

EnergyBus

The CANopen-Based Communication Protocol for LEVs

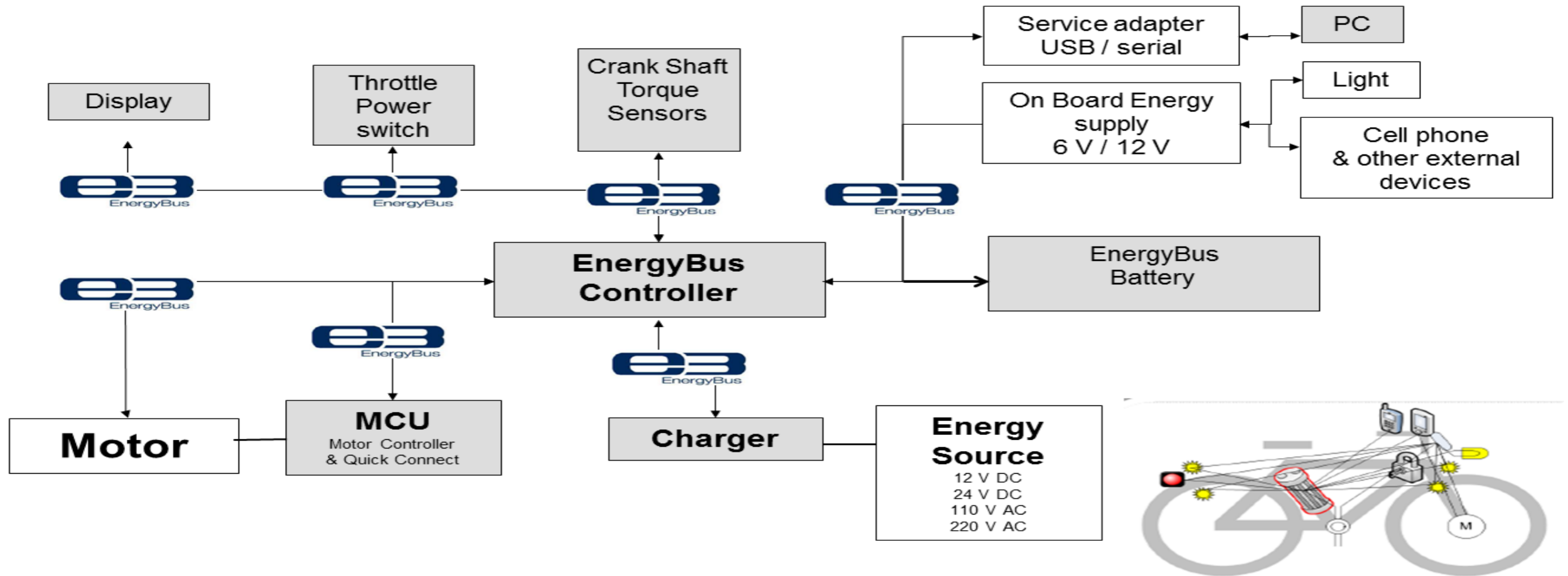
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<< Agenda <<

- **What is EnergyBus ?**
- **Why EnergyBus ?**
- **How does it work?**

<< EnergyBus <<



... a network for electrical energy and data exchange

<< Agenda <<

- What is EnergyBus ?
- Why EnergyBus ?
- How does it work?

