Incubation for the United Nations Vector Tile Toolkit

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Abstract

The United Nations Vector Tile Toolkit (UNVT) is an open source software project established under Working Group 4 (WG-4) of the United Nations Open GIS Initiative in 2018 with an objective to enable the use of open source vector tile technologies within the United Nations operations and also within the United Nations member states among other applications. To incubate UNVT, the project is being developed in the following three directions. (1) In order to establish a sustainable software development community, the project has a good momentum to apply for the Open Source Geospatial Foundation (OSGeo) incubation process guided by the principle to leave no one behind. (2) Through its Running Code, UNVT makes unique contribution to the global agendas under the United Nations Committee of Experts on the Global Geospatial Information Management (UN-GGIM). (3) In order to minimize the work duplication and maximize the shared experience, the UNVT team demonstrates the implementation of vector tiles and then the project participants apply the service in practice. Following the resolution in the Preamble of the Charter of the United Nations, UNVT is trying to combine the efforts of the peoples of the United Nations to address global issues using the latest vector tile technology that enables the dissemination of any vector geospatial information efficiently and independently.

1. Initiation of UNVT

The United Nations Vector Tile Toolkit (UNVT) was initiated in 2018 under Working Group 4 (WG-4) of the United Nations Open GIS Initiative. The top priority for UNVT is to provide an open source solution for producing, hosting, styling, and optimizing basemap vector tile service for the United Nations operations hosted in the United Nations Global Service Centre (UNGSC). UNVT was started as a collaborative project by the United Nations Geospatial Information Section (UNGIS), the UNGSC, and the Geospatial Information Authority of Japan (GSI).

The author took the lead of UNVT by designing and developing it. UNVT features fast production of large-scale vector tiles by its stream-oriented architecture and careful partition of the task. UNVT successfully produced prototype vector tiles from a global basemap vector dataset hosted in UNGSC for the internal purpose of the United Nations operations, which is a hybrid data that uses the whole OpenStreetMap dataset. By applying careful technical and operation decisions, the production of global vector tiles up to buildings level in a large scale took only 80 hours (Fujimura et al., 2019).

The second challenge after this technical success was to sustain the project so that it can contribute to the United Nations, United Nations member states, and any public or other organizations that publish web maps.

2. Demonstrations and capacity building

UNVT was built on and built as open source software. This means that UNVT needs to have a community of engineers who use it and contribute further to UNVT. In this regard, our priorities were the demonstration of UNVT and further capacity building while using UNVT. From the experience in the implementation in UNGSC, GSI, and other partners, we identified as a major obstacle the lack of computing environment ready for UNVT. The preparation of a UNVT-ready Linux server typically required a day of labor. This made it difficult for us to promote the value of UNVT because the preparation process itself tired the audiences who were interested in UNVT.

To drastically shorten the steps before demonstrating or capacity building with UNVT, we adopted a method to use single-board computers commonly used in the STEAM (Science, Technology, Engineering, the Arts and Mathematics) education. We developed a Docker (Docker Inc., 2020a) container image called v6 (United Nations Vector Tile Toolkit, 2020a) which runs on arm32v6/alpine (Docker Inc., 2020b). With this image, we were able to demonstrate UNVT or to exercise a capacity building session by just connecting a Raspberry Pi (Raspberry Pi Foundation, 2020)

to a PC and log into the Raspberry Pi (Photo 1).

This Raspberry Pi implementation is used for demonstration and in the capacity building practice not only inside the United Nations Secretariat, but also in the following organizations and opportunities:

- Geospatial Information Authority of Japan (GSI)
- Hands-on sessions hosted by the Open Source Geospatial Foundation (OSGeo) Japan Chapter
- Knowledge Co-Creation Program titled "Planning and Management of National Mapping and Surveying" of the Japan International Cooperation Agency (JICA) (Japan International Cooperation Agency, 2019)
- A lecture at Aoyama Gakuin University (Photo 2).

The latest material for the demonstration and capacity building on UNVT uses as an example the disaster response to Typhoon Hagibis in 2019 (Fig. 1), which is available on the Web (United Nations Vector Tile Toolkit, 2020b).

Photo 1   Misora (UNVT Raspberry Pi implementation) for demonstrations and capacity building of UNVT.

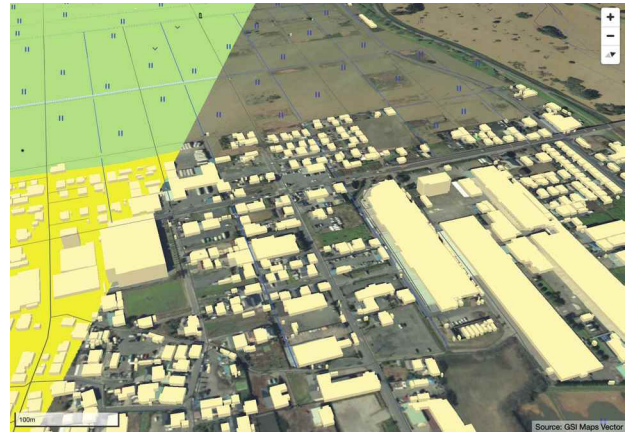Photo 2   Exercise using Raspberry Pi implementation of UNVT.

