Digital iPod Out OTG Solution
Dual Role USB HUB

EX.
5
C.A. No.17-1194-JDW

Unwired Technology
October 23, 2013

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Agenda

- Overview of Standard Linux USB SW Architecture
  - Overview of Enumeration, Role Reversal and Gadget data flows
- Overview of Unwired Linux USB SW Architecture
  - Overview of Enumeration, Role Reversal and Gadget data flows
- Overview of Unwired Dual Role USB HUB HW

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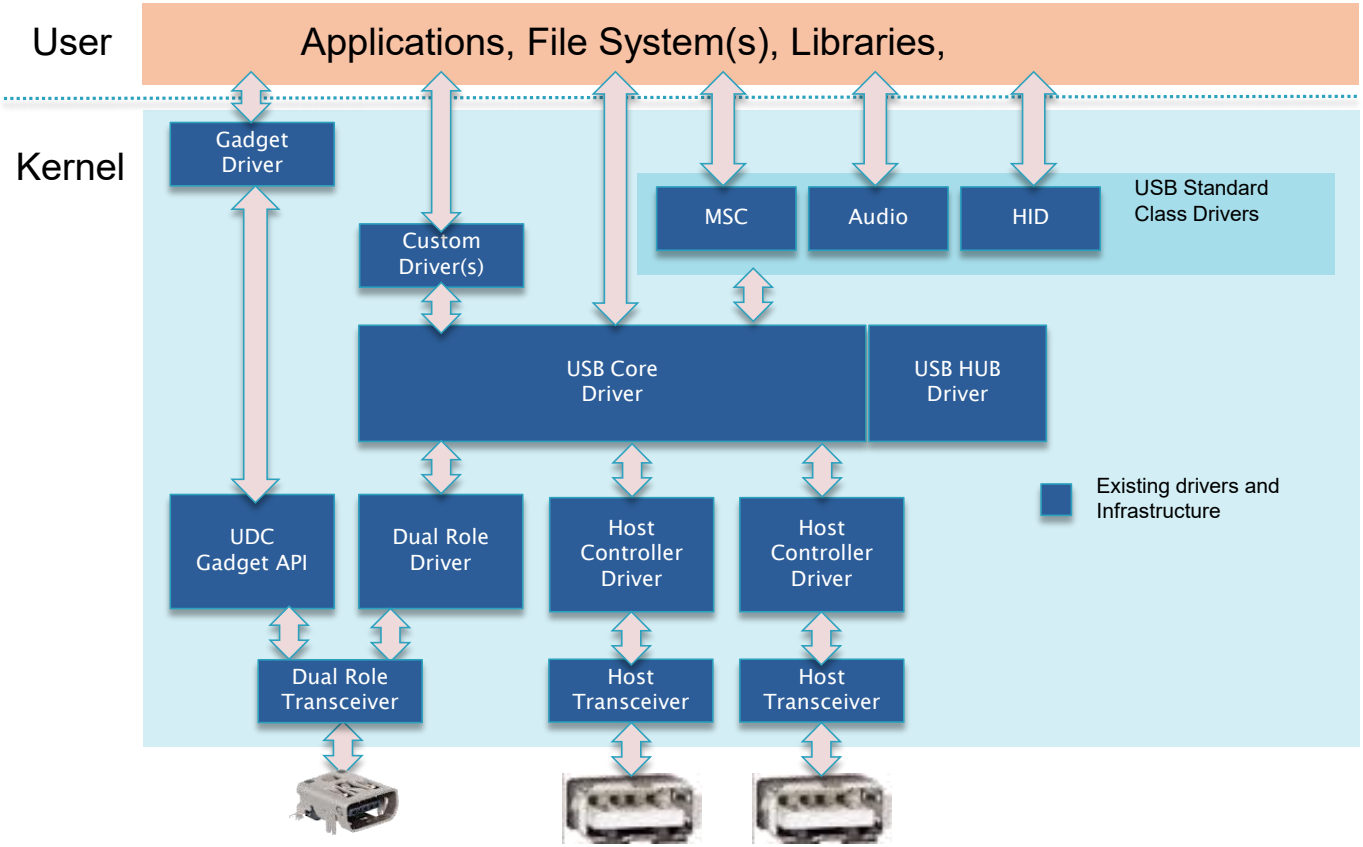
Linux USB Host / Gadget Software Architecture (Standard)