<< Motivation <<

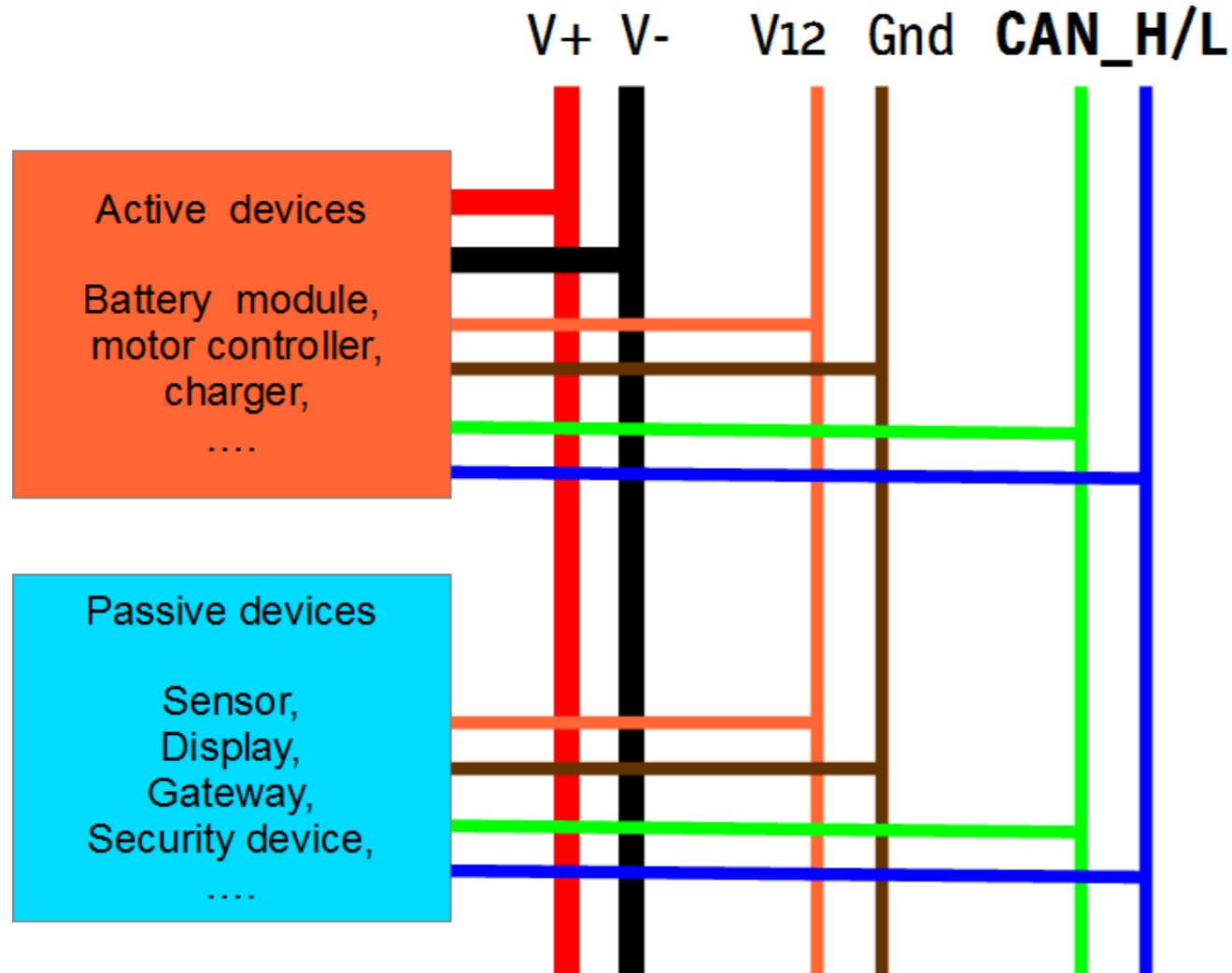


- Standardized connector between battery and charger
- One charger for all batteries
- Interoperability and Plug'n'Play
- Public charging infrastructure
- Less risks
- Common service interface
- Defined communication with additional components

