Open Geospatial Consortium

OGC Geotech Interoperability Experiment

Kick-off meeting

Scott Simmons, OGC
Mickaël Beaufils, GeoScience DWG
2202 2022

Call for participants results overview

- 39 answers
- Countries: France, US, UK, Germany, Switzerland, Austria, Spain, Japan, New Zealand
- Academia, Consulting, Public agencies, Software vendors
- Standard communities: bSI, OGC, AGS, DIGGS, CGI-IUGS

Agenda

- Welcome and overview of IE process – Scott Simmons, OGC
- Introductions – all attendees

- **Geotech IE main objectives – Mickaël Beaufils, BRGM**
- Presentation of IFC Tunnel GeoSubGroup work and data model - Jonas Weil, IC Group
- Detailed work packages description – Mickaël Beaufils
- Work Organization – Mickaël Beaufils and Scott Simmons

Founding organizations

- MINnD (Modélisation des informations interopérables pour les infrastructures durables) National Project, France
- Bureau de Recherches Géologiques et Minières (BRGM), France

ATLAS by AFNeT

Delegation for the Civil Engineering Domain

MINnD saison 2
Modélisation des INformations INteropérables pour les INfrastructures Durables

Mandate as leader for geotechnics

Géosciences pour une Terre durable
brgm

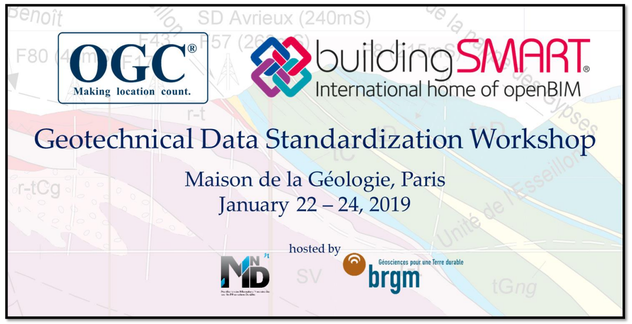
National project to enhance IT standards for the industry

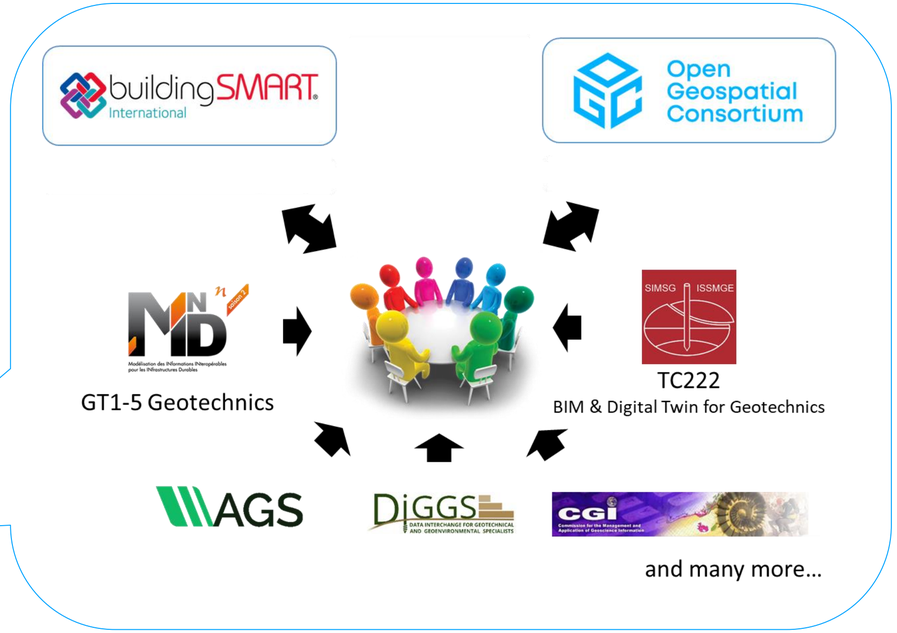
National project to extend OpenBIM capacities to infrastructure and their environment

French Geological Survey
OGC Member
OGC Geoscience DWG Chair (M. Beaufils)

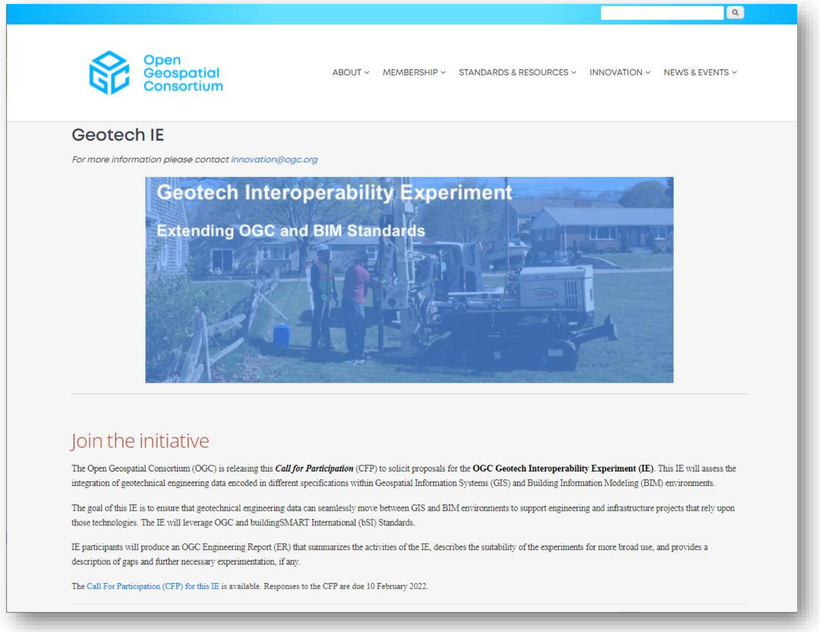
From the Geotechnical Data Standardization Workshop to the Geotech IE

