

# Smart Battery System Manager

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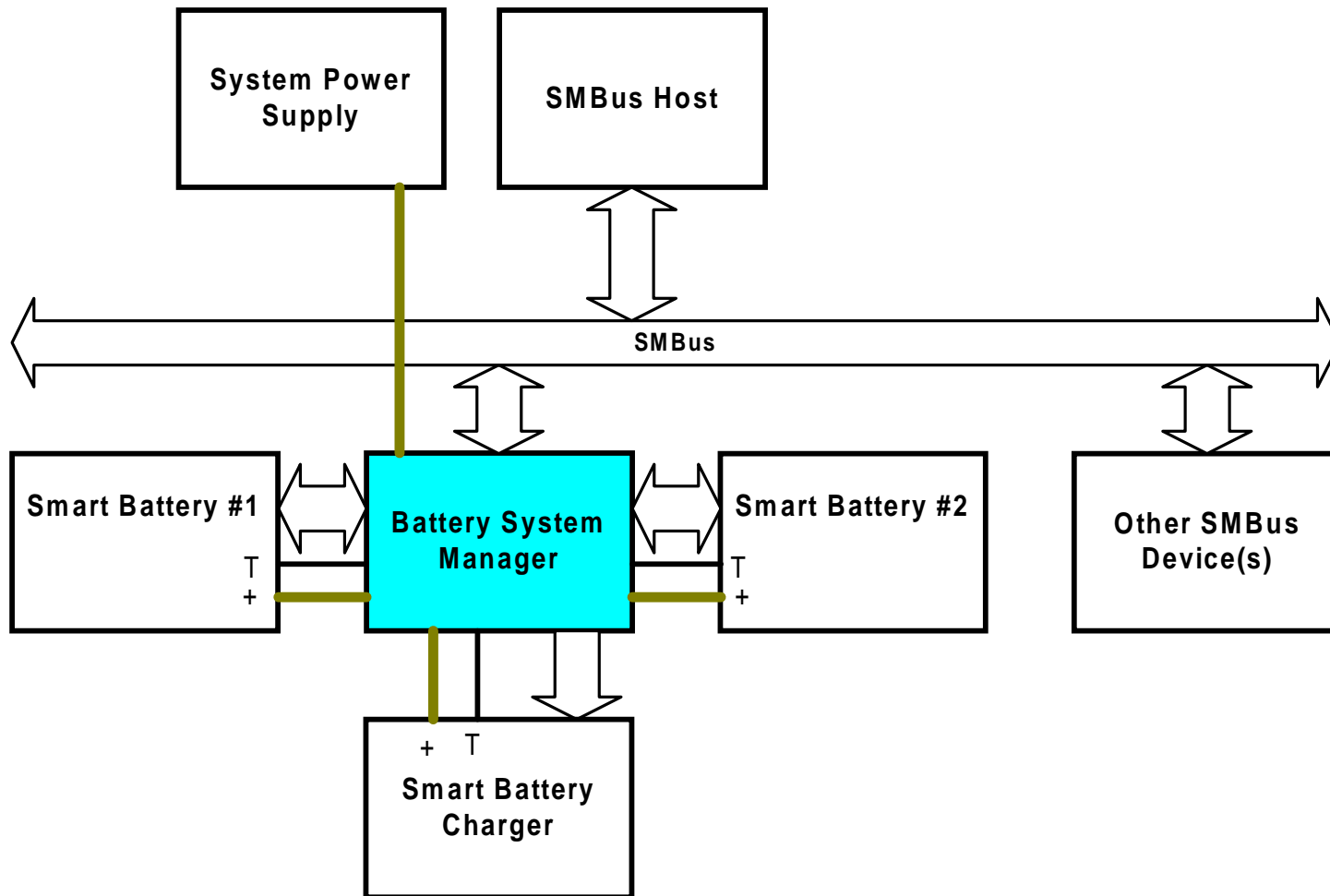


