Vector Tiles Pilot Call for Participation (CFP)

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Abbreviations

The following table lists abbreviations used in this CFP.

CFP	Call for Participation
CR	Change Request
DER	Draft Engineering Report
DWG	Domain Working Group
ER	Engineering Report
GeoINT	Geospatial Intelligence
GPKG	GeoPackage
IER	Initial Engineering Report
IP	Innovation Program or Intellectual Property
MVT	Mapbox Vector Tiles
OGC	Open Geospatial Consortium
ORM	OGC Reference Model
OWS	OGC Web Services
PA	Participation Agreement
protobuf	Google Protocol Buffers
POC	Point of Contact
Q&A	Questions and Answers
RM-ODP	Reference Model for Open Distributed Processing
SOW	Statement of Work
SWG	Standards Working Group
TBD	To Be Determine (at a later date)
TC	OGC Technical Committee
TEM	Technical Evaluation Meeting
TIE	Technology Integration / Technical Interoperability Experiment
URL	Uniform Resource Locator
VT	Vector Tiles
WFS	Web Feature Service
WMTS	Web Map Tile Service
WG	Working Group (SWG or DWG)

Chapter 1. Introduction

The Open Geospatial Consortium (OGC®) is releasing this *Call for Participation* ("CFP") to solicit proposals for the OGC Vector Tiles Pilot Initiative ("Initiative" or "Pilot"). The initiative will run like a plugfest-pilot due to the short proposed time frame. The proposal submission deadline and other key dates can be found in the Master Schedule.

Vector Tiles is a technology that optimizes delivering vector data over the web to create maps. The approach provides a pre-defined shape (i.e. tile) to package vector data. Vector Tiles provide various opportunities:

- Incentivize commercial innovation while simplifying interoperability for command and control, consumer mapping and many other applications.

- Enable faster map loads (reducing size) and flexible styling with modern, easy-to-use tools.

The following image provides a map created from Vector Tiles.
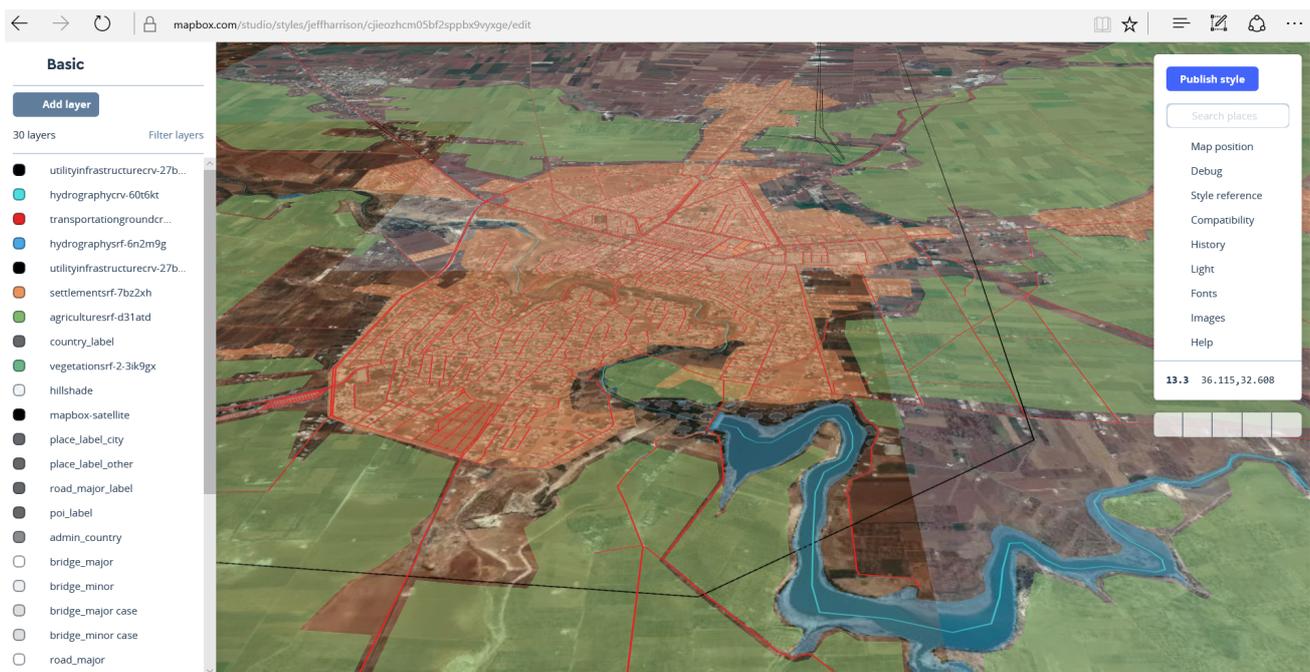
Figure 1. Map Created from Vector Tiles Sources

The map showing Daraa (in Syria) was created and shared in minutes with no training or experience. The preparation time included adding multiple layers, conversion, and simple styling. It used the NGA Topographic Data Store (TDS) data based on OpenStreetMap (OSM).

Vector Tiles provide an efficient and effective method of delivering GeoINT data due to the efficiencies for querying vector data and compacting of the files. Sponsors are interested in Vector Tiles Standardization in the following cases:

- OGC Web Services (WFS and WMTS)

- Denied, Degraded, Intermittent, or Limited Bandwidth (DDIL) container format (GeoPackage)

The OGC has coordinated several initiatives to advance the use of Vector Tiles. Testbed 12 and Testbed 13 advanced ideas, found issues and proposed change requests to existing standards. However, a better forward strategy is to advance extensions in current OGC standards. The specifics of the proposed technical work are detailed in the Requirements and Technical Deliverables sections.

This Pilot will propose several draft standard(s) including: a Conceptual abstract model for vector tiles that can be used across OGC standards, and extensions for WFS 3.0, WMTS 1.0 and GeoPackage 1.2. Servers and clients will be developed to demonstrate the feasibility of the proposed solution.

