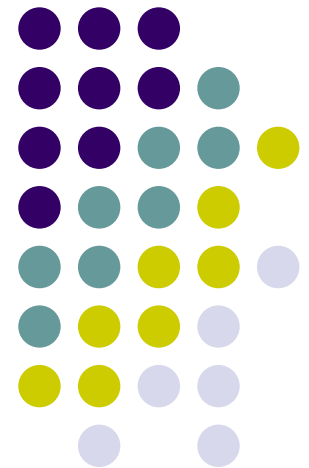# UBGI and Address Standards
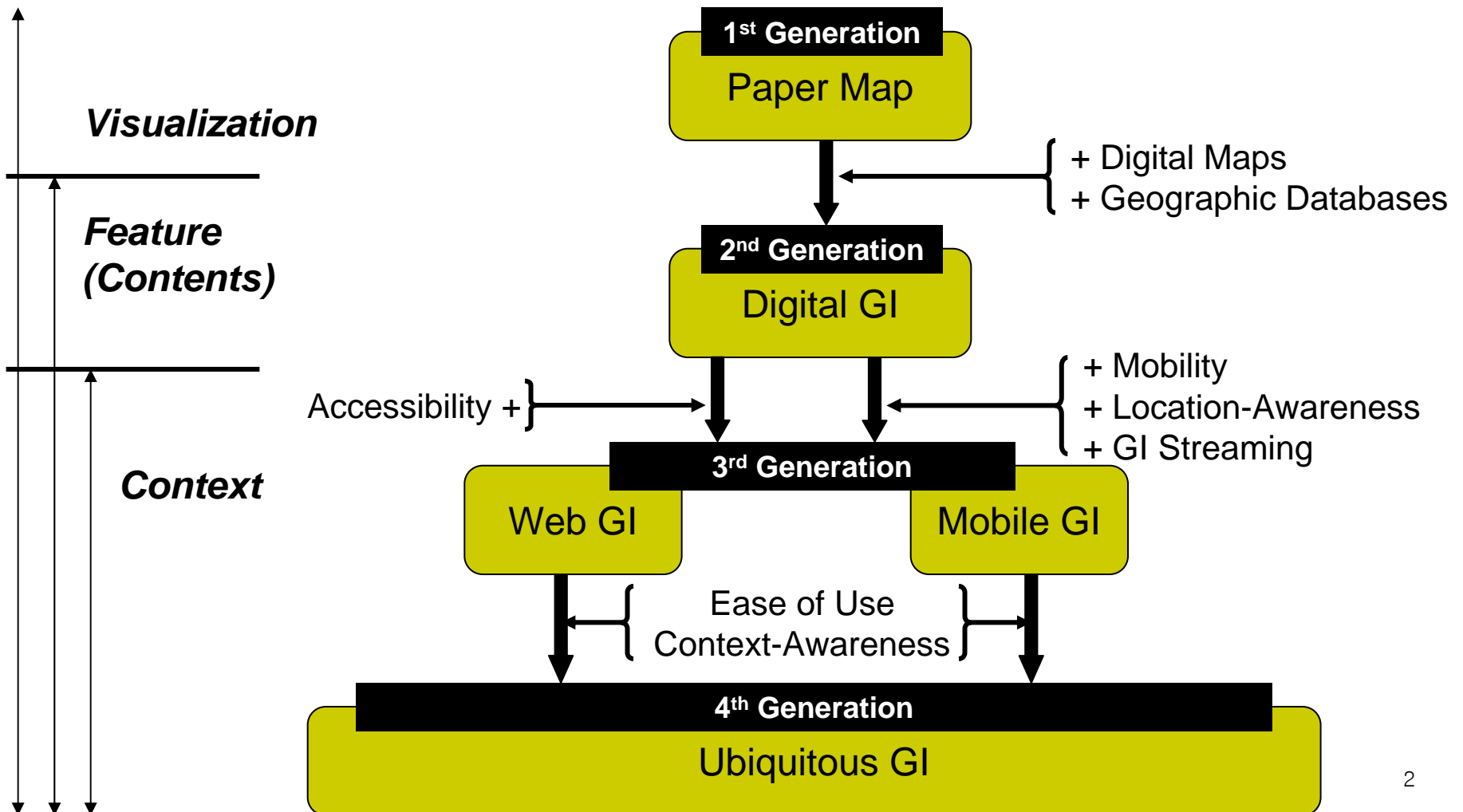
2008. 5.25
Copenhagen, Denmark

Sang-Ki Hong

Convenor, WG 10

Evolution of Geographic Information

Visualization

Feature (Contents)

