

## Introduction

A microgrid is a group of interconnected loads and distributed energy resources. The microgrid has the ability to work in both grid-connected and islanded modes.

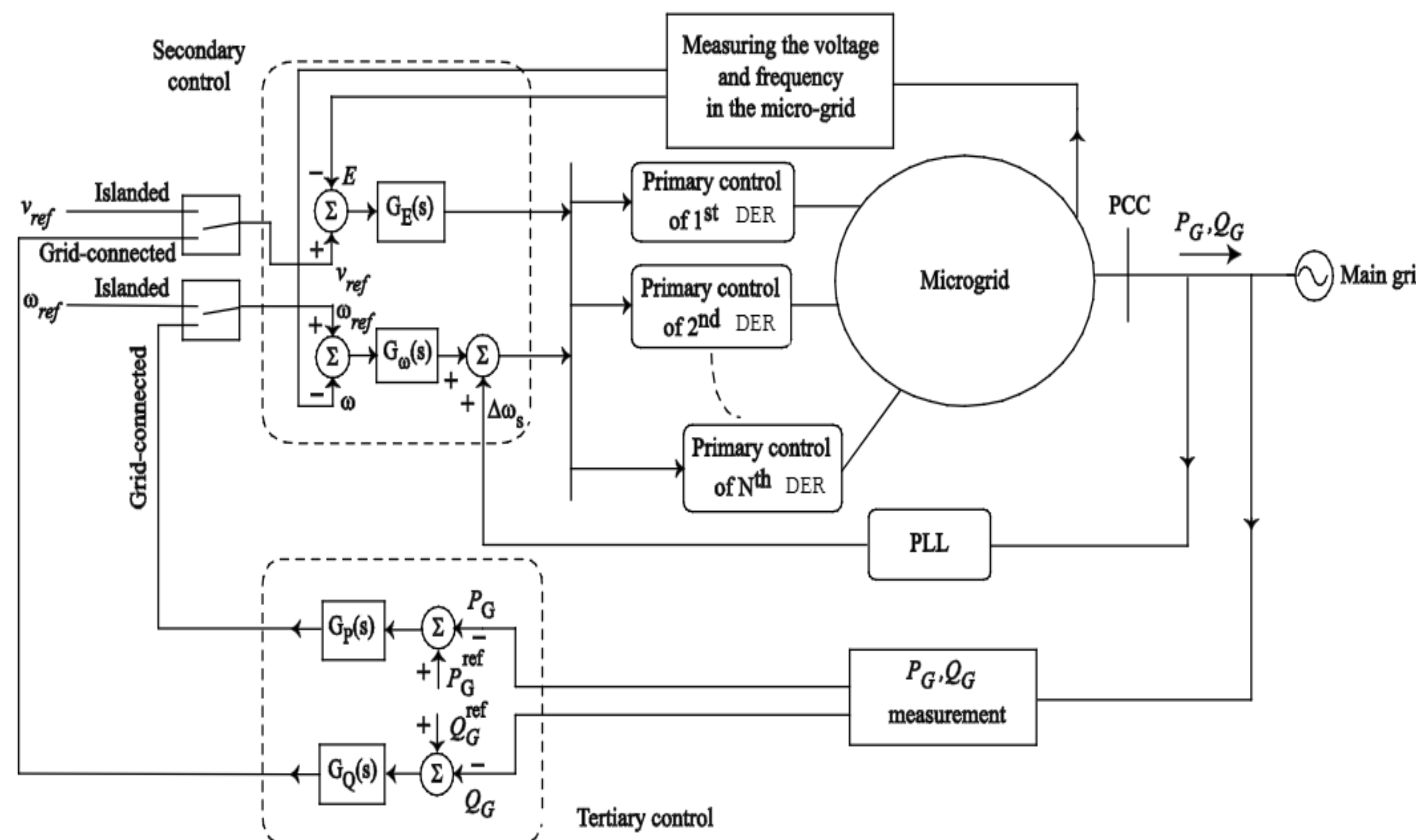
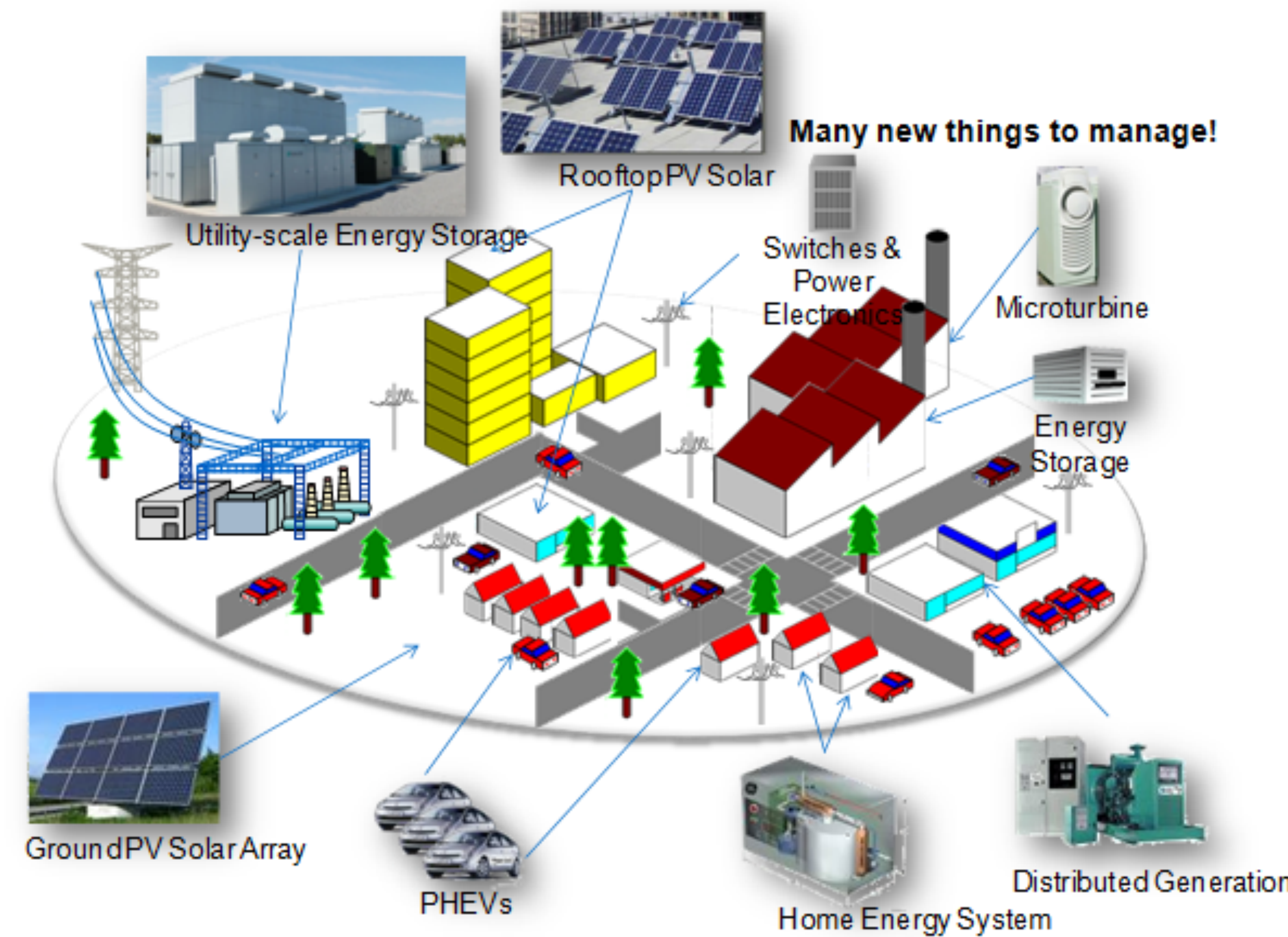
The Microgrid control functions as the brain of the microgrid, and thus requires a complex design consisting of three levels of control: primary, secondary, and tertiary.