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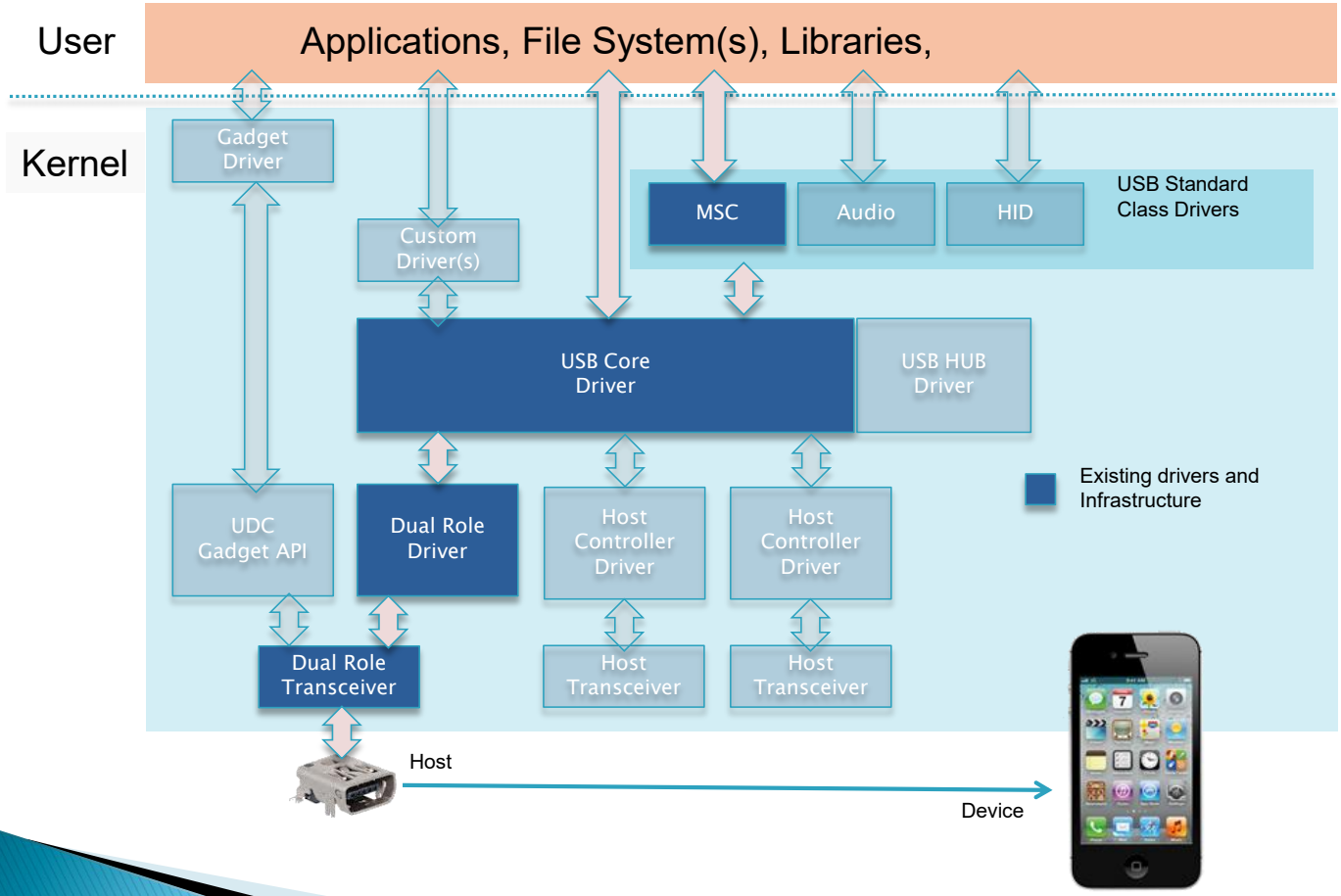
Linux USB Host / Gadget Software Architecture (Host)



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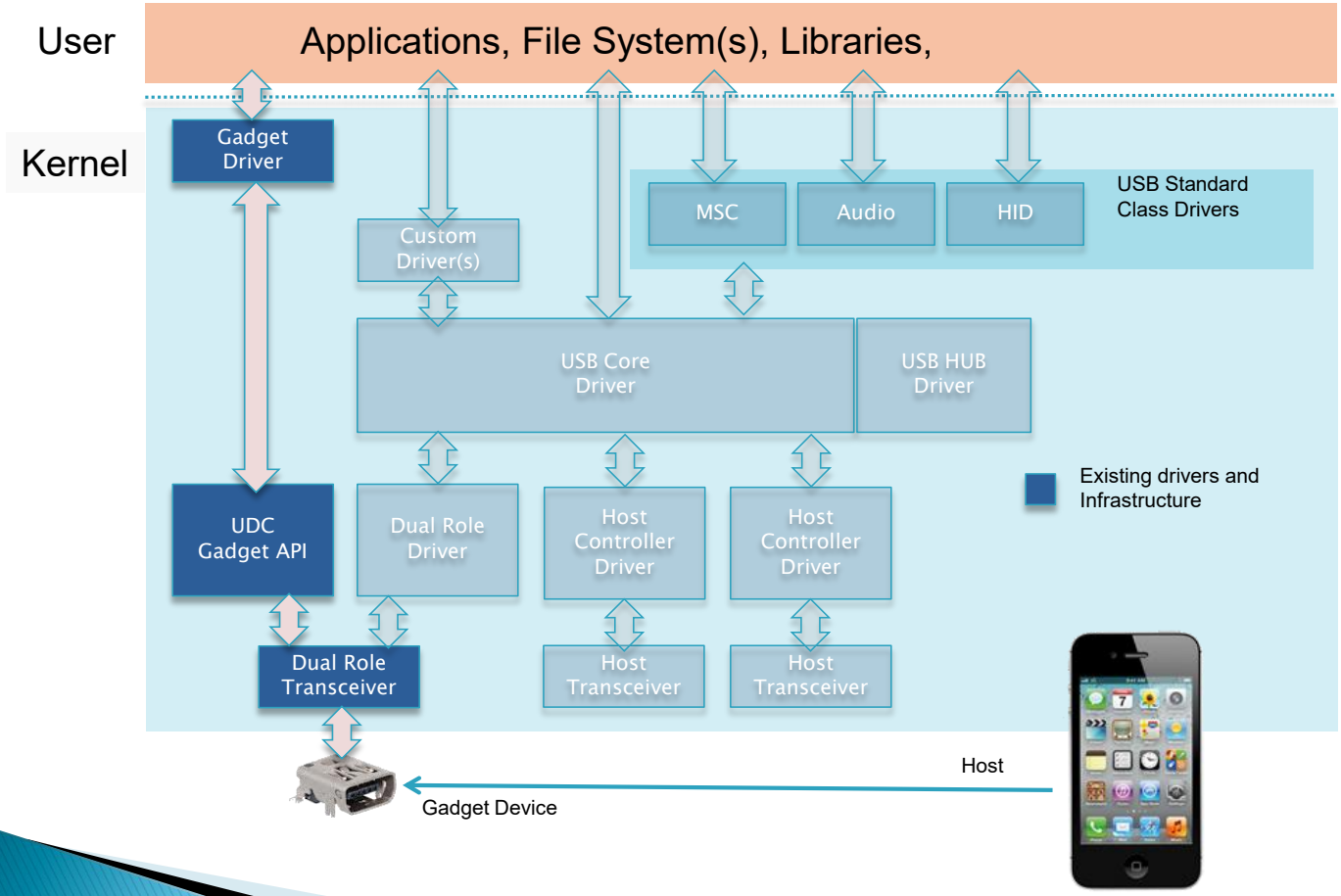
Linux USB Host / Gadget Software Architecture (Gadget)



