



transforming the way the world works

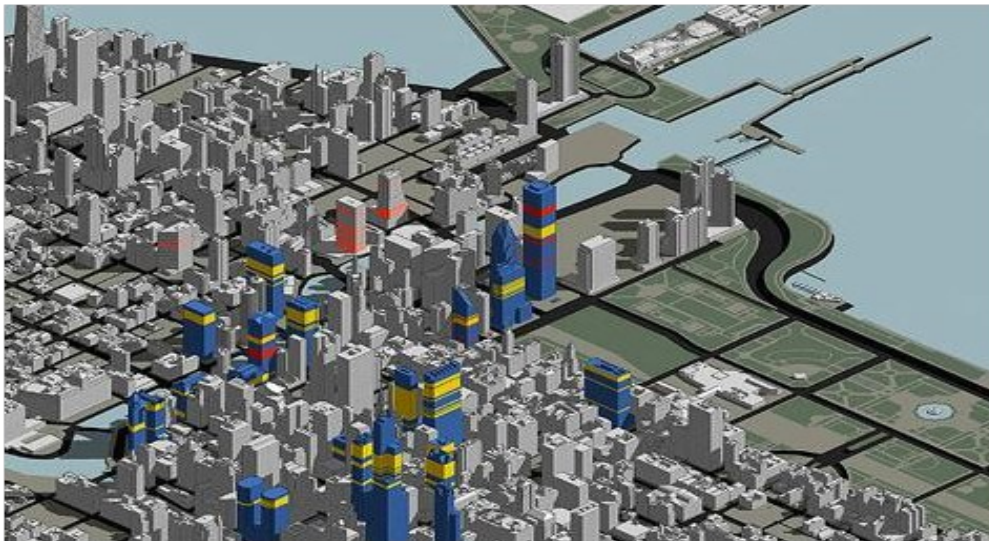


**Open Standards for GeoSpatial and BIM Data, How are They Developed and What is Their Role in Building and Operating Built Environment**

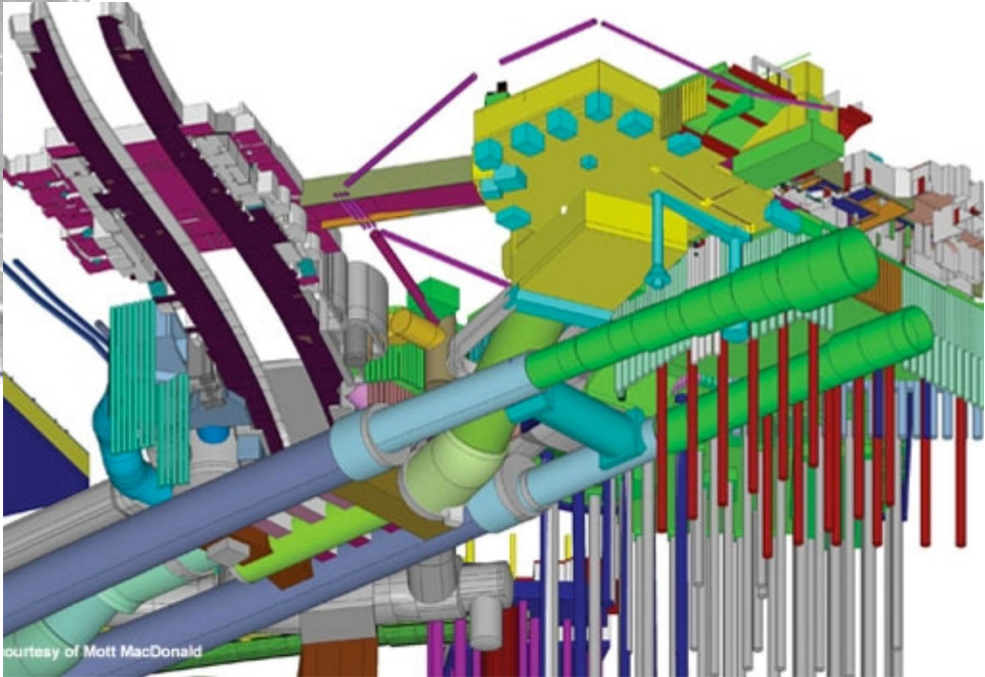
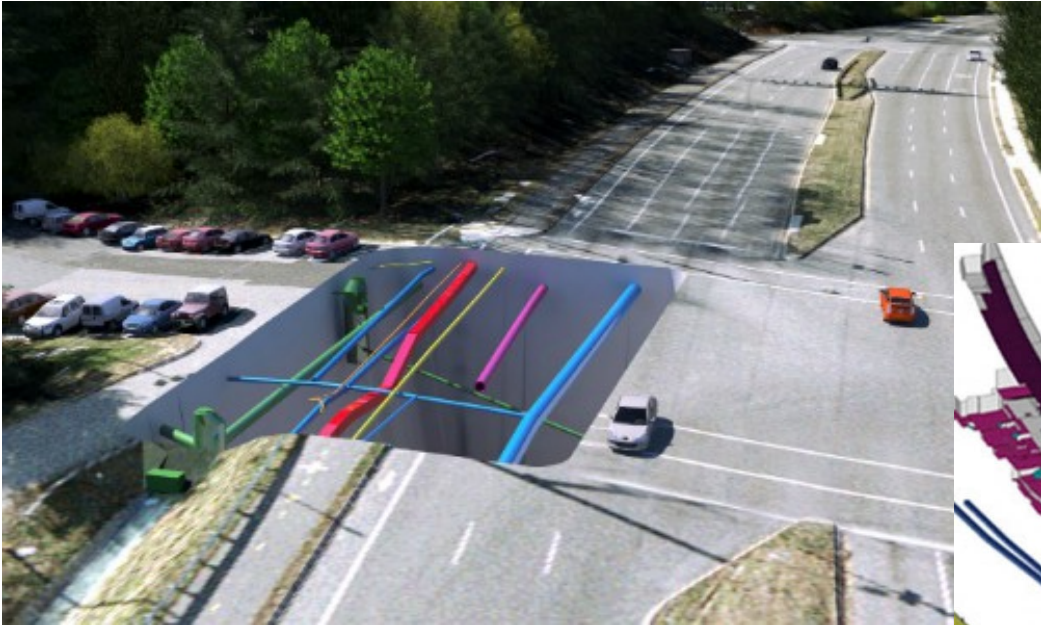
**Leif Granholm**  
**BIM Ambassador**

