Challenges and Solutions for Multi-Master / Multi-Slave PMBus Systems

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What is a Multi-Master PMBus System?

- In SMBus a “Master” is any device that initiates a digital transmission
  - Drives the CLK through entire transmission
  - Drives DATA during Address and Command, may drive/read DATA during the data phase of a transmission
- Only 1 “Master” at a given time
  - A System “Host” for Telemetry
  - A Powered Device for AVS, Configuration
  - A System Host for Fault Management

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Why do Multi-Master systems exist?

- System Host plus one or more powered devices using PMBus to actively control or monitor their power supply
  - Adaptive Voltage Scaling (AVS) through PMBUS (not AVSBus)
  - Adaptive Power
    - Scaling Operating Modes based on temperature, power, etc
- Multiple System Hosts
  - Separate Telemetry, Configuration and/or Fault Handling
  - External Interface with Internal Bus

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Challenges of Multi-Master Systems – Slave Side

- Host Notify Protocol
  - Slave becomes a Master in response to a Fault

- Paged Devices
  - How does the Master know the “active” page?
    - Especially problematic when “Masters” may alternate

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Challenges of Multi-Master Systems – Master Side

- Master Side Challenges
  - Transmission Collisions
    - SMBUS Bit-Arbitration
  - Coordinating Bus Traffic
    - Time Division Multiplexing, Defined Idle Delay, Shared Interrupt
  - Legacy Devices
    - May not support Multi-Master solutions
    - May not fully support bit arbitration

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Challenges of Multi-Master Systems – System Side

- System Side Challenges
  - Bus Congestion
  - Repeated Collisions

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Solutions to Multi-Master Systems – Slaves

- Paged Devices
  - Use PAGE_PLUS_READ / PAGE_PLUS_WRITE
    - Changes current page, so must be used on every command
  - Use devices that allow pages to be assigned unique Slave Addresses
    - Avoids using pages and the problems with pages
- Host Notify Protocol
  - Forces Multi-Master System
  - Slave device becomes Master during fault

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Solutions to Multi-Master Systems – Masters

- Use 1 System Host as a Bridge
  - Avoid the Multi-Master system altogether
    - Host needs multiple communications ports
    - Adds delay to Communication Reponses

- Determine who gets to talk next
  - Shared Interrupt uses 1 I/O from each powered device
    - Some powered devices may not support I/O control
  - Time Division Multiplexing – Everyone gets a turn
  - Programmable Idle Delay
    - Staggers start devices in start time
    - Idle delay sets bus priority
    - Matched Delays will default to Slave Address Arbitration

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Resolving Conflicts

- Collision Resolution
  - I2C / SMBus Bit Arbitration
  - Bit Arbitration Loss
    - Reduced Idle time to grant Priority for next transmission
    - Random Idle time to prevent repeated collisions
- Interrupting In-Process Command
  - SMBus Time-Out = 25ms!

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Thank you!

Questions?

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