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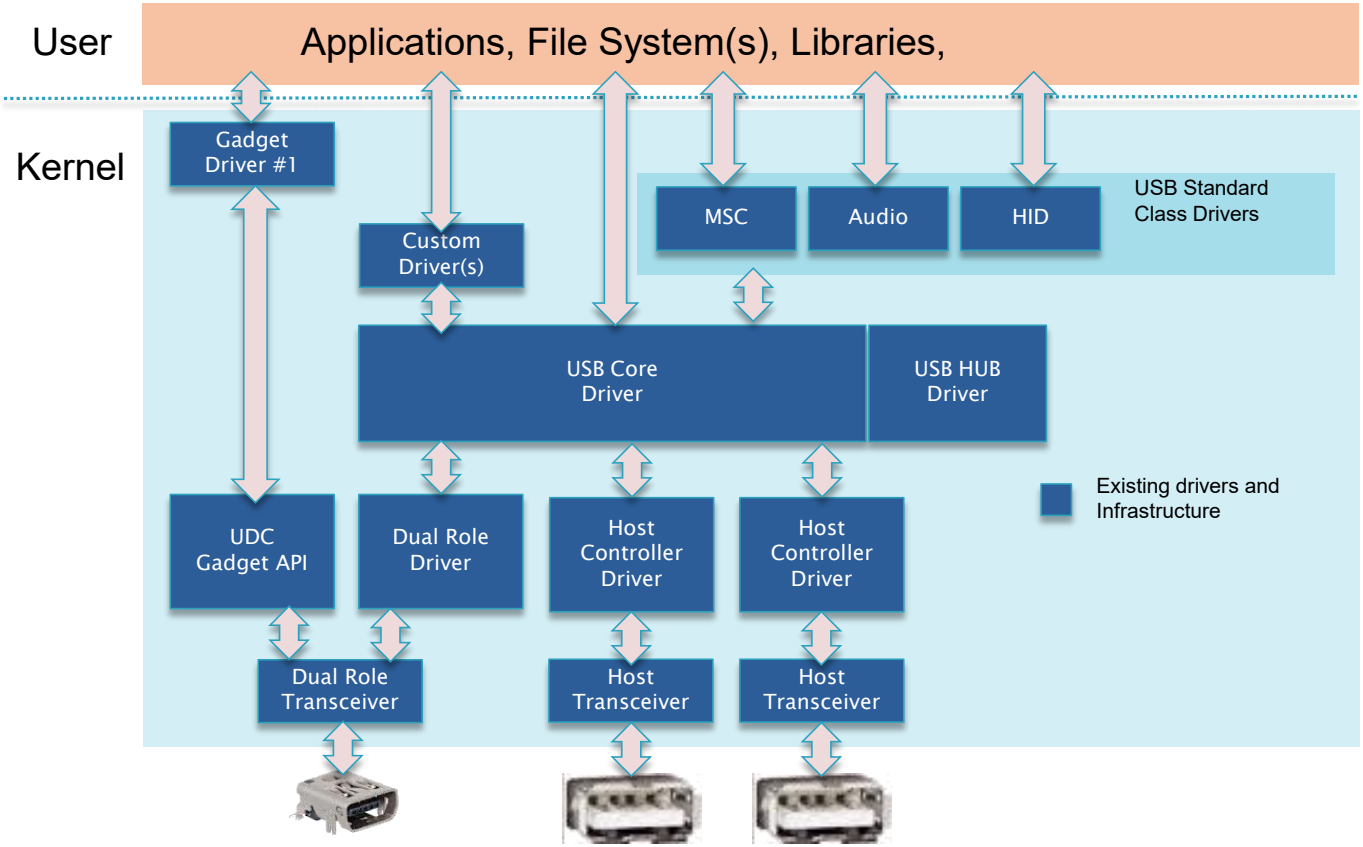

