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Machine Learning and Software Defined Networks for Renewable Energy Integration

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Introduction

- Renewable energy sources are vitally important for the future of our planet.
- The interaction between renewables and technology also is growing rapidly.
- This PhD project aims to combine several approaches from two different disciplines. These approaches are mainly Machine Learning, Computer Networks and Renewable Energy Integration, Power System Quality Control.
- This research will deliver effective, secure, resilient power systems by implementing advanced machine learning and software defined networking solutions for power networks.
- The project contributes to United Nation's Sustainable Development Goal -7 (affordable and clean energy), Sustainable Development Goal -11 (Sustainable cities and communities) and Sustainable Development Goal -13 (Climate Action).

Methodology

- First, there were several experiments carried out on power network testbed in order to increase the understanding of the traffic between microgrids.
- An algorithm called Network Published Shared Variable (NPSV) was implemented to allow grids to send out their instant data through connection to other grids via TCP connection.
- Second, Microgrids traffic were tested with the help of NPSV algorithm under the different level of background traffic and network behaviours were observed.
- Now, an evaluation of quality metrics on power networks task is being performed and collected data are now being analysed by using appropriate data analysis techniques.
- As future work, proposed SDN-Enabled Microgrid Topology will be implemented. Figure 2 shows the structure of proposed method
- It is possible that information comes from microgrids can be managed by different controllers and in case of delay or link failure, any inconvenience will be effectively tolerated by implementing this proposed approach.
- Sequential Learning Algorithms will be used to improve Quality of Services metrics. The results of Machine Learning algorithms will be critically reviewed to provide more realistic and reliable solution for improvement of Quality of Services metrics.