# Agenda

- ➔ ● Battery System Management
- Smart Battery System Manager
- SBSM Requirements
- Composite Battery Information
- Integration into System Software
- Summary
- Call to Action



# Battery System Management



# Battery System Management

- Discharging
  - Constant power to system
    - Low battery
    - Battery removal
- Charging
  - Ensure all batteries optimally charged
  - Manage optional simultaneous charging
- Safety
  - Not allow unsafe configurations
  - Make connections between charger and battery being charged
  - Manage optional simultaneous discharge
    - Prevent large unplanned current flows
- Misc
  - Battery conditioning



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# Why Smart Battery System Manager?

- Smart Battery Selector specification was relatively silent on roles and responsibilities
  - Each solution had different characteristics
- Architecture limited to serial charge/discharge of batteries
- Battery system safety could be compromised by errant software



# What should the SBSM do?

- Provide a single entity responsible for battery system management
  - Controls when and which battery(s) charge
  - Controls when and which battery(s) discharge
- Allows more flexibility of battery system architectures than selector
- Abstract and simplify battery system interface to OS
- Focuses battery system safety in one place



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# SBSM Specification Goals

- Use same registers as Selector where possible
  - Subset of the existing selector registers
  - Superset of required selector functionality
- Provide more design flexibility
  - Hide implementation details from the OS
  - Remove architectural limits
    - Allow simultaneous battery operations
    - Allow autonomous battery conditioning etc.