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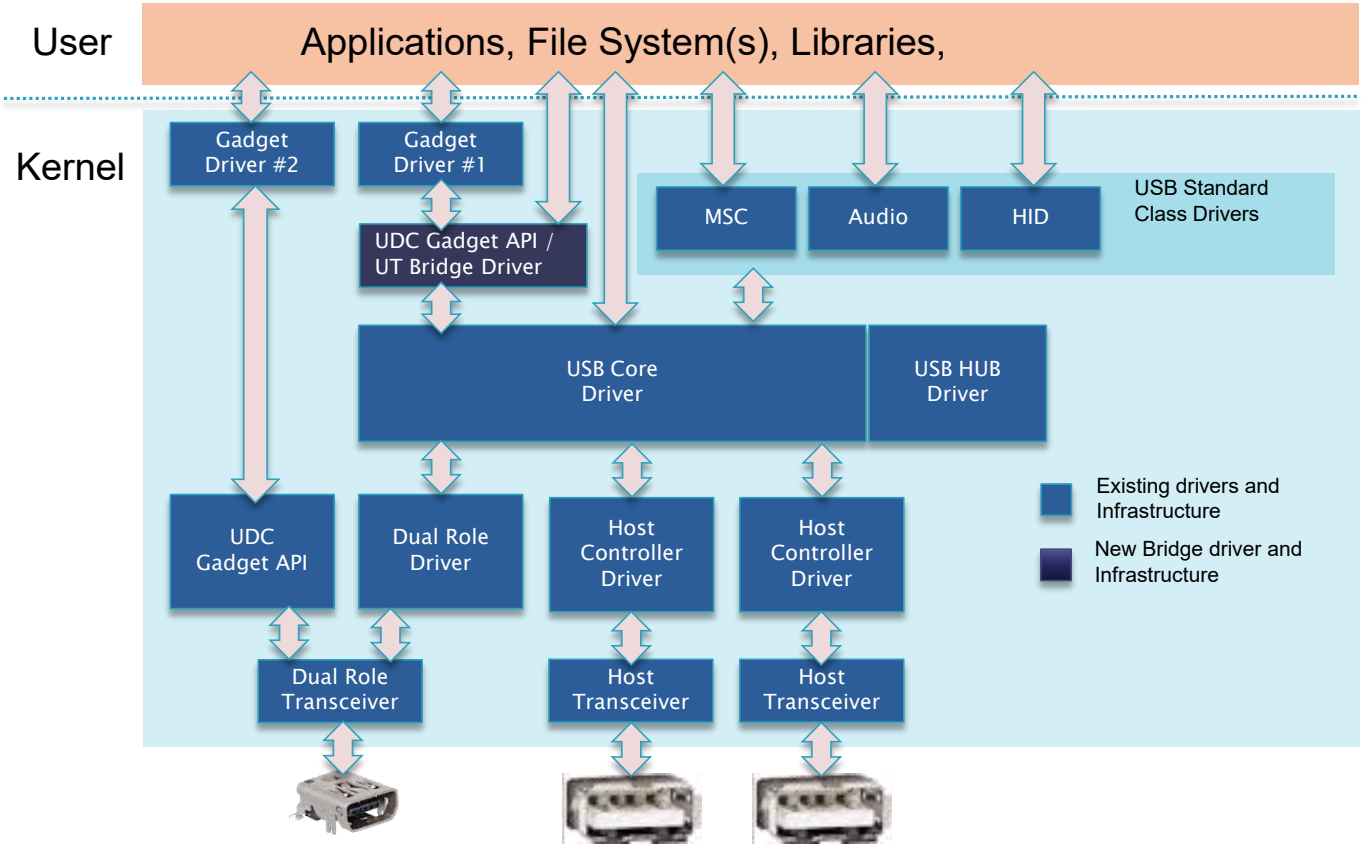
Linux USB Host / Gadget Software Architecture (Unwired)



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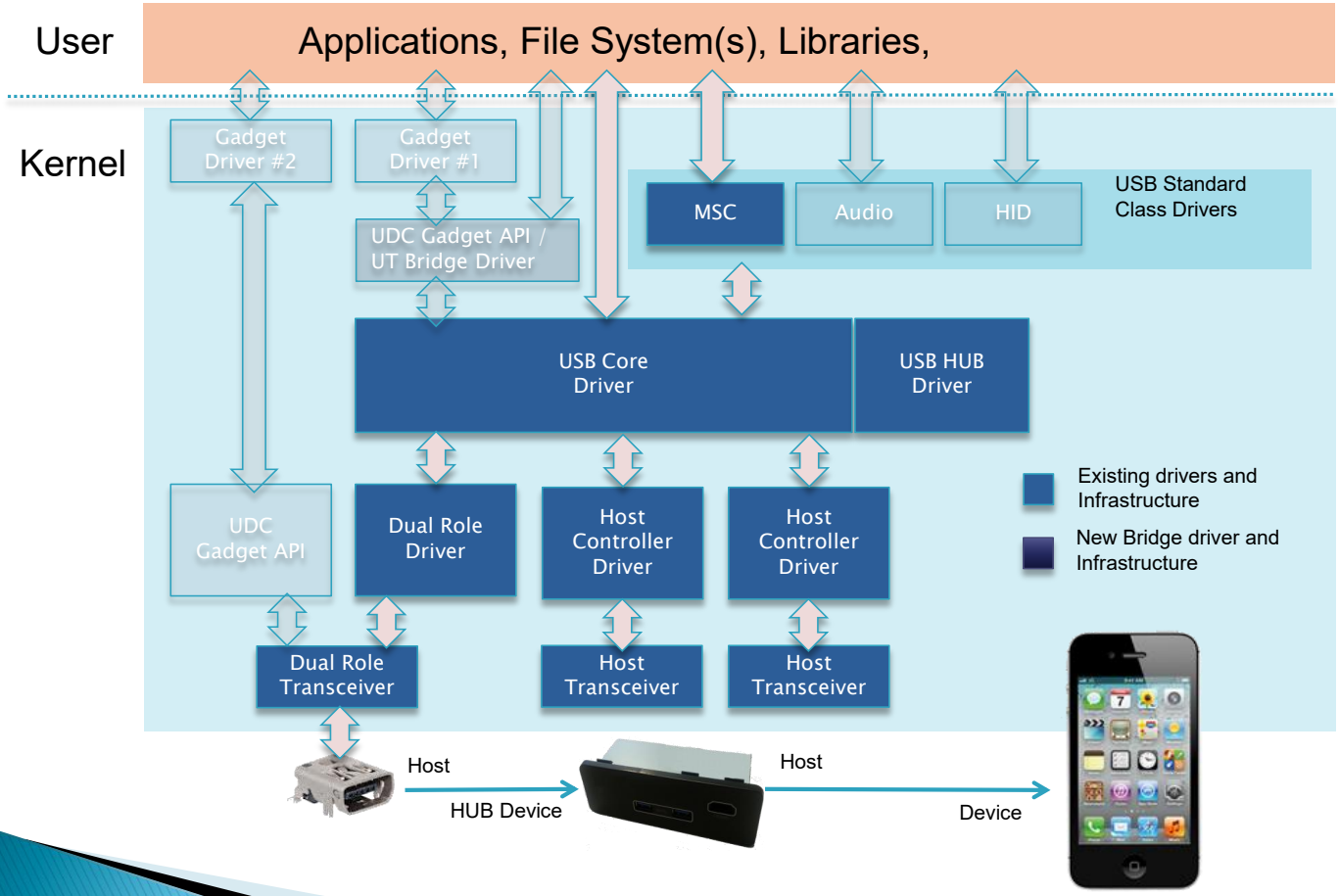
Linux USB Host / Gadget Software Architecture (Host)



