mipi alliance

IF IT'S NOT MIPI, IT'S NOT MOBILE

Beyond Sensors:
What's New in MIPI I3C® v1.1

Ken Foust, Principal Engineer, Intel

MIPI I3C WG Chair

12 February 2020

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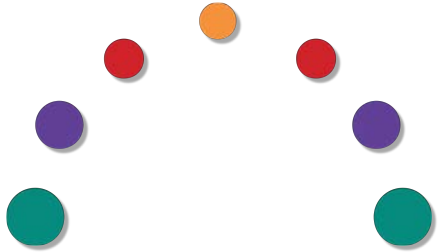
Outline



An Introduction to MIPI Alliance

- Peter Lefkin, Managing Director

Beyond Sensors: What's New in MIPI I3C® v1.1

- Introduction to MIPI I3C
- Current status
- Industries beyond mobile and usages beyond sensing
- I3C evolution – v1.0 vs. v1.1
- Why adopt I3C v1.1?
  - Deeper dives into Multi-lane for Speed, HDR-BT and Slave Reset
- What's next?
- Additional resources

About MIPI Alliance

Peter Lefkin
Managing Director, MIPI Alliance

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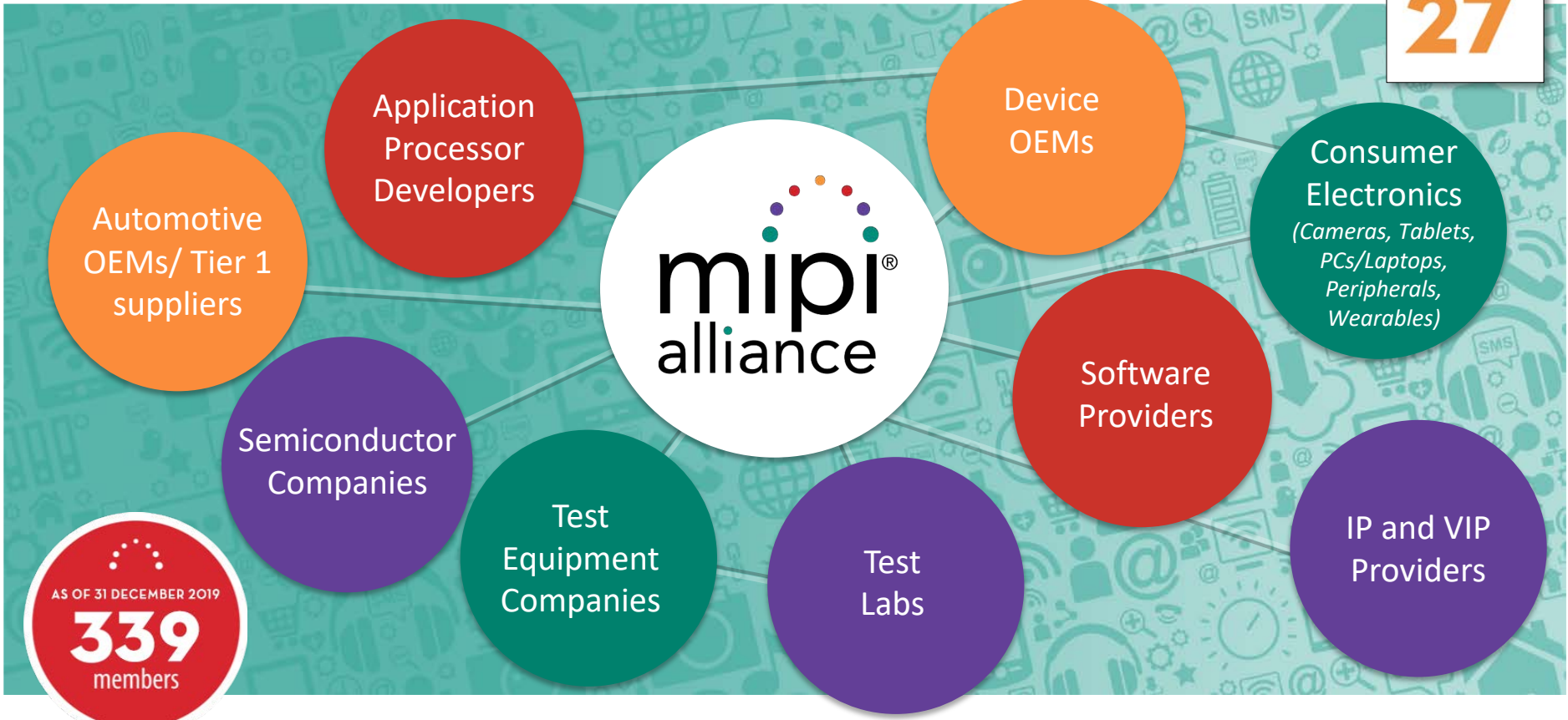
2003