The extensions will serve as basis for National System for Geospatial Intelligence (NSG) Profiles.

1.1. OGC Innovation Program Initiative

This Initiative is being conducted under the OGC Innovation Program. The OGC Innovation Program provides a collaborative agile process for solving geospatial challenges. Organizations (sponsors and technology implementers) come together to solve problems, produce prototypes, develop demonstrations, provide best practices, and advance the future of standards. Since 1999 more than 100 initiatives have been taking place from in-kind interoperability experiments run by a working group to multi-million dollar testbeds with hundreds of participants.

Innovation Program initiatives include testbeds, interoperability experiments, pilots, concept development studies, hackathons and plugfests. The OGC also maintains a list of candidate ideas for future initiatives.

1.2. Benefits of Participation

This Initiative provides a business opportunity for stakeholders to mutually define, refine, and evolve service interfaces and protocols in the context of hands-on experience and feedback. The outcomes are expected to shape the future of geospatial software development and data publication. The sponsorship supports this vision with cost-sharing funds to partially offset the costs associated with development, engineering, and demonstration of these outcomes. This offers selected Participants a unique opportunity to recoup a portion of their Initiative expenses.

1.3. Initiative Policies and Procedures

This initiative will be conduced under the following OGC Policies and Procedures:

- This Initiative will be conducted in accordance with OGC Innovation Program Policies and Procedures.

- OGC Principles of Conduct will govern all personal and public Initiative interactions.

- Participants drafting documents for the Initiative are required to allow OGC to copyright and publish documents following the OGC Intellectual Property Rights Policy.

1.4. Initiative Roles

The roles generally played in any OGC Innovation Program initiative include Sponsors, Bidders, Participants, Observers, and the Innovation Program Team ("IP Team"). Additional explanations of the roles are provided in the Tips for New Bidders.

The IP Team for this Initiative will include an Initiative Director and an Initiative Architect. Unless otherwise stated, the Initiative Director will serve as the primary point of contact (POC) for the OGC.

The Initiative Architect will work with Participants and Sponsors to ensure that Initiative activities and deliverables are properly assigned and performed. They are responsible for scope and schedule control, and will provide timely escalation to the Initiative Director regarding any severe issues or risks that happen to arise.

Chapter 2. Proposal Evaluation Criteria

2.1. Process

Proposals will be evaluated according to criteria that can be divided into three areas: Technical, Management, and Cost. Each review will commence by analyzing the proposed deliverables in the context of the Sponsor Priorities, examining viability in light of the requirements and assessing feasibility against the use cases.

The review team will then create a draft Initiative System Architecture from tentatively selected Proposals. This architecture will include the proposed components and relate them to available hardware, software, and data. Any candidate interface and protocol specification received from a Bidder will be included.

The review team will then create a draft Demonstration Concept document that will explain the ability of proposed software components (from tentatively selected Proposals) to work together in a demonstration context. It will also identify any remaining gaps.

At the Decision Technical Evaluation Meeting 1 (TEM-1), the IP Team will present Sponsors with draft versions of the Initiative System Architecture, the Demonstration Concept, and program management approach. The team will also present draft recommendations regarding which parts of which proposals should be offered cost-sharing funding (and at what level). Sponsors will decide whether and how draft recommendations in all these areas should be modified.

Immediately following TEM I, the IP Team will begin to notify Bidders of their selection to enter negotiations for potentially becoming Initiative participants. Selected Bidders must be available for these contacts to be made to enable confirmation of continued interest.

A Decision Technical Evaluation Meeting 2 (TEM-2) meeting will be conducted where the IP Team will present to Sponsors the revised artifacts and Initiative participant recommendations. In addition to confirming the modifications decided in TEM I, Sponsors will have a final opportunity to decide whether the proposed Initiative participant recommendations are proper and affordable.

Following TEM-2, the IP Team will finalize the Initiative System Architecture, Demonstration Concept, and program management approach. It will also develop the Statement of Work (SOW) being part of the Initiative participant Agreement for each selected Bidder and notify this organization of its selection to enter final negotiations for becoming an Initiative participant. Selected Bidders must be available for these contacts to be made to enable ongoing negotiation of a contract.

2.2. Management Criteria

- Adequate, concise descriptions of all proposed activities, including how each activity contributes to achievement of particular requirements and deliverables. To the extent possible, it is recommended that Bidders utilize the language from the CFP itself to help trace these descriptions back to requirements and deliverables.

- Willingness to share information and work in a collaborative environment

- Contribution toward Sponsor goals of enhancing availability of standards-based offerings in the marketplace

2.3. Technical Criteria

- How well applicable requirements in this CFP are addressed by the proposed solution

- Proposed solutions could be executed within available resources

- Proposed solutions support and promote the Initiative system architecture and demonstration concept

- Where applicable, proposed solutions are OGC-compliant

2.4. Cost Criteria

- Cost-share compensation request is reasonable for proposed effort

2.5. Monthly Process Reporting

Initiative participant business/contract representatives are required (per a term in the Participation Agreement contract) to report the progress and status of the participant's work. Detailed requirements for this reporting will be provided during contract negotiation. Initiative accounting requirements (e.g., invoicing) will also be described in the contract.

The IP Team will provide monthly progress reports to Sponsors. Ad hoc notifications may also occasionally be provided for urgent matters. To support this reporting, each Pilot participant must submit (1) a Monthly Technical Progress Report and (2) a Monthly Business Progress Report by the first working day on or after the 10th of each month. Templates for both of these report types will be provided and must be followed.

The purpose of the Monthly Business Progress Report is to provide initiative management with a quick indicator of project health from the perspective of each Pilot participant.

The IP Team will review action item status on a weekly basis with the Initiative participants

assigned to complete those actions. Initiative participants must be available for these contacts to be made. Action item status reports will be posted to pilot web sites each week.

Chapter 3. Master Schedule

The following table details the major Initiative milestones and events. Dates are subject to change.

