Eyes in the sky to
feet on the ground

ogc.org/disasterspilot

OGC Disaster Pilot 2021
Call for Participation (CFP)

Version 1.1 - 20 April 2021

Table of Contents

Chapter 1. Introduction

The Open Geospatial Consortium (OGC®) is releasing this Call for Participation ("CFP") to solicit proposals for the **OGC Disaster Pilot 2021** (also called "Pilot"). The goal of this Pilot is to further improve the ability of key decision makers and responders to discover, manage, access, qualify, share, and exploit location-based information in support of disaster preparedness and response and multi-hazard risk analysis.

Government agencies worldwide are producing huge streams of observation data, industry is innovating with remarkable analytics and Artificial Intelligence (AI) tools, and yet common disasters like disease, flooding and wildfires are still creating almost unimaginable social and economic impacts. What is missing? A critical component is that these amazing systems still don't talk to each other as parts of a common Spatial Data Infrastructure (SDI). The whole is less than, not greater than the sum of the parts. With the OGC Disaster Pilot 2021, the response community has the opportunity to bridge this divide, bringing together the Disaster SDI puzzle pieces that connect the right players from the data providers all the way to the first responders and the decision makers and everyone in between, forming a pattern that can adapt to any disaster, any region, any combination of data sources and tools.

The challenge is more urgent than ever as climate trends worsen the frequency and effects of a range of disasters, from storms and floods to drought, wildfire, and crop failure. These effects are further complicated by health impacts in stressed communities. It is increasingly clear that there is neither time nor space to wait for the puzzle pieces to somehow fall into place.

What OGC and its industry, government and academic members do is to make it easier and faster to fit those puzzle pieces to the pattern when needed, because the immense array of complex combinations of technological, architectural, standardization and operational requirements have been rigorously tested and documented in initiatives like the Disaster Pilot. It is both essential and central to the OGC mission of making geospatial information FAIR (Findable, Accessible, Interoperable, Reusable).

1.1. Background

Building on the success and outcomes of the Disasters Resilience Pilot as well as other Innovation Program (IP) initiatives, OGC is now preparing to execute Disaster Pilot 2021. A key output from previous efforts has been recognition and acknowledgement of the need to address:

- Key components in the value chain,

- Stakeholder-identified value chain gaps,

- Optimal workflows and services necessary to produce both analysis ready data (ARD) and decision ready information (DRI) products and services so as to support timely decision making.

NOTE	By some estimates, 80% of response time is spent procuring and preparing data, so that 20% can be spent learning from it.

The vision of this initiative revolves around bringing the technological pieces together and increasing stakeholder engagement, in order to reduce the preparation time we can no longer afford, and accelerate our ability to transform data from observation into decision. This will require bridging the divides between providers, responders and other stakeholders, forming a connected ecosystem of data and technologies, and developing the capacity to produce DRI products that answer decision makers' questions almost as fast as they can be posed.

A disaster can be overwhelming, expected in some fashion but still unique in its details and progression, often piling on to or cascading into additional crisis situations. Preparation and coordination of scalable response capacity can, however, meet this challenge. Envisage that disaster relief forces from supporting jurisdictions quickly integrate and analyze vast streams of real time data from multiple sources to monitor the evolving situation and plan their responses. Hybrid scalable cloud-based systems bring advanced AI processing, machine learning algorithms, and simulation models right to where earth observation (EO) and other data are already uplinked, prepared, and curated, generating ARD products with the characteristics, scale and speed that the complex situation demands. Convenience Application Programming Interfaces (API's), as well as edge computing devices and download-and-go GeoPackage containers and viewers, bring DRI directly to field workers' mobile devices even in resource-constrained, low-connectivity areas.

Meanwhile, Web publication of "structured data" that link well-known content with up-to-the-minute situation details enables search engines to push disaster-relevant information up in search results and help the public to stay on top of fast-moving events. All of this is possible through the preparation of technologies, geospatial standards, and data sharing arrangements that bring the right information at the right time to the right people in the right place.

The Scope

The technical scope of the Pilot will revolve around a key set of significant technology trends and related standards:

1. **Integrating and Transforming Provider Data**: Hybrid applications-to-the-data EO cloud exploitation platforms that seamlessly bring analysis-ready imagery, in situ, social, economic, environmental, health, and other data streams into scalable cloud environments where advanced processing, modeling, and algorithms can be directly and flexibly applied to them.

2. **ARD and DRI Services**: assessing and validating ARD standards, then integrating both space-based and local data sources on demand, providing targeted information products to local analysts and field responders through modern convenience API's, optimized hybrid-cloud services, and mobile-ready online-offline Geopackage tools.

3. **Web Search Optimization for Disasters**: Web publication of linked "structured data" that connects well-known local geography with up-to-date conditions, observations, and predictions.

The Mission

The Pilot mission is to develop capabilities and practices that are able to address the full cycle of disaster management across a wide range of hazards, including but not limited to:

1. Landslides

2. Flooding and Inundation

3. Pandemics

4. Droughts

5. Wildfires

6. Hurricanes

7. Maritime Domain Oil Spills

The Focus

In order to successfully implement and test critical technical and organizational aspects of the envisioned ecosystem, this CFP focuses on initial scenarios that address hazard early warning, monitoring, vulnerability assessment, disaster detection, impact awareness, and disaster response related to:

1. Landslide / flooding hazards and pandemic impacts within the Rímac and Piura river basins in Peru.

2. Flooding hazards and pandemic impacts within the Red River basin in Manitoba, Canada

3. Integration of Health and EO data and services for pandemic response in a region of the United States.

Initial scenarios will integrate social, economic, health, and environmental, and other information to address key indicators of risk, vulnerability, and impact identified by the sponsors. This information will directly influence the scope and nature of disaster and pandemic response

activities.

Components and solutions implementing these initial scenarios are anticipated to be portable and scalable for testing and application by the sponsors and identified stakeholders in other geographic locations. Additional focus areas and natural hazards types (e.g. Droughts, Wildfires, Oil Spills) may be selected for follow-on scenarios by Pilot sponsors subject to availability of additional funding. Respondents to this CFP may address additional focus areas of interest in their responses, in order to inform potential development of follow-on Pilot activities.