January 2019

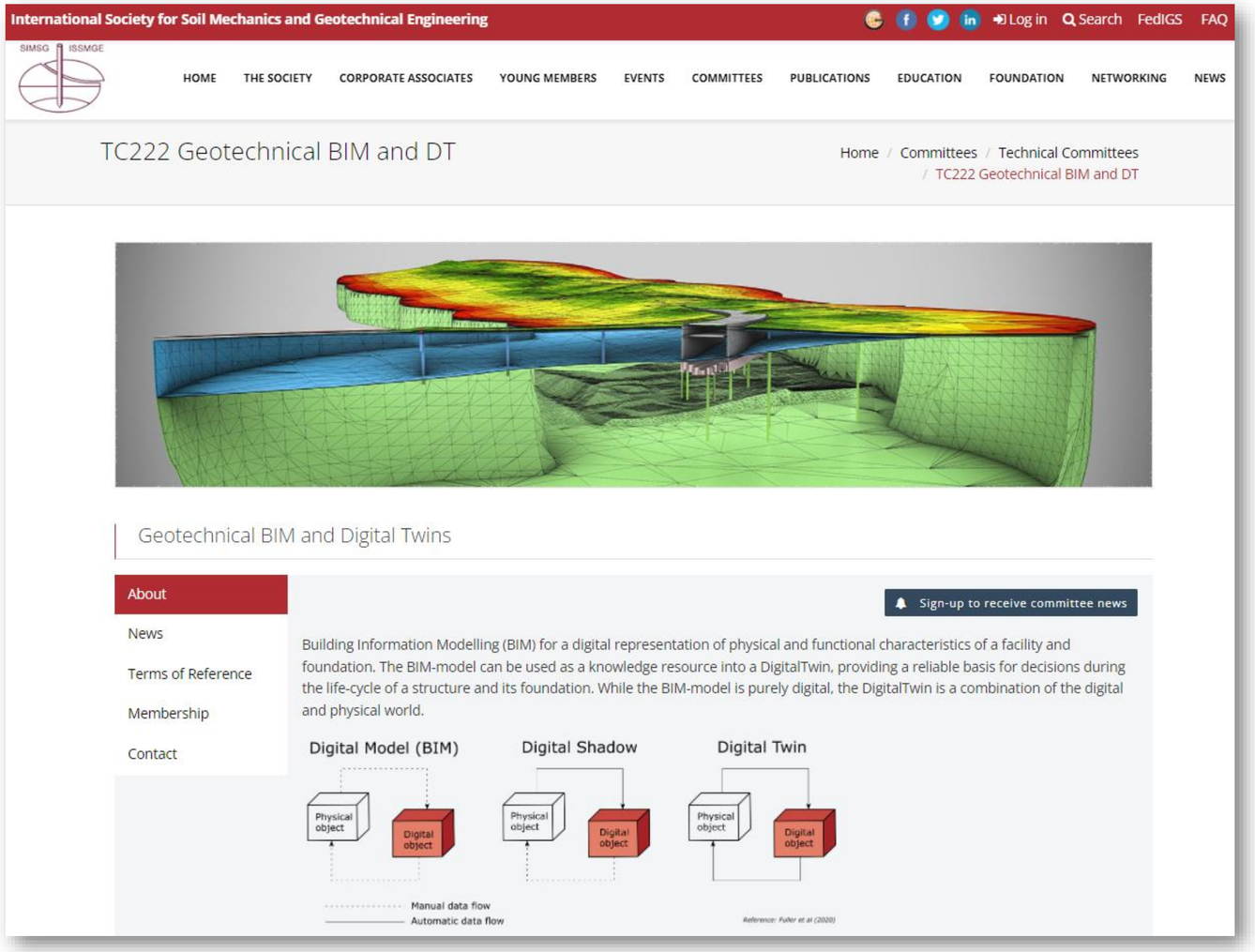




January 2022



Official support from ISSMGE TC222



International Society for Soil Mechanics and Geotechnical Engineering
TC222 : Geotechnical BIM & Digital Twins

Chair: Magnus Romoen (Norwegian Geotechnical Institute)
Vice-chair : Mickaël Beaufils (BRGM)

Current status:
Call for participation through the « national bodies »
First meeting expected in March – April 2022

https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

Geotech IE objectives and Work Packages

Community oriented goals

- Contribute to federate the geotechnical community around a common position / proposal for geotechnical data,
  - Scientific – IT connection
  - BIM – GIS and more connection
  - Users – Solution providers connection

Work packages:

- #1: Common conceptual model
- #4: Technical paper
- #5: Implementation Guide for Software Vendors

Technical oriented goals

- Propose effective solutions to enable digital continuity between GIS and BIM

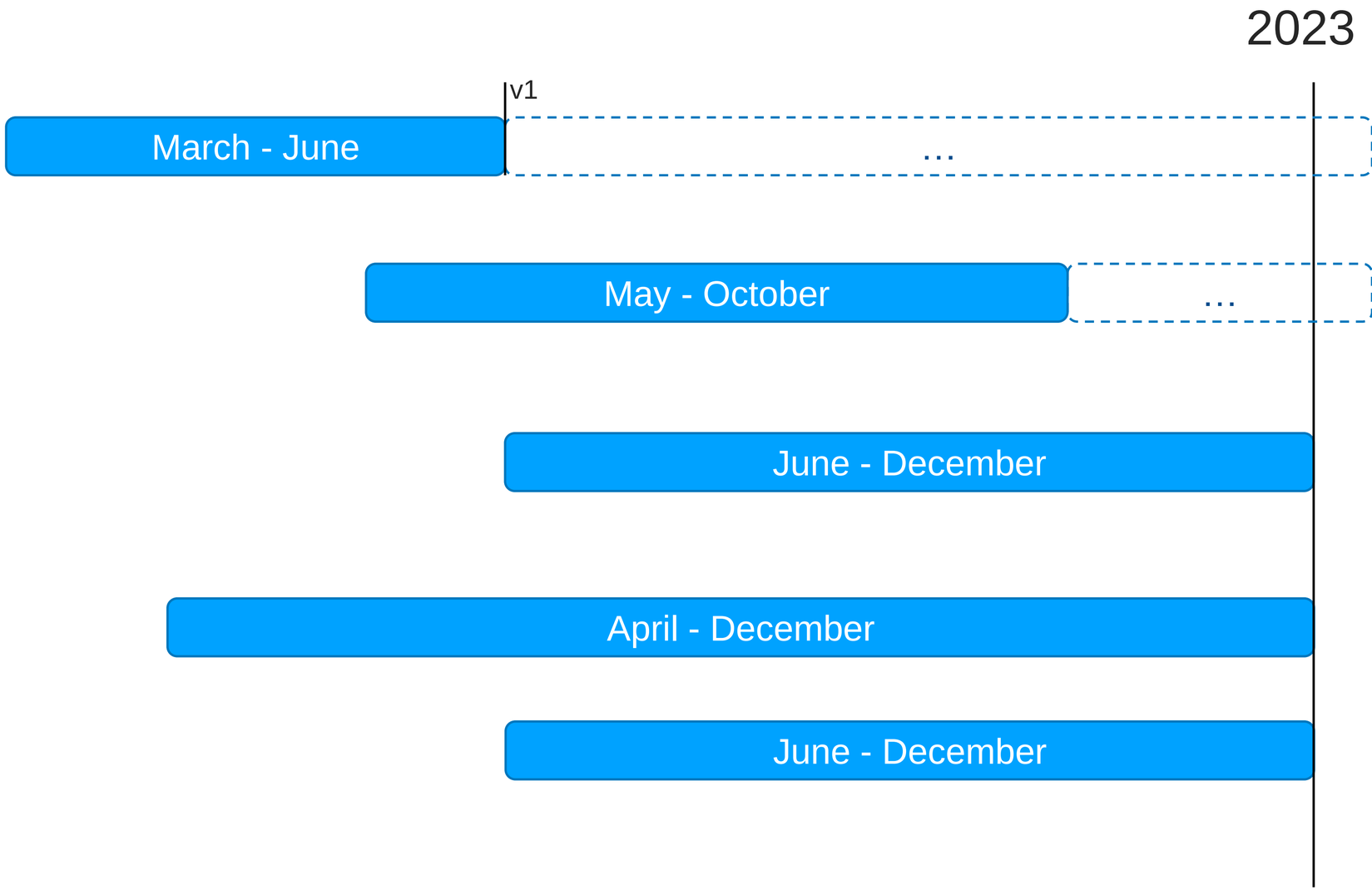
Work packages:

- #2: Extension of OGC Geoscience standards,
- #3: Technical documentation on the use of OGC APIs
- #3bis: Implementation forum

Image courtesy © ESRI

Geotech IE Timeline

- #1: Common conceptual model
- #2: Extension of OGC Geoscience standards
- #3: Technical documentation on the use of OGC APIs
- #4: Technical paper
- #5: Implementation Guide for Software Vendors