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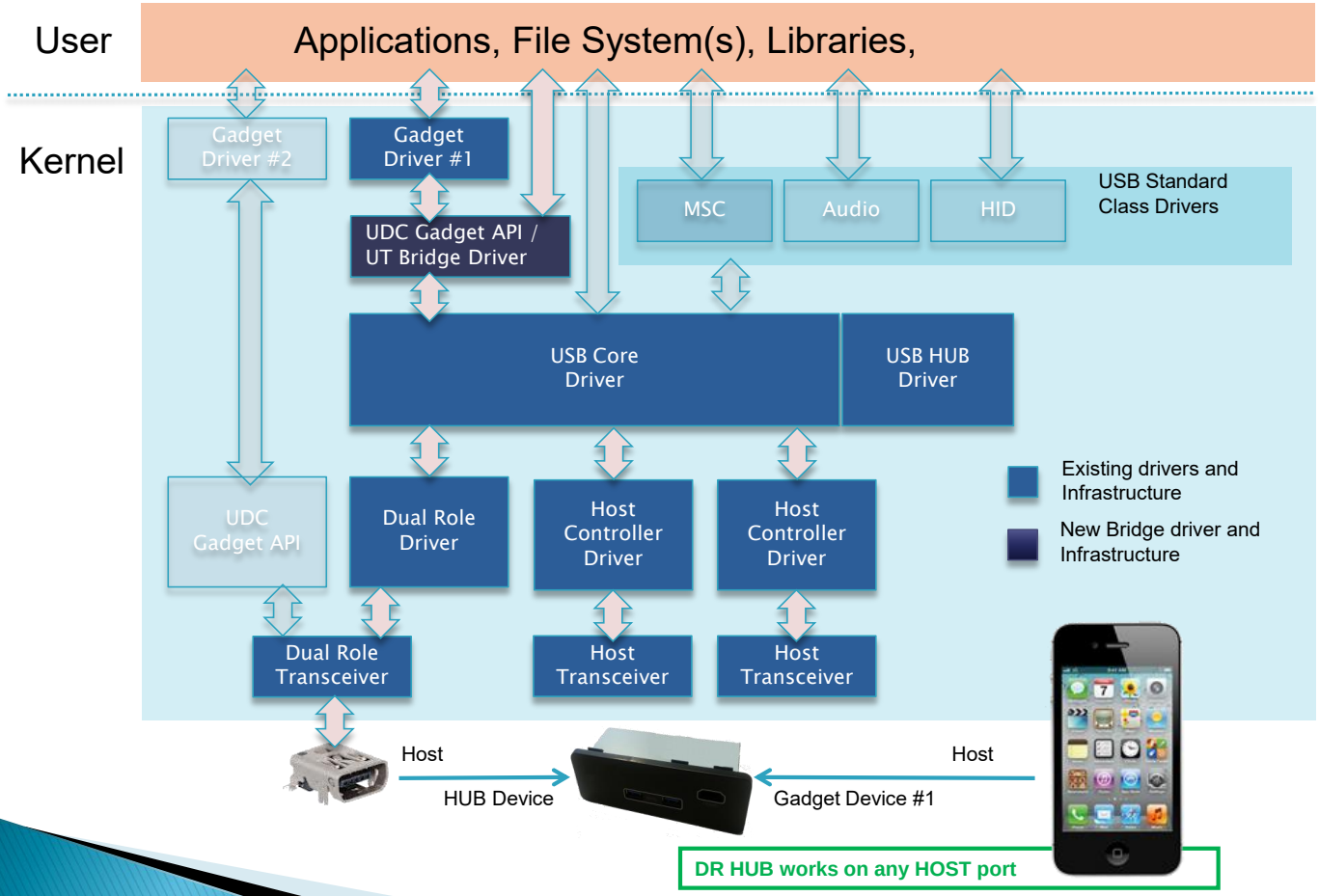
Linux USB Host / Gadget Software Architecture (Gadget)



