Historical Database for DynaMIT2.0

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Outline

1. Motivation
2. Methodology
3. Experiment
4. Summary

Outline

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

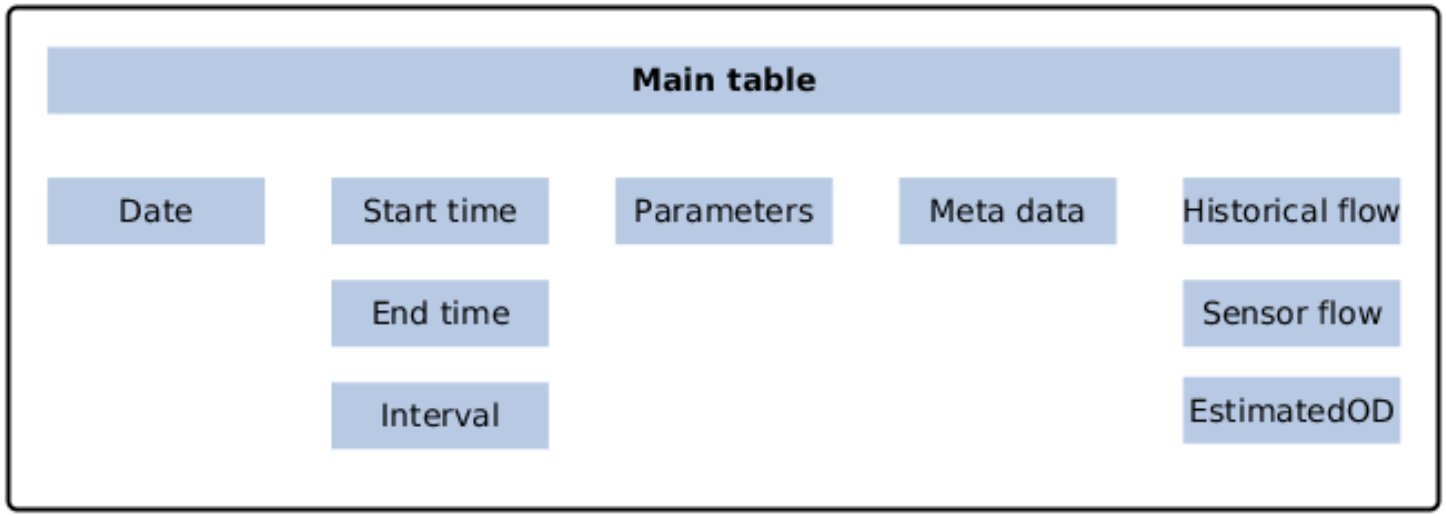
To design a program that can automatically **save** results from the DynaMIT simulation ,**update** the historical OD-flow and **render** proper demand input for the real-time DynaMIT simulation.

