

# Nexus: A Universal Platform Enabling Context-Aware Applications



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# Overview

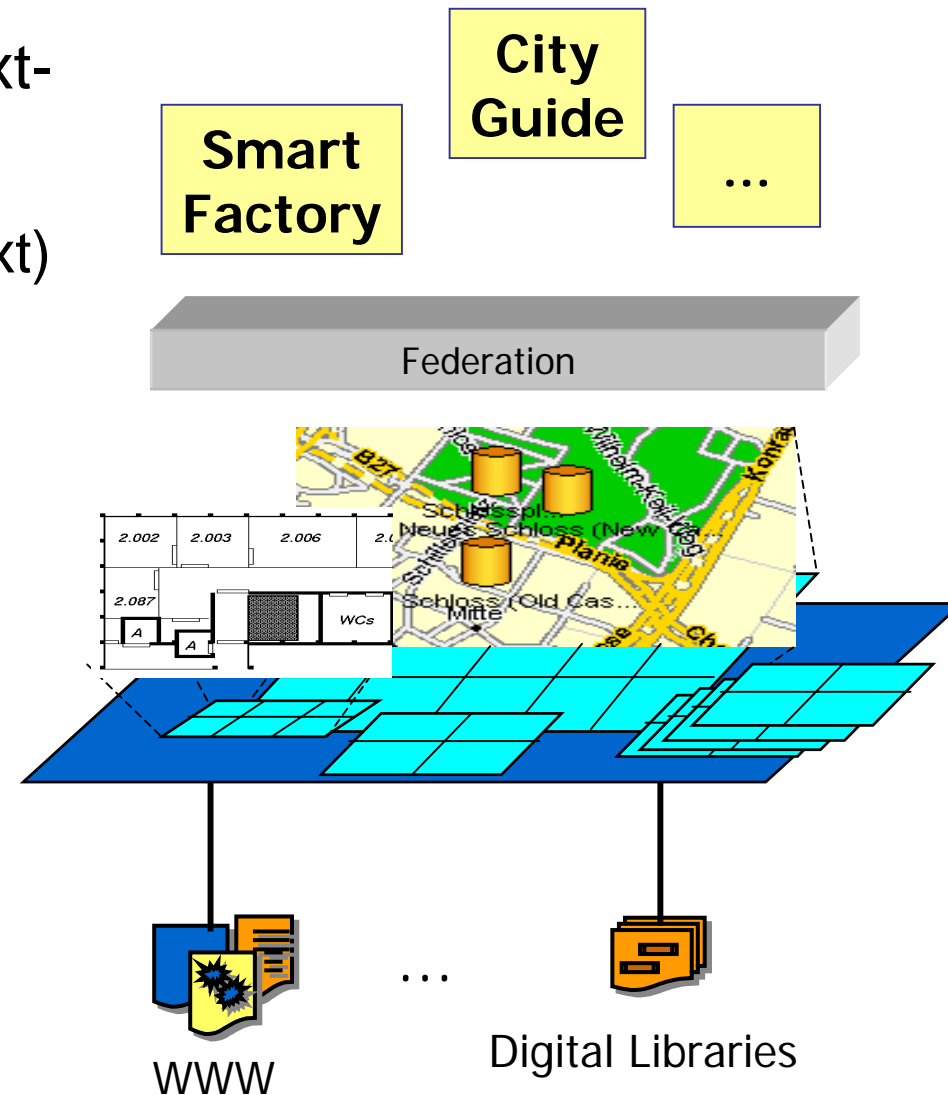


- The vision of shared world models
- From application needs to the platform
- The Nexus Augmented World Model
- New services: what we can do now
- Conclusion

# Vision: Federated, Shared World Models



- Context Model: Information for Context-aware Applications
  - location, identity, time (primary context)
  - environment, POIs, sensor data, relevant web sites
- Shared: enables interoperability between applications
  - modeling is expensive
  - shared resources
- Federated: combining local world models to a global view
- Open

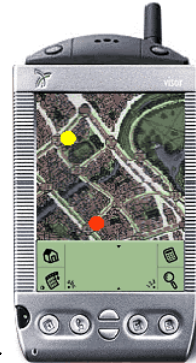


# What context-aware applications want to know



Where are nearby  
italian restaurants?  
*(my user is hungry)*

Where am I?  
*(want to show on the map)*



Is there a wireless  
network with better  
bandwidth?  
*(this picture is really big)*

