About MIPI Alliance

We are a global, collaborative organization comprised of over 280 member companies spanning the mobile and mobile-influenced ecosystems.

MIPI Alliance is leading innovation in mobile interface technology.
MIPI Alliance Member Ecosystem

- Device OEMs
- Semiconductor Companies
- Software Providers
- Application Processor Developers
- Consumer Electronics – Camera, Tablet, PC/Laptop, Peripherals
- Test Equipment Companies
- Test Labs
- IP and VIP Providers
- Handset Manufacturers
Active Technical Working Groups

- Camera
- Debug
- Display
- Low Latency Interface
- Low Speed Multipoint Link
- PHY (C/D/M)
- Reduced Input Output
- RF Front End
- Sensor / I²C
- Software
- Test
- UniPro

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MIPI DisCo and ACPI: Streamlining MIPI Component Integration

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MIPI Software WG Chair

2 February 2017
Agenda

- MIPI Software Working Group Charter
- ACPI Overview
- MIPI DisCo implementation of ACPI
- MIPI SoundWire example
- Open Property Database
- Benefits of using DisCo-defined property sets
- Streamlining the Platform Integration Process
- Call to Action
MIPI Software Working Group Charter

- Develop uniform hardware description mechanism for components/devices
- Define an extensible framework, flexibly applicable to all MIPI interfaces
- Ensure compatibility with existing mechanisms defined by MIPI interfaces
- Minimize cost for platform silicon (gate count, resource efficiency) and OS (code footprint, responsiveness)
- Provide consistent capabilities, w/o constraints/restrictions on implementation
- Enable OS consistency for capabilities and controls through reference implementation
ACPI Overview

- ACPI-compliant platforms present data to the OS via static tables and the Namespace – scope of the MIPI Software specification.
- ACPI Namespace is a hierarchical representation of the platform based on bus/controller/device topology.
- Namespace is comprised of System Descriptor Tables containing ACPI header and machine language.
- A platform has a Root Table, a Differentiated System Descriptor Table (DSDT) and 0 or more Secondary System Descriptor Tables (SSDT).
- AML is a machine-independent interpreted language describing Namespace objects.
- MIPI controllers/devices are defined as static container objects (DeviceObject) that include component- and platform-specific data.
Discovery and Configuration: MIPI DisCo

- DisCo mechanisms use ACPI Objects like _DSD (Device-Specific Data) to provide property sets to upper layer software.
- Information encoded in _DSD properties includes:
  - Platform-specific information
    - E.g. Intra-device and host-device connection information
    - Platform design variations
    - Properties are required if applicable; information must be obtained from platform
  - Component-specific information that cannot be discovered
    - E.g. clock rates supported, features available
    - Typically described in device datasheet or implementation guides
    - Properties are optional; component-specific drivers can hard-code information
    - Vendor-specific information can also be described via _DSD
- _DSD properties are portable!
  - Can also be supported in non-ACPI environment e.g. DeviceTree
### MIPI SoundWire Example: Platform

<table>
<thead>
<tr>
<th>Property String</th>
<th>Property Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;mipi-sdw-lane-&lt;n&gt;-mapping&quot;</td>
<td>String</td>
<td>Identifier encoded as a string. This property is used by driver software to determine which lanes are connected to lanes on the Master or on other Slaves via a Slave Link.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device</th>
<th>Property Key</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave #1</td>
<td>&quot;mipi-sdw-lane-1-mapping&quot;</td>
<td>&quot;master-lane-3&quot;</td>
</tr>
<tr>
<td>Slave #1</td>
<td>&quot;mipi-sdw-lane-2-mapping&quot;</td>
<td>&quot;slave-link-A&quot;</td>
</tr>
<tr>
<td>Slave #1</td>
<td>&quot;mipi-sdw-lane-3-mapping&quot;</td>
<td>&quot;slave-link-B&quot;</td>
</tr>
<tr>
<td>Slave #2</td>
<td>&quot;mipi-sdw-lane-2-mapping&quot;</td>
<td>&quot;master-lane-3&quot;</td>
</tr>
<tr>
<td>Slave #2</td>
<td>&quot;mipi-sdw-lane-1-mapping&quot;</td>
<td>&quot;slave-link-A&quot;</td>
</tr>
<tr>
<td>Slave #3</td>
<td>&quot;mipi-sdw-lane-1-mapping&quot;</td>
<td>&quot;master-lane-2&quot;</td>
</tr>
<tr>
<td>Slave #3</td>
<td>&quot;mipi-sdw-lane-2-mapping&quot;</td>
<td>&quot;slave-link-B&quot;</td>
</tr>
<tr>
<td>Slave #3</td>
<td>&quot;mipi-sdw-lane-3-mapping&quot;</td>
<td>&quot;slave-link-A&quot;</td>
</tr>
<tr>
<td>Slave #4</td>
<td>&quot;mipi-sdw-lane-2-mapping&quot;</td>
<td>&quot;master-lane-1&quot;</td>
</tr>
<tr>
<td>Slave #4</td>
<td>&quot;mipi-sdw-lane-1-mapping&quot;</td>
<td>&quot;slave-link-B&quot;</td>
</tr>
</tbody>
</table>
MIPI SoundWire Example: Component

