

Land usage - Höfn

201805 Research



Outline

- Introduction
- Flow
- Implementation
- Table schema
- Method
- Result



Introduction

- To provide more cell surrounding data for positioning.
- To avoid some special location: river , desert , ocean
- To lock some special location: MRT , tunnel , highway
- Help to judge location indoor/outdoor.



Land usage Parser

- OSM Parser (**one time process**)
 - A jar file
 - Query on official OSM database and get the GIS data.
 - Process and simplified GIS data to WKT format.
 - Save to tsv file for Hofn.
- Hofn (daily process)
 - A jar file.
 - Generate relation between cell and polygon use different rule by Hofn type.
 - Save to tsv file for positioning.



Data

- NT2_CELL_DIFF_tech.csv from Hilo output
 - Hilo will compare today's NT_CELL_tech.csv and yesterday's NT_CELL_tech.csv in cell key, longitude, latitude, azimuth, indoor columns and record it's new add , removed or modified.
- NT2_GEO_POLYGON.tsv from OSM Parser
 - Because GIS data (river...) will not frequently change, no need to generate everyday. This file is like a library only for read no write. We'll generate a new one to substitute old one until big change happend.
- NT2_CELL_POLYGON_tech.tsv from Hofn
 - Generate relation between new add cell / modified cell and polygon. Append these results to the latest NT2_CELL_POLYGON_tech.tsv



Flow



Simple Flow

NT_Hilo (py)

(daily process)

NT2_CELL_DIFF_LTE.csv

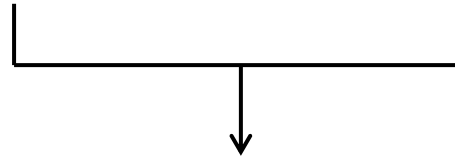
NT2_CELL_DIFF_UMTS.csv

NT2_CELL_DIFF_GSM.csv

OSM Parser (jar)

(one time process)

NT2_GEO_POLYGON.tsv



Land_Hofn (jar)

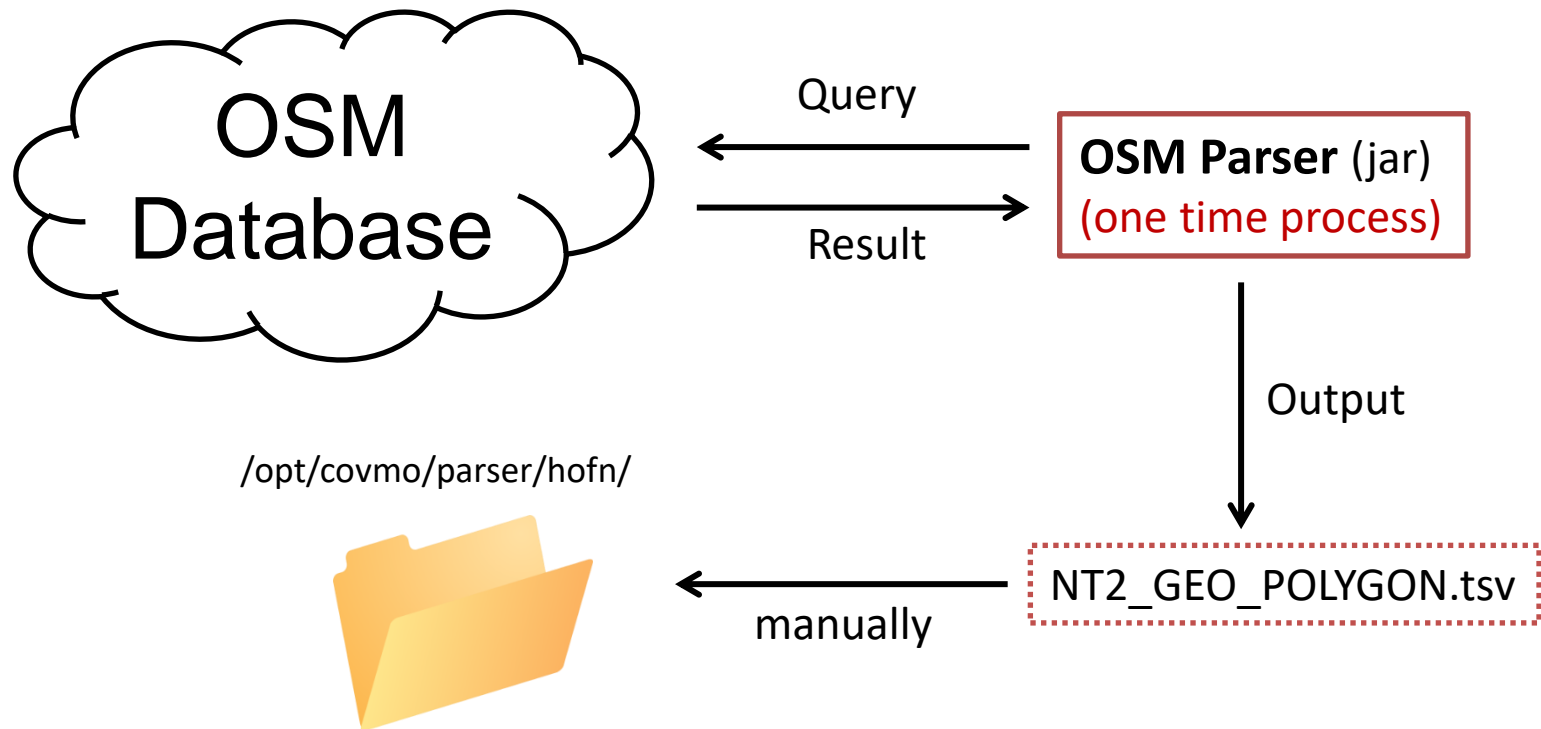
(daily process)

