

Scalable Integrated Situational Awareness System for Smart Grids

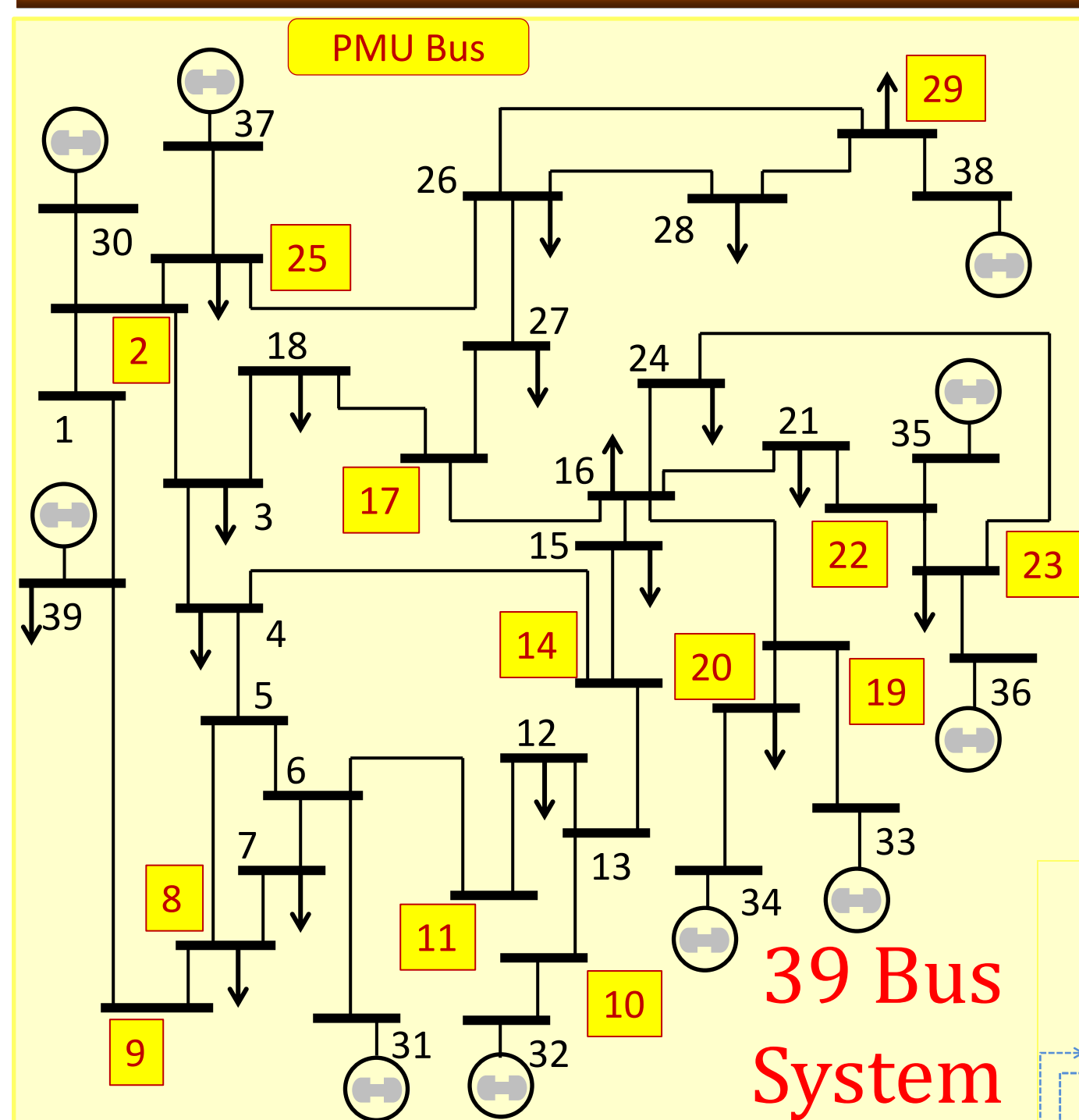
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Introduction