<table>
<thead>
<tr>
<th>Property String</th>
<th>Property Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;mipi-sdw-sw-interface-revision&quot;</td>
<td>Integer</td>
<td>This is a 32-bit value where the upper word contains the major version number of this Specification, and the lower word contains the minor version number. This entry shall be provided if any other property entry within this structure is populated. Example: 0x00010000 equates to Specification v1.0.</td>
</tr>
<tr>
<td>“mipi-sdw-max-clock-frequency”</td>
<td>Integer</td>
<td>This value provides the maximum Bus clock in Hz for this master. This is the maximum usable Bus clock frequency for this platform.</td>
</tr>
<tr>
<td>“mipi-sdw-clock-frequencies-supported”</td>
<td>Package</td>
<td>A package containing one integer entry for each clock frequency supported. Frequencies are represented in Hz.</td>
</tr>
<tr>
<td>“mipi-sdw-supported-clock-gears”</td>
<td>Package</td>
<td>A package containing one integer entry for each supported gear, e.g. {1, 2, 3, 4, 8, 16}. Some Masters may only support a single gear, or powers of two.</td>
</tr>
<tr>
<td>“mipi-sdw-data-port-type”</td>
<td>Integer</td>
<td>Type of Data Port. 0: Full Data Port 1: Simplified Data Port 2: Reduced Data Port</td>
</tr>
</tbody>
</table>
_DSD Property Database

• _DSD can be used to provide MIPI- and Vendor-defined Property Sets
  – Component vendors can define their own property sets

• _DSD Database:
  – An open repository currently under development
  – Supports publication of property set definitions from component vendors, consumable by driver and firmware developers
  – MIPI SWWG will promote DisCo properties as specifications are released

• Mailing list: https://lists.acpica.org/mailman/listinfo/dsd
MIPI DisCo Benefits

• Driver
  – Pre-DisCo, drivers are developed on a single platform, and then re-built or ported to new platforms
    • A driver for a given component on platform A must be modified to work on platform B
    • Many versions of drivers exist (must be supported) for the same component
  – DisCo-compliant drivers for a MIPI component can be written once, consuming ACPI-provided properties for device and platform configuration.
    • No more forking drivers per-platform

• Firmware
  – Information is OS-agnostic
  – Simple presentation of DisCo properties
  – Drop-in property sets from component vendors
Platform Component Integration

- Component vendor provides component-specific DisCo property sets
  - Datasheet and/or electronic format

- Platform designer imports vendor-provided properties

- Platform designer adds platform implementation-specific properties as needed

- Existing OS drivers work as-is
  - Drivers for new components developed based on DisCo specifications can be re-used
Call To Action

• Component Vendors:
  – Utilize _DSD properties for components defined in MIPI DisCo Specifications
  – Describe vendor-specific properties through the _DSD database
    • Consider applicability- candidate for a future DisCo spec? Engage SWWG
    • Publish existing vendor-defined DeviceTree property sets to the _DSD database
  – Provide component-specific static _DSD packages to customers
  – **Provide tools to dynamically produce _DSD packages for customers**
  – Provide links to product information in the MIPI product registry: registry.mipi.org

• System Integrators:
  – Utilize _DSD properties for platform configurations defined in MIPI DisCo Specifications
  – Integrate component-specific packages from component vendors

• All:
  – **Participate in DisCo Spec development, property set definition**
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BACKUP
MIPI DisCo Development Process

• MIPI Software WG members work with other WGs to jointly define property sets for MIPI component types (e.g. SoundWire)
• SWWG develops specification, ongoing reviews with other MIPI Working Groups.
• Other WG ratifies content; SWWG owns content and publishes, with board approval.
• Software WG specs are made available to non-MIPI members via http://Software.MIPI.org
Device(SWC0) { // SoundWire Controller 0, Full Device Descriptor
  Name(_HID, "VEND0000") // sample Vendor ID
  Name(_DSD, Package() {
    ToUUID("daffd814-6eba-4d8c-8a91-bc9bbf4aa301"),
    Package () {
      Package (2) ("mipi-sdw-sw-interface-revision", 0x00010000), // v 1.0
    },
    ToUUID("dbb8e3e6-5886-4ba6-8795-1319f52a966b"), // Hierarchical Extension
    Package () {
      Package (2) ("mipi-sdw-link-0-subproperties", "SWM0"),
    }
  })
  Name(SWM0, Package() { // SoundWire Master 0
    ToUUID("daffd814-6eba-4d8c-8a91-bc9bbf4aa301"),
    Package () {
      Package (2) ("mipi-sdw-max-clock-frequency", 9600000),
    }
  })

  Device(SWS0) { // SoundWire Slave 0
    Name(_ADR, 0x00055AA55AA)
    Name(_DSD, Package() {
      ToUUID("daffd814-6eba-4d8c-8a91-bc9bbf4aa301"),
      Package () {
        Package (2) ("mipi-sdw-sw-interface-revision", 0x00010000), // v 1.0
        // ...
        Package (2) ("mipi-sdw-source-port-list", 0x06),
        Package (2) ("mipi-sdw-sink-port-list", 0x18),
      },
      ToUUID("dbb8e3e6-5886-4ba6-8795-1319f52a966b"), // Hierarchical Extension
      Package () {
        Package (2) ("mipi-sdw-dp-0-subproperties", "P0SP"),
        Package (2) ("mipi-sdw-dp-1-source-subproperties", "S1SP"),
      }
    })
  }

  Name(P0SP, Package() {
    ToUUID("daffd814-6eba-4d8c-8a91-bc9bbf4aa301"),
    Package () {
      Package (2) ("mipi-sdw-port-max-wordlength", 16),
      Package (2) ("mipi-sdw-port-min-wordlength", 8),
    }
  }) // End SWC0.SWS0.P0SP

  Name(S1SP, Package() {
    ToUUID("daffd814-6eba-4d8c-8a91-bc9bbf4aa301"),
    Package () {
      Package (2) ("mipi-sdw-port-max-wordlength", 16),
      Package (2) ("mipi-sdw-port-min-wordlength", 8),
      Package (2) ("mipi-sdw-data-port-type", 0),
      // ...
    }
  }) // End SWC0.SWS0.S1SP
  // End SWC0.SWS1
  // End SWC0 // End SWC0