

Web3D 2026

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A Reality Modeling Language to Facilitate the Definition of WebXR-enabled Spatial Computing Experiences

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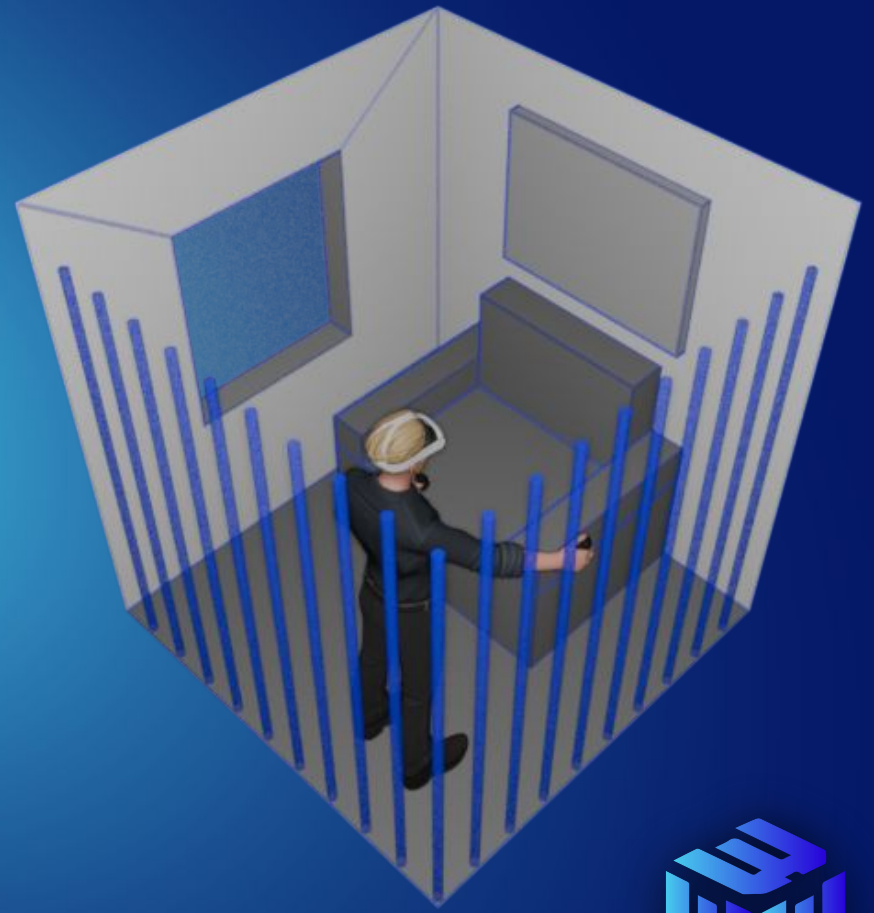
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Introduction

Developing engaging XR experiences is often a difficult task due to **the lack of spatial and semantic data of the physical environment.**

While new hardware platforms include sensors to obtain a basic replica of the users' physical surroundings, **they are often limited to simple interior spaces with immovable objects.**

Ultimately, **these issues hinder the creation of intuitive interaction techniques and, thus, the general adoption of XR technologies.**



State of the Art

While there is no shortage of 3D file formats based on scene graphs (glTF, USD… or X3D), **to describe physical environments, it is necessary to include (geo)spatial and semantic information.**

Standards such as BuildingSmart IFC-BIM or OGC CityGML allow the declaration of such information… but each of them **is limited by the closed conceptual models of their respective knowledge fields.**

This has led to market fragmentation and the formation of information silos, hindering the development of software solutions for many industrial sectors.



Reality Modeling Language

The main goal of the project is to p**rovide a common way to describe the physical world in an open, federated and interoperable way**, enabling the creation of spatial interaction techniques for WebXR.