(It's) The People

While the objectives of an OGC Pilot are primarily technical, it is true that effective organizational and personal collaborations are just as important. In disaster management and response situations, physical analysis and synthesis centers have often been shown to foster critical exchanges of knowledge and effective plans for action, providing the rapid feedback loops required for timely decisions. The Pilot will include a series of workshops as well as other outreach activities intended to involve initiative stakeholders — sponsors, participants, and other collaborators — in designing and evaluating the technical capabilities that the Pilot will prototype. These activities will also be designed to model approaches to reproducing the impact of physical synthesis centers in a distributed environment by leveraging the sorts of virtual collaboration tools that have become both necessary and remarkably effective in recent times.

1.2. OGC Innovation Program Initiative

This Pilot 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 120 initiatives have been conducted. Coordinated and managed by the OGC IP Team, each initiative has the goal to stepwise increase Technology Readiness Levels (TRL) for geospatial IT solutions, including software architecture, interface design, information and data models, as well as related standards and specifications. Run globally, the Innovation Program further validates and tests geospatial technology based on OGC standards, identifies future OGC standardization work items, and builds know-how in applying existing standards to real world spatial data sharing challenges.

1.3. Benefits of Participation

This Initiative provides a unique opportunity to work jointly with a full range of stakeholders, from EO data providers and relief organizations to field responders, towards the goal of applying standards-based geospatial IT solutions to real problems of marshaling coordinated, effective responses to complex disaster scenarios.

The outcomes are expected to shape the future of disaster management ecosystems through user-centric interoperability arrangements, identification of critical data sharing challenges and the delivery of cloud computing scale and agility to field personnel and relief organizations when and where they need it. Pilot sponsorship supports this vision with cost-sharing funds to largely

offset the costs associated with development, engineering, and demonstration of these outcomes. This offers selected Participants a unique opportunity to recoup a significant portion of their initiative expenses.

1.4. Master Schedule

The following table details the major Initiative milestones and events.

Milestone	Date	Activity
M01	21 April 2021	Release of Call for Participation (CFP)
M02	21 May 2021	Responses due
M03	4 June 2021	Participant selection and agreements
M04	9-10 June 2021	Virtual kick-off meeting
M05	14-15 July 2021	Workshop #1: critical indicators and data flow coordination
M06	22 September 2021	Workshop #2: guidance for disaster readiness
M07	30 October 2021	Draft Pilot Report and Guides
M08	18 November 2021	Final Pilot Report and Guide
M09	08 December 2021	Final Pilot Demonstration
M10	23 December 2021	Pilot Report, Guide & Video Public Release

Table 1. Master schedule

Chapter 2. Technical Architecture

This section provides the initial draft technical architecture and identifies all requirements and corresponding work items. It references the OGC Standards Baseline, i.e., the complete set of member approved Abstract Specifications, Standards including Profiles and Extensions, and Community Standards. Further information on the OGC standards baseline can be found online.

The goal of this Pilot is to explore and advance geospatial standards-based solutions for improving disaster management, by developing prototypical components and services that utilize modern cloud architecture and next generation technologies to optimize collaborative workflows that are able to rapidly and scalably provision ARD and DRI products, services, and applications. The sponsors of this activity anticipate opportunities to seamlessly and efficiently transition from these prototypical capabilities into operational ones following the conclusion of the Pilot effort. The activity will address the following key components of a geospatial information flow for disaster management operations:

- **Reduced Time to Discover, Access and Transform Data:** Near-real-time cloud-based discovery, processing, and access of analysis ready geospatial data (ARD) from diverse sources.

- **Analysis and Decision Ready Services:** Analysis, visualization, and collaboration processes enabling generation of situation-appropriate , decision-ready information and indicators (DRI).

- **Decision Support:** On-demand and event-driven dissemination of DRI to responders, decision makers, and other disasters stakeholders.

- **Mobile Devices:** Usage of offline data containers to work with DRI in the field under connected-disconnected conditions.

- **Work the Web:** Enhancements to data services to optimize discoverability by mainstream search engines and potential of linked data approaches to improve public awareness.

2.1. Problem Statement and Research Questions

The Pilot will address these challenges:

Disaster management frequently encounters key data sharing challenges that make present solutions more difficult, slower, and less effective than they could be:

- Data, particularly EO data, can be hard to find, complicated to share, difficult to access, and slow (or unable) to be processed into common forms that are suitable for analysis and integration.

- Integration of diverse data sources into end-user information products can in turn be both arduous and slow to adapt to the needs of particular disaster situations and user / responders.

- End-user information products in their volume and frequency often overwhelm the

connectivity available to responders and relief organizations in impacted regions.

- Local information such as in situ sensor observations, field reports, and volunteered information, are often difficult to collect and even more difficult to incorporate back into provided information products.

- Up-to-date and actionable event information, even when openly available, can be difficult for the affected public to find and stay on top of.

The Pilot will explore solutions to these challenges in consideration of the following research questions:

- How can space-based EO data most efficiently be staged to cloud-based storage for fast, scalable processing?

- What is the best definition of and approach to ARD for disaster management applications?

- Can new file-based approaches such as SpatioTemporal Asset Catalog (STAC) replace or compliment existing registry and catalog solutions? What are the pros and cons?

- How feasible and useful is ad hoc definition and generation of decision ready information? What documentation of provenance and workflow is needed for efficient operation?

- How much processing needs to sit with the data? When do we combine processing with data, data with processing? In the same cloud, different clouds?

- What are the challenges of integrating spatial data of different types from different sources (weather and climate, federal, statistical and socio-economic, provincial and local data); possibly stored in separate cloud environments?

- What role should models, whether primarily functional or machine learning based, play in decision ready information products for disaster management. What special treatment do they require?

- How can we make applications and data available where needed for multiple stakeholders, including the public?

- How can the insights and solutions created by in-person geospatial fusion and analysis centers be replicated virtually with distributed collaboration and computing tools?

- How can field workers and the public discover current and actionable information in poorly connected, sometimes poorly resourced environments?