MIPI ALLIANCE FORMED TO STANDARDIZE CAMERA AND DISPLAY INTERFACES

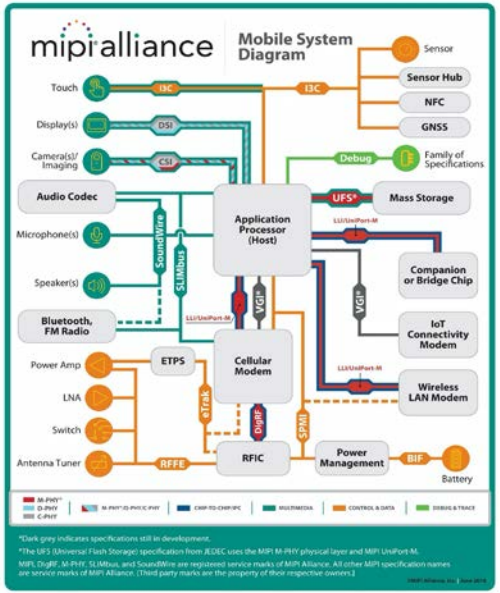
MIPI Alliance Member Ecosystem



MIPI Specifications Leveraged Beyond Mobile

Number of current specifications

48



Fundamentally, usage rights are granted to members royalty free for implementation of MIPI specifications from all MIPI members

Beyond Sensors:

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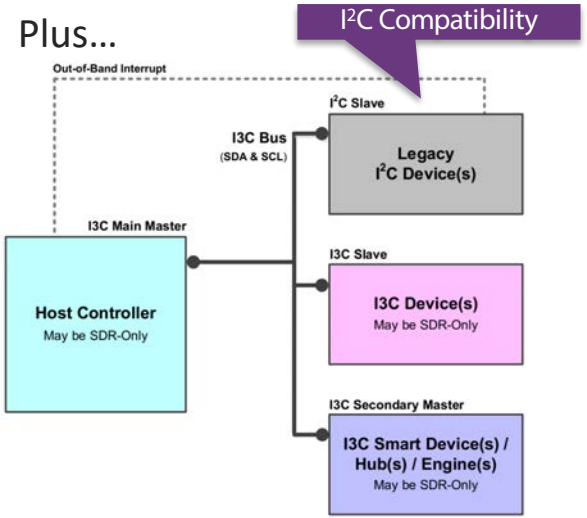
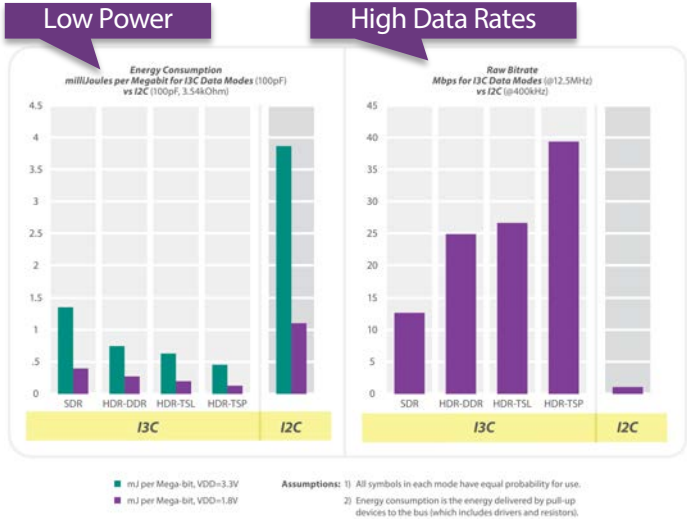
What is MIPI I3C®?