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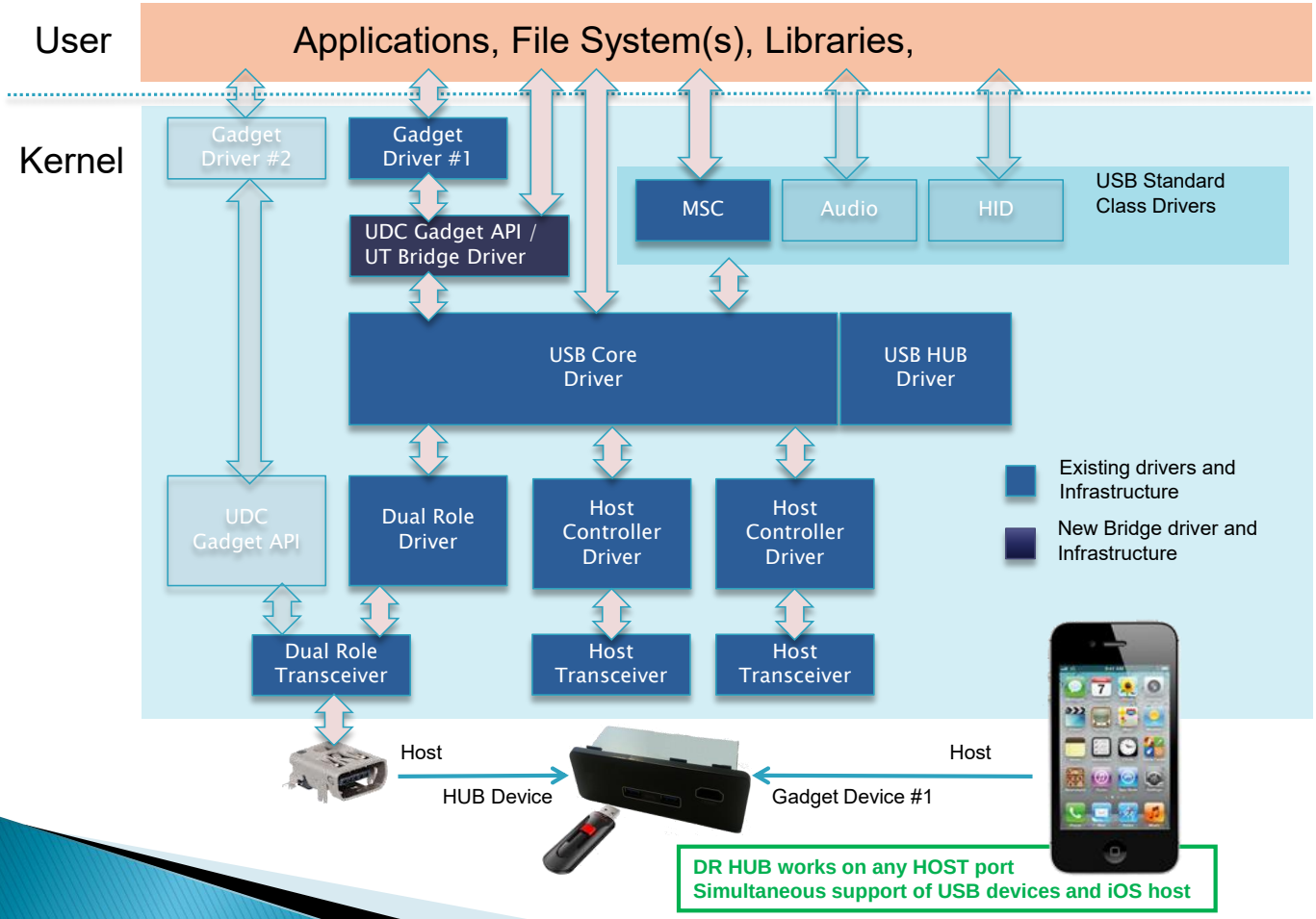
Linux USB Host / Gadget Software Architecture (Gadget)



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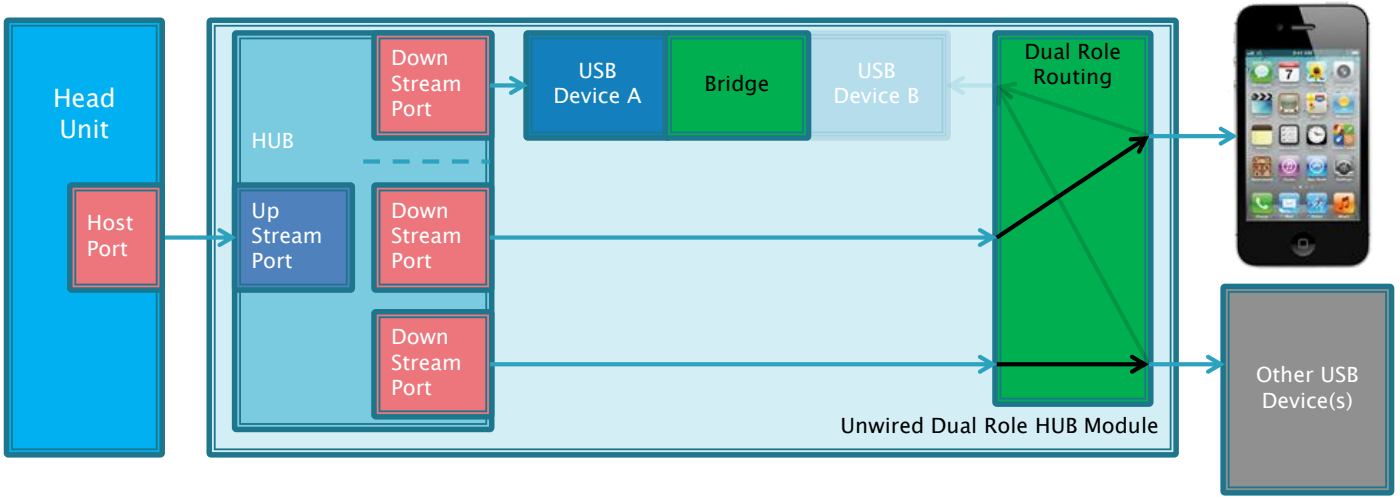
Dual Role HUB Concept



Description :

- At power up Head Unit detects a USB hub and a custom device (Bridge)
- Head Unit will load custom driver for the Bridge device supplied by Unwired
- Bridge driver has ability to control routing of any downstream port of the hub to either the Bridge or straight to the hub
- USB port routing is direct to the Hub for initial connection as a normal USB device.

