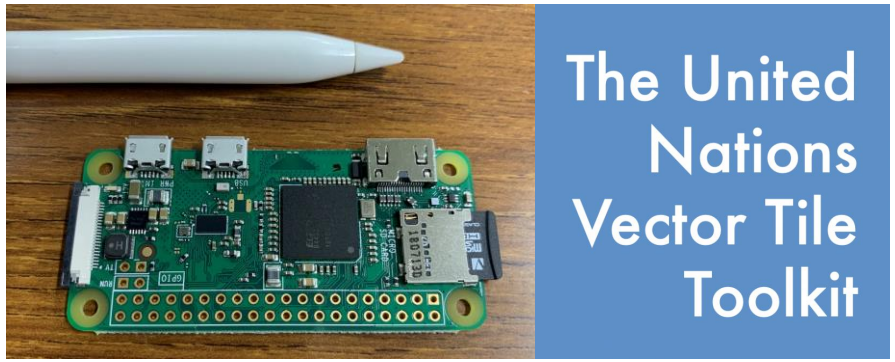
GSGF Principle 4 through the United Nations Vector Tile Toolkit (**UNVT**)



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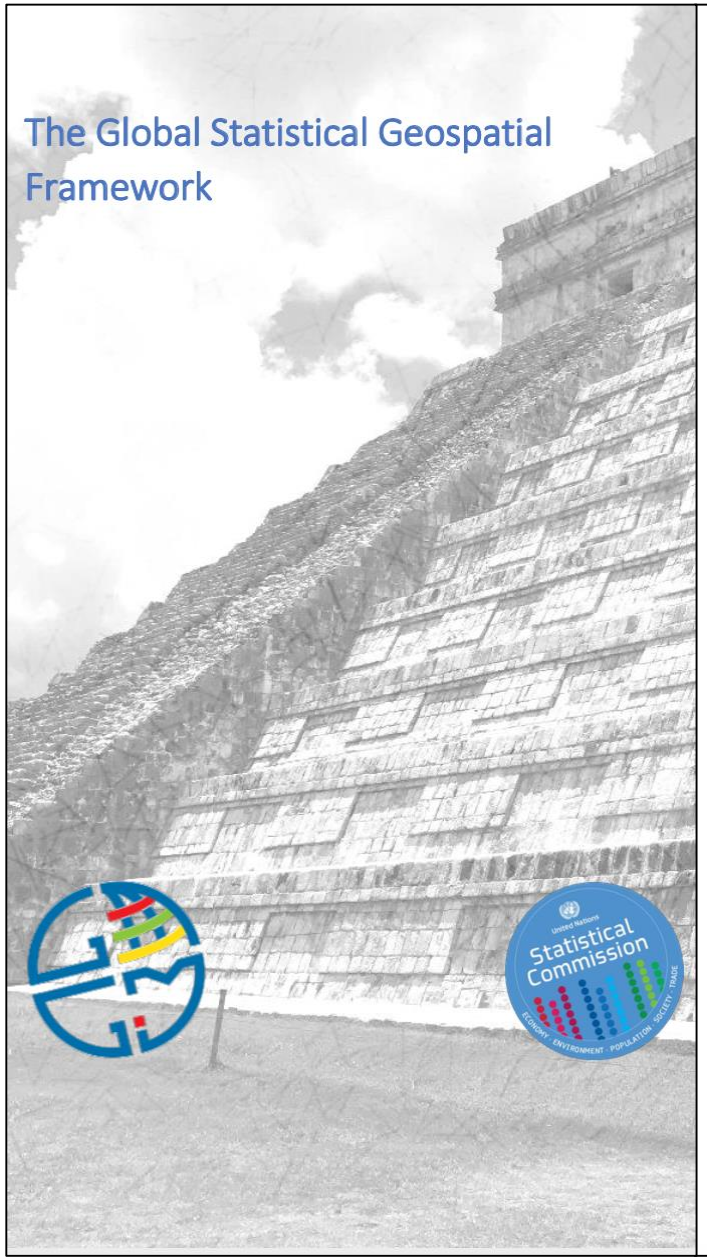
国土地理院

I appreciate WG-3 for an opportunity to contribute to the implementation of GSGF.

GSGF Principle 4



Principle 4: Statistical and geospatial interoperability

Data, Standards, Processes, and Organisations

Principle 4: *Statistical and geospatial interoperability (data, standards, processes and organisations)* enables greater standardisation and use of data which will lead to improved efficiency and simplification in the creation, discovery, integration, and use of geospatially enabled statistics. It also increases the potential application of a larger range of data and technologies, and thereby enables a wider range of information to be available and accessible for use in decision-making, and addresses aspects of better cooperation between all stakeholders producing and using statistical and geospatial information.

Why do we need this Principle?

Greater interoperability between statistical and geospatial data and metadata standards is required to overcome structural, semantic, and syntactic barriers between data and metadata from different communities and providers. This also improves the discovery, access, and use of geospatially enabled statistical data. Enhancing interoperability improves the fitness-for-use of geospatial and statistical data for their use in a range of applications and data management systems, including data modelling and production planning. Clear agreement on standards and commitment to their implementation are therefore critical to realise the benefits of interoperability.

What does this Principle cover?

