

**TITLE:** Temporal Domain Working Group Draft 0.7 Charter  
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## 1. Introduction

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This Domain Working Group (DWG) charter defines the role for OGC activities concerning temporal aspects of geospatial interoperability, and to provide an open forum for the discussion and presentation of interoperability requirements, use cases, pilots, and implementations of OGC standards in this domain. This Charter will be presented to the OGC's Technical and Planning Committees for consideration.

Common data definitions, structures, syntax, and conceptual definitions exist concerning time, but differing versions and interpretations occur, increasing the cost of managing information and increasing the scope for error, especially as the use of higher geospatial and temporal precisions and longer timescales become more widespread. Also, temporal and geospatial coordinates can become inseparable aspects of moving features and non-terrestrial applications exist.

### 1.1 Working Group

The OGC Temporal Domain Working Group will follow the policies and procedures of the [Technical Committee](#).

The Temporal Domain Working Group, a subgroup of the Technical Committee, of individuals composed of members of the TC and invited guests, will solve interoperability problems of data and metadata specifications, automatic conversion of temporal Coordinate Reference Systems (CRSs) and propose and establish an authoritative framework for temporal CRSs, for recommendation to the Technical Committee.

The Temporal Domain Working Group will:

- Provide a forum for discussion and documentation of interoperability requirements for those interested in the temporal aspects of geospatial data and services;
- Provide a forum to discuss and recommend document actions related to Interoperability Program Reports;
- Develop Change Request proposals for existing OGC Standards;
- Collaborate as required with other DWGs;

- Identify and document problems with temporal aspects of other, non-OGC, standards;
- Develop engineering reports with the intent of seeking approval by the Technical Committee for release of these documents as OGC White Papers, [Discussion Papers](#) or [Best Practices Papers](#);
- Have a formal approved charter that defines the Temporal DWG's Scope of Work and estimated timeline for completion of the work;
- Have all-member voting policies (unless otherwise stated);
- Have missions and goals defined by the TC.

The Temporal DWG will not work on Request For Comment (RFC) submissions, candidate standards, or revisions to existing OGC Standards, but will develop change requests to document interoperability requirements that can be submitted as work items to a Standards Working Group.

The Temporal DWG will have public collaboration, such as in teleconference, email discussions, and a public Wiki. The Temporal DWG shall make a motion to the TC to approve public participation in the DWG. Voting in the Temporal DWG will be by a simple majority of OGC Members present at the DWG meeting, not just Voting Technical Committee Members, with the caveat that no OGC Member organization may cast more than one vote in a DWG vote

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## 2. Purpose of Working Group

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The Temporal Domain Working Group will:

1. Act as a focus to discuss and help resolve time issues arising from geospatial interoperability.
2. Clarify the role of **time** alongside *space*, and strive for a handling of time which is coherent and integrated with that of space.

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## 3. Problem Statement

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3.1. Many web services are now being used to analyze and present historical data. A number of technical approaches have been taken, such as mapping the data times to the frames of a video stream. As well as the technical challenges of ensuring such data are represented accurately in relation to other data, there is not widespread awareness of when countries switched from the Julian calendar to the Gregorian, such as most recently in 1923.

For example, much weather and climatological data are currently being extracted from historical diaries and ships logs and if even dates and times are being converted by well known software libraries, it is not clear that the software is correct. And, of course, countries have changed their boundaries too over historical time, so there is the potential for timing errors of several days.

3.2. As second, or even sub-second, precision timing becomes important, for example, in relation to fast moving features, it may be important to recognize the existence of the leap seconds, as well as the leap years, in the internationally recognized Gregorian calendar and the standardized notation of ISO8601:2004. These timing errors of several seconds could result in positional errors of hundreds of metres.

For example, times specified by the GPS constellation of satellites do not acknowledge leap-seconds, as they are determined by Atomic Time rather than UTC and they are now 35 seconds apart. Some GPS software in devices gets this discrepancy wrong.

3.3. When statistical summaries of aggregations of values are created, the time labeling of such summaries may be ambiguous, or different approaches used, making direct comparison of values problematic. Also, time series of such data may be irregular or sparse in time as well as space, presenting other challenges for efficient representation.

3.4. Web services are already being used to present geospatial data from other planets, possibly with completely different time coordinates and calendars, such as helio-centric space weather.

3.5. This lack of awareness can give rise to badly implemented algorithms, overly complicated software, mislabeled data, and erroneous information processing.

