# Semantic Grid Infrastructure for Applications in Biomedicine

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# Outline

- Semantic Grid
  - Grid, Grid Services, OGSA
  - Semantics, Ontologies
  - Semantic Web Services
- SEAGRIN – Semantic Grid Infrastructure
  - Biomedical grid
  - “Overlay grid”

# Grids

- Computational grids for sharing high-end resources (supercomputers)
- sharing across organization boundaries more important than computations
- Collaborative grids for videoconferencing and remote control of instruments
- Information grids for sharing data and knowledge

# Grid services

- 1st generation grids (SETI@home) made ad hoc
- 2nd generation (Globus2) used many specialized protocols (GRAM, GASS, LDAP, GridFTP, ...)
- 3rd generation based on Web Services - SOAP/ XML messaging and open standards