Context

1st Generation
Paper Map

+ Digital Maps
+ Geographic Databases

2nd Generation
Digital GI

Accessibility +

+ Mobility
+ Location-Awareness
+ GI Streaming

3rd Generation

Web GI

Mobile GI

Ease of Use
Context-Awareness

4th Generation
Ubiquitous GI
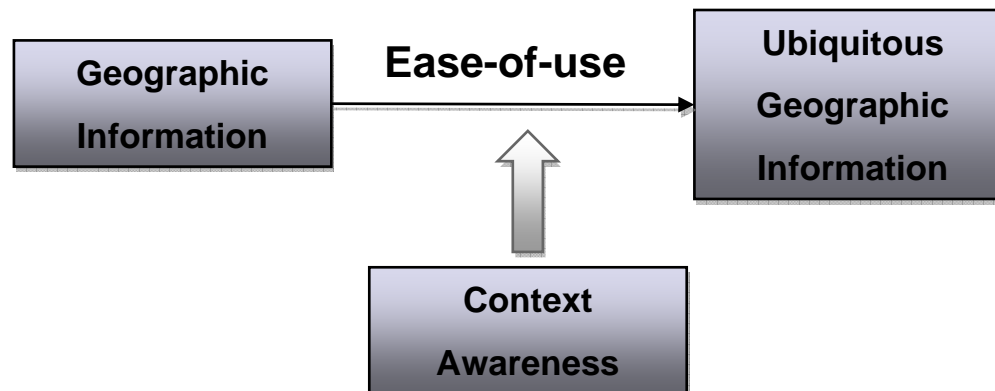
2

Ease-of-use for GI

- Two conditions for ease-of-use
  - access necessary geographic information at anytime and anywhere regardless of the types of hardware or communication methods
  - any user (i.e., anything) should be able to use the necessary GI regardless of the user specialty without interpretation or individualization efforts

```
┌──────────────┐   Ease-of-use   ┌──────────────┐
│  Geographic  │ ──────────────► │  Ubiquitous  │
│  Information │                 │  Geographic  │
│              │                 │  Information │
└──────────────┘        ▲        └──────────────┘
                        │
                 ┌──────────────┐
                 │   Context    │
                 │  Awareness   │
                 └──────────────┘
```
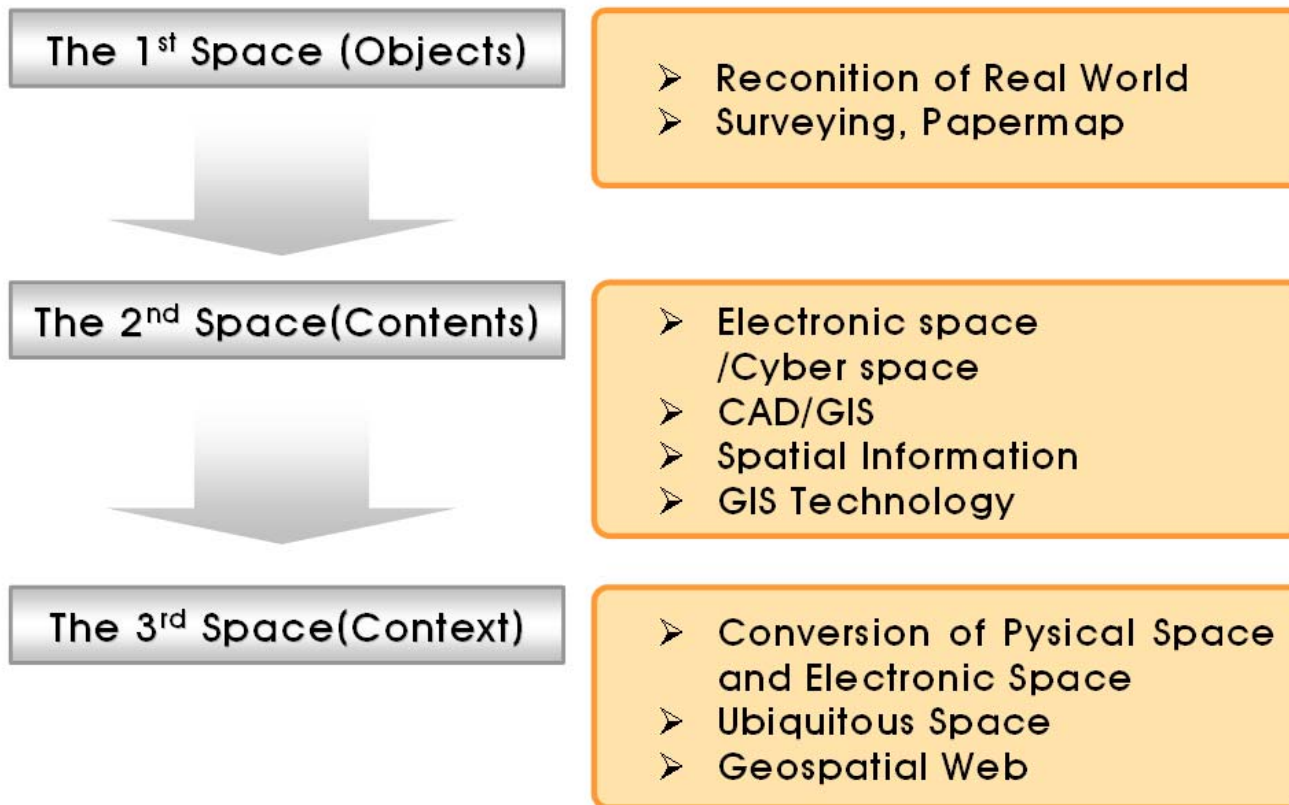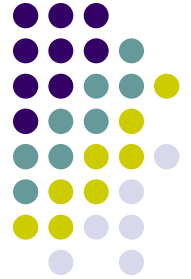
UBGI: Definition

- Geographic Information

  - provided to users at anytime, anywhere, and with any device to anything

  - upon his/her contexts

the surroundings, circumstances, environment, background or settings which determine, specify, or clarify the meaning of an event

(in *Wikipedia*) including the location of users, applications, hard/software environments

"Users" includes not only human beings but also applications and devices with communication.

Space Paradigm Shift

The 1st Space (Objects)
- ➢ Reconition of Real World
- ➢ Surveying, Papermap

The 2nd Space(Contents)
- ➢ Electronic space /Cyber space
- ➢ CAD/GIS
- ➢ Spatial Information
- ➢ GIS Technology

The 3rd Space(Context)
- ➢ Conversion of Pysical Space and Electronic Space
- ➢ Ubiquitous Space
- ➢ Geospatial Web

Address in the third space

- Rethink address's role as a spatial reference system in the new space
- Efforts to make the location information available in ubiquitous way
  - Example: ISO PT19151 *Dynamic position identification scheme for ubiquitous space*
- Treatment of semantic components in GI including address
  - ISO PT19150 *Geographic Information – Ontology*
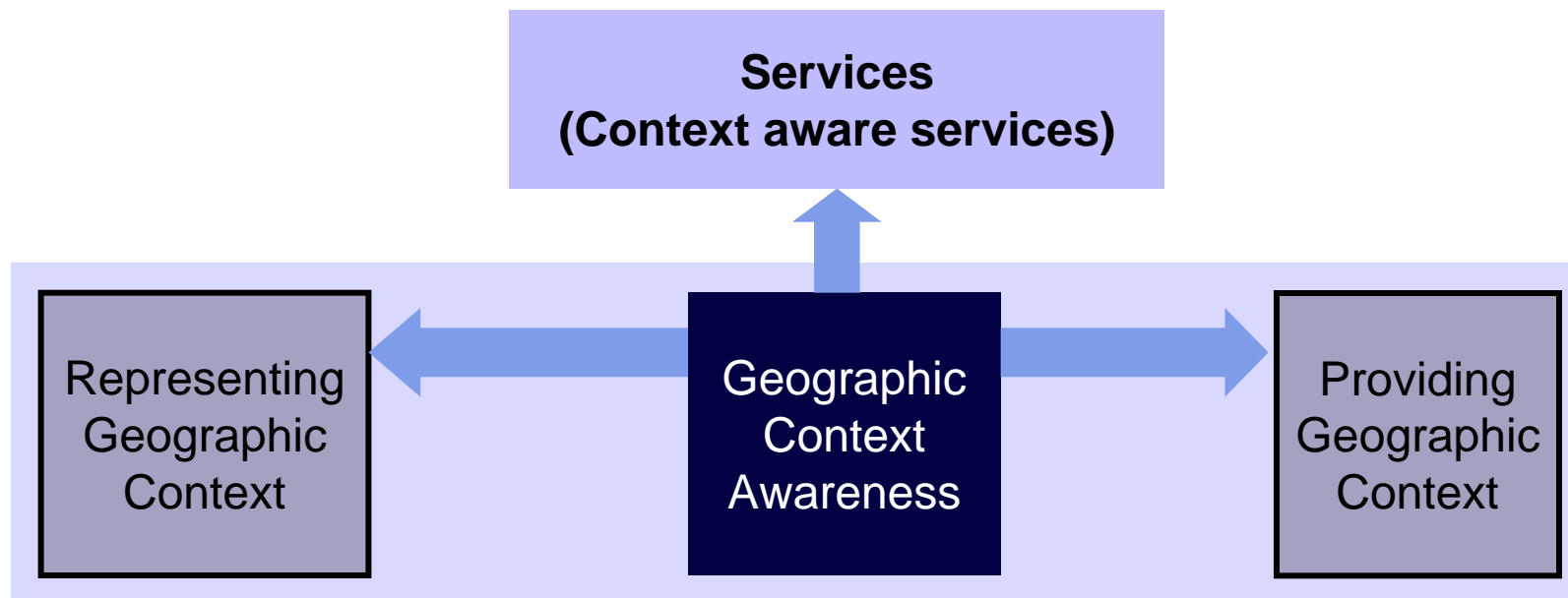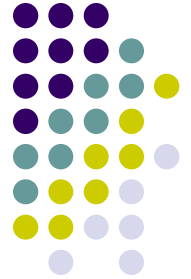
Context awareness and address
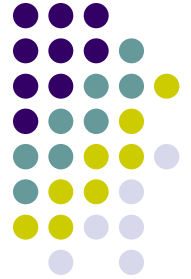
Geographic Context-Awareness
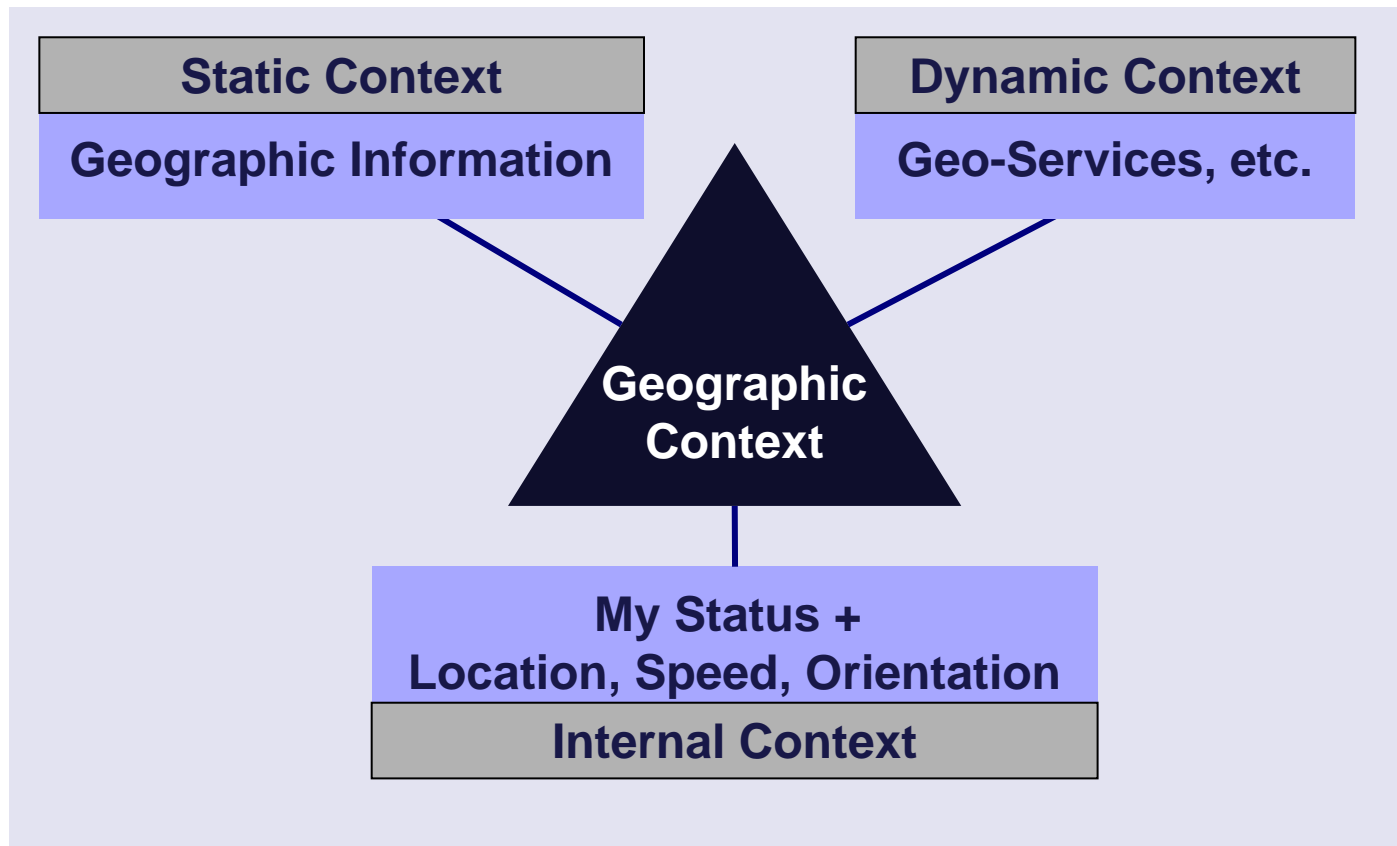
Aspects of context-awareness

