A Generic Microgrid Controller: Specifications

OVERVIEW

Interest in microgrids has increased in recent years due to need for increased reliability and resiliency of the electric grid, as well as adapting to increased penetration of intermittent resources. A barriers to microgrid deployment is lack of standardization and high cost of microgrid controller. To address standardization and reduce costs, specifications for a Generic Microgrid Controller (GMC) were developed with the goal to facilitate the design and ease of adaptation of microgrid controllers to various microgrids.

GMC specifications were demonstrated for two different micorgirds, a 20MW-Class community microgrid and a 10MW-Class medical center microgrid, and core functions were assessed and evaluated in hardware-in-the-loop (HIL) using an OPAL-RT system.

GOALS

- Develop specifications for a Generic Microgrid Controller
- Develop a microgrid controller complaint with GMC specifications
- Test the GMC in HIL for at least two microgrids

RESULTS

GMC specifications were developed by Advanced Power and Energy Program (APEP) and integrated into IEEE 2030.7 microgrid controller working group through participation of APEP as the vice-chair. The idea behind these specifications is to encourage a common framework for microgrid controllers across the industry.

GMC has a modular architecture. Each module has a “fill-in the blanks” form to describe the asset to the Master Microgrid Controller (MMC). MMC is required to have two main/core functions: Transition (Connect/Disconnect) and Dispatch which are considered the minimum additional functionality above the device or asset level.

Both of the core functions, Transition Function and Dispatch Function, receive requests from the grid or microgrid operator.

