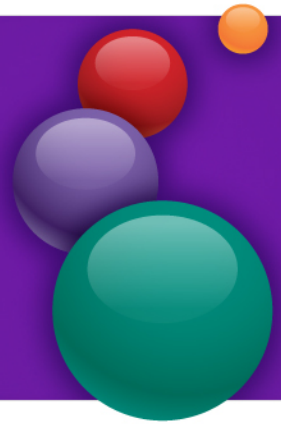
MIPI DisCo and ACPI: Streamlining MIPI Component Integration



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Rob Gough

MIPI Software WG Chair

2 February 2017

MIPI Overview

www.mipi.org

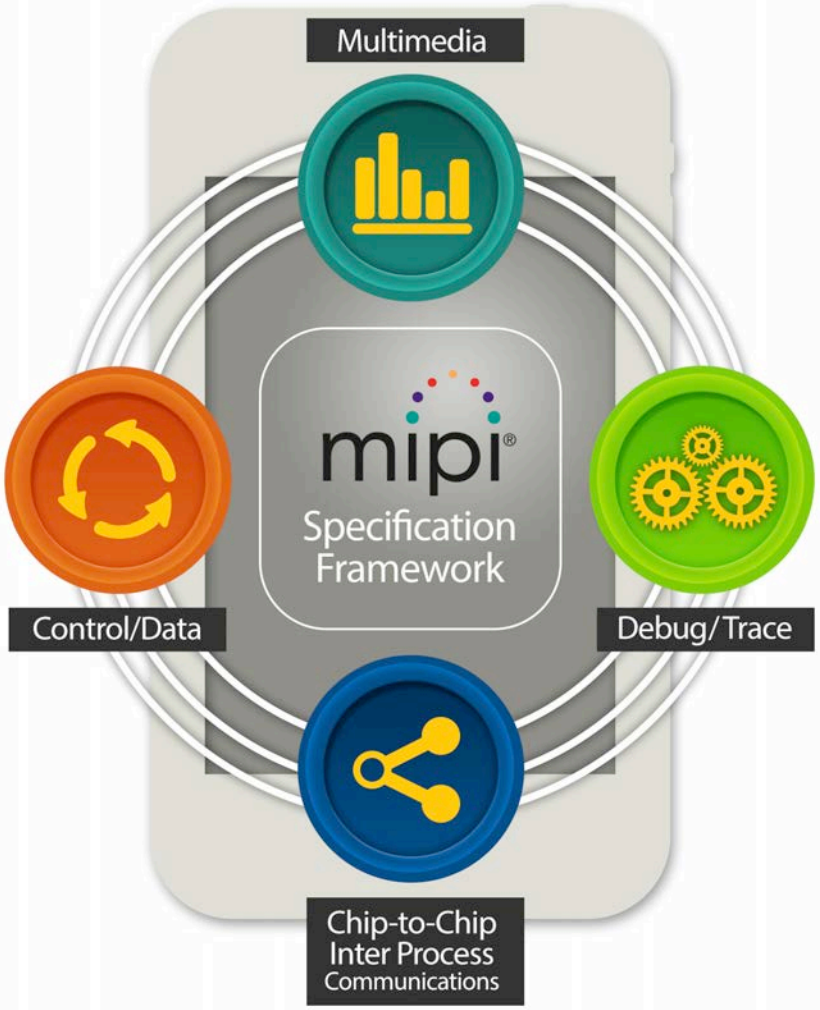
Peter Lefkin
MIPI Alliance
Managing Director

2 February 2017

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.



