i-locate and indoor open data

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We spend 90% of our time indoor

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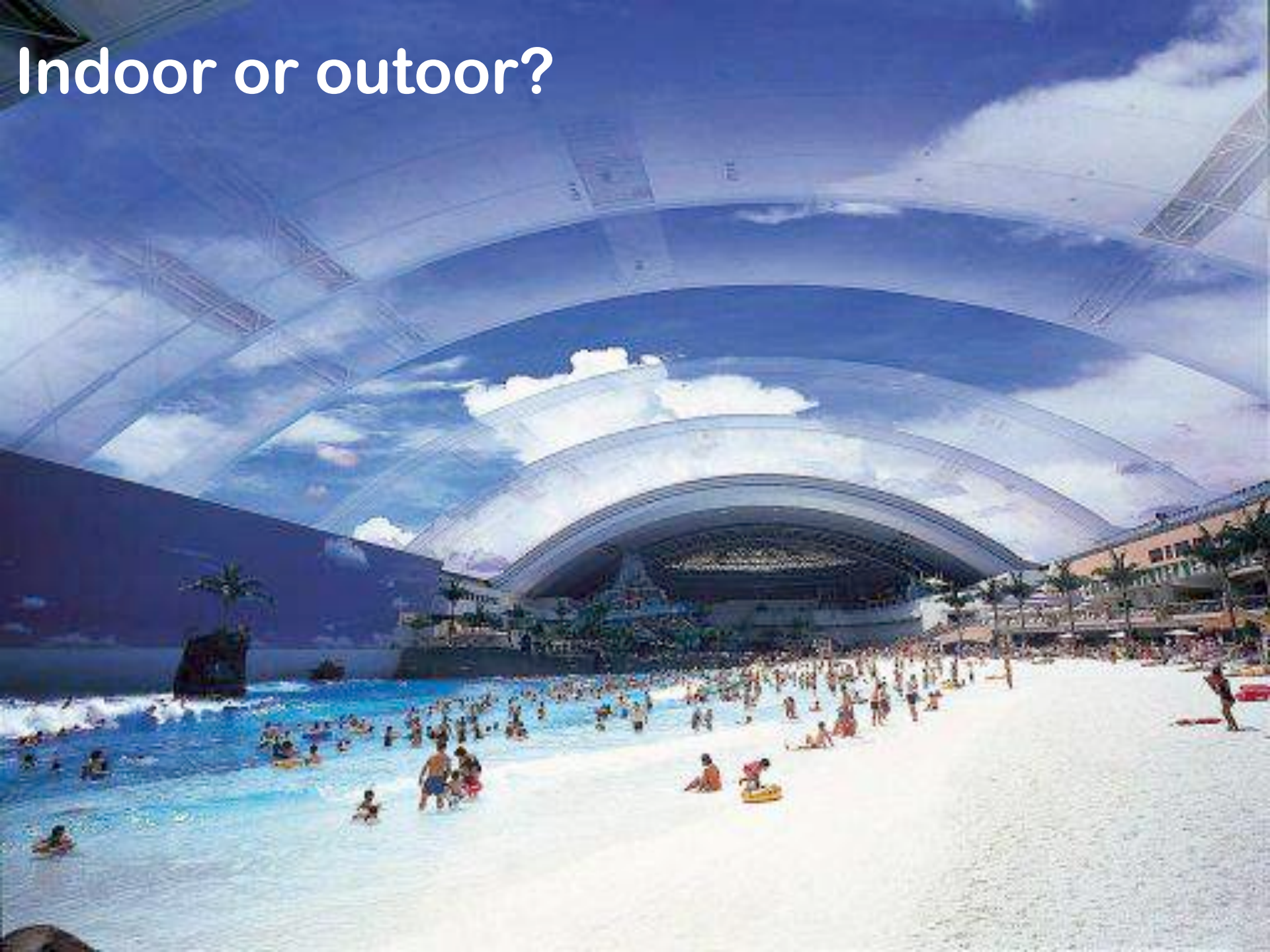
Modern architectures are so complex and articulated that event the concept of indoor and outdoor are blended

Indoor or outoor?




Growing number of hybrid or blended spaces

Traditionally indoor routing has been based on signals

Oversimplifying

Without i-locate

With i-locate

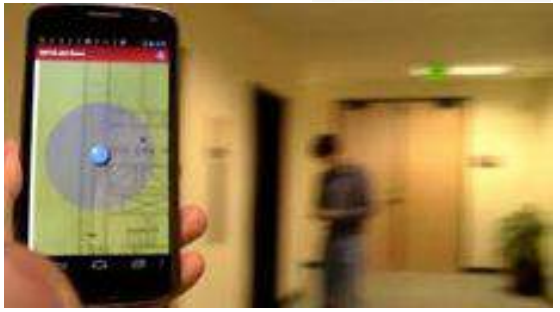
Recently, accurate indoor localisation technologies are now available for indoor Location Based Services (LBS)

NOKIA
Connecting People

Google

WiFiSLAM

ekahau

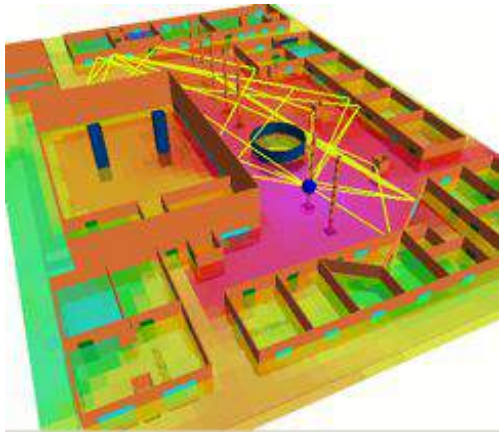


Navizon

CISCO SYSTEMS

Different solutions, different approaches…

- Commercially availabile solutions are essentially based on triangulation of radio signal (GPS, WiFi, Bluetooth, ZigBee, mobile telephone cells)
- They should ensure«data fusion» to handle, in an integrated way, localisation both indoor and outdoor.
- Accuracy varies from few meters (WiFi) down to few centimeters (Bluetooth, ZigBee)



Integrated indoor/outdoor location, tracking & management of assets (human, material) based on open GI are key drivers for innovation & business activities in several value added scenarios

All market analysts agree that market of indoor LBS is set to grow in the next 4 years to a multi-billion market.

However…

Barriers

Three main barriers limit the use of hybrid indoor/outdoor LBS

- Lack of indoor maps available as open data.
- Lack of interoperable technological ecosystems.
- Limited support for indoor/outdoor LBS by current GI standards.