#1: Common conceptual model

- Conceptual model:
  - The way you « mentally » discrete and organize things
  - « From chaos to order »
  - Synonyms (or close match): Ontology, domain model

  - Building a conceptual model is about identifying and defining:
    - Discrete objects and inter-relationships
    - Properties and inter-relationships
    - Objects / properties relationships

- A pure conceptual model / ontology is technology agnostic

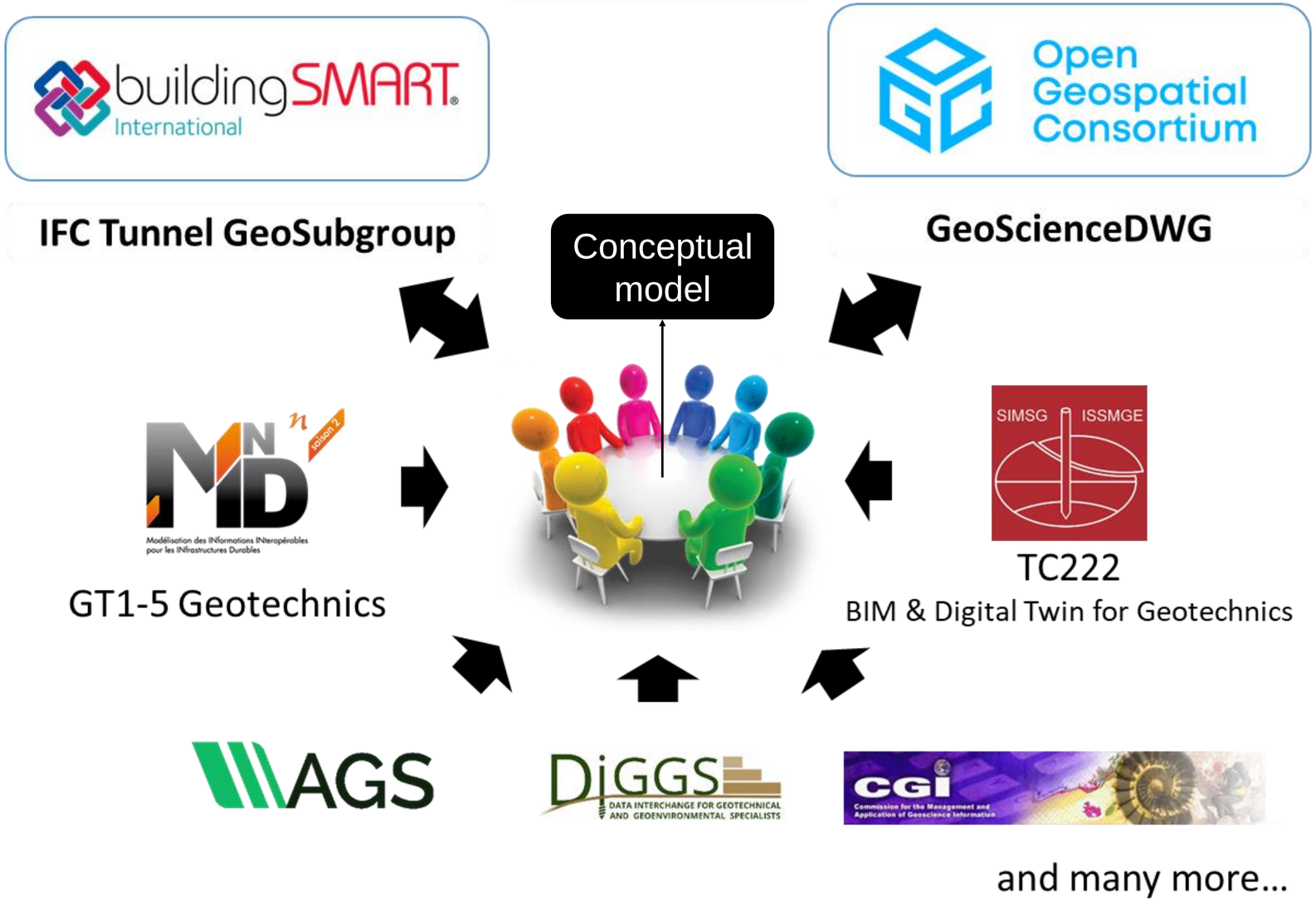
The bSI IFC Tunnel model for geotechnics

- Presentation by Jonas Weil, Leader of the bSI IFC Tunnel GeoSubgroup

- NB :
  - This meeting is not to discuss the choices made in the group
  - The common conceptual model task will be the opportunity to have open discussion on concepts / properties / terminology

  - Any interest on the bSI IFC tunnel project?
    - Contact Michel Rives - michel.rives@vianova-systems.eu