Milestone	Date	Event
M01	July 06, 2018	Sponsors Kickoff
M02	July 11, 2018	Call for Particiaption (CFP) released
M03	August 06, 2018	Proposals due
M04	August 13, 2018	Participant selection and agreements
M05	August 17, 2018	Virtual kickoff
M06	August 24, 2018	Interim meeting 1
M07	August 31, 2018	Interim meeting 2
M08	September 07, 2018	Interim meeting 3
M09	September 10-14, 2018	Discussion at Working Groups
M10	September 21, 2018	Interim meeting 4
M11	September 28, 2018	End & Final Reports

Table 1. Milestone schedule

Suggested Planned RoadMap to Standardization

	Standardization Roadmap Note
NOTE	Standardization is completely member-driven and this schedule is subject the Working Groups resources and priorities. It is recommended that a Vector Tiles Standard Working Group (SWG) is created that will discuss and manage the process for submission of a Vector Tiles Conceptual Abstract Model and the proposed extensions.

Date	Event
September 28 2019	Initialization of a Vector Tiles SWG approval
December 10-14, 2019	SWG Discussions
March 2019	Approval votes start and Release for Public comment
April - June 2019	Expected public release of the standard

Table 2. Standardization Roadmap Suggested Schedule

3.1. Milestones

Call for Participation

The CFP consists of stakeholder role descriptions, proposal submission instructions and

evaluation criteria, a master schedule and other project management artifacts, Sponsor requirements, and a initiative architecture. The responses should include the proposing organization's technical solution, its cost-sharing requests for funding, and its proposed in-kind contributions to the initiative. The Proposal Submission Procedures section provides more details.

Once the original CFP has been published, ongoing authoritative updates and answers to questions can be tracked by monitoring the CFP Clarifications page. Instructions for accessing this page are included under Proposal Submission Procedures.

Participant Selection and Agreements:

Bidders may submit questions via timely submission of email(s) to the OGC Technology Desk. Question submitters will remain anonymous, and answers will be regularly compiled and published in the CFP Clarifications page.

OGC may also choose to conduct a Bidder's question-and-answer webinar to review the clarifications and invite follow-on questions.

Following the closing date for submission of proposals, OGC will evaluate received proposals, review recommendations with the Sponsor, and negotiate Participation Agreement (PA) contracts, including statements of work (SOWs), with selected Bidders. Participant selection will be complete once PA contracts have been signed with all Participants.

Kickoff: A Kickoff is a meeting (face-to-face or virtual) where Participants, guided by the Initiative Architect, will refine the Initiative architecture and settle upon specific use cases and interface models to be used as a baseline for prototype component interoperability. Participants will be *required* to attend the Kickoff, including breakout sessions, and will be expected to use these breakouts to collaborate with other Participants and confirm intended *Component Interface Designs*.

Regular Teleconference and Interim Meetings After the Kickoff, participants will meet virtually in a frequent basis remotely via web meetings and teleconferences.

Development of Engineering Reports, Change Requests, and Other Document Deliverables: Development of Engineering Reports (ERs), Change Requests (CRs) and other document deliverables will commence during or immediately after Kickoff. Participants will deliver an Initial Engineering Report (IER) plus several iterations of a Draft Engineering Report (DER). Full process details can be found in the ER Development Process.

Under the Participation Agreement (PA) contracts to be formed with selected Bidders, *ALL* Participants will be responsible for contributing content to the ERs. But the ER Editor role

will assume the duty of being the *primary* ER author.

Final Summary Reports, Demonstration Event and Other Stakeholder Meetings: Participant Final Summary Reports will constitute the close of funded activity. Further development work might take place to prepare and refine assets to be shown at the Demonstration Event and other stakeholder meetings.

Assurance of Service Availability: Participants selected to implement *service* components must maintain availability for a period of no less than one year after the Participant Final Summary Reports milestone. OGC might be willing to entertain exceptions to this requirement on a case-by-case basis.

Detailed requirements for meeting all these delivery milestones are provided in Appendix A Management Requirements.

3.2. Monthly Process Reporting

Pilot participant business/contract representatives are required (per a term in the Participation Agreement contract) to report the progress and status of the Pilot participant's work. Detailed requirements for this reporting will be provided during contract negotiation. Initiative accounting requirements (e.g., invoicing) will also be described in the contract.

The IP Team will provide monthly progress reports to Sponsors. Ad hoc notifications may also occasionally be provided for urgent matters. To support this reporting, each Pilot participant must submit (1) a Monthly Technical Progress Report and (2) a Monthly Business Progress Report by the first working day on or after the 10th of each month.

Templates for both of these report types will be provided and must be followed. The purpose of the Monthly Business Progress Report is to provide initiative management with a quick indicator of project health from the perspective of each Pilot participant.

The IP Team will review action item status on a weekly basis with Pilot participants assigned to complete those actions. Pilot participants must be available for these contacts to be made. Action item status reports will be posted to pilot web sites each week.

Chapter 4. Summary of Initiative Deliverables

The following table summarizes the full set of Initiative deliverables. Technical details can be found in the Appendix B Technical Architecture.

All Participants are **required** to provide at least some level of **in-kind contribution** (i.e., activities requesting no cost-share compensation). As a rough guideline, a proposal should include at least one dollar of in-kind contribution for every dollar of cost-sharing compensation requested. All else being equal, **higher levels of in-kind contributions will be considered more favorably** during evaluation.

Some participation may be fully in-kind. However, to help maintain a manageable process, Bidders are advised to avoid attempts to use the Initiative as a platform for introducing new requirements not included in the Appendix B Technical Architecture. Any additional in-kind scope should be offered outside of the formal bidding process, where an independent determination can be made as to whether it should be included in Initiative scope or not. Items deemed out-of-Initiative-scope might be more appropriate for inclusion in a later OGC Innovation Program initiative.

Any item proposed as a fully in-kind contribution to meet a requirement already included in Appendix B Technical Architecture will likely be accepted if it meets all the other evaluation criteria and does not create an added burden on other Participants.