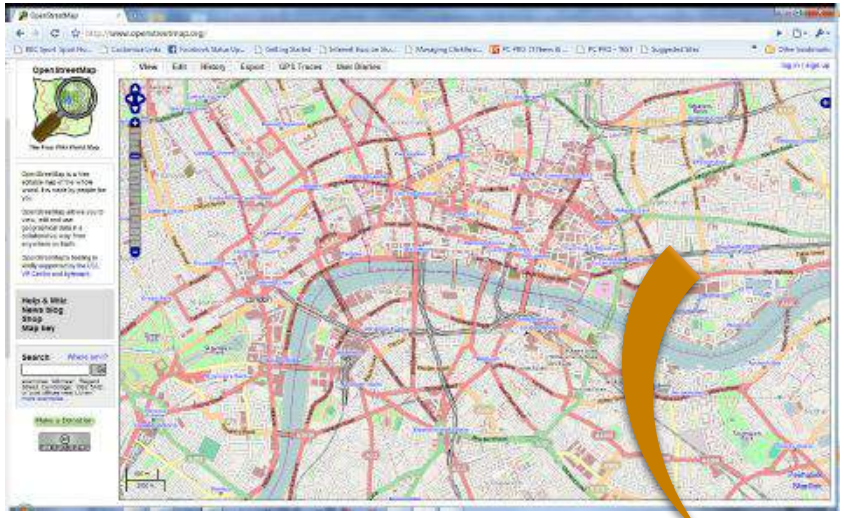
Objectives of i-locate

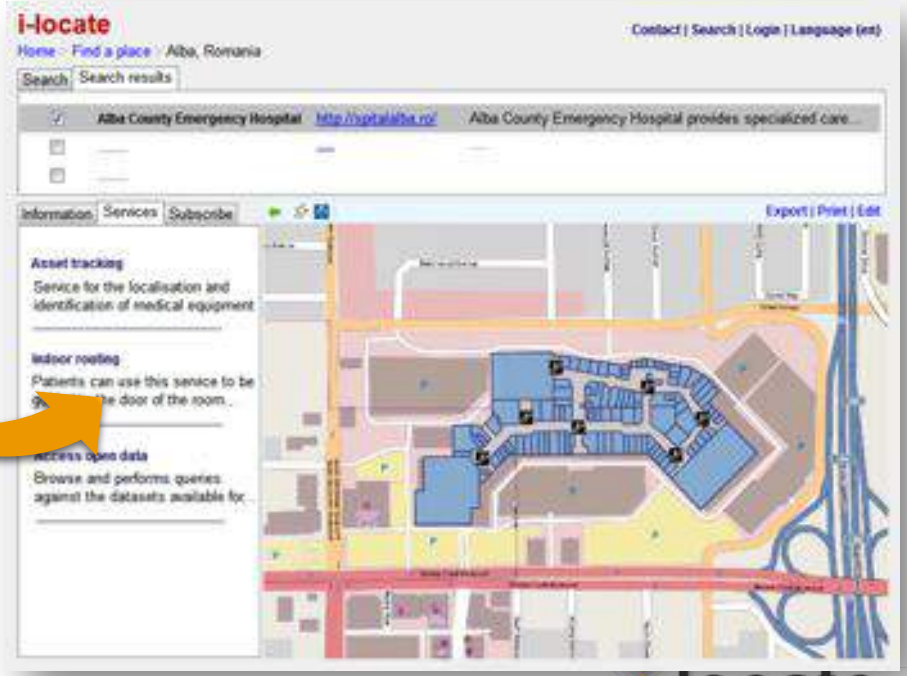
Objective 1: to create a «virtual hub» for indoor mapping

- Private **buildings accessible to the public**
- Private properties
- Creation of a single point of entry to open indoor GI in Europe and beyond

Objective 1: to create a «virtual hub» for indoor mapping

To develop an indoor counterpart to OSM

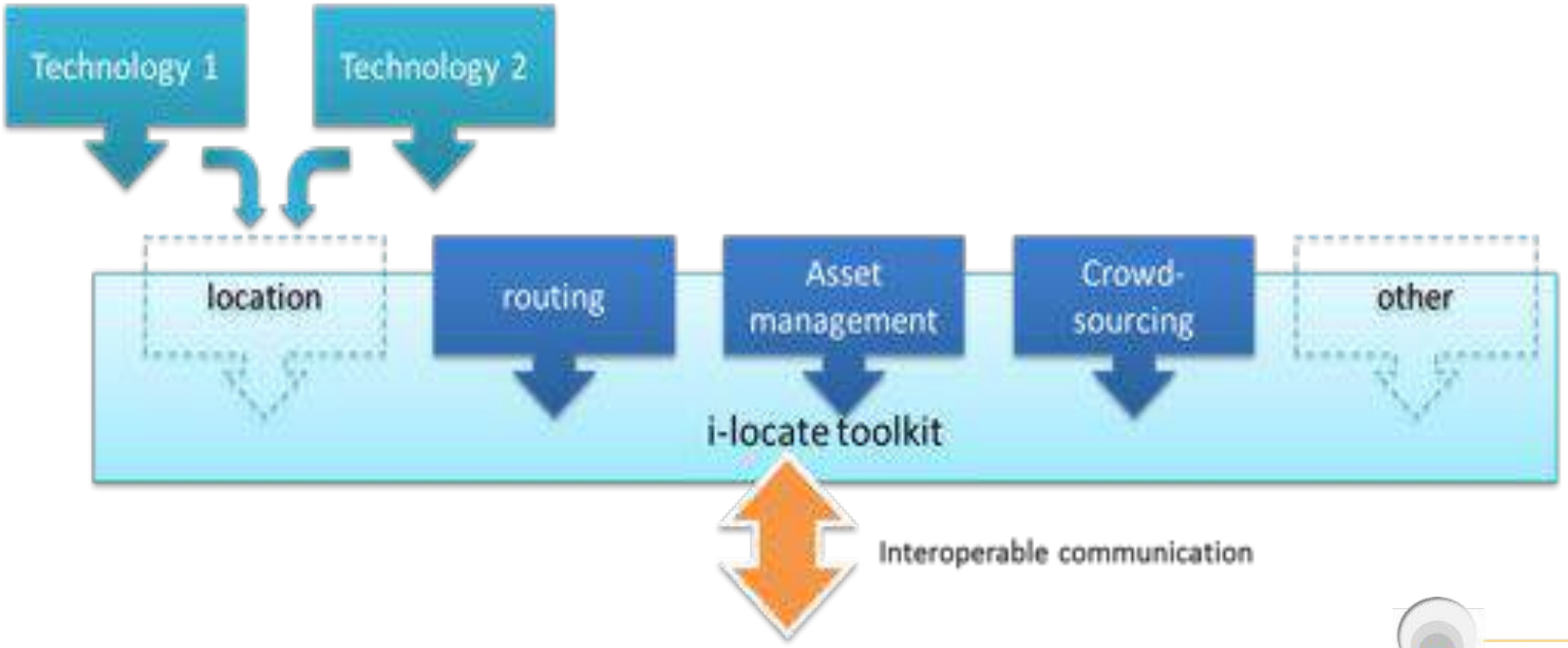




Open data for indoor and outdoor. Why do we need this?

Objective 2: open source i-locate toolkit

- Provision of interoperable indoor/outdoor LBS
- Web- and mobile-based visualisation and management of open indoor GI
- Crowdsourcing-oriented provision of open GI regarding indoor/outdoor spaces
- Open communication interfaces (open standards)
- Scalability



Objective 2: open source i-locate toolkit

- **Open Source** middleware based on **open standard**
- Ready to deploy **software toolkit** that can be used to easily create innovative businesses

Scenarios addressed

i-locate addresses 2 scenarios:

- Scenario 1: guidance of patients through an health care path

- Scenario 2: Smart tracking and asset management for lean asset management models

Objective 3: The creation of mobile client-side technologies

App for iOS and/or Android devices capable to access the toolkit's services

Objective 4: specific privacy and security policies

Technology and the pilots will be built upon a Privacy Impact Assessment (PIA) and a TVRA (Threat, Vulnerability and Risk Analyses)

Objective 5: The adopt current location based standards and to contribute to their extension and use

- Interoperability is necessary to **maximise takeover** and impact of the project

EUROPEAN STANDARDS ORGANIZATIONS

Making location count.
www.opengeospatial.org

Objective 6: To pilot –for the duration of 12 months- within a real-life operational scenario

Involve a variety of **appropriate user communities**







Main achievements

1st Achievement

Definition of a reference architecture for indoor and outdoor LBS


Which are the requirements of laypeople?

Which are the requirements of industry?