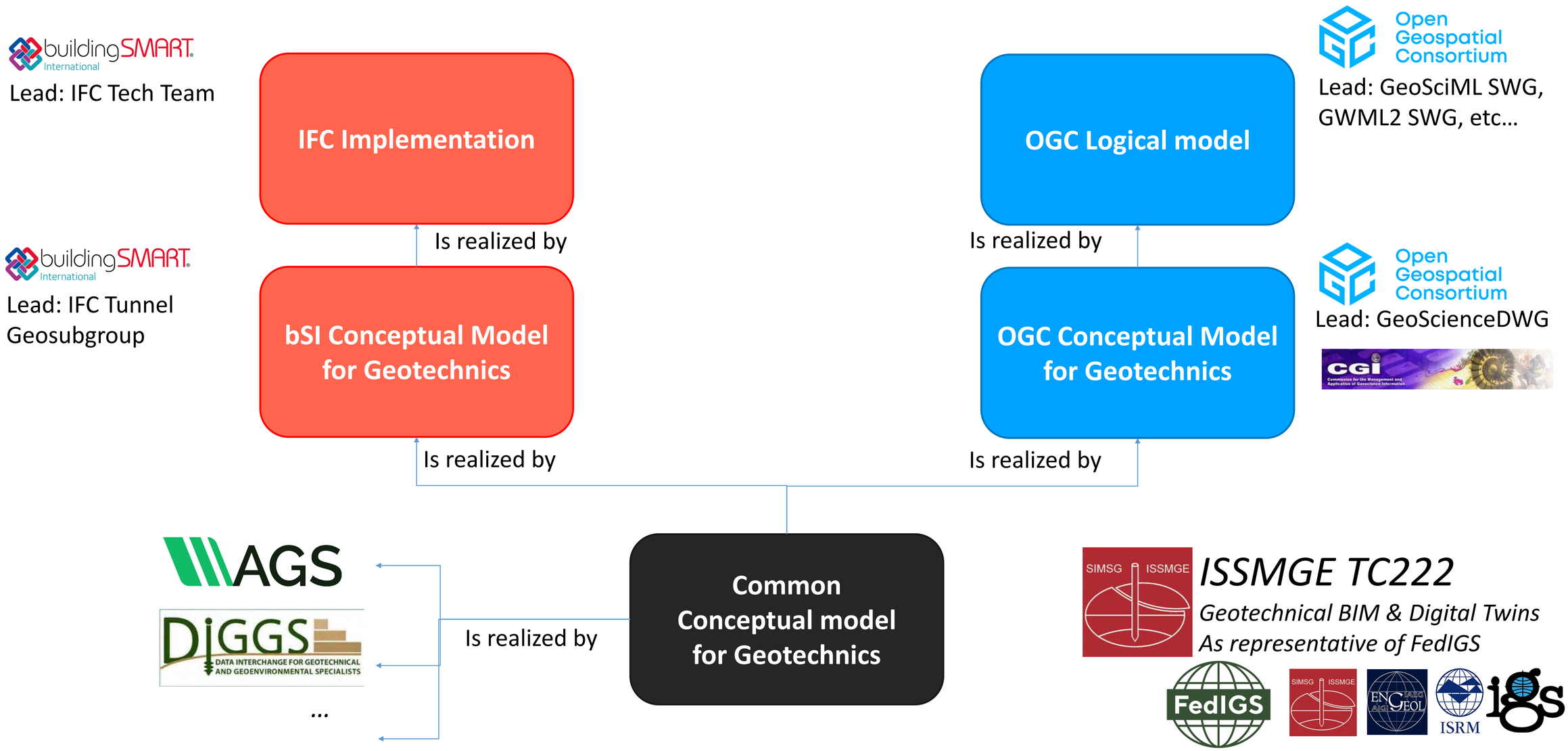
#1: Common conceptual model



- Conceptual model:
  - Technology agnostic
  - Base for all implementations

#1: Common conceptual model - Usage

Based on existing working groups / organizations on February 2022



#1: Common conceptual model

- Perimeter / Priorities proposal:
  - Main focus
    - Description of observation support and investigations (Book A), models and their components (Book B)
    - In the domain of geology, hydrogeology, geotechnics, geohazards
    - Features (objects), properties and accepted values for them
  - Also in scope
    - The domain of geoenvironment (geochimestry), impact on surrounding construction
    - Description of the geotech Synthesis Model (Book C)

#1: Common conceptual model

- Proposal:
  - Base of work:
    - Start from the model of the bSI IFC Tunnel geosubgroup
    - Adjust what should be adjusted / enhanced based on a « gentleman » consensus

- Methodology:
  - Issues on GitHub regarding the data model:
    - Concept names and definitions
    - Properties, definitions and result expression
    - Relationships betweens objects, between properties
  - Open for discussion, adjustments then validation
  - Same idea for attributes / properties

- Deliverable: UML Model with associated documentation

#2: Extension of OGC GeoScience Standards

OGC Standards and Working Groups for Geoscience

GeoSciML

The GeoScience Markup Language (GeoSciML) is a data model and data transfer standard for geological data.

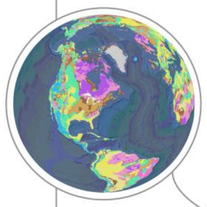
It formalizes the description of geological features commonly portrayed in geological maps, cross sections, geological reports and databases. It provides geological surveys, and other geoscience data providers, a common vocabulary for the electronic dissemination of geoscientific information.

GeoSciML is an XML–based data transfer standard for the exchange of digital geoscientific information. It accommodates the representation and description of features typically found on geological maps (eg, geologic units, structures, earth materials), as well as being extensible to other geoscience data such as drilling, sampling, and analytical data.

Supporting objects such as the geologic timescale and vocabularies are also provided as linked resources, so that they can be used as classifiers for the primary objects in the GeoSciML standard.

GeoSciML is used in the OneGeology project to propose a dynamic digital geological map data for the world.

Resources: http://www.geosciml.org/
https://www.opengeospatial.org/standards/geosciml



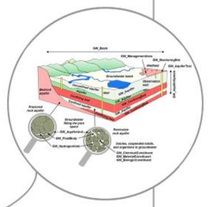
OGC®
Making location count.
www.opengeospatial.org

The Open Geospatial Consortium (OGC) is an international organization committed to develop and promote open standards for the global geospatial community. Its membership includes more than 500 organizations that come from across government, commercial organizations, non-governmental organizations, academic, and research institutes.

OGC activities address both semantic and technological standardization in a wide variety of domains including: Geosciences & Environment; Smart Cities, IoT & Sensor Webs, mobile technology, 3D & Built Environment, Emergency Response & Disaster Management, Energy & Utilities, and many more.

With the main objective to propose standards to the International Organization for Standardization (ISO), OGC regularly collaborates with other international organizations, such as Research Data Alliance, the World Meteorological Organization or building Smart International and many more in order to propose consistent standards and solutions.

International Organization for Standardization · RDA Research Data Alliance · World Meteorological Organization · buildingSMART International · ...



GroundWaterML2

The GroundWater Markup Language 2 (GroundWaterML 2 or GWML2) is is an international standard for the online exchange of groundwater data that addresses the problem of data heterogeneity.

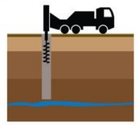
This problem makes groundwater data hard to find and use because the data are diversely structured and fragmented into numerous data silos. Overcoming data heterogeneity requires a common data format; however, until the development of GWML2, an appropriate international standard has been lacking.

As part of the WaterML 2.0 standard and linked to GeoSciML, GWML2 introduces some concepts such as aquifers and water wells, as well as related measurements and groundwater flows.

It describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

GWML2 has developed, tested and implemented by several groundwater data providers from North America, Europe, and Australasia, and facilitates many forms of data exchange, information representation, and the development of online web portals and tools.

Resources: https://www.opengeospatial.org/standards/gwml2



Even though several standards already exist to describe a borehole, its associated data and their position along a borehole (including OGC standards), they all restrict themselves to a specific viewpoint.

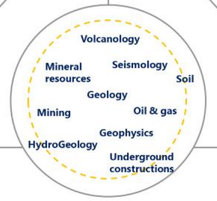
Involving key implementers and editors of the existing standards, the Borehole Interoperability Experiment (Borehole IE) aims at defining a domain agnostic and comprehensive (umbrella) vocabulary for a general concept of boreholes, which may eventually become its own specification and be properly reused by various domains when needed.

Based on a wide variety of use cases such as 'scientific exchange within and across research infrastructures', 'industrial', 'building and construction', 'regulatory obligations' and 'geo-resources monitoring and exploitation' it will provide the basis for establishing a better integration of existing standards and possibly a future common approach for describing boreholes.

The Borehole IE is defining a domain neutral semantic for a general concept of borehole and its associated data. It will also produce a public OGC engineering report summarizing the overall cross-domain, inter-standard findings and recommendations for a best practice implementation that should follow.

Resources:
https://github.com/opengeospatial/boreholeie/
http://www.opengeospatial.org/projects/initiatives/boreholeie

BoreholeIE



The GeoScienceDWG is a joint group between OGC and the Commission for the Management and Application of Geoscience Information of the International Union of Geological Sciences (CGI-IUGS).

The GeoScience Domain Working Group (DWG) is a forum to discuss, organize and harmonize geoscience related standards.

In this context, Geoscience encompasses several scientific domains which all aim to provide a better understanding and representation of the Earth: Geology, Geomechanics, Geophysics, Geotechnics, Hydrogeology, Mineralogy, Seismology or Volcanology.

Goals of GeoScienceDWG include: 1- Foster technical solutions which support interoperable concepts, data definitions, formats and services for publishing, search, and exchange of geoscience information; 2- Ensure thematic/semantic coherence within the Geoscience domains and the Geoscience related ones; and 3- Establish a workable approach to managing standards for geoscience spatial features, their temporal aspects, related metadata, and other business information.