- Innovative new 2-wire interface for sensing and beyond
- Key features address historical pain points
  - In-band Interrupt, Dynamic Addressing, Multi-Master, Standardized Commands, Time Control, Hot-Join, Error Detection and Recovery
  - Plus…





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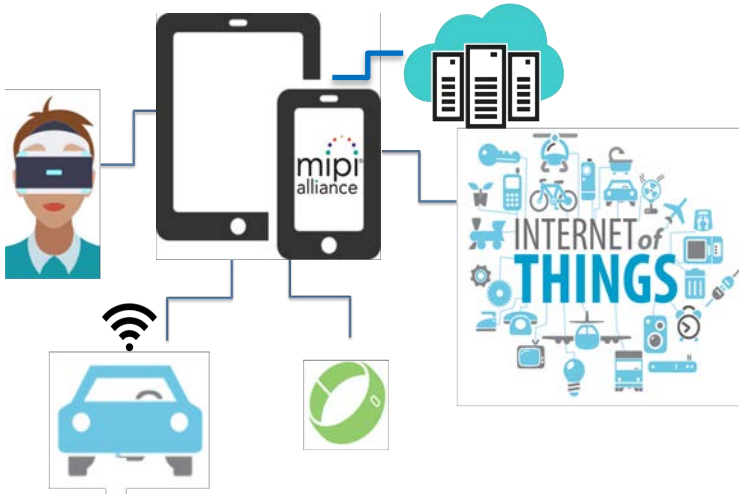
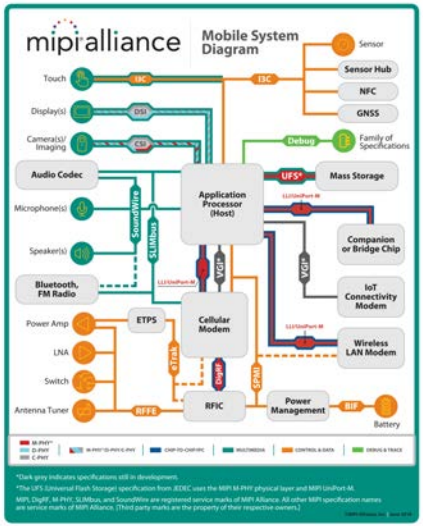
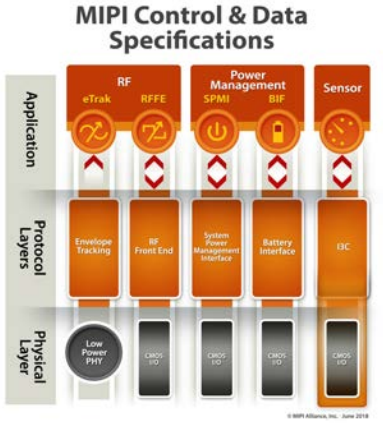
MIPI I3C® for Ubiquitous Low Speed Interfacing