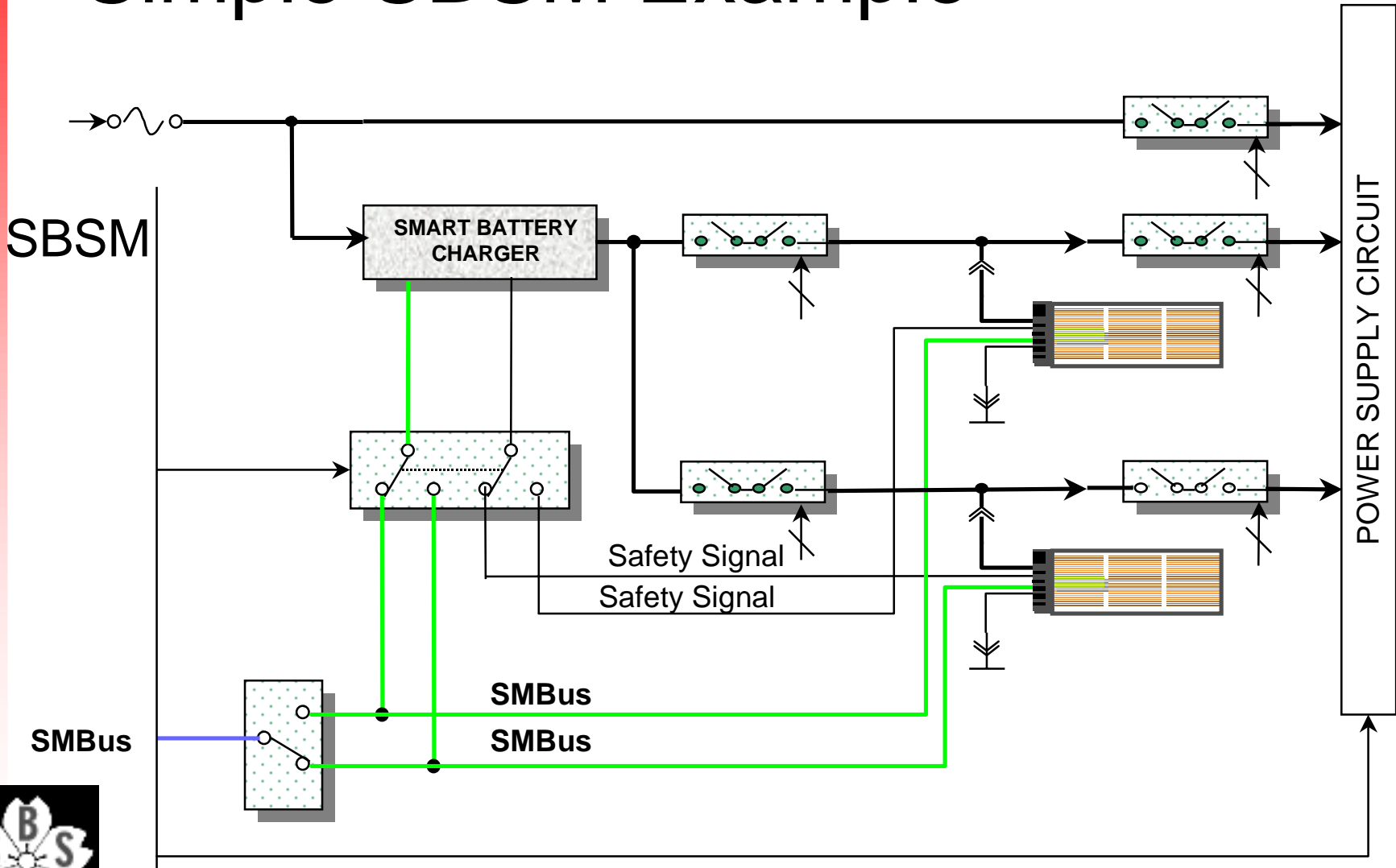


## SBSM Spec Goals (cont.)

- All implementations provide “same” information to the OS
- Minimal required feature set
  - Feature enhancements such as simultaneous discharge allowed but add additional requirements
  - Features scale with cost
- Battery System safety the responsibility of the SBSM