NT2_CELL_POLYGON_LTE.tsv

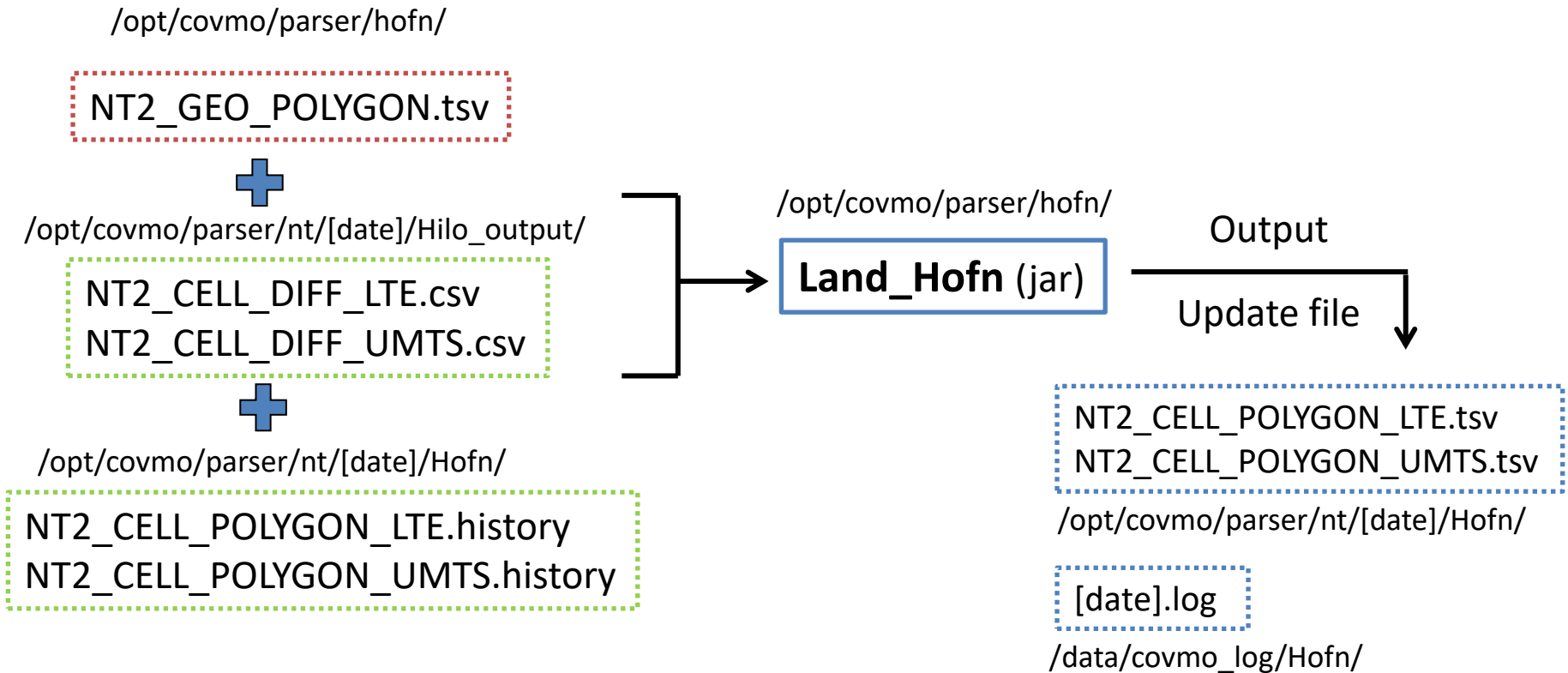
NT2_CELL_POLYGON_UMTS.tsv



OSM Parser (one time process)



Hofn (daily process)



Implementation



One time action

1. Create folder for Hofn
 1. /data/covmo_log/Hofn/ (for log files)
 2. /opt/covmo/parser/hofn/ (for reference file and jar file)
2. Put NT2_GEO_POLYGON.tsv file to /opt/covmo/parser/hofn/
3. Put NT2_CELL_POLYGON_[tech].tsv file to /opt/covmo/parser/nt/nt_ready/
4. Put Hofn.jar to /opt/covmo/parser/hofn/



Daily action by script

1. Create /check Hofn folders
 1. /data/covmo_log/Hofn/ (for output log file)
 2. /opt/covmo/parser/nt/[date]/Hofn/ (for Hofn output files)
2. Copy latest NT2_CELL_POLYGON_[tech].tsv files from /opt/covmo/parser/nt/nt_ready/ to /opt/covmo/parser/nt/[date]/Hofn/
3. Change file type from NT2_CELL_POLYGON_[tech].tsv to NT2_CELL_POLYGON_[tech].history
4. Call Hofn.jar
 - `java -jar Hofn.jar /opt/covmo/parser/nt/[date]/Hilo_output/ /opt/covmo/parser/nt/[date]/Hofn/`
5. If Hofn safe exit(0), copy NT2_CELL_POLYGON_[tech].tsv files from /opt/covmo/parser/nt/[date]/Hofn/ to /opt/covmo/parser/nt/nt_ready/



Gen NT flow (NT2 process)

gen_nt_db.sh

Check/Create folders ...

Check/Create Hofn folders ...

Copy NT_* files from nt_ready to Hilo_input

Copy NT2_CELL_POLYGON_tech.tsv files from nt_ready to Hofn

**Change file type NT2_CELL_POLYGON_TECH.tsv to
NT2_CELL_POLYGON_TECH.history**

Keep going original NT2 process

Call Hofn.jar

If exit code=0, copy all *.tsv files from Hofn to nt_ready

...



Parameters

- OSM Parser (**one time process, manually trigger**)
 - Output file path
 - Ex: `java -jar OSM_Parser.jar /data/hofn/`
- Hofn (daily process, script trigger)
 - Input path , output path

Ex: `java -jar Hofn.jar /opt/covmo/parser/nt/[date]/Hilo_output/
/opt/covmo/parser/nt/[date]/Hofn/`



Hofn Exit code

- Exit 0 : safe exit
 - Exit 1 : failed
 - Exit 2 : input data not exist or insufficient
-
- Only exit 0 will output result files and script will copy result files to nt_ready.



Module version

- Hofn – v1 or later
- Hilo – v16 or later
 - support schema with Hofn v1 (GSM not yet ready)
 - GSM will support from Hilo v17
- Voronoi – v33 or later
 - support cell base voronoi



Initial files

- \\192.168.3.242\Project3\CovMo\Module\Geolocation\Landusage_Hofn\Project base OSM data



About Hofn Process



Hofn

- Trigger once will process all technology if file is exist.
- Process from GSM , UMTS to LTE. If file insufficient will skip this technology. If all technology been skipped will exit(2).
- If file is exist but no cell difference records will safe exit(0) and output NT2_CELL_POLYGON_tech.tsv files.
- If Hofn folder already contain NT2_CELL_POLYGON_tech.tsv files before process, Hofn will delete these files and keep process.



File check

1. Check NT2_GEO_POLYGON.tsv if not exist → exit (2)
2. Check file by tech
3. Check NT2_CELL_DIFF_tech.csv
4. Check NT2_CELL_POLYGON_tech.history
5. If all tech files are insufficient will exit(2)
6. If occur other unexpected error will exit (1) and delete the exist NT2_CELL_POLYGON_tech.tsv files.



log

```
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - Hofn process start
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - Hofn version: 1
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - Hofn input path: /opt/covmo/parser/nt/20180326/Hilo_output/
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - Hofn output path: /opt/covmo/parser/nt/20180326/Hofn/
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - Hofn log path: /data/covmo_log/Hofn/20180326.log
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - UMTS process start
2018-05-03 10:55:24.234 [main] INFO com.ghgtinc.landusage.LandusageParser - NT2_CELL_POLYGON_UMTS.tsv file already exist! Hofn will delete this file.
2018-05-03 10:55:24.250 [main] INFO com.ghgtinc.landusage.LandusageParser - NT2_CELL_POLYGON_UMTS.tsv has been deleted.
2018-05-03 10:55:25.469 [main] INFO com.ghgtinc.landusage.LandusageParser - 0 Indoor cells have been processed.
2018-05-03 10:55:25.469 [main] INFO com.ghgtinc.landusage.LandusageParser - 0 Outdoor cells have been processed.
2018-05-03 10:55:25.469 [main] INFO com.ghgtinc.landusage.LandusageParser - UMTS process done.
2018-05-03 10:55:25.475 [main] INFO com.ghgtinc.landusage.LandusageParser - LTE process start
2018-05-03 10:55:25.475 [main] INFO com.ghgtinc.landusage.LandusageParser - NT2_CELL_POLYGON_LTE.tsv file already exist! Hofn will delete this file.
2018-05-03 10:55:25.477 [main] INFO com.ghgtinc.landusage.LandusageParser - NT2_CELL_POLYGON_LTE.tsv has been deleted.
2018-05-03 10:56:11.585 [main] INFO com.ghgtinc.landusage.LandusageParser - 4 Indoor cells have been processed.
2018-05-03 10:56:11.585 [main] INFO com.ghgtinc.landusage.LandusageParser - 8122 Outdoor cells have been processed.
2018-05-03 10:56:11.585 [main] INFO com.ghgtinc.landusage.LandusageParser - LTE process done.
```