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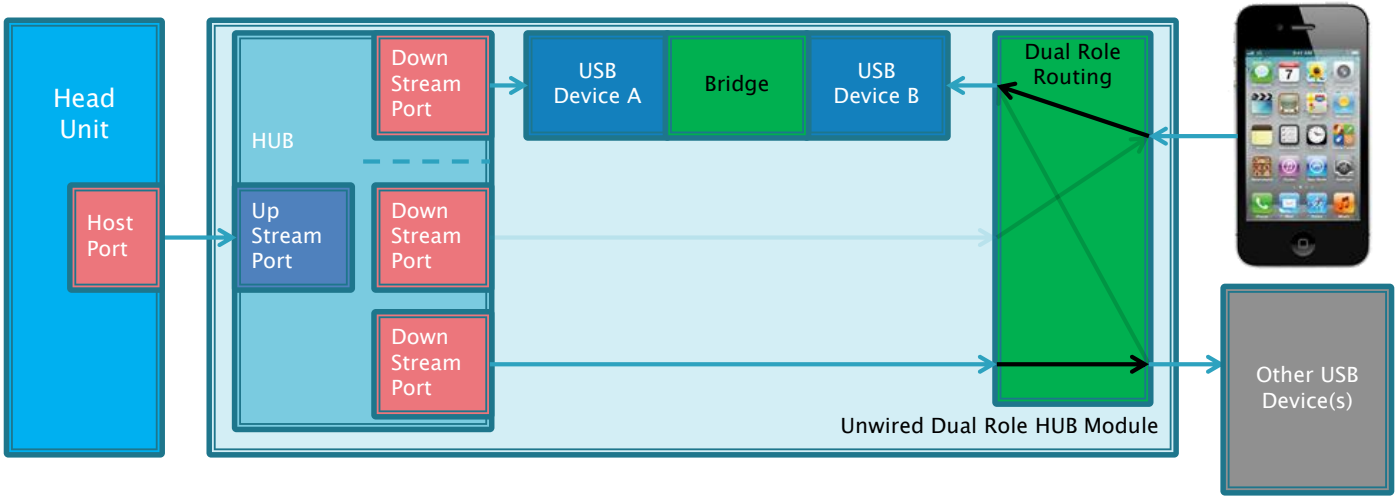
Dual Role HUB Concept



Description :

- Upon connection to Apple device the head unit will authenticate and then command the Bridge driver to role reverse resulting in the Apple device to be routed to the Bridge
  - Module contains a single Bridge
  - Either user accessible port may be role reversed and connected to the bridge
- When the iOS device is in host mode it will transfer data to Device B and Device B will transfer it to Device A.
- The Bridge driver in the head unit will read the data from endpoints in device A and pass it to a gadget driver

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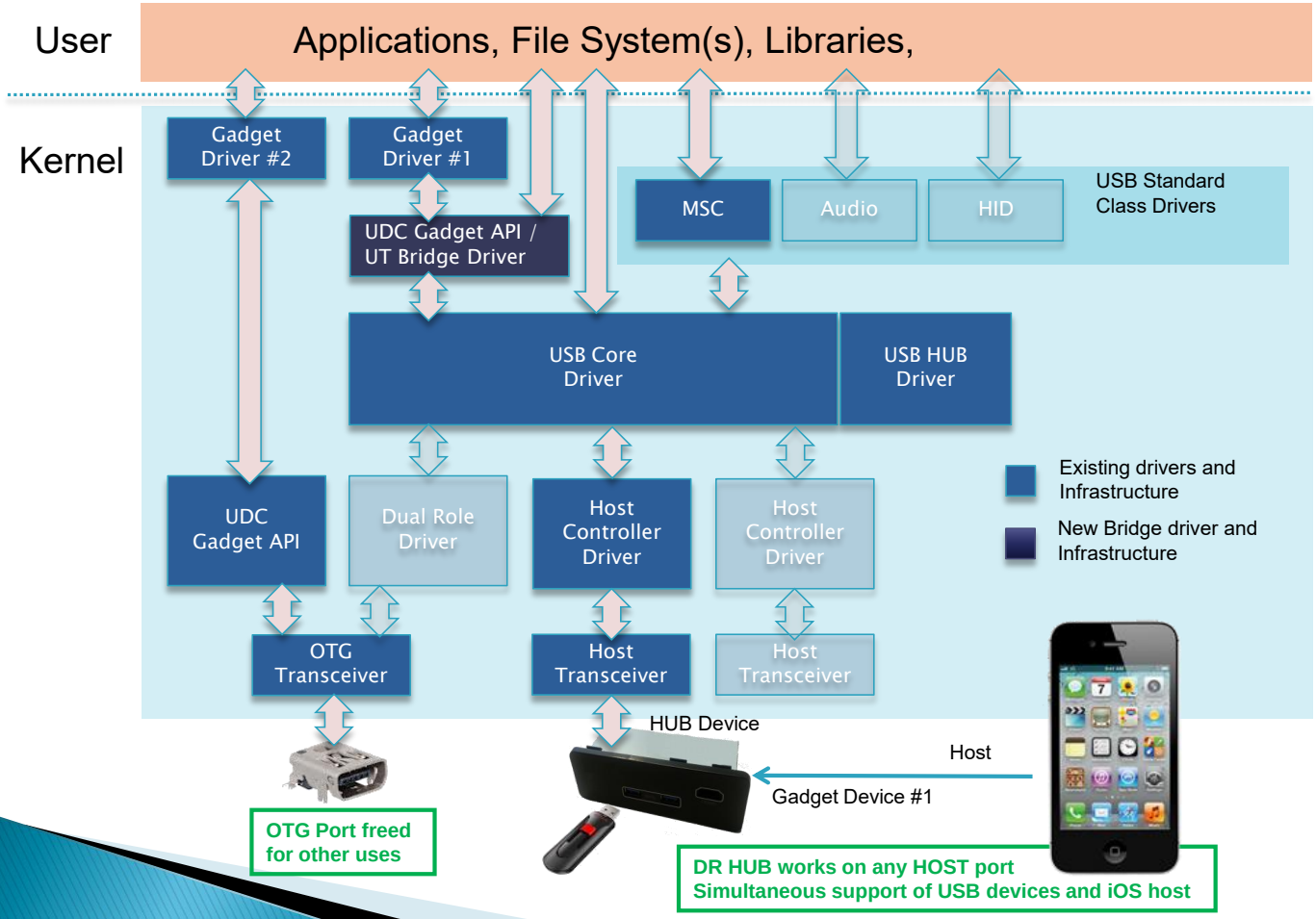
Linux USB Host / Gadget Software Architecture (Unwired)