# Geospatial and semantic 3D

- Geospatial community getting aware of 3D technology
  - Cadastre, terrain, design, Smart Cities
- New standards developed by OGC, CityGML, IndoorGML, InfraGML, KML (Google Earth format), 3D services in collaboration with web3D (webGL, X3D)
- New Urban Planning Domain Working Group in OGC



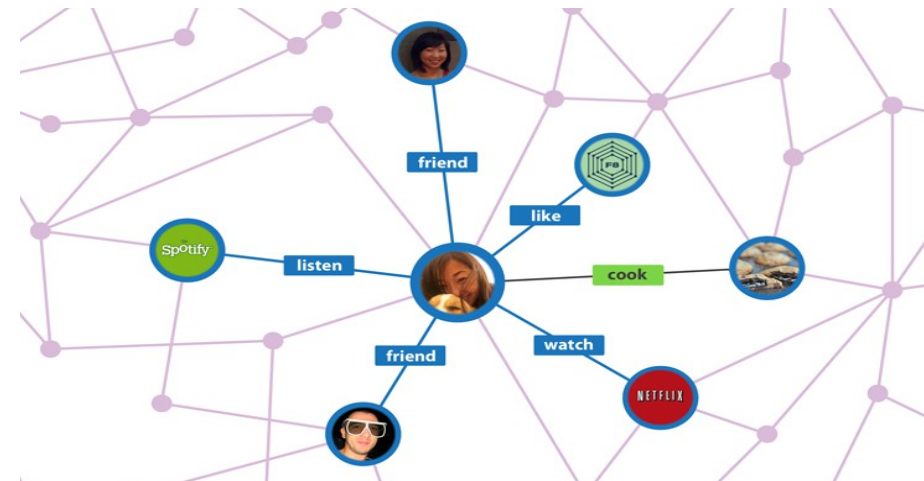
# BIM for Infrastructures



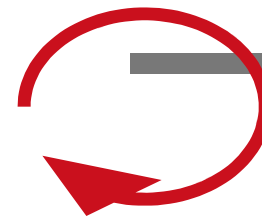
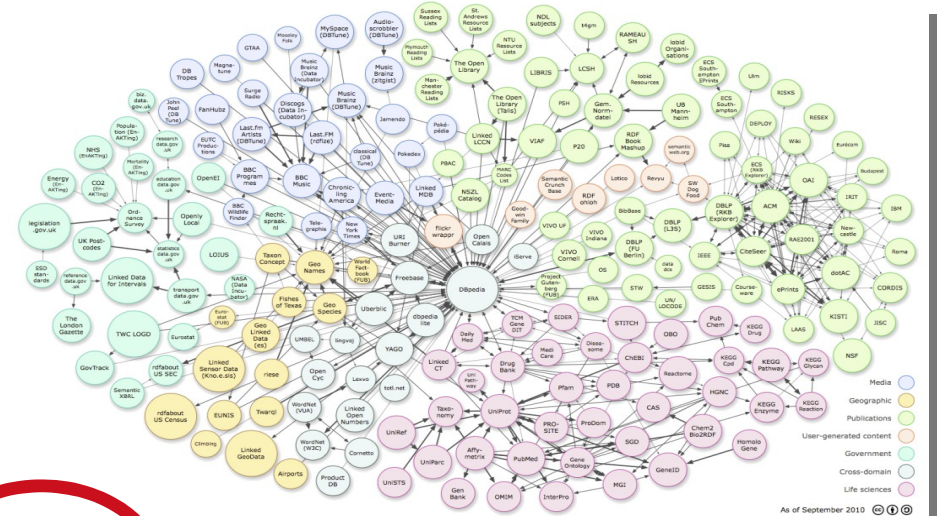
# Semantic data on the Web