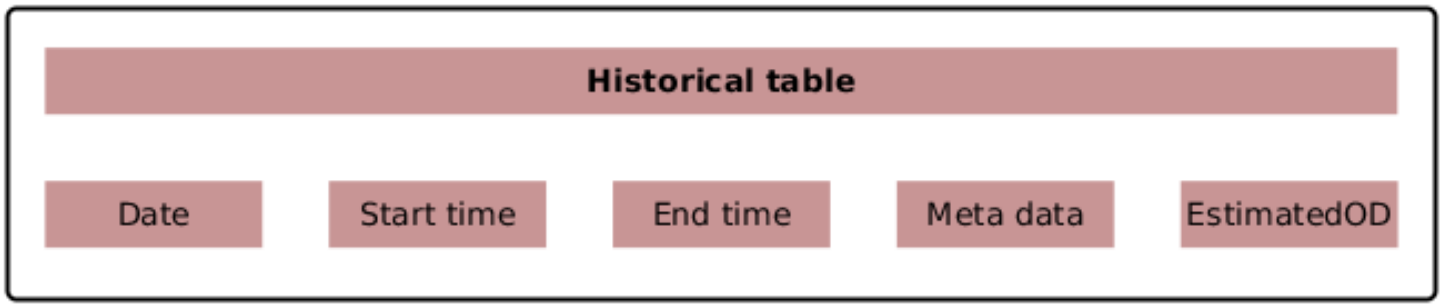
Outline

Functions

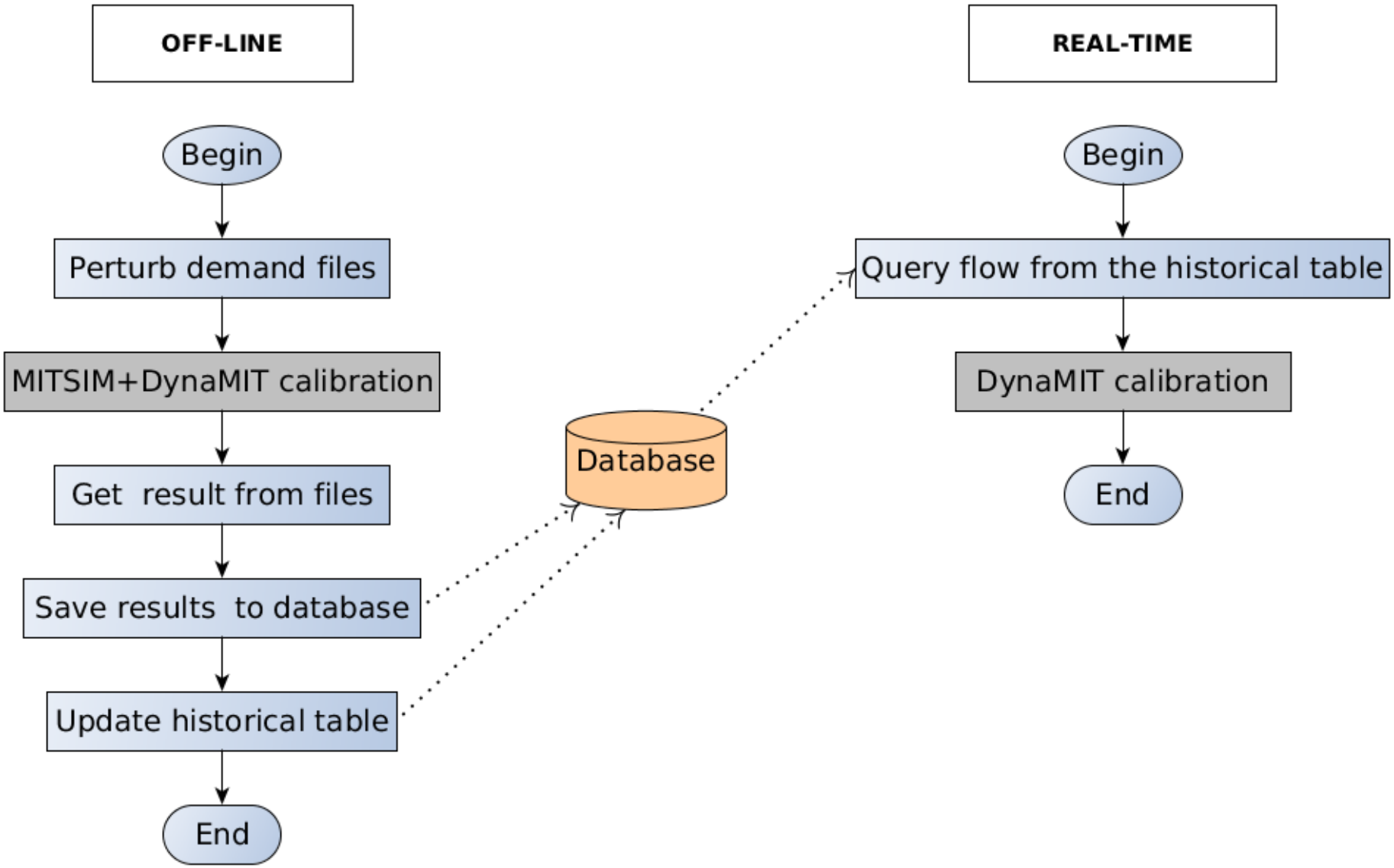
- Save DynaMIT input and output files to database
- Update the exist records in database
- Render best-fit historical data given by the input parameters of real-time DynaMIT simulation
- Auto-check and backup

