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Batteries2030+ Roadmap

Thematic area: BMS

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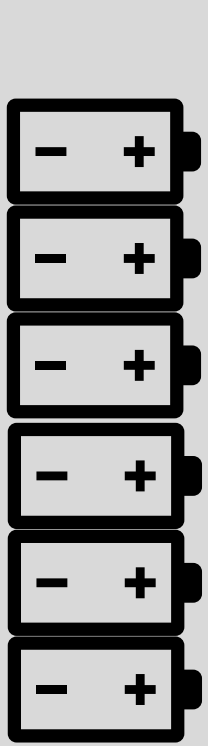
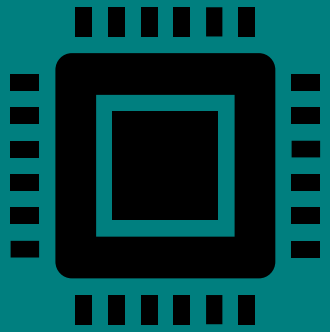
BMS – What is it?



Cell voltage
Module current
Pack temp
Cooling temp

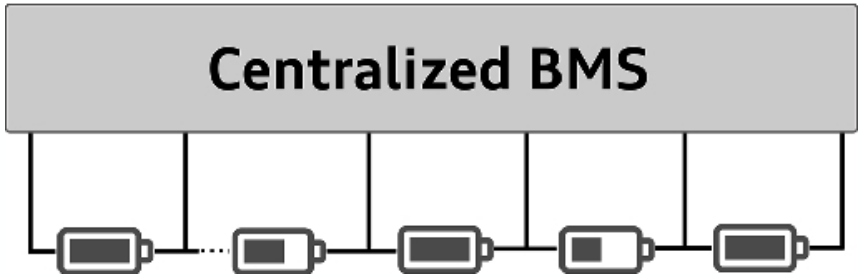
BMS SLAVE



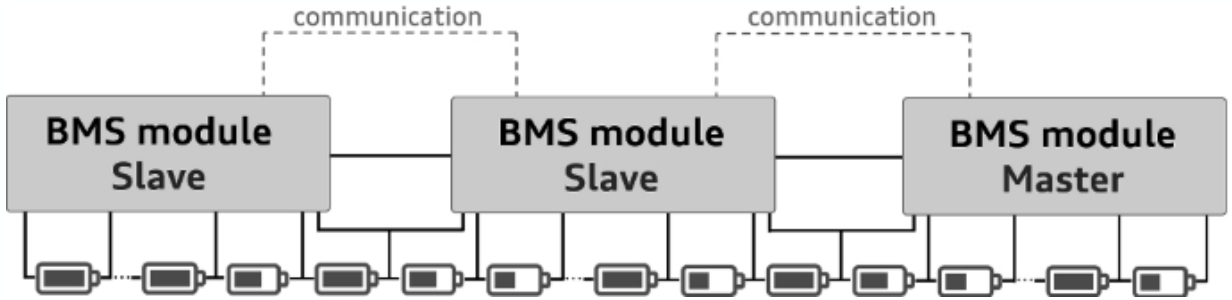
Sensor readout
Safety windows
Max charge/discharge
Total operation time
Total cycle number
State of Charge
State of Health
State of Balance
…

Safe operation
Cell balancing
Range prediction
Current limiting
Communication
Thermal management
…

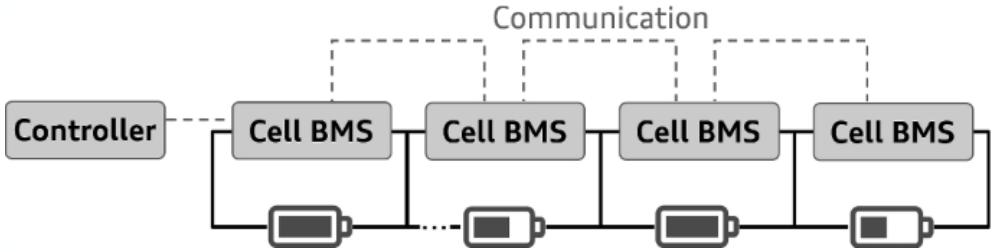
BMS - Topology



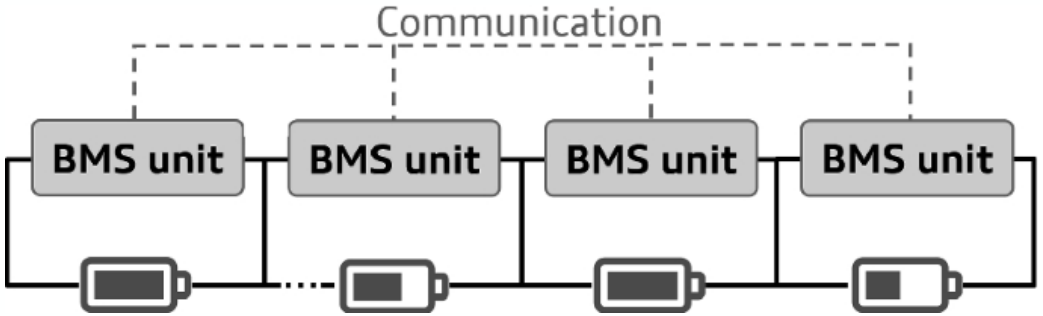
Slave incorporated in the master
Only small systems