Fig. 1   kawagoe – UNVT demonstration system on Raspberry Pi, which uses as an example the disaster response to Typhoon Hagibis in 2019.

3. Forum publicity

In order to promote UNVT in the context of different sectors or disciplines, it is essential to expose it in the forums of the respective communities. As the first step, we focused on (1) the United Nations forums, such as the Regional Committee of the United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP), (2) geospatial software developer community forums, such as Free and Open Source Software for Geospatial (FOSS4G), (3) international capacity building opportunities, and (4) geospatial information industry.

In the context of the integration of the geospatial and statistical information as in the Global Statistical Geospatial Framework (Global Geospatial Information Management Secretariat, 2019), we produced vector tiles of the city block polygon data from the Statistics Bureau of Japan provided as open data (Fig. 2). On November 5, 2019, UNVT first appeared in the context of the United Nations Global Geospatial Information Management (UN-GGIM) by introducing these vector tiles as a contribution from UNVT to the Global Statistical Geospatial Framework through Working Group 3 (Integrating Geospatial Information and Statistics) of UN-GGIM-AP (Photo 3).

In the margin of the UN-GGIM-AP plenary on November 5, 2019, GSI received a request from the UN Economic and Social Commission for Asia and the Pacific (ESCAP) to present UNVT in the context of the land information management for the Central Asian region. By utilizing the vector tiles produced using UNVT by a UNVT

partner from the National Institute for Agro-Environmental Sciences (Fig. 3), the author could present UNVT in the context of the land information management just 10 days after the request (Photo 4).

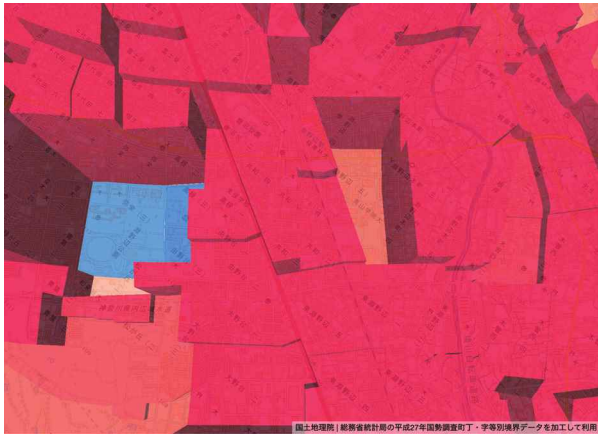Table 1 shows the UNVT publicity activities from June 2019 to February 2020.

Fig. 2 Vector tiles from open data from the Statistics Bureau of Japan produced using UNVT.

Photo 3 Presentation at the UN-GGIM-AP Plenary in 2019.

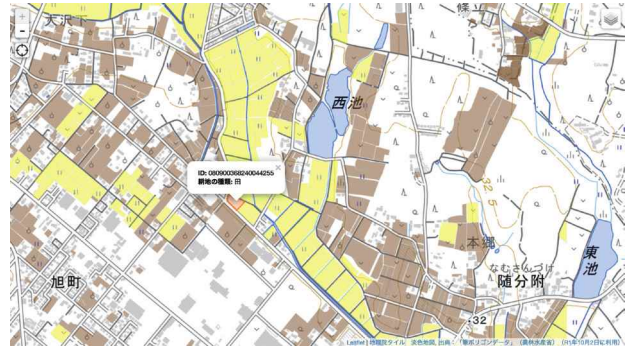**Photo 4** Presentation at the ESCAP Workshop on Central Asia.

Fig. 3 Vector tiles from open data from the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) produced using UNVT by a UNVT partner from the National Institute for Agro-Environmental Sciences.

Fig. 4 Promotion of geospatial partnership included in the SDGs Action Plan 2020 of the Government of Japan (in the red rectangle).

We have reached out to the decision makers to explain the importance of UNVT. With respect to the Sustainable Development Goals (SDGs), the SDGs Promotion Headquarters of the Government of Japan introduced the "SDGs Action Plan 2020" under the leadership of the Prime Minister which details various efforts of the Government of Japan. Based on the good examples of the partnership under UNVT, the SDGs Action Plan included for the first time an action item for "Promotion of Partnership in Geospatial Information" as a mechanism or measure to promote the SDGs implementation (Fig. 4). This will enable further collaboration within the Government of Japan to promote the application of geospatial information in different disciplines using interoperable vector tile technology. UNVT contributes to the achievement of the SDGs especially from the perspective of Goal 9 (industry, innovation and infrastructure)

and Goal 17 (partnership for the goals).