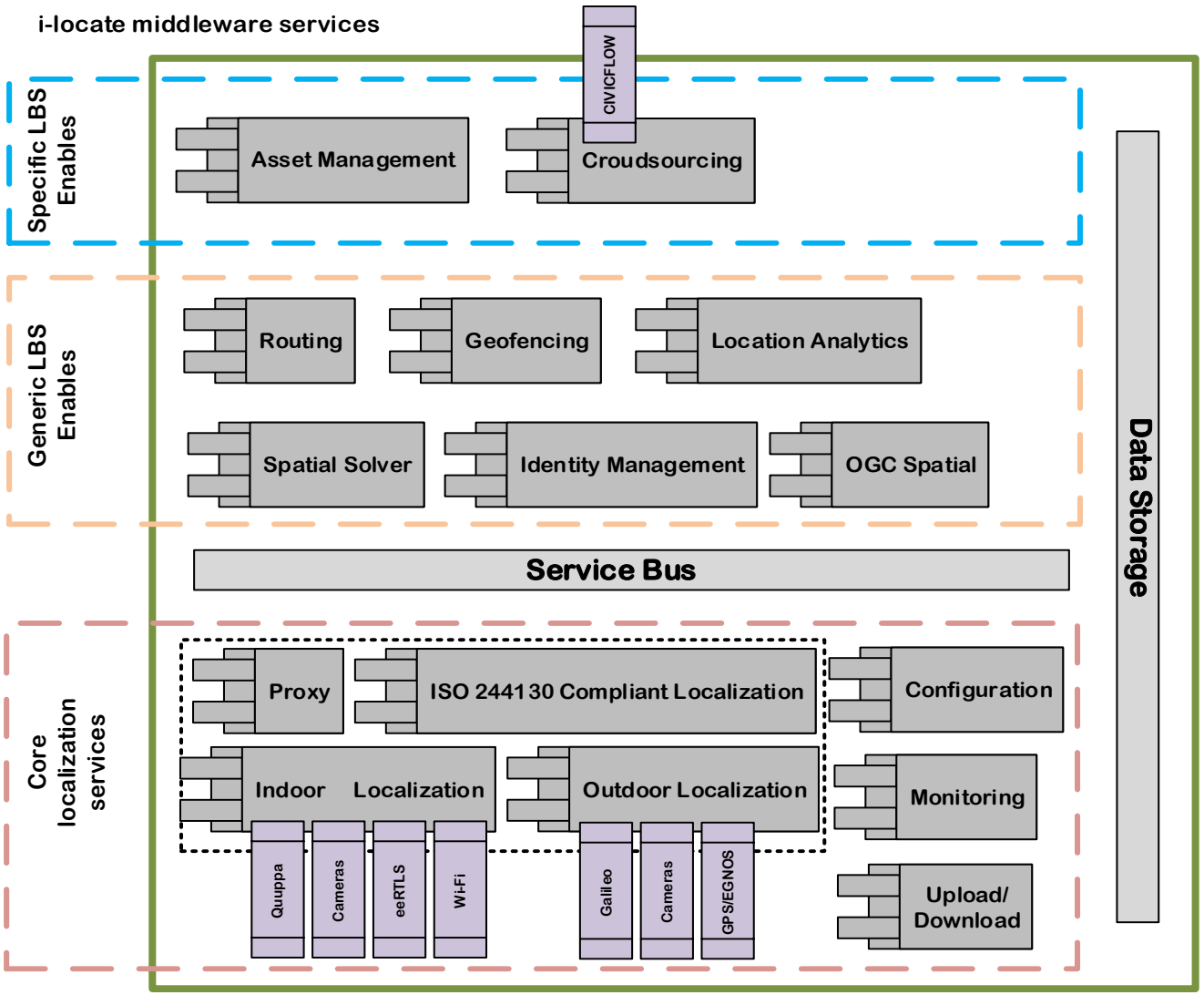

Which are the requirements of public service providers?

Macro use case scenarios identified

- Asset management, localization and tracking of assets in a building and its premises (e.g., wheelchairs in a hospital)
- Citizen welcoming and guidance, guidance of persons outdoor/indoor (e.g., a patient from home to a surgery room for a visit)
- People localization, localization and tracking of persons indoor
- Control of traffic, control of the traffic on a panoramic road and detection of cues, accidents, etc. - specific for one site (Tremosine)

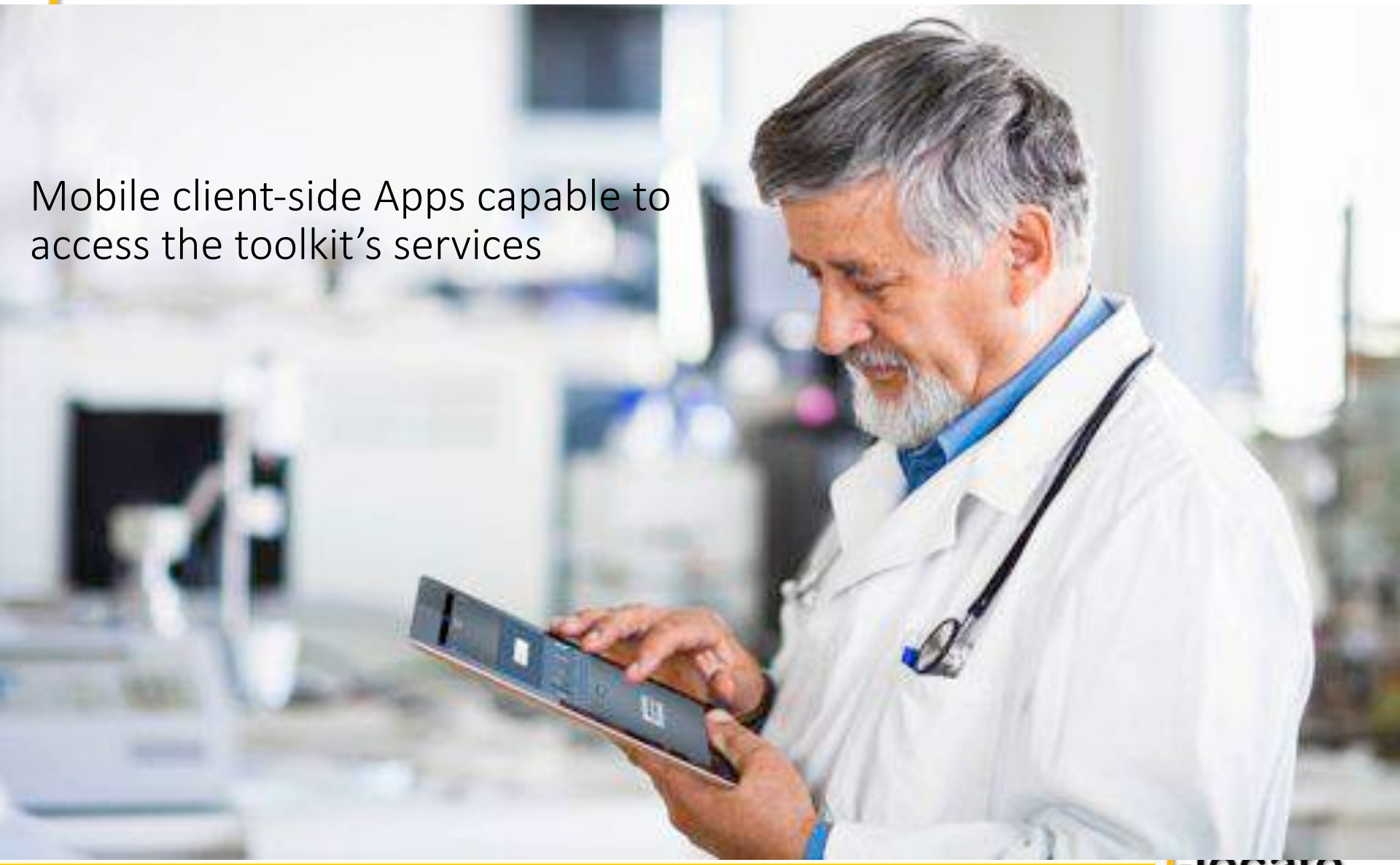
First milestone: release of system architecture (M06)

System architecture



Design of mobile applications

Mobile client-side Apps capable to access the toolkit's services

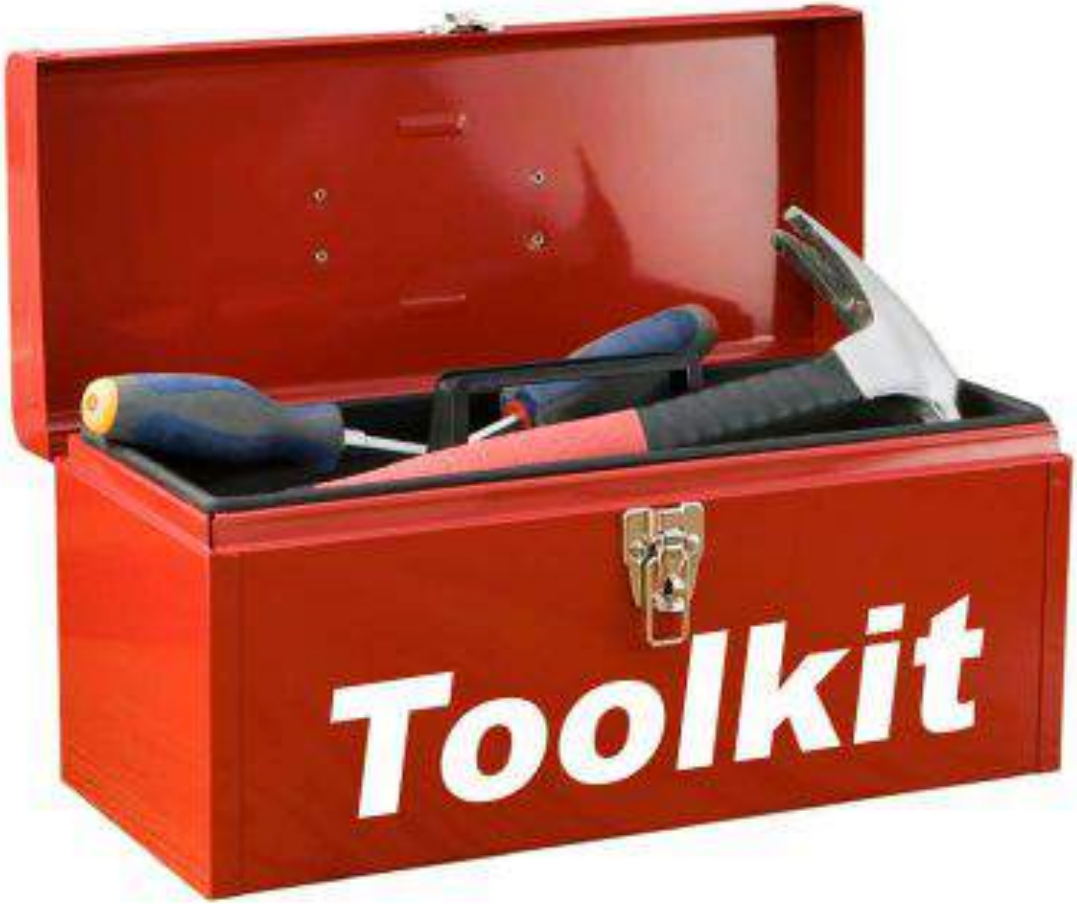


2nd Achievement

Development of the first version of the i-locate set of technologies:

- Toolkit V1
- Mobile apps V1
- Portal (originally planned only at M18) V1

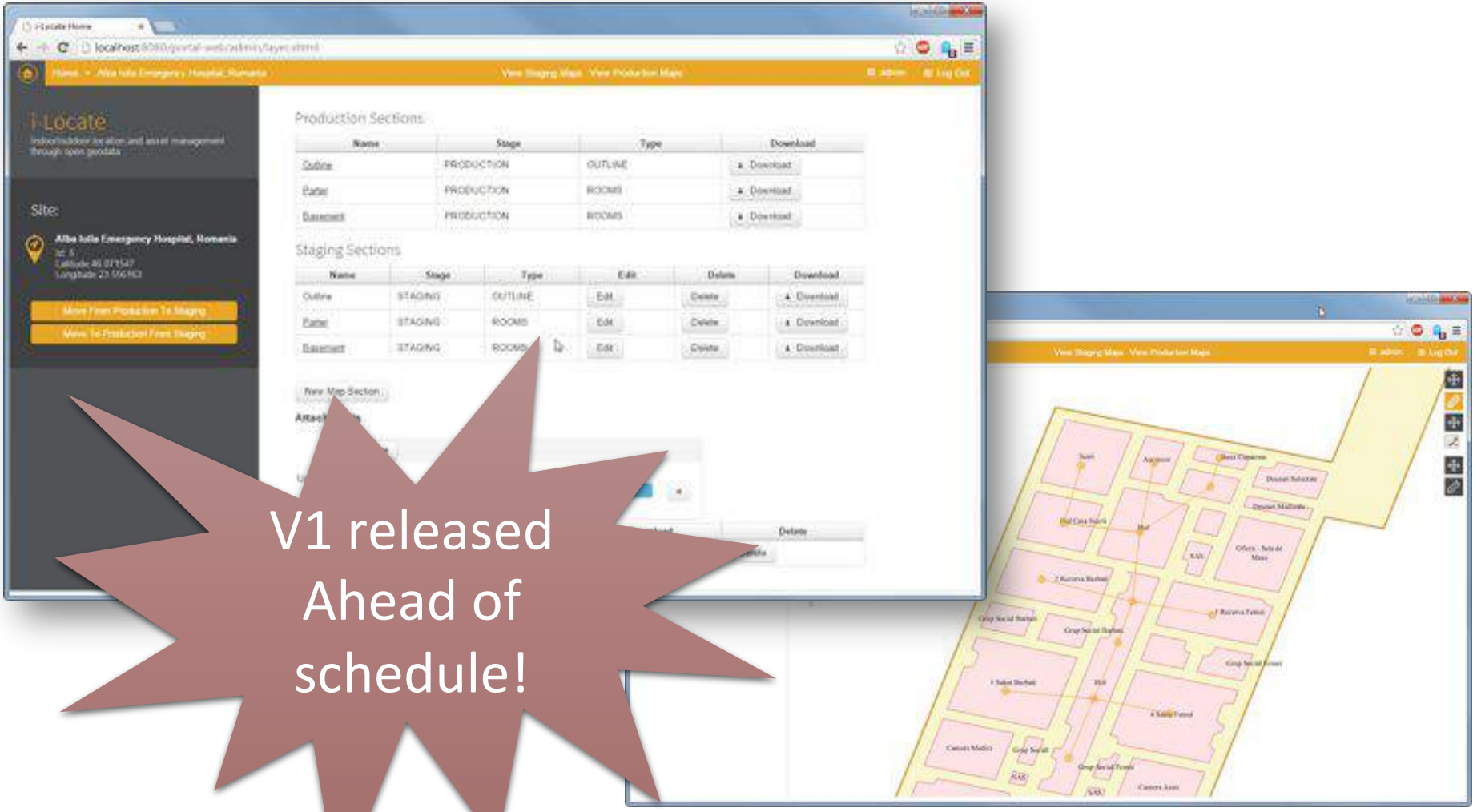
i-locate toolkit V1



Core App

The open data portal (the “virtual hub”)

Version 1



3rd Achievement

Significantly contributed to standardisation activities in the LBS domain

Standards supported

- OWS (WMS - Web Map Service, WFS - Web Feature Service, etc.) to access:
  - OSM
  - INSPIRE
- Support for dates and times will be based on ISO 8601:2004
- Data model ISO 55000-1-2 on asset management (new module for IndoorGML)
- Simple positioning data as ISO 19111
- Real time LBS ISO/IEC 24730-1:2014 standard on “Information technology - Real-time locating systems (RTLS)”
- IndoorGML

Why IndoorGML?

Main contribution to standardisation (IndoorGML)

- 1st reference implementation of IndoorGML
- Development of validation services
- Development of a portal to support data creation
- Development of mobile and web applicaitons
- Availability of compliant datasets
- Preparation of training material

Why IndoorGML?

- No standard for indoor LBS
- For example, OpenStreetMap indoor data model has been changed several times over the last 3 years

IndoorGML scope

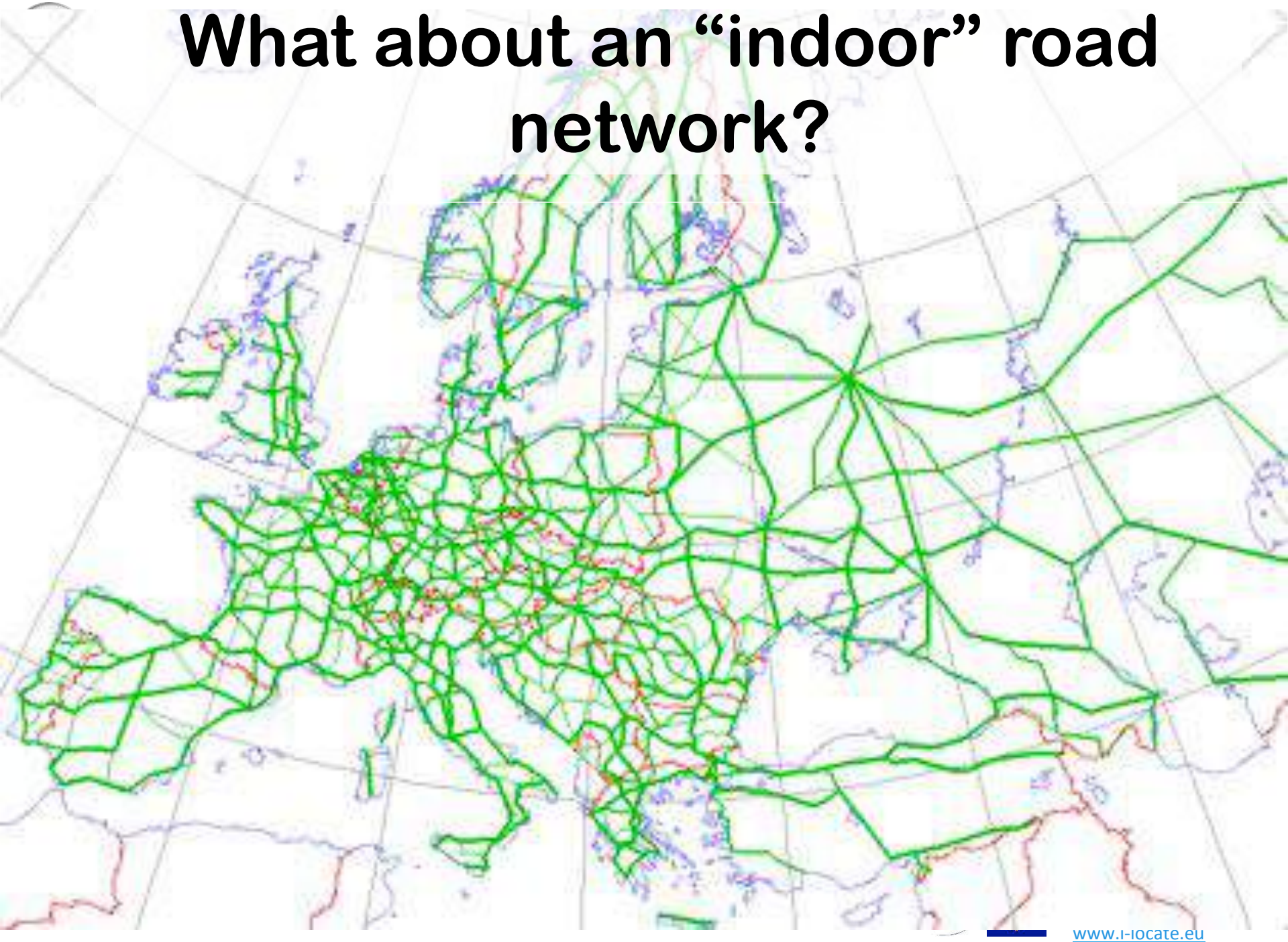
Several standards have been published to describe 3D geometry and semantics of buildings not only for outdoor space but also indoor space:

- IFC: Mainly focused on BIM
- KML
- CityGML: LoD 4: Interior space
- others

However, they lack of important features, which are required by **indoor navigation**.

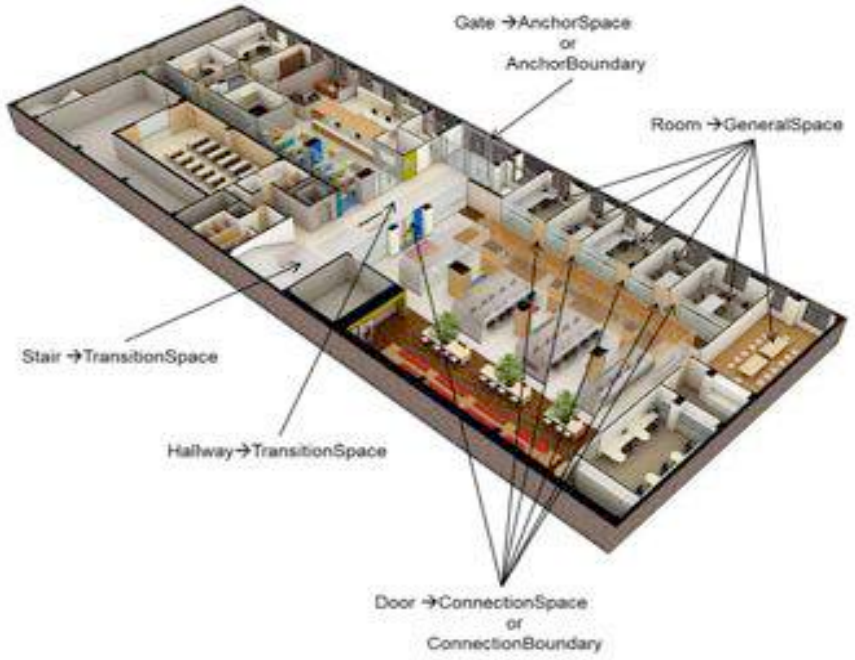
The goal of **IndoorGML** is to represent and allow for exchange of geoinformation that is required to build and operate indoor navigation systems.

What about an “indoor” road network?

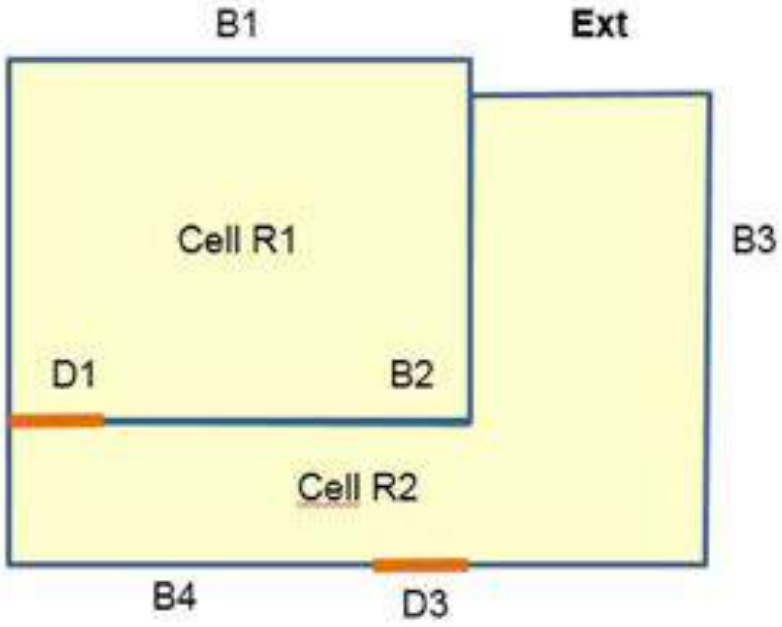


Significant differences emerge when stepping indoor

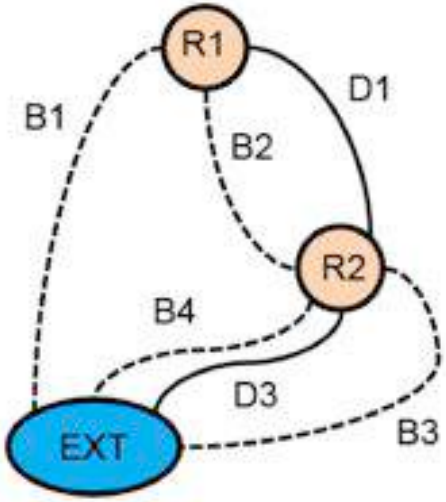
- different navigation constraints such as steps, stairs, doors
- classical navigation metaphors (e.g. “after 200 meters turn right”) may not be entirely appropriate
- Higher degrees of freedom of the user



