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Design and Development of the UN Vector Tile Toolkit

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The United Nations Vector Tile Toolkit

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26-31 August 44.43555, 26.102347

Our vision

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1. What if the public sector basemaps are responsive like in video games?
2. Public organizations also deserves the best web map technology.
3. Open source is the method to unite.

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Our product

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UN Vector Tile Toolkit

that strives to leave no one left behind from the vector tile technology

Network of Developers and Operators

that strives to define the common problems and solve them.

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Use OSS, inside public organizations

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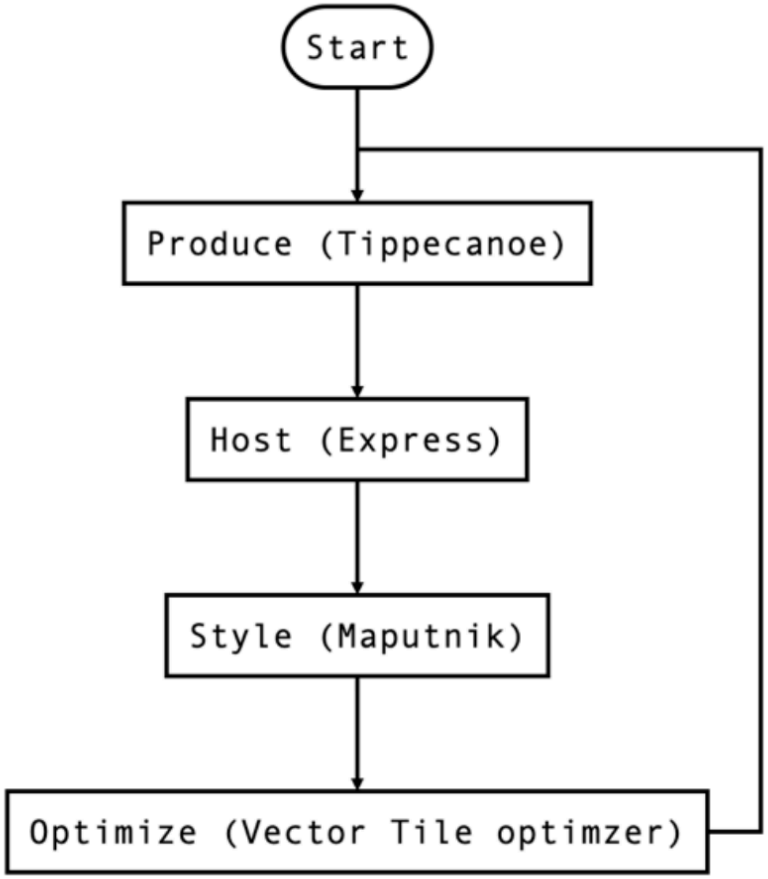

- Design for diverse and large data.
  - Use GeoJSON Text Sequence (GeoJSONS) in pipes so that data can be mixed and fixed easily, and be handled concurrently.

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Major achievements

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1. Produce vector tiles around the world in 80 hours with UN internal PostGIS basemap data and 1 MacBook Pro.
2. Be interoperable even with proprietary web map frameworks via server-side image tile rendering.

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In 80 hours: why does it matter?

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1. We need continuous update.
2. Computing infrastructure is not so abundant in public organizations.

→ We needed computationally efficient way to produce/update vector tiles.

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3 tips...

(1) Divide and rule

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Handling 100 streams of 1GB is easier than
1 stream of 100GB or
10000 streams of 10MB.

Design decisions:

1. Handle data by z=6 modules.
2. Process modules using a 2 to 5 concurrent task queue for efficient use of IO and CPU.

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(2) Heuristics: stop hitting the ocean

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1669 modules out of 4096 actually does not have any OSM feature.

We reduced 40% of the tasks by skipping them.

