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 Lytehaause, Planetary CARE
- Mak Joshi, Schneider Electric
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- Christine Perey, PEREY Research & Consulting
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- Jone Ibarzabal, Purple Blob, Digital Twins
- Santosh Mallesan, Verizon
- Stephen Hauer, Poliigon

8. References

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