Principle 4 covers the interoperability of all data, metadata, standards, and good practices that facilitate the integration and output of geospatially enabled statistical data. This includes tools and methods which are used in all stages of the statistical production process. It also addresses supporting processes, including reproducibility, quality management and the mechanisms by which stakeholders and users interact. Principle 4 recognises that both the statistical and geospatial communities operate their own general data models, metadata capabilities, architectures and data infrastructure. For example, the statistical community use the GSIM, SDMX, and DDI mechanisms. In parallel, the geospatial community commonly use the GFM and developed the ISO:19115 metadata standard, plus several application specific standards[35] and good practices to support interoperability of data.

Within the statistical community there is a need to consistently build geospatial processes, standards, and good practices into statistical business processes and data management systems as a fundamental element, not just to disseminate statistical data. To ensure this occurs, countries are urged to consider how to incorporate existing geospatial frameworks, standards, good practices, and processes more explicitly into the CSPA and its components. This would in turn provide greater efficiency and

[35] For a discussion on these statistical and geospatial models and metadata standards, see: http://ggim.un.org/meetings/2015-2nd_Mtg_EG-ISGI-Portugal/documents/Connecting%20Geographic%20and%20Statistical%20Information%20Standards%20EG-ISGI%202015.pdf and http://ggim.un.org/meetings/2015-2nd_Mtg_EG-ISGI-Portugal/documents/Metadata%20interoperability%20cover%20paper%20EG-ISGI%202015.pdf

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Clear agreement on standards and **commitment to their implementation** are therefore critical to realise the benefit of interoperability.

(p. 27)

Implementing service based or machine readable access mechanisms (e.g. through APIs) that provide greater **efficiency** of access and use and allow **adaptation and evolution of uses through time** (p. 29)

3. **Semantic interoperability** ensures that the precise format and meaning of exchanged data and information is preserved and understood: "What is sent is understood". This includes syntactic aspects, such as the terminology used to describe concepts, as well describing the exact format of the information.
4. **Technical interoperability** covers the linking systems and services of applications and infrastructures. Aspects include interface and services specifications, and data and metadata standards and formats.

Each of these items are crucial towards the integration and output of geospatially enabled statistical data and share a close interlinkage with each other.

Objectives of this Principle

In implementing Principle 4, the following key elements should be targeted:

Standards and good practices

- Enabling experts from the statistical and geospatial community to fully understand the nature, potential and limitations of other data domains;
- Facilitating smooth communication between experts by using consistent and understandable terminology;
- Provision should be made such that data, tools, processes and methodologies are documented in the official languages of the country;
- Guaranteeing preservation and persistence of data and tools;
- Ensuring that only open and international standards and good practices are implemented, ideally by using or further developing existing standards or connecting between existing standards; and only creating new standards and practices when necessary and doing so collectively;
- Ensuring transparency and visibility of data and metadata; and,
- Safeguarding common quality Principles.

National Laws and Policies

- Supporting cooperation of stakeholders through arrangements and legislation.

Infrastructure

- Ensuring that geospatially enabled/integrated data can flow freely between statistical and geospatial data producers, and from data producers to data users without having to worry about technical, national laws and policies, organisational, economic, language and conceptual barriers or national borders;
- Implementing service based or machine-readable access mechanisms (e.g. through APIs) that provide greater efficiency of access and use and allow adaptation and evolution of uses through time;
- Developing common solutions, so data and tools can be re-used, avoiding duplication of effort, through a single national fundamental geospatial infrastructure;

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Our focus #2 in implementing Principle 4

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Our focus #3 in implementing Principle 4

Ensuring that data and **tools** are **open and free**, wherever possible, so that users have access to the full range of information with **no information loss** due to technical or other **interoperability** issues. (p. 30)

- Ensuring that users, no matter if they come from both a geospatial or statistical background, can discover and access the required information via defined technical and user interfaces that do not require cross domain knowledge; and,
- Ensuring that data and tools are open and free, wherever possible, so that users have access to the full range of information with no information loss due to technical or other interoperability issues;

Relationship to other Principles

Interoperability concerns how data travels from the source to the end-user; for example, across the full statistical production process, including dissemination to intermediate and end-users. As a result, interoperability issues in most cases cut across the other Principles of the GSGF rather than belonging to one Principle only. Interoperability is critical to the successful implementation of the GSGF.

The full implementation of interoperability described in this Principle is particularly important for Principle 5, as failure to achieve interoperability in any of the other Principles will often result in incomplete or less useful information for the end-user.

Key Stakeholders

Often, NSOs and NGIAs are augmented by administrative data custodians, which also act as providers of statistical data, but which are often not interoperable with statistics and geospatial information (for example administrative boundaries – see Principle 3). Other stakeholders are the main global standard setting bodies such as ISO, OGC and IHO and the organisations driving the Modernisation of Official Statistics, such as UNECE[37].

The **European Commission** is the custodian of INSPIRE as the most important standard setting framework for geospatial information in Europe with **Eurostat** maintaining the European Statistical System and contributing with respect to standard setting activities, such as SDMX and ModernStats. The regional overview is further supported by the UN Regional Commission for Europe, **UNECE**, in supporting the "Modernstats" initiative for the modernisation of official statistics.