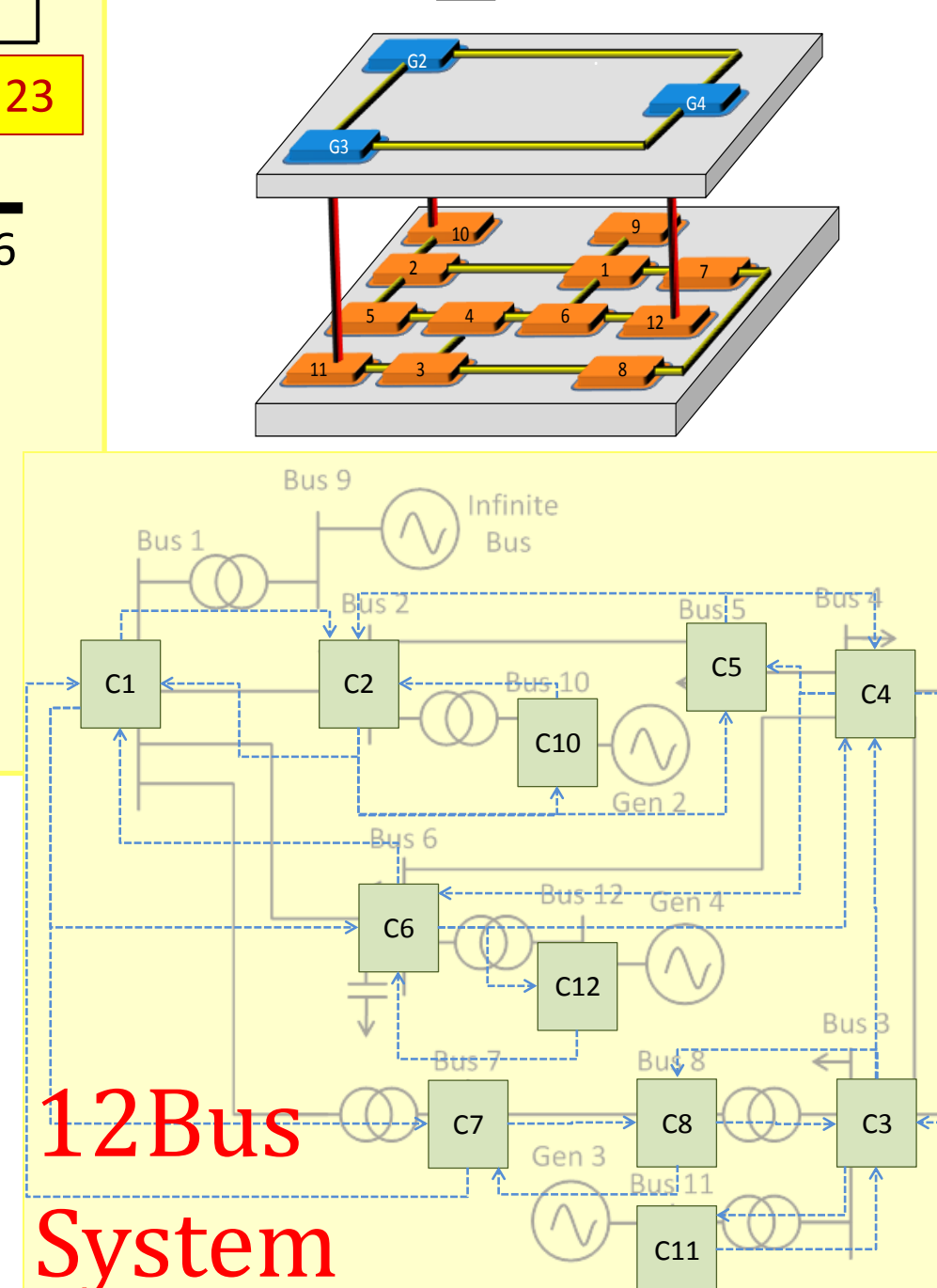
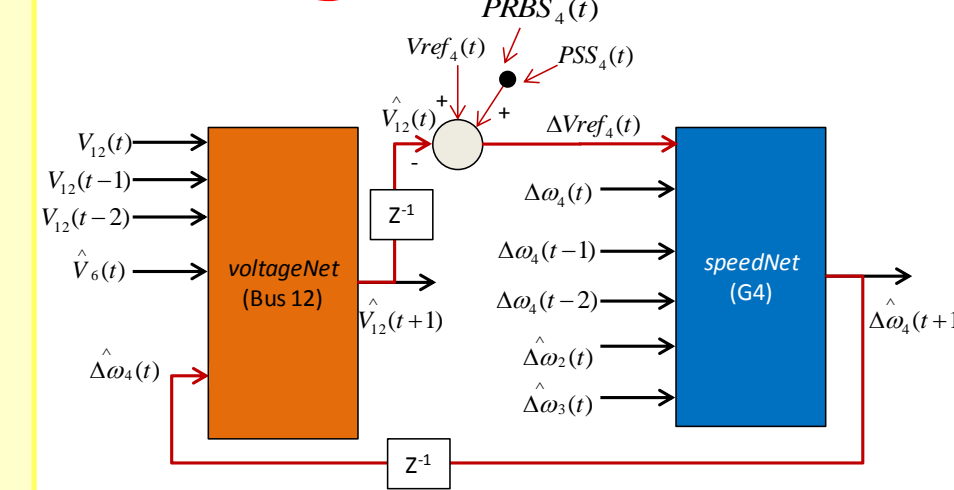
In a **smart grid**, monitoring of system variables such as voltages and speed deviations of generators is important for assessing its **stability**, and making proper **control** decisions. Development of wide area monitoring system is, hence, important for **situational awareness**; especially in a smart grid where integration of **renewable resources**, **distributed generation** and **bidirectional power flows** can lead to instabilities if proper control action is not taken at the right time, place and context.