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Dual Role HUB Development Status

- **Initial HW development timeline based upon lead customer**
  - **Form factor HW for lead customer available to OS providers only**
  - **Target for SW development Hubs (FPGA) 11/22/2013**
  - **Target for GM Form factor Hubs (ASIC) April 2014**

- **Linux Driver available as Beta**
  - **Based on Kernel 3.8 / 3.10**
  - **GPL based kernel driver**
    - **Requires SLA (to enforce driving feedback into mainline)**
  - **Tested using two Ubuntu PC's connected to hub as Host and Gadget**
    - **Gadget 0**
    - **NCM Gadget**
    - **USB Audio Gadget**
    - **ACM Serial Gadget**

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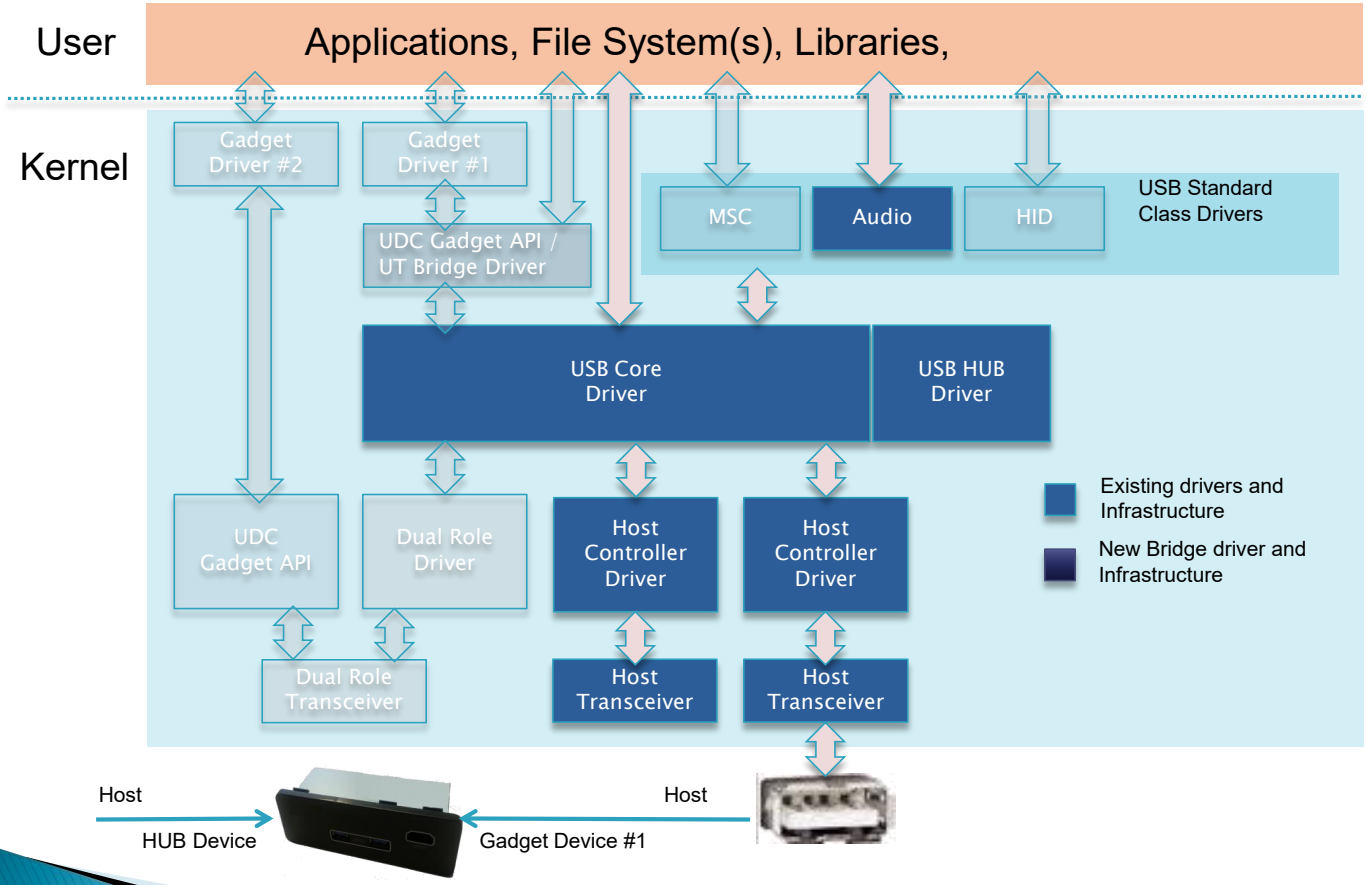
Linux USB Host on DR Port Example



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Dual Role HUB & Driver Recap

- **Enables Role Reversal of devices connected via USB Hubs**
  - **Role Reversal can be managed in User space and/or in Kernel.**
- **Works with Any USB Host capable port**
  - **Does not require a Dual Role port on the host**
- **Integrates with existing Kernel with minimal changes.**
  - **Bridge data transfer can be managed in User space and/or in Kernel**
- **Allows re-using or optimization of existing Linux gadget driver's**
  - **Standard UDC/Gadget API Interface exposed via Unwired Bridge Driver**
  - **Optional Direct Interface exposed via Bridge Driver**

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