<< Agenda <<

- **What is EnergyBus ?**
- **Why EnergyBus ?**
- **How does it works?**

<< EnergyBus Communication <<

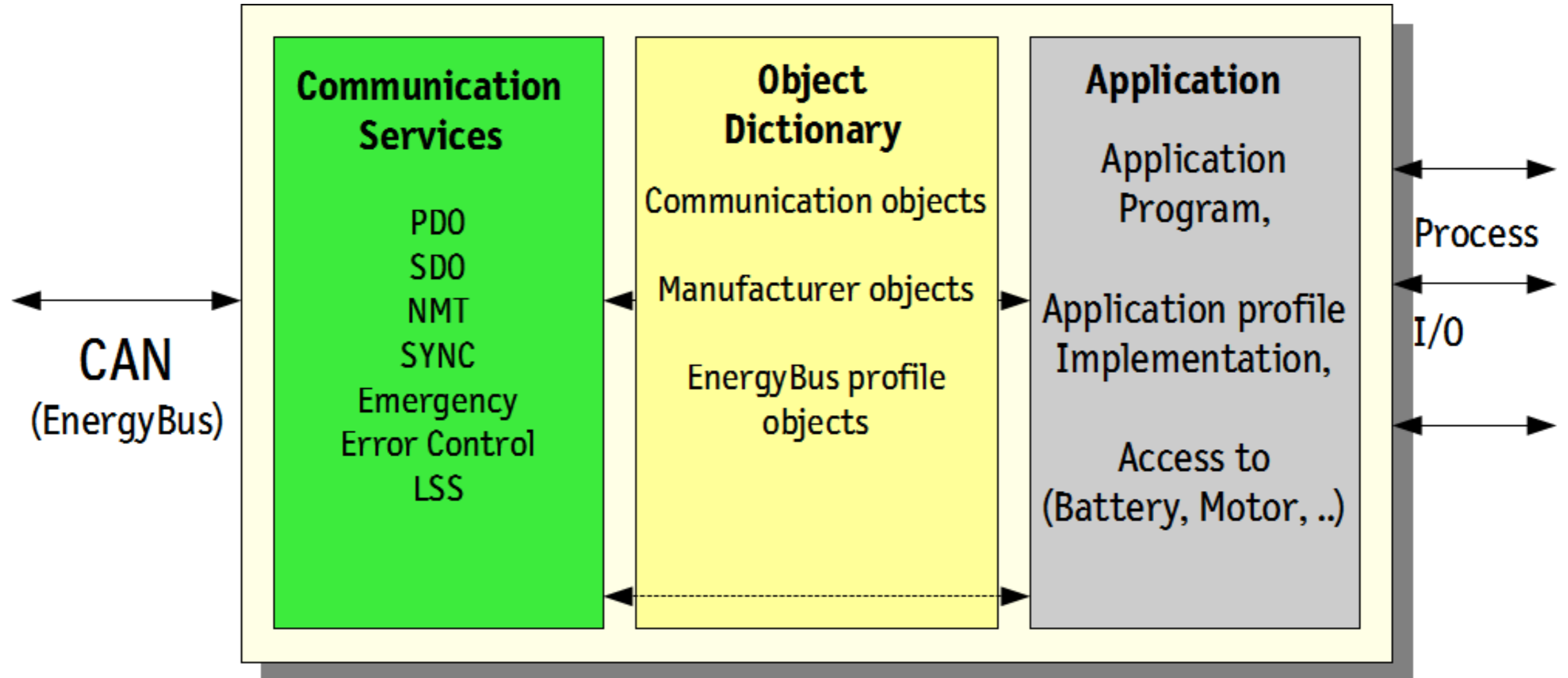


- Communication based on CAN (250 kBit/s)
- CANopen is used as higher-layer protocol
- EnergyBus communication is defined as CANopen application profile

<< CANopen <<

- Higher-Layer-Protocol based on CAN
- Up to 127 nodes in one network
- Defined list of device parameters = Object Dictionary
- Defined communication services
 - Service Data Object service (SDO)
 - Access to all parameters in object dictionary
 - Process Data Object service (PDO)
 - Fast access to process data
 - Emergency messages = error messages
 - Layer Setting Services to dynamically assign node-Ids
- Device functionality defined in device or application profiles

