USB On-The-Go

Mechanical Presentation
Agenda

- USB Topology
- Cables
- Adapters
- Connectors
USB Topology - 1

- One host
- Multiple hubs and peripherals
- Cabling forces host to peripheral connection
- Can’t connect PDA to camera
**USB Cabling - 1**

- **Existing Cables**
  - Std-A to Std-B
  - Std-A to Mini-B

- **Mini-B added in Oct 2000 for smaller devices**
USB Cabling - 2

- **OTG Cables**
  - Added Dec 2001
  - Mini-A to Std-B
  - Mini-A to Mini-B

- **Mini-AB receptacle**
  - Accepts Mini-A plug
  - Accepts Mini-B plug

- **Devices can’t use Mini-A receptacle**
With Mini-AB, can connect PDA to camera

- **A-device** = device with Std-A or Mini-A plug
- **B-device** = device with Std-B or Mini-B plug
Four cables now specified

- Std-A to Std-B 5m max
- Std-A to Mini-B 5m max
- Mini-A to Std-B 4.5m max
- Mini-A to Mini-B 4.5m max

Mini-A plug cables limited to 4.5m max
- Longer lengths result in transmission delay failures when adding adapter
Adapters - 1

- **Adapter:** Mini-A plug to Std-A receptacle
- **Purpose:** Allow connection to captive cable devices
- **Adapter can be used with non-captive cables**
Adapters - 2

- Adapter: Std-A plug to Mini-A receptacle
- Purpose: Allow connection to captive cable devices
- Adapter can be used with non-captive cables
Adapters - 3

❖ Std-B and Mini-B adapters not allowed
  – Such an adapter will cause transmission delay failures

❖ Max adapter length = 15cm
  – Longer adapter will cause transmission delay failures
  – See OTG Supplement, Section 4.4

❖ Adapter is only legal use of Mini-A receptacle
The following colors are mandated for the plastic inside the mini connectors

- **Connector**
  - Mini-A receptacle: White
  - Mini-AB receptacle: Gray
  - Mini-B receptacle: Black
  - Mini-A plug: White
  - Mini-B plug: Black
Connector Features - 1

- 5-pin (one ID pin), 0.8mm pitch
- Smaller for portable devices
- Compliant with USB specifications
  - 500 mA power
  - 480 Mbps, high-speed
**Connector Features - 2**

- **Increased cycle life**
  - Mini: 5000 mate/unmate cycles
  - Standard: 1500 mate/unmate cycles

- **Polarization features to prevent improper mating**

- **Shielding features for EMI protection**
Mini USB Connector

Mini-A

Mini-B

Mini-AB

Plug

Receptacle
## Mini USB Connector - Assignment

<table>
<thead>
<tr>
<th>Contact Number</th>
<th>Signal Name</th>
<th>Typical Wiring Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBus</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>ID</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Black</td>
</tr>
<tr>
<td>Shell</td>
<td>Shield</td>
<td>Drain Wire</td>
</tr>
</tbody>
</table>
Cable Style Construction

Twist Signaling Pair: AWG#28
- White: D-
- Green: D+

Non-twisted Power Pair: #20~28AWG
- Red: Vbus
- Black: Power Ground

Polyvinyl Chloride (PVC) Jack

Outer Shield 65% Interwoven Tinned Copper Braid

Inner Shield Aluminum Metallized Polyester

Tinned Copper Drain Wire: #28AWG
Mini-A and Mini-B Plugs
Standard-A & Mini-A

Mini "A"  Standard "A"
Max cable length = shorter of 4.5m or 25ns electrical length

Std-B Plug

<table>
<thead>
<tr>
<th>Std-B</th>
<th>Mini-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>Pin 1</td>
</tr>
<tr>
<td>Pin 2</td>
<td>Pin 2</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Pin 3</td>
</tr>
<tr>
<td>Pin 4</td>
<td>Pin 4</td>
</tr>
<tr>
<td>Pin 5</td>
<td>Shell</td>
</tr>
</tbody>
</table>
Max cable length = shorter of 4.5m or 25nsec electrical length

Type Mini A
- Pin 1
- Pin 2
- Pin 3
- Pin 4
- Pin 5
- Shell

Type Mini B
- Pin 1
- Pin 2
- Pin 3
- Pin 4
- Pin 5
- Shell
Interface of Plugs

Standard "B"  Mini "B"  Mini "A"  Standard "A"
Standard-B & Mini-B
Upside Down Receptacle
Combo Connector

- Features - latching, power jack
- Possible application – cell phone

Feb 26, 2002
USB-IF Integrator’s List

Listed Compliant Cable & Connectors
Approved by Certified Test Labs
Members Only Events