That took 47.532 seconds

```
2018-05-03 10:56:11.594 [main] INFO com.ghgtinc.landusage.LandusageParser - That took 47.532 seconds
```



Table schema



Table schema (tsv file)

NT2_GEO_POLYGON.tsv

POLYGON_ID	POLYGON_NAME	POLYGON_STR	HOFN_TYPE
Id from OSM	Name from OSM	WKT format string Can be: POLYGON, LINESTRING	Define by GHT



Table schema (tsv file)

NT2_CELL_POLYGON_LTE.tsv / NT2_CELL_POLYGON_UMTS.tsv

PU_ID	ENODEB_ID	CELL_ID	POLYGON_STR	POLYGON_ID	HOFN_TYPE	POS_TYPE	POS_INDOOR_TYPE	DIST_MIN	DIST_MAX
LTE: PU_ID UMTS: RNC_ID	LTE: ENODEB_ID UMTS: SITE_ID	Both CELL_ID in LTE & UMTS	WKT format string Can be: POLYGON, LINESTRING	Id from OSM	Define by GHT	Define by GHT	Indoor type judge by HOFN	Minimum distance from cell to polygon (village only)	Maximum distance from cell to polygon (village only)



HOFN_TYPE

HOFN_ TYPE	Tag	Black/ White	Cell type	WKT format	POS_ TYPE	Relative
1	Water	100% black	Outdoor	Polygon	5	
2	Coastline	Black boundary	Outdoor	Linestring	4	
3	Under ground MRT	100% white	Indoor	Polygon	2	
4	Bridge	Safe area	Outdoor	Polygon	3	Water
5	Island	Safe area	Outdoor	Polygon	3	
6	Tunnel	100% white	Indoor	Polygon	2	
7	Highway	Safe area	Outdoor	Polygon	3	
8	Highway on Mars	100% white	Outdoor	Polygon	2	Village
9	Indoor Building	100% white	Indoor	Polygon	2	
10	Ship Road	Safe area	Outdoor	Polygon	3	Water
11	Village	Safe area	Outdoor	Polygon	3	Highway



POS_TYPE

POS_ TYPE	Priority	Probability	Black/ white	WKT format	Note
1	1	100%	White	Linestring	...
2	2	100%	White	Polygon	MRT /Tunnel / indoor building...
3	3	Non 100%	White	Polygon	Ship road /highway /village...
4	4	100%	Black	Linestring	Coast line
5	5	100%	Black	Polygon	Water



Method



Brief method-OSM Parser

- Find OSM tag and Country code.
- Query by OSM tag .
- Mapping longitude and latitude.
- Merge linestring if it could be merge.
- Remove duplicate polygon.
- Remove useless (too small or ...) polygon.
- Save as WKT format.
- Note: some of step need manual adjustment.

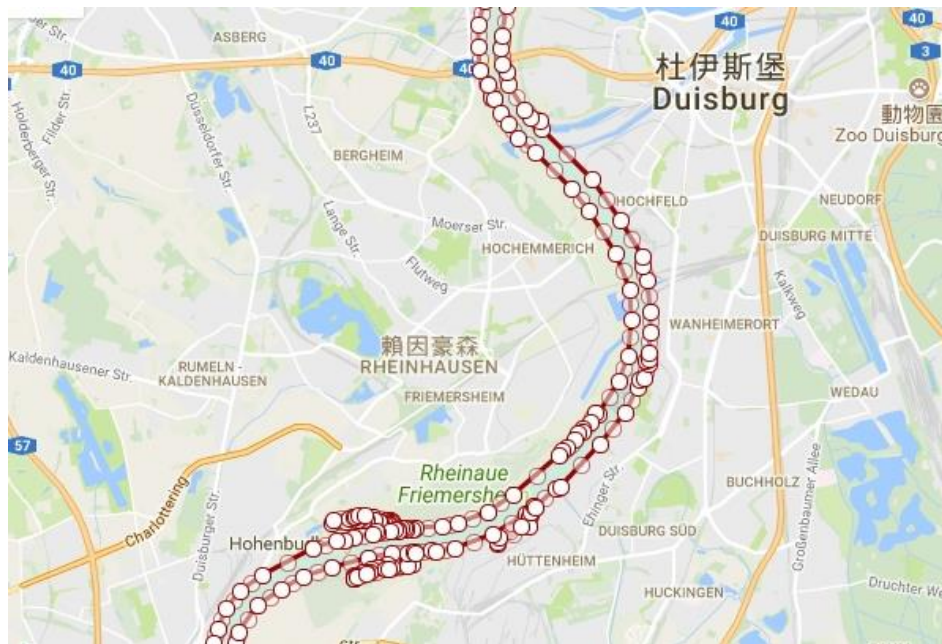


OSM tag

HOFN_TYPE	HOFN_TYPE	Tag in OSM
1	Water	waterway = riverbank natural = water natural = bay
2	Coastline	natural = coastline
3	Under ground MRT	route = subway
4	Highway over water	bridge = yes
5	Island	place = island place = islet
6	Tunnel	tunnel = yes
7	Highway	Highway = motorway Highway = trunk Highway = primary
8	Highway on Mars	Highway remove village
9	Indoor Building	name = xxx
10	Ship road	route = ferry
11	Village	place/shop/amenity ...

Water

- River, Lake, Reservoir ... water type and people should not inside.