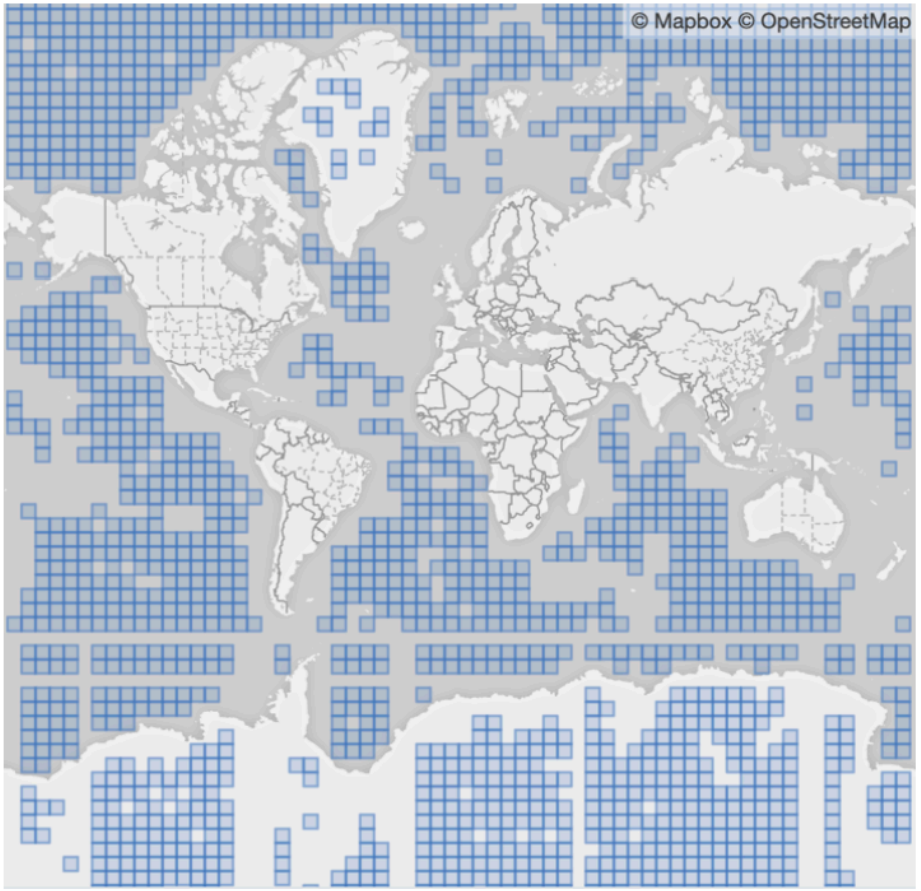

Figure 2. No-feature-modules

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(3) Add meta-tasks for faster extraction

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When extracting data from planet.osm.pbf, use 12 areas of even data size, instead of 2427 modules directly.