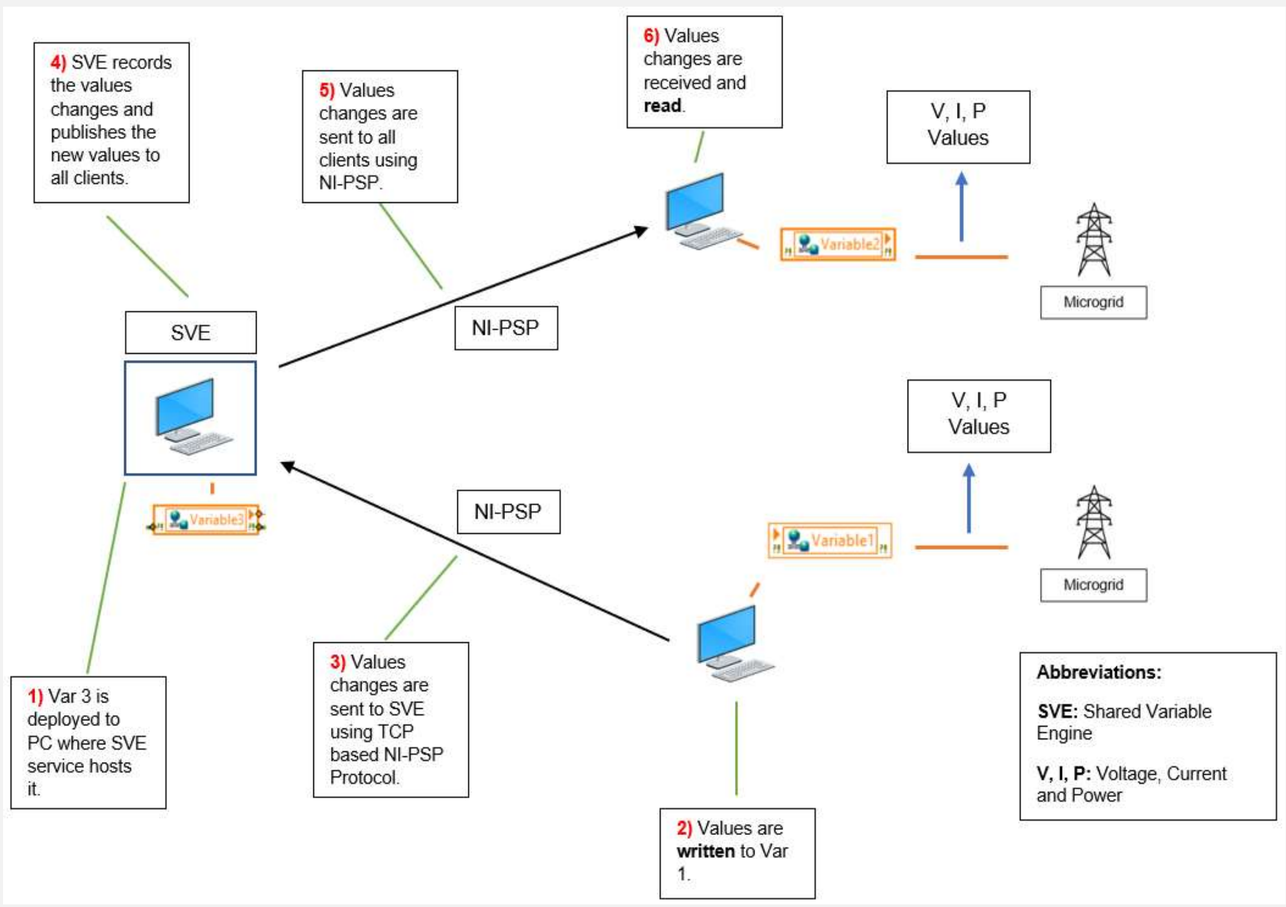

Figure 1. An Overview of Implemented Network Published Shared Variable Algorithm (NPSV) For Microgrids.