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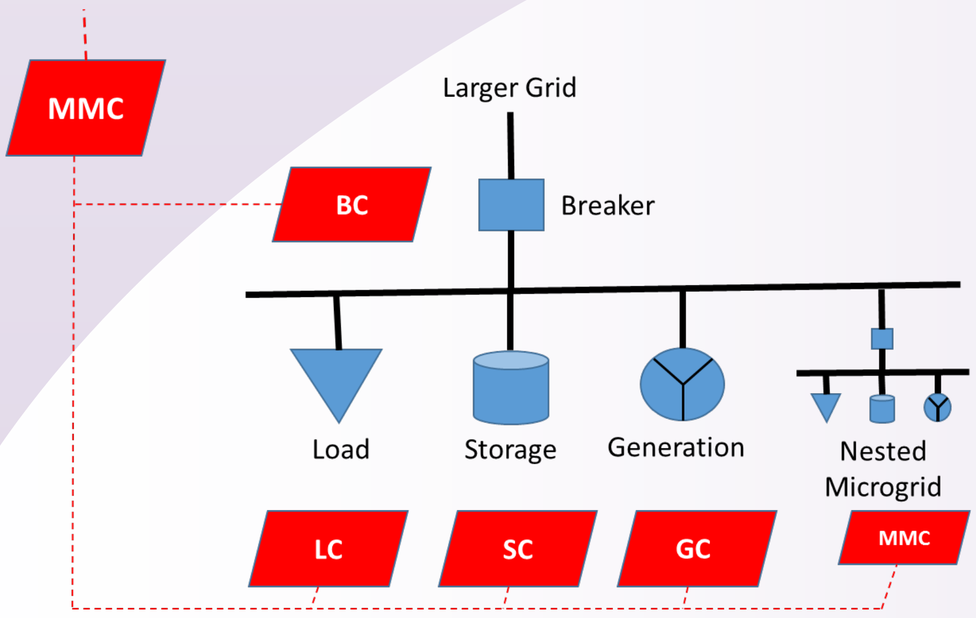
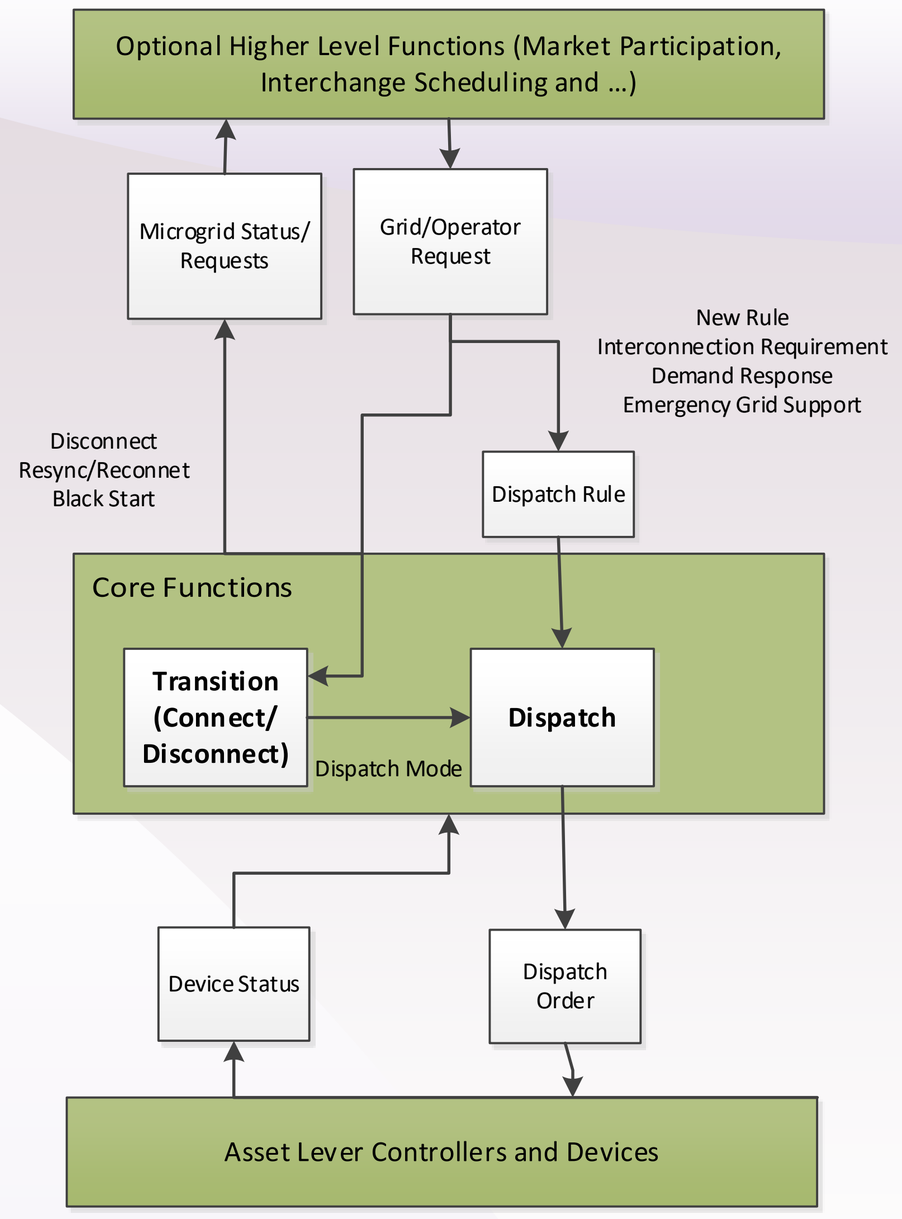


GMC Modular Architecture



MMC Core Functions, Adapted from IEEE 2030.7

RESULTS (continued)

The dispatch rule is predetermined by the operator or a sophisticated optimization algorithm subject to grid requests and constraints. The dispatch mode is determined by the Transition Function which, when islanded, Emergency Dispatch Order is used to minimize loss of critical loads. Based on the dispatch rule and dispatch mode, the Dispatch Function determines the dispatch order and informs asset controllers.

The Transition Function includes (1) unplanned islanding, (2) planned islanding, (3) reconnection, and possibly (4) black start. It detects an unplanned island and orders the Dispatch Function to execute the unplanned islanding dispatch order. The Transition Function also accesses services from the Dispatch Function to achieve real and reactive power balancing necessary for successful planned islanding and reconnection.

RECENT PUBLICATIONS/PAPERS

G. Razeghi, F. Gu, R. Neal, S. Samuelsen (2018). A generic microgrid controller: Concept, testing, and insights. Applied Energy. Vol. 229, pp. 660-671.

S. Samuelsen (2018). A Generic Microgrid Controller. Final Technical Report, DOE-UCI-00730.

PERSONNEL

Graduate Students: Fei Gu
Staff: Ghazal Razeghi
Principal Investigator(s): Scott Samuelsen

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