First actions of the group focus on the realization of three Interoperability Experiments : 1 – Linked Data for Environmental Features, 2 – Borehole and associated data information description, and 3 - 3D-4D model discovery capabilities.

Resources: https://external.opengeospatial.org/twiki_public/GeoScienceDWG/WebHome

GeoScienceDWG

The Environmental Linked Features Interoperability Experiment (ELFIE) is intended to test existing OGC and W3C standards with the goal of establishing a best practice for exposing links between and among environmental domain and sampling features in a highly adoptible standards compliant way that is compatible with modern web search technology.

The IE is focused on two cross-domain use cases:
1) exposing topological and domain feature model relationships between features and
2) description of sampling data available for and linked to sampled domain features

While addressing these use cases, the IE has aimed to address issues of encoding data as specific views of a linked data graph that would be passed between systems. These linked data graph views are expected to support archictures involving linked data catalogs and registries.

For example, data providers can use the linked data graph views as a way to advertise their monitoring or domain features to catalogs or other applications that want to crawl and index available data. Similarly, integrated catalogs that index and construct links between features can use the views as a linked data response to search queries.

The IE has produced numerous experimental demonstration JSON-LD instance files and a number of demonstration visualizations.

Resources:
https://opengeospatial.github.io/ELFIE/

ELFIE

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Carina Kemp – AARNET (carina.kemp@aarnet.edu.au), Matthew Harrisson – BGS (mh@bgs.co.uk), David Blodgett – USGS (dblodgett@usgs.gov), Sylvain Grellet – BRGM (s.grellet@brgm.fr)

Want a PDF version of that poster?
Just catch that QRCode.

#2: From the Common Conceptual Model to the Extension of OGC GeoScience Standards

- Step 1: Gap analysis
  - Existing concept to reuse?
  - Existing concept to connect with?
  - Missing properties?

- Step 2: Different kind of intervention

New concept with associated properties

Specializations of that concept with associated properties

New properties to be added to that concept

#2: Extension of OGC GeoScience Standards

Expectations of interventions on identified OGC based data models. Not exhaustive. Not final.

For observations and measurements	OM:Observation	GSML:Borehole	GSML:GeologicSpecimen	INSPIRE EF: EnvironmentalMonitorinFeature
For geological modeling	GSML:GeologicUnit	GSML:ShearDisplacementStructure	GSML:Contact	GSML:Fold
For hydrogeological modeling	GWML2:HydrogeoUnit	GWML2:FluidBody	GWML2:FluidBodySurface	GWML2:HydrogeoVoid
For geotechnical modeling	GeotechnicalUnit Continuum	GeotechnicalUnit Rock mass	Discontinuity	
For geotechnical prognosis	TypicalSection	LandInfra:Alignment	GeotechnicalInfluence Zone	
For geomodel description	EPOS:ModelView			
For surrounding construction description	Several concepts from the MUDDI conceptual model			

Legend: Type of intervention

- New concept with associated properties
- Specializations of that concept with associated properties
- New properties to be added to that concept

#2: Extension of OGC GeoScience Standards

Expectations of interventions on identified OGC based data models. Not exhaustive. Not final.

Identified Data Models in OGC (not exhaustive)

- OGC GeoSciML: A base model for geoscience, including geology
- OGC GroundWaterML2: An extension of GeoSciML to address hydrogeology
- OGC OMS: A model to describe Observation, Measurements & Samples

Proposal

- Edit OGC GeoSciML: Add missing attributes for geotechnical purpose
- Edit OGC GroundWaterML2: Add missing attributes for geotechnical purpose
- Specify OGC GeotechML2: An extension of GeoSciML to introduce geotechnics specific objects (GeotechnicalUnit, …) and associated properties
- Specialize OGC OMS: Identify Procedures, Observed Properties that are relevant for geotechnics.

Deliverable: Enriched OGC technical specifications, proposed adjustments to IFC.

#3: Technical documentation on the use of OGC APIs

- The main focus of the IE work consists of calling OGC APIs to dynamically provide attribute values from GIS and BIM data stores.
- The technical documentation will focus on describing the use of OGC APIs in the context of geotechnics by specifying, in particular, the formalism of the requests to be formulated and that of the results that can be obtained.
- The APIs targeted in particular are the OGC SensorThings API and OGC API - Features.

- **Deliverable:** Technical documentation on the use of OGC APIs and/or a dedicated page on an open access website.

