Historical Database for DynaMIT2.0

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Outline

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Starting point

The aim of the on–line calibration is to use the off–line calibrated parameter values as starting points and perform a local optimization step towards the unobserved true values[1].

Precise historical OD flow $=>$ Accurate estimated OD-flow

[1] Constantinos,A(2004) On–line Calibration for Dynamic Traffic Assignment

OD-Flow Analysis(1)

Altered by many factors:

- rush hour
- weather
- holiday
- ...

Needs to be stratified under several tags

OD-Flow Analysis(2)

The historical data may be not accurate at first.

Needs update process

Insights

- Set up database for storage
- Update historical data with estimated data
- Provide best-fit historical flow

Goal

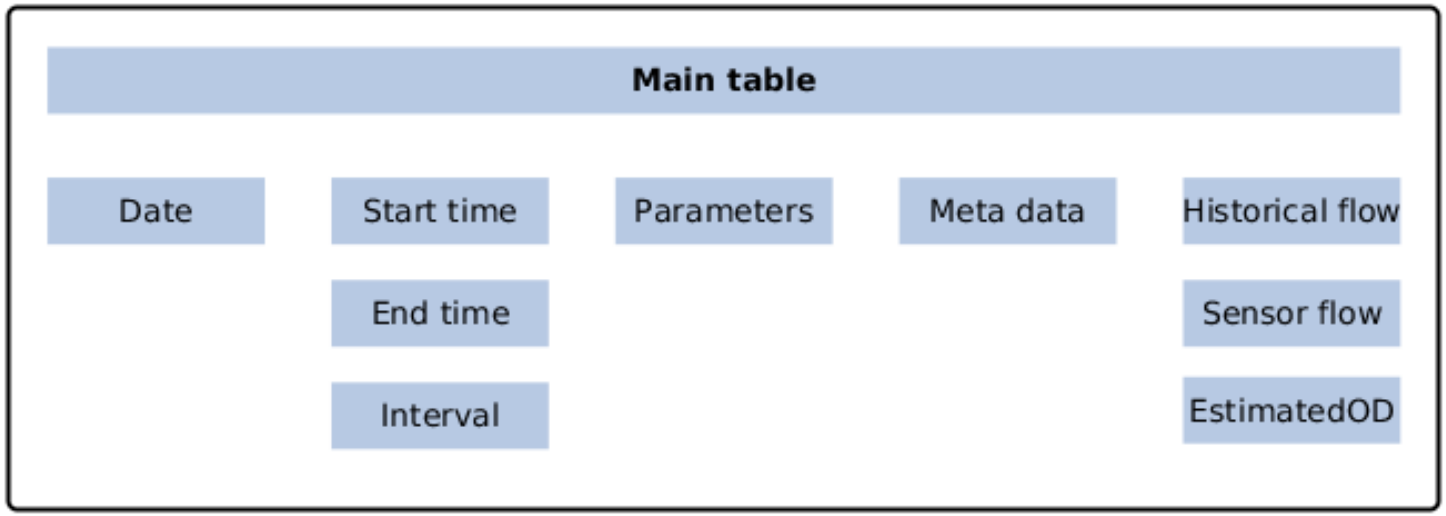
To design a program that can automatically **save** results from the DynaMIT simulation ,**update** the historical OD-flow and **render** proper demand input for the real-time DynaMIT simulation.