Table definition





Flow diagram



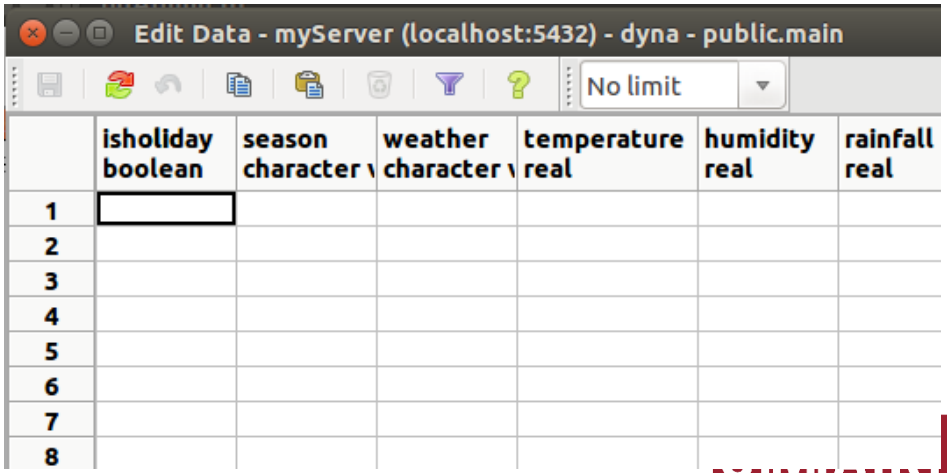
Project description

- 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

Update algorithm:

- Last EstimatedOD
- Moving Average
- 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
```

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```
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

Purpose

- Examine the historical database for DynaMIT
- Compare different algorithms for update process

Design

- Mode: DynaMIT+MITSIM, with on-line calibration
- Parameters: 15:00-21:00, 10 days, 1633 OD-pairs, 650 sensor flow counts
- **Algorithms for 'update process':**
  - Fixed historical OD-flow
  - Last estimated OD-flow
  - Simple moving average
  - Exponential moving average
  - Smoothing Model
- Performance analysis: RMSN for sensor data

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Update algorithm(1)

Fixed historical OD-flow (**control group**):

$$x_h^{H,n} = x_h^{H,n-1} = Const$$

Last estimated OD-flow:

$$x_h^{H,n} = \hat{x}_h^n$$

Notation:

- $x_h^{H,n} \sim$ Historical OD-flow at interval h after n days
- $\hat{x}_h^n \sim$ Estimated OD-flow at interval h on the n^{th} day

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Update algorithm(2):Moving Average

Simple moving average:

$$x_h^{H,n} = \frac{1}{M}\left(\sum_{k=0}^{M-1} \hat{x}_h^{n-k}\right)$$

Exponential moving average:

$$x_h^{H,n} = \alpha \cdot \hat{x}_h^n + (1-\alpha) x_h^{H,n-1}$$

Notation:

- $x_h^{H,n} \sim$ Historical OD-flow at interval h after n days
- $\hat{x}_h^n \sim$ Estimated OD-flow at interval h on the n^{th} day
- $M \sim$ Window size
- $\alpha \sim$ Degree of weighting decrease between zero and one

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Update algorithm(3):Smoothing Model[2]

Smoothing model formula:

$$x_h^{H,n} = x_h^{H,n-1} + \alpha(\hat{x}_h^n - x_h^{H,n-1})$$

Notation:

- $x_h^{H,n} \sim$ Historical OD-flow at interval h after n days
- $\hat{x}_h^n \sim$ Estimated OD-flow at interval h on the n^{th} day
- $\alpha \sim$ A scalar between zero and one

[2]Kalidas, A. (1996) Estimation and Prediction of Time-Dependent Origin-Destination Flows

Measurement

Root Mean Square Normalized(RMSN):

$$RMSN = \frac{\sqrt{N \sum_{i=1}^{N} (y_i - y_i^*)^2}}{\sum_{i=1}^{N} y_i^*}$$

- $y_i \sim$ The i^{th} sensor data calculated from DynaMIT
- $y_i^* \sim$ The i^{th} sensor data generated from MITSIM/hist_flow

Data excel

- FHOD-Fixed Historical OD-flow
- LEOD-Last Estimated OD-flow
- SMA -Simple Moving Average
- EMA -Exponential Moving Average
- SM -Smoothing Model

	FHOD	LEOD	SMA	EMA	SM
Day01					
Day02					
Day03					
Day04					
Day05					
Day06					
Day07					
Day08					
Day09					
Day10					

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Anticipation

- Update process reduces the error
- Error descends with iteration
- Algorithm with slow change may perform better than drastic one

Outline

Finished progress

- Implemented a database-based simulation infrastructure
  - Define table
  - Grab and insert data
  - Top-level script
- Designed 'update process' test

Future research

- The experiment given above
- Find source for the metadata
- Refactoring & Documentation

Questions

Thank you!