

End to end testing and benchmarking of appliance disaggregation

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BIDGELY

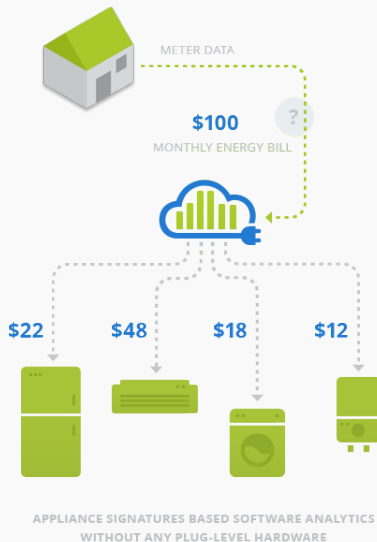
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An End to End Test runner that tests Bidgely's whole software and hardware pipeline and generates comparisons with past performance as well as ground truth.

What does Bidgely do ?



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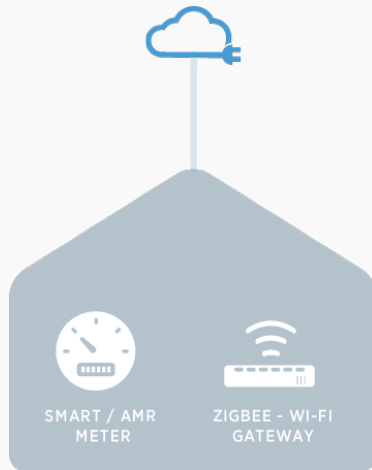
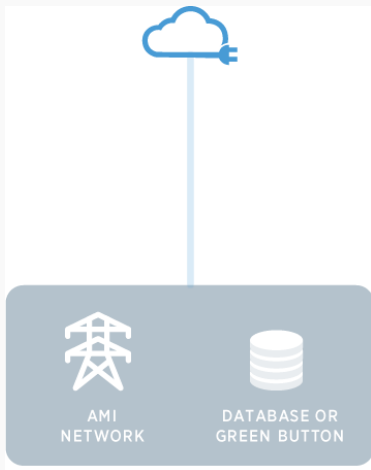
What is Disaggregation?

The process of analyzing changes in consumption of a home to deduce the appliances used and the individual energy consumption.

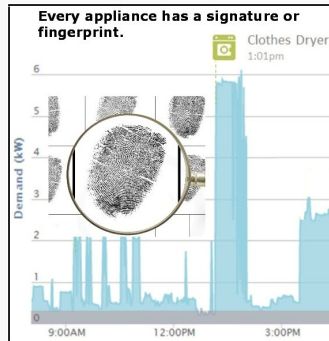
- ▶ Input: a data stream of household electricity usage from a single point (e.g. smart meter data, gateway)
- ▶ External input: Weather, temperature etc.
- ▶ Output: Amount of consumption of each major Appliance.

How does that work?

Collect Data



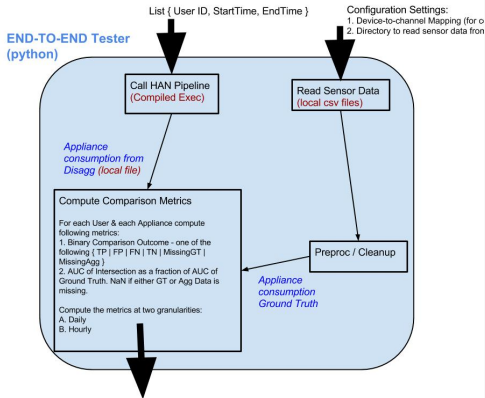
Learn from Data



How to test and benchmark?

An end to end tester for comparing results and ground truth.

End to End Tester



Output: A set of CSV files

Two CSV files per user: one for daily, another for hourly.

Name of the csv file: <User id>_<StartTime>_<EndTime>_<daily | hourly>E2Emetrics.csv

Format of the csv file:

-- One row per epoch (epoch = day | hour)

-- Columns: Appliance Name, epoch timestamp, and the metrics listed above

Use-cases

1. Be able to quickly see disag results for Pilots training data (with sensors)
2. Have this run on-demand on a new version of algorithm, for a quick sanity-check, or for quickly getting disag results on a set of users.
3. Have this run as a daily cron-job to create a disag end-to-end accuracy report with the latest development branch. Goal is to catch early on any surprises that new features / bug fixes might create. A separate cron-job can create the executable from HEAD of development branch and put it in the local cron jobs to run on a daily basis.