Are there any  
loudspeakers nearby?  
*(want to send audio data to my  
user)*

→ Queries to the world (about the context)

# Augmented World Query Language (AWQL)



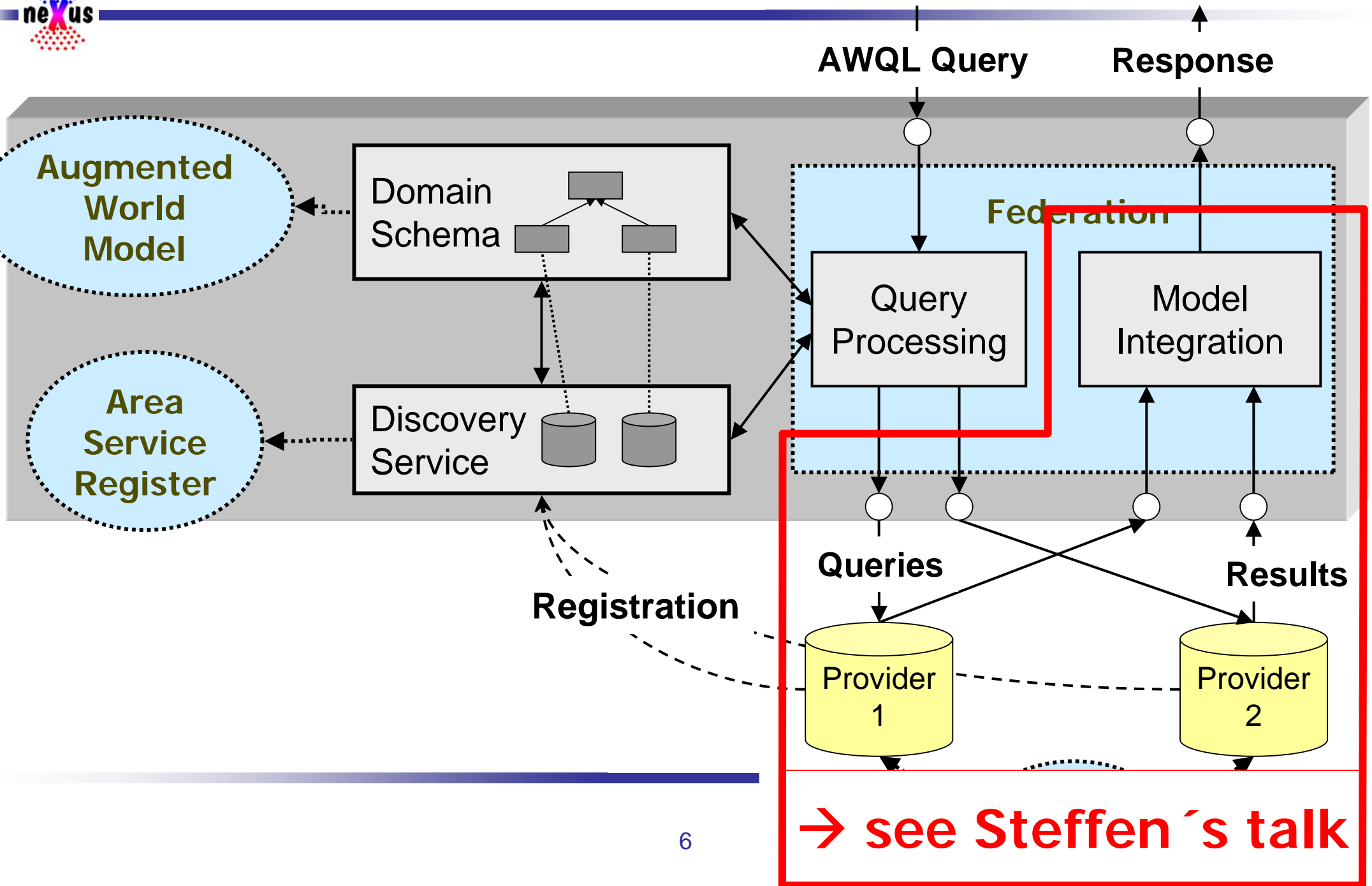
Museum  
Guide

```
<awql>
  <restriction>
    <and>
      <equal attr="type" val="Exhibit"/>
      <inside attr="pos">
        the geometry of the room
      </inside></and>
    </restriction>
    <filter>
      <include>pos information
      </include>
      <excludeallother/>
    </filter>
    <nearest pos="the position">
      10
    </nearest>
  </awql>
```

I want the position and the information about the nearest 10 exhibits.