The European Forum for Geography and Statistics focuses on the development of best practices in the production of geospatially enabled statistics in Europe and acts as the professional network and organises the European annual conference on the integration of statistics and geospatial information, further enhancing knowledge exchange and communication.

Regionally, Europe have led with various initiatives and bodies supporting interoperability and the UNSC acts as the global custodian for statistics and geospatial information and their integration, while supporting capacity building.

European Efforts towards Interoperability

[37] This is not limited to those countries within the geographic bounds of Europe and includes several non-European Member States: https://www.unece.org/oes/nutshell/member_states_representatives.html

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UNVT's contribution to GSGF Principle 4 via WG-3

The United Nations Vector Tile Toolkit

Value	**Commitment to implementation** are critical.
Element 1	Implement **access mechanisms** that provide greater efficiency. Allow adaptation and evolution through time.
Element 2	Develop **common solutions**. Promote reuse and avoid duplication of efforts.
Element 3	Ensure that **tools are free and open**. No information loss or interoperability issues.

UNVT in a nutshell

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The United Nations Vector Tile Toolkit

Open Source Software to support the use of **Vector Tile Technology** by any organizations.

Based on the experience in web maps for more than 15 years in GSI

Established under the **United Nations Open GIS Initiative** WG4 in 2018.

UN Open GIS INITIATIVE

Mandate and Experience of GSI for the UNVT

Article 27.2 of Survey Act: Minister … must publish … maps … .

→ It is our Minister's mandate to publish web maps.

2003	GSI started web maps using the **Vector Tile Technology**.
2012	GSI adopted **Open Source Software** for the operation of its web maps. Open Source Software at that time was based on Image Tile Technology.
2014	Vector Tile Technology under **Open Source License** became available. GSI started **GSI Vector Tile Engineering Experiment**.
2015	The **UN Open GIS Initiative** was established.
2017	Japan contributed a basemap expert to the United Nations Secretariat.
2018	The **UN Open GIS Initiative** created the **UNVT**.

What is the Vector Tile Technology?