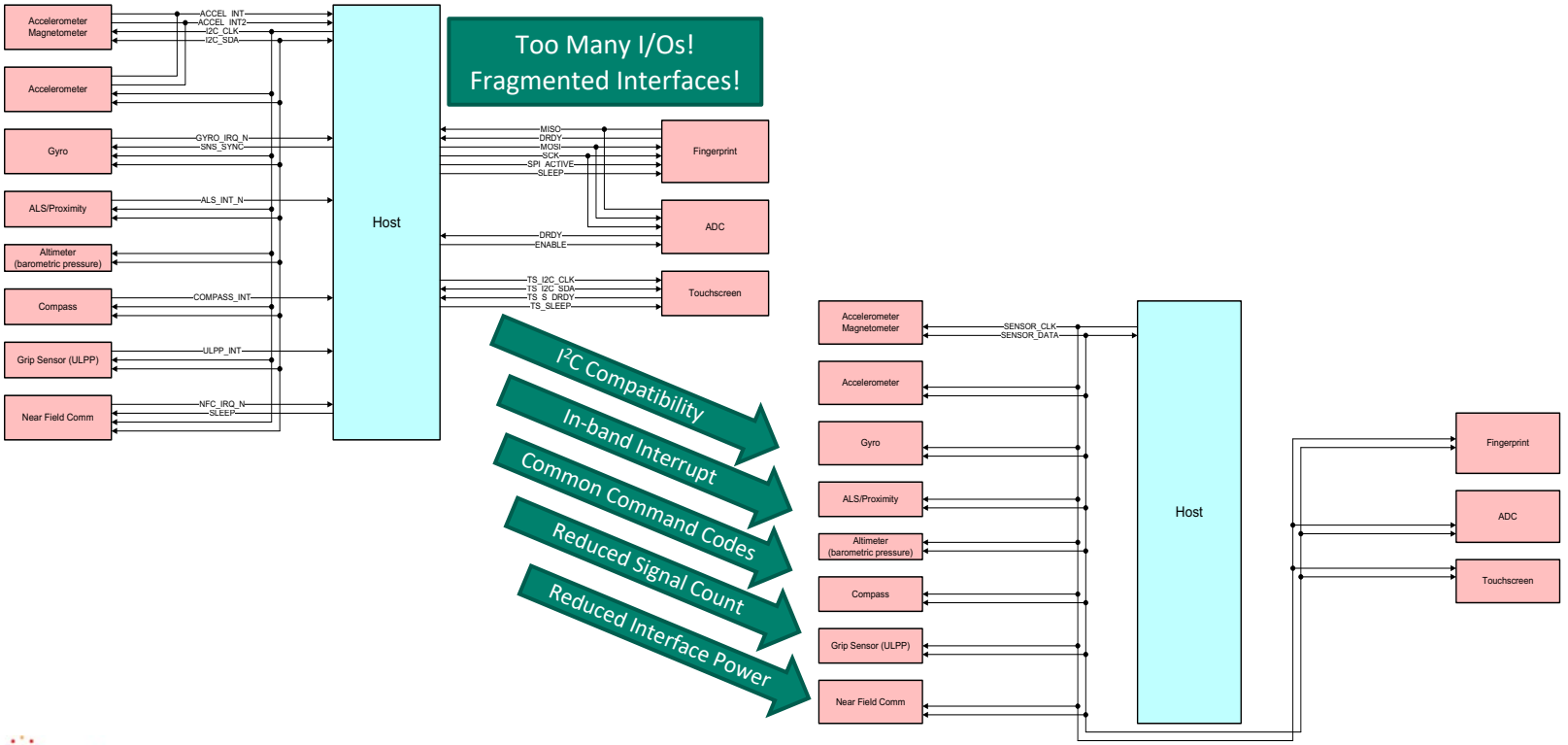
- Anywhere sensors are used, MIPI I3C belongs
- Aimed toward historical I²C, SPI and UART applications in…







MIPI I3C® Vision



Current Status

- MIPI I3C v1.1 specification is now released!
- MIPI I3C v1.0 maturing
  - Interoperability confirmed via multiple MIPI sponsored plugfests
  - Master and Slave IP available from all major providers
  - Test/Analysis equipment available
- Standardized Host Controller Interface (MIPI I3C HCI^{SM} v1.0)
  - MIPI I3C HCI^{SM} v1.1 in development
- Linux Kernel support for I3C subsystem
- 5G Ready
- MIPI I3C v1.1 interoperability workshop(s) in planning

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Capabilities Beyond the Mobile Industry

- Internet of Things (IoT)
  - An efficient way to connect sensors to SoCs
- High Performance Compute / Servers
  - MIPI driving industry liaisons to ensure adoption while shunting fragmentation
- Automotive
  - Let’s discuss these new challenges on next slide…

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MIPI I3C® for Automotive

- Opportunities
  1. Control/manageability
  2. Sensor data transport
- Challenges
  - Functional Safety (FuSa)
  - Reliability
  - Security
  - EMI/EMC
  - Long reach

FIGURE 1
Automotive leveraging the mobile smartphone

Source: MIPI Alliance

Source: MIPI Whitepaper – Driving the wires of Automotive
http://resources.mipi.org/mipi-automotive-white-paper

Usages Beyond Sensing

- As part of its charter, the I3C WG carries the responsibility to ensure MIPI I3C “maintains a relevant feature set and scope”
- The following notable usages, among others, have been instrumental in evolving I3C forward:
  - MIPI Camera Control Interface (CCI[SM])
  - MIPI Touch over I3C
  - MIPI Debug for I3C[SM]
  - System Manageability