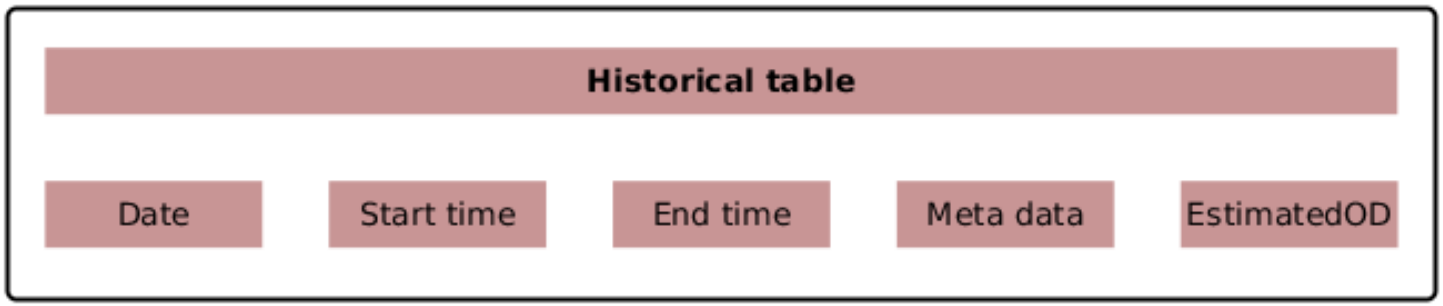
Outline

Functions

- Save DynaMIT input and output files to database
- Update the exist records in database
- Render best-fit historical data given by the input parameters of real-time DynaMIT simulation
- Auto-check and backup

Table definition





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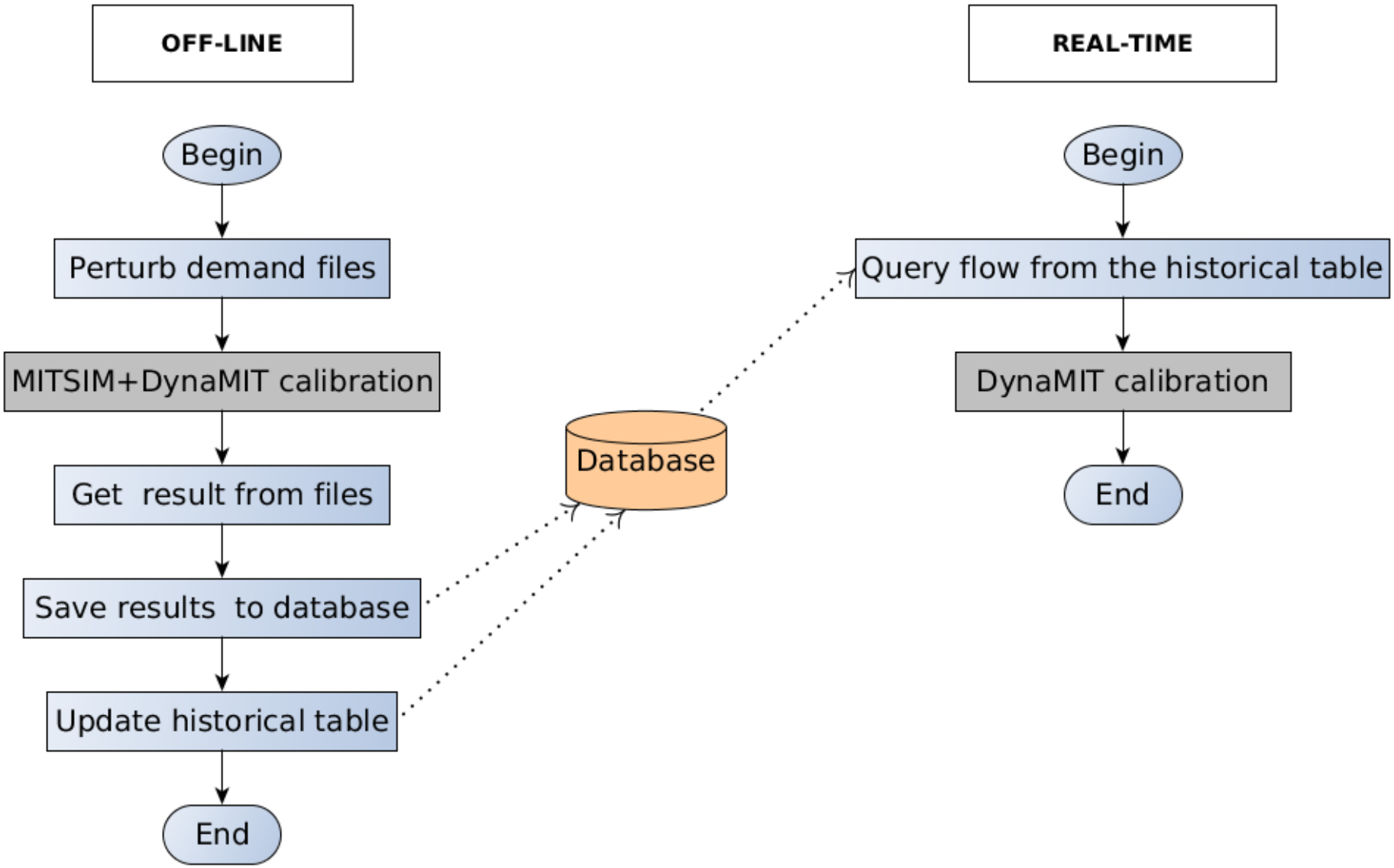
Flow Diagram