Google Knowledge Graph



Facebook Open Graph



W3C Linking open-data community project

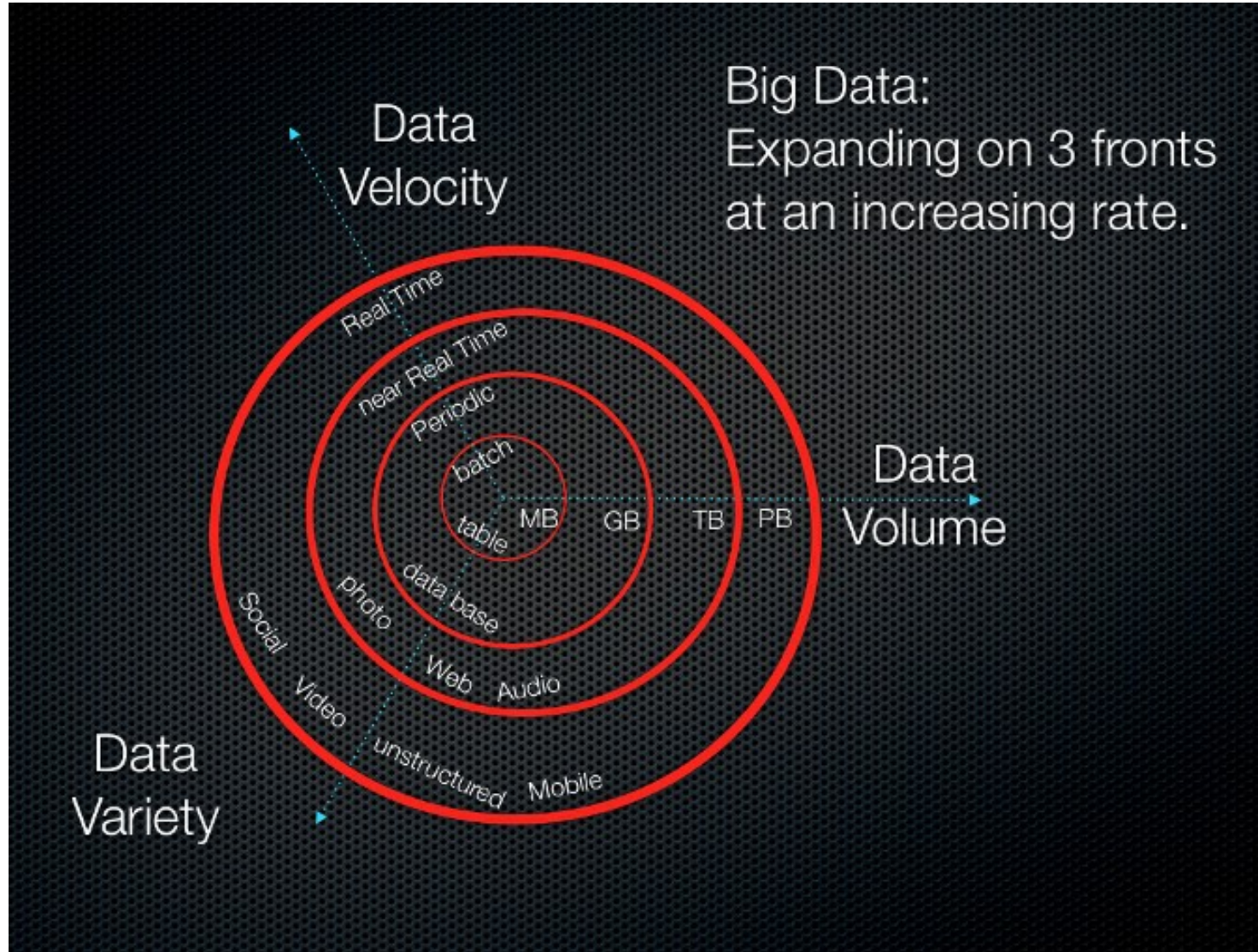
Web of Data  
(open, standard, structured decentralized)

**Big data** is an evolving term that describes any voluminous amount of structured, semi-structured and unstructured **data** that has the potential to be mined for information.



# Big Data: 3Vs

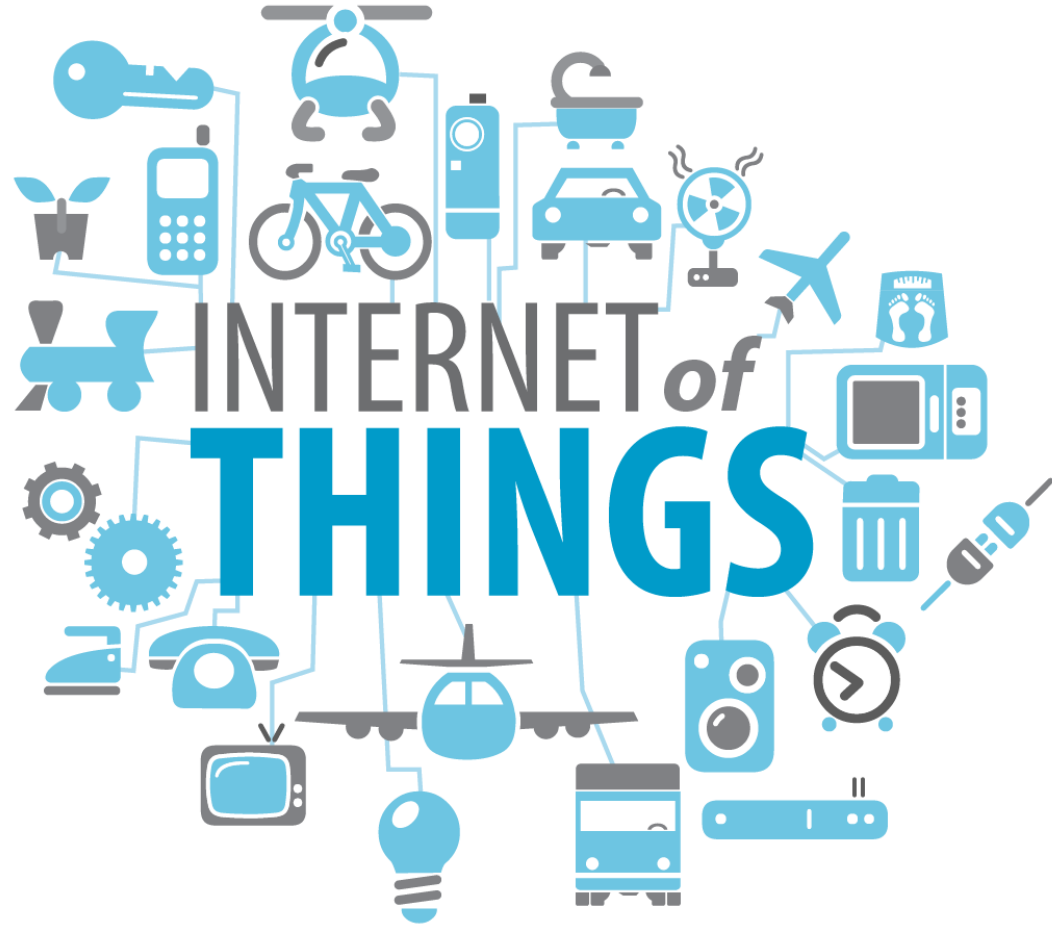
## Volume, Variety, Velocity



# Internet of Things

The **Internet of Things** (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing **Internet** infrastructure.