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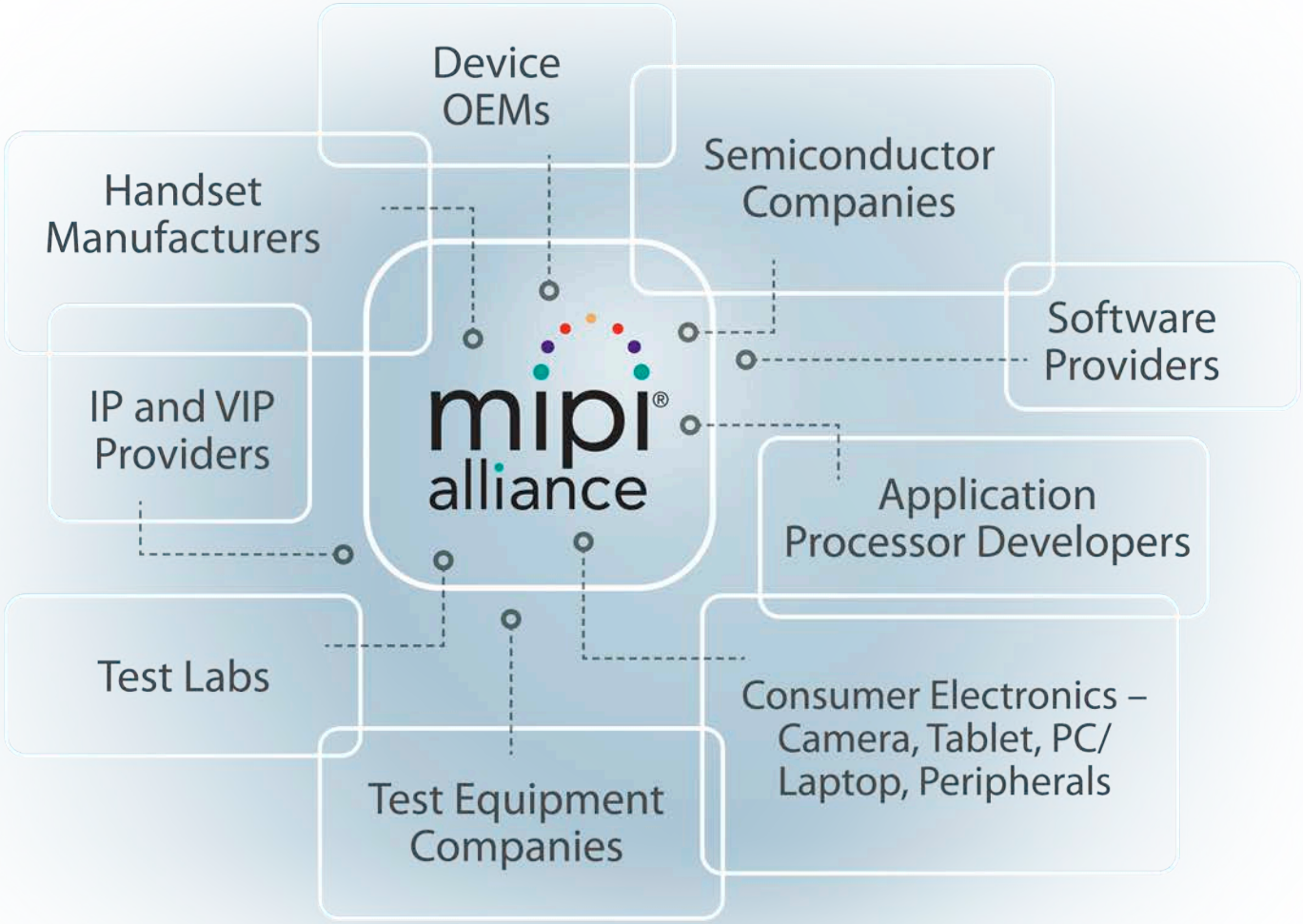
MIPI Alliance Member Ecosystem



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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 / I3C℠	Software	Test	UniPro℠

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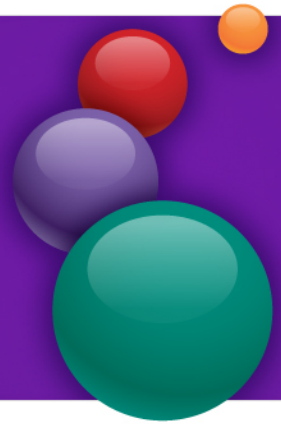
MIPI DisCo and ACPI: Streamlining MIPI Component Integration



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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

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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

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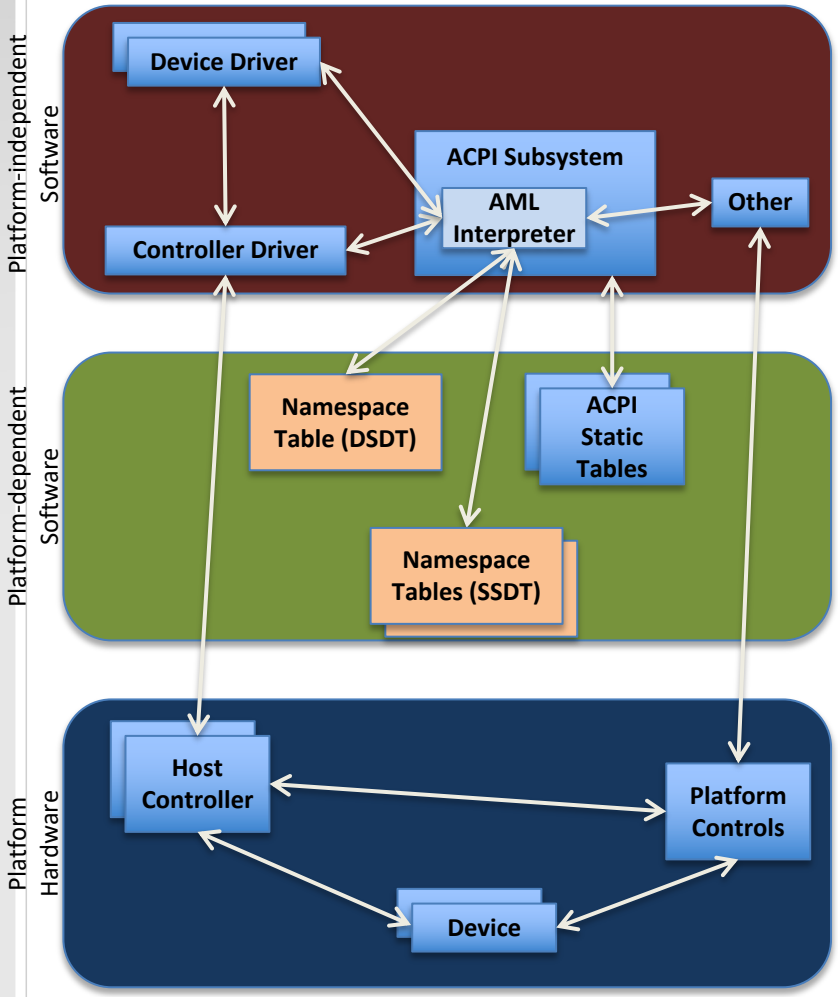
ACPI Overview



