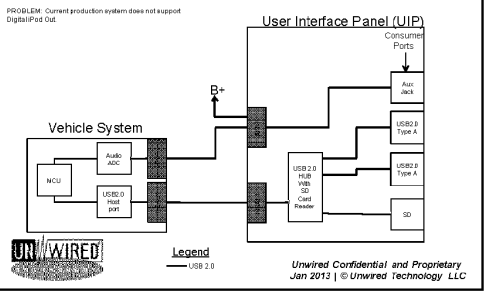
Vehicle System Diagram

Baseline NGI Design (MY13)

PROBLEM: Current production system does not support Digital iPod Out



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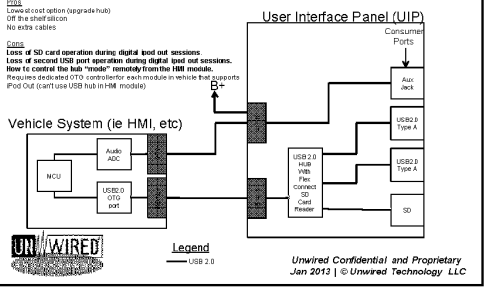
Option A: Flex Connect Hub

(MY16 NGI Support for Apple Digital iPod Out)

Pros
Lowest cost option (upgrade hub)
Off the shelf silicon
No extra cables

Cons
Loss of SD card operation during digital ipod out sessions.
Loss of second USB port operation during digital ipod out sessions.
How to control the hub "mode" remotely from the HMI module.
Requires dedicated OTG controllerfor each module in vehicle that supports iPod Out (can't use USB hub in HMI module)



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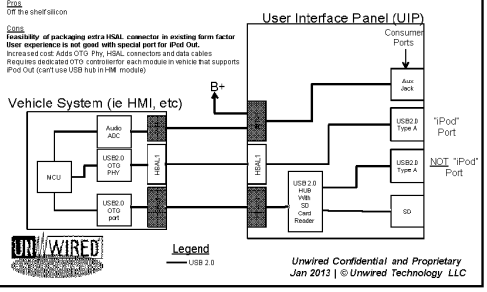
Option B: OTG

(MY16 NGI Support for Apple Digital iPod Out)

Pros
Off the shelf silicon

Cons
Feasibility of packaging extra HSAL connector in existing form factor
User experience is not good with special port for iPod Out.
Increased cost: Adds OTG Phy, HSAL connectors and data cables
Requires dedicated OTG controllerfor each module in vehicle that supports iPod Out (can't use USB hub in HMI module)



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Summary

- Neither option A or B complies fully with existing functional requirements.
  - Option A does not allow access to the SD card or the second USB port if a iOS device is plugged in. Eg can't run vehicle nav app when iphone is connected (which is likely all the time).
  - Option B forces the user to 'find the right port' to make the phone work. Eg K2 vehicles have 5 ports in reach of the driver but only one will work. 80% chance to get it wrong.
- Option B may not package.
- Option B is expensive.

Conclusion: Neither option looks good. Need another option.

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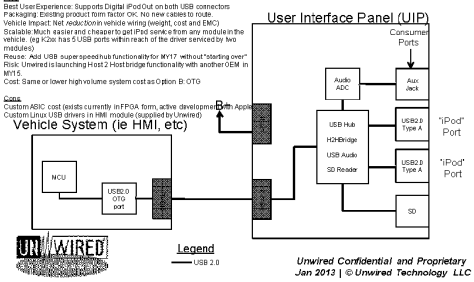
Option C: Host 2 Host Hub

(MY16 NGI Support for Apple Digital iPod Out)

Pros
Best User Experience: Supports Digital iPod Out on both USB connectors
Packaging: Existing product form factor OK. No new cables to route.
Vehicle Impact: Net *reduction* in vehicle wiring (weight, cost and EMC)
Scalable: Much easier and cheaper to get iPod service from any module in the vehicle. (eg K2ie has 5 USB ports within reach of the driver serviced by two modules)
Reuse: Add USB super speed hub functionality for MY17 without "starting over"
Risk: Unwired is launching Host 2 Host bridge functionality with another OEM in MY15.
Cost: Same or lower high volume system cost as Option B: OTG

Cons
Custom ASIC cost (exists currently in FPGA form, active development with Apple)
Custom Linux USB drivers in HMI module (supplied by Unwired)



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USB Host to Host Bridge

Purpose

Provide a gateway for two USB 2.0 hosts to communicate with each other over standard USB protocol for purposes of control sessions, file transfers and streaming content. Specifically, one host is meant to be the car radio (head unit) and the other is a personal mobile device such as phone or tablet.

General Assumptions and Requirements

- Compliance to USB Device standards (where possible)
- Compliance to Mobile Device Manufacturer's proprietary messaging protocols, endpoint, thru put, latency and requirements. Such requirements may not all be known up front and may change over time.
- Custom USB driver in the headunit
- Automotive Grade components
- Package size, cost, and board space minimized
- Adaptable to changing requirements from mobile device manufacturers
- Field Firmware Upgradeable

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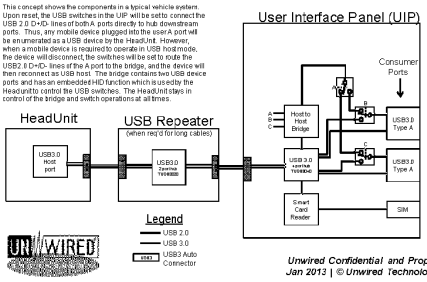
Vehicle System Diagram

(Vehicle Specific Concept)

This concept shows the components in a typical vehicle system. Upon reset, the USB switches in the UIP will be set to connect the USB 2.0 D+/D- lines of both A ports directly to hub downstream ports. Thus, any mobile device plugged into the user A port will be enumerated as a USB device by the HeadUnit. However, when a mobile device is required to operate in USB host mode, the device will disconnect, the switches will be set to route the USB2.0 D+/D- lines of the A port to the bridge, and the device will then reconnect as USB host. The bridge contains two USB device ports and has an embedded HID function which is used by the HeadUnit to control the USB switches. The HeadUnit stays in control of the bridge and switch operations at all times.



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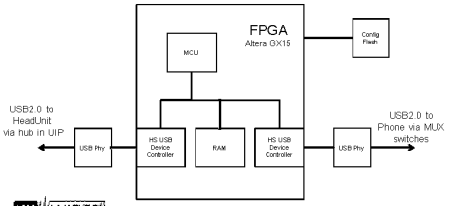
Bridge Requirements

(Bridge Hardware Design Concept using Automotive Qualifed Components)



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