# Simple SBSM Example

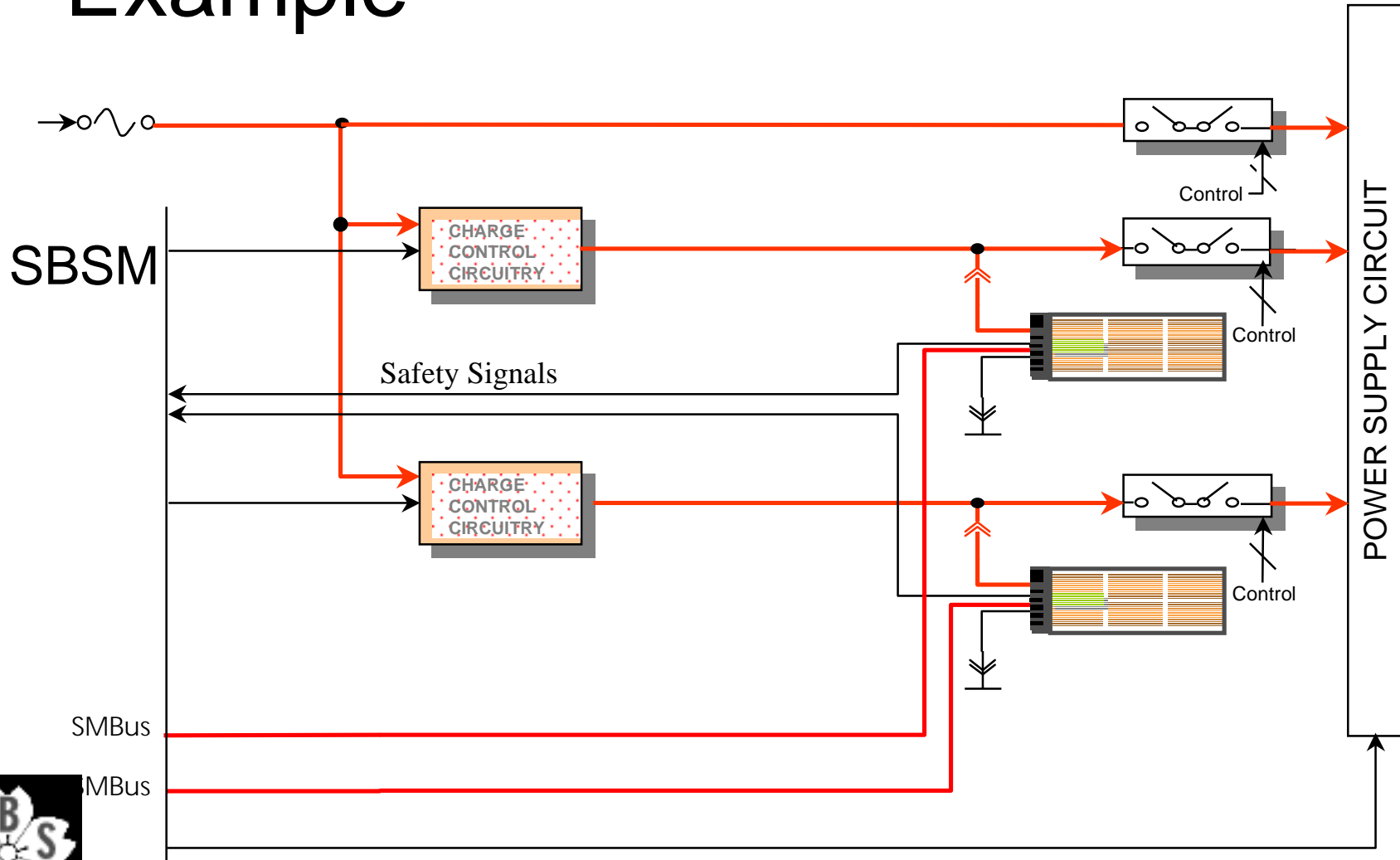


# Simultaneous Charge/Discharge

- Simultaneous charge and discharge - a good option for Lithium-ion batteries
- Can be built using existing SBS components such as SBS and SBC
- Or proprietary designs OK as long as they use the SBSM interface
  - allows for more product differentiation



