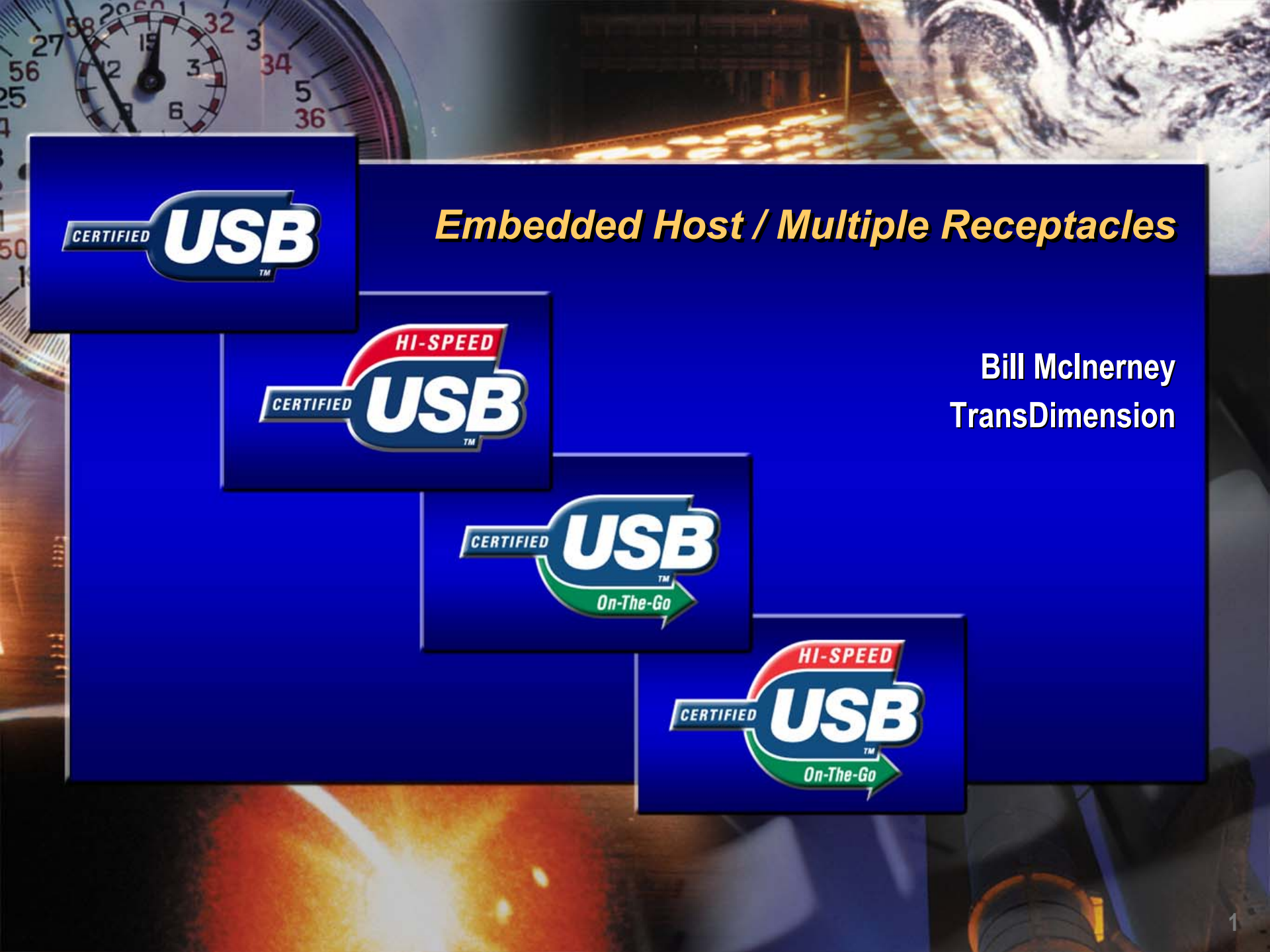


Embedded Host / Multiple Receptacles

Bill McInerney
TransDimension

Thanks

- Ed Beeman
- Paul Berg
- Joe Meza
- Mark Paxson
- USB OTG Working Group

Embedded Host and Multiple Receptacle

- Introduction
- Host Ports Definitions
- Embedded Host –
  - Certification Requirements
  - Targeted Peripheral List (TPL)
  - Power
  - Speed
  - Transfer Types
  - Hub Support
  - SRP/HNP
  - Labeling Recommendations
- Multiple Receptacles
  - Products with Multiple Type-B
  - Products with Multiple Type-B
  - Products with Type A & Type-B
  - Products with Mini AB
  - Products with Mini A
- Logo Eligibility Overview
- Recommendations and Best Practices

Introduction

This presentation is to clarify the USB-IF's standing on the topics of Embedded Host and Multiple Receptacle Products – It is NOT a specification.