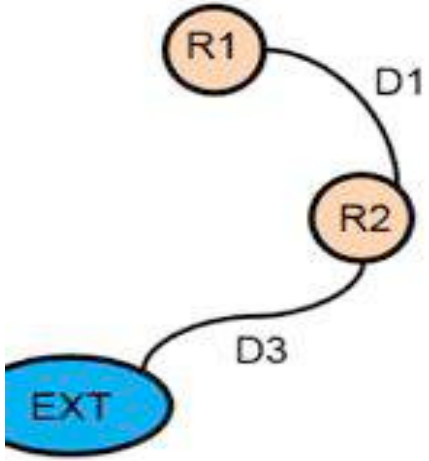
In practice



topographic space

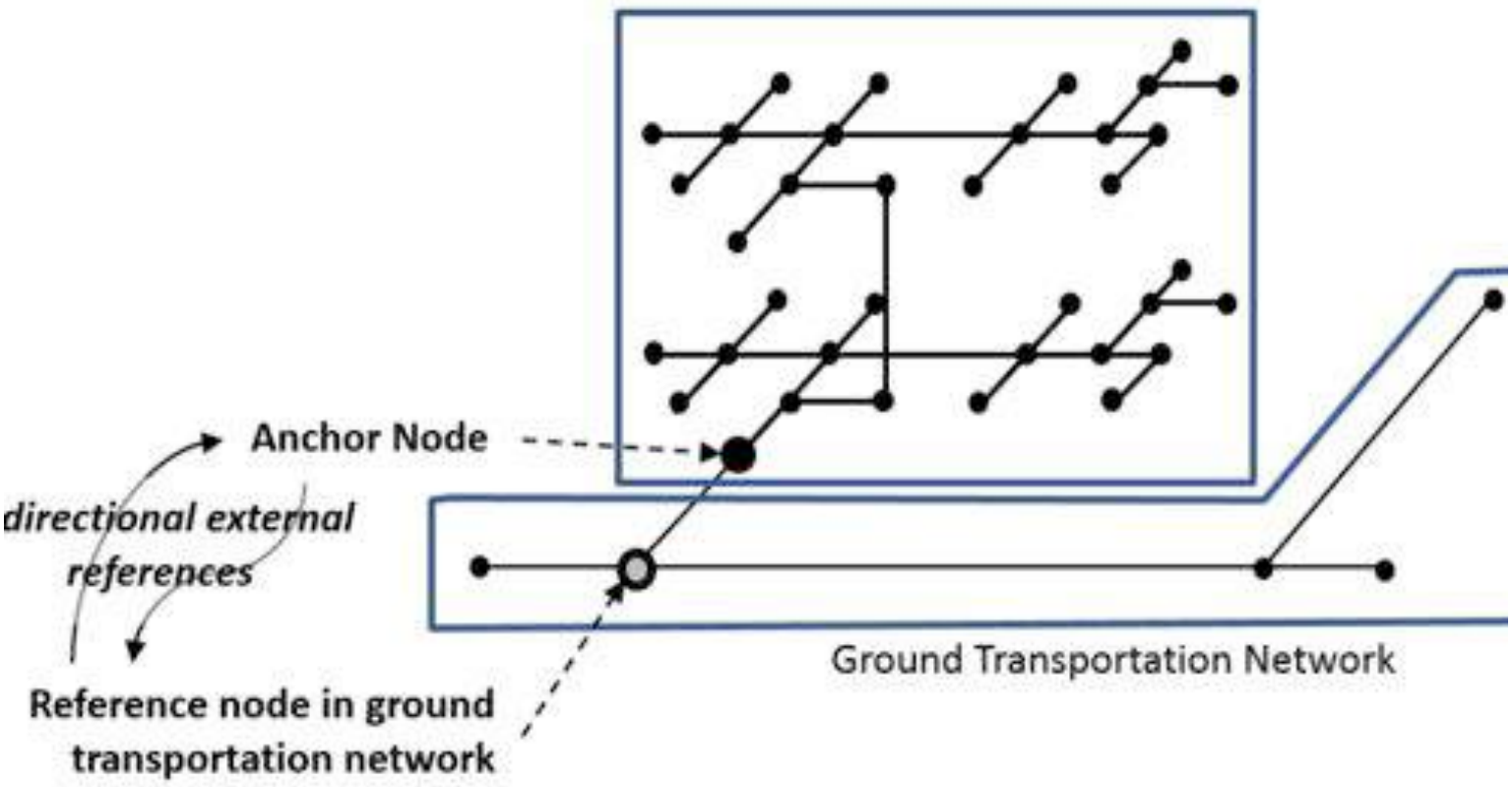


adjacency graph
in dual space



connectivity graph
in dual space

Indoor and outdoor

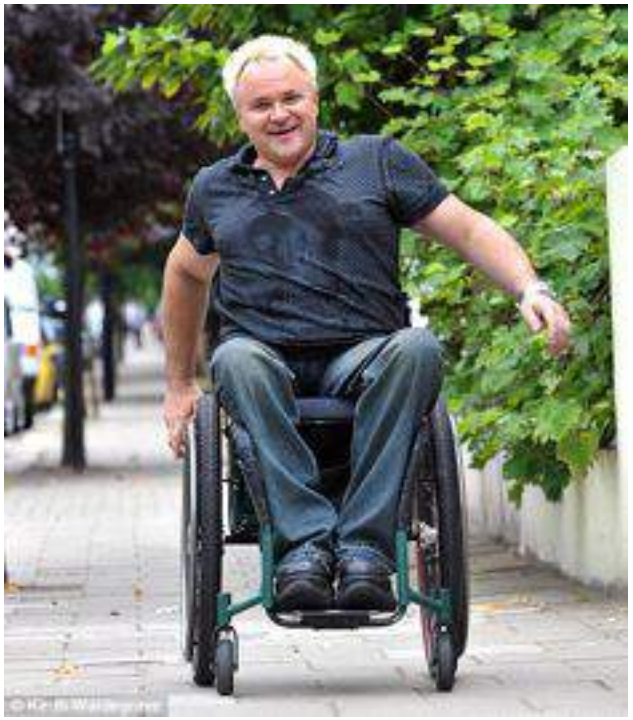


Courtesy of OGC


Which mobility modes do we need when we are indoor?

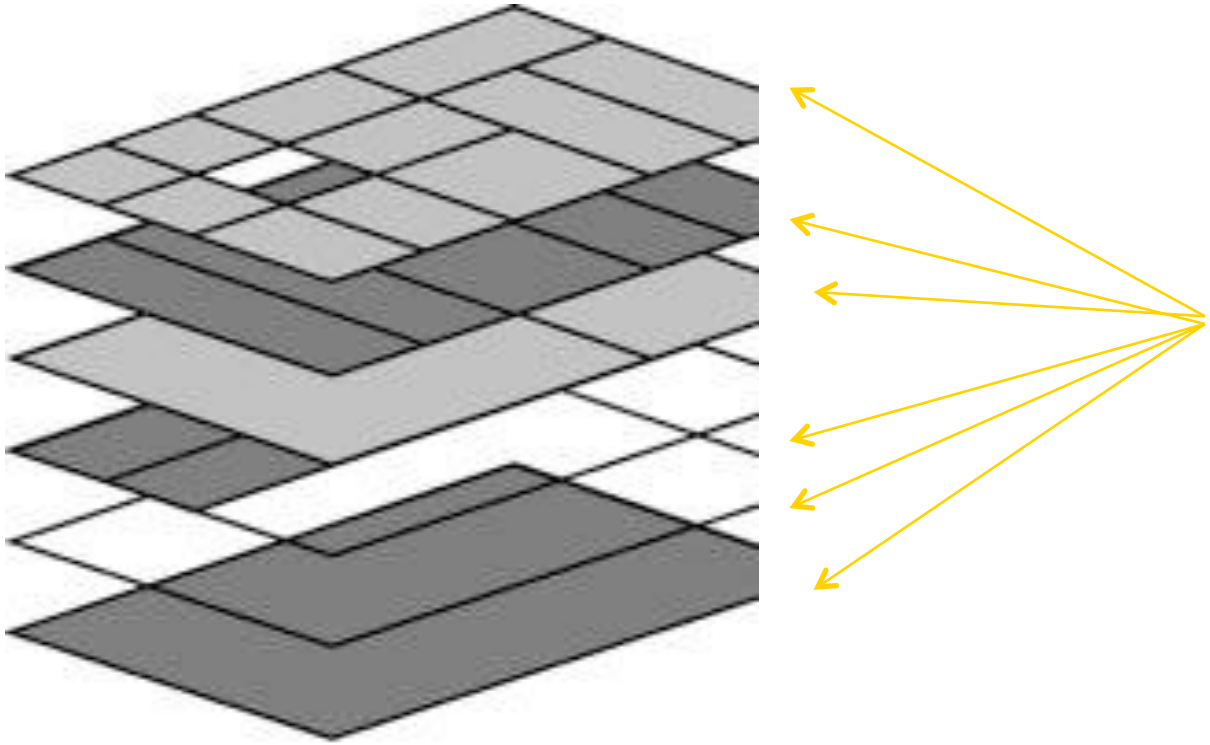
It gets more complicated than that

- Different connectivity graphs at the same time
  - Walking user
  - Wheelchair user
  - Robots
  - Etc.

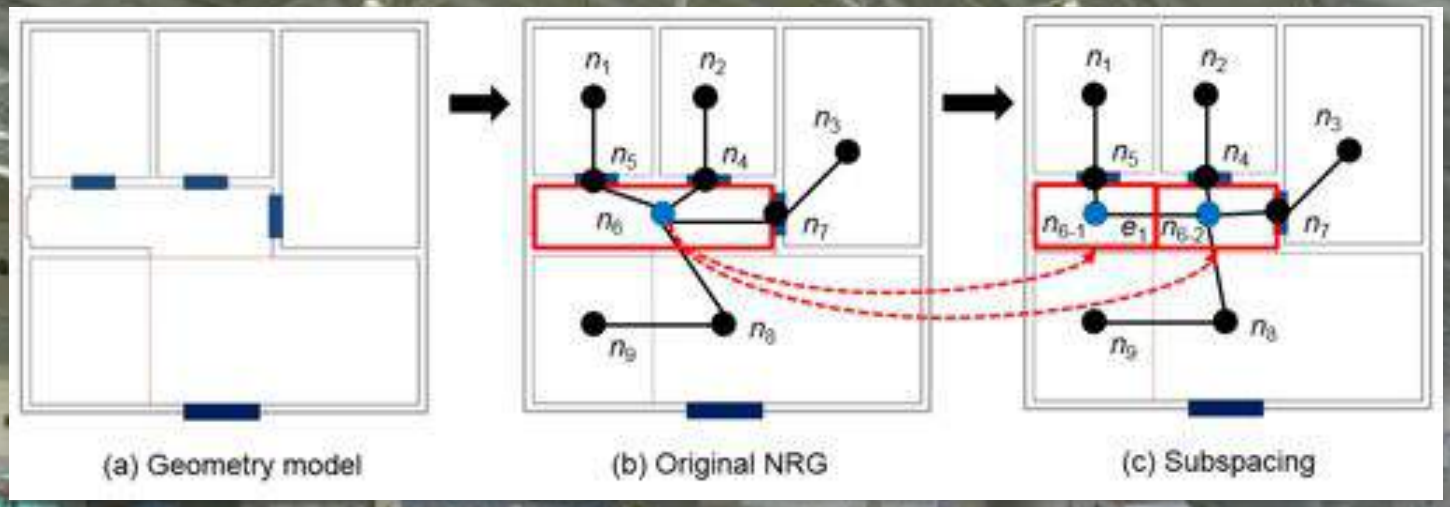


MLS (Multiple Layered Space representation)