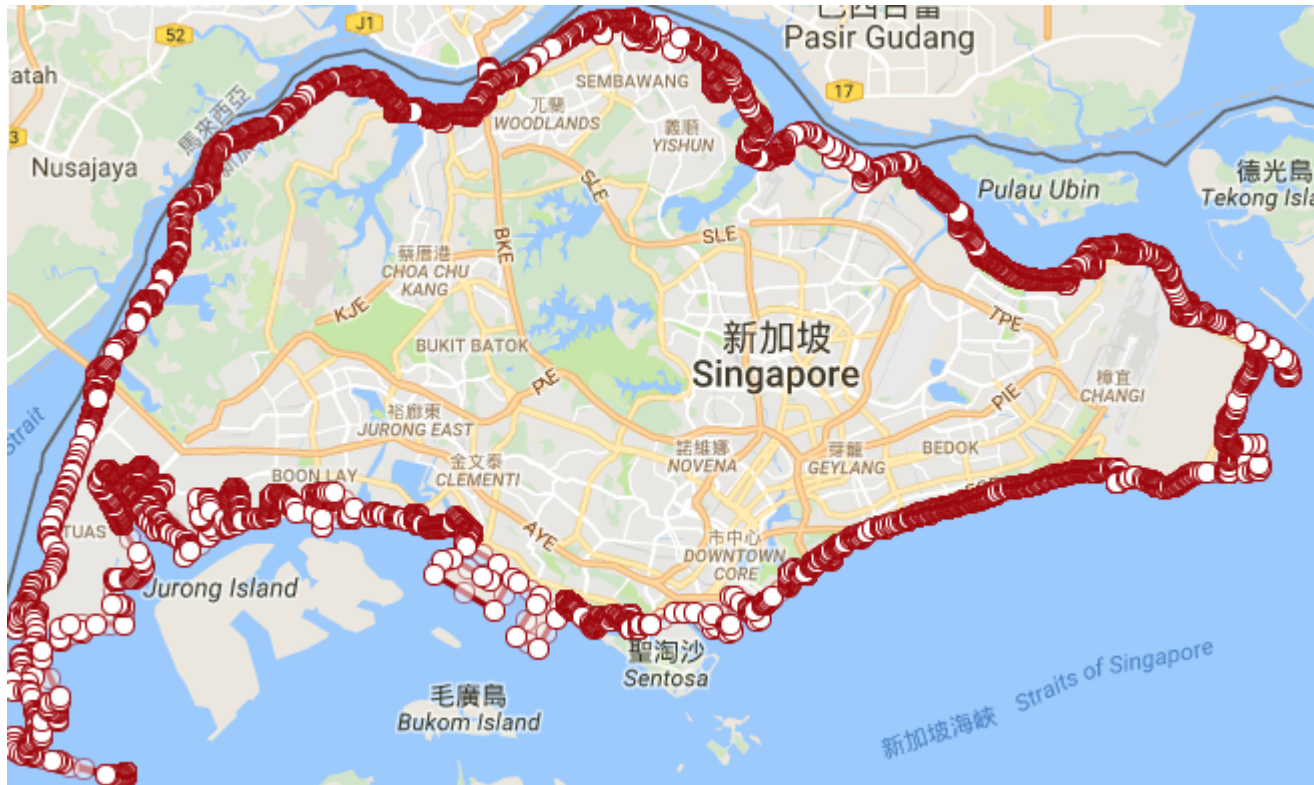
Rhein river, Germany



Sun Moon Lake, Taiwan

Coast line

- Coast line of a Country.



Coast line, Singapore

MRT

- Under ground MRT



MRT Circle Line, Singapore

Bridge

- Bridge/pedestrian overpass over water.



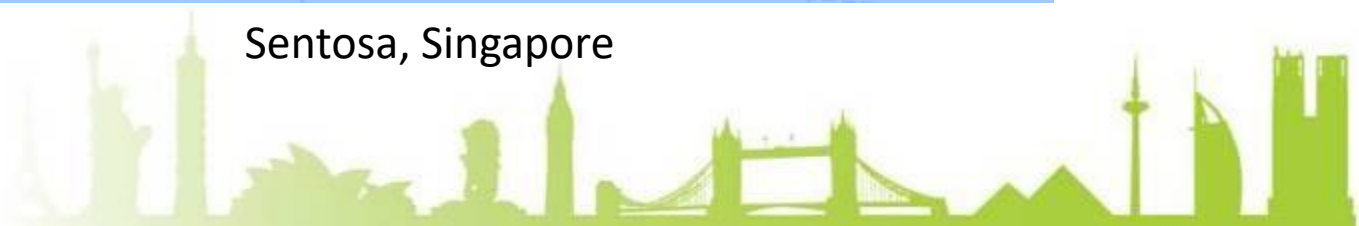
Bridge over Marina Bay , Singapore

Island

- Island or islet outside the main land



Sentosa, Singapore



Tunnel

- Highway tunnel



Mucha tunnel, Formosa Highway , Taiwan

Highway

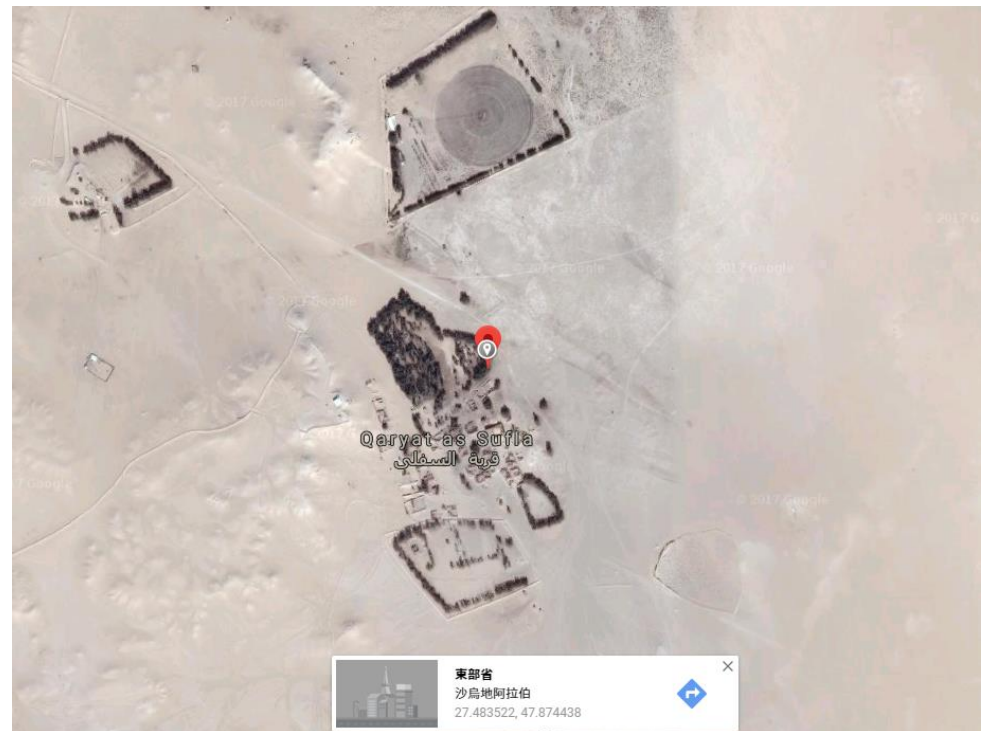
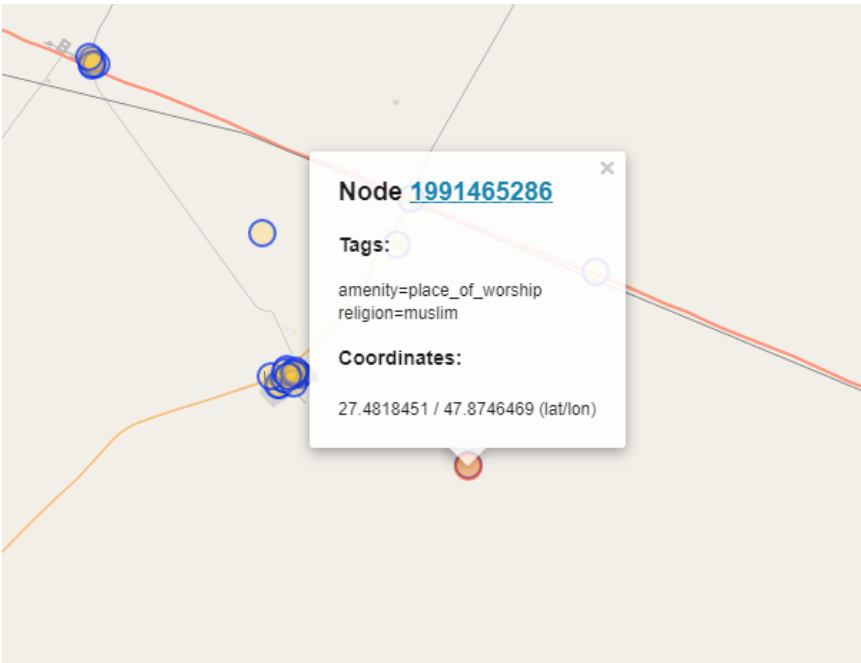
- Highway/ Free way / Primary way



Route 40 Highway , Saudi Arabia

Village

- Small village in desert/forest ...