- How to handle security (privacy, propriety, authenticity, integrity), particularly in emergency situations?

- How can field data and observations (e.g. health) be collected and funneled back into analysis environments to support up-to-date awareness?

- What is a simple but effective model for public and population health information?

2.2. Aim

Explore and advance geospatial standards-based solutions for improving disaster management

by rapid prototyping and experimentation with Web APIs. Exercise discovery, virtual collaboration, dynamic integration of data from various sources, and connected-disconnected dissemination. Understand how structured data can help with search engine optimization and develop GeoPackage viewers that effectively support field operations in disaster management situations.

2.3. Previous Work

- Disasters Interoperability Concept Development Study (CDS)

- Disasters Resilience Pilot 2019

- EO Cloud Platform CDS

- Health Spatial Data Infrastructure CDS

- Earth Observation Applications Pilot

- Testbed 16 Earth Observation Clouds Thread

- Smart City Interoperability Reference Architecture (SCIRA)

- IMIS IoT Pilot

2.4. Scenario & Requirements

Pilot Scenario

Previous work inside and outside of OGC has delineated cycles of activity phases involved in disaster management, all of which depend on getting the right information to the right people at the right time.
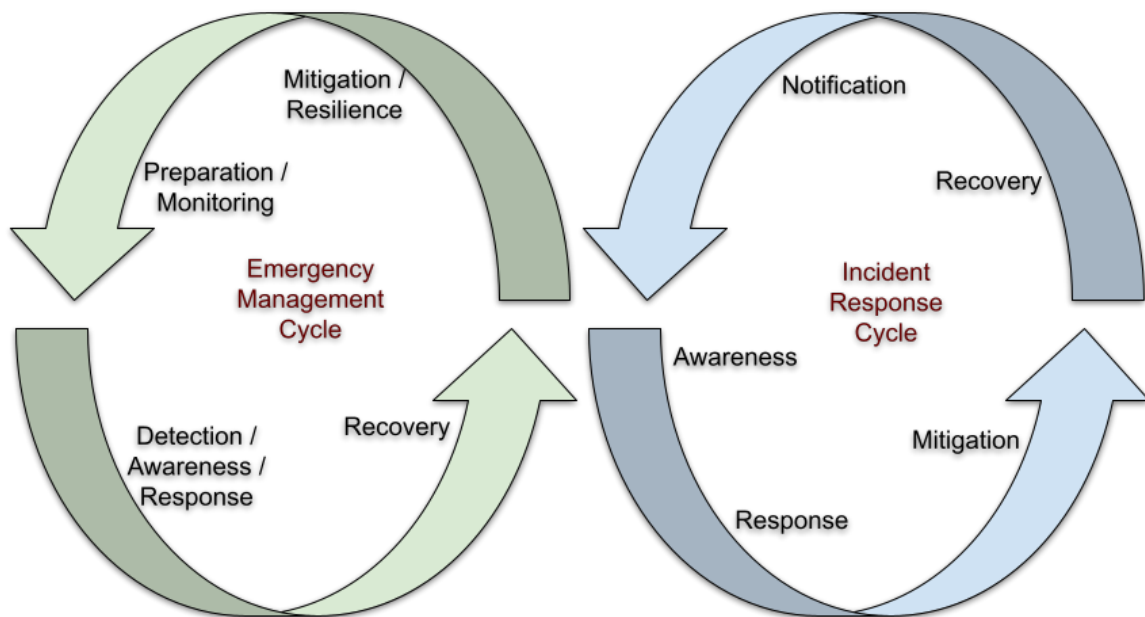
Figure 1. Emergency management and incident response phases

Within the longer term emergency management cycle are shorter term incident response phases for which the ability to move fast and adapt are particularly important. The implementation and testing of complete emergency management lifecycles is beyond the scope and timeframe of the current initiative; this Pilot will focus on a core set of short-fuse tasks leading up to and into incident response activities:

- Risk and vulnerability assessment and preparation.

- Hazard monitoring and threat prediction.

- Disaster detection and tracking.

- Impact awareness and reporting.

- Disaster response and mitigation activities.

Support for these activities in the pilot will target landslide and/or flooding hazards affecting three river basins in two geographic regions:

1. Landslide and flooding hazards within the Rímac and Piura river basins in Peru, in collaboration with the Peruvian Space Agency (CONIDA) as well as other Peruvian government and non-governmental organizations.

- ◦ Example data sources

  - ▪ PeruSAT-1

  - ▪ LandSAT

  - ▪ Sentinel-1

  - ▪ National Water Authority ANA hydrological meteorological stations

  - ▪ Geophysical Institute of Peru IGP seismic network

2. Flooding hazards within the Red River basin in Manitoba, Canada, in collaboration with Natural Resources Canada as well as other Canadian federal, provincial, and non-governmental organizations. Depending on funding arrangements, the study area may be extended into U.S. portions of the Red River basin.

   - ◦ Example data sources

     - ▪ RADARSAT Constellation Mission available through NRCan's Earth Observation Data Management System

     - ▪ Worldview (MAXAR)

     - ▪ Weather and climate data - e.g., Environment and Climate Change Canada's Canadian Ice Service and GeoMet Weather Service.

     - ▪ Federal data – e.g., NRCan's Canadian Geospatial Platform/Open Maps, Statistics Canada socio-economic data.

     - ▪ Provincial data – e.g., Manitoba Open Government Portal (Open MB)

     - ▪ Local data – e.g., Municipal information, field observations

3. Pandemic impact and response in an additional region of the United States, focusing on health SDI and EO datasets to be provided by Pilot sponsors.

Work in each target region will incorporate reporting and assessment of COVID-19 pandemic impacts on affected populations. This information will be used to influence the scope and nature of supported disaster response activities.

Pilot requirements

- **Req 1** Visualization of the right information at the right time using GeoPackage data containers and GeoPackage viewers, with generation of GeoPackage offline containers to allow taking all relevant information into the field even given connectivity issues. Map Markup Language (MapML) technology shall also be explored in the context of visualization.

- **Req 2** Access by disaster relief forces to data from multiple sources that can be integrated and analyzed quickly, applying AI, simulation models, and other analytical tools to distill the relevant information.