The Internet of Things (IoT) is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS)  
<sup>7</sup>and the Internet.



# Standardization organization types

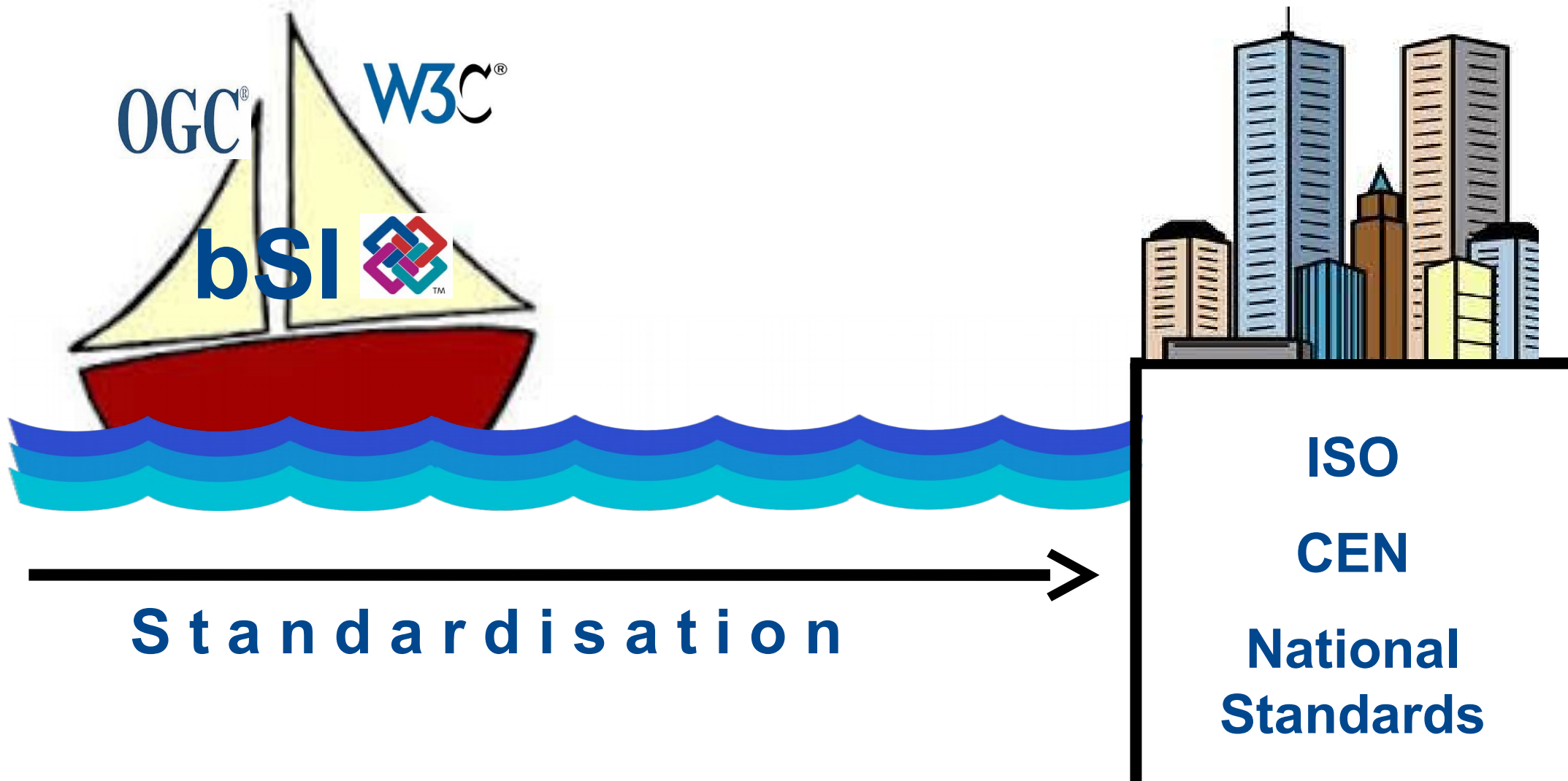
- “Formal” standardization organizations
  - General national standards bodies, ANSI, DIN, SFS, SIS  
Members of ISO International Organization for Standardization and CEN
  - IEEE Institute of Electrical and Electronics Engineers  
IEEE standards affect a wide range of industries including: power and energy, biomedical and healthcare, [Information Technology](#) (IT), telecommunications, transportation, nanotechnology, information assurance, and many more. In 2013, IEEE had over 900 active standards, with over 500 standards under development.
  - IEC International Electrotechnical Commission
  - ITU, ETSI telecomm standards



# Standardization organization types

- “Independent” standardization organizations owned by members with no formal position
  - W3C World Wide Web Consortium, web standards, XML, HTML...
  - OGC Open Geospatial Consortium, GeoSpatial standards, GML...
  - IETF Internet Engineering Task Force, internet Standards, TCP/IP
  - buildingSMART information related standards for construction and built environment