Qurayyah, Saudi Arabia

Indoor building

- Special building for indoor cell



Webe digital building, Malaysia



Ship road

- Ship road over lake/river/...

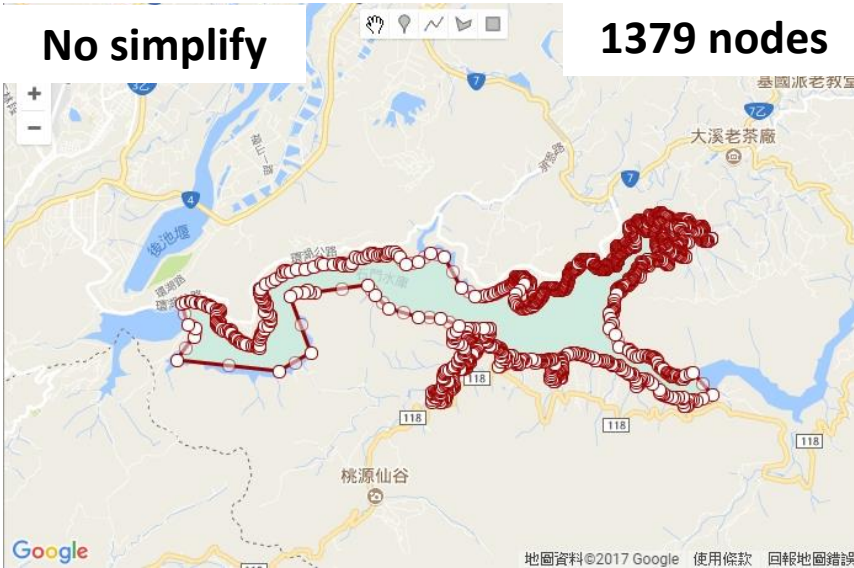


Linie Rorschach - Langenargen, Switzerland

Simplify with different level

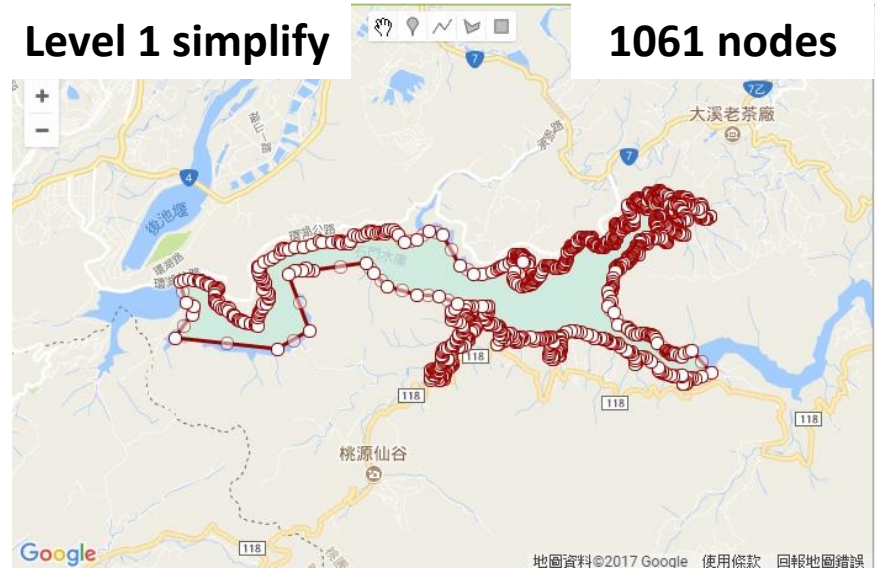
No simplify

1379 nodes



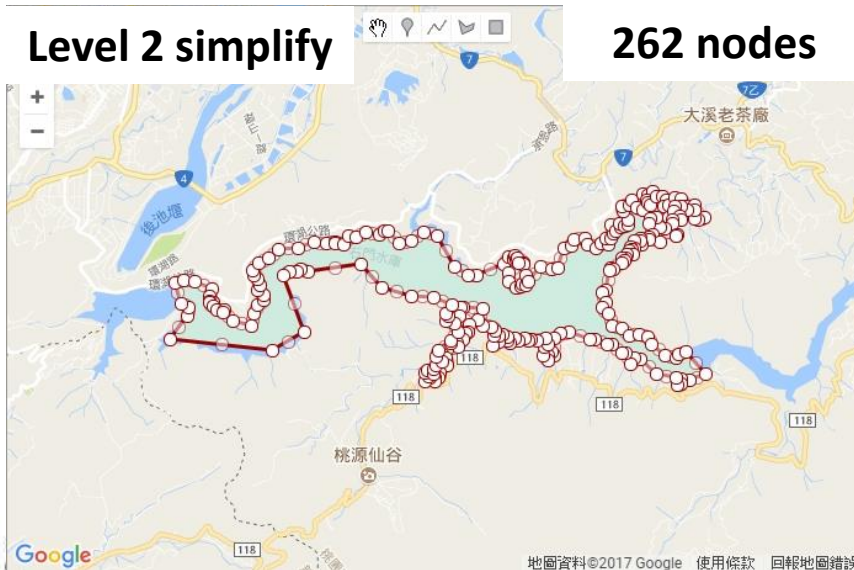
Level 1 simplify

1061 nodes



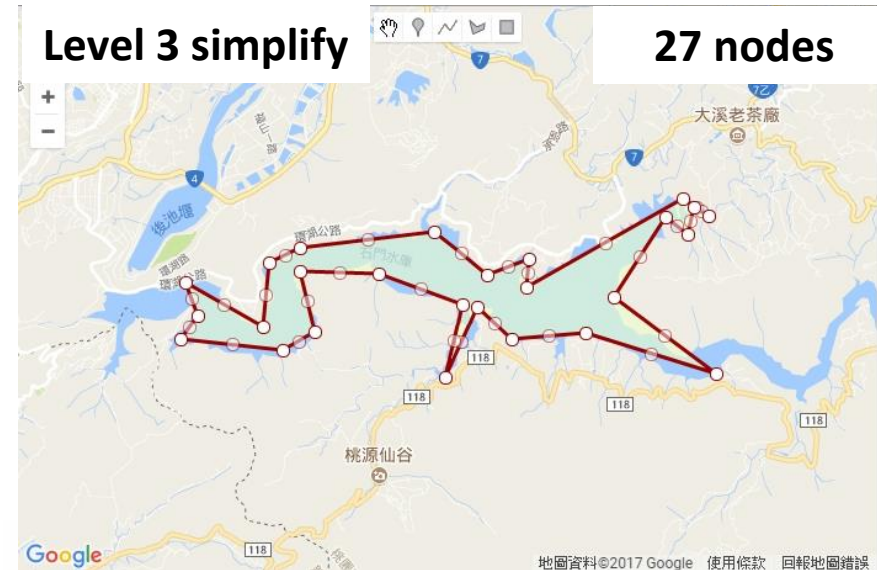
Level 2 simplify

262 nodes



Level 3 simplify

27 nodes



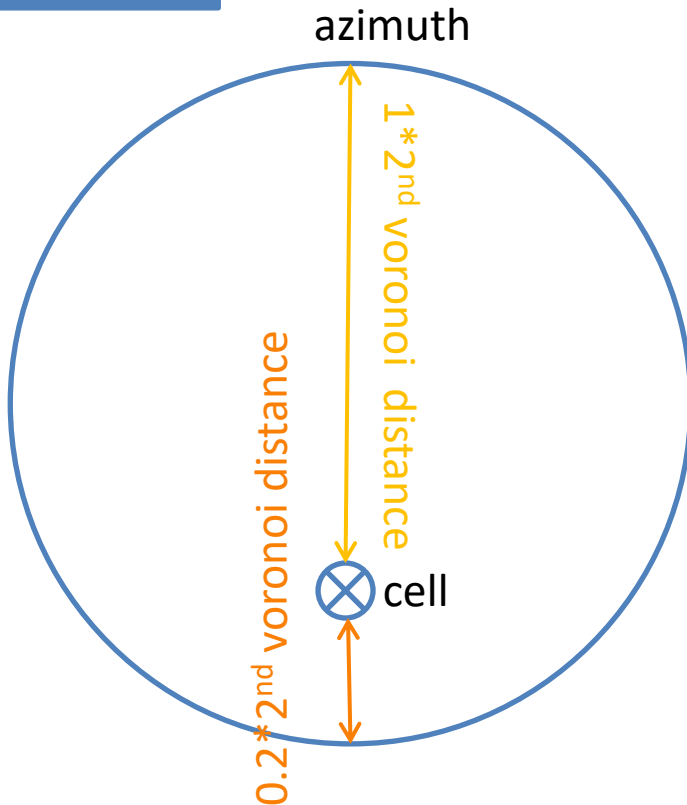
Brief method-Hofn

- Use cell properties to create a searching area.
 - Outdoor cell use 2 tier max cell base voronoi distance as searching area.
 - Indoor cell use site base voronoi distance as searching area.
- Record polygons which covered by searching area.



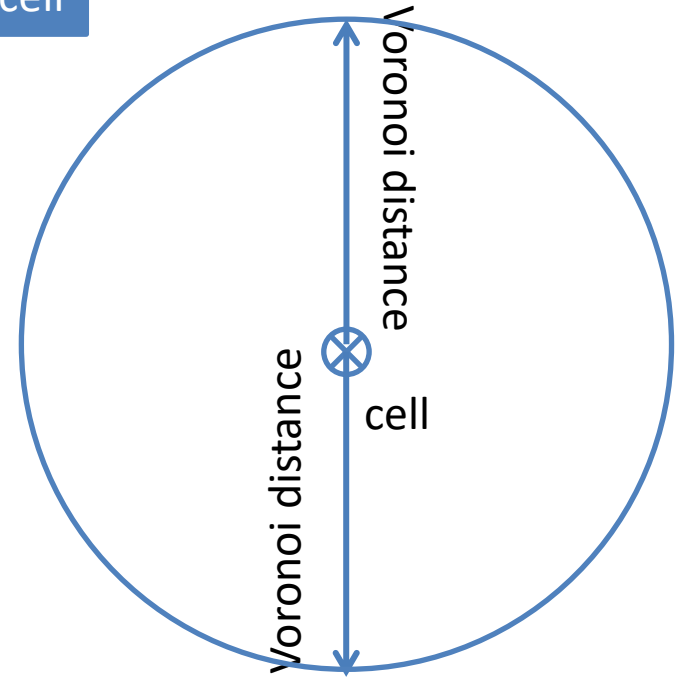
Searching area

Outdoor cell