Address as a context representation

- In order to achieve the context-awareness, following aspects should be considered
    - How to represent geographic context;
    - How to provide geographic context;
    - How to interpret geographic context.
- Address as a geographic identifier reference system is one of the representations of context
- Addresses need to be examined in the broad framework of managing heterogeneity of context representation and provision
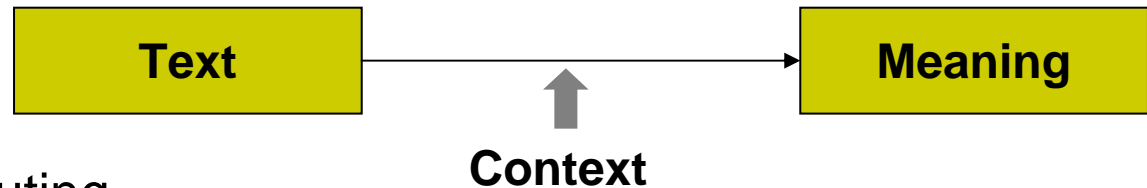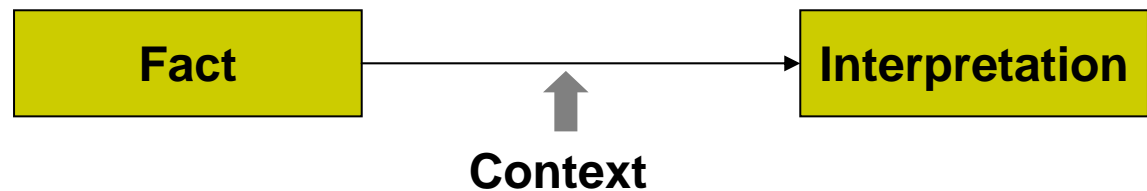
Context Modeling

- ## Context Modeling
  - Most basic part of UBGI
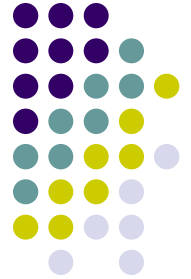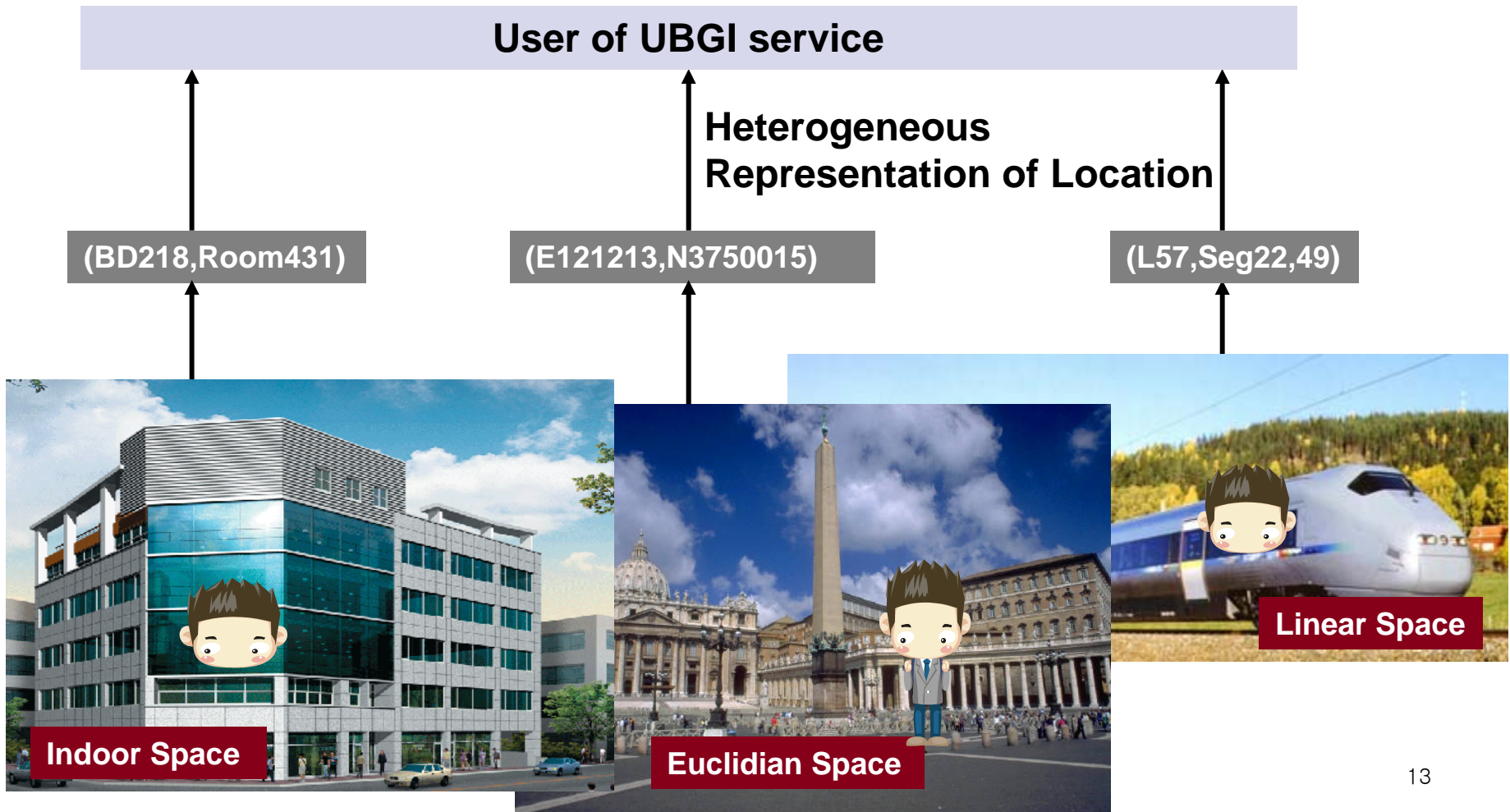 - A Framework of Context is required to describe context