Tile

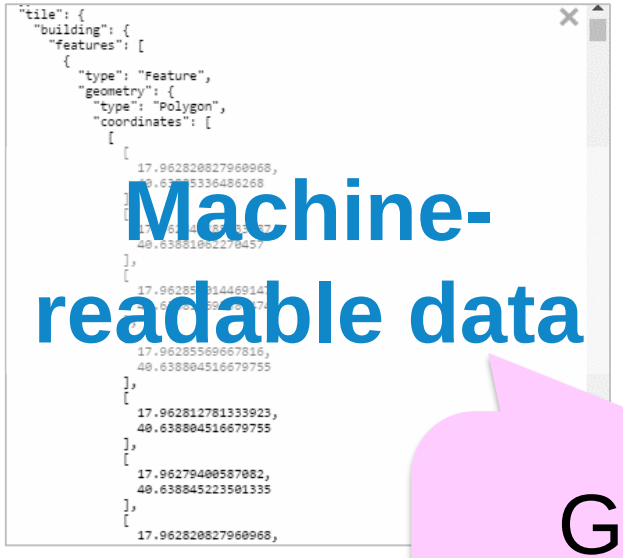
Image Tile

Vector Tile

Image Tile

Rendered Image

Vector Tile



Machine-readable data

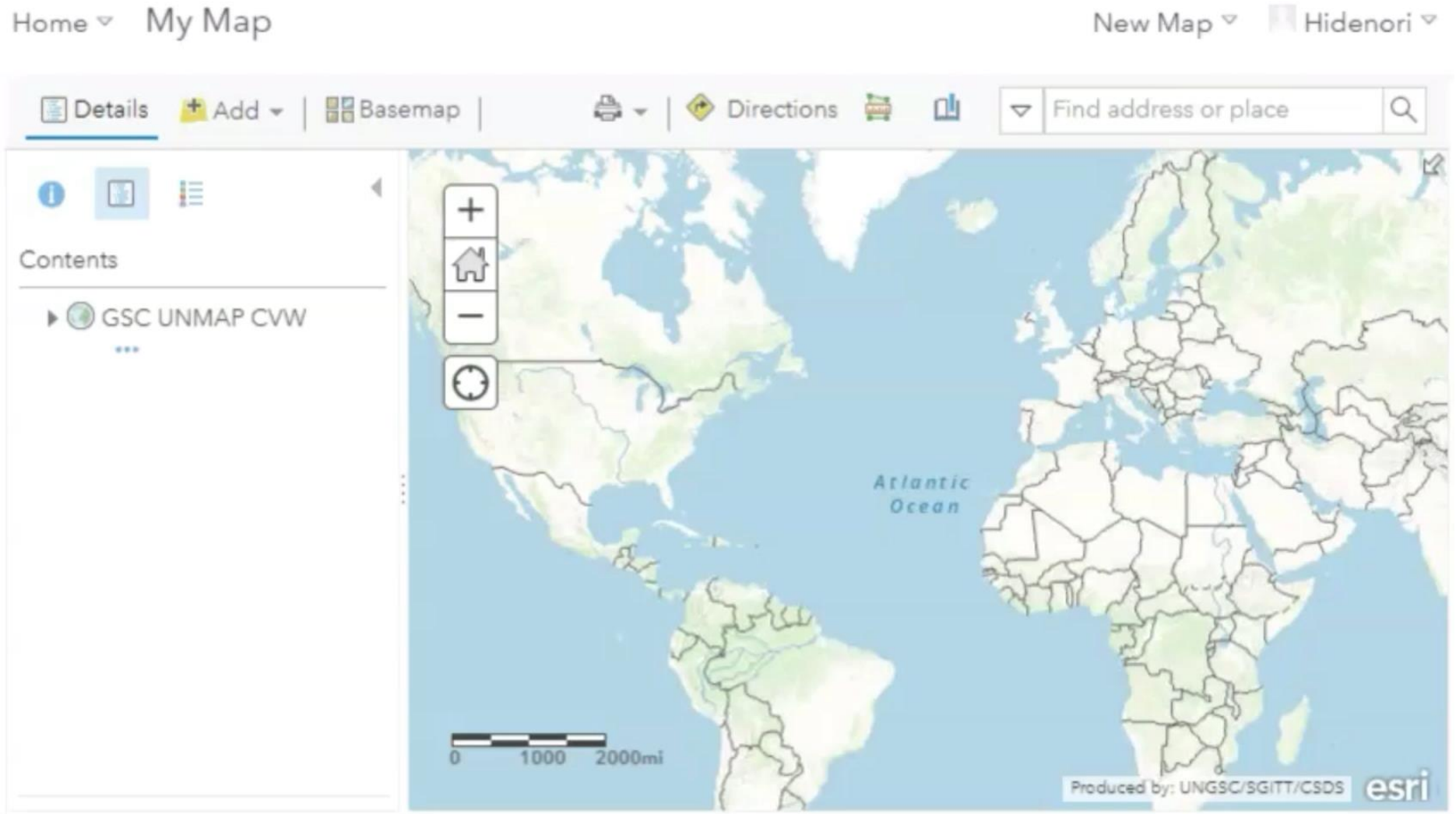
GSGF Principle 4
machine-readable

Image Tile

Vector Tile

GSGF
Principle 4
greater efficiency

BEFORE UN enterprise web map with image tiles

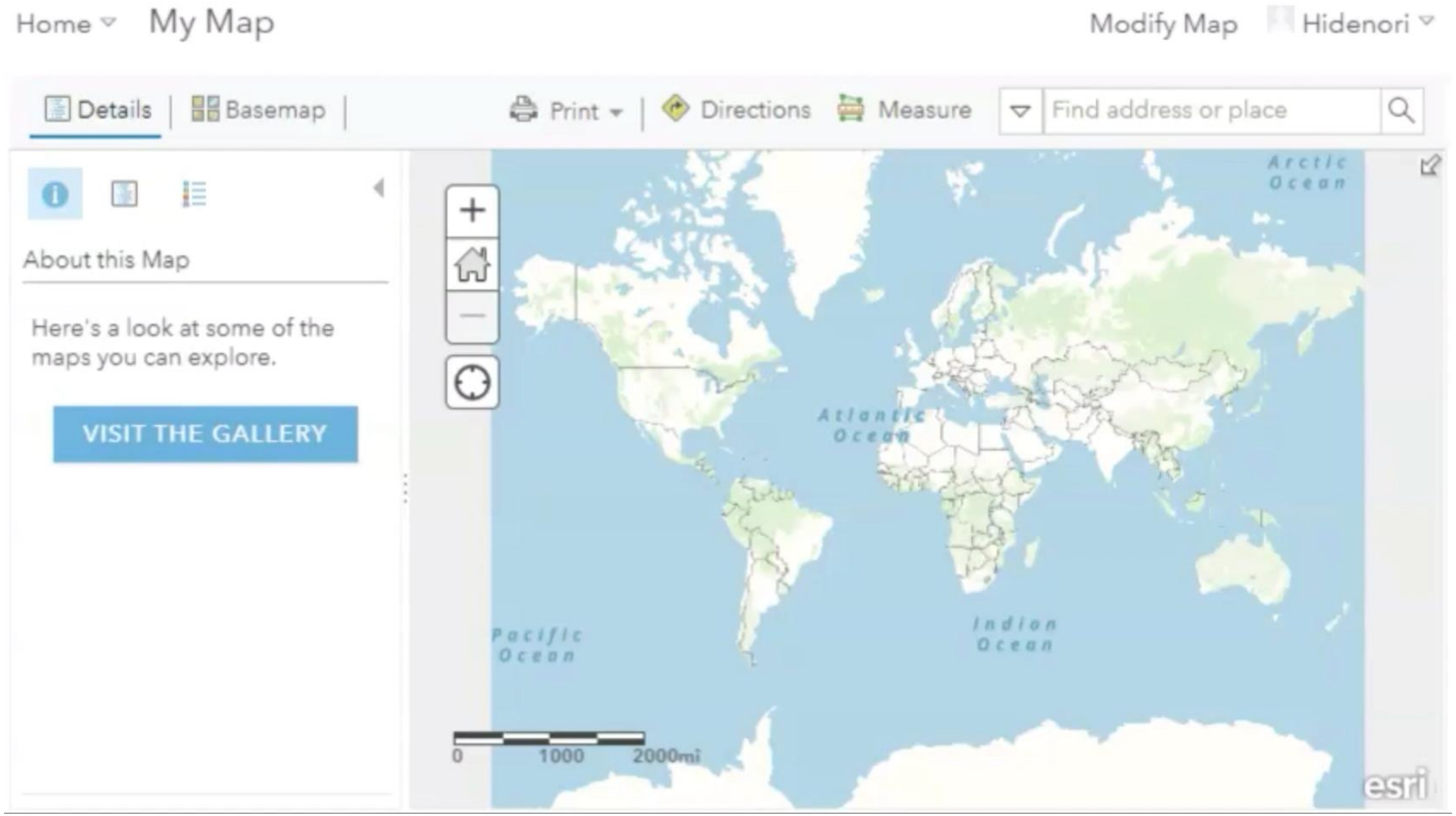


UN data

Not very responsive

Detailed map not globally available