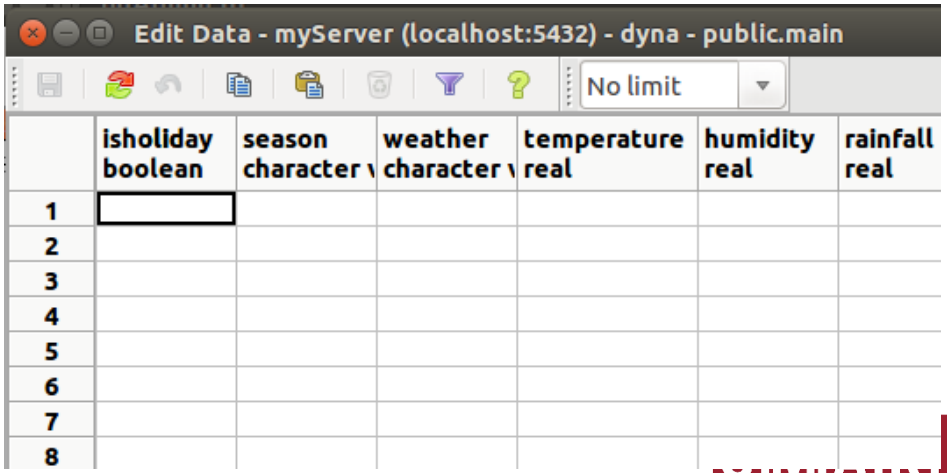
Project description

- Database: PostgreSQL
- Language:
  - Python (file operation)
  - Java (database I/D/U/Q)
  - Shell (whole process)

Setup process

- CREATE TABLE: database.config
- Framework parameter: params.config & init.sh
- Generate demands: demand_perturb.py

```
//Metadata(Tags)
Column= "isHoliday"      Type = "boolean"
Column= "season"                Type = "varchar(1000)"
Column= "weather"               Type = "varchar(1000)"
Column= "temperature"           Type = "real"
Column= "humidity"              Type = "real"
Column= "rainfall"              Type = "real"
Column= "wind"                  Type = "real"
Column= "incidents"             Type = "varchar(10000)"
Column= "specialEvent"          Type = "varchar(10000)"
Column= "description"           Type = "varchar(10000)"
```



Insert process(main table)

- dtaparam.dat
- behavior.dat
- supplyparam.dat
- sensor.out
- demand.dat
- estimatedOD*
- EOD.txt
- sen_flw_*
- sen_spd_*
- ...

Update process(hod table)

main::estimatedOD => hod::historicalOD

- Last EstimatedOD
- Moving Average(SMA,EMA)
- Smoothing Model

Generate historical data process

SELECT estimatedOD FROM hod WHERE ...