→ faster data scan

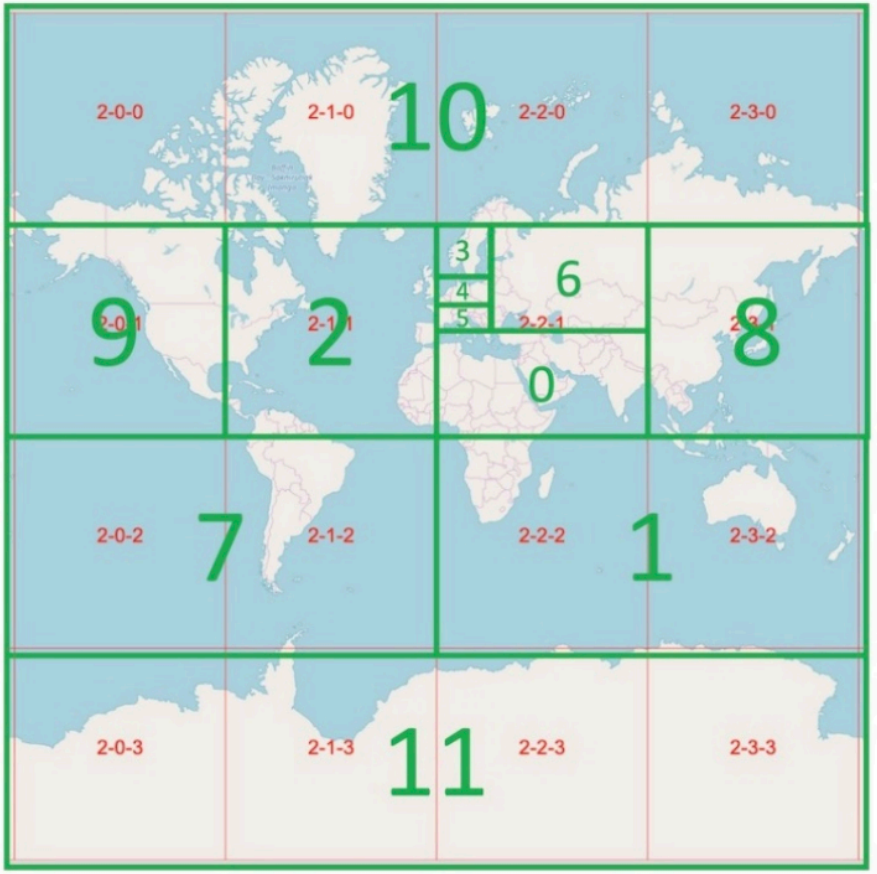

Figure 3. Division of globe into 12 areas based on the distribution of OpenStreetMap data

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Around the world in 80 hours!

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Table 2. Production time of global vector tiles divided by 'duodecim' areas

Area	OSM PBF size	Number of modules	Production time (d: day, h: hour, m: minutes)
#0	4.9GB	128	6h 53m
#1	4.9GB	512	13h 19m
#2	12GB	256	19h 36m
#3	1.5GB	16	1h 9m
#4	9.3GB	8	4h 0m
#5	8.0GB	8	3h 24m
#6	5.4GB	96	5h 54m
#7	2.0GB	512	4h 21m
#8	4.8GB	256	8h 25m
#9	6.0GB	256	8h 36m
#10	510MB	1024	2h 42m
#11	29MB	1024	1h 3m
World	45GB	4096	79h 22m (3d 7h 22m)

80 hours with 1 PC
= 8 hours with 10 PCs.

Table 1. Specification for the production time measurement

Source data	planet-190429.osm.pbf
Computer	MacBook Pro (13-inch, 2017, Two Thunderbolt 3 ports) with 2.3GHz Intel Core i5 and 8GB 2133MHz LPDDR3
Storage	Sandisk Extreme 900 (480GB)

Another tip: use fast storage.

According to github.com/openmaptiles/openmaptiles/issues/242, OpenMapTiles requires 37 days, which is as long as around 900 hours, to produce global vector tileset with its default production script.