BEFORE UN enterprise web map with vector tiles



UN data

More details

Less responsive

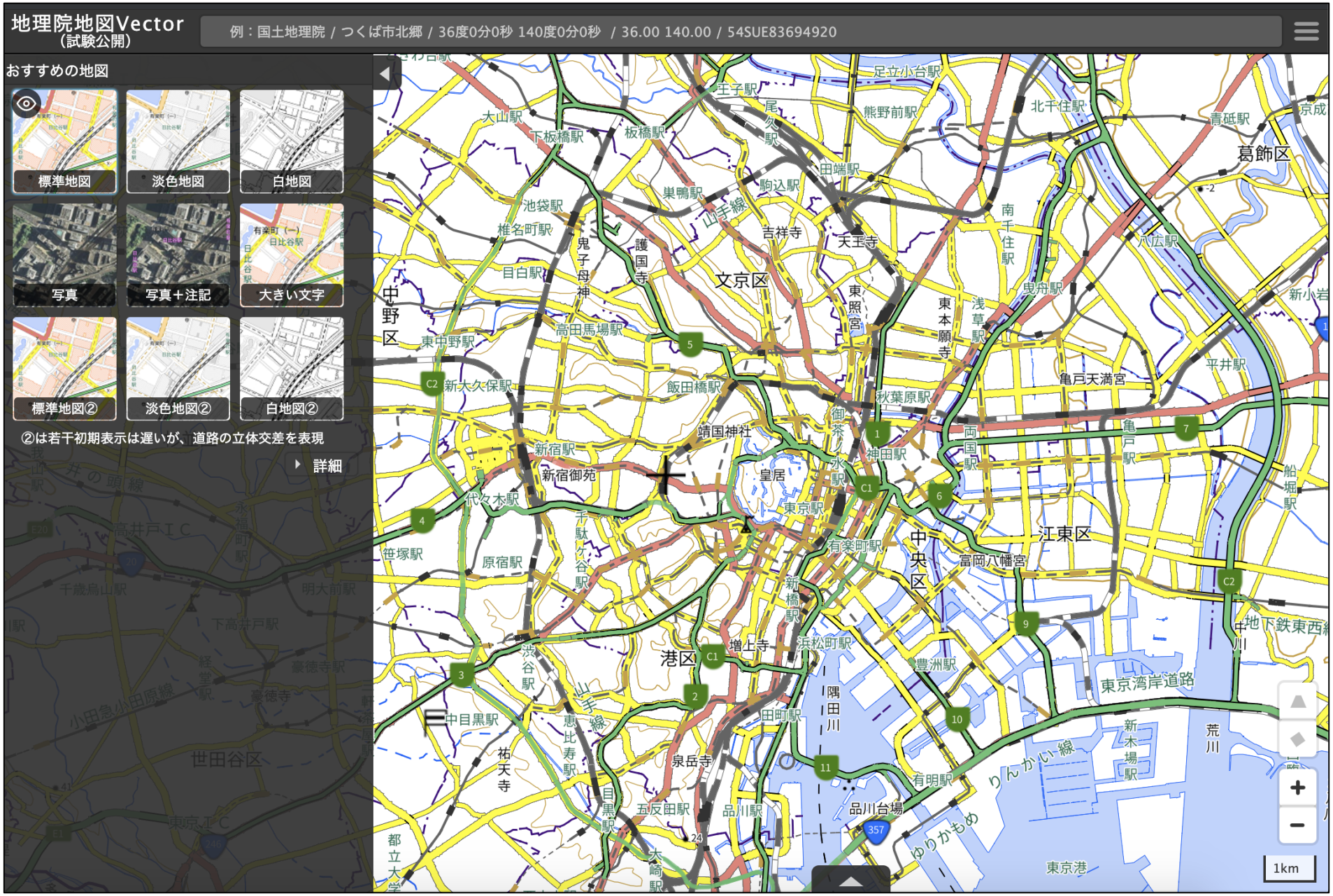
AFTER Proposed UN enterprise web map using UNVT

UN data

Building-level details with global coverage

Responsive as in video games

UNVT also used in GSI Maps Vector (July 2019)



we the peoples of the United Nations have resolved to combine our efforts

- Preamble of the Charter of the United Nations

Why is UNVT Open Source?