Applications have recently arisen that are beyond the original vision of the USB specification:

- Inexpensive host and peripheral controllers.
- Peripherals that have more than one USB receptacle.
- Embedded Hosts and Multiple Receptacle Products that interoperate with one or more broad classes of USB peripherals.

- USB-IF is expanding test coverage of the compliance tests to begin including some of these common cases. As has always been the case, a product can only receive a logo if an applicable compliance program exists for that product.

Host System Definitions

Conventional USB Host System:

- Multiple Standard-A receptacles, and no Standard-B receptacles.
- Each Type-A receptacle connects to the dedicated downstream port of a root hub in the Host.
- Each root hub connects to a Host Controller that is responsible for scheduling and controlling the transactions on the root hub ports.
- Each port must be capable of supplying 100mA for enumeration, and 500mA for operation.
- Each port capable of configuring and operating any USB device (all transfer types & speeds).
- Capable of running an advance OS supporting plug and play, power management, and multitasking.
- Capable of operating multiple USB devices concurrently.

Embedded Host System:

- Type-A ports on a product that do not operate either as a hub or as a full host.
- Embedded Host systems may or may not contain Type-B ports.
- Uses an embedded specific operating system. Certain software or drivers may not be readily available on these products.
- Limited resources with little expansion capability.
- May provide as little as 8mA on each downstream port

Embedded Host -Certification Requirements

Eligibility for the USB logo requires compliance with:

Host System Electrical Testing

- A device enumerated with a VID of 0x1A0A shall be recognized as a Compliance Tester.
- Type-A ports must pass host system electrical compliance tests.

Targeted Peripheral List Testing

- The Targeted Peripheral List (TPL) lists;
  - specific products and/or
  - classes of products that have been tested and verified as compatible with the host function.
- If class support is claimed, interoperability with a sample of that "class" has to be proven.
- Upon connection, the user must be notified whether or not the peripheral is supported. The indication may be as simple as an LED labeled to convey success or failure. Textual messages are preferred for products that have such a display.

Embedded Host -Targeted Peripheral List (TPL)

Manufacturer	Model	VendorID	ProductID	Description	Speed
Logitech	M-BJ58	0x046D	0xC00E	USB Wheel Mouse	LS
Yamaha	YST-MS35D	0x0499	0x3002	USB Speakers	FS
TEAC Corporation	FD-05PUB	0x0644	0x0000	USB Floppy Drive	FS
Hewlett Packard	D125X1	0x03F0	0x2311	All-In-One Printer, Scanner, Copier	HS

Testing Version of TPL

Class Name	Description	Class Code	Sub Class Code	Protocol	Speeds supported
Mass Storage	Support for USB Floppy drives.	08h	04h	50h	HS,FS
Devices Tested					
Manufacturer	**Model**	**VendorID**	**ProductID**	**Description**	
TEAC Corporation	FD-05PUB	0x0644	0x0000	USB Floppy Drive	HS

Customer Version of TPL

Embedded Host -Power

- Must supply a minimum of 8mA on VBUS.
- Must supply the maximum amount of current that any device in the Targeted Peripheral List will consume while operating.
- If power consumption is not specified on the TPL or if support is claimed for a class of peripherals, then the host must meet the power requirements of a standard host (supply 500mA).
- Must have capability to provide max power on all of its Type-A receptacles simultaneously.
- Must report a failure to the user when peripherals are connected that consume more power than can be supplied
  - This would typically be an unsupported device

Embedded Host -Speed

- For Certification eligibility silicon and IP designs must support either:
  - All three speeds, or
  - Full- and Low-Speeds
- End products only need to support the speeds required by the devices on its Targeted Peripheral List.
- High-, Full-, and Low-Speed may be supported in any combination as dictated by the TPL.
- The TPL must list the supported speeds for each device or class.
- An Embedded Host must report a warning message to the user when an unsupported peripheral is connected, no matter what speed the peripheral requires.

Embedded Host -Transfer Types

- Four USB transfer types: Control, Isochronous, Bulk, and Interrupt.
- Must support Control transfers in order to be able to enumerate connected peripherals.
- Besides Control, Embedded Hosts need only support transfer types required by their Targeted Peripheral List.

Embedded Host -Hub Support

- Hub support is not required for Embedded Host ports.
- Embedded Host may support any number of hubs within the limits set by the USB Specification.
- The Embedded Host must provide an indication to the user of any unsupported hub configuration.
- Products that offer hub support must report an “Excessive Power” message to the user when a hub is connected which consumes more power than the Embedded Host can supply, just as it would with any other peripheral.