- ## Context
  - in Linguistics

| Text | →→→ | Meaning |

  Context

  - in Ubiquitous Computing

| Fact | →→→ | Interpretation |

  Context

Address-related Issues in UBGI

Heterogeneous representation of location

User of UBGI service

Heterogeneous
Representation of Location

(BD218,Room431)   (E121213,N3750015)   (L57,Seg22,49)

Indoor Space

Euclidian Space

Linear Space
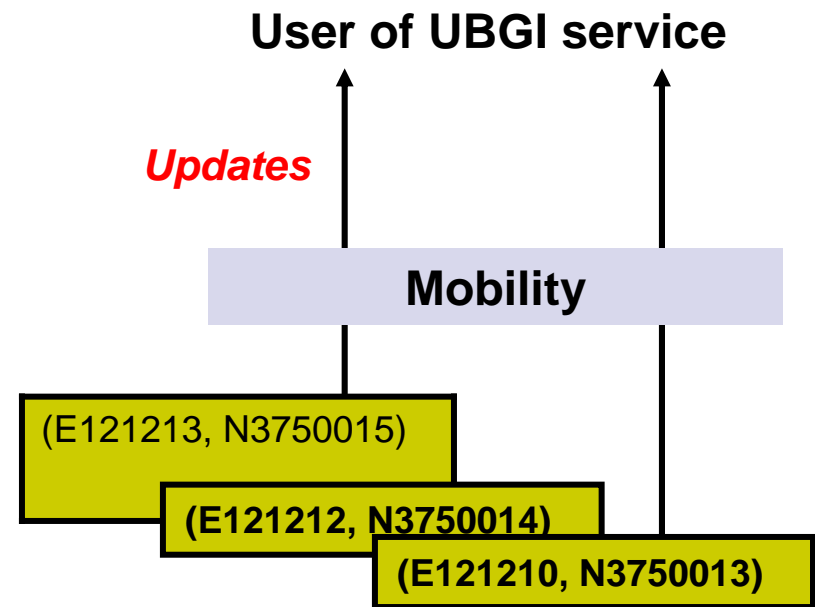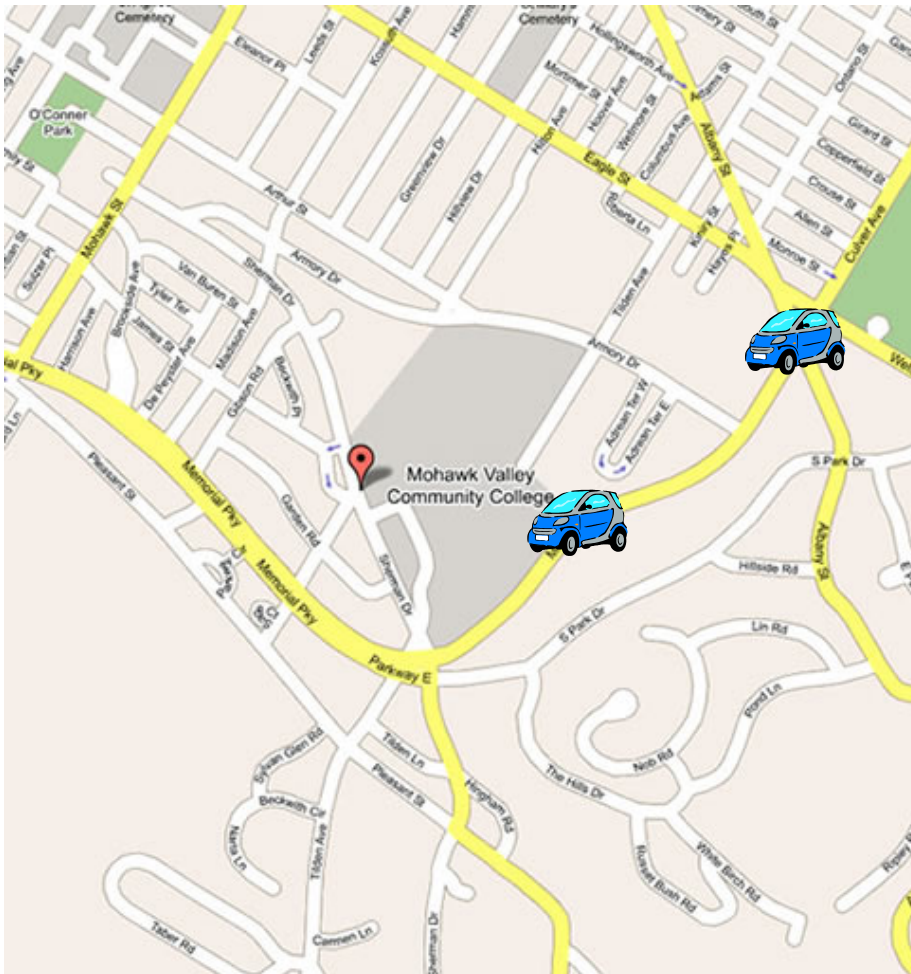
13

Location and Data Transformation

- Seamless transformation of location information between different applications

- ISO 19133 *Geographic Information-Location based services – Tracking and Navigation* deals with address in terms of navigation service

- Address model loosely based on the Electronic Commerce Code Management Association (ECCMA)'s The International Address Element Code (IAEC)