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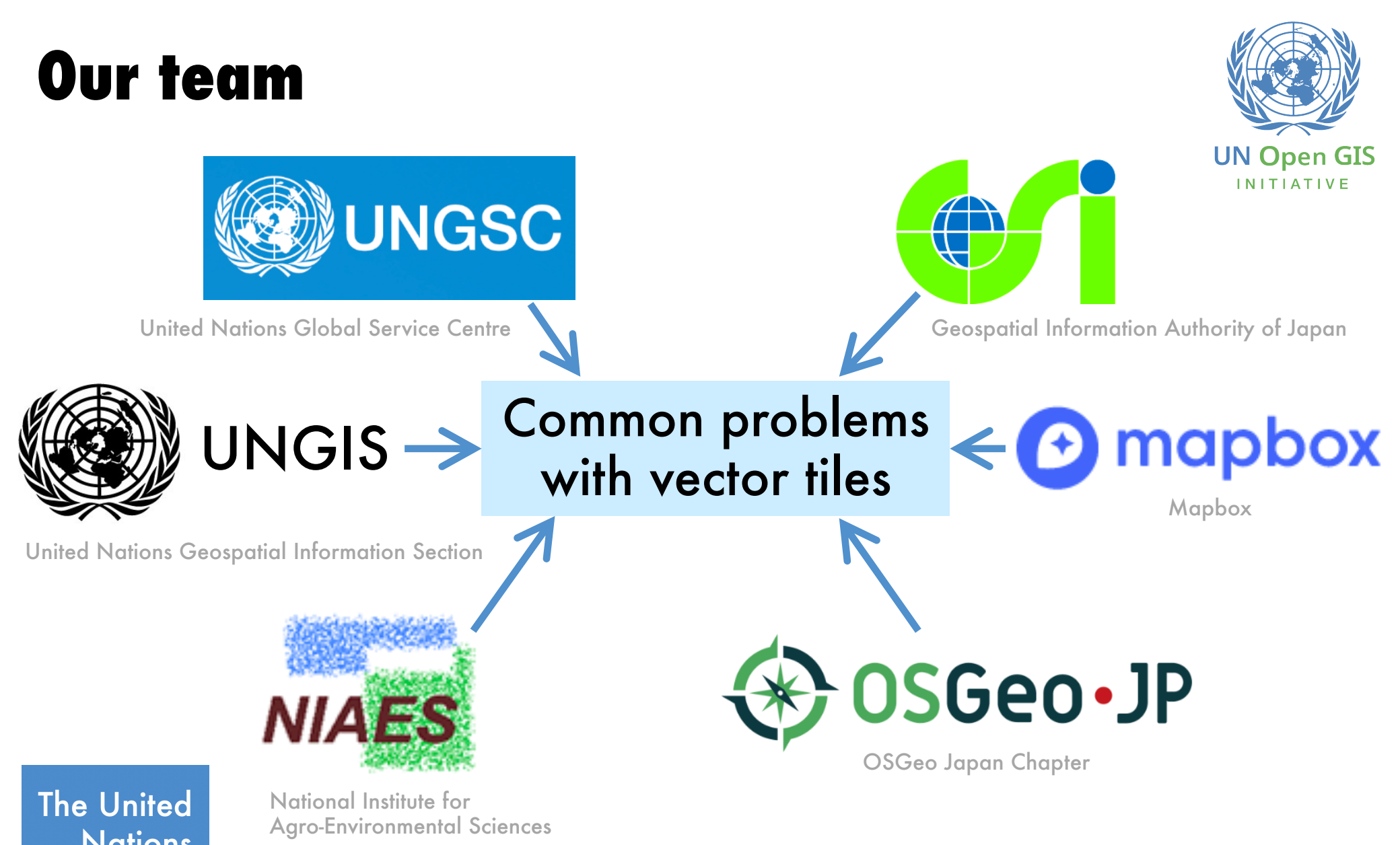
Our team



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We stick to tackling common problems

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DONE

- ✓ Share tips for producing vector tiles using existing best open source tools.
- ✓ Establish interoperability with different frameworks.

TODO

- ☐ Have compact interface with underlying server infrastructure.
- ☐ Avoid getting stuck in enterprise web environment.
- ☐ Have less steep learning curve.

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2019-07-29: GSI released GSI Maps Vector