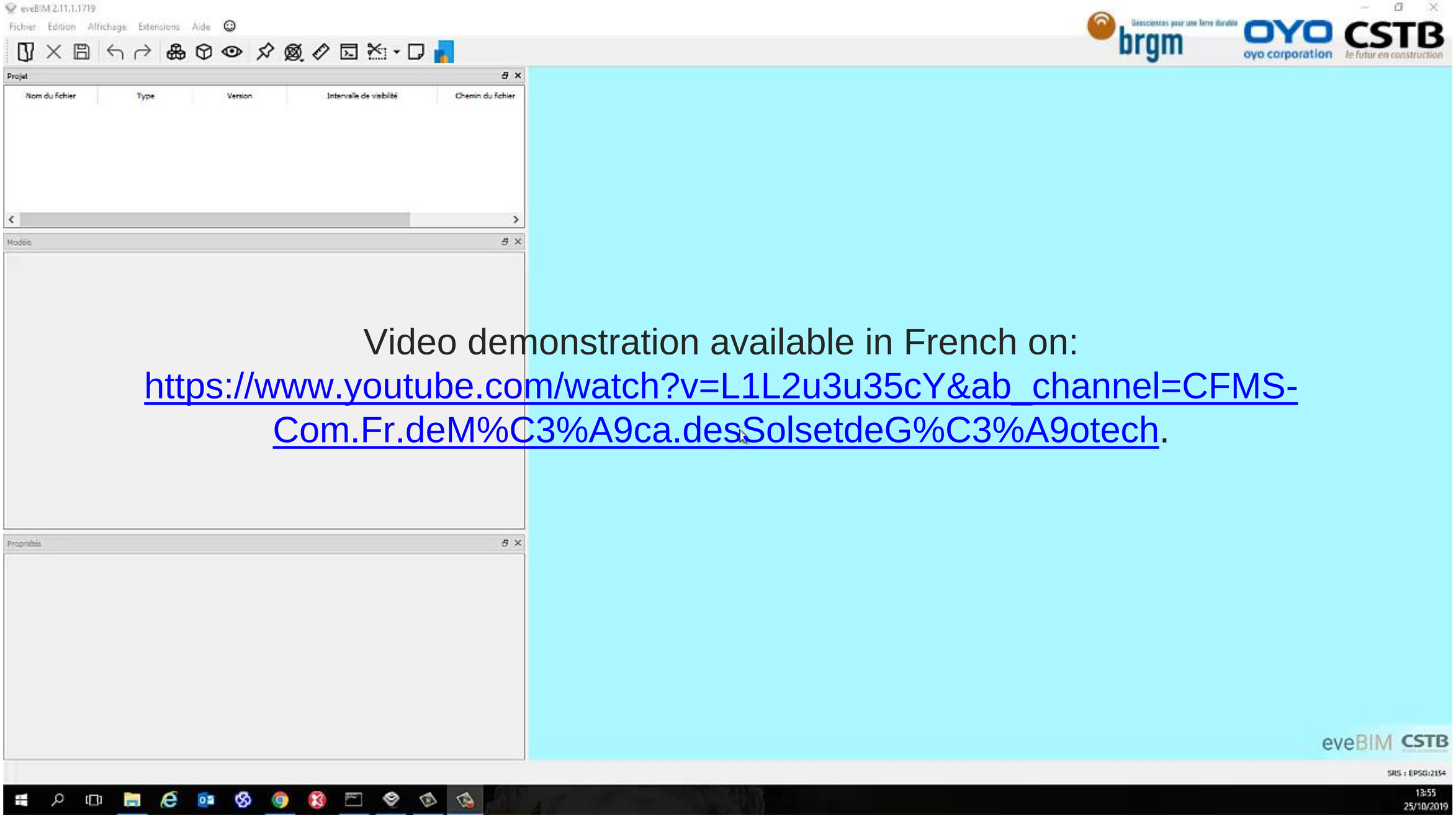
#3bis : Implementation forum

- Demonstration opportunity

- Envisaged implementations
  - OGC API – Features instances to share:
    - Observation supports descriptions (eg. Borehole, Sample)
    - Models descriptions (eg. Geological model, …)
    - Model components descriptions (eg. Geologic Unit)

  - OGC SensorThings API instances to share:
    - Borehole logs and diagraphies
    - Laboratory tests and analysis

  - Any software (especially BIM oriented) demonstration showing usage of such APIs



Video demonstration available in French on:
https://www.youtube.com/watch?v=L1L2u3u35cY&ab_channel=CFMS-Com.Fr.deM%C3%A9ca.desSolsetdeG%C3%A9otech.

#4: White Paper

Paper objective

This paper exposes a position regarding Digital Continuity for Geotechnics at the BIM era. It introduces challenges and also envisions solutions to address it.

The co-authors listed below share this vision and propose to collaborate to develop or support this initiative.

Co-authors / supporters

Confirmed:

Scott Simmons, OGC, Chief Standards Officer

Richard Petrie, buildingSmart International, Chief Executive

Mickaël Beaufils, BRGM, OGC GeoScience DWG Chair

Michel Rives, Vianova Systems, IFC Tunnel Project Leader

Jonas Weil, IC-Group, IFC Tunnel Geo-Subgroup Leader

Magnus Romoen, NGI, ISSMGE TC222 Chair

Harvey Thorleifson, Minessota Geological Survey, CGI-IUGS Chair

Andrew Hugues, BGS, OGC MUDDI SWG Co-chair

Isabelle Halfon, BRGM, Geotechnical Engineer

Elodie Vautherin, COLAS, Geotechnical Engineer

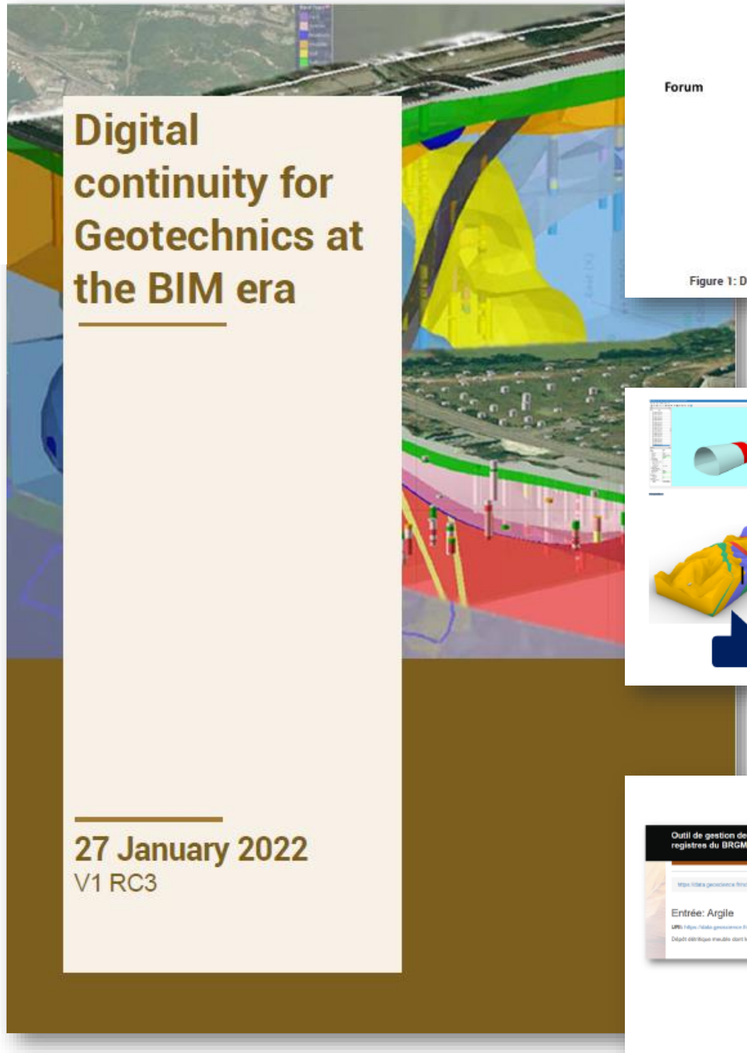
Pierre Garnier, COLAS, Geotechnical Engineer

Sylvie Bretelle, Geotechnical Engineer

Expected (please feel free to adjust and move to the confirmed section):

Julian Lovell, AGS, Chair

Robert Bachus, DIGGS, Chair



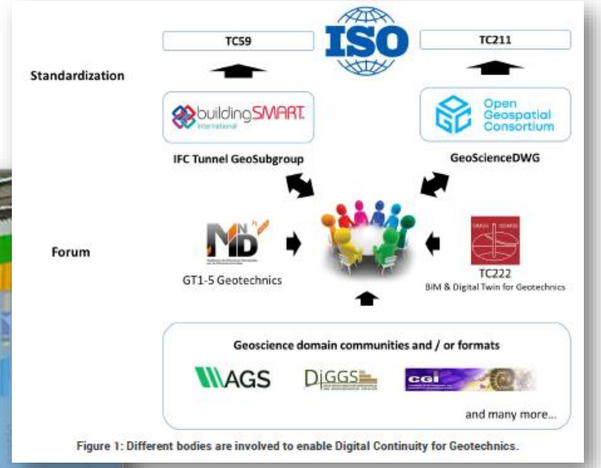
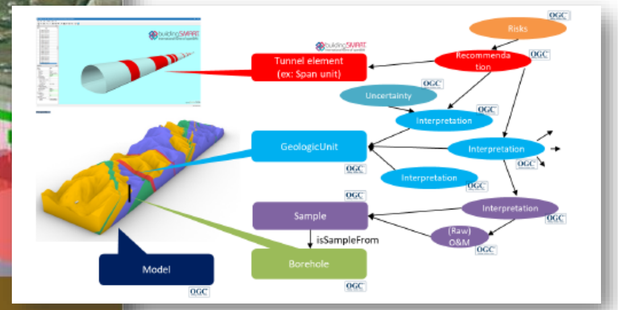


Figure 1: Different bodies are involved to enable Digital Continuity for Geotechnics.