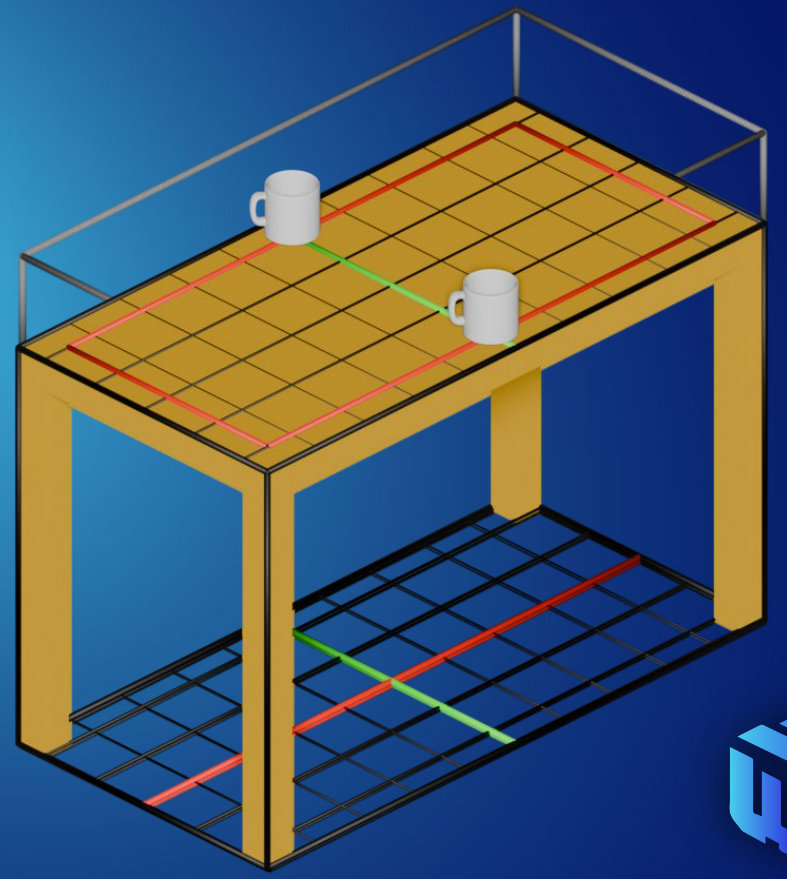


Spatial Description

Each RML entity has its own “space”, including origin points, 3D volumes and coordinate reference systems.

Furthermore, **each space can contain subspaces** (e.g., the rooms of a house) **or automatically generate others** based on gravity or the relative location of the user.

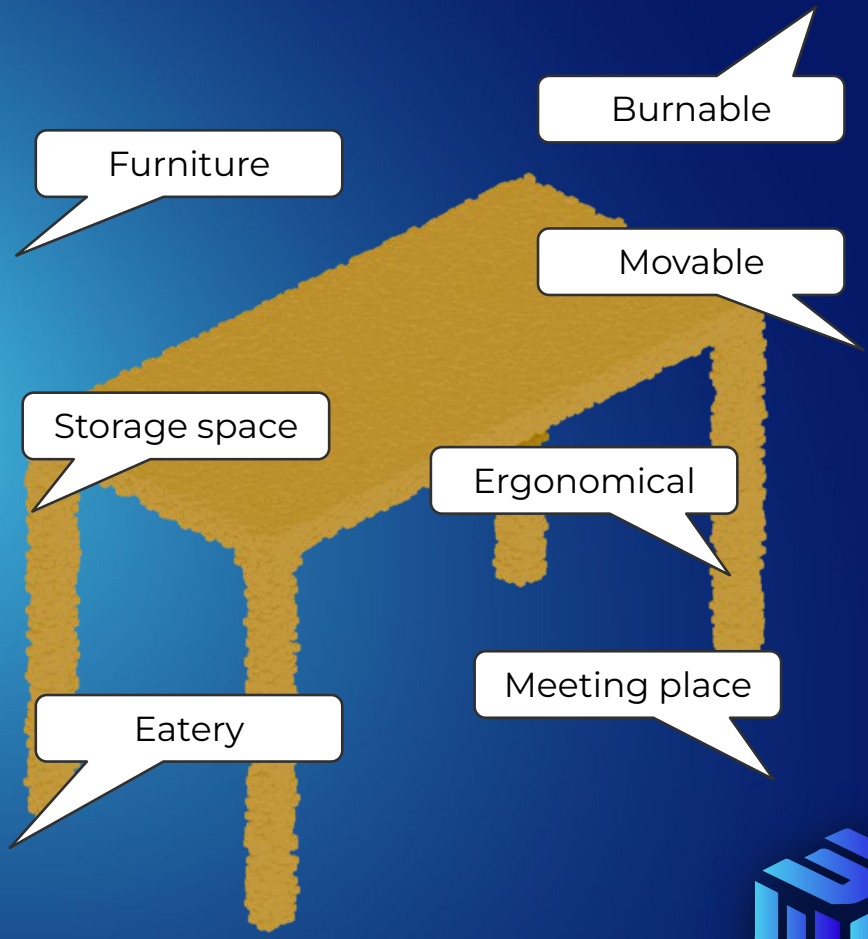
This facilitates the definition of spatial queries (e.g., “is the cup on the table?”), as well as **the implementation of new navigation and distribution systems.**