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## **4. Charter**

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### **4.1 Charter Members.**

The initial membership of the Temporal DWG will consist of the following members and individuals with extensive education and experience in temporal issues, namely:

Rob Atkinson, CSIRO, Australia;

Peter Baumann, Jacobs University, Bremen, Germany;

Lorenzo Bigagli, CNR-IIA, Italy

Mike Botts, Botts Innovative Research, USA;

Peter Broßeit, Technical University, Dresden, Germany;

Piero Campalani, Jacobs University, Bremen, Germany;

Chris Little, Met Office, Exeter, UK;

Matthias Müller, Technical University, Dresden, Germany;

Christine Perey, Perey Research & Consulting, Switzerland;

Scott Simmons, CACI; USA

Stephen Smyth, Open Site Plan, USA.

### **4.2 Key Activities.**

4.2.1. Identify and publicize, produce and publish easily accessible educational materials, so that software developers create correct software;

4.2.2. In particular, publish a Best Practice document for processing and handling time data and metadata across a variety of use cases and communities of interest;

4.2.3. Agree a temporal conceptual model to ensure realistic scoping of the OGC temporal problems.

4.2.4. Establish a registry of temporal information and reference values to support both manual and automatic processing of time metadata, hosted by a committed, persistent,

authoritative organization to inform the Best Practice. Initially this is envisaged to be the OGC Naming Authority, but could transfer later to another more appropriate body.

4.2.5. Develop a community of people and organizations outside of OGC who are interested in temporal issues in relation to geospatial data.

### **4.3 Business Case**

The cost and scale of the Year 2000 problem and its resolution is indicative of the hidden costs of building software with a limited, short term scope. There are still occurrences of popular software failing on or after leap days (or non-leap days). The year 2038 is likely to see similar errors when the 32 bit clocks of Unix time flip over to 1 January 1970 as  $2^{32}$  milliseconds are counted. Even if the hardware is 64 or 128 bit based, who is going to guarantee that there is no 32 bit software left?

As archives of inappropriately labeled data build up, it becomes almost impossible to justify the wholesale conversion of datasets to a consistent time labeling. Doing things early and correctly is the only reasonable option.

As more global, historical and cultural data become amenable to geospatial processing, the temporal aspects are intrinsic and cannot be added later.

As the issue of time in CRSs is overarching across all of OGC, the Temporal DWG will seek to include background from as many OGC stakeholder groups and WGs as possible. To this end, the Temporal Domain Working Group is open to all who are interested in the topic.

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## **5. Organizational Approach and Scope of Work**

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### **5.1 Temporal Domain Working Group Business Goals**

5.1.1. Publish a Best Practice document for temporal aspects of geospatial data.

5.1.2. Establish and maintain registers of key information to allow the correct manual or machinable interoperability of geospatial data, metadata and services in a range of temporal coordinates.

### **5.2 Temporal Domain Working Group: Mission and Role**

5.2.1. To ensure that OGC is recognized as an authoritative voice for temporal aspects of geospatial data and services.

5.2.2. To ensure that OGC standards have a consistent and sustainable approach to handling temporal CRSs and labeling of data and services.

5.2.3. To ensure that temporal aspects of OGC standards will integrate with other external standards consistently, correctly and effectively.

5.2.4. To ensure the OGC has access to an expert community who can define Best Practice.

### **5.3 Activities planned for Temporal Domain Working Group**

Some of the information to contribute to the detailed plans are in Annex A. It is envisaged that most of the work will be within one year.

5.3.1. Identify and document a wide ranging set of temporal Use Cases.

5.3.2. Identify or develop an appropriate temporal conceptual model to underpin the interoperability efforts.

5.3.3. Clarify and propose a preferred terminology and publish at <http://opengis.net/def/> as an official OGC resource.

5.3.4. Accumulate information and resources to specify Best Practices, covering:

- a) Coordinate systems and datums/epochs (years/days since 0 BCE, milliseconds since 1/1/1970, days since last Sunday, Sidereal, ..);
- b) Calendars (Proleptic-Gregorian, Julian, Mayan, 360 day year, etc);
- c) Notation (ISO8601 or restrictive profile, etc);
- d) Time Proxies (count tree rings, mm of ice/sediment core, king-lists, etc).

5.3.5. Cutting across these are also the concepts of:

- a) Multiple time dimensions (e.g. 'real' time versus forecast time);
- b) Relative and absolute time;
- c) Points, periods and durations, frequency and periodicity.