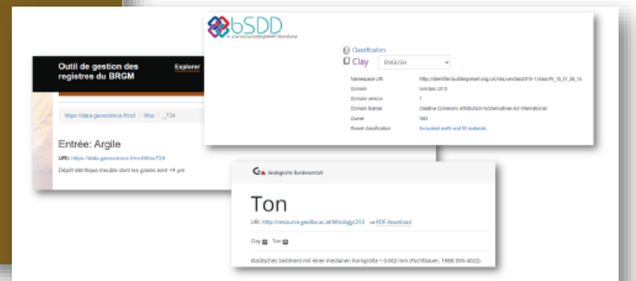


Figure 6: Clay in English / Argile in French / Ton in German: beside the language, several definitions exist. Reference to registries, thesaurus or data dictionaries enable to clarify the one that is used by the data provider.

https://github.com/opengeospatial/Geotech/blob/master/Geotech_IE/white_paper/Digital%20continuity%20for%20Geotechnics%20at%20the%20BIM%20era%20v1RC3.pdf

#4: White Paper > Technical paper

- The paper resulting from this IE will describe a proposal for the joint use of OGC and bSI standards for geotechnical data. Based on case studies, it will discuss the advantages of each format. In general, it will highlight the complementarity of the OGC and OpenBIM standards, especially for geotechnical data.

- The Technical Paper will be co-authored and endorsed by OGC and/or bSI members active in the geotechnical field.

- **Deliverable:** OGC - bSI Technical Paper for geotechnical data management

#5: Recommendation to software vendors

- Complementing the technical documentation on the use of OGC APIs, an implementation guide is to be developed to suggest relevant interactions and visual renderings for geotechnical data retrieved through OGC APIs.

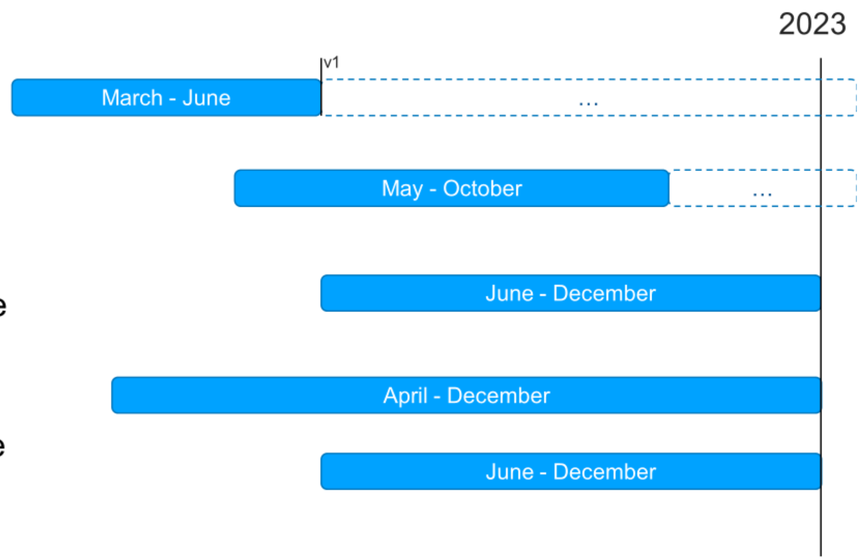
- The guide will focus describing how to reproduce classical representations that geotechnical engineers and users normally consume from the data provided by OGC APIs. Satisfying these users will help facilitate the adherence and adoption of the standards by the community.

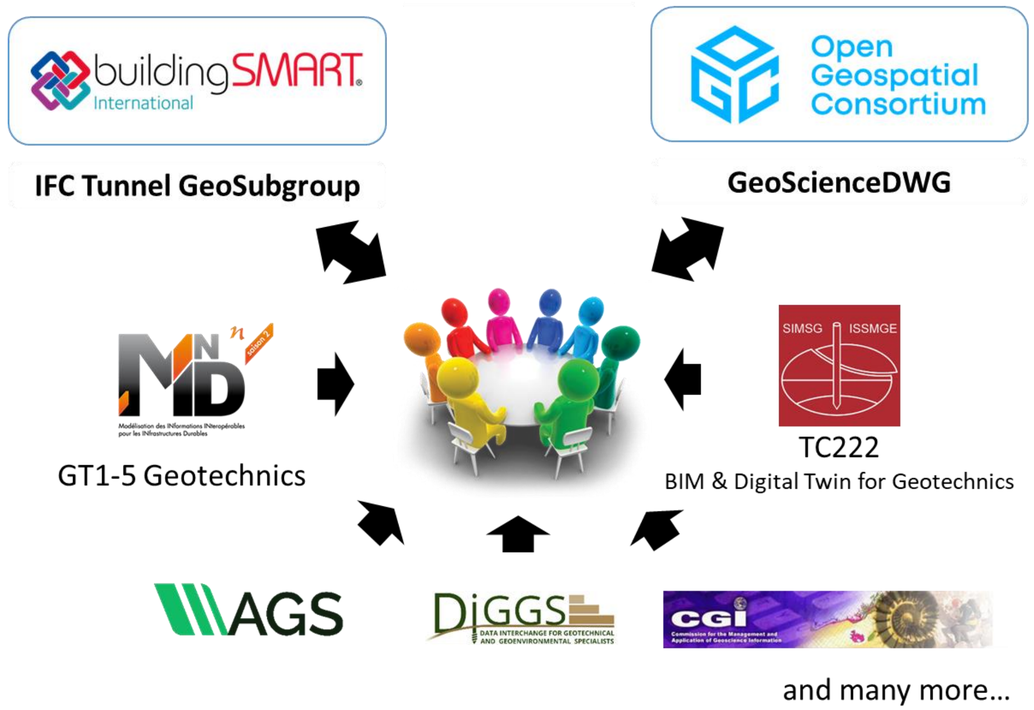
- **Deliverable:** Implementation Guide for software vendors

Work organization – “Challenges”