- **Req 3** Evaluation of the maturity of Applications-to-the-Data (A2D) specifications that provide the necessary interfaces to support ad-hoc deployment, execution, and result

provisioning for the applications and allow the provisioning of Earth observation data processing applications to data and processing platforms in an interoperable way.

- **Req 4** Enforcement of access controls across platform boundaries (federated/delegated access) and identity management.

- **Req 5** Demonstration of how the OGC-API suite can be integrated with JSON-LD and aligned with schema.org to enhance the semantic definition of the OGC- API schemas and give a clear path for OGC-API generated content to be incorporated into web search engine indexes.

- **Req 6** User interface compliance to Web Content Accessibility Guidelines (WCAG) 2.1.

- **Req 7** Access and use of metadata to enable geospatial dataset discovery and access considering multilingual requirements for metadata (English, French, Spanish).

- **Req 8** Support for notifying stakeholders that new/updated disaster products are available (e.g., push notifications).

- **Req 9** Support for national-level dissemination platforms/solutions enabled by Commercial Off the Shelf (COTS) and Open Source spatial data infrastructure technology (e.g., Canadian Geospatial Platform, USGS GeoPlatform, AmeriGEO GeoPlatform).

- **Req 10** Facilitation of two workshops to present intermediate Pilot outcomes and receive feedback from Pilot collaborators.

2.5. Architectural Viewpoints

Pivotal Points of Interoperability

The following figure illustrates the pivotal points of interoperability (PPI's) and user feedback loops that determine whether EO data can be effectively deployed to support disaster management and response.
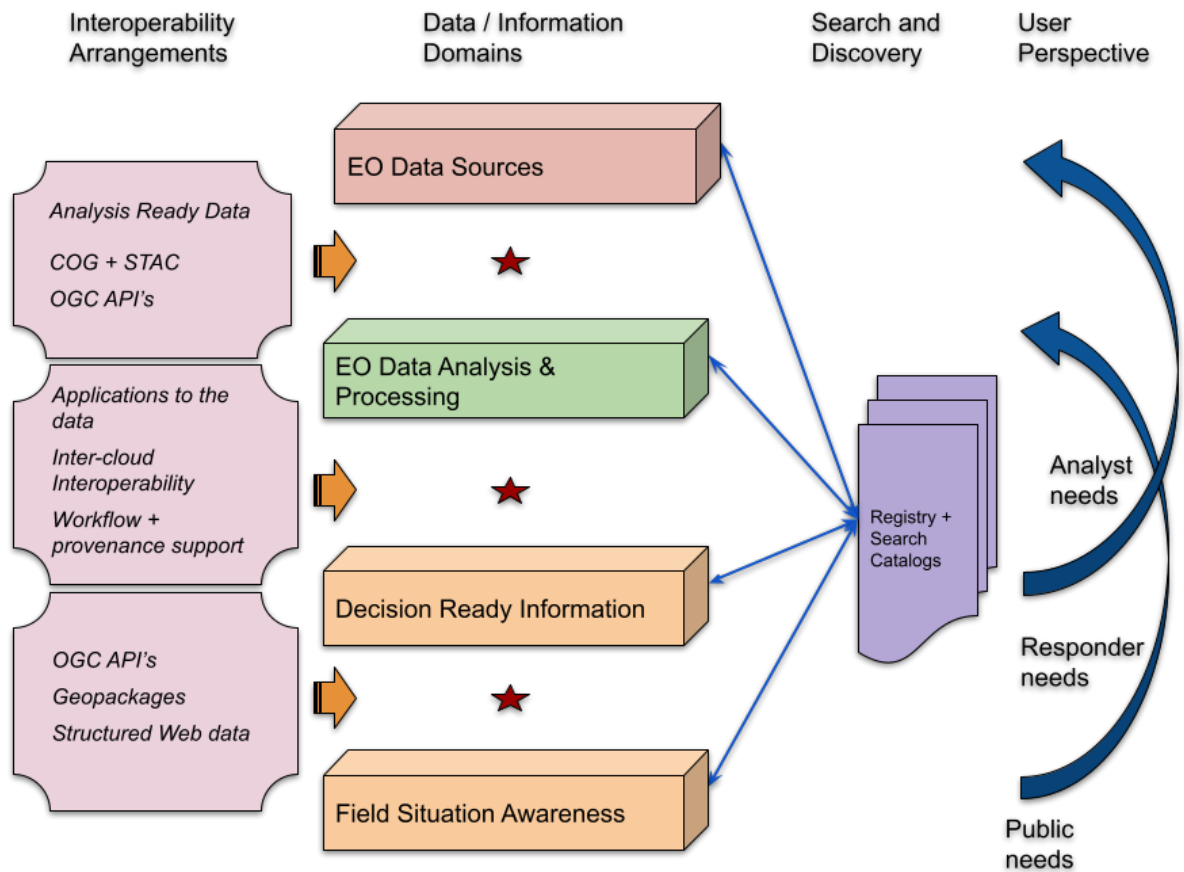
Figure 2. Pivotal points of interoperability (PPI's)

These pivotal points have been identified as particular interoperability challenges for data sharing that successfully brings value from "**eyes in the sky**" to "**feet on the ground**". For this reason, the Pilot design is intended to test promising tools, technologies, standards, and collaborative strategies for addressing interoperability at these critical interchange points within the overall Pilot system. The figure illustrates not only the PPI's controlling data flows, but also the common role of a search and discovery function to direct those flows, and corresponding user feedback / collaboration mechanisms that lead to selection and configuration of data flows most impactful for a particular disaster situation.