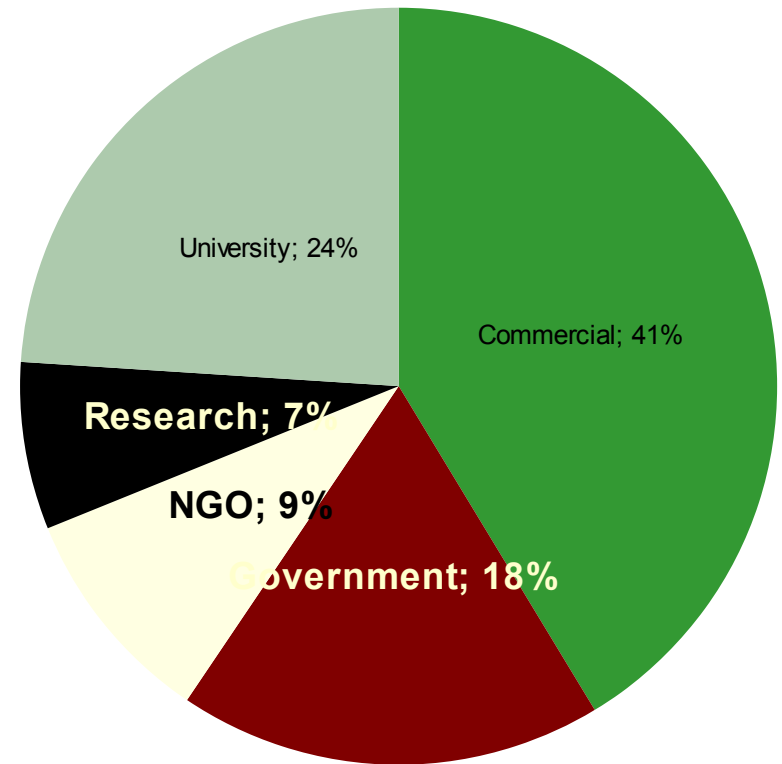
# Standardisation vs. Standards



# The Open Geospatial Consortium

Not-for-profit, international voluntary consensus standards organization; leading development of geospatial standards

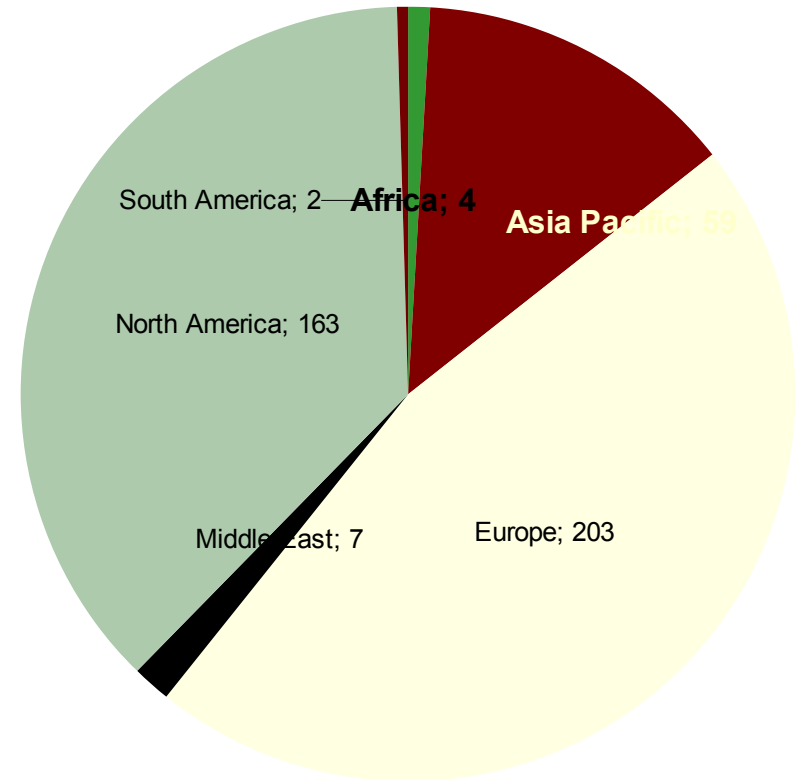
- Founded in 1994.
- 480+ members and growing
- 38 standards
- Hundreds of product implementations
- Broad user community implementation worldwide
- Alliances and collaborative activities with ISO and many other SDO's



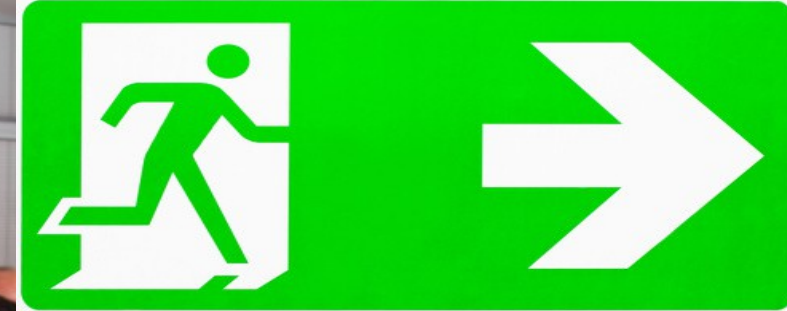
# OGC at a Glance

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# What most people think about standards work!