- AWQL:
  - simple spatial query language
  - restriction: which objects?
  - filter: what part of objects?
  - nearest: only  $k$  objects, sort by distance

# Architecture of the Nexus Federation



# Context Servers (Nexus: Spatial Model Server)



- Store local context models
- Common interface: AWQL (easy to wrap)
- Registered at the Area Service Register
- Different types:
  - **Spatial database systems** or GIS for huge or detailed models of seldomly changing data
  - **Location Service**: efficient, main memory management of mobile objects; high update rates, less persistency
  - **Sensors**: either feeding context servers or a tiny Spatial Model Server (ContextCube: 5-sensor platform with 1MB AWQL implementation)

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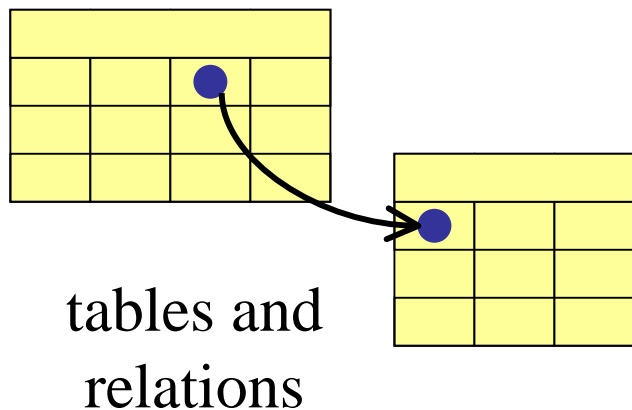


# Ontology

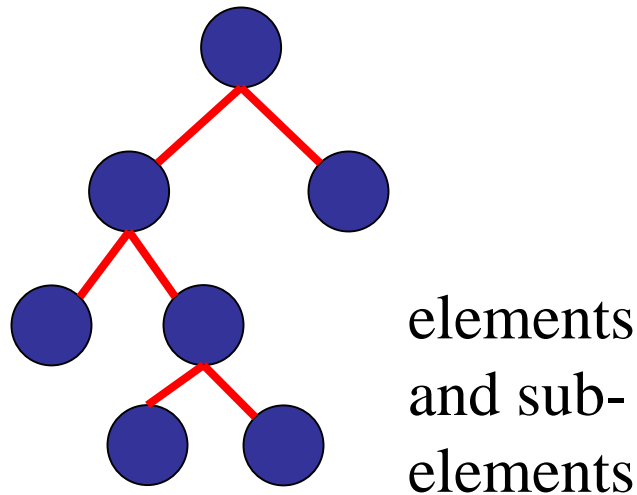


- "the study of existence"
- prerequisite for semantic interoperability, common language (or schema); defines "what is a building"
- should be a standard – but what about flexibility?
- data modeling:

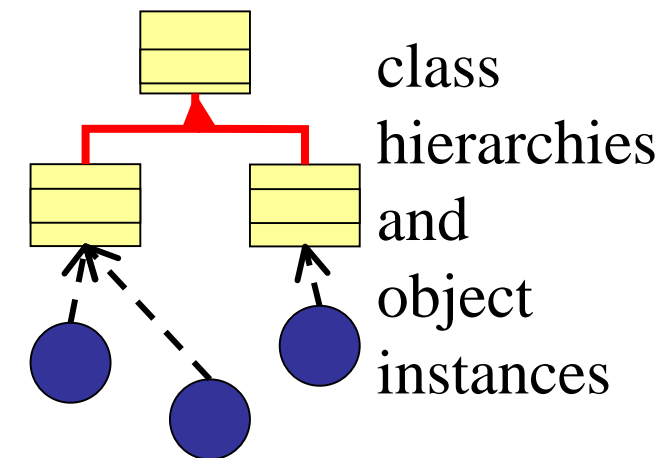
## relational



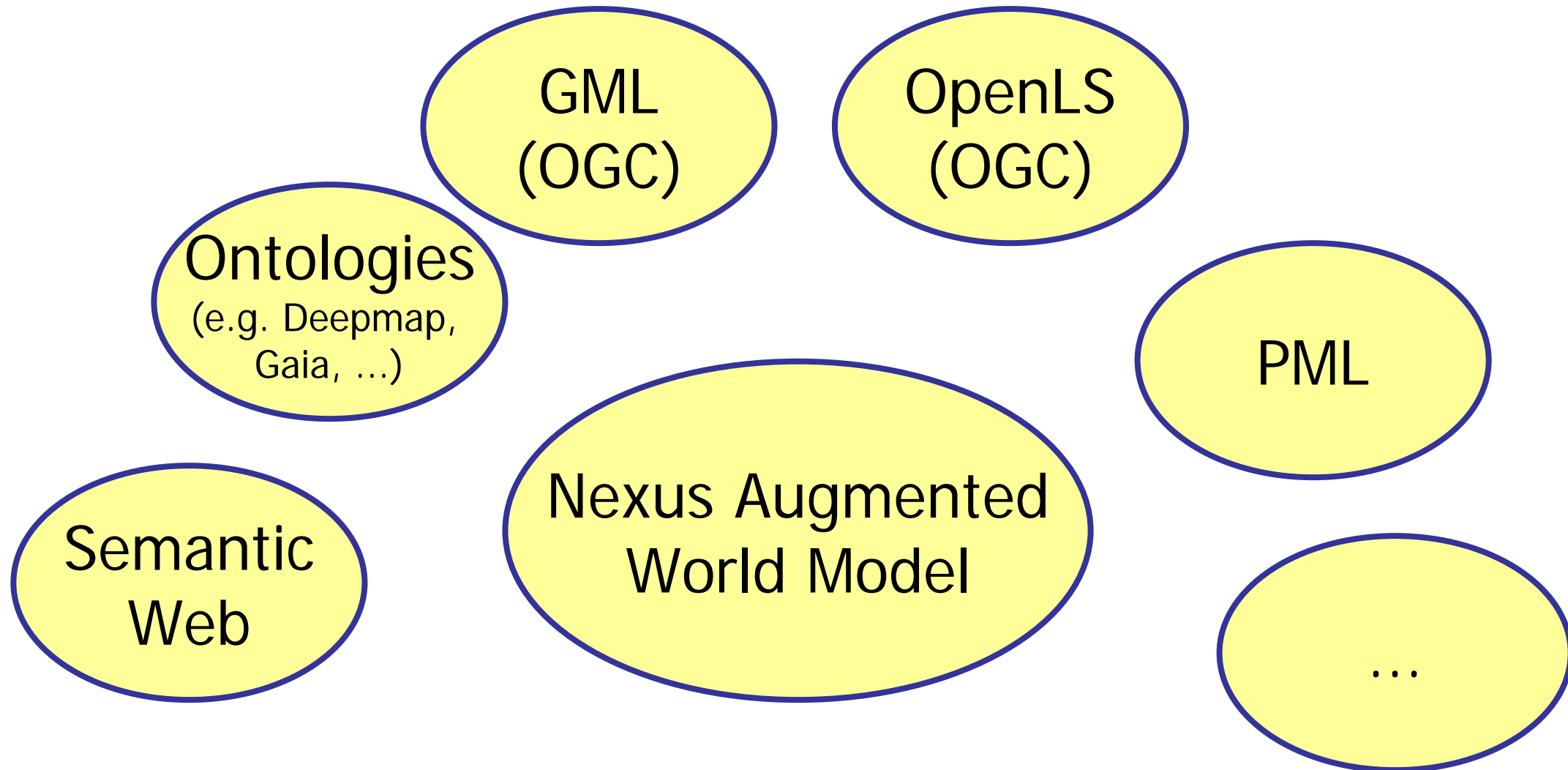
## hierarchical



## object-oriented



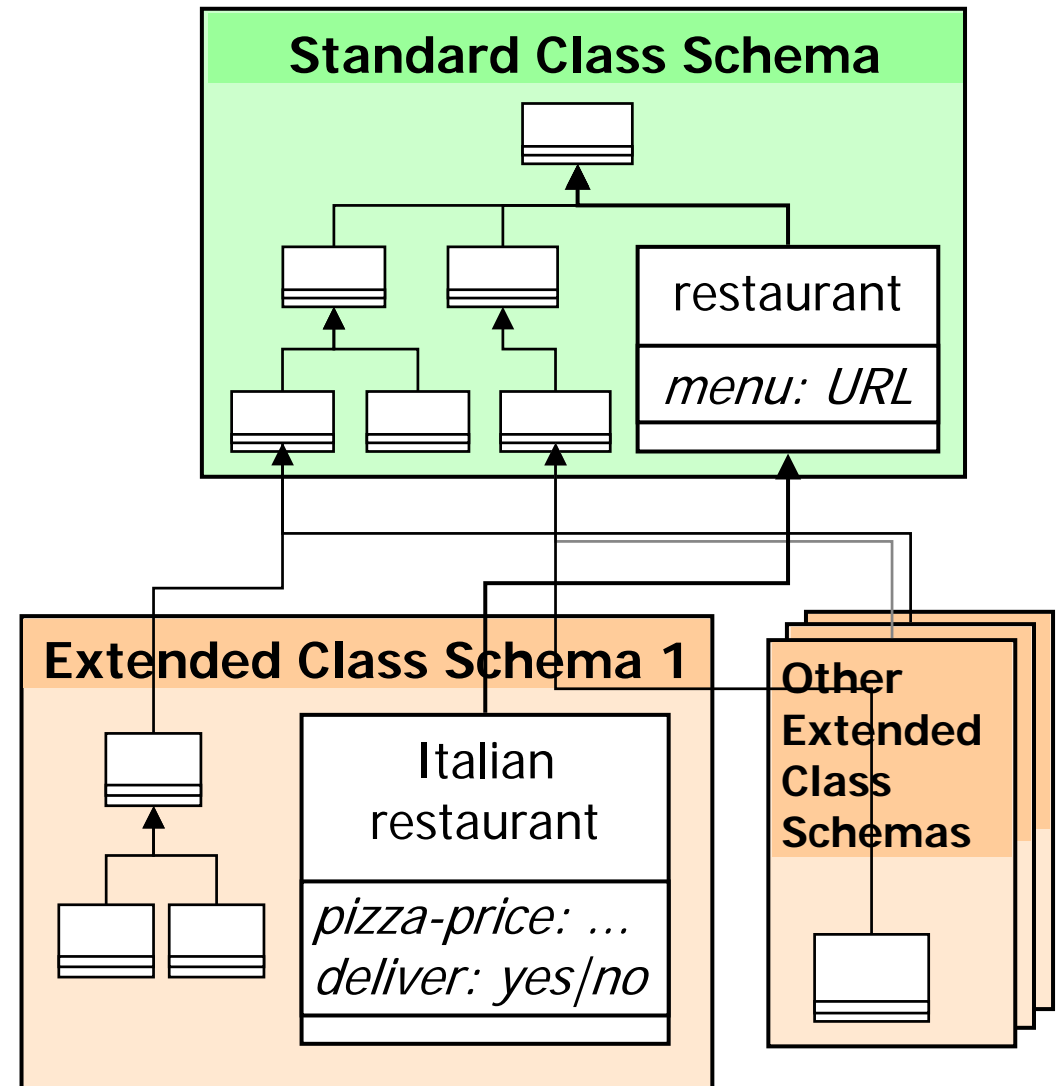
# Which Ontology for Context-Awareness?



# Extensibility of the Augmented World Model



- Standard Class Schema
  - Base ontology
  - Fundamental object classes
  - Needed by most applications
  - Ensures interoperability
  - Unique identifier for every object instance
- Extended Class Schema
  - For future applications
  - Objects inherit from Standard Class Schema



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# Enhanced services



- Context-aware service discovery:
  - model services (devices, applications, anything user or app. needs)
- Multi-modal navigation:
  - not on one data set, but on the current state of the world (including diff. transportation systems)
- FriendFinder (or FoeWarner)
  - Track mobile users. Privacy!
  - TelCos can do this now. But we can do more ...

# More enhanced services



- Spatial Events
  - Define predicates on the real world, get notification
  - "I am near a shoe shop" or "> 5 people at the coffee corner"
- Geocast
  - send messages to geographic areas ("emergency")
- Context-aware communication: model network infrastructure
  - discover Wireless LANs on the way of the user
  - hoarding (pre-fetching)
- . . .

# Conclusion



- Vision of federated, shared world models:
  - federation has to cope with complexity and consistency
  - ontology is prerequisite for interoperability
  - extensibility for usability
  - enhanced context-aware services
- Semantic Web – but with an infrastructure that provides efficient management and retrieval capabilities
  - Assumption of Locality
- Internet for context-awareness