Component Architecture

The following figure provides an overview of the component architecture to be implemented and tested during the pilot.
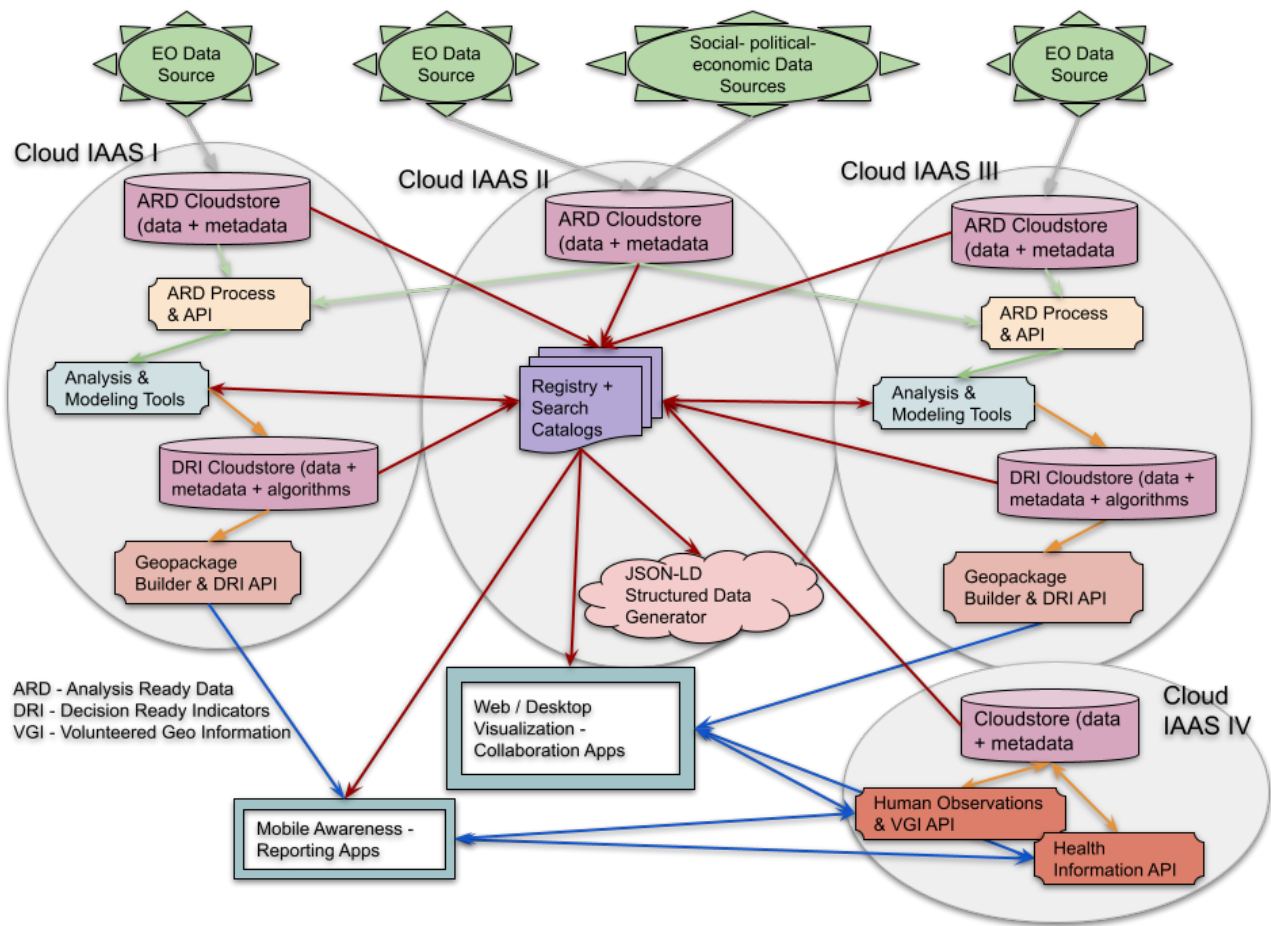
Figure 3. Overview of pilot component architecture

Almost all of the components in this ecosystem are to be implemented as a form of "As A Service (AAS)" virtual capability, whether infrastructure, data, information, application, or software. This design also recognizes that important EO and other data resources will generally be managed in more than one cloud or hybrid environment, requiring inter-cloud exchanges to support both application processing "close to the data" and ubiquitous cross-cloud search and discovery functions. In such an ecosystem, ubiquitous metadata is essential, represented by a Registry + Search component supported by metadata flow (red lines) between all of the other components. Other flows include raw data upload (gray), data flow (green), information flow (yellow) and application flow (blue or black).

User Perspective

The following figure presents user perspectives of the Pilot architecture that connect each user persona with the components / API's / applications that constitute each user's primary interface with that architecture. The six user personas are described in the table below. A critical element of successful disaster management is collaboration between stakeholders such as represented by these personas, both through sharing of data / information and through direct exchange of knowledge that leads to better ideas and actions.
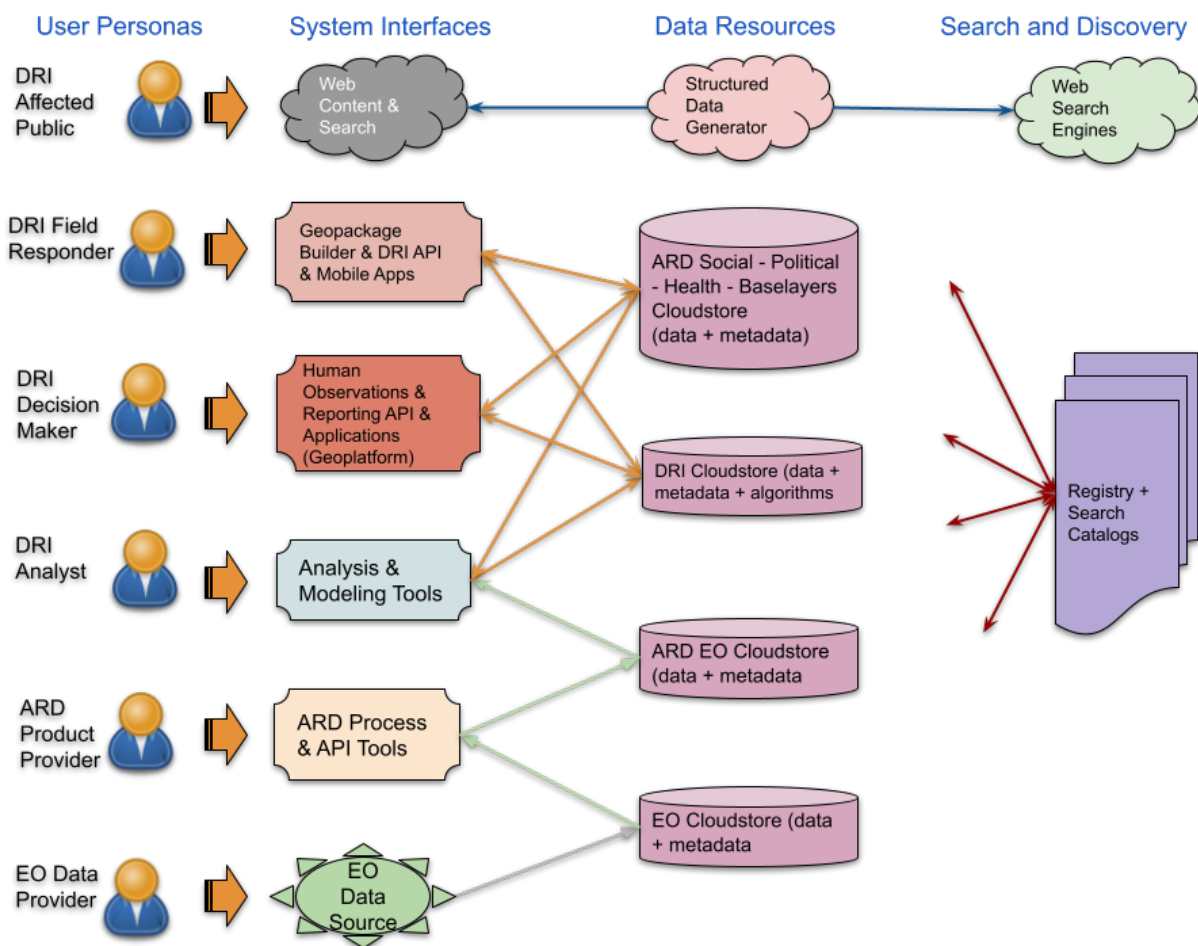
Figure 4. Overview of pilot user perspectives