# Or How Many Others View Standards

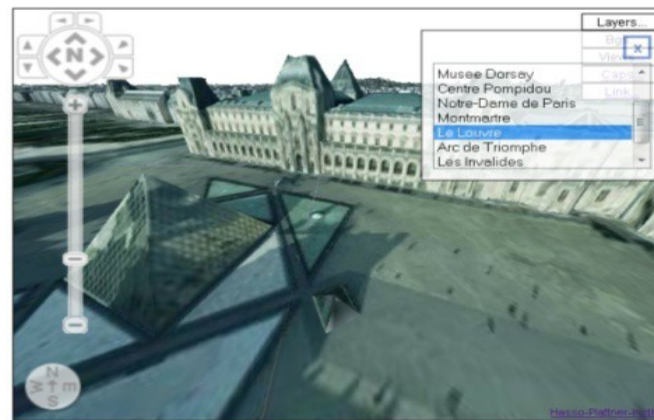
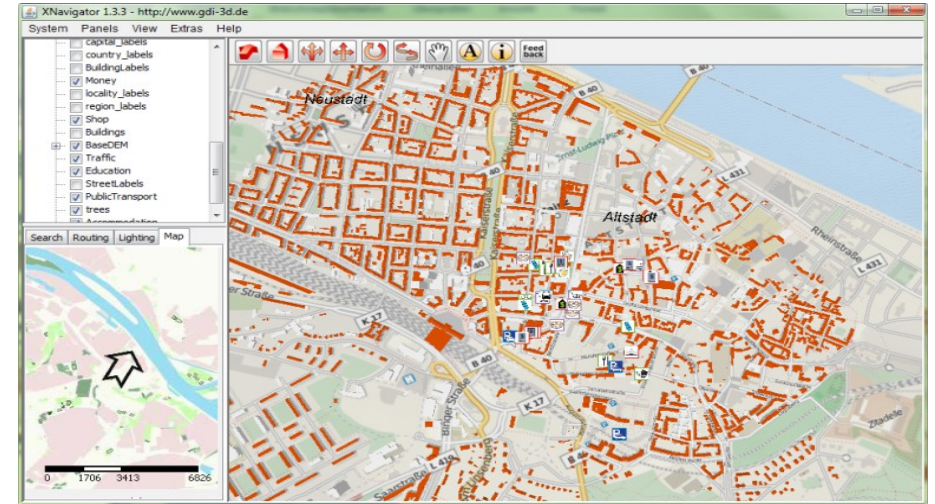
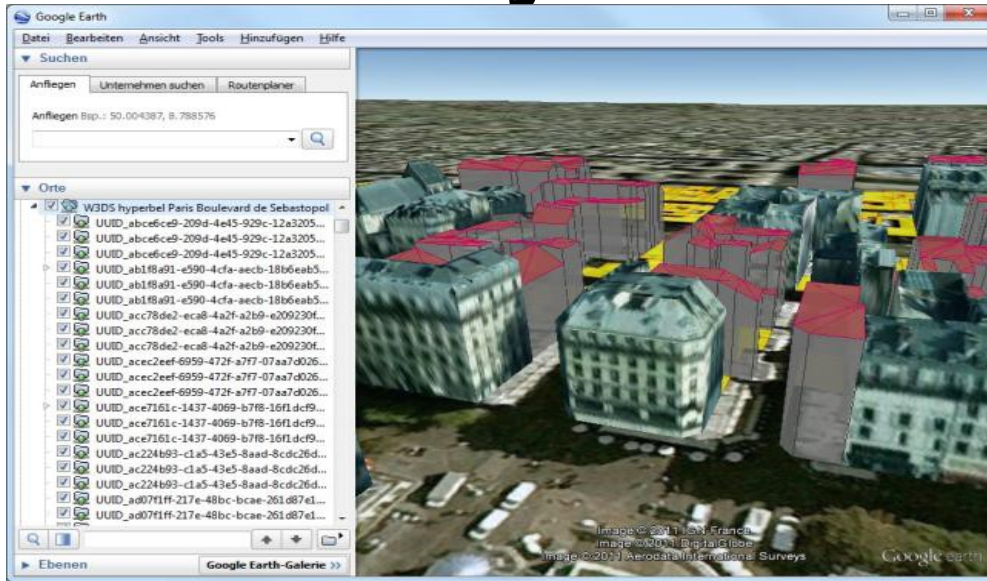


# Standards Development is not easy!



- Requires collaboration on a global basis
- Requires consensus by many organizations
- Requires give and take
- Requires certified, repeatable process