Use 2 tier max voronoi distance
(cell base voronoi distance)

indoor cell

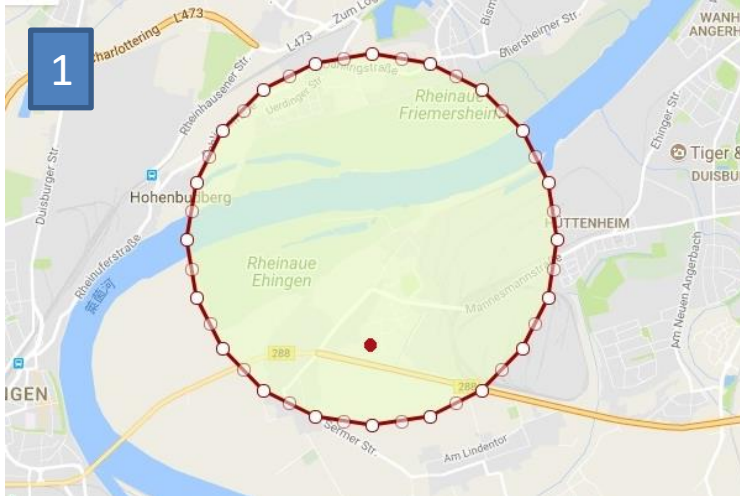


Voronoi distance Rule :

Voronoi distance \leq 200 meters
→ 200 meters.

Voronoi distance $>$ 200 meters
→ $\frac{\text{voronoi distance}}{5} + 200$ meters.

Keep overlap part - outdoor cell



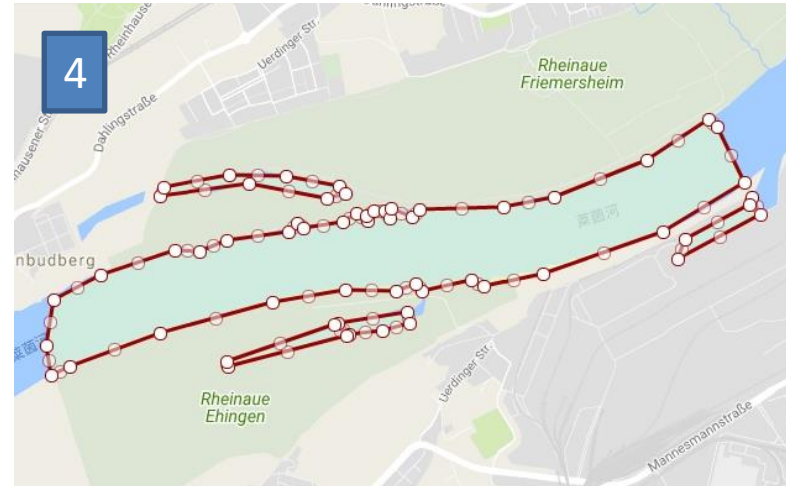
Searching area
(From NT2_CELL_DIFF_LTE.csv)



River polygon
(From NT2_GEO_POLYGON.tsv)



Overlapping part



Result polygon
(save to NT2_CELL_POLYGON_LTE.tsv)

Keep overlap part - indoor cell

- Cell should not far from MRT line than 50 meters

FET Include case

RNC_ID=107 SITE_ID=N2076



FET Exclude case

RNC_ID=107 SITE_ID=N0260



Keep overlap part - indoor cell



Searching area
(From NT2_CELL_DIFF_LTE.csv)



MRT polygon
(From NT2_GEO_POLYGON.tsv)



Overlapping part



Result polygon
(save to NT2_CELL_POLYGON_LTE.tsv)