Modular layout, typical for EV's



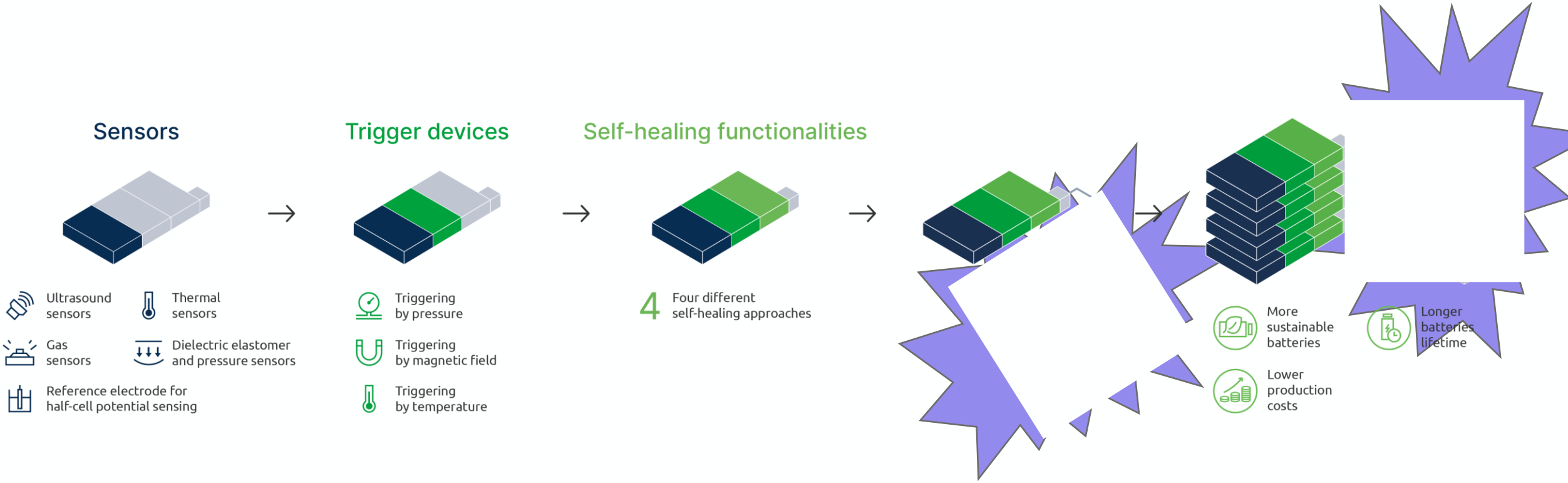
Distributed, simple BMS per cell
Not widely used



Decentralized, BMS unit combines slave and master functions

https://doi.org/10.1007/978-3-030-52794-5_13

BMS - role in current B2030+ roadmap projects

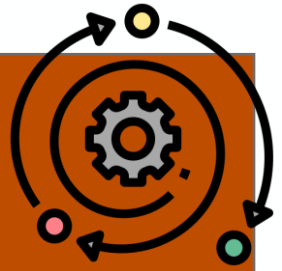


BMS – Core topic in B2030+ projects

- Pressure and temperature at cell level
- Gas
- ToF
- Reference electrode
- Fiberoptic thermals and pressure
- Interface resistance
- Electrochemical sensors
- reference electrode
- …

More advanced sensors

More complex actuation



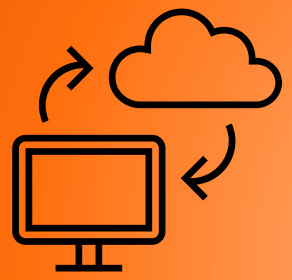
- Induce heating
- Induce pressure
- Apply magnetic field
- Run physics-based model
- Data-driven (ML) SOx models
- Reinforcement learning
- Integrate into EMS
- Minimize component cost
- Run real-time
- Cloud-integration
- Cyber-secure
- …

BMS – Integration into Roadmap

- Role of BMS beyond first life
- Integration of BMS in BIGMAP for validation
- Role of BMS in manufacturing
- Role of BMS in Digital Battery Passport
- BMS for pack performance optimization
- …

BMS – Other research topics

BMS second life
Modular design
Input for recycling



Cloud-based BMS
Minimal hardware

World model integration
Digitalization

Digital twin
Vehicle model integration

Thank you

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