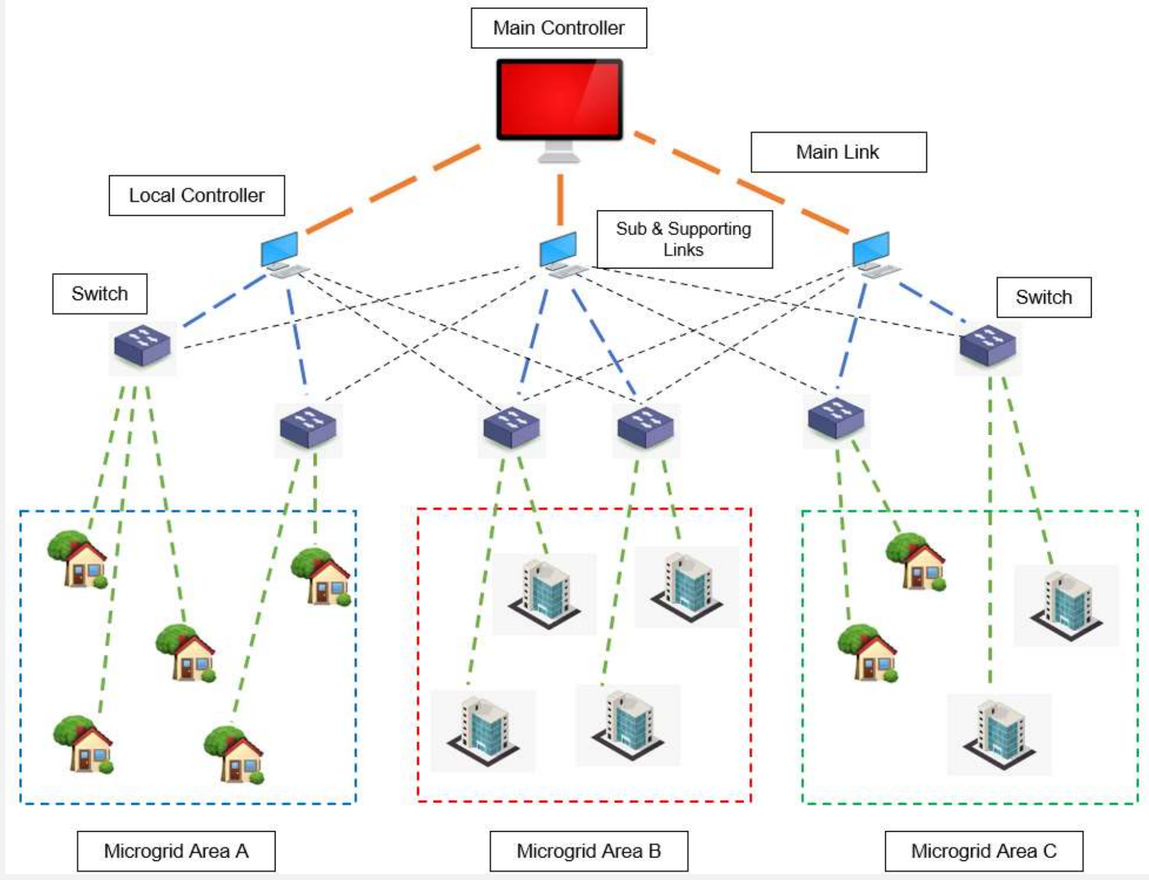

Figure 2. A General Structure of Proposed SDN-Enabled Microgrid Topology. [1]

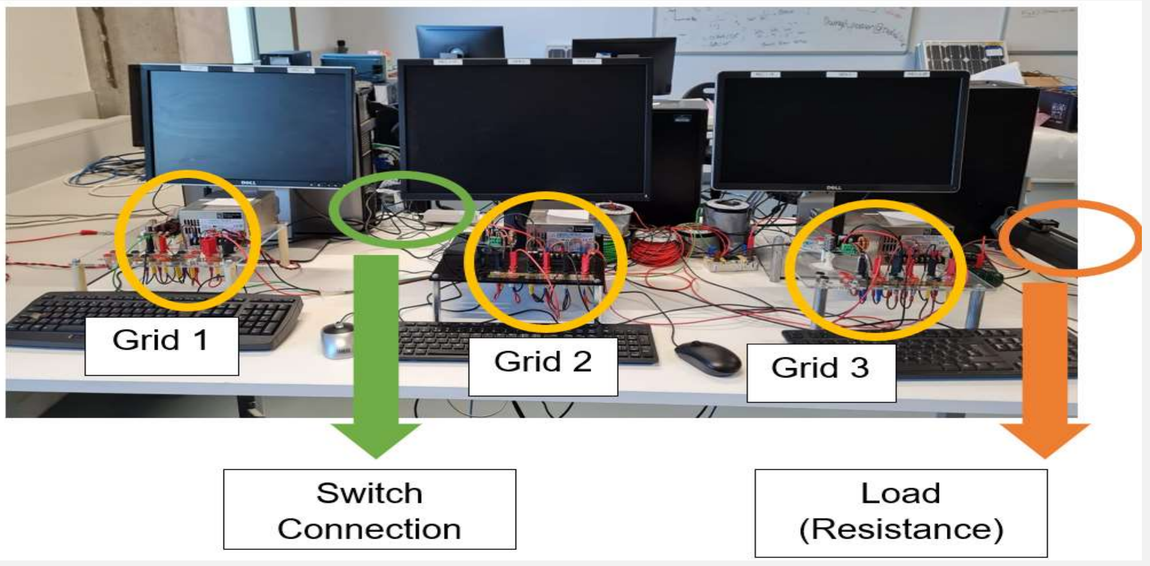

Figure 3. A Prototype Design of Power Network Testbed.

Microgrid Testbed

- Microgrid testbed is located at TU Dublin's Energy System laboratory. The components of testbed are shown in figure 3.
- This testbed configuration consists of 3 standalone grids, 3 computers where computer programmes were deployed to manage microgrid traffic and the instant status of each grid.
- There is a resistance which can be changed in order to place a load on the microgrid at any time and lastly these grids are connected to each other via a layer 2 network connection that enables them to send their critical data such as voltage, power and current all the time.

Acknowledgement

- [1] Z. Lu, C. Sun, J. Cheng, Y. Li, Y. Li, and X. Wen, "SDN-enabled communication network framework for energy internet," Journal of Computer Networks and Communications, vol. 2017, pp. 1–13, 06 2017.
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Host Institution: University College Cork, Ireland — Coláiste na hOllscoile Corcaigh; MTU — Ollscoil Teicneolaíochta na Mumhan, Munster Technological University; Maynooth University, National University of Ireland Maynooth; Trinity College Dublin, Coláiste na Tríonóide, Baile Átha Cliath, The University of Dublin