Test System

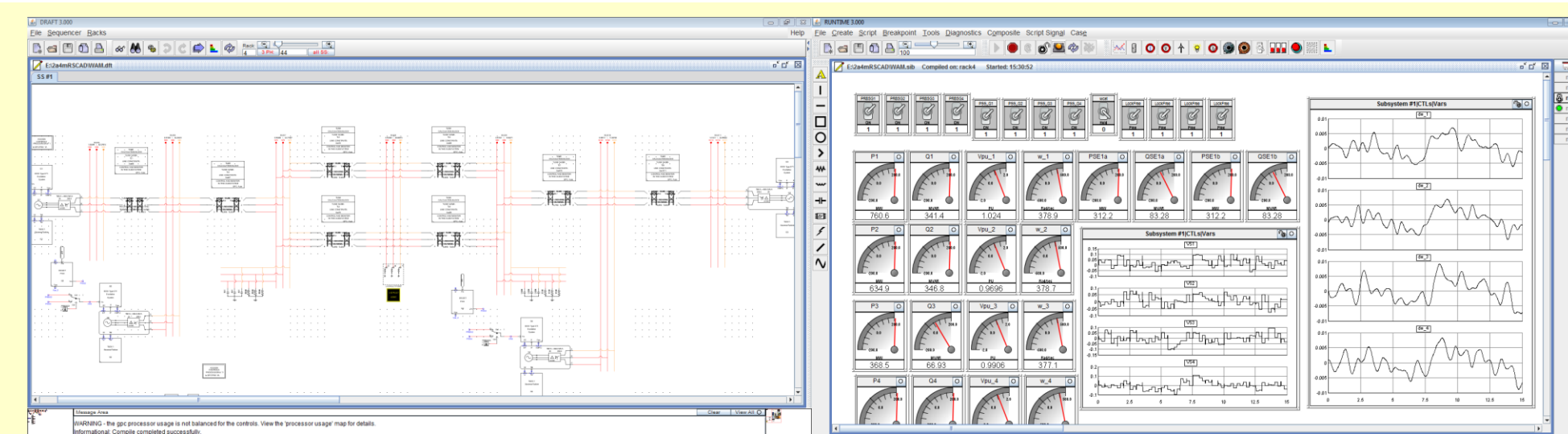


Case I: 12 bus system implemented and **Case II:** 39 Bus system implemented using integrated CNN with coupled **speedNet** and **voltageNet**.