Geotech IE Timeline

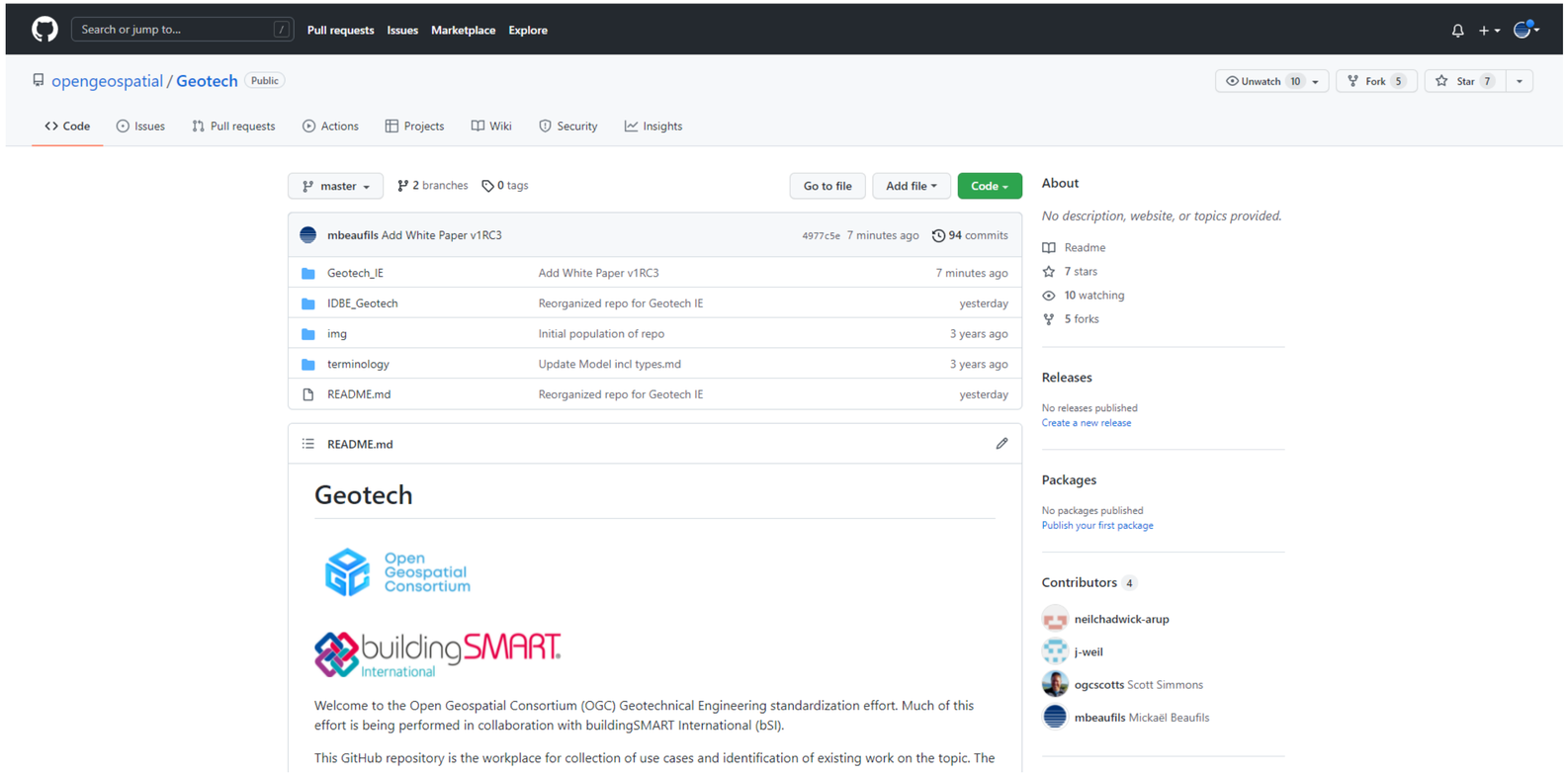
- #1: Common conceptual model
- #2: Extension of OGC Geoscience standards
- #3: Technical documentation on the use of OGC APIs
- #4: Technical paper
- #5: Implementation Guide for Software Vendors





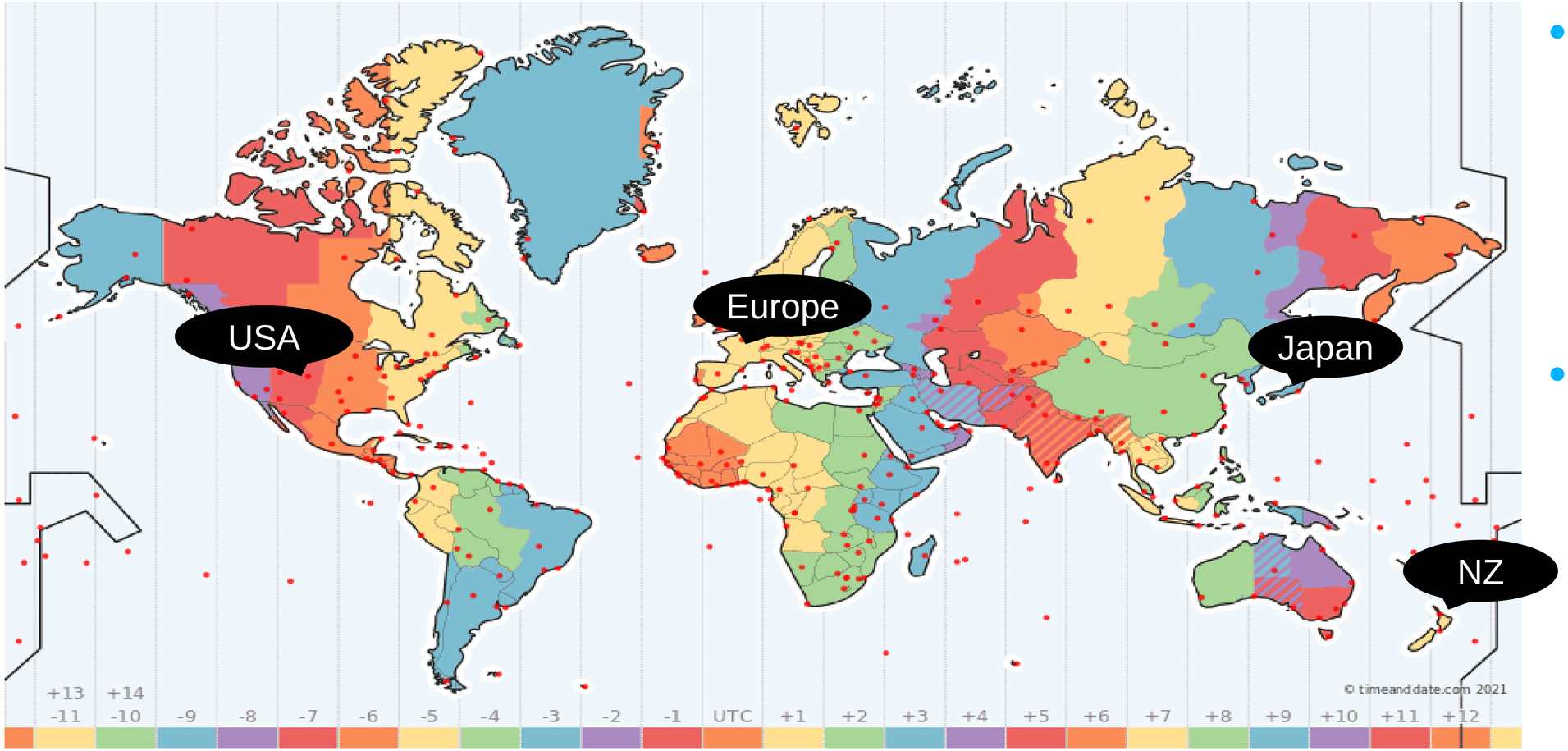
- Two needs:
  - Have to privilege homework
  - Meetings dedicated to verification / validation

Work organization – “Workspace”



- Mail list: geotech.ie@lists.ogc.org
- GitHub: https://github.com/opengeospatial/Geotech

Work organization – “Meetings”



- Proposed meeting duration and frequency:
  - 1h (virtual) meeting every Thursday
- Proposed main slot based on participants answers:
  - 1400 Paris
  - 600 Denver
  - 2300 Tokyo

Slot 1:	**600**	**1400**	**2300**
Slot 2:	**1400**	**2200**	**600**

Questions?

Contact: m.beaufils@brgm.fr

Thank You

Community

500+ International Members
110+ Member Meetings
60+ Alliance and Liaison partners
50+ Standards Working Groups
45+ Domain Working Groups
25+ Years of Not for Profit Work
10+ Regional and Country Forums

Innovation

120+ Innovation Initiatives
380+ Technical reports
Quarterly Tech Trends monitoring

Standards

65+ Adopted Standards
300+ products with 1000+ certified implementations
1,700,000+ Operational Data Sets
Using OGC Standards

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