5.3.6. Define operations or processes to meet the needs of OGC standards:

- a) Temporal sub-setting and aggregation as part of service definitions (e.g., coverages: "January average daily maximum temperatures for 1980-2010" versus "average January day time maximum temperature for 1980-2010");
- b) CRS transforms (Gregorian - Japanese Imperial - Chinese - climate calendar - carbon time - geological epochs, etc.);
- c) Metrics operations ("How many days are between X and Y? How many seconds?", "Every January 1st from now back to year 1000", "Is interval X contained in Y?", etc).

5.3.7. Establish reference registries of CRS definitions and entities.

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## **6. References**

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6.1. International Atomic Time, TAI, Bureau International des Poids et Mesures, BIPM, [www.bipm.org](http://www.bipm.org)

6.2. International Earth Rotation & Reference Systems Service, IERS, <http://www.iers.org>

6.3. ISO 8601:2004, Data elements and interchange formats - Information interchange - Representation of Dates and Times, [http://en.wikipedia.org/wiki/ISO\\_8601](http://en.wikipedia.org/wiki/ISO_8601)

6.4. OGC NA, OGC Naming Authority, <http://www.opengeospatial.org/ogcna>

6.5. Calendrical Calculations, Dershowitz & Reingold, CUP, ISBN-13: 978-0521702386

- 6.6. Planetary & Lunar Coordinates for Years 2001-2020, TSO, ISBN-10: 011 887312 1
- 6.7. ISO19108: 2002, Geographical Information - Temporal Schema

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## **Annex A. Details of Proposed Activities for Temporal DWG**

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- A.1. Identify and document a wide ranging set of temporal Use Cases:
- a) Historical geospatial data that may have differing Julian to Gregorian transitions;
  - b) Necessity of using Leap-Seconds;
  - c) Geographic place identification, with a temporal aspect. E.g. Stadiums being renamed with sponsorship deals, Peking/Beijing, St Petersburg etc;
  - d) Geographic place identification, with differing extents or locations, for the same identifier, which have changed over time. This may need “previous version” or “subsequent version” operations;
  - e) The increasing importance of integrating space weather information.
- A.2. Identify or develop an appropriate temporal conceptual model to underpin the interoperability efforts.
- a) Create OWL ontologies of the temporality model ISO 19109 application schemas.
- A.3. Clarify and propose a preferred terminology and publish at <http://opengis.net/def/> as an official OGC resource:
- a) ISO8601:2004 is preferred. Not ISO8601:2000 or ISO8601:1988;
  - b) Profile of ISO8601:2004?
  - c) Generalize URIs for temporal coordinate systems towards temporal reference systems in general to cover cases such as UTC and geological times.
- A.4. Accumulate information and resources to specify Best Practices, covering:
- a) Coordinate systems and datums/epochs (years/days since 0 BCE, milliseconds since 1/1/1970, days since last Sunday, ...);
  - b) Calendars (Proleptic-Gregorian, Julian, Mayan, 360 day year, sidereal, etc);
  - c) Notation (ISO8601 or restrictive profile, etc);
  - d) Proxies for time (tree ring numbers, mm of ice or sediment core, king-lists, etc).
- A.5. Cutting across these are also the ideas of:
- a) Multiple time dimensions (e.g. ‘real’ time versus forecast time); see WMS1.3BP Elevation and Time 12-111r1;
  - b) Relative and absolute time;
  - c) Points, periods and durations, frequency and periodicity. ISO 8601 profile!
- A.6. Define operations or processes to meet the needs of OGC standards:
- a) Temporal sub-setting and aggregation as part of service definitions (e.g., coverages: "January average daily maximum temperatures for 1980-2010" versus "average January day time maximum temperature for 1980-2010");
  - b) CRS transforms. E.g. Gregorian - climate calendar - carbon time – geological – astronomical, etc.);
  - c) Metrics operations ("How many days between X and Y? How many seconds?", "Every Jan 1st from Now back to 1000BCE", "Is interval X contained in Y?", etc).

A.7. Establish reference registries of CRS definitions and entities.

- a) Develop a WKT specification for time, similar to spatial, focussing on complex temporal geometries, such as multi-period, multi-instant, etc, as above.

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## **Annex B. Currently Out of Scope Activities for Temporal DWG**

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B.1. Taking into account relativistic corrections to time values.

B.2. Mapping between the ISO 8601:2004 Gregorian calendar and other solar, lunar, luni-solar, observed and other calendars.