Integrated CNN



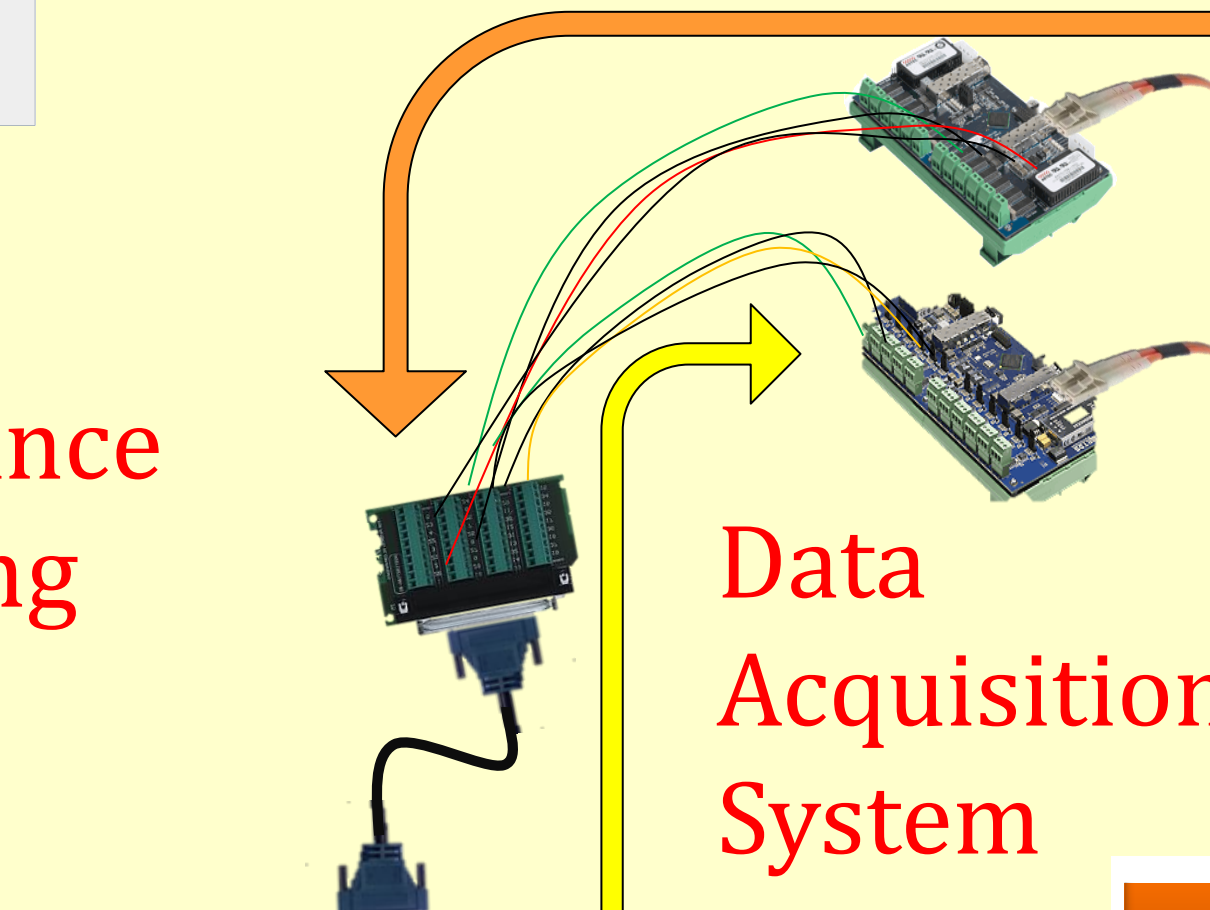
Implementation



RSCAD Host PC



High
Performance
Computing
Cluster



Data
Acquisition
System



Real-Time Digital Simulator

Results

Data obtained from RTDS is used for **predictive state estimation** using cellular neural networks (CNN) implemented on high performance computing (HPC) platforms. **Scalability** is achieved by reducing the size of neural network in each cell representing the different components and exploiting on the local connectivity of the **networked system**.

- A. Speed deviation prediction of nine generators
- B. Bus voltage prediction of the 39 buses
- C. Coefficients of determination between the actual and the predicted **speed deviations**
- D. Coefficients of determination between the actual and the predicted **bus voltages**