# 3D and CityGML



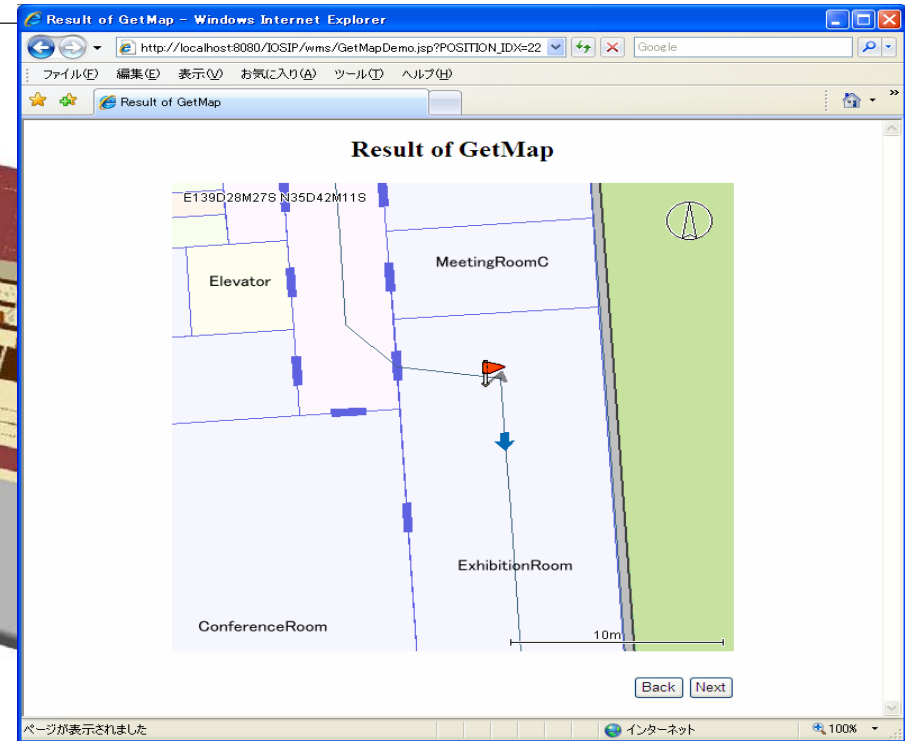
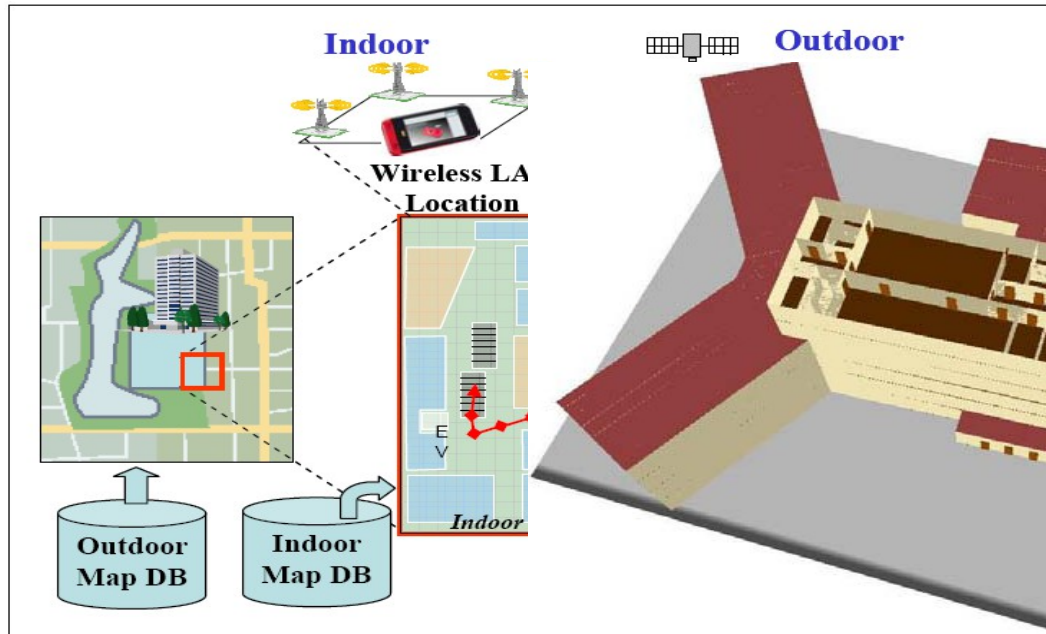


# CityGML

- Application independent Geospatial Information Model for virtual 3D city and landscape models
  - comprises different thematic areas(buildings, vegetation, water, terrain, traffic etc.)
  - data model(UML)according to ISO 191xxstandard family
  - exchange format results from rule-based mapping of the UML diagrams to a GML3 application schema
  - ongoing standardisation process in OGC
- CityGML represents
  - 3D geometry, 3D topology, semantics and appearance
  - In 5 discrete scales (Levels of Detail, LOD)

# Indoor location/navigation

Integrated indoor/outdoor navigation  
using OGC CityGML, WMS



# InfraGML

- use case driven subset of LandXML functionality
- interoperability standard vs. negotiable template
- SDO support
- avoid possible legal issues
- enables OGC baseline consistency
- GML provides:
  - feature model
  - geometry support
  - coordinate reference systems
  - linear referencing
  - TIN support
  - compatibility with CityGML, TransXML

# The ISO/TC 211

## Geographic information/Geomatics

(2012-11)



- *... building the foundation of the geospatial infrastructure, brick by brick ...*

# Introduction: buildingSMART today

## Values

- Open
- Neutral
- International
- Non Profit

## Goals

- Create openBIM standards
- Host open BIM forums
- Certify software & people
- Become a trusted resource
- Promote active use

## Standards Focus

- Data
- Processes
- Dictionaries
- BIM Standards

## History

- 1995 Established
- 2000 IFC2 Release
- 2012 IFC4 Release
- 2013 First ISO Standards

A world wide **Alliance**  
driving the transformation of  
the built environment  
through creation & adoption of  
open, international standards



Richard Petrie  
CEO



Patrick MacLeamy  
Chairman

## International Network

- Australasia
- Benelux
- Canada
- China
- French
- German
- Hong Kong
- Italia
- Japan
- Korea
- Middle East
- Nordic
- Norway
- Singapore
- United Kingdom
- USA



# ISO/TC 59 Buildings and civil engineering works

## Scope:

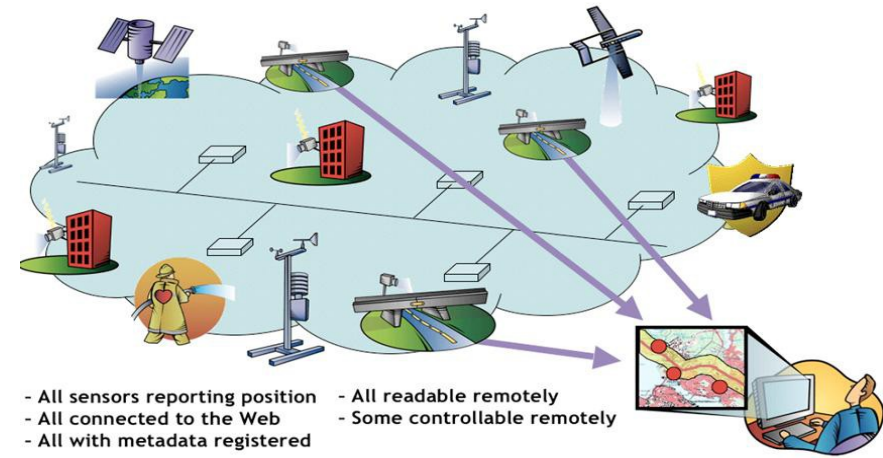
### **Standardization in the field of buildings and civil engineering works organization of information in the processes of design, manufacture and construction**

- general geometric requirements for buildings, building elements and components including modular coordination and its basic principles, general rules for joints, tolerances and fits;
- general rules for other performance requirements, including functional and user requirements related to service life, sustainability, accessibility and usability;
- general rules and guidelines for addressing the economic, environmental and social impacts and aspects related to sustainable development;
- geometric and performance requirements for components that are not in the scope of separate ISO technical committees;
- procurement processes, methods and procedures.

