render the screen

ThinClient - Citrix ThinClient



ThinClient

- Receiver is a Linux application that provides access to a session running on a server.
- When the connection to the server is established, it is similar to working on a local computer on the client side



Extended Solutions - i.MX 6 Series



Extended Solutions – i.MX 6 Series

Reference Name	Part #	Type	Highlight	General Stage
HDMI and LCD interlaced display mode	i.MX6 Series	Community Link for HMI Solutions	It can support HDMI ad LCD interlaced display output mode. All of the i.MX6 series can be applied with this patch.	Patch is ready on community
HDMI Overscan Android Kitkat and Jelly Bean	i.MX6 Series	Community Link for HMI Solutions	HDMI overscan solutions for Android Kitkat and Jelly Bean.	Patch is ready on community
Dual Camera Preview & Encode	i.MX6 Series	Community Link for ADAS Solutions	The pacakge support preview and encode dual camera. It can reach one 1080P channel and one XGA channel preview and encode at the same time.	Patch is ready on community
One Camera Preview on Two Display	i.MX6 Series	Community Link for ADAS Solutions	The package support preview one camera at two display.	Patch is ready on community
VDI & Alpha Blending for TV input on Android	i.MX6 Series	Community Link for ADAS Solutions	The package enable Android VDI & Alpha Bending when using TV input, and this useful for rear view application.	Patch is ready on community
BT656 and BT1120 Output	i.MX6 Series	Community Link for HMI Solutions	The package support BT656 and BT1120 output for i.MX6 ipuv3. With this patch, the i.MX6 can support the CVBS output on TV encoder. It is useful for a TV box.	Patch is ready on community
MIPI CSI camera with virtual channel 3	i.MX6 Series	Community Link for ADAS Solutions	Sample code for iMX6 SabreSD to use MIPI CSI camera with virtual channel 3.	Patch is ready on community
Bluetooth support on iMX6SL EVK	iMX6SL	Community Link for Connectivity Solutions	For default Android JB4.3 GA1.1.0 BSP, iMX6SL EVK board doesn't support BlueTooth, this patch for Android support AR3002 bluetooth.	Patch is ready on community
Uboot logo keep from uboot to kernel	i.MX6 Series	Community Link for General Solutions	This patch made the display no interrupt from uboot to kernel to Android. The IPU and related hardware display interface will only be initialized once in Uboot, the kernel code will skip the IPU initialization.	Patch is ready on community
USB Role Switch Patch for i.MX6	i.MX6 Series	Sharepoint Link for General Solutions	Two packages are released for i.MX6 platform. One is for L3.0.35_4.1.0_130816 kernel and is verified on SabreSD i.MX6Q platform, and the other is for L3.10.17_1.0.0 kernel and is compatible with Apple MFi Accessory Interface.	Patch is ready on sharepoint
SPI Slave Mode Support	i.MX6 Series	Sharepoint Link for General Solutions	The default Linux Release BSP only support SPI master mode. With this patch, the SPI can work in slave mode.	Patch is ready on sharepoint

Wrap-Up



Session Wrap-Up

- **Through this topics, you can:**
 - Know Freescale available reference design solutions on i.MX
 - Understand the key features of each reference solution
 - Help to promote the right part and solution to your customers, convert more opportunities into business
 - More information is required, please contact with local Freescale office



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