Screen-shot

```
dynamit@DynaMIT-WS:~/student/mengyue/drill/test$ . 2_simulationToDatabase.sh

==============================OcSimu2Db_Platform==============================
=============================================================MENG YUE==August 3,2016=
```

```
LOOP8|=>SIMUDATE: 2016/01/08


Check date: 2016/01/08
Connecting to database...
Database connected.
Searching date 2016/01/08


Update process: HOD for 2016/01/08
```

```

Clear backup...
=== mv output/temp files after run of DynaMIT in current directory to destimatio
n ===
```

```
Run DynaMIT&MITSIM...
****   DynaMIT Real-time and Closed-Loop version 2.1.0  ****
Based on DynaMIT Corba-free version
Build date: Feb 24 2016 19:53:35
```

```
Insert to database...
Connecting to database...
Database connected.
THU>>>Load data path and database configuraion
THU>>>Handling inserting CONFIG TABLE process~
THU>>>Interval number = 4
THU>>>Get IdList 7 1 1 1
THU>>>Handling inserting MAIN TABLE process~
THU>>>24648, 1690577, 9783, 33859, 9783, 48560
THU>>>Insert main record 260
THU>>>Finished inserting!
THU>>>Check validity!
THU>>>Validity Approved!
Database disconnected.


Backup DynaMIT results...


Load from database and save to files...
Connecting to database...
Database connected.
length=2
/home/dynamit/student/mengyue/drill/test/DBSAVE/DynaMIT_FILE08/
2016/01/08
Database disconnected.


Finished Loop08 !
```

```
LOOP2|=>SIMUDATE: 2016/08/11
Connecting to database...
Database connected.
Searching date 2016/08/11

[ERROR]:The date is already exist, abort this simulation and go next loop
```

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Outline

Test

- Mode: DynaMIT+MITSIM, with on-line calibration
- Parameters: 21:00-21:20, 10 DAYS, 1633 OD-pairs, 650 sensor flow counts
- Algorithms for 'update process':
  - Fixed historical OD-flow(FHOD)
  - Last estimated OD-flow(LEOD)
  - Simple moving average(SMA)
  - Exponential moving average(EMA)
- Examination: comparing the deviation on sensor data

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Measurement

$$SSD = \frac{\sum_{t=1}^{T}\sum_{k=1}^{N}(z_{tk} - \hat{z}_{tk})^2}{T \cdot N}$$

- $SSD \sim$ Sum of Square Deviation
- $t \sim$ measurement time
- $k \sim$ sensor id
- $z \sim$ sensor data calculated from DynaMIT
- $\hat{z} \sim$ sensor data generated from MITSIM