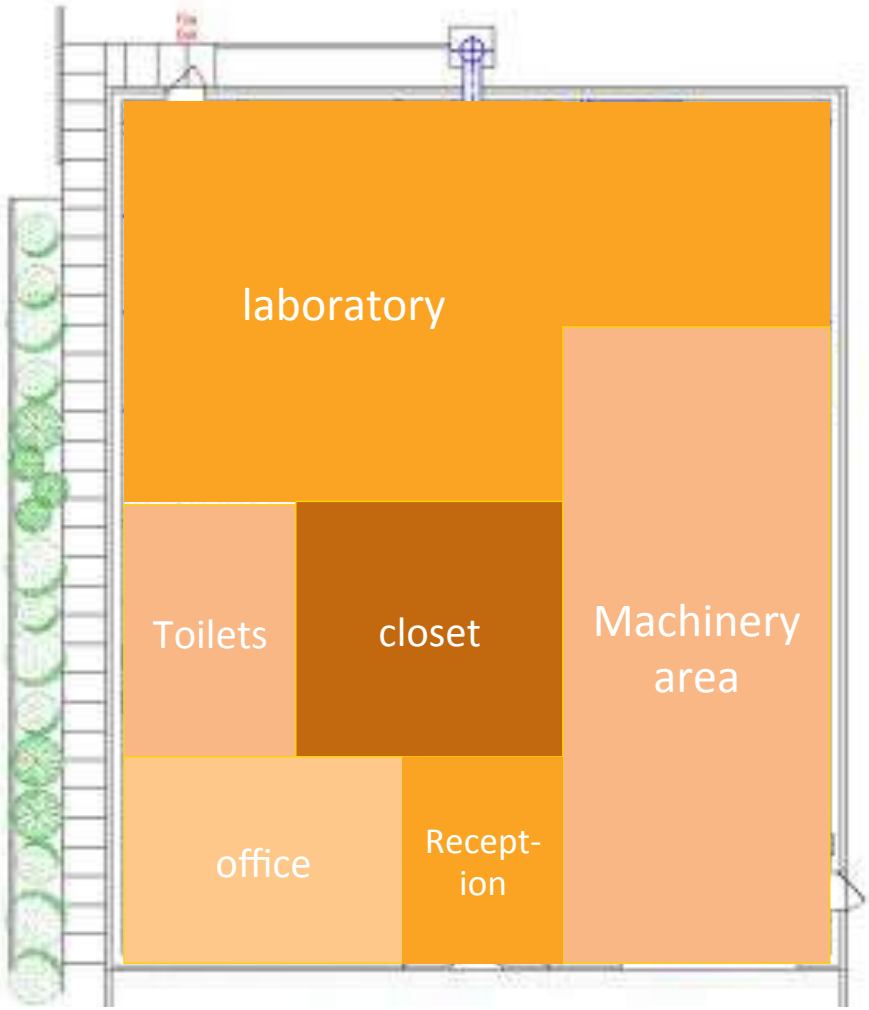
"an object is at any given time exactly in one cell (named state) in each layer simultaneously. This overall state is thereby denoted by the combination of active states from all space layers"