# Simultaneous Mode SBSM Example



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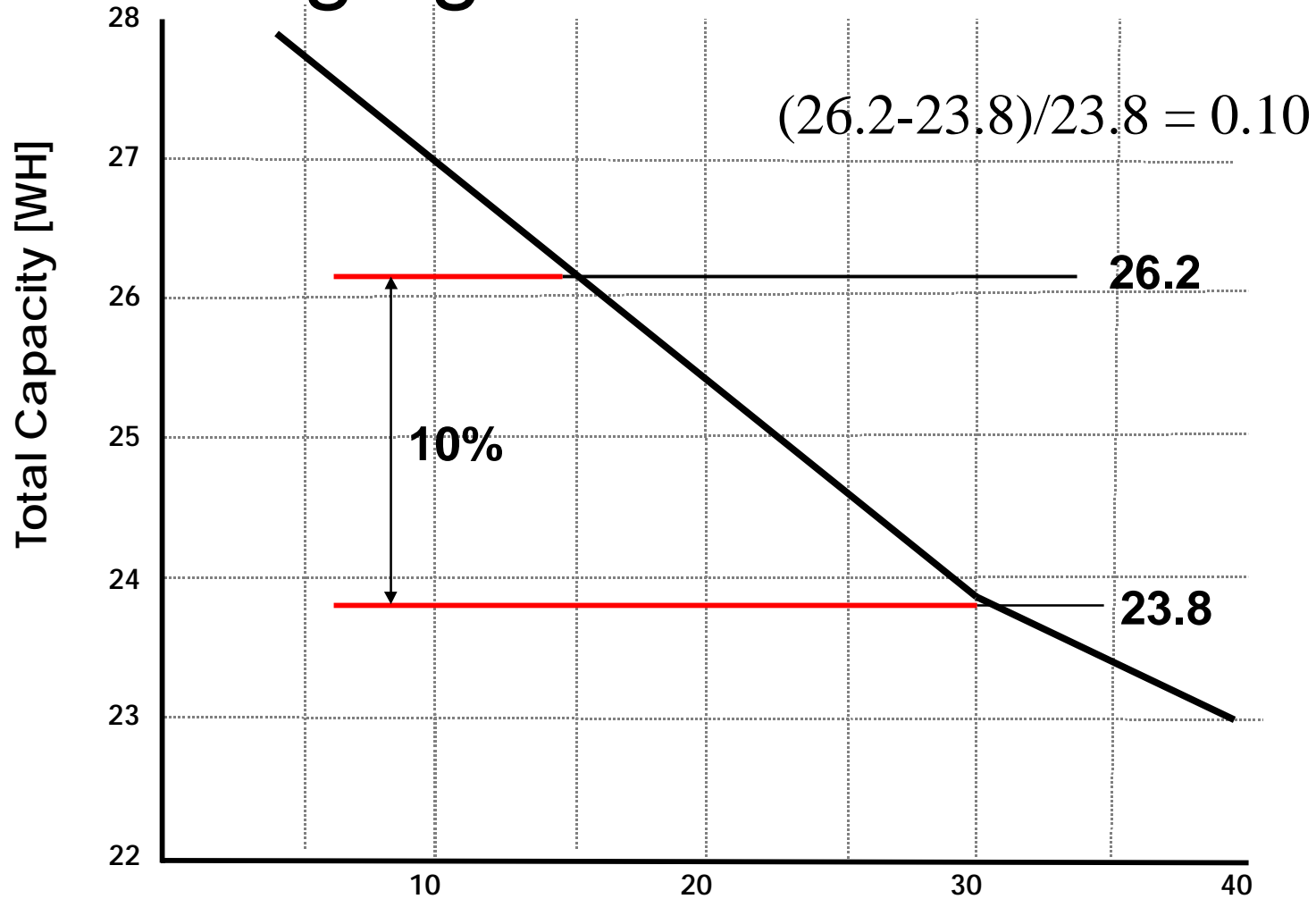


# Composite Battery Information

- Simultaneous battery usage adds complexity
- Data is NOT just the sum of the individual parts
  - Capacity is greater and run times longer when discharging simultaneously
  - Charge time reduced during simultaneous charge
- OS and Users need accurate data
  - As input to OS power policy
  - To get accurate run time information