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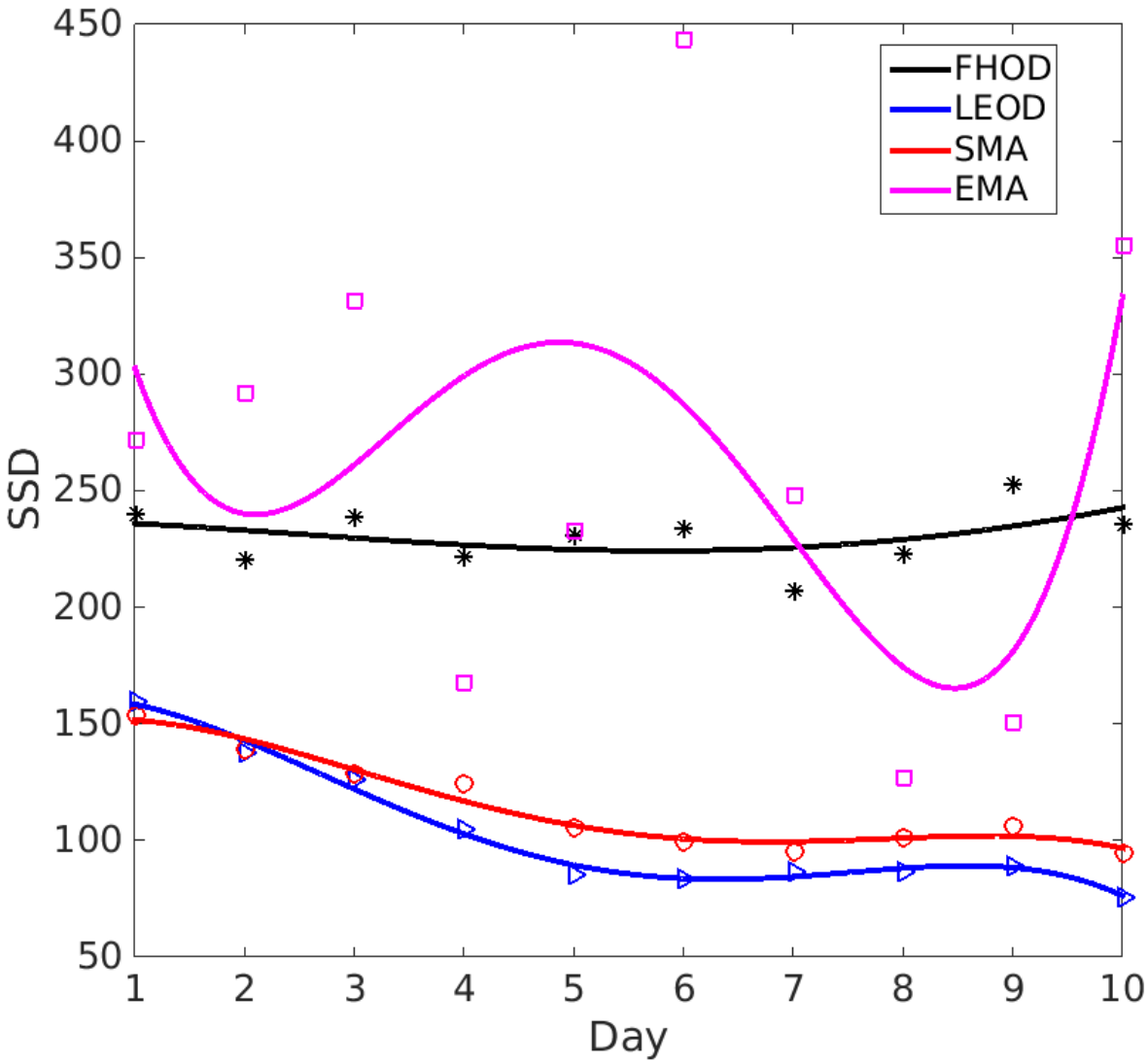
Result(1)

$$SSD = \frac{\sum_{t=1}^{T}\sum_{k=1}^{N}(z_{tk} - \hat{z}_{tk})^2}{T \cdot N}$$

	FHOD	LEOD	SMA	EMA
Day01	240.5446	159.7300	153.6781	271.6938
Day02	220.5035	138.1935	139.0477	292.1262
Day03	239.0592	126.1138	128.6850	331.6473
Day04	221.9104	104.8381	124.4123	167.9585
Day05	230.9269	85.4904	105.4735	232.7762
Day06	234.1285	83.5442	99.6369	443.7015
Day07	207.4577	86.6100	95.2712	248.3496
Day08	223.0069	86.7131	101.3600	127.0642
Day09	253.0600	89.0012	106.1977	150.8777
Day10	235.9300	76.0623	94.6892	355.5285

Result(2)



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Conclusion

- Update process reduces the error
- Error descends with iteration
- LEOD and SMA performance better
- EMA fluctuates too much

Outline

Finished progress

- Implemented a database-based simulation infrastructure
  - Define table
  - Grab and insert data
  - Top-level script
- Compared several 'update process' algorithms
  - Updating does have effect
  - LEOD and SMA better

Future research

- Find source for the metadata
- More test data and more algorithms
- Refactoring & Documentation

Questions

Thank you!