- The scope needs to be expanded to cover all GI data types and properties
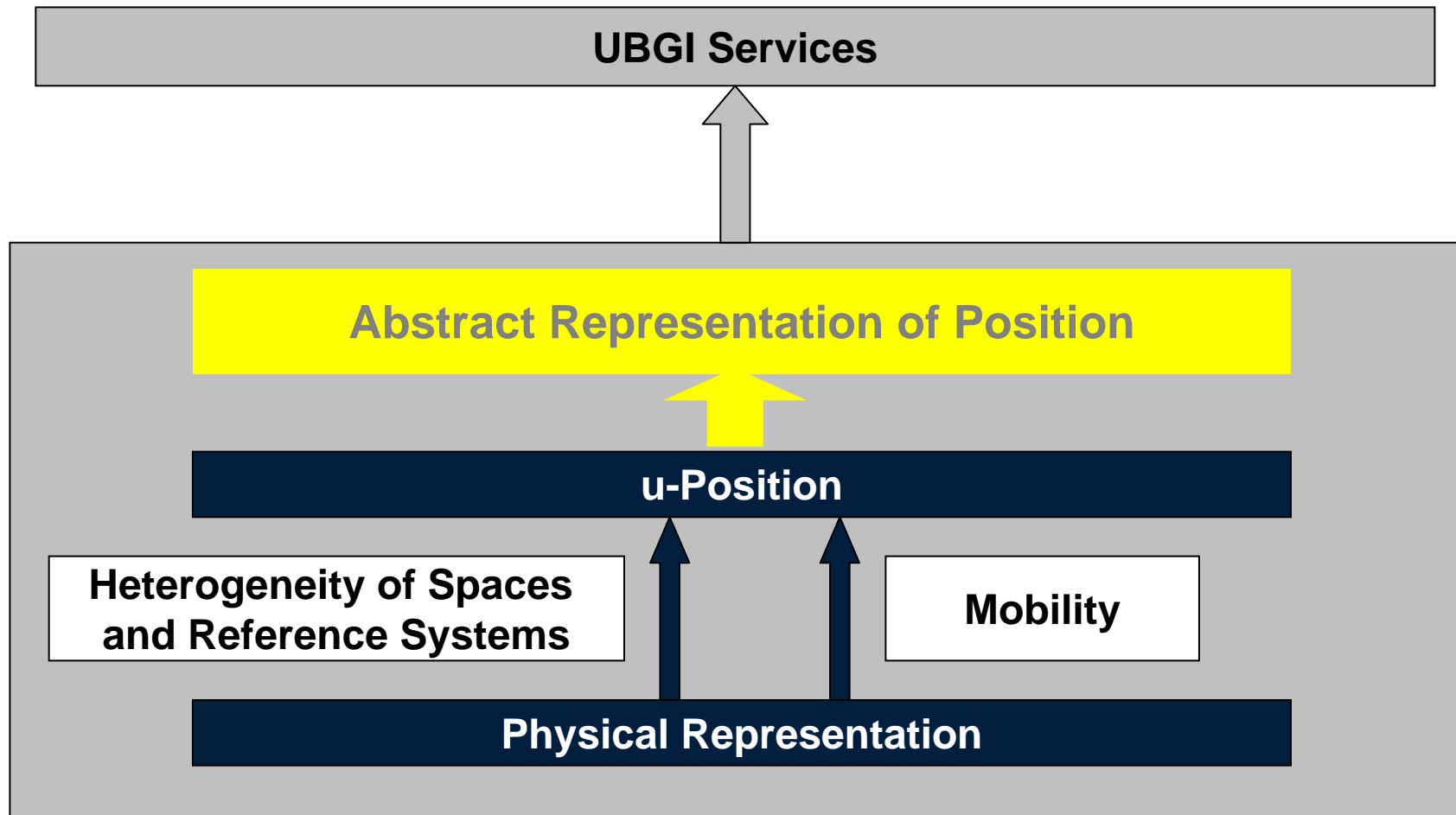
LBS and Linear Referencing

- The outcome of *ISO 19148, Geographic Information- Location based services – Linear referencing* will have an impact on addressing since street-based addresses are usually linearly referenced

Managing Mobility

User of UBGI service

Updates

Mobility

(E121213, N3750015)

(E121212, N3750014)

(E121210, N3750013)

u-Position:
A Logical Location Representation

UBGI Services

Abstract Representation of Position

u-Position

Heterogeneity of Spaces and Reference Systems

Mobility

Physical Representation

Transparency of Heterogeneous Spaces and Reference Systems

User of UBGI service

http://scientists.uk/JamesWatt

Encapsulation by u-Position

(BD218,Room431)

(E121213,N3750015)

(L57,Seg22,49)

Indoor Space

Euclidian Space
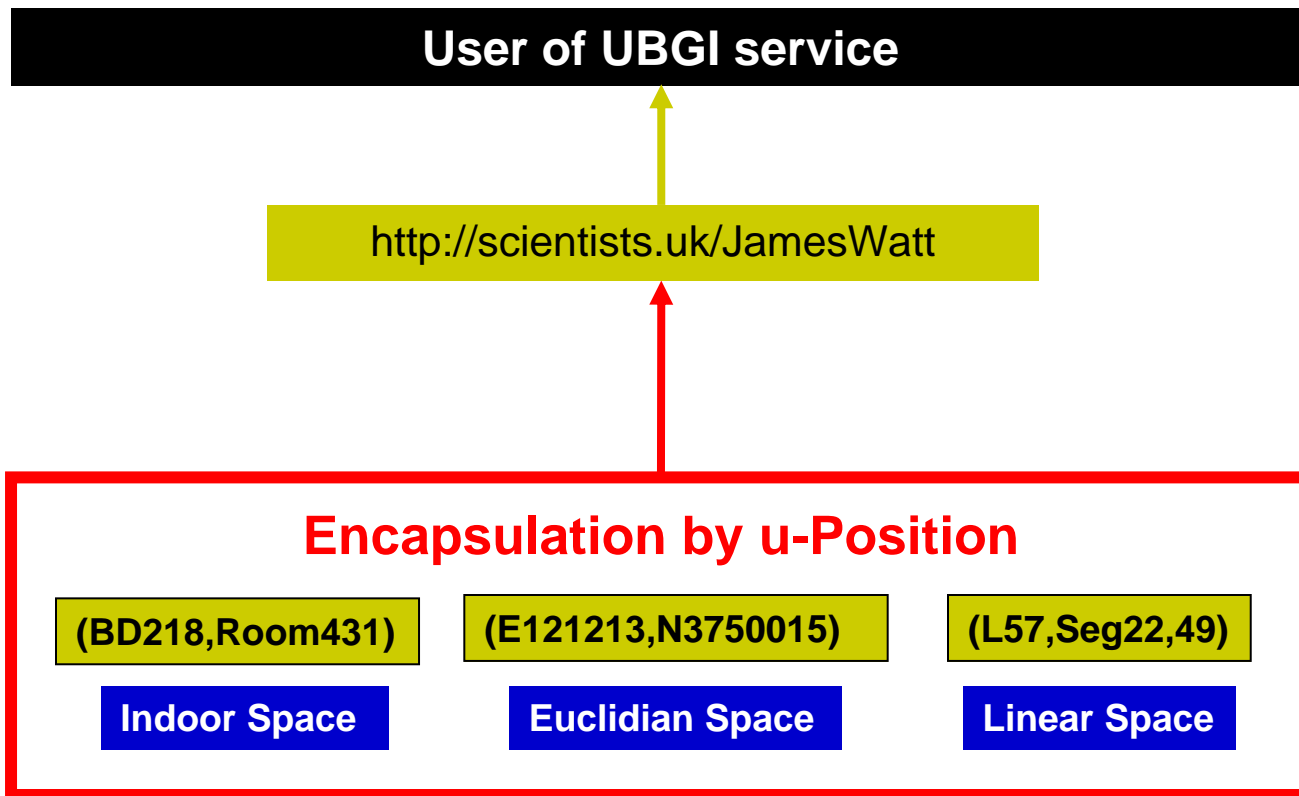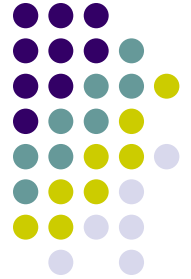
Linear Space

Seamless Space

Linear Space: (L57,Seg22,49)

Indoor Space: (BD218,Room431)

Euclidian Space : (E121213, N3750015)

Multiple location identifiers

Public   Personal   Criteria

Quantitative
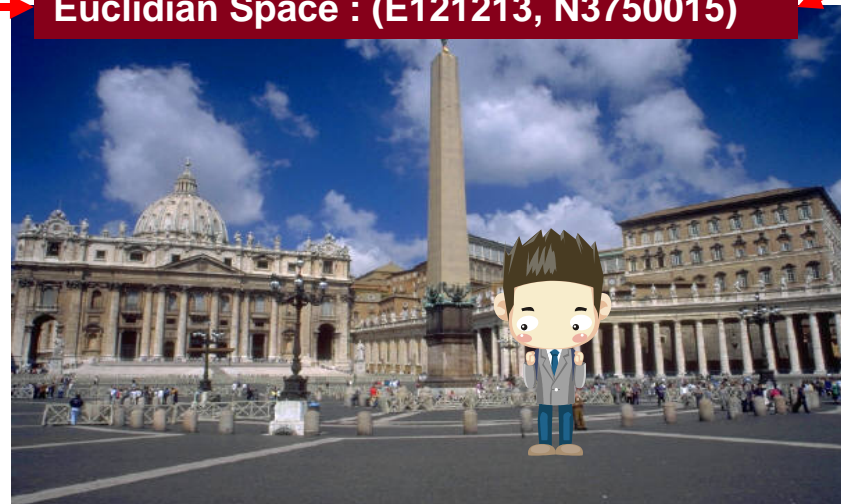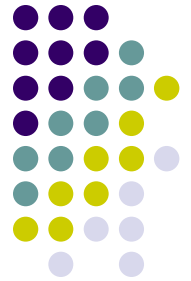
Geodetic coordinate system   Facility coordinate system