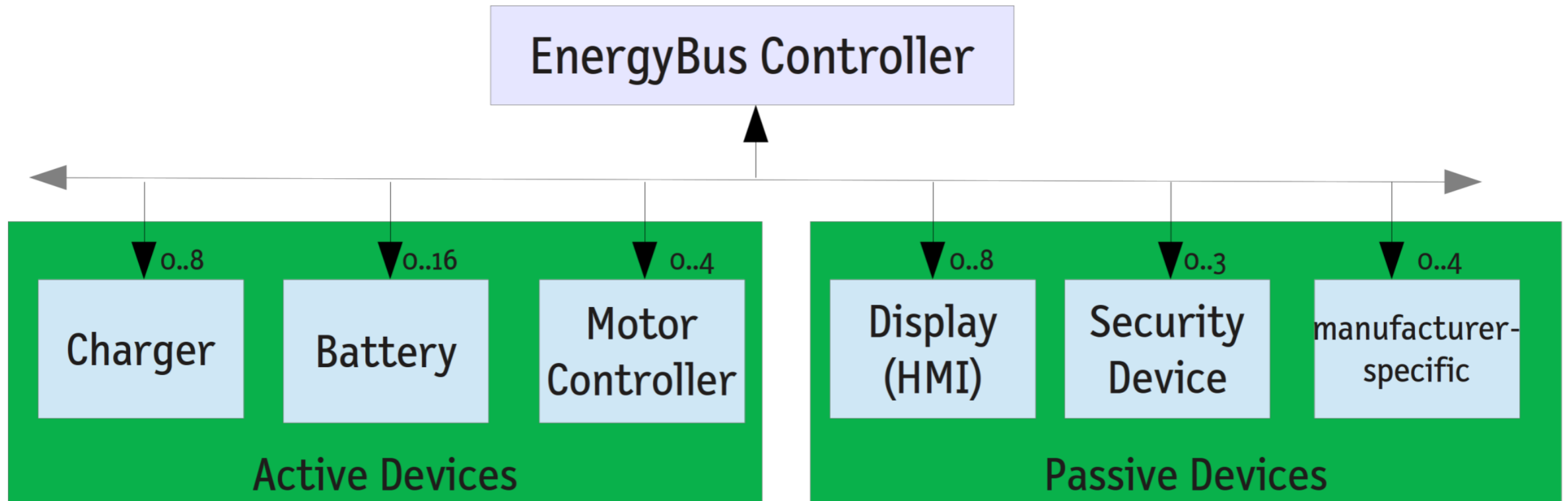
<< CANopen Device Model <<



<< CANopen Application Profile 454 <<

- Definitions of various EnergyBus components
 - Battery, charger, display, motor controller, security device, ...
- Definitions of mandatory and optional parameters for all components
- Definitions of value representations (ranges, SI units, +/- , ..)
- Definitions of various state machines and behavior definitions
- Definitions of data which are transferred cyclically
- Definitions of error messages and warnings