*User	Application	Description
DRI Affected Public	Structured Web content	Paula, who suffers from asthma, lives in an area impacted by flooding and a moderate COVID prevalence. She needs to stay on top of safe access to supplies as well as news about both the chances of evacuation and arrangements for it to be protective of health during a pandemic.
DRI Field Responder	Mobile apps	Frank is a first responder with emergency medical training who makes home visits to vulnerable residents and supports flood evacuation efforts. He uses mobile apps (phone and/or tablet) that provide him information on risks, vulnerabilities, and resources. Apps also allow him to report health status, resource, or hazard observations.
DRI Decision Maker	Mobile & desktop apps	Danielle works for a relief agency planning and supervising outreach efforts. She works with a variety of apps and targeted information products to do this, as well as working with both field personnel and analysts to suggest new and improved information products.

*User	Application	Description
DRI Analyst	Desktop apps & cloud tools	Adam finds and analyzes a wide range of EO ARD and other data to support disaster management efforts. He works with information users and data providers to develop and deploy workflow recipes for useful decision ready information products.
ARD Product Provider	Cloud tools	Priya works with data providers and analysts to specify, set up tools for, and produce analysis ready, cloud hosted EO data products
EO Data Provider	Varies	Dimitri is an engineer for a satellite based EO organization. He works on both sensor tasking and on the ground segment processes that bring observation data to cloud hosting environments for product production and exploitation.

Table 2. User personas

2.6. Work Items & Deliverables

The following figure focuses on identity and wiring of the individual components being solicited for this Pilot. In many cases, multiple components of the same type and role are being requested in order to demonstrate interoperability of multiple platforms and technologies, as well as to provide a data-rich ecosystem for generating effective information products.

Figure 5. Pilot work items and deliverables (black lines indicate 2-way information flow)

Some of these components, such as EO data sources, will mostly be provided by Pilot sponsoring, supporting, and collaborating organizations. Other components are expected to be implemented primarily by selected participants, although some component instances may also be shared by sponsors, such as the Canadian Geospatial Platform (FGP). Except for mobile or pure desktop applications, all components are expected to leverage modern cloud platform architecture (i.e., infrastructure, data, information, and application/software services as well as community tools).

The following list identifies all document and component deliverables that are being sought to support the Pilot. All participants are required to participate in all technical discussions and support the development and testing of the overall Pilot system as well as the reports, videos, and other outreach activities with their contributions.

Documents

D001 OGC Disaster Pilot Summary Engineering Report

An Engineering Report which documents all work being executed, experiments conducted, analysis performed, the conclusions, and recommendations for future activities.

D002 OGC Disaster Pilot EO Data Provider Disaster Readiness Guide

A guide for EO data providers, ARD product providers, DRI analysts, and other supporting stakeholders on how to prepare and coordinate with others in order to leverage standards-based

cloud computing platforms in support of disaster management and response efforts.

D003 OGC Disaster Pilot JSON-LD Structured Data Engineering Report

An Engineering Report which documents using JSON-LD with OGC API's to generate structured web page data for search engine optimization of disaster related information.

D004 OGC Disaster Pilot EO Data User Disaster Readiness Guide

A guide for EO data users, relief organizations, field personnel, and other response stakeholders on how to prepare and coordinate with others in order to leverage standards-based cloud computing platforms in their disaster management and response efforts.

Components

D100 Data Discovery Components

Service(s) and associated application(s) supporting near-real-time registration, search, and discovery of ARD sources and decision ready information products (e.g., CCMEO's Canadian Geospatial Platform cloud infrastructure, catalogues, online dashboards, push notifications, etc.). The data discovery component will also support discovery of contextual social-political-health datasets as well as local observations reported from impacted areas.

D101-4 Analysis Ready Data Component

Cloud-based storage, processing, and service elements to support loading, preparation, and access to individual satellite-based observational datasets as well as other (e.g. demographic) datasets in forms suitable for analysis, visualization, and integration into decision ready information products.

D105-8 Analytical Processing Components

Analysis application elements (processing, workflow, and associated functions) that can be deployed to cloud platforms near to source datasets and support agile, rapid, and scalable generation of decision ready (e.g. indicator) information products. These products will usually be based on pre-existing, well known and documented "recipes" but may also be developed on the fly as disaster situations and understanding, as well as data availability, unfold.