Telephone number

Mile post

Address

Room number

Facility name

Zip code

Floor layout

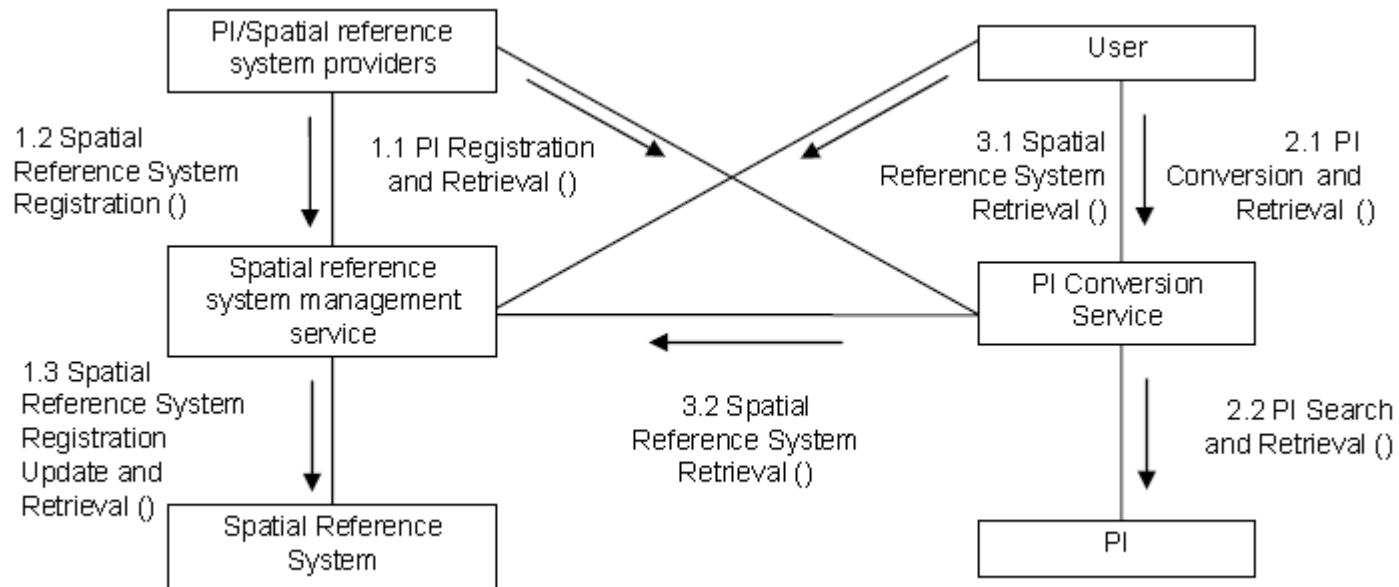Qualitative
Value
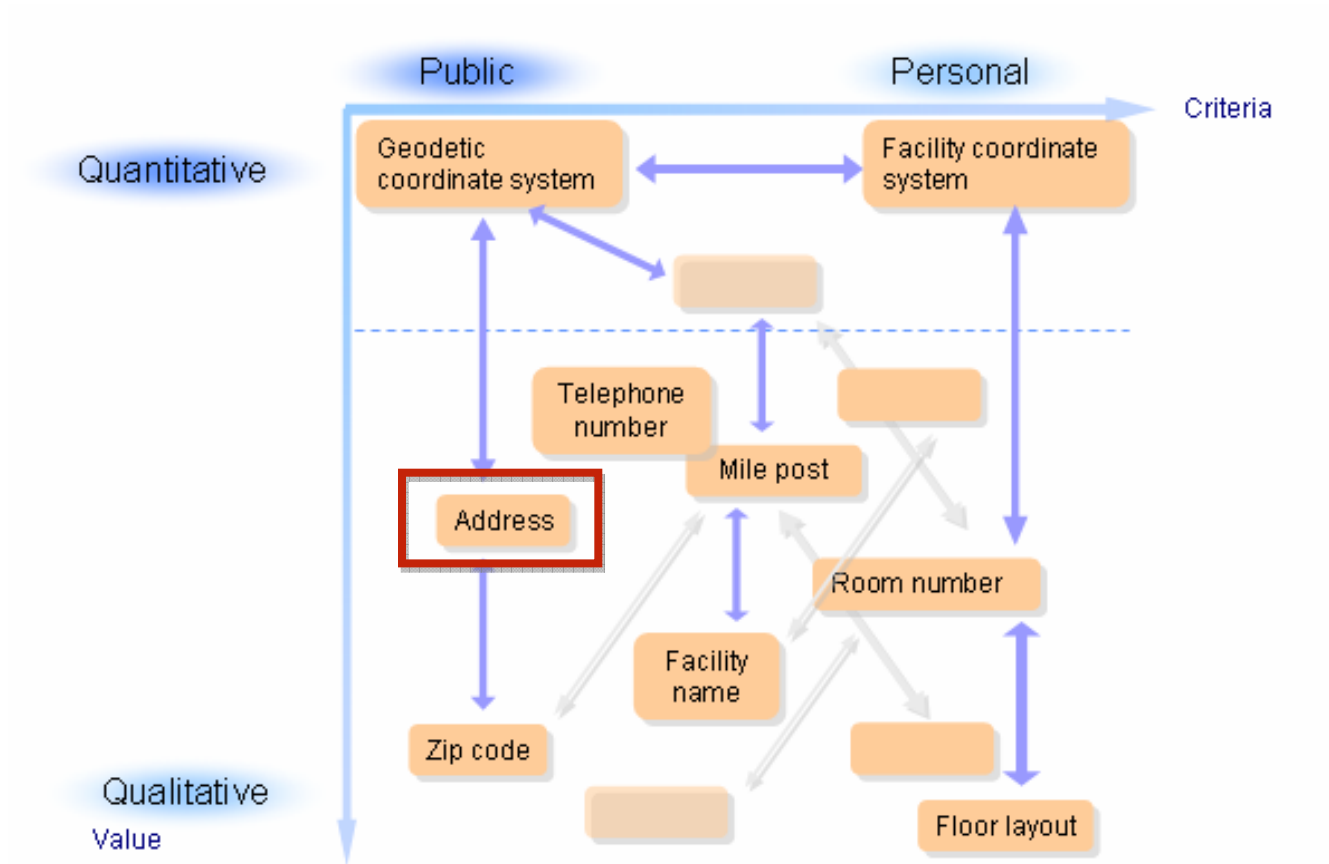
Mechanism for resolving spatial identifiers

- A mechanism to enable the encoding and conformance of different location descriptions between communities

- NWIP for Place Identifiers (PIs) Standard
  - a reference model and a suite of service interfaces for the representation of place information (ISO/TC211 N2413)

PI reference model

Geo-labels

Static Context

Geographic Information

Dynamic Context

Geo-Sensor

Context Awareness

How to Identify and Retrieve Geographic Information in Mobile Environment ?

Object Identifier or Foreign Key like DB ?