4.1. Summary of Technical Deliverables

The following table summarizes the full set of technical deliverables for this Initiative. Additional details can be found under Technical Deliverables. Management deliverables are described in Appendix A Management Requirements.

ID	Technical Deliverable
D001	WFS 3.0 Extension Engineering Report
D002-1	WFS Vector Tiles Server - 1st Instance
D002-2	WFS Vector Tiles Server - 2nd Instance
D003	WMTS Profile Engineering Report
D004-1	WMTS Vector Tiles Server - 1st Instance
D004-2	WMTS Vector Tiles Server - 2nd Instance
D005	GeoPackage 1.2 Vector Tiles Extension Engineering Report
D006	GeoPackage 1.2 Producer
D007	Conceptual Model
D008	WFS Client

ID	Technical Deliverable
D009	WMTS Client
D010	GeoPackage Client
D0011	Summary Engineering Report

Table 3. Technical Deliverables

4.2. Tips for New Bidders

Bidders who are new to OGC initiatives are encouraged to review the following tips:

- In general, the term "activity" is used as a verb describing work to be performed in an initiative, and the term "deliverable" is used as a noun describing artifacts to be memorialized and delivered for inspection and use.

- The roles generally played in any OGC Innovation Program initiative are defined in the OGC Innovation Program Policies and Procedures, from which the following definitions are derived and extended.

  ◦ **Sponsors** are OGC member organizations that contribute financial resources to steer Initiative requirements toward rapid development and delivery of proven candidate specifications to the OGC Standards Program. These requirements take the form of the deliverables described herein. Sponsors representatives help serve as "customers" during Initiative execution, helping ensure that requirements are being addressed and broader OGC interests are being served.

  ◦ **Bidders** are organizations who submit proposals in response to this CFP. A Bidder selected to participate will become a Participant through the execution of a Participation Agreement contract with OGC. Most Bidders are expected to propose a combination of cost-sharing request and in-kind contribution (though solely in-kind contributions are also welcomed).

  ◦ **Participants** are selected OGC member organizations that generate empirical information through the definition of interfaces, implementation of prototype components, and documentation of all related findings and recommendations in Engineering Reports, Change Requests and other artifacts. They might be receiving cost-share funding, but they can also make purely in-kind contributions. Participants assign business and technical representatives to represent their interests throughout Initiative execution.

  ◦ **Observers** are individuals from OGC member organizations that have agreed to OGC intellectual property requirements in exchange for the privilege to access Initiative communications and intermediate work products. They may contribute recommendations and comments, but the IP Team has the authority to table any of these contributions if there's a risk of interfering with any primary Initiative activities.

- The **Innovation Program Team** (IP Team) is the management team that will oversee and coordinate the Initiative. This team is comprised of OGC staff, representatives from member organizations, and OGC consultants. The IP Team communicates with Participants and other stakeholders during Initiative execution, provides Initiative scope and schedule control, and assists stakeholders in understanding OGC policies and procedures.

- The term **Stakeholders** is a generic label that encompasses all Initiative actors, including representatives of Sponsors, Participants, and Observers, as well as the IP Team. Initiative-wide email broadcasts will often be addressed to "Stakeholders".

- **Suppliers** are organizations (not necessarily OGC members) who have offered to supply specialized resources such as capital or cloud credits. OGCs role is to assist in identifying an initial alignment of interests and performing introductions of potential consumers to these suppliers. Subsequent discussions would then take place directly between the parties.

- Non-OGC member organizations must become members in order to be selected as Participants.

- Any individual wishing to gain access to the Initiative's intermediate work products in the restricted area of the Portal (or attend private working meetings / telecons) must be a member-approved user of the OGC Portal system. Intermediate work products that are intended to be shared publicly will be made available as draft ER content in a public GitHub repository.

- Individuals from any OGC member organization that does not become an Initiative Sponsor or Participant may still (as a benefit of membership) quietly observe all Initiative activities by registering as a Testbed *Observer*.

- Prior initiative participation is not a direct bid evaluation criterion. However, prior participation could accelerate and deepen a Bidder's understanding of the information presented in the CFP.

- All else being equal, preference will be given to proposals that include a larger proportion of in-kind contribution.

- All else being equal, preference will be given to proposed components that are certified OGC-compliant.

- All else being equal, a proposal addressing all of a deliverable's requirements will be favored over one addressing only a subset. Each Bidder is at liberty to control its own proposal, of course. But if it does choose to propose only a subset for any particular deliverable, it might help if the Bidder prominently and unambiguously states precisely what subset of the deliverable requirements are being proposed.

- The Sponsor(s) will be given an opportunity to review selection results and offer advice, but ultimately the Participation Agreement (PA) contracts will be formed

bilaterally between OGC and each Participant organization. No multilateral contracts will be formed. Beyond this, there are no restrictions regarding how a Participant chooses to accomplish its deliverable obligations so long as the Participant's obligations are met in a timely manner (e.g., with or without contributions from third-party subcontractors).

- In general, only one organization will be selected to receive cost-share funding per deliverable, and that organization will become the *Assigned Participant* upon which other Participants will rely for delivery. Optional in-kind contributions may be made provided that they don't disrupt delivery of the required, reliable contributions from *Assigned Participants*.

- A Bidder may propose against any or all deliverables. Participants in past initiatives have often been assigned to make only a single deliverable. At the other extreme, it's theoretically possible that a single organization could be selected to make all available deliverables.

- In general, the PAs will not require delivery any component source code to OGC.

  ◦ What is delivered instead is the behavior of the component in the TIEs, and the corresponding documentation of findings, recommendations, and technical artifacts in the related ER(s).

  ◦ In some instances, a Sponsor might expressly require a component to be developed under open-source licensing, in which case the source code would become publicly accessible outside the Initiative as a by-product of implementation.

- Results of other recent OGC initiatives can be found in the OGC Public Engineering Report Repository.