1. **Participation** – open innovation & project sustainability
2. **Transparency** and **Accountability**
3. **More competition** – cost reduction
   - e.g. GSI provides 3 billion tiles per month without cost recovery.
   - Serving 3 billion tiles using commercial service takes millions or ten millions of USD (!).
   - Great cost reduction was possible by using general-purpose Cloud Service thanks to Open Source Software.

The UNVT Team

Cross-sector and interdisciplinary cooperation (IGIF Str. Pathway 7)

UN Open GIS INITIATIVE

GeoThings

Geospatial Information Authority of Japan

National Astronomical Observatory of Japan

National Institute for Agro-Environmental Sciences

Mapbox

Mapple On

OSGeo Japan Chapter

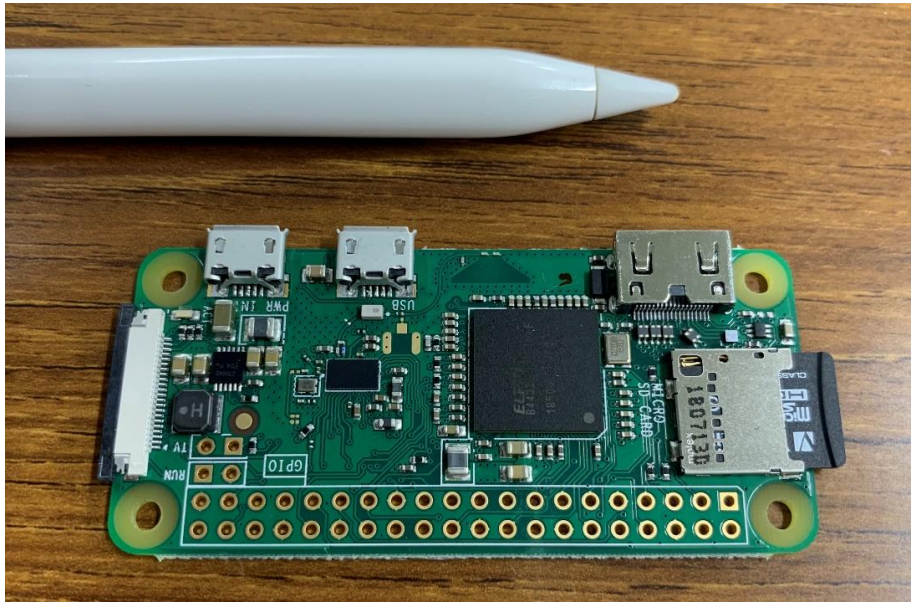
UN Geospatial Information Section

UN Global Service Centre

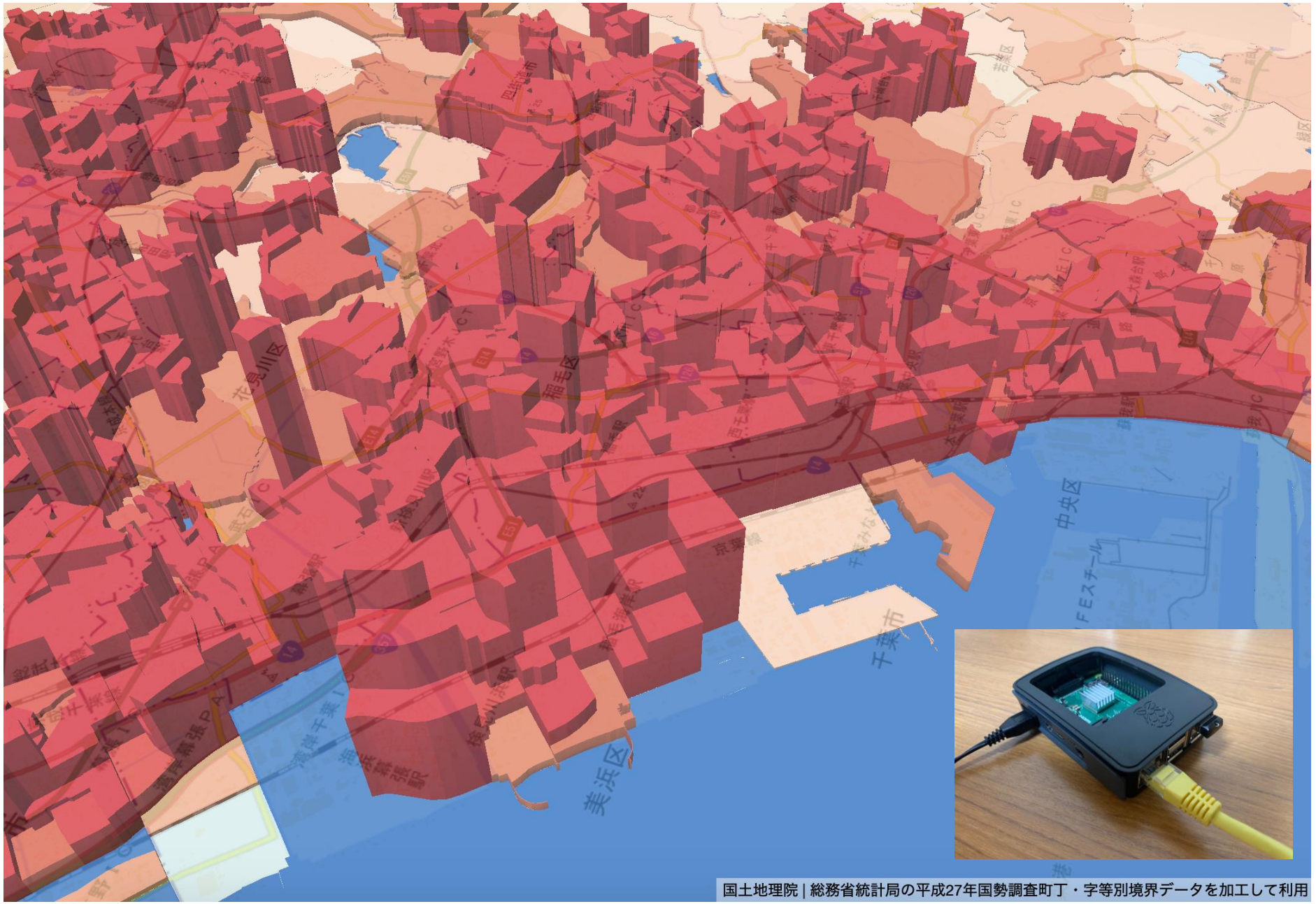
Recent development: Tiny PC implementation