My Status + Location, Speed, Orientation

Internal Context

We need a Mechanism to Identify a Geographic Object (Feature) and Retrieve its information

Geo-Labeling

23

Address as a Geo-Label

2. Complex Geographic Context Information

Geographic Information

Features

Geo-Label

User

Real World

1. Simple Geographic Context Information

UFID

Geo-Label

2-D Barcode

RFID

iPointer™*

(* iST company: http://www.i-spatialtech.com/ipointer.htm)

How to get Geo-Labels

Clicking on the real world:
We have a database for this feature. But …

Databases
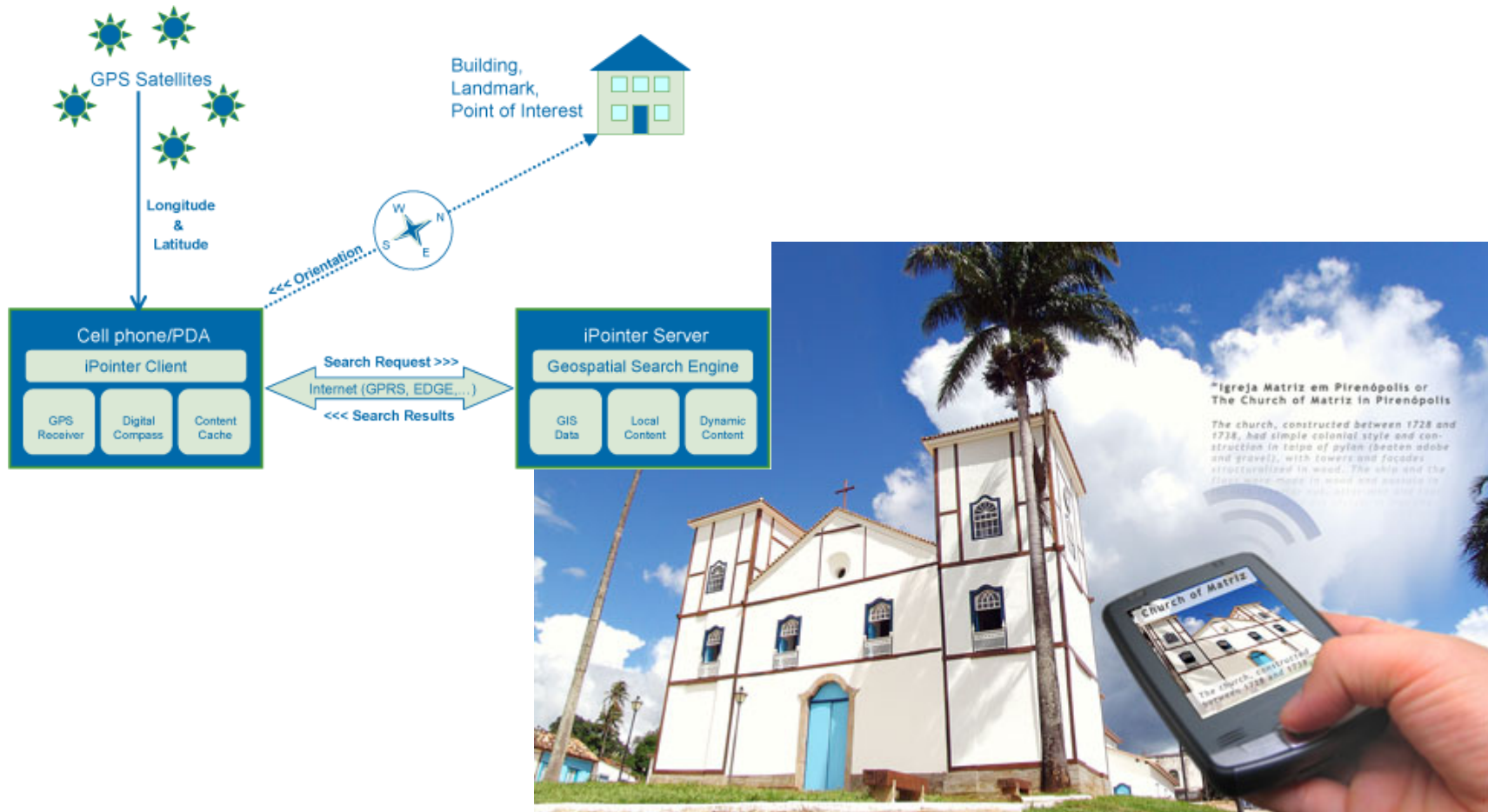
How to bring the data to this PDA?

How to identify this feature
in the real world
without OID or foreign key?

How to assign an identifier to each
feature ?

We have a PDA for displaying the
data about this feature.

Geo-labeling example: iPointer™

- in http://www.i-spatialtech.com/ipointer.htm

Address and Indoor Space

| Level 0
Terrain Model |

| Level 1
Block Model |

| Level 2
Texture Model |

| Level 3
Detail Architecture Model |

| Level 4
Interior Model |

Extension

- Cellular Space
- Indoor-Outdoor Connection

CityGML

IndoorGML
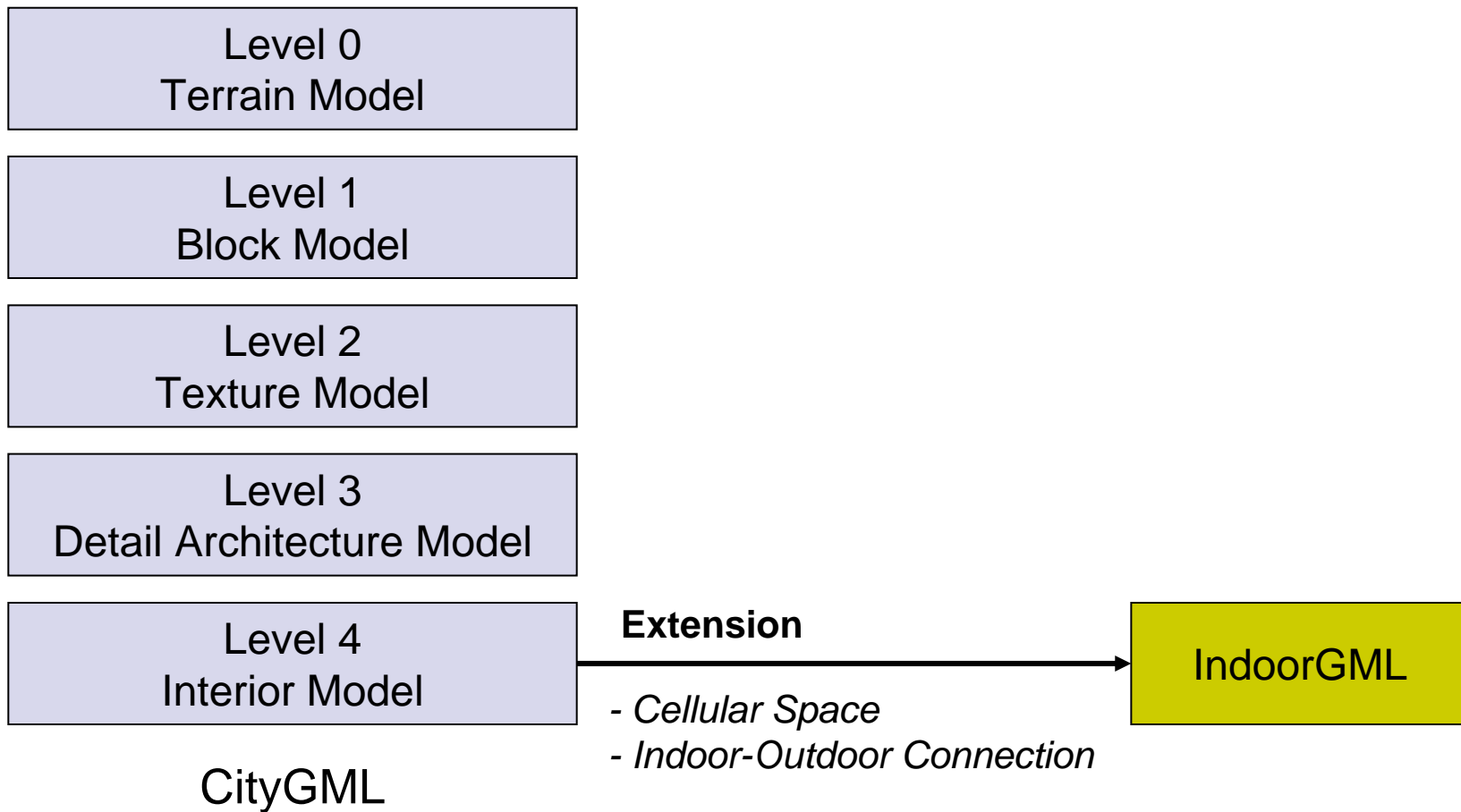
Treatment of Indoor Space

Current Spatial Data Models and Standards

- CItyGML
- GML
- OGC SFG Interface

Indoor Spatial Data Models and Standards

- CityGML/IndoorML
  - Indoor/Outdoor Connection
  - Cellular Space
- Interfaces and Operators for Indoor Objects