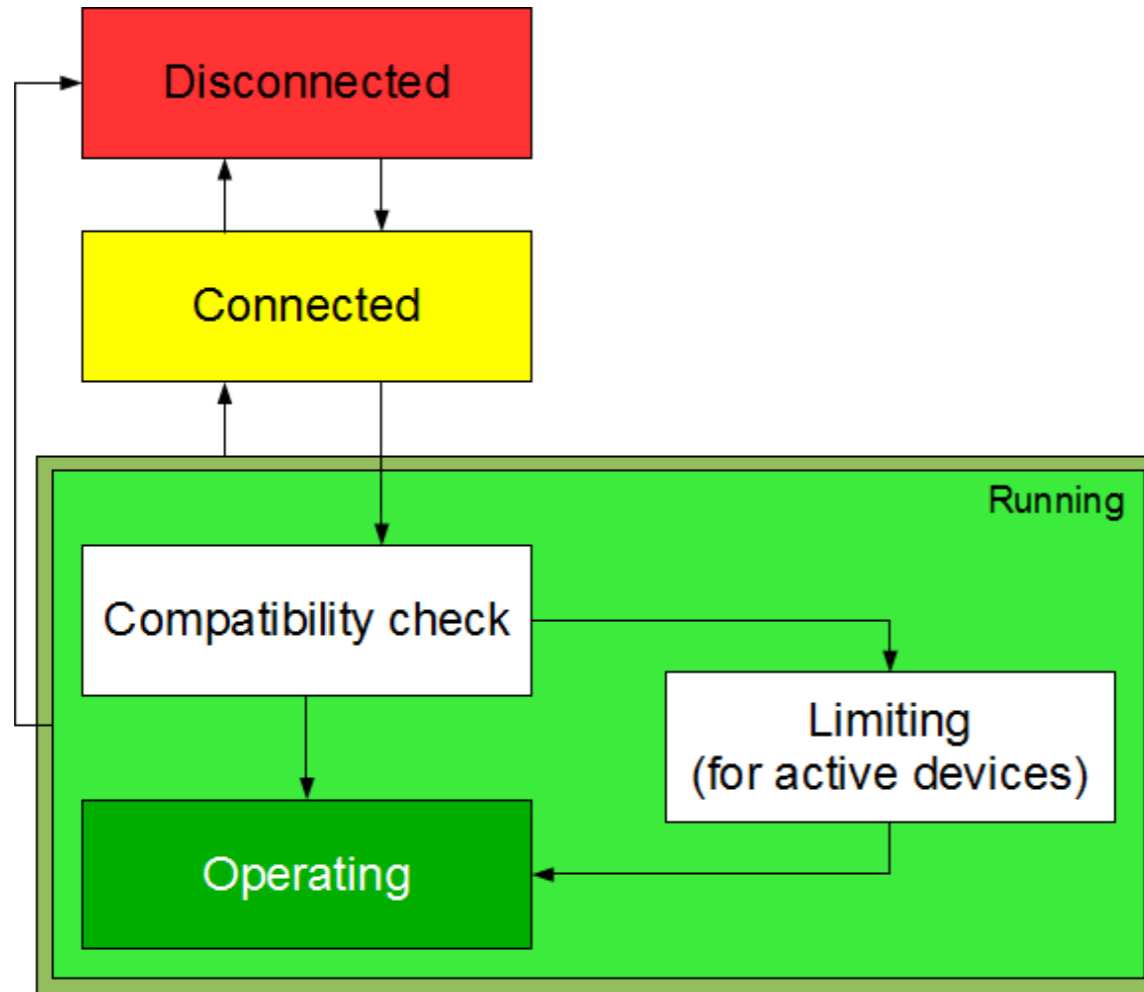
<< EnergyBus Network <<



- Connected to Power Line
- 12V auxilliary voltage
- CAN communication

- 12V auxilliary voltage
- CAN communication

<< EnergyBus State Machine <<

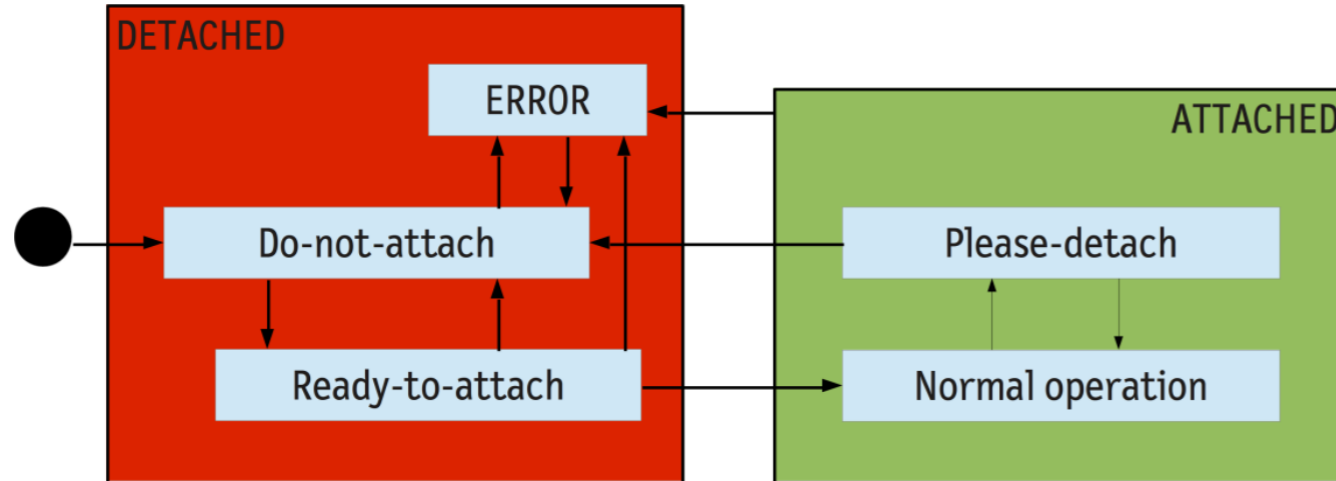


- Connected
 - Connected to CAN
- Compatibility Check
 - Check if devices fit together
- Limiting
 - Configuration of limits
- Operating
 - Normal operation

<< Example: Battery <<

- **Common EnergyBus Parameters(objects)**
 - Device status, control word, rated voltage ,
- **Parameters for active devices**
 - Maximum input current, maximum output current, maximum and minimum voltage, allowed peak values for currents and voltage,
 - Voltage or current limitation
- **Battery specific parameters**
 - Type, actual capacity, rated capacity, temperature
 - *Cell voltages and currents,*
 - *Deep discharge counters, total Wh output,*
 - *Short cut counters, over-temperature counters, error history, ...*