## Methodology & Approach

The Hierarchical structure of microgrids has three main parts; Primary Control, Secondary Control, and Tertiary Control.

- Primary Control
  - Locally implemented at each DER
  - Voltage stability provision
  - Frequency stability
  - Plug and play capability of DER's
- Secondary Control
  - Communicates with Tertiary and Primary control
  - Compensates voltage and frequency deviations caused by primary control
- Tertiary Control
  - Communicates with secondary control, Microgrid and the main power grid
  - Power flow control

## How Does the Hierarchical Structure of the Microgrid Work to Produce Consistent Power for Consumers?



A. Bidram and A. Davoudi, "Hierarchical structure of microgrids control system," *IEEE Trans. Smart Grid*, vol. 3, pp. 1963-1976, Dec. 2012.

## Conclusions

Control systems are a key part of the structure of microgrids, functioning as a "brain" for the system and allowing it to maintain uninterrupted function in either grid-connected or islanded modes.

The control structures require a complex design with three different levels of hierarchy, these being the primary, secondary, and tertiary levels, each with unique capabilities and vulnerabilities. The collaboration of all control hierarchies is essential for the microgrid to function properly in either typical or extenuating circumstances.

## Future Activities

- Studying the cyber security aspect of the microgrid control system
- Learning more about the control systems and taking a deeper dive into more complicated diagrams
- Look into machine learning and Artificial intelligence that could end up being apart of the control system

## Acknowledgements

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