Embedded Host -SRP/HNP

Session Request Protocol (SRP)

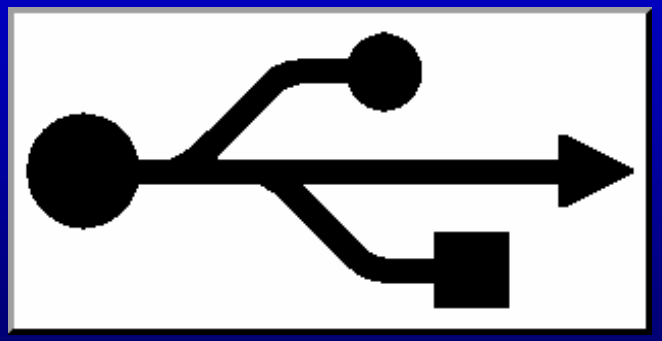
- Embedded Hosts may optionally support the SRP.
- Embedded Hosts that do support SRP must comply with the requirements for SRP as outlined in the OTG supplement, including section 5.1.4 VBus Capacitance.

Host Negotiation Protocol

- HNP is reserved for USB OTG products only and must not be implemented on Type-A ports.

Embedded Host -Labeling Recommendation

- To avoid giving the impression that the Type-A port offers standard USB host or hub functionality, the product should have some graphical or textual label adjacent to the receptacle that in some way indicates the limited functionality (e.g., a camera icon).
- The port may or may not display the USB icon, at the manufactures discretion.



Multiple Receptacles –Products with Multiple Type-B

- The Mini-B receptacle is commonly used only on small devices that do not have room for a Standard-B receptacle. The functions and behaviors associated with both types of Type-B receptacles are identical.
- Nominally, a device will only have a single Type-B receptacle.
- The purpose of multiple connections would be for connections to multiple independent hosts.

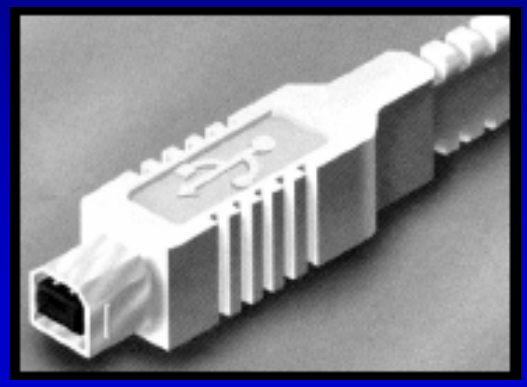
Certification Requirements:

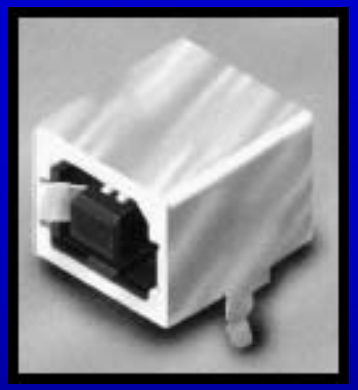
- Certification available for products with multiple Type-B ports.
- Each port must pass all peripheral compliance testing.
- Each Type-B port must have an independent peripheral controller.
- Each port must be capable of operating independently from other Peripheral Controllers.
- The device must support enumeration and control on all of the Type-B receptacles simultaneously.
- All Type-B ports must support the same speeds.
- A product cannot require multiple connections to a single host.

Multiple Receptacles –Products with Multiple Type-B

Recommendations:

- All Peripheral Controllers on a device should have the same capabilities, and have access to the same resources.
- In the unusual case where non-equivalent ports are the best solution for the customer (i.e. different drivers), vendors should make the difference obvious by physically separating the ports on the product and by labeling the product in a way that highlights the differences.
- An example would be a printer/scanner/copier which would tie in all 3 functions through a B receptacle in the back that would tie to a PC and then also had a B receptacle on the front that allowed for printing only from a laptop.
- Each Type-B port should use the USB icon to identify its functionality.





Multiple Receptacles –Products with Multiple Type-A

Certification Requirements:

- All ports using Type-A receptacles must comply with all of the Embedded Host recommendations listed earlier.
- If simultaneously accessible, then all Type-A ports must operate concurrently, independent of the activity on the other ports.
- The product must be able to supply the required current to all Type-A ports simultaneously.
- All Type-A ports must support the same speeds.
- All Type-A ports must support the same devices.

Recommendations:

- Same as for multiple B.

Multiple Receptacles –Products with Type-A & Type-B

Example:

- Printers with a Type-B port used for PC connect, and a Standard-A port on the front for camera connection only.