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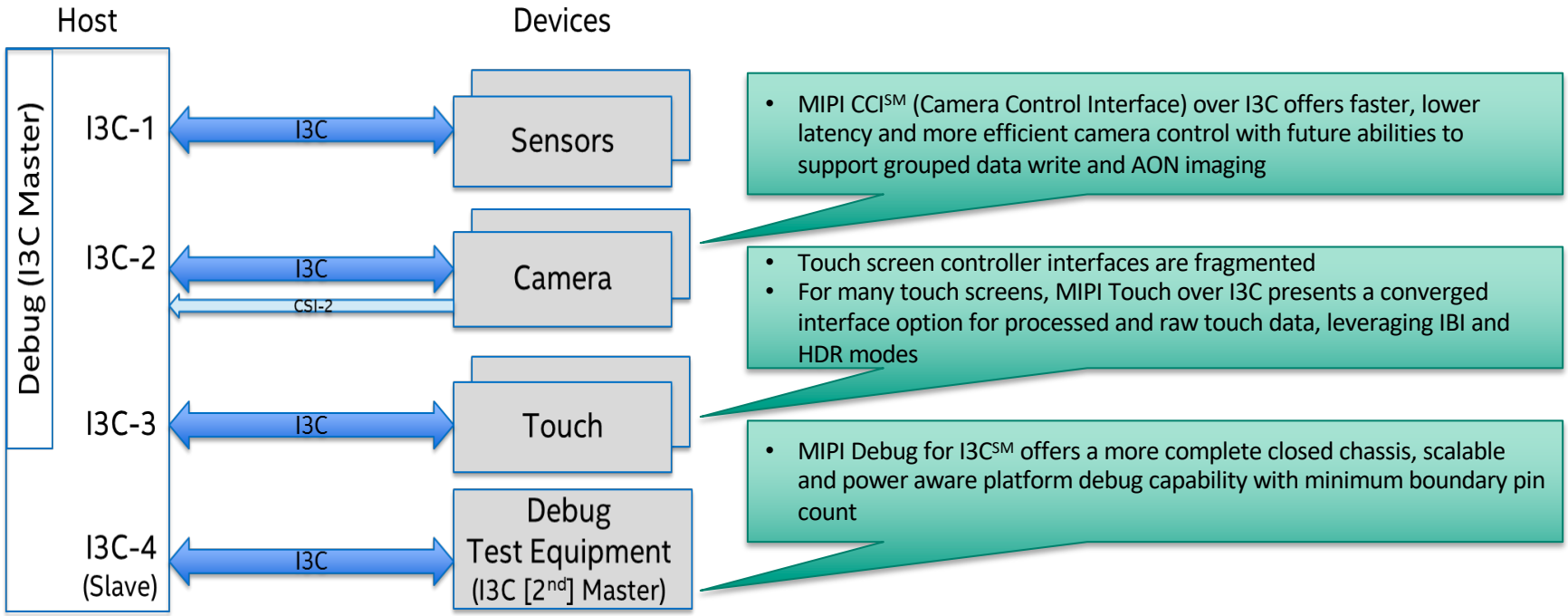
Usages Beyond Sensing – MIPI Collaborations

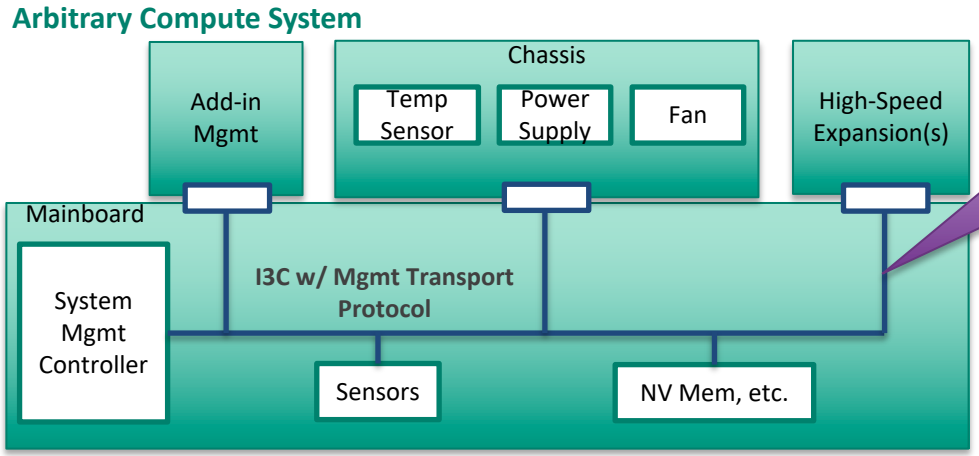


- MIPI CCI℠ (Camera Control Interface) over I3C offers faster, lower latency and more efficient camera control with future abilities to support grouped data write and AON imaging