ISO19107 → Standard for Indoor Spatial Data Model

Spatial Theory →

Indoor Spatial Theory
- Primitive Types for Indoor Spatial Objects
- Topology for Indoor Spatial Objects
- Operators for Indoor Spatial Objects
- Data Models for Cellular Space and R3 Space
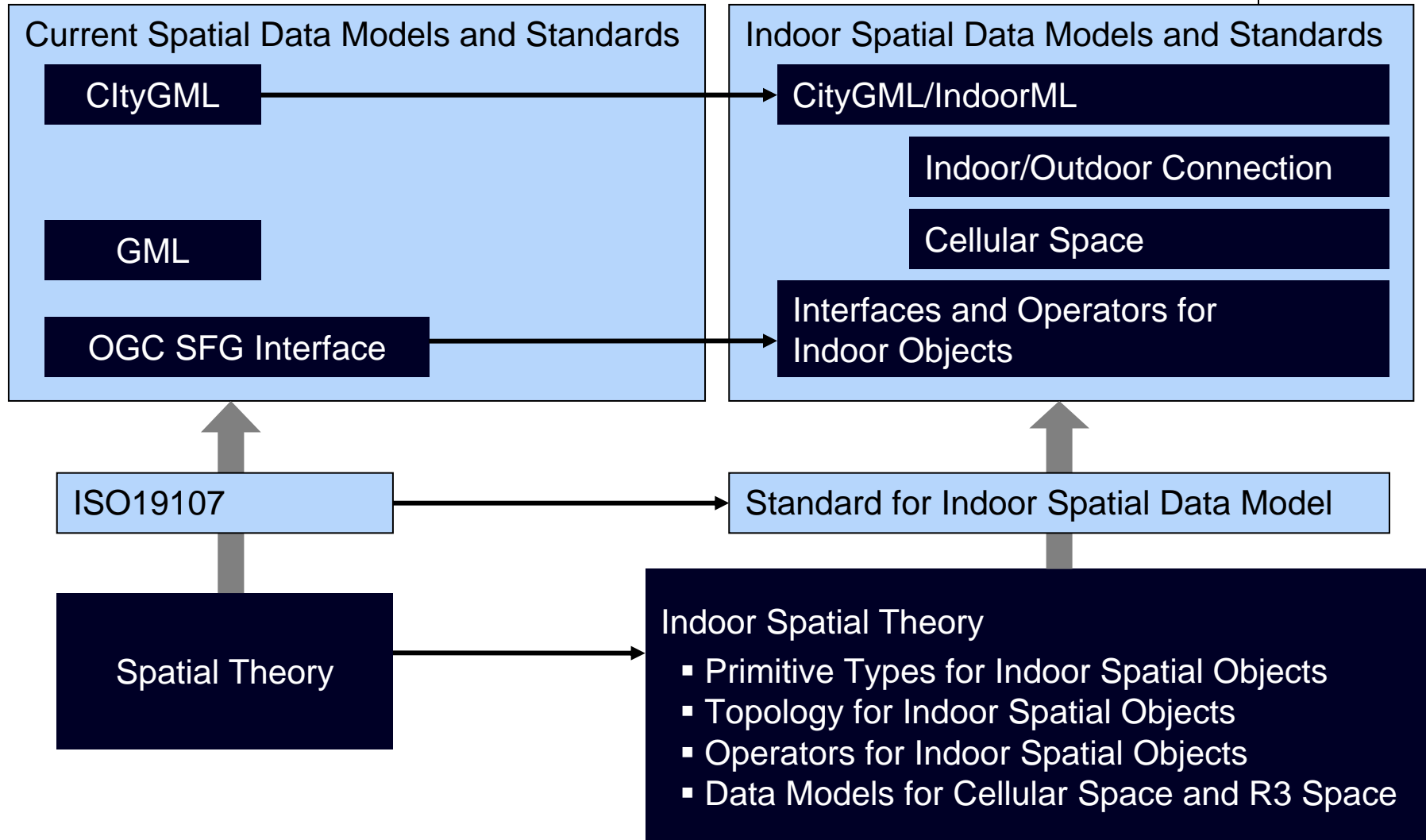
New Notion of Space

- Most systems of spatial databases
  - Based on quantitative (e.g. geometric) notation of space
  - e.g. coordinates, ISO19107, GML, linear reference

- But "some" applications DO NOT require quantitative notion
  - I'm in room 422.
  - How many persons are in the lobby?

- Space with only qualitative description
 - Symbolic space, Cellular space, etc..

Address and Symbolic Space

- Cellular Space (or Symbolic Space)
  - Motivations
    - Location Reference for Indoor Space
      - Cell ID rather than (x,y,z) coordinates for location reference
      - Example: Meeting at Room 422
    - Indoor Positioning Technology
      - Most practical technologies: Cell-Based Positioning
      - Example: RFID Technologies
  - No Geometry
    - Each cell may have its geometry
  - Only topology between cells describes the nature of space

Example of Symbolic Space
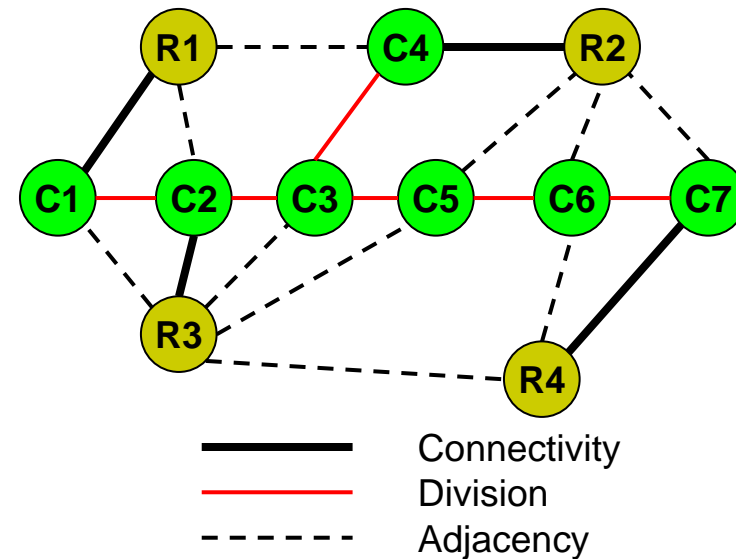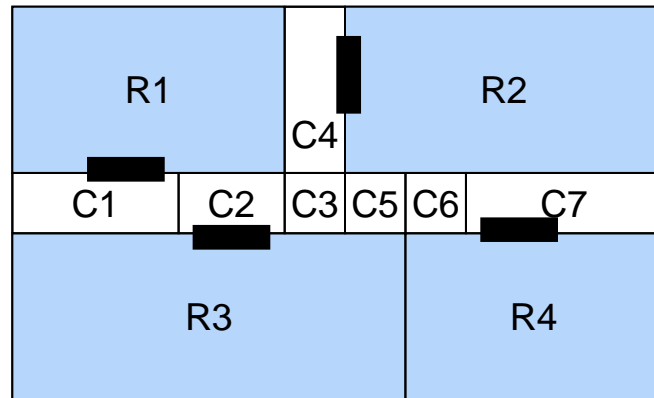
- No Geometry
- Topology between cells
  - Example: Connectivity, Adjacency, Division, Overlap
- Indoor-Outdoor Connection
- Relationship between cell and moving object

Conclusion

- Address is important because it is one of the major forms of spatial referencing which provides context.

  - The challenge is how to extract unambiguous location information

- In UBGI environment , the location information can be easily exchanged and used without further conversion or transformation

- The "free text" address can be correctly interpreted since the geographic context will be always provided

- UBGI concepts and standards can help to resolve some of the difficult issues in standardizing addresses