Certification Requirements:

- USB-IF certification is available for products in this category that meet the following requirements:
- All Type-B ports must pass previously discussed B port compliance tests.
- All Type-A ports must pass previously discussed A port compliance tests.
- If simultaneously accessible, then Type-A and Type-B ports must operate concurrently.
- Speeds supported on Type-A and on Type-B receptacles need not be the same.
- Products with a Type-B and multiple Type-A receptacles may not have a mixture of A-ports that only offer limited Embedded Host capability and A-ports that offer full-function hub capability.
  - All Type-A receptacles must either be connected to an Embedded Host controller or all Type-A receptacles must be connected to a hub controller that serves the Type-B port.
- Products in this category are eligible for the standard USB logo, not the USB OTG logo, and may use the Hi-Speed banner if the Type-B port(s) are Hi-Speed compliant.

Multiple Receptacles –Products with Type-A & Type-B

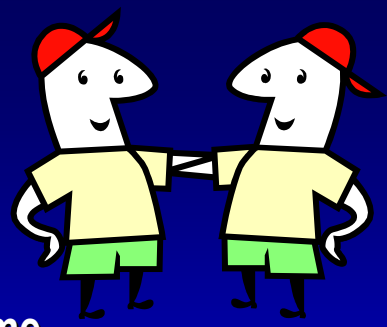
Recommendations:

- **To avoid giving the impression that the Type-A port offers standard USB host or hub functionality, the product should have some graphical or textual label adjacent to the receptacle that in some way indicates the limited functionality (e.g., a camera icon). The port may or may not display the USB icon, at the manufacturer's discretion.**
- **Products in this category that operate at Hi-Speed as a device are encouraged but not required to provide Hi-Speed in their Embedded Host Controller. This avoids sending a potentially confusing message by the use of the Hi-Speed logo.**

Logo Eligibility

- Certification and logo eligibility is reviewed on a product basis, not on a port basis.
- Product certification is granted only when all ports are compliant with the relevant tests.
- Products are only eligible to use a single USB logo. Products may not use multiple USB logos.
- Products with Type-B ports are eligible for the Hi-Speed banner if all Type-B ports are Hi-Speed compliant. Any Type-A ports on such a product are encouraged but not required to be Hi-Speed capable.
- Products with one or more Standard-A ports and no Type-B ports are eligible to use the Hi-Speed banner if all ports are Hi-Speed compliant.
- Products with a Type-AB receptacle are only eligible for one of the USB OTG logos.
- If a product uses the Hi-Speed logo (based on its Type-B capability) and its Type-A port has a Hi-Speed certified peripheral on it's TPL that is not supported in Hi-Speed mode, then any packaging, documentation or advertisement that contains the Hi-Speed logo and mentions support for this peripheral must include a disclaimer stating that the peripheral is not supported at its highest speed.
- Product upgrades that would expand the test requirements for the product (adding a transfer type, adding HS host support, adding a USB OTG peripheral, etc) require that the device be recertified.
- In addition to passing compliance testing and being on the Integrators List, the company must sign the USB-IF Trademark License to be eligible to use the logo on their product.

Recommendations and Best Practices



Equivalency:

- Products with multiple USB ports of the same type should provide the same functionality and behavior on all such ports (this is the equivalency principle). Using any one of these ports should not affect the functionality of any of the other equivalent ports.
- In some product configurations there are compelling business or technical reasons that prevent compliance with the principle of equivalency. In these cases, care should be taken to avoid potential user confusion by clearly communicating the difference in functionality. Suggestions include:
  - 1) Label the non-equivalent ports in a manner that makes their different functionalities apparent.
  - 2) Physically separate the offending ports, placing them on different surfaces of the product, if possible.
  - 3) Provide user documentation that clearly explains the differences between the non-equivalent ports.

Consistency & Familiarity:

- Products should avoid mixing Standard- and Mini- receptacles wherever possible. In general, Mini- receptacles should only be used on products without sufficient space for standard receptacles.
- Care should be taken to ensure that behavior is consistent when connected to a PC and when not connected to a PC.

Recommendations and Best Practices

Labeling:

- Where possible, labeling should be used on Embedded Hosts and products with Multiple Receptacles to help instruct customers in proper use of the ports. The trident icon should be placed adjacent to any Type-B ports to indicate their USB functionality.
- Type-A ports that offer full hub or host functionality should also be labeled with the trident icon.
- Type-A ports that offer Embedded Host functionality may or may not use the icon, but should also consider some other form of labeling, either iconic or textual, to communicate their specific functionality.

False Hubs:

- The term ‘False Hub’ refers to a device with both Type-B and Type-A receptacles but which does not support the direct routing of data between the Type-B receptacle and the Type-A receptacle(s) as with a standard hub.
- Great care should be taken in the industrial design and port labeling of such a product to communicate to the user the unique nature of the Embedded Host port.

Conclusion

- Questions?

For More Information

Visit the USB-IF OTG Web Site:

- http://www.usb.org/developers/onthego/