1. The UN solution is not for external access.
2. Need to involve more participants to sustain the UNVT.
3. Implement the UNVT in a tiny PC for demos and capacity building.

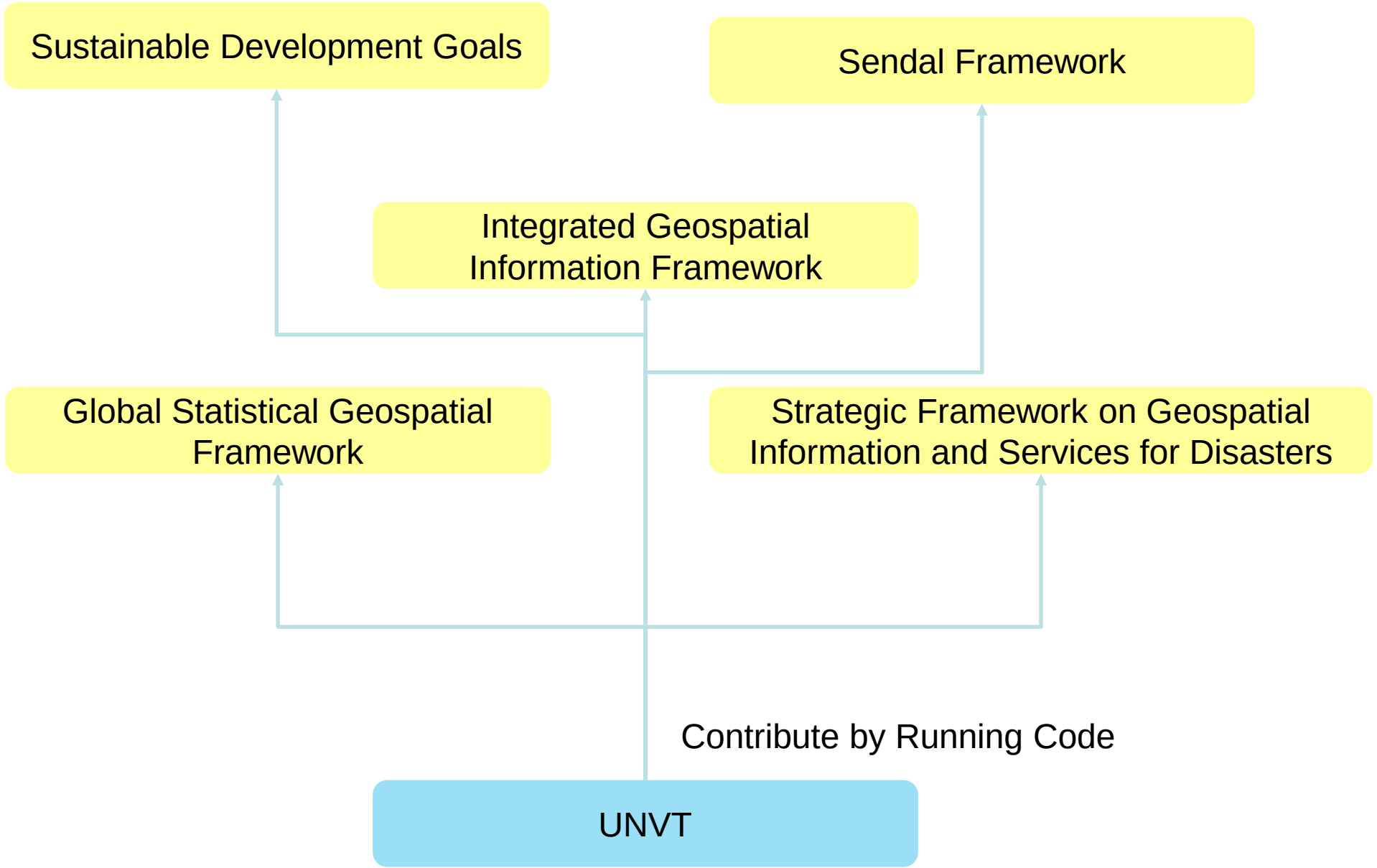
USD $10 – 50
Frequently used for STEM education or IoT