Subspacing as subgraphs



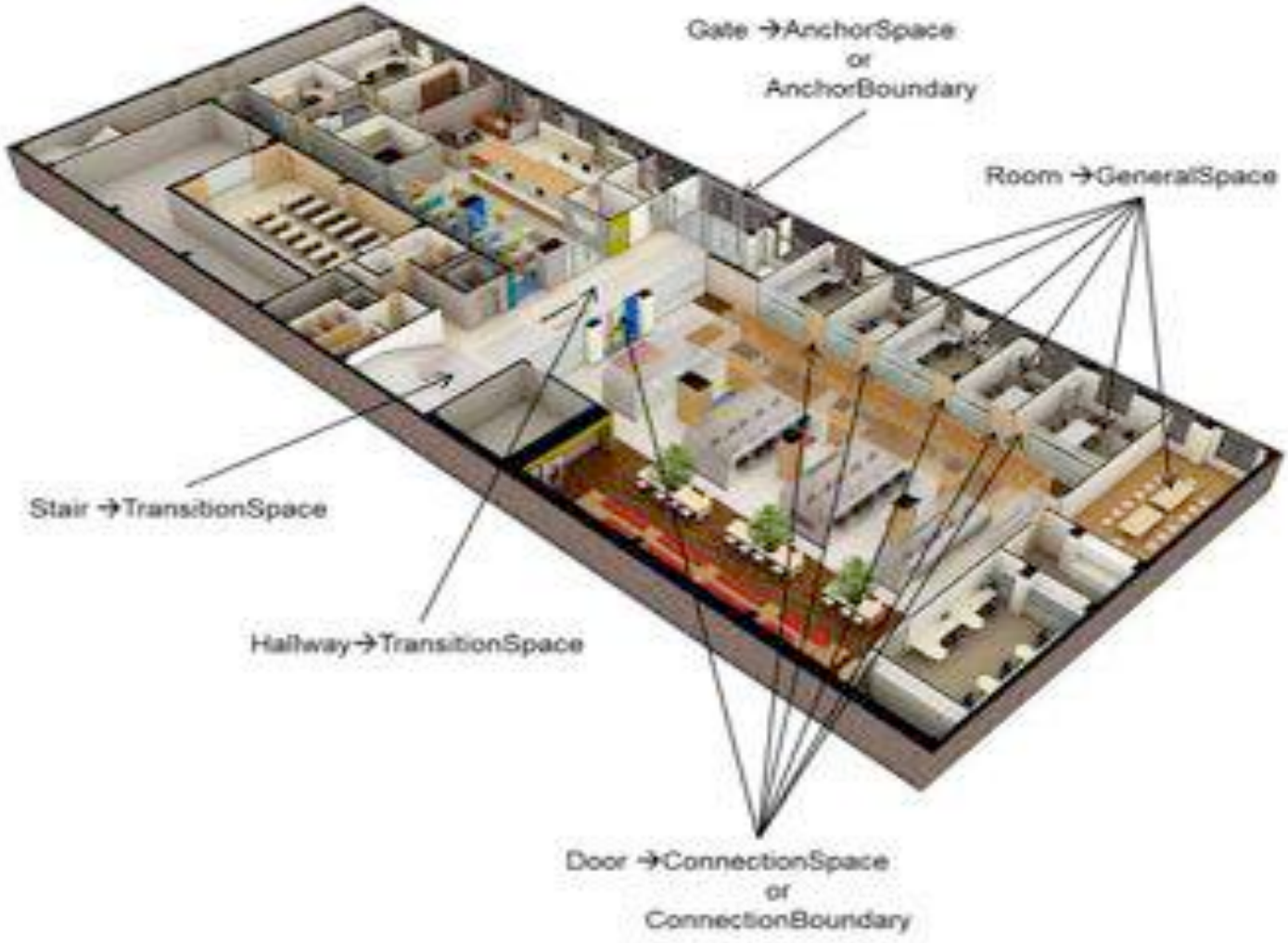
Geometries needed



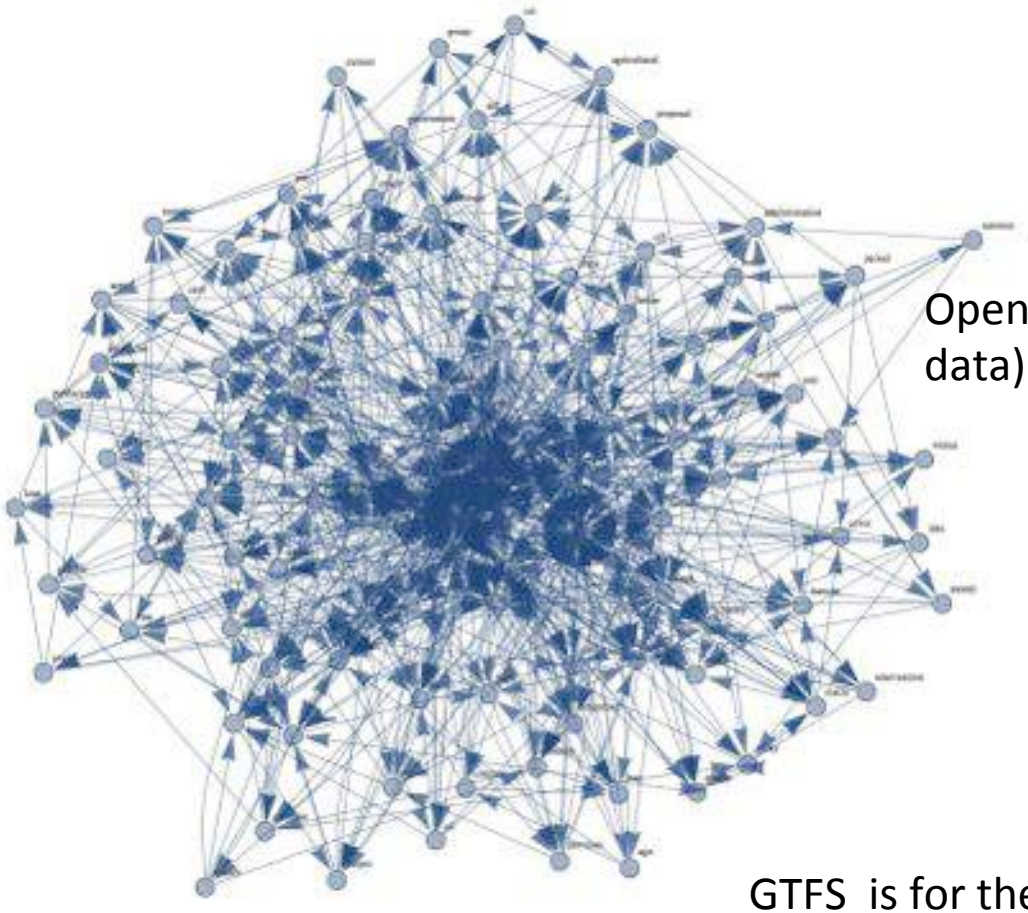
Building Geometry

Cell Geometry

Data model


Gate →AnchorSpace
or
AnchorBoundary
Room →GeneralSpace
Stair →TransitionSpace
Hallway→TransitionSpace
Door →ConnectionSpace
or
ConnectionBoundary

The outdoor graphs



OpenStreetMap (OSM) format (road network data) and GTFS (public transport data)

GTFS is for the static exchange of public transport stop and schedule data.

Semantic classification

OmniClass™ A Strategy for Classifying the Built Environment

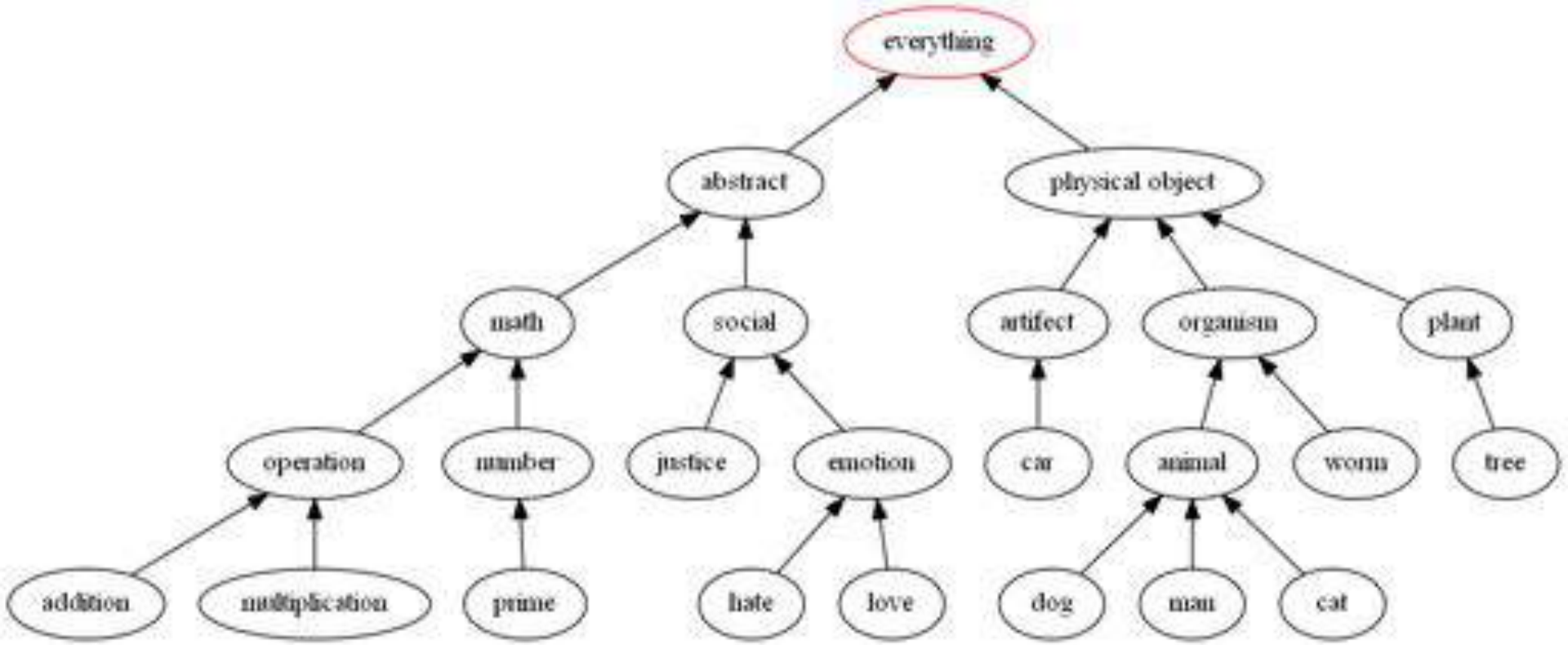
"The OmniClass Construction Classification System (known as OmniClass™ or OCCS) is a classification system for the construction industry"
(table 13 – names by function)

OmniClass Number	Level 1 Title	Level 2 Title	Level 3 Title	Level 4 Title	Definition
13-51 14 33			Nursery, Special Care		Space used for observation of newborn infants prior to placement in a newborn nursery or when their condition requires heightened attention or special intervention
13-51 14 35			Patient Room		Space used for overnight patient care.
13-51 14 35 11				Patient Room, Airborne Infection Isolation	Space used for protective segregation of inpatients who have or are suspected of having contagious diseases.
13-51 14 35 13				Patient Room, Bariatric	Space used for the care of patients who are morbidly obese in an acute care inpatient nursing unit
13-51 14 35 15				Patient Room, Intensive Care	Space used for care of patients whose health status requires highly focused and concentrated medical care services by staff with specialized training and skills.
13-51 14 35 17				Patient Room, Intensive Care, Airborne Infection Isolation	Space used for protective segregation of intensive care patients who have or are suspected of having contagious diseases.
13-51 14 35 19				Patient Room, Intensive Care, Protective Environment Isolation	Space used for protective segregation of intensive care patients whose immune system is compromised.
13-51 14 35 21				Patient Room, Isolation	Space used for restrained isolation of patients for a short duration in a mental health setting
13-51 14 35 23				Patient Room, Monitored	Space used in an inpatient setting where a patient care

From omniclass to SKOS

OmniClass classification of spaces by function, a taxonomy in SKOS (Simple Knowledge Organization System),

Each concept of OmniClass is an individual instance of the *Concept* class *(*direct child of *Thing)* in OWL;




THANK
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DANKSCHEEN
BÏYAN
SHUKRIA
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TASHAKKUR ATU
SUKSAMA
EKHMET
GRAZIE
MEHRBANI
PALDIES
KOMAPSUMNIDA
MAAKE
GOZAIMASHITA
EFCHARISTO
JUSPAXAR
BOLZÏN
MERCI