Date	Event
2019-06-25	Joint Event organized by the Permanent Mission of Japan to the United Nations and United Nations Office of Information and Communications Technology on Partnership in Geospatial Information and Technology for United Nations Operations (New York, USA)
2019-08-26	UN Open GIS Initiative Workshop (Bucharest, Romania)
2019-08-28	FOSS4G 2019 Bucharest (Bucharest, Romania)
2019-09-14	FOSS4G Niigata 2019 (Niigata, Japan)
2019-09-30	JICA training course exercise (Tsukuba, Japan)
2019-10-13	FOSS4G 2019 Kobe (Kobe, Japan)
2019-11-03	UN-GGIM-AP WG-3 Workshop (Canberra, Australia)
2019-11-05	UN-GGIM-AP Plenary (Canberra, Australia)
2019-11-15	ESCAP Workshop on Land Information Management (Tashkent, Uzbekistan)
2019-11-22	Mapping Technology Association Symposium (Tokyo, Japan)
2019-11-28	GSI Maps Partner Network Conference (Tokyo, Japan)
2019-11-30	Geospatial Expo 2019 (Tokyo, Japan)
2019-12-03	JICA training course exercise (Tsukuba, Japan)
2019-12-10	ISO/TC 211 19160-2 workshop (Omiya, Japan)
2020-01-09	Lecture for senior professionals in the geospatial industry (Tokyo, Japan)
2020-01-14	Lecture in Aoyama Gakuin University (Sagamihara, Japan)
2020-02-05	Mapbox meetup (Tokyo Japan)
2020-02-26	UN-GGIM WG-Disasters Conference 2020 (Tokyo, Japan; postponed)

GSI, in tandem with UN-GGIM WG-Disasters, UN-GGIM-AP, and JICA, is promoting the operational aspect of the geospatial information within the context of the UN-GGIM. They co-hosted the UN-GGIM WG-Disasters Conference 2020 on February 25 and 26, 2020 (Fig. 5). UNVT played critical role in adding operational aspects by exercising web-based disaster information sharing using the Raspberry Pi implementation of UNVT on February 26, 2020. This conference and the related exercises were postponed due to the COVID-19 situation in the spring of 2020. However, UNVT is ready for other opportunities.

Fig. 5 Website of the UN-GGIM WG-Disasters Conference 2020 (https://ggim-tokyo-2020.github.io).

4. Networking participants in operation

The most important tools to promote and sustain UNVT are the concrete examples of its application. We focus on close collaboration between partners with specific operational services such as UNGSC, GSI, and the National Institute for Agro-Environmental Sciences. The UNVT project publishes the list of vector tile sets produced by UNVT (Fig. 6) (United Nations Vector Tile Toolkit, 2020c).
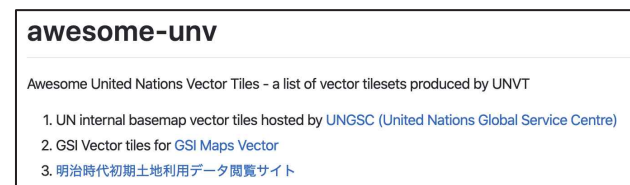

Fig. 6 List of vector tiles produced using UNVT.

We also display the logos of organizations associated with UNVT, which agreed to be included in the display (Fig. 7).

Fig. 7 Logos of the organizations associated with UNVT, which agreed to be included in the display.

5. Conclusion

The preamble of the Charter of the United Nations reads: "We the peoples of the United Nations have resolved to combine our efforts." UNVT calls for combining our efforts to promote the application of geospatial information.

We propose a mechanism to sustain UNVT through the FOSS (Free and Open Source Software) model (Fig. 8). We share our codes and documents as FOSS. This enables interdisciplinary and cross-sector partnership in the use of UNVT. Such partnership expands the application fields of the UNVT. The expanded application fields will sustain UNVT as FOSS.
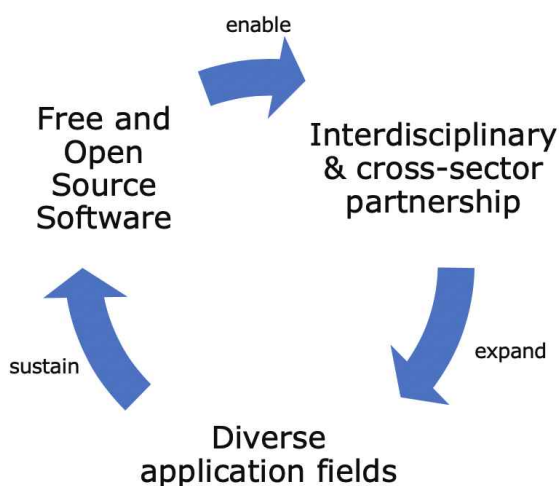

Fig. 8 Proposed mechanism to sustain UNVT.

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