Extensible Syntax

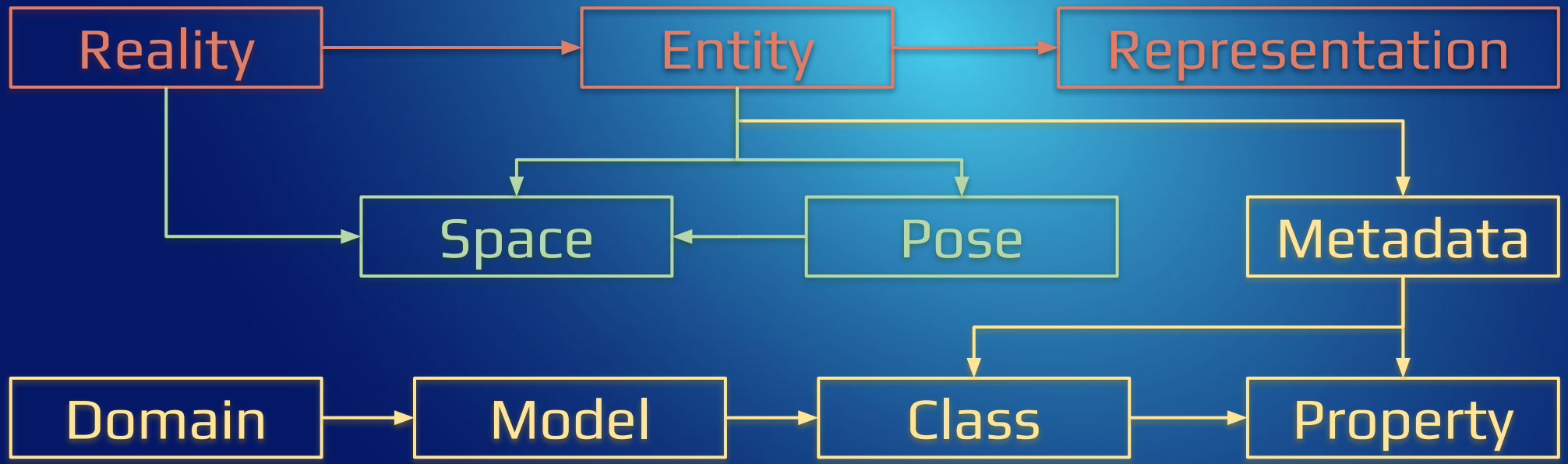
Rather than requiring a complete ontology of the entire Universe from the beginning, the **extensible syntax system of RML empowers experts from different fields to collaboratively build it step by step.**

In practice, this means **each RML entity can be assigned multiple classes and properties at the same time**, creating a “semantic hotpot” where multiple users can add and/or retrieve what they need.