- A Bidders Q&A Webinar will likely be conducted soon after CFP issuance. The webinar will be open to the public, but prior registration will be required.

Appendix A: Proposal Submission Guidelines

A.1. General Requirements

The following requirements apply to the proposal development process and activities.

- Proposals must be submitted before the appropriate response due date indicated in the Master Schedule.

- Proposing organizations must be an OGC member and familiar with the OGC Mission, Vision, and Goals. Proposals from non-members will be considered, if a completed application for OGC membership or a letter of intent to become a member if selected for funding is submitted prior to or along with the proposal. If you are in doubt about membership, please contact OGC at techdesk@opengeospatial.org.

- Proposals may address selected portions of the initiative requirements as long as the solution ultimately fits into the overall initiative architecture. A single proposal may address multiple requirements and deliverables. To ensure that Sponsor priorities are met, the OGC may negotiate with individual Bidders to drop, add, or change some of the proposed work.

- Participants selected to implement component deliverables will be expected to participate in the full course of interface and component development, TIEs, and demonstration support activities throughout Initiative execution.

- In general, a proposed component deliverable based on a product that has earned OGC Certification will be evaluated more favorably than one which has not.

- Participants selected as Editors will also be expected to participate in the full course of activities throughout the Initiative, documenting implementation findings and recommendations and ensuring document delivery.

- Participants should remain aware of the fact that the Initiative components will be developed across many organizations. To maintain interoperability, each Participant should diligently adhere to the latest technical specifications so that other Participants may rely on the anticipated interfaces during the TIEs.

- All Selected Participants (both cost-share and pure in-kind) must attend with **at least one of their technical representative per assigned thread to the Kickoff**. Participants are also encouraged to attend at least with one technical representative the *Demonstration Event*.

- No work facilities will be provided by OGC. Each Participant will be required to perform its PA obligations at its own provided facilities and to interact remotely with other Initiative stakeholders.

- Information submitted in response to this CFP will be accessible to OGC staff members and to Sponsor representatives. This information will remain in the control of these stakeholders and will not be used for other purposes without prior written consent of the Bidder. Once a Bidder has agreed to become an Initiative Participant, it will be required to release proposal content (excluding financial information) to all Initiative stakeholders. Commercial confidential information should not be submitted in any proposal (and, in general, should not be disclosed during Initiative execution).

- Bidders will be selected to receive cost sharing funds on the basis of adherence to the requirements (as stated in in the CFP Appendix B Technical Architecture) and the overall quality of their proposal. The general Initiative objective is for the work to inform future OGC standards development with findings and recommendations surrounding potential new specifications. Bidders are asked to formulate a path for producing executable interoperable prototype implementations that meet the stated CFP requirements, and for documenting the findings and recommendations arising from those implementations. Bidders not selected for cost sharing funds may still be able to participate by addressing the stated CFP requirements on a purely in-kind basis.

- Bidders are advised to avoid attempts to use the Initiative as a platform for introducing new requirements not included in the Appendix B Technical Architecture. Any additional in-kind scope should be offered outside the formal bidding process, where an independent determination can be made as to whether it should be included in Initiative scope or not. Items deemed out-of-scope might still be appropriate for inclusion in a later OGC Innovation Program initiative.

- Each Participant (including pure in-kind Participants) that is assigned to make a deliverable will be required to enter into a Participation Agreement contract ("PA") with the OGC. The reason this requirement applies to pure in-kind Participants is that other Participants will be relying upon their delivery to show component interoperability. Each PA will include a statement of work ("SOW") identifying Participant roles and responsibilities.

A.2. What to Submit

The two documents that shall be submitted, with their respective templates are as follows:

1. Technical Proposal: https://portal.opengeospatial.org/files/?artifact_id=80085

2. Cost Proposal: https://portal.opengeospatial.org/files/?artifact_id=80084

A **Technical Proposal** should be based on the Response Template and must include the following:

- Cover page

- Overview (Not to exceed two pages)

- Proposed contribution (Basis for Technical Evaluation; not to exceed 5 pages)

- Understanding of interoperability issues, understanding of technical requirements and architecture, and potential enhancements to OGC and related industry architectures and standards

- Recommendations to enhance Information Interoperability through industry-proven best practices, or modifications to the software architecture defined in RFQ Annex B o Knowledge of and access to geospatial data sets for the Arctic by providing references to data sets or data services

- Ideas for improving the requirements and for any development of videos and presentation material, if applicable

- Proposed work organized by technical activity type (this section will be considered in making the management evaluation of the proposal)

The Cost Proposal should be based on the two worksheets contained in the Cost Proposal Template and must include the following:

- Completed Pilot Cost-Sharing Funds Request Form

- Completed Pilot In-Kind Contribution Declaration Form

Additional instructions are contained in the templates themselves.

A.3. How to Transmit the Response

Guidelines:

- Proposals shall be submitted to the OGC Technology Desk (techdesk@opengeospatial.org).

- The format of the technical proposal shall be Microsoft Word or Portable Document Format (PDF).

- The format of the cost proposal is a Microsoft Excel Spreadsheet.

- Proposals must be submitted before the appropriate response due date indicated in the Master Schedule.

A.4. Questions and Clarifications

Once the original CFP has been published, ongoing authoritative updates and answers to questions can be tracked by monitoring the main public page of the project.

Bidders may submit questions via timely submission of email(s) to the OGC Technology Desk. Question submitters will remain anonymous, and answers will be regularly compiled and published on the CFP clarifications page.

OGC may also choose to conduct a Bidder's question-and-answer webinar to review the clarifications and invite follow-on questions.

Update to this CFP and links to the questions and clarifications will be posted in the main page of the project: http://www.opengeospatial.org/projects/initiatives/vt-pilot-2018.

Appendix B: Technical Architecture

This appendix provides descriptions of type of deliverables, OGC baseline, and identifies all requirements and corresponding work items.

B.1. Types of Deliverables

Deliverables can take the form of Documents or Implementations.