D109 Structured Web Data Publishing Component

Component that draws from other Pilot components to generate and publish disaster-oriented web content that incorporates structured data, in order to make relevant and up-to-date decision ready information visible more prominently and specifically in major search engine results. This includes integrating OGC API services that provide such information with JSON-LD and aligning with schema.org in order to give a clear path for API resource content to be fully represented in web search engine indexes.

D110 Pandemic Health Spatial Data Information Component

Data and services component that implements a model for pandemic health SDI information based on draft findings of the OGC Health SDI CDS to support addressing a COVID-19 disease pandemic that overlaps with environmental disasters such as landslides and/or flooding. The

component shall interoperate with other Pilot components to collect health data from field personnel or other data sources, as well as provision health data for incorporation into information products that support field operations and health intervention decision making. Among the information components to be prototyped are identities and locations of health resources, such as health care facilities and major supplies. The component shall leverage standard identifiers such as GS1 GLN identification keys to accurately and consistently track these resources. The component shall also be evaluated for compatibility with Health SDI data provided by Pilot sponsors from a region of the United States.

D111-3 Decision Ready Information Components

Service and packaging elements deployed "near" to decision ready information products to make them discoverable and accessible to field application clients in environments of widely variable connectivity. This component shall support delivery of requested and/or subscribed information products as geopackages in order to address connected-disconnected operations.

D114-5 Mobile Analysis and Visualization Components

Mobile client application able to discover, request, and download decision ready information products as geopackages in support of disaster response field personnel, operations, and decision making during connected-disconnected operations

D116-7 Analysis, Visualization, Collaboration Components

Web / desktop client application able to interact with cloud based server components to discover, request, and download both ARD and DRI products for analysis and visualization by analysts and decision makers. The component shall also support virtual collaboration between distributed stakeholders both in the interpretation of such datasets, and in the design and selection of "recipes" for generation of decision ready information products. These "virtual fusion center" collaborations are expected to be mainly synchronous, but may on occasion require asynchronous interaction. Visualization approaches shall explore MapML implementations where possible.

D118 Field Information Awareness and Reporting Component

Mobile applications (e.g., based on the CCMEO developed NRCan Observer application) and cloud-based server components providing access to decision ready information products and reporting / data collection capabilities for field operation support in disaster preparation, management, and response.

D119-20 Cloud Infrastructure Component

Infrastructure-As-A-Service offering able to elastically provision virtual host and container-based computing as well as file / object storage and Internet connectivity that supports dataflows both within that infrastructure and between distinct cloud infrastructures and providers.

Chapter 3. Deliverables Summary & Funding Status

The following table summarizes the full set of deliverables. It is expected that cost-share funding will be available for all work items. Currently, many work items are marked as *funding pending* due to pending completion of some sponsor contracts. Updates to sponsor status will be provided in the section Corrigenda & Clarifications as they become available.

ID	No.	Document / Component	Funding Status
D001	*1*	Pilot Summary Engineering Report	funded
D002	*1*	EO Data Provider Disaster Readiness Guide	funding pending
D003	*1*	JSON-LD Structured Data Engineering Report	funded
D004	*1*	EO Data User Disaster Readiness Guide	funded
D100	*1*	Data Discovery Component	funded
D101-4	*4*	ARD Component	funded
D105-8	*4*	Analytical Processing Component	funded
D109	*1*	Structured Web Data Publishing Component	funded
D110	*1*	Pandemic Health Spatial Data Information Component	funded
D111-3	*3*	DRI Component	funded
D114-5	*2*	Mobile Analysis and Visualization Component	funding pending
D116-7	*2*	Web/Desktop Analysis, Visualization, & Collaboration Component	funding pending

ID	No.	Document / Component	Funding Status
D118	*1*	Field Observation and Reporting Component	funding pending
D119-20	*2*	Cloud Infrastructure Component	funding pending

Table 3. CFP Deliverables and Funding Status

ID	No.	Document / Component	Funding Status
D118	*1*	Field Observation and Reporting Component	funding pending
D119-20	*2*	Cloud Infrastructure Component	funding pending

Chapter 4. Miscellaneous

4.1. 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 an initiative architecture. The responses to this CFP should include the proposing organization's technical solution, cost-sharing requests for funding, and proposed in-kind contributions to the initiative.

Once the original CFP has been published, ongoing authoritative updates and answers to questions can be tracked by monitoring the CFP Corrigenda Table and the CFP Clarifications Table.

4.2. 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 Sponsors, 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.

4.3. Kick-off

The Kickoff is a virtual meeting (using GoToMeeting) 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.

4.4. Regular Teleconference and Interim Meetings

After the Kickoff, participants will meet on a frequent basis remotely via web meetings and teleconferences.

4.5. Workshop events

In the course of Pilot execution, two virtual workshops will be held to foster interchange and collaboration with stakeholders, including sponsors, supporters, participants, responsible government agency representatives, and inter- / non-governmental relief organizations. Participants will be required to take part in these workshops, the first of which will focus on critical data flows and indicators, while the second will bring together guidance for improved disaster readiness.

4.6. Development of Engineering Reports, Change Requests, and Other Documentary Deliverables

Development of Engineering Reports (ERs), Change Requests (CRs), videos, and other documentary deliverables will commence during or immediately after Kickoff.

Under the Participation Agreement (PA) contracts to be executed with selected Bidders, ALL Participants will be responsible for contributing content to project documents and videos, but the document Editors will assume the duty of being the primary document authors and coordinators.

4.7. 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.

4.8. Assurance of Service Availability

Participants selected to implement service components are expected to maintain availability of both services and supported datasets for a period of no less than six months after the Participant Final Summary Reports milestone.

Appendix A: Pilot Organization and Execution

A.1. Initiative Policies and Procedures

This initiative will be conducted 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.

A.2. Initiative Roles

The roles generally played in any OGC Innovation Program initiative include Sponsors, Bidders, Participants, Observers, and the Innovation Program Team ("IP Team"). Explanations of the roles are provided in Annex: 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. The Initiative Architect is 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.