- 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

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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

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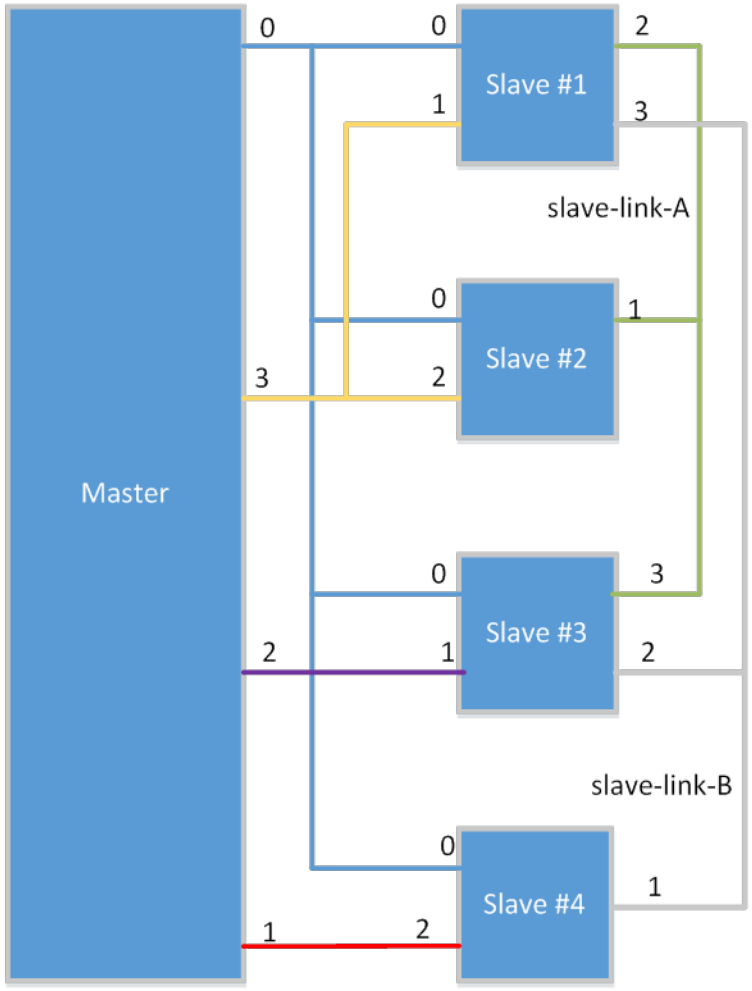
MIPI SoundWire Example: Platform

Property String	Property Data Type	Description
"mipi-sdw-lane-<n>-mapping"	String	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. ...

Device	Property Key	Value
Slave #1	"mipi-sdw-lane-1-mapping"	"master-lane-3"
	"mipi-sdw-lane-2-mapping"	"slave-link-A"
	"mipi-sdw-lane-3-mapping"	"slave-link-B"
Slave #2	"mipi-sdw-lane-2-mapping"	"master-lane-3"
	"mipi-sdw-lane-1-mapping"	"slave-link-A"
Slave #3	"mipi-sdw-lane-1-mapping"	"master-lane-2"
	"mipi-sdw-lane-2-mapping"	"slave-link-B"
	"mipi-sdw-lane-3-mapping"	"slave-link-A"
Slave #4	"mipi-sdw-lane-2-mapping"	"master-lane-1"
	"mipi-sdw-lane-1-mapping"	"slave-link-B"



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MIPI SoundWire Example: Component

Property String	Property Data Type	Description
"mipi-sdw-sw-interface-revision”	Integer	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.
“mipi-sdw-max-clock-frequency”	Integer	This value provides the maximum Bus clock in Hz for this master. This is the maximum usable Bus clock frequency for this platform.
“mipi-sdw-clock-frequencies-supported”	Package	A package containing one integer entry for each clock frequency supported. Frequencies are represented in Hz.
“mipi-sdw-supported-clock-gears”	Package	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.
“mipi-sdw-data-port-type”	Integer	Type of Data Port. 0: Full Data Port 1: Simplified Data Port 2: Reduced Data Port

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_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

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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

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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**

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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

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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

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ASL Example

```
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
```


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