B.1.1. Documents

Engineering Reports (**ER**) and **Change Requests** (**CR**) will be prepared in accordance with OGC published templates. Engineering Reports will be delivered by posting on the (members-only) *OGC Pending directory* when complete and the document has achieved a satisfactory level of consensus among interested participants, contributors and editors. Engineering Reports are the formal mechanism used to deliver results of the Innovation Program to Sponsors and to the OGC Standards Program for consideration by way of Standards Working Groups and Domain Working Groups.

IMPORTANT	Participants delivering Engineering Reports should also deliver Change Requests that arise from the documented work.

B.1.2. Implementations

Services, **Clients**, **Datasets** and **Tools** will be provided by methods suitable to its type and stated requirements. For example, services and components (e.g. a WFS instance) are delivered by deployment of the service or component for use in the Initiative via an accessible URL. A Client software application or component may be used during the Initiative to exercise services and components to test and demonstrate interoperability; however, it is most often not delivered as a license for follow-on usage. Implementations of services, clients and data instances will be developed and deployed in all threads for integration and interoperability testing in support of the agreed-up thread scenario(s) and technical architecture. The services, clients, and tools may be invoked for cross-thread scenarios in demonstration events.

B.2. Baseline Architecture

B.2.1. OGC Reference Model

The OGC Reference Model (ORM) version 2.1, provides an architecture framework for the ongoing work of the OGC. Further, the ORM provides a framework for the OGC Standards

Baseline. The OGC Standards Baseline consists of the member-approved Implementation/Abstract Specifications as well as for a number of candidate specifications that are currently in progress.

The structure of the ORM is based on the Reference Model for Open Distributed Processing (RM-ODP), also identified as ISO 10746. This is a multi-dimensional approach well suited to describing complex information systems.

The ORM is a living document that is revised on a regular basis to continually and accurately reflect the ongoing work of the Consortium. Bidders are encouraged to learn and understand the concepts that are presented in the ORM.

This appendix refers to the RM-ODP approach and will provide information on some of the viewpoints, in particular the Enterprise Viewpoint, which is used here to provide the general characterization of work items in the context of the OGC Standards portfolio and standardization process, i.e. the enterprise perspective from an OGC insider.

The Information Viewpoint considers the information models and encodings that will make up the content of the services and exchanges to be extended or developed to support this initiative. Here, we mainly refer to the OGC Standards Baseline, see section Standards Baseline.

The Computational Viewpoint is concerned with the functional decomposition of the system into a set of objects that interact at interfaces – enabling system distribution. It captures component and interface details without regard to distribution and describes an interaction framework including application objects, service support objects and infrastructure objects. The development of the computational viewpoint models is one of the first tasks of the Pilot, usually addressed at the Kickoff.
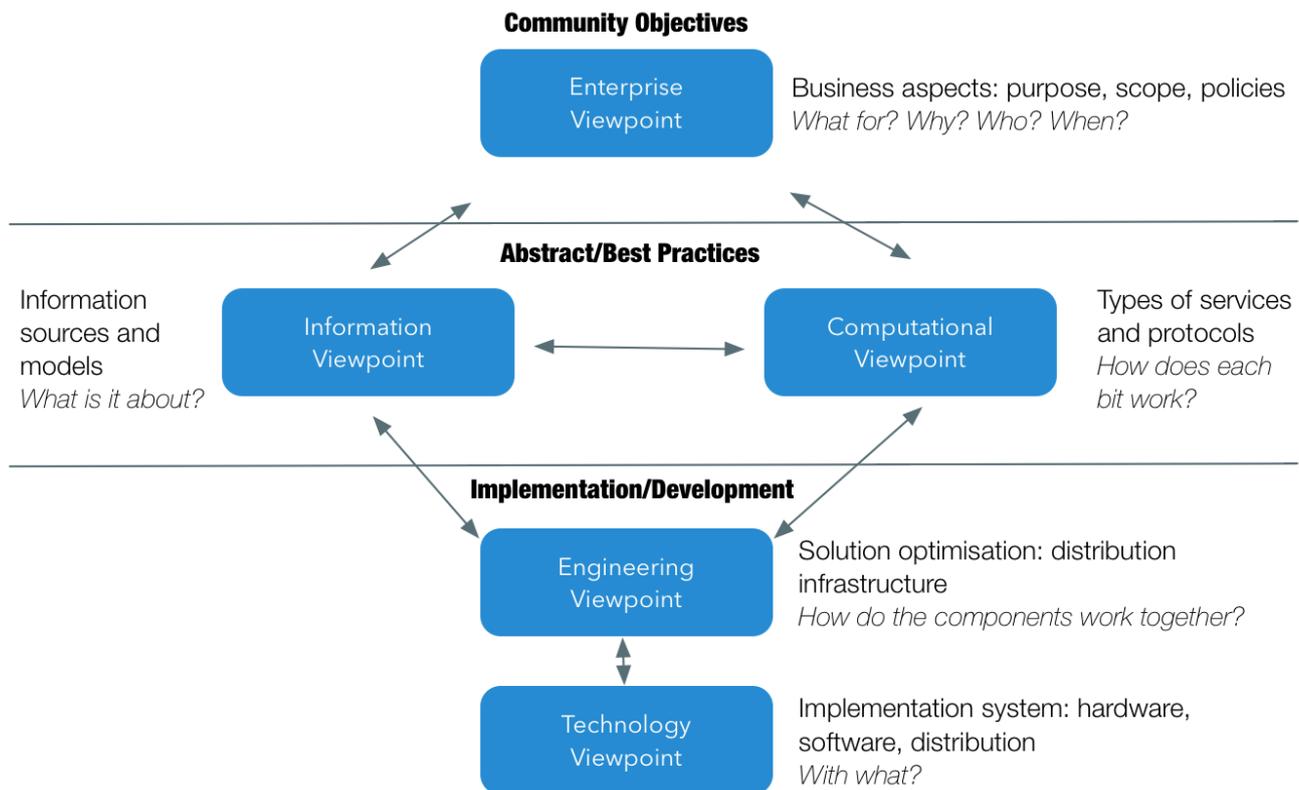
Figure 2. Reference Model for Open Distributed Computing

The Engineering Viewpoint is concerned with the infrastructure required to support system distribution. It focuses on the mechanisms and functions required to:

a. support distributed interaction between objects in the system, and

b. hides the complexities of those interactions.