# Discharging



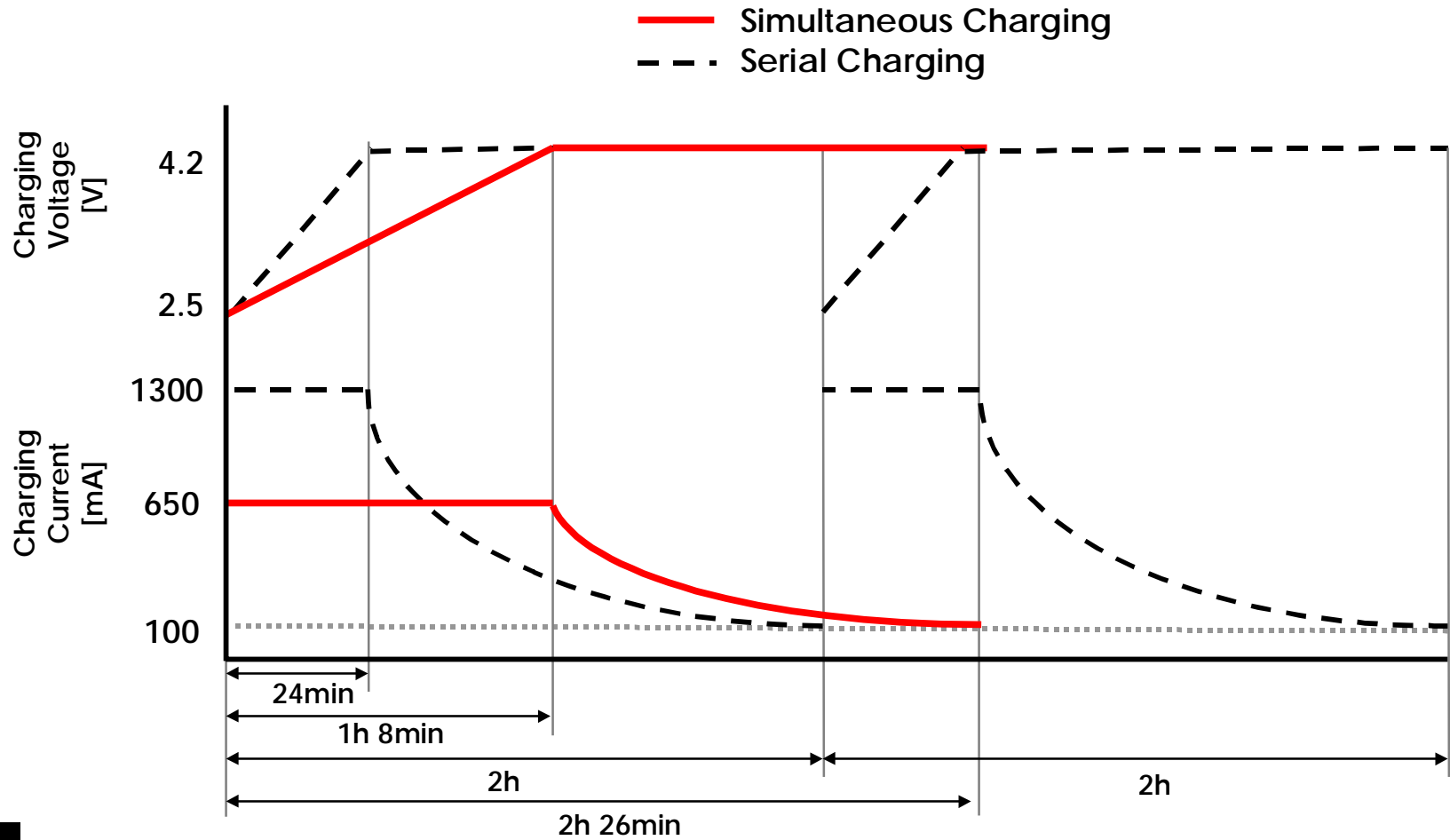
Data supplied by Fujitsu

Smart Battery System Manager, R. Dunstan, Intel





# Charging



Data supplied by Fujitsu



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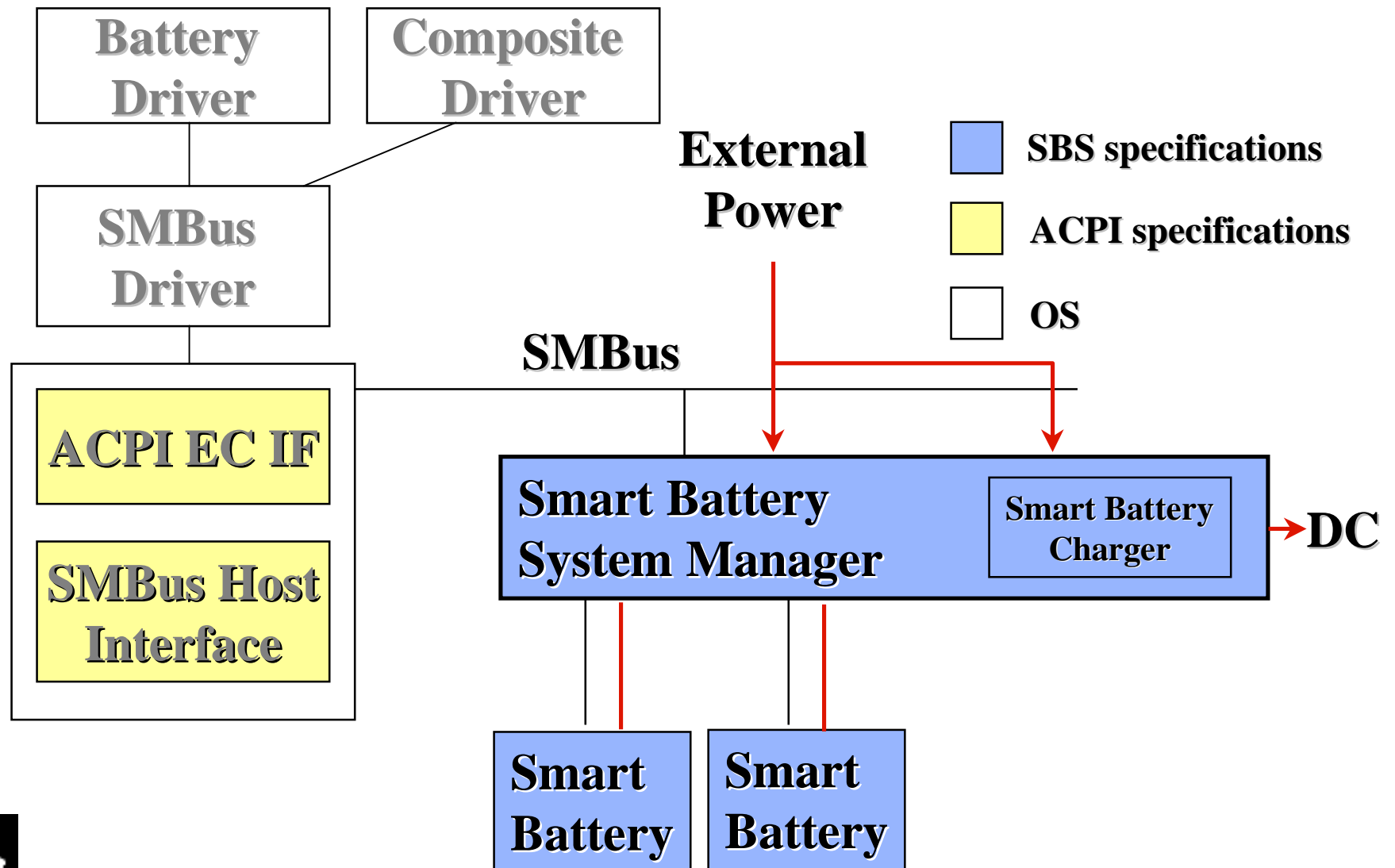
# Simple OS Interface

- Read only configuration Registers
- Hides details of architectural implementation
- Common OS interface
- Allows many battery topologies

SMB (r/w)				POWER_BY (r)				CHARGE (r)				PRESENT (r)			
Battery connected to System SMBus (communications)				Battery connected to System PS (power & comm.)				Battery connected to Charger (power & comm.)				Battery (s) present			
D	C	B	A	D	C	B	A	D	C	B	A	D	C	B	A



# Where the SBSM fits



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# Summary - Platform Hardware

- SBSM specification allows variations in battery system architectures
  - Simultaneous charging and discharging
- Platform owns power system
  - Reports battery system status and status changes to OS
  - Supplies composite battery data during simultaneous discharge
  - Responsible for Battery System policy (e.g. safe management of discharging and charging)



# Summary - Operating System

- OS role in battery management redefined
  - Gets battery system status
  - Gets event notifications when battery system status changes
  - Plays NO role in power system configuration
- OS always gets accurate data from the active battery(s) during discharge - serial or simultaneous



# Summary - OEM Benefits

- Smart Battery System specifications offer OEMs flexibility and product differentiation
- Simultaneous charging and discharging enhance battery performance
- Readily available components simplify battery system design and integration





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# Call to Action

- Specification posted on the SBS Implementers website <http://www.sbs-forum.org>
- Participants invited to review and use Smart Battery System Manager in their designs

