

# Real/Virtual World Integration

## Domain Exploratory Group Proposal

### FINAL

Approved by Oversight Committee September 28, 2022

#### 1. Proposers

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#### 2. Exploratory Group Goals

This exploratory group will:

- Build consensus and draft a proposed charter for one or more Real/Virtual World Integration Domain Working Groups focusing on one or more of the topics mentioned below.
- Prioritize topics according to relevance, urgency and feasibility within the exploratory group.
- Specify concrete projects intended to result in running code/systems and demonstrations.

The Real/Virtual World Integration Domain Working Group will not define new standards but rather coordinate with existing SDOs where appropriate.

#### 3. Potential Working Group Goals and Deliverables

The scope of Real/Virtual World Integration includes:

- Definition of constructs describing the physical world (“reality”),
- Definition of constructs describing created content intended to represent or accompany entities in reality,
- Technical methods to integrate created (digital) content with reality.

This will mean examining technologies such as:

- Describing the real world
  - Semantic representations
    - OGC CityGML 3.0, BIM-IFC etc.
    - EU INSPIRE semantic models
    - support semantic translation between publication and application
  - Unique real-world identifiers (ex. URIs)
    - encode position, bounding volume, semantic type, disambiguation
    - find or define URI registers, distributed if feasible
  - OGC GeoPose 1.0
    - support transformation between publication and application spatial reference frames
    - support 6 degree-of-freedom geo-located poses
  - Digital Twins, IoT, WoT
    - Select, refine, or define efficient publish/subscribe protocols
    - Support federation of data from multiple vendors
    - Support harmonization of data from multiple sensor types
      - Imaging sensors
        - Cameras and other imaging sensors
        - LIDAR
        - Depth cameras
      - Sound
        - Microphones
        - Hydrophones
      - Weather
        - Temperature
        - Wind velocity
        - Humidity

- Solar radiation
  - Air pressure
  - Precipitation
  - Medical
    - Heart rate monitors
    - Temperature
    - EKG
    - Imaging modalities data like CT, MR, X-ray, PET, Ultrasound
  - Industrial sensors
    - Temperature Sensors.
    - Pressure sensors.
    - Level sensors.
    - Infrared sensors.
    - Proximity sensors.
    - Smoke sensors.
    - Optical Sensors.
    - MEMS Sensors.
  - Building instrumentation sensors
    - Occupancy
    - Door and window state
    - Temperature
    - Air pressure/flow
    - Humidity
    - Noise
    - Light
    - VoC
    - CO2
  - Sensor ontologies (ex. <https://www.w3.org/TR/vocab-ssn/>)
  - [Web of Things \(WoT\) Architecture W3C Recommendation](#)
  - ISO/IEC DIS 21823-1 Interoperability for Internet of Things Systems - Part 1: Framework
- Affecting the real world
  - [OGC SensorThings API Part 2 – Tasking Core](#)
  - [IEEE 7007-2021 Ontological Standard for Ethically Driven Robotics and Automation Systems](#)
- Positioning/Localization
  - Visual Positioning Services
    - API standards
    - Parameter encodings
    - Digital twin integration (common base data)
- Discovery of spatial services and experiences
  - Discover real-world spatial services (ex. visual positioning service, reality modeling or digital twin service)
  - Discover real-world spatial experiences
  - Integration with reality models or digital twins (ex. real-world URIs)
  - Integration with real-world spatial experience creation environments
  - Decentralized or federated
- Open reality modeling platform (like OpenStreetMap++)
  - Open platform for prototyping, R&D etc.
  - Open data via crowdsourcing
  - Extensible Semantic Model.
  - Automated geo-alignment of digital twins
  - Open visual positioning service
  - <http://openhybrid.org/index.html>

#### 4. Coordination

SDOs and other non-profit organizations that could bring valuable input:

- OGC ([CityGML 3.0](#), [GeoPose 1.0](#), [Sensor Web Enablement \(SWE\)](#), [OGC API - 3D GeoVolumes](#), [OGC API - Environmental Data Retrieval](#) (key for weather))
- Khronos Group (OGC extensions to Khronos glTF 2.0 supporting OGC GeoPose 1.0 and OGC CityGML 3.0 semantics)
- W3C (Immersive Web WG - WebXR, and Geo-alignment, Devices and Sensors WG - GeoLocation API, browser-based sensor streaming, Spatial Data on the Web WG, Web of Things WG)
- Spatial Web Foundation
- IEEE P2874 Spatial Web WG
- Web3D Consortium
- Open Metaverse Interoperability ([W3C Community Group](#))
- Open [Metaverse Interoperability \(OMI\) Group](#)

Companies that could bring valuable input:

- Companies involved in real-world mapping/modeling/digital-twins (ex. Hexagon, Cesium, Esri, Nomoko)
- Companies involved in real-world positioning/localization such as visual positioning, 5G positioning, LIDAR etc.
- Companies with XR infrastructure/tools/platforms (ex. Apple, Google, Microsoft, Meta, Nvidia, Sony, Samsung, HTC, Snap, MagicLeap, Niantic, Vuforia, Unity, Unreal)

#### 5. Risk Factors

- Lack of software developers for prototype development
- Lack of real-world open data
- Lack of contribution/adoption by larger industry players

#### 6. Target timeline to create proposed Working Group charter

8 weeks

#### 7. Additional Contributors

<Forum members who wish to **proactively contribute** to this activity>

- Patrick Cozzi, Cesium
- Scott Simmons, OGC
- Forrist Tanner Lytehaase, Planetary CARE
- Mak Joshi, Schneider Electric
- Jan-Erik Vinje, OnSiteViewer AS
- Christine Perey, PEREY Research & Consulting
- Ali C. Hantal, XR Masters, Open AR Cloud
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## 8. References

Topic Brainstorming Spreadsheet, Real/Virtual World Integration section:

<https://docs.google.com/spreadsheets/d/1-Ya0RVDpRD8yXJFeRSKOPXmknfdPMFLSD-YcXr9tcFw/edit#gid=0>

The OARC Open Spatial Computing Platform (OSCP) is focused on creating open source prototypes for key technology building blocks and exercising these prototypes along with partners in real-world testbeds (e.g., Cosmos/NGI Atlantic <https://www.auroraviewer.org>, Los Angeles/US, Bari/IT, Istanbul/TR, Ankara/TR). The current building blocks include:

- spatial services
- experience discovery
- GeoPose-compliant positioning (e.g., visual positioning services)
- GeoPose-compliant broker
- reality modeling

OARC GitHub: <https://github.com/OpenArCloud>