It exposes the distributed nature of the system, describing the infrastructure, mechanisms and functions for object distribution, distribution transparency and constraints, bindings and interactions. The engineering viewpoint will be developed during the Initiative, usually in the form of TIEs, where Participants define the communication infrastructure and assign elements from the computational viewpoint to physical machines used for demonstrating Initiative results.

B.2.2. OGC Standards Baseline

The OGC Standards Baseline is the complete set of member approved Abstract Specifications, Standards including Profiles and Extensions, and Community Standards.

OGC standards are technical documents that detail interfaces or encodings. Software developers use these documents to build open interfaces and encodings into their products and services. These standards are the main "products" of the Open Geospatial Consortium and have been developed by the membership to address specific interoperability challenges. Ideally, when OGC standards are implemented in products or online services

by two different software engineers working independently, the resulting components plug and play, that is, they work together without further debugging. OGC standards and supporting documents are available to the public at no cost. OGC Web Services (OWS) are OGC standards created for use in World Wide Web applications. For this Initiative, it is emphasized that all OGC members have access to the latest versions of all standards.

Any Schemas (xsd, xslt, etc.) that support an approved OGC standard can be found in the official OGC Schema Repository.

The OGC Testing Facility Web page provides online executable tests for some OGC standards. The facility helps organizations to better implement service interfaces, encodings and clients that adhere to OGC standards.

B.2.3. OGC Best Practices and Discussion Papers

OGC also maintains other documents relevant to Innovation Program initiatives, including Engineering Reports, Best Practice Documents, Discussion Papers, and White Papers.

B.3. Requirements

Sponsors are interested in improving the dissemination of GeoINT data. Vector Tiles provide an efficient and effective method of delivering GeoINT data that is queried, edited and compact in file size. Sponsors are interested to have Vector Tile Standardization in the following cases:

- OGC Web Services (WFS and WMTS)

- Denied, Degraded, Intermittent, or Limited Bandwidth (DDIL) container format (GeoPackage)

The extensions will serve as basis for National System for Geospatial Intelligence (NSG) Profiles.

Several OGC Initiatives and on-going standardization activities are relevant to this Initiative:

- OGC Testbed 12: Vector Tiling Implementation Engineering Report (OGC16-067r4) discusses the topic of implementing vector tiles in an OGC GeoPackage. It also provides the Tile Encoding approach using GeoJSON.

- Testbed 12 Vector Tiling Engineering Report (OGC 16-068r4) provides on the general aspects of vector tiling, include tiling approaches and strategies, tiling schemes, data coherence, simplification, scalability and styling.

- OGC Testbed-13: Vector Tiles Engineering Report (OGC 17-041) captures the

evaluation of existing vector tiling solutions. The evaluation was used to define a conceptual model that integrates elements from different approaches to vector tiling. The implementations integrated vector tiles containing World Geodetic System 1984 (WGS84), European Terrestrial Reference System 1989 (ETRS89) and British National Grid projection data, standards based tile schemas and moving features. Best practice guidelines for the use of Symbology Encoding (SE) and Styled Layer Descriptor (SLD) were also provided ensuring the service was optimized for analysis and low-bandwidth networks. The report concluded with an investigation on how existing OGC services may be extended with the necessary capabilities enabling the full range of geometry types and tiling strategies to support vector tiling.

- Since OGC ER 17-041 was published the OGC has started implementation work of a draft Web Feature Service 3.0 based upon OpenAPI. This work is being captured at: https://github.com/opengeospatial/WFS_FES. This work has a new architecture that will be reused for the WFS 3.0 extension work.

This Pilot will propose several draft standard(s) including: a Conceptual abstract model for vector tiles that can be used across OGC standards, and extensions for WFS 3.0, WMTS 1.0 and GeoPackage 1.2. Servers and Clients will be developed to demonstrated the feasibility of the proposed solution.
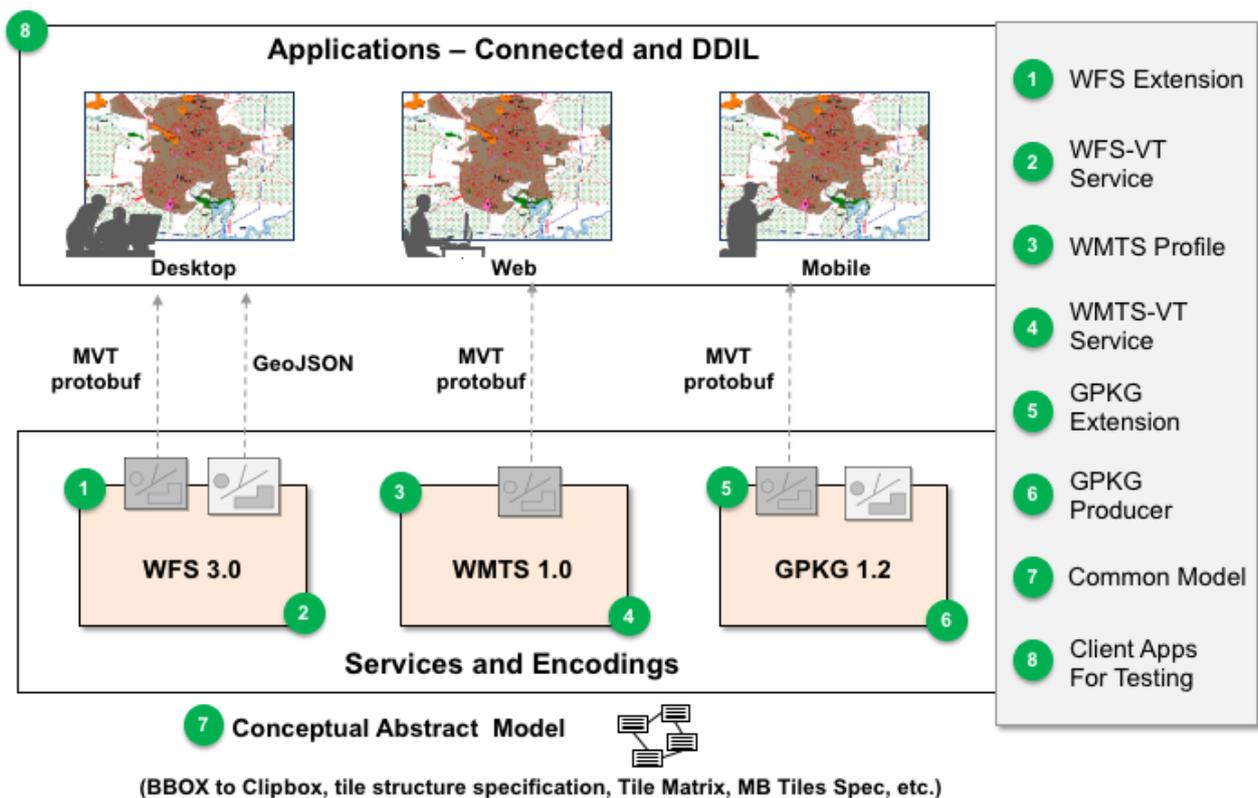