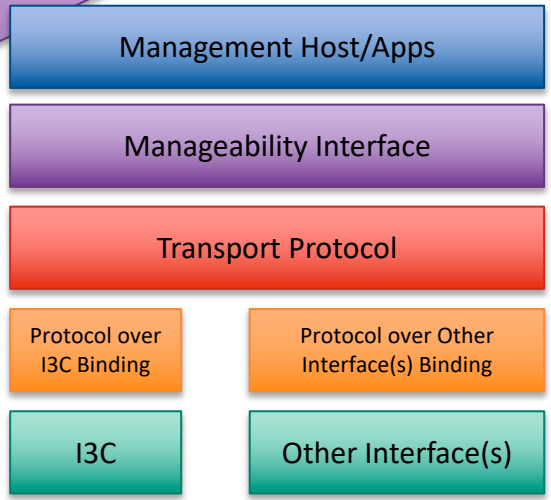
- Touch screen controller interfaces are fragmented
- For many touch screens, MIPI Touch over I3C presents a converged interface option for processed and raw touch data, leveraging IBI and HDR modes

- MIPI Debug for I3C℠ offers a more complete closed chassis, scalable and power aware platform debug capability with minimum boundary pin count

Usages Beyond Sensing – System Manageability



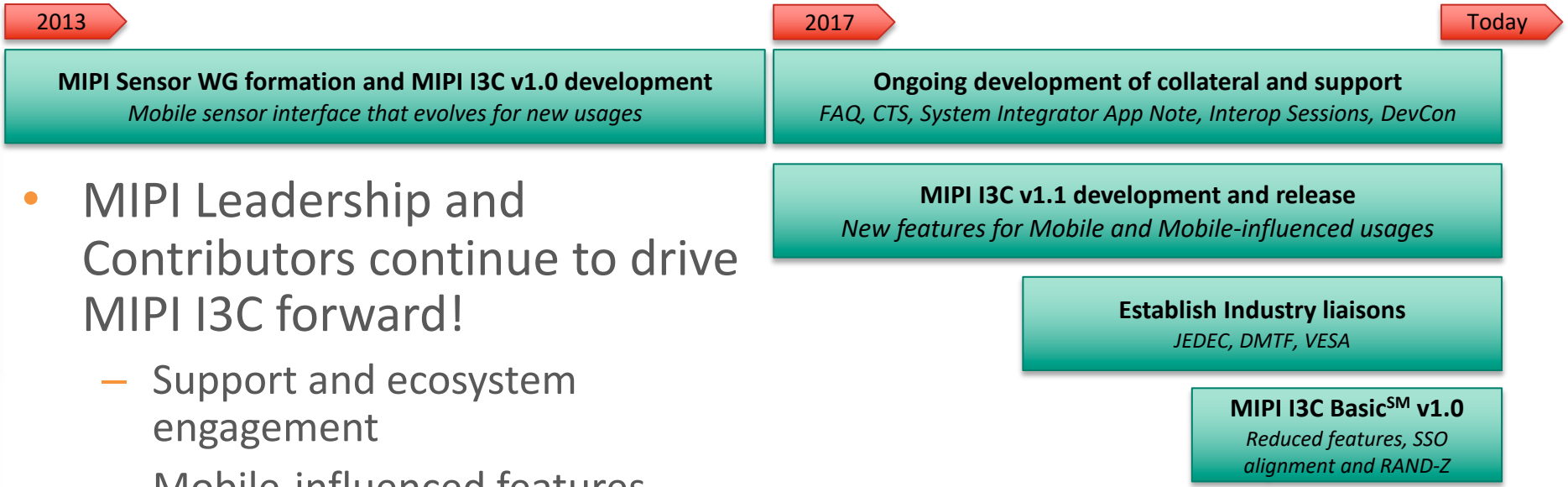
- MIPI I3C can be used to manage complex systems when a common Management Transport Protocol is adopted (e.g. MCTP)



- A simple binding can allow a common Transport Protocol over the MIPI I3C interface