Self-hosted basemap vector tiles https://maps.gsi.go.jp/vector

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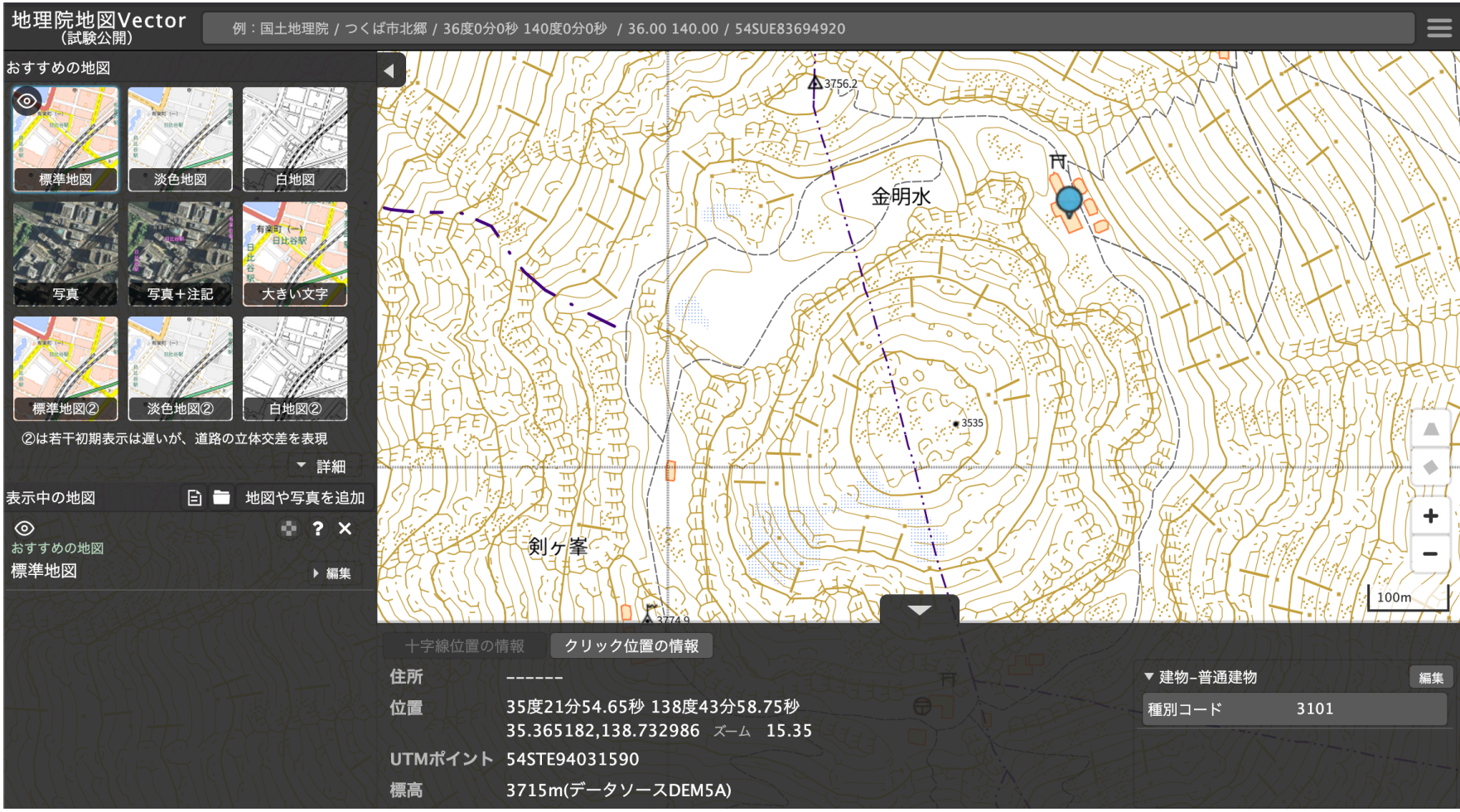

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Ango: Docker-based hands-on materials

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A Docker container image that contains everything from the UN Vector Tile Toolkit.

- Works even with Raspberry Pi (armhf).
- For technology transfer and demo.
- To be ready in FOSS4G 2019 Niigata.

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Striving to expand the network

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2018-12	Version 1 released in FOSS4G Asia 2018.
2019-06	Demonstrated to Chief Information Technology Officer of the UN Secretariat.
2019-08	FOSS4G 2019 Bucharest and UN Open GIS Workshop in conjunction
2019-09	FOSS4G 2019 Niigata
2019-10	Hands-on training for the staff from national mapping agencies, as a part of a JICA (Japan International Cooperation Agency) training course.
2019-11	UN-GGIM WG-Disasters session in UN-GGIM-AP plenary * GGIM: Global Geospatial Information Management
2019-11	A presentation in GSI Maps Partner Network
2019-12	Discussion session for the application of the UN Vector Tile Toolkit for Disaster Management
2020-03	UN-GGIM WG-Disasters Task Group B: Scenario-based Exercise

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- All the schedule is subject to change.

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https://github.com/un-vector-tile-toolkit

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