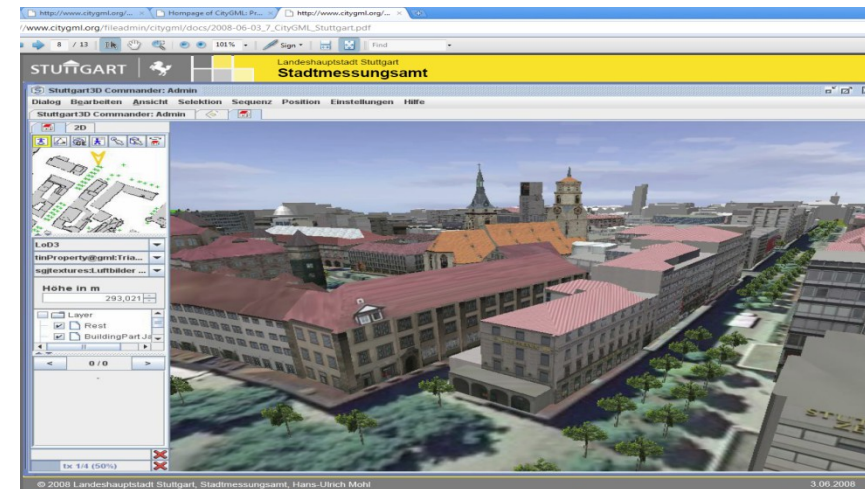
# Spatial Architecture for Smart Cities

- Integration of Geo-information, Sensor Webs, Built Environment using open standards
- Interoperability of independent software implementations in an open framework
- Market opportunities through innovations in open standards
- Vendor-neutral best practice reusable in any Smart City

Contact: George Percivall ([gpercivall@opengeospatial.org](mailto:gpercivall@opengeospatial.org))



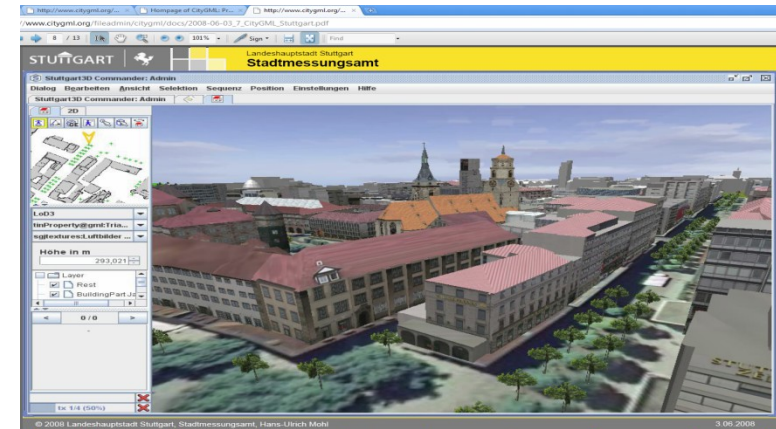
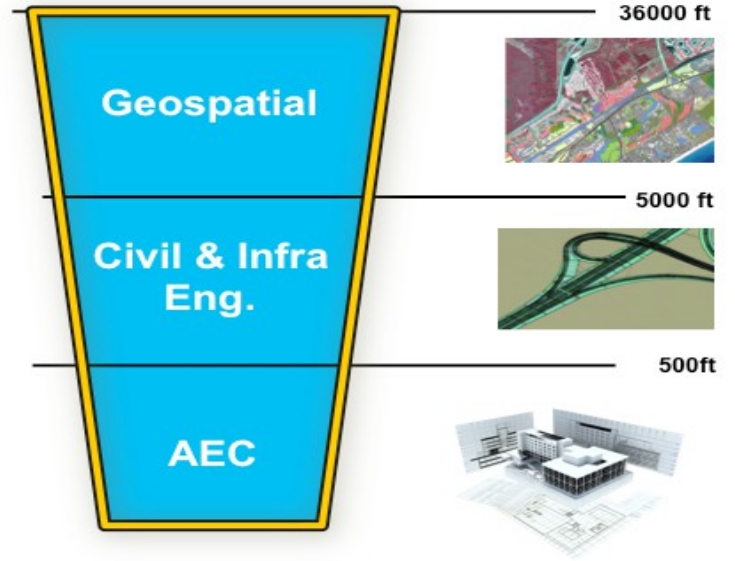
OGC Sensor Web Enablement



CityGML graphic source; Thomas Kolbe, Berlin TU

# Location Services for Smart Cities

- **Citizen Services**
  - Location-aware municipal services using open data and standards
- **Energy and Utilities management**
  - Smart Energy
  - Smart Water Management
- **Disaster and Emergency Response**
  - Common Operational Picture
- **Urban Maps**
  - 3D City Models
  - Indoor Venue Maps
  - Interoperability with BIM
- **Sensor Webs**
  - Situational awareness from fusion of sensor observations



Source; Thomas Kolbe, Berlin TU



# Summary

- Integration of GeoSpatial and BIM should be implemented through “Multi-Kernel” approach
- Softwares implement the standards they need information from to the extent they need, not full implementations

Thank you