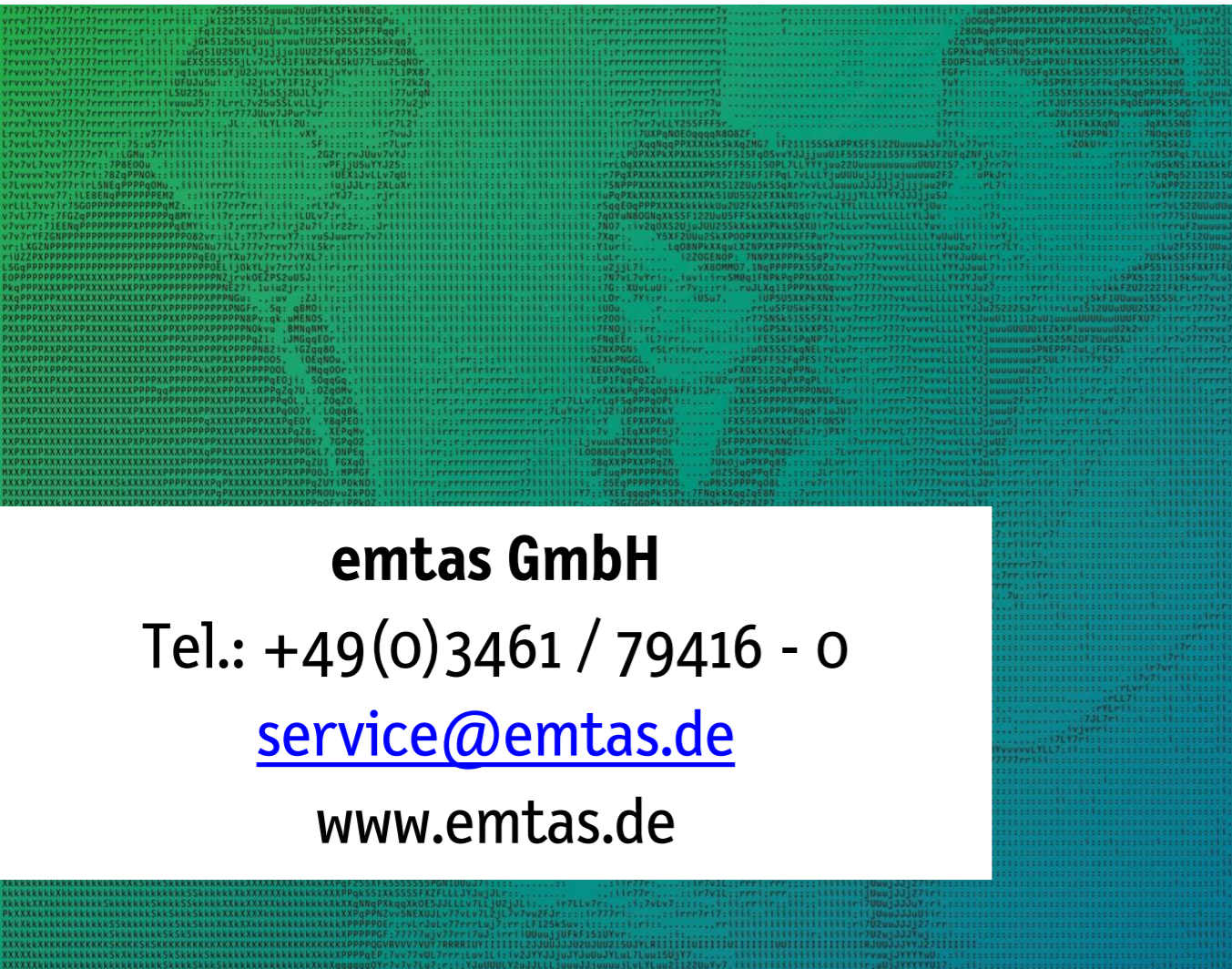
<< Battery state machine <<



- Do-not-attach battery not yet ready for connection to Power Line
- Ready-to-attach battery is ready to connect to power line
- ERROR an internal error has occurred
- Please-detach battery reports that it shall be detached
- Normal operation battery is connected to power line and works normally

◀◀ Further Information ◀◀

- EnergyBus e.V.
 - www.energybus.info
- CAN in Automation e.V.
 - CiA application profile 454
- EnergyBus Stacks, Services and Tools
 - <http://www.emtas.de>
- EnergyBus training in Merseburg, Germany
 - April 6th 2017 in German language



We are happy to answer your EnergyBus questions.

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