How HAN works



Figure : Smart Energy Meter and Gateway Device

Plug level Sensors



End to End Tester design

- ▶ The tool accepts csv with the user id's and the timestamp to run the tests
- ▶ sensor vs han pipeline exec output
- ▶ sensor vs disagg from api
- ▶ hanpipeline exec output vs disagg from api
- ▶ hanpipeline exec output vs hanpipeline exec output
- ▶ disagg api vs disagg api

Syncing data

```
→ redesign git:(master) ✗ clear

→ redesign git:(master) ✗ python sync_data.py -h
usage: sync_data.py [-h] [--sync_raw] [--run_han] [--sync_ground_truth]
                  [--cluster CLUSTER] [--output OUTPUT] [--env ENV]
                  [--sync_disagg_api]
                  input_csv

Fetches data for running qa experiments from various sources, stores data in
outputdir

positional arguments:
  input_csv            Input file with uuid, tstart, tend

optional arguments:
  -h, --help            show this help message and exit
  --sync_raw, -sr       Sync raw data by first creating a sync job in dev
                        machine and copying the results back to
                        DISAGG_BASE_DIR
  --run_han, -rh        Run hanpipeline for the users, expects data to be
                        available on DISAGG_BASE_DIR
  --sync_ground_truth, -sg
                        syncs sensor data for the ground truth channels
  --cluster CLUSTER, -c CLUSTER
                        dev/prod cluster, use with sync_disagg_api
  --output OUTPUT, -o OUTPUT
                        override output directory set in conf
  --env ENV, -e ENV     dev or prod column, use with sync_disagg_api
  --sync_disagg_api, -sd
                        sync disagg data from cassandra

→ redesign git:(master) ✗
```

Generating metrics

```
bidgely@Bidgely-HP-Pavilion-15-Notebook-PC... x bidgely@Bidgely-HP-Pavilion-15-Notebook-PC... x
→ redesign git:(master) X python generate_metrics.py -h
usage: generate_metrics.py [-h] [--output OUTPUT]   

    input_csv source1 source2 form
    (pause)
    (then hanpipeline exec output vs hanpipeline exec output)

Runs the hanpipeline, converts to intermediate csv and also generates qa
metrics for disagg comparing with sensor data. keys: 1: sensor vs han pipeline
exec output 2: sensor vs disagg from api 3: hanpipeline exec output vs disagg
from api 4: hanpipeline exec output vs hanpipeline exec output 5: disagg api
vs disagg api (ize)

positional arguments:
  input_csv             Input file with uuid, tstart, tend
  source1               source against which you are comparing, reference
  source2               the source which you are going to compare against the
                       reference
  form                 a key stating what kind of comparison is going to
                       happen, check help for keys

optional arguments:
  -h, --help            show this help message and exit
  --output OUTPUT, -o OUTPUT
    (Credits)          override output directory set in conf

→ redesign git:(master) X
→ redesign git:(master) X
```

Results

aggregate_daily_comparison.csv - LibreOffice Calc

ID	UID	timeslap	COOKING_OVEN_g	COOKING_OVEN_algo	SPACE_HEATER_g	SPACE_HEATER_algo	COOKING_TOASTER_g	COOKING_TOASTER_algo	WATER
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1400930400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1400716800	0	0	2261.83375	2261.83375	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1400632000	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1400888000	0	0	517.12	517.12	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1400917000	0	0	1963.35388889	1963.35388889	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401062400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401148800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401235200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401321600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401408000	0	0	900.778888889	900.778888889	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401484400	0	0	7877.92786782	7877.92786782	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401580800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401667200	0	0	164.35805863	164.35805863	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401753600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401840000	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1401926400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402012800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402099200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402185600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402272000	0	0	280.543611111	280.543611111	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402358400	0	0	11486.3318984	11486.3318984	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402444800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402531200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402617600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402704000	0	0	521.719305556	521.719305556	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402790400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402876800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1402963200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403049600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403136000	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403222400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403308800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403395200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403481600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403568000	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403654400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403740800	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403827200	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1403913600	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1404000000	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1404086400	0	0	0	0	0	0	
5714.2d87fecb-beed-4c15-83b7-82297a4a2362		1404172800	0	0	0	0	0	0	

Current status and post midsem plans

- ▶ Bug fixes for the end to end tester.
- ▶ A testing Suite for gateway devices.
- ▶ A Simulation Suite for mocking houses, to be used with end to end tester

Summary

- ▶ Build a tool for comparing ground truth to the disaggregation results.
- ▶ Built tools for automating data fetching for testing and benchmarking.
- ▶ Automate more things in the future.

Questions