A.3. Types of Deliverables

All activities in this Pilot will result in a Deliverable. These Deliverables can take the form of Documents, Implementations, and/or Videos.

A.3.1. Documents

Engineering Reports (ER), Guides, 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.

A.3.2. Implementations

Services, Clients, Datasets, Schemas, API documentation, and Tools will be provided by methods suitable to each type and stated requirements. For example, services and components (e.g., a WPS 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, the client software is most often not delivered licensed for follow-on usage. Implementations of services, clients, and data instances will be developed and deployed in all activities for integration and interoperability testing in support of the agreed-up activity scenario(s) and technical architecture. The services, clients, and tools may be invoked for cross-activity scenarios in demonstration events.

A.3.3. Videos

Each participant shall develop and deliver or participate in the production of a short video that can be used in outreach activities on a royalty-free basis. The videos will be free and clear to be placed on the OGC YouTube Channel and Project page with no restrictions. The video shall illustrate the initial challenge(s) and developed solutions. The video can be done using screen-capturing of clients or slides with (English) voice over. Participants shall cooperate with OGC in translation of videos to additional languages (e.g. French, Spanish) as needed, as well as incorporation in sponsor-produced summary videos. Good examples for videos are available from previous initiatives, such as Arctic Spatial Data Pilot (video 1, video 2), Vector Tiles Pilot (video), or Testbed-13 (video 1, video 2).

A.4. Proposals & Proposal Evaluation

Proposals are expected to be short and precisely addressing the work items a bidder is interested in. A proposal template will be made available. The proposal, including technical and financial details, has a page limit as defined in Appendix A. Details on the proposal submission process are provided in Appendix A: Proposal Submission Guidelines. The proposal evaluation process and criteria are described below.

A.4.1. Evaluation Process

Proposals will be evaluated according to criteria based on three areas: management, technical, 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.

At the Technical Evaluation Meeting (TEM), the IP Team will present Sponsors with draft versions

of the initiative system architecture 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, the IP Team will begin to notify Bidders of their selection to enter negotiations for potentially becoming initiative Participants. The IP Team will develop for each selected bidder a **Participant Agreement** (PA) and a **Statement of Work** (SOW).

A.4.2. Evaluation Criteria

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.

Technical Criteria

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

- Proposed solutions can be executed within available resources.

- Proposed solutions support and promote the initiative system architecture and demonstration concept.

- Where applicable, proposed solutions are OGC-compliant.

Cost Criteria

- Cost-share compensation request is reasonable for proposed effort.

- All Participants are required to provide at least some level of in-kind contribution (i.e., activities or deliverables offered that do not request 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. Participation may be fully in-kind.

A.5. Reporting

Initiative participant business/contract representatives are required (per the terms 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 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 Technical Progress Report and (2) a Business Progress Report. Both reports shall be delivered every second month by the first working day on or after the 4th of that month. Templates for both of these report types will be provided and must be followed.

The purpose of the 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.

Appendix B: Proposal Submission Guidelines

B.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, Technical Interoperability Experiments, 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 technical representative 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 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.

B.2. What to Submit

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

1. Technical Proposal: https://portal.ogc.org/files/?artifact_id=82493

2. Cost Proposal: https://portal.ogc.org/files/?artifact_id=82494

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

- Cover page

- Overview (Not to exceed one page)

- Proposed contribution (Basis for Technical Evaluation; not to exceed 1 page per work item)

- 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 Appendix B: Technical Architecture

- If applicable, knowledge of and access to geospatial data sets by providing references to data sets or data services

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.

B.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 shall be a Microsoft Excel Spreadsheet.

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

B.4. Questions and Clarifications

Once the original CFP has been published, ongoing authoritative updates and answers to questions can be tracked by monitoring this CFP.

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 table.

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 including questions and clarifications will be posted to the original URL of this CFP.

B.5. 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 developed

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. Non-members are welcomed to submit proposals as long as the proposal is complemented by a letter of intent to become a member if selected for.

- 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 an 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 subParticipants).

- 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 Participant Agreements will not require delivery any component source code to OGC.

  ◦ What is delivered instead is the behavior of the component installed on the Participant's machine, and the corresponding documentation of findings,

recommendations, and technical artifacts as contributions to the initiative's Engineering Report(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 C: Abbreviations

The following table lists all abbreviations used in this CFP.

API	Application Programming Interface
ARD	Analysis Ready Data
A2D	Applications to the Data
CCMEO	Canada Centre for Mapping and Earth Observation
CDS	Concept Development Study
CFP	Call for Participation
CR	Change Request
COG	Cloud Optimized GeoTIFF
DRI	Decision Ready Information
DWG	Domain Working Group
ER	Engineering Report
FGP	Federal Geospatial Platform
GML	Geography Markup Language
IoT	Internet of Things
IP	Innovation Program
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
JSON-LD	JSON Linked Data
ODC	Other Direct Costs
OGC	Open Geospatial Consortium
PA	Participant Agreement
POC	Point of Contact
PPI	Pivotal Point of Interoperability
Q&A	Questions and Answers
SDI	Spatial Data Infrastructure
SOW	Statement of Work
STAC	Spatiotemporal Asset Catalog
SWG	Standards Working Group
TC	OGC Technical Committee
TEM	Technical Evaluation Meeting
TIE	Technology Integration / Technical Interoperability Experiment

URL	Uniform Resource Locator
WCAG	Web Content Accessibility Guidelines
WG	Working Group (SWG or DWG)
XML	Extensible Markup Language

Appendix D: Corrigenda & Clarifications

The following table identifies all corrections that have been applied to this CFP compared to the original release. Minor editorial changes (spelling, grammar, etc.) are not included.

Section	Description
1.1 initial scenarios	Added 3. Integration of Health and EO data and services for pandemic response in a region of the United States.
2.4 Pilot Scenario	added 3. Pandemic impacts in an additional region of the United States, focusing on health SDI and EO datasets to be provided by Pilot sponsors.

The following table identifies all clarifications that have been provided in response to questions received from organizations interested in this CFP.

Question	Clarification
—	—