Result table

NT2_GEO_POLYGON.tsv

POLYGON_ID	POLYGON_NAME	POLYGON_STR	HOFN_TYPE
319673952	UNKNOWN	POLYGON((100.9595405 3.7926016,100.9589542 3.789647,100.9596348 3.7829312,100.961	1
219386436	Sungai Perak	POLYGON((100.8955 4.42475,100.89825 4.42825,100.90075 4.437,100.9014154 4.4437054,	1
161007514	UNKNOWN	POLYGON((102.124722 3.4802225,102.1269722 3.4792434,102.1312482 3.4806791,102.134	1
163932074	Sungai Klang	POLYGON((101.4564865 3.038723,101.4545621 3.0402687,101.4523351 3.0448319,101.448	1
162933750	Sungai Puluh	POLYGON((101.3664502 3.0485057,101.3654105 3.0471921,101.3634121 3.0471932,101.36	1
167034813	Sungai Sementa Kecil	POLYGON((101.3597626 3.0718103,101.360454 3.0723784,101.3616911 3.0727285,101.362	1
167034837	UNKNOWN	POLYGON((101.3561706 3.0766749,101.356441 3.0760359,101.3566527 3.0763613,101.356	1
167034777	UNKNOWN	POLYGON((101.3694787 3.0549128,101.3705364 3.054291,101.3714625 3.0539673,101.371	1
162933746	UNKNOWN	POLYGON((101.3661788 3.0473387,101.3662311 3.0464051,101.3661583 3.0440665,101.36	1
167034809	UNKNOWN	POLYGON((101.3661788 3.0473387,101.371005 3.0482878,101.3718651 3.0476536,101.372	1
162933755	UNKNOWN	POLYGON((101.394017 3.0603327,101.3947833 3.0600924,101.3913319 3.061003,101.3921	1
167034768	UNKNOWN	POLYGON((101.3923413 3.0879786,101.3921644 3.0866161,101.3929197 3.0852462,101.39	1
167044461	UNKNOWN	POLYGON((101.2488902 3.0242125,101.2489113 3.0232433,101.2490073 3.0232523,101.24	1
167044486	UNKNOWN	POLYGON((101.2525326 3.0194318,101.252949 3.0193347,101.252959 3.0196599,101.2528	1
167044422	UNKNOWN	POLYGON((101.2720461 3.0304323,101.2713776 3.0312554,101.271057 3.0315355,101.270	1
167044389	UNKNOWN	POLYGON((101.2397245 3.0177022,101.2397832 3.0173425,101.2398807 3.0170471,101.23	1
167044455	UNKNOWN	POLYGON((101.2660718 3.0288617,101.2657713 3.0291885,101.2650633 3.0297154,101.26	1
167933663	UNKNOWN	POLYGON((101.2318739 3.0088085,101.2321162 3.0084937,101.2321599 3.0078604,101.23	1
167933686	UNKNOWN	POLYGON((101.2229571 3.0036909,101.2243509 3.0017869,101.2243946 3.0003457,101.22	1



