[1] F. B. dos Reis, R. Tonkoski, B. Bhattarai, and T. M. Hansen, “A Real-World Test Distribution System with Appliance-Level Load Data for Demand Response and Transactive Energy Studies,” IEEE Access, 2021.

# Midwest 240-Node

## Description

The GridLAB-D Midwest 240-Node distribution test system. The elements of the network are from a real 240-node distribution system from the Midwest region of the U.S. made available by Dr. Z. Wang from Iowa State University at http://wzy.ece.iastate.edu/Testsystem.html. The OpenDSS models were converted to GridLAB-D. The network release accompanies a yearlong smart meter data for 2017 from the same system, being in an hourly resolution were 1,120 customers are aggregated in 193 load nodes. The Midwest 240-Node synthetic residential load is generated based on the real smart meter data having granular-level information for all homes in the distribution system (i.e., individual appliances that constitute the home load), and the aggregate of all customer load emulates the real smart meter data. The one-year synthetic appliance data has a mean absolute percentage error of 2.58% compared to the smart meter data.

## Size

The total size of all the objects are 773 MB, and are separated in:

- GridLAB-D model → “Midwest-240-Node_s.glm” is 136 KB
- GridLAB-D model for player files → “Midwest-240-Node.glm” is 154 KB
- Number of homes by load node → “number_of_homes.csv” is 2 KB
- granular-level load information → “multy.7z” is 420 MB (5.6 GB when uncompressed)
    - single customer example → “multHDF0.h5” is 5 MB
- GridLAB-D player file → “year_min_l.7z” is 338 MB (5.5 GB when uncompressed)
    - single load node example → “load_profile_PQ_1.csv” is 29 MB

## Platform

To use the files the authors recommend installing GridLAB-D version 3.1 or newer, and Python with pandas to easily read the HDF5 file format. The utilized version of Python is 3.7.3 and the Pandas package version is 0.24.2.

## Major component description

The GridLAB-D model “Midwest-240-Node_s.glm” contains the elements of the network. By running the “Midwest-240-Node_s.glm” a power flow for a single time is performed.

The GridLAB-D model “Midwest-240-Node.glm” contains the elements of the network and the link for the players load files. By running the “Midwest-240-Node.glm” a power flow for every minute for the year of 2017 is performed.

The comma-separated values file “number_of_homes.csv” has two columns. The first contains the load node identifier (i.e., from 0 to 192). The second column contains the respective number of homes of that load node.

The folder “multy.7z” contains 1,120 customer granular-level load information. The files are named with a prefix “multHDF”, followed by their identifying number, and with the postfix “.h5”. Each file in the "multy" folder contains the complete data of the arrival of appliances for an individual customer. Thus, having all the individual appliance information and the time the appliance starts to be served. The appliance information are "start time", "duration", "power", "skedulable", "shifting window -", "shifting window +", "reactive", "Zp", "Ip", "Pp", "Zq", "Iq", "Pq", and "indeX". Where "start time" time the appliance arrived in the queue; "duration" duration of the appliance; "skedulable" boolean to classify if appliance is schedulable or not; "shifting window -" and "shifting window +" start and end of the schedulable window; "power" active power (W); "reactive" reactive power of the appliance (VAR); "Zp", "Ip", "Pp" active power polynomial ZIP parameters; "Zq", "Iq", "Pq" reactive power polynomial ZIP parameters; and the "indeX" is the index of the appliance in the list (dependent on Season).

The folder “year_min_l.7z” contains 193 nodal load active reactive power load data in a minute resolution. The files are named with a prefix “load_profile_PQ_”, followed by their load node identifying number, and with the postfix “.csv”. Each file in the "year_min_l" folder contains the complex value of the nodal load in rectangular form (W) and (VAR) for the aggregation of the homes generated in a minute resolution.

## Detailed setup instructions

To utilize the files from this dataset, place the full dataset at a given folder. Follow to perform the uncompressing of the “multy.7z”, and “year_min_l.7z” folders. Once that has been performed the folder should contain all the necessary files being ready to be utilized. Please make sure no errors have occurred during the downloading and uncompressing process.

## Detailed run instructions

Please make sure to install the necessary resources from the platform section. Furthermore, please remember to perform the detailed setup instructions before proceeding with the instructions in this section.

With the required platform install resources, with command line access. From your command line (e.g., in Win10 the Command Prompt) go to the folder containing the data. Once on the folder you will be able to run the GridLAB-D power flow analysis. By executing the command “gridlabd Midwest-240-Node_s.glm” you will perform the power flow analysis for a single time. By executing the command “gridlabd Midwest-240-Node.glm” you will perform the power flow analysis with for the entire year in a minute resolution.

In other to read the granular-level load information it is recommended to utilized Python. An example of reading the HDF5 files presented as follows:

- On your command line go to the “multy” folder,
- Run the commands:
    - “python”,
    - “import pandas as pd”
    - “df=pd.read_hdf(‘multHDF0.h5’)”

The Python variable “df” will have data frame with all the data withing the folder “multHDF0.h5”.

## Output description

Running the power flow GridLAB-D file “gridlabd Midwest-240-Node_s.glm” will output the voltages at every node, and the current at every element. Running the power flow GridLAB-D file “gridlabd Midwest-240-Node.glm” will output the voltages at every node, and the current at every element. Since the file “Midwest-240-Node.glm” solves the power flow for the year of 2017 in a minute resolution the following variables are true time: power in overhead lines, voltage at loads, and all the available variables for a given line.

More outputs can be added. Please referee to GridLAB-D documentation for changing the output http://gridlab-d.shoutwiki.com/.

## Contact information

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