Geospatial Statistical integration demo for WG-3



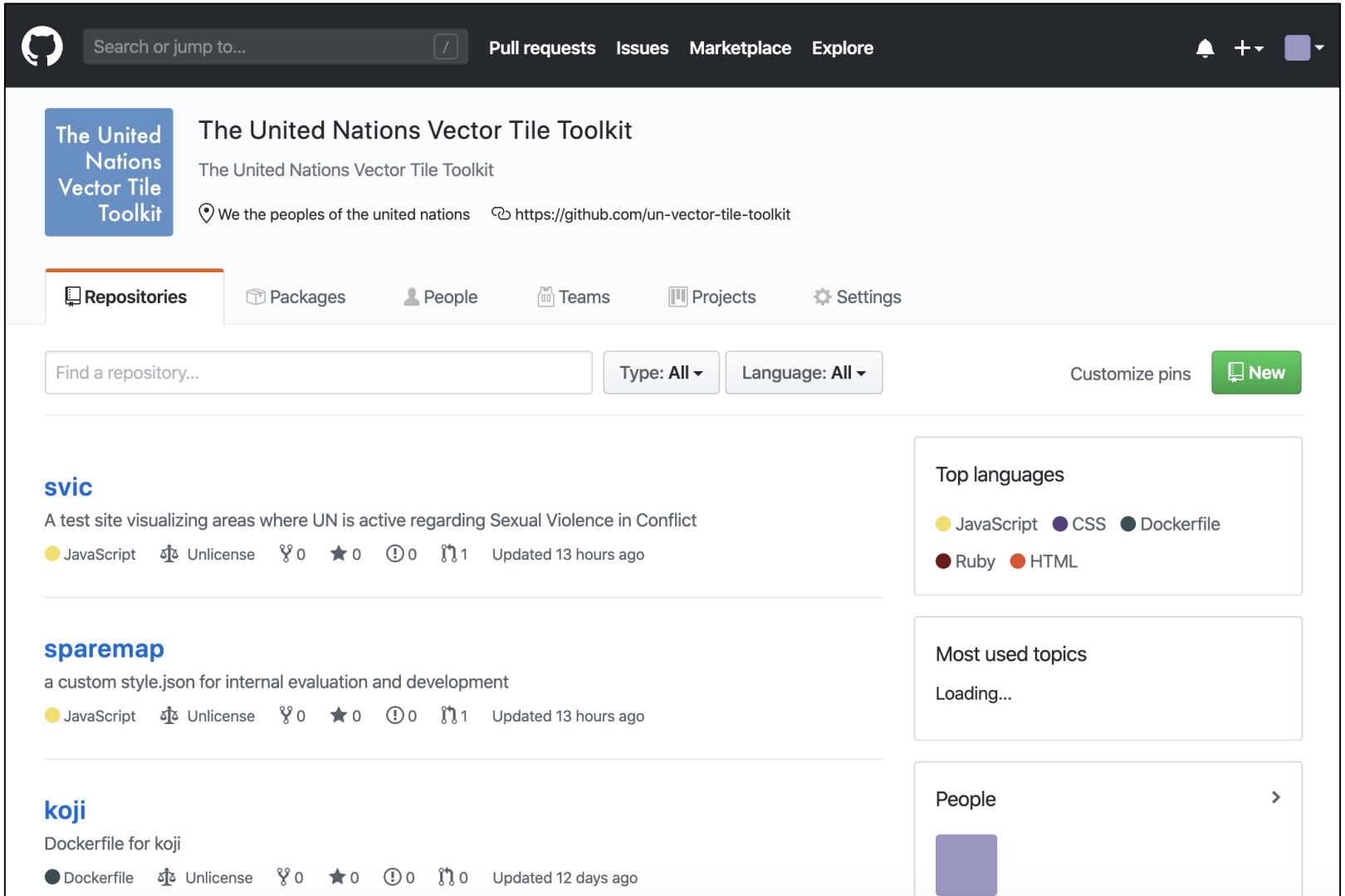
UNVT contributes by Running Code



UNVT is available to anyone as FOSS4G

FOSS4G: Free and Open Source Software for Geospatial

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



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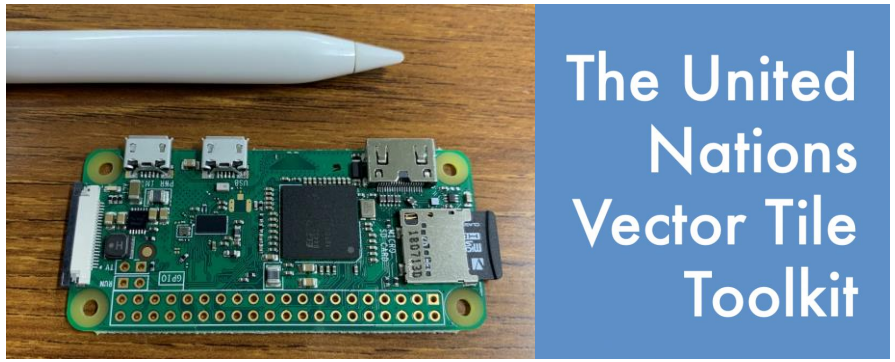

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