Figure 3. Architecture of the Pilot

A conceptual abstract model will be developed that captures the information about the tiles structure. That conceptual model will be used as a basis to provide vector tile data in WFS, WMTS and GeoPackage. The conceptual abstract model will provide the details about the following:

- Tile size

- Tile scheme

- Tile data format

- Tile projection

- Extent of data

- Zoom range

- Dimension

The proposed conceptual model will try to accommodate the Mapbox Vector Tile Specification. It is expected that the tiles will be delivered in two encodings:

1. Google Protocol Buffers (a.k.a., protobuf) as defined by Mapbox Vector Tiles

2. GeoJSON

Various clients shall be developed to access the WFS and WMTS Services as well as to interact withe GeoPackage files. Expected clients can be Desktop Clients, Web Clients and Mobile Clients.

The extensions developed shall be based on the following "base" standards and guides:

- WFS 3.0 Draft Implementation to create a Vector Tiling Extension Implementation https://rawgit.com/opengeospatial/WFS_FES/master/docs/17-069.html

- WMTS 1.0 Standard to create a Vector Tiling Extension Implementation http://portal.opengeospatial.org/files/?artifact_id=35326

- GeoPackage 1.2 Standard http://www.geopackage.org/spec120/index.html#_ogc_geopackage_encoding_standard

- Guide to create a GeoPackage Community Extension http://www.geopackage.org/extensions.html

- OGC Tile Matrix Set Standard Candidate 17-0803 https://portal.opengeospatial.org/files/79767

B.4. Technical Deliverables

The following subsections provide details surrounding the technical deliverables for this Initiative. Management deliverables are described in Appendix A Management Requirements.

D001: WFS 3.0 Extension Engineering Report – A WFS 3.0 Extension written as a draft OGC standard. The report shall take into account the WFS extension approach documented in Testbed 13. The WFS 3.0 standard is written as a RESTful reusable OpenAPI set of components with responses in JSON and HTML.

D002: WFS Vector Tiles Server – A WFS Service build as WFS 3.0 Tiles Server Extension as describe in [D001] It shall take into account recommendations from the OGC Testbed-13: Vector Tiles Engineering Report (OGC 17-041). The Server shall have as an output Mapbox Vector Tile encoded as Google Protocol Buffers and GeoJSON. The server can provide other outputs as well.

Two Servers are expected to be developed.

D003: WMTS Profile Engineering Report – A WMTS Profile written as a draft OGC standard The report shall take into account the proposed WMTS Extension and Change Request 517 (TB13: Vector Tiling Support). The profiles shall be based on WMTS 1.0 standard.

D004: WMTS Vector Tiles Server – The Server will prototype the profile described in [D003]. The Server shall have as an output Mapbox Vector Tile encoded as Google Protocol Buffers. The server can provide other outputs as well.

Two Servers are expected to be developed.

D005: GeoPackage 1.2 Vector Tiles Extension Engineering Report – An extension to Geopackage 1.2 written as a draft OGC standard that describes the mechanism to store and retrieve vector tiles in GeoPackage.

D006: GeoPackage 1.2 Producer – An implementation that is able to store and retrieve vector tiles in GeoPackage as described in [D005].

D007: Conceptual Model – A Conceptual abstract model for Vector Tiles, written as a draft standard that can can provide the framework to serve Vector Tiles in different OGC Standards (e.g. WFS, WMTS and GeoPackage). It should be general enough to fulfill all the requirements and should be compatible with Mapbox Vector Tile Specification. It should be compatible with a GeoJSON encoding. Applicable concepts from other OGC specifications, such as the OGC Tile Matrix Set Standard Candidate (17-0803), should also be taken into account.

D008: WFS Client – A client that interacts with the WFS Vector Tiles Server.

D009: WMTS Client – A client that interacts with the WMTS Vector Tiles Server.

D010: GeoPackage Client – A client that interacts with the GeoPackage Vector Tiles data.

D011: Summary Engineering Report - A report that summarizes the initiative including outputs, lessons learnt and recommendations.

B.5. Additional Notes about Requirements and Deliverables

Bidders are permitted to elaborate on these high-level flows to provide further detail in their proposals so long as the general nature of the CFP preplanning requirements is preserved.

Then during Kickoff, Participants (guided by the Initiative Architect) will refine this architecture and settle upon specific use cases and interface models to be used as a baseline for subsequent development work. This will ensure a mutual understanding of the detailed interfaces that will support component interoperability.