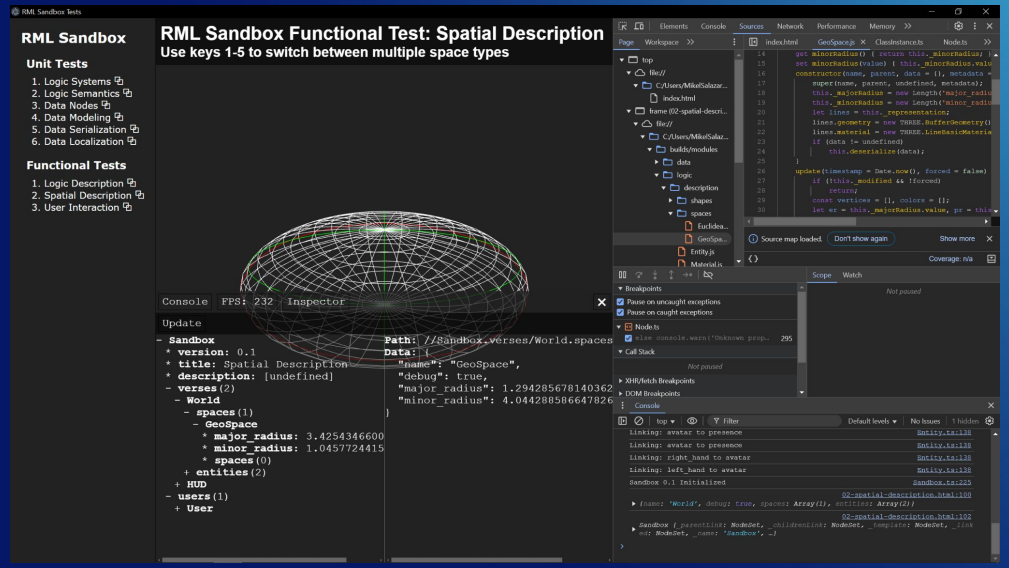
Implementation

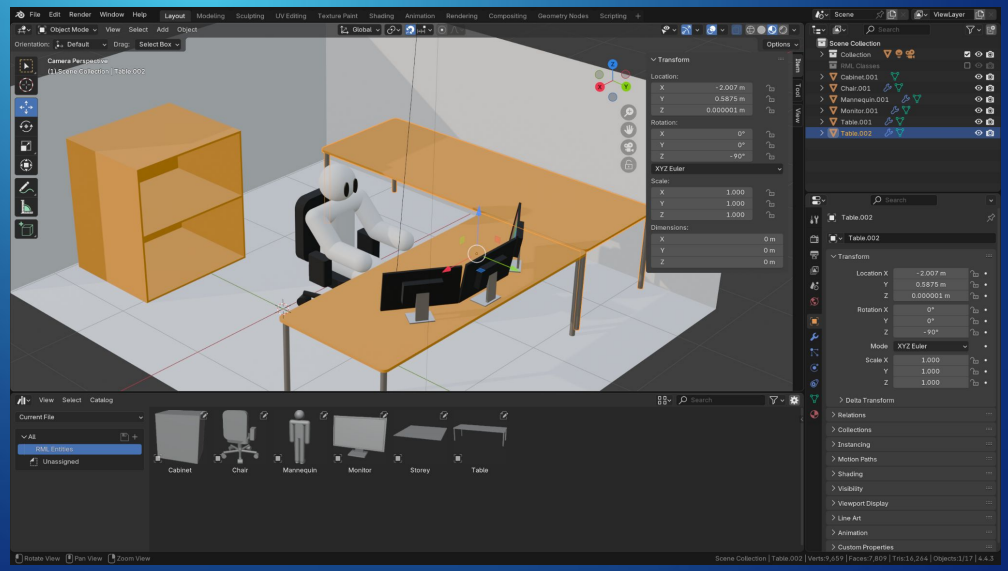
To properly translate these ideas into code, we use **a simple node graph that can be easily managed by humans and computer systems alike**:



Validation

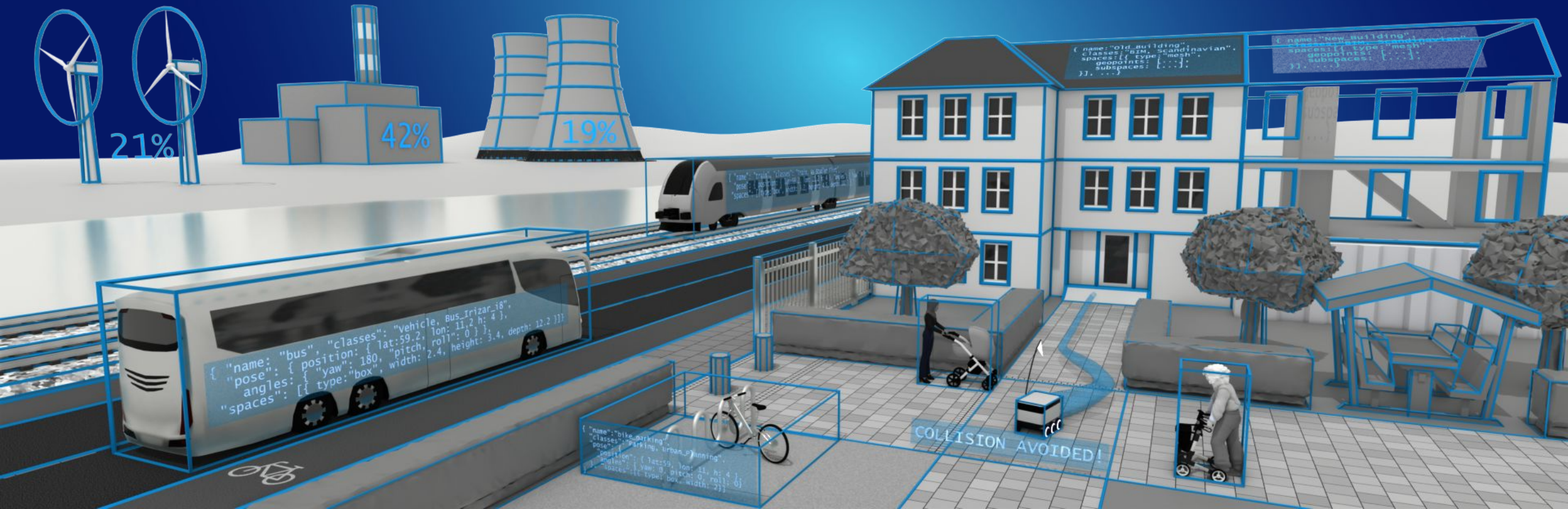
To properly validate the Reality Modeling Language an experimental TypeScript implementation was developed on top of the Theejs engine. In combination with the WebXR API, this facilitated the definition of a catalog of interaction techniques that worked in multiple XR headsets.





Conclusions

Creating a formal language to describe reality in an interoperable way is possible… albeit it requires rethinking how we understand the world.



Next Steps

- Development of a framework based on the Reality Modeling Language that facilitates the creation of XR browsers.
- X3D Importer and Exporter (with additional Spatial and semantic components).
- Validate the resulting XR browsers in real-world scenarios.





Thank You!

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