MIPI I3C® Evolution at a Glance

- MIPI Leadership and Contributors continue to drive MIPI I3C forward!
  - Support and ecosystem engagement
  - Mobile-influenced features
  - Industry liaisons



MIPI I3C® v1.0 vs. I3C v1.1

Feature	I3C v1.0	I3C v1.1
12.5 MHz SDR (Legacy I^2C Slave Compatibility)		
1.2V-3.3V Operation for 50pf C_{load}		
In-band Interrupt (w/MDB)		
Dynamic Address Assignment		
Error Detection and Recovery		
Common Command Codes		
Secondary Master		
Timing Control (Synchronous and Asynchronous)		

Feature	I3C v1.0	I3C v1.1
HDR-DDR		
HDR-TSL/TSP		
HDR-BT (Bulk-Transport)		
Slave Reset		
Set Static Address as Dynamic Address CCC (SETAASA)		
Grouped Addressing		
Device to Device(s) Tunneling		
Multi-lane for Speed (Dual/Quad for all modes)		
Monitoring Device Early Termination		

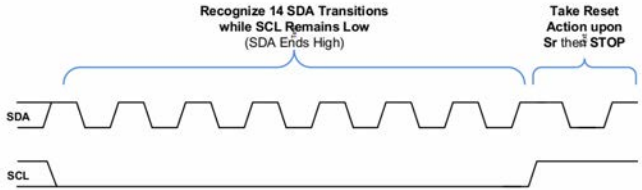
Why Adopt MIPI I3C® v1.1?

- More clearly written document
- Higher speeds through Multi-lane and new HDR mode (HDR-BT)

Deep Dive Topic

- Configurable, pattern-based Slave Reset

Deep Dive Topic



- Grouped Addressing, Device to Device(s) Tunneling, Comprehensive Multi-Mastership…

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Higher Speeds

- Multiple lanes specified for all modes (SDR, DDR, TSP, BT)
  - Employs additional physical Data (SDA[1-3]) wires for faster payload transfer
    - Single Clock (SCL) used
  - Coexistent with normal 2-wire operation
    - Frame formats, sequencing and timing consistent with I3C
  - Standardized configuration and link test
- New HDR Mode: Bulk Transport (HDR-BT)
  - Gives highest throughput using Clock-and-Data, DDR transmission model
  - Supports Single/Dual/Quad lanes
  - Built upon I3C's standardized HDR (High Data Rate) modality
  - Feature rich: CRC16/32, Slave Clock drive on Read, Command/Control decoupled from Data, Wide data block model (32-bytes)

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Slave Reset

- In-band, pattern-based Slave Reset
- Allows different levels of Reset of one or more selected Slaves, while avoiding Reset of others
- Enhances error escalation and recovery mechanism
- Standardized configuration (RSTACT CCC)
  - Set different levels of Reset (from I3C Peripheral to whole Device)
- Each I3C Slave reacts to the Slave Reset Pattern as configured
  - Coexistent with all I3C modes

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What's Next for MIPI I3C®?

- Sensor WG ramping up discussion on the next evolution of MIPI I3C
- Considering multiple capabilities / improvements
  - Long reach
  - Specification development improvements
  - Automotive requirements
  - Speed increases
  - New multi-lane uses
  - New PHY approaches
  - Standardized connectors
  - Feature refinements
- Reaching out to industry partners and forming liaisons
- Join us now to ensure that MIPI I3C evolves to meet the needs of new industries and usages!

Additional Resources

- MIPI I3C WG (formerly Sensor WG)
  - https://www.mipi.org/groups/sensor
- MIPI I3C Specification
  - https://www.mipi.org/specifications/i3c-sensor-specification
- Whitepaper: Introduction to the MIPI I3C Standardized Sensor Interface
  - http://resources.mipi.org/i3c-sensor-specification-whitepaper-from-mipi-alliance
- MIPI I3C Frequently Asked Questions
  - https://www.mipi.org/resources/I3C-frequently-asked-questions
- MIPI I3C System Integrator's Application Note
  - https://mipi.org/sites/default/files/mipi_I3C-and-I3C-Basic_app-note-system-integrator_v1-0p.pdf
- MIPI Automotive Whitepaper: Driving the Wires of Automotive
  - http://resources.mipi.org/mipi-automotive-white-paper

Any Questions?

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