Result table

NT2_CELL_POLYGON_LTE.tsv

PU_ID	ENODEB_ID	CELL_ID	POLYGON_STR	POLYGON_ID	HOFN_TYPE	POS_TYPE	POS_INDOOR_TYPE	DIST_MIN	DIST_MAX
100	120070	11	POLYGON((101.30776 3.37708,101.30785 3.37672,101.30568 3.37597,101.30408 3.3748,101.30207 3.3736,101.30006 3.3724,101.29805 3.3712,101.29604 3.37,101.29403 3.3688,101.29202 3.3676,101.29001 3.3664,101.28800 3.3652,101.28600 3.364,101.28400 3.3628,101.28200 3.3616,101.28000 3.3604,101.27800 3.3592,101.27600 3.358,101.27400 3.3568,101.27200 3.3556,101.27000 3.3544,101.26800 3.3532,101.26600 3.352,101.26400 3.3508,101.26200 3.3496,101.26000 3.3484,101.25800 3.3472,101.25600 3.346,101.25400 3.3448,101.25200 3.3436,101.25000 3.3424,101.24800 3.3412,101.24600 3.34,101.24400 3.3388,101.24200 3.3376,101.24000 3.3364,101.23800 3.3352,101.23600 3.334,101.23400 3.3328,101.23200 3.3316,101.23000 3.3304,101.22800 3.3292,101.22600 3.328,101.22400 3.3268,101.22200 3.3256,101.22000 3.3244,101.21800 3.3232,101.21600 3.322,101.21400 3.3208,101.21200 3.3196,101.21000 3.3184,101.20800 3.3172,101.20600 3.316,101.20400 3.3148,101.20200 3.3136,101.20000 3.3124,101.19800 3.3112,101.19600 3.31,101.19400 3.3088,101.19200 3.3076,101.19000 3.3064,101.18800 3.3052,101.18600 3.304,101.18400 3.3028,101.18200 3.3016,101.18000 3.3004,101.17800 3.2992,101.17600 3.298,101.17400 3.2968,101.17200 3.2956,101.17000 3.2944,101.16800 3.2932,101.16600 3.292,101.16400 3.2908,101.16200 3.2896,101.16000 3.2884,101.15800 3.2872,101.15600 3.286,101.15400 3.2848,101.15200 3.2836,101.15000 3.2824,101.14800 3.2812,101.14600 3.28,101.14400 3.2788,101.14200 3.2776,101.14000 3.2764,101.13800 3.2752,101.13600 3.274,101.13400 3.2728,101.13200 3.2716,101.13000 3.2704,101.12800 3.2692,101.12600 3.268,101.12400 3.2668,101.12200 3.2656,101.12000 3.2644,101.11800 3.2632,101.11600 3.262,101.11400 3.2608,101.11200 3.2596,101.11000 3.2584,101.10800 3.2572,101.10600 3.256,101.10400 3.2548,101.10200 3.2536,101.10000 3.2524,101.09800 3.2512,101.09600 3.25,101.09400 3.2488,101.09200 3.2476,101.09000 3.2464,101.08800 3.2452,101.08600 3.244,101.08400 3.2428,101.08200 3.2416,101.08000 3.2404,101.07800 3.2392,101.07600 3.238,101.07400 3.2368,101.07200 3.2356,101.07000 3.2344,101.06800 3.2332,101.06600 3.232,101.06400 3.2308,101.06200 3.2296,101.06000 3.2284,101.05800 3.2272,101.05600 3.226,101.05400 3.2248,101.05200 3.2236,101.05000 3.2224,101.04800 3.2212,101.04600 3.22,101.04400 3.2188,101.04200 3.2176,101.04000 3.2164,101.03800 3.2152,101.03600 3.214,101.03400 3.2128,101.03200 3.2116,101.03000 3.2104,101.02800 3.2092,101.02600 3.208,101.02400 3.2068,101.02200 3.2056,101.02000 3.2044,101.01800 3.2032,101.01600 3.202,101.01400 3.2008,101.01200 3.1996,101.01000 3.1984,101.00800 3.1972,101.00600 3.196,101.00400 3.1948,101.00200 3.1936,101.00000 3.1924,100.99800 3.1912,100.99600 3.19,100.99400 3.1888,100.99200 3.1876,100.99000 3.1864,100.98800 3.1852,100.98600 3.184,100.98400 3.1828,100.98200 3.1816,100.98000 3.1804,100.97800 3.1792,100.97600 3.178,100.97400 3.1768,100.97200 3.1756,100.97000 3.1744,100.96800 3.1732,100.96600 3.172,100.96400 3.1708,100.96200 3.1696,100.96000 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3.0268,100.72200 3.0256,100.72000 3.0244,100.71800 3.0232,100.71600 3.022,100.71400 3.0208,100.71200 3.0196,100.71000 3.0184,100.70800 3.0172,100.70600 3.016,100.70400 3.0148,100.70200 3.0136,100.70000 3.0124,100.69800 3.0112,100.69600 3.01,100.69400 3.0088,100.69200 3.0076,100.69000 3.0064,100.68800 3.0052,100.68600 3.004,100.68400 3.0028,100.68200 3.0016,100.68000 3.0004,100.67800 3.0,100.67600 2.9988,100.67400 2.9976,100.67200 2.9964,100.67000 2.9952,100.66800 2.994,100.66600 2.9928,100.66400 2.9916,100.66200 2.9904,100.66000 2.9892,100.65800 2.988,100.65600 2.9868,100.65400 2.9856,100.65200 2.9844,100.65000 2.9832,100.64800 2.982,100.64600 2.9808,100.64400 2.9796,100.64200 2.9784,100.64000 2.9772,100.63800 2.976,100.63600 2.9748,100.63400 2.9736,100.63200 2.9724,100.63000 2.9712,100.62800 2.97,100.62600 2.9688,100.62400 2.9676,100.62200 2.9664,100.62000 2.9652,100.61800 2.964,100.61600 2.9628,100.61400 2.9616,100.61200 2.9604,100.61000 2.9592,100.60800 2.958,100.60600 2.9568,100.60400 2.9556,100.60200 2.9544,100.60000 2.9532,100.59800 2.952,100.59600 2.9508,100.59400 2.9496,100.59200 2.9484,100.59000 2.9472,100.58800 2.946,100.58600 2.9448,100.58400 2.9436,100.58200 2.9424,100.58000 2.9412,100.57800 2.94,100.57600 2.9388,100.57400 2.9376,100.57200 2.9364,100.57000 2.9352,100.56800 2.934,100.56600 2.9328,100.56400 2.9316,100.56200 2.9304,100.56000 2.9292,100.55800 2.928,100.55600 2.9268,100.55400 2.9256,100.55200 2.9244,100.55000 2.9232,100.54800 2.922,100.54600 2.9208,100.54400 2.9196,100.54200 2.9184,100.54000 2.9172,100.53800 2.916,100.53600 2.9148,100.53400 2.9136,100.53200 2.9124,100.53000 2.9112,100.52800 2.91,100.52600 2.9088,100.52400 2.9076,100.52200 2.9064,100.52000 2.9052,100.51800 2.904,100.51600 2.9028,100.51400 2.9016,100.51200 2.9004,100.51000 2.9,100.50800 2.8988,100.50600 2.8976,100.50400 2.8964,100.50200 2.8952,100.50000 2.894,100.49800 2.8928,100.49600 2.8916,100.49400 2.8904,100.49200 2.8892,100.49000 2.888,100.48800 2.8868,100.48600 2.8856,100.48400 2.8844,100.48200 2.8832,100.48000 2.882,100.47800 2.8808,100.47600 2.8796,100.47400 2.8784,100.47200 2.8772,100.47000 2.876,100.46800 2.8748,100.46600 2.8736,100.46400 2.8724,100.46200 2.8712,100.46000 2.87,100.45800 2.8688,100.45600 2.8676,100.45400 2.8664,100.45200 2.8652,100.45000 2.864,100.44800 2.8628,100.44600 2.8616,100.44400 2.8604,100.44200 2.8592,100.44000 2.858,100.43800 2.8568,100.43600 2.8556,100.43400 2.8544,100.43200 2.8532,100.43000 2.852,100.42800 2.8508,100.42600 2.8496,100.42400 2.8484,100.42200 2.8472,100.42000 2.846,100.41800 2.8448,100.41600 2.8436,100.41400 2.8424,100.41200 2.8412,100.41000 2.84,100.40800 2.8388,100.40600 2.8376,100.40400 2.8364,100.40200 2.8352,100.40000 2.834,100.39800 2.8328,100.39600 2.8316,100.39400 2.8304,100.39200 2.8292,100.39000 2.828,100.38800 2.8268,100.38600 2.8256,100.38400 2.8244,100.38200 2.8232,100.38000 2.822,100.37800 2.8208,100.37600 2.8196,100.37400 2.8184,100.37200 2.8172,100.37000 2.816,100.36800 2.8148,100.36600 2.8136,100.36400 2.8124,100.36200 2.8112,100.36000 2.81,100.35800 2.8088,100.35600 2.8076,100.35400 2.8064,100.35200 2.8052,100.35000 2.804,100.34800 2.8028,100.34600 2.8016,100.34400 2.8004,100.34200 2.7992,100.34000 2.798,100.33800 2.7968,100.33600 2.7956,100.33400 2.7944,100.33200 2.7932,100.33000 2.792,100.32800 2.7908,100.32600 2.7896,100.32400 2.7884,100.32200 2.7872,100.32000 2.786,100.31800 2.7848,100.31600 2.7836,100.31400 2.7824,100.31200 2.7812,100.31000 2.78,100.30800 2.7788,100.30600 2.7776,100.30400 2.7764,100.30200 2.7752,100.30000 2.774,100.29800 2.7728,100.29600 2.7716,100.29400 2.7704,100.29200 2.7692,100.29000 2.768,100.28800 2.7668,100.28600 2.7656,100.28400 2.7644,100.28200 2.7632,100.28000 2.762,100.27800 2.7608,100.27600 2.7596,100.27400 2.7584,100.27200 2.7572,100.27000 2.756,100.26800 2.7548,100.26600 2.7536,100.26400 2.7524,100.26200 2.7512,100.26000 2.75,100.25800 2.7488,100.25600 2.7476,100.25400 2.7464,100.25200 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2.604,100.01400 2.6028,100.01200 2.6016,100.01000 2.6004,100.00800 2.5992,100.00600 2.598,100.00400 2.5968,100.00200 2.5956,100.00000 2.5944,100.99800 2.5932,100.99600 2.592,100.99400 2.5908,100.99200 2.5896,100.99000 2.5884,100.98800 2.5872,100.98600 2.586,100.98400 2.5848,100.98200 2.5836,100.98000 2.5824,100.97800 2.5812,100.97600 2.58,100.97400 2.5788,100.97200 2.5776,100.97000 2.5764,100.96800 2.5752,100.96600 2.574,100.96400 2.5728,100.96200 2.5716,100.96000 2.5704,100.95800 2.5692,100.95600 2.568,100.95400 2.5668,100.95200 2.5656,100.95000 2.5644,100.94800 2.5632,100.94600 2.562,100.94400 2.5608,100.94200 2.5596,100.94000 2.5584,100.93800 2.5572,100.93600 2.556,100.93400 2.5548,100.93200 2.5536,100.93000 2.5524,100.92800 2.5512,100.92600 2.55,100.92400 2.5488,100.92200 2.5476,100.92000 2.5464,100.91800 2.5452,100.91600 2.544,100.91400 2.5428,100.91200 2.5416,100.91000 2.5404,100.90800 2.5392,100.90600 2.538,100.90400 2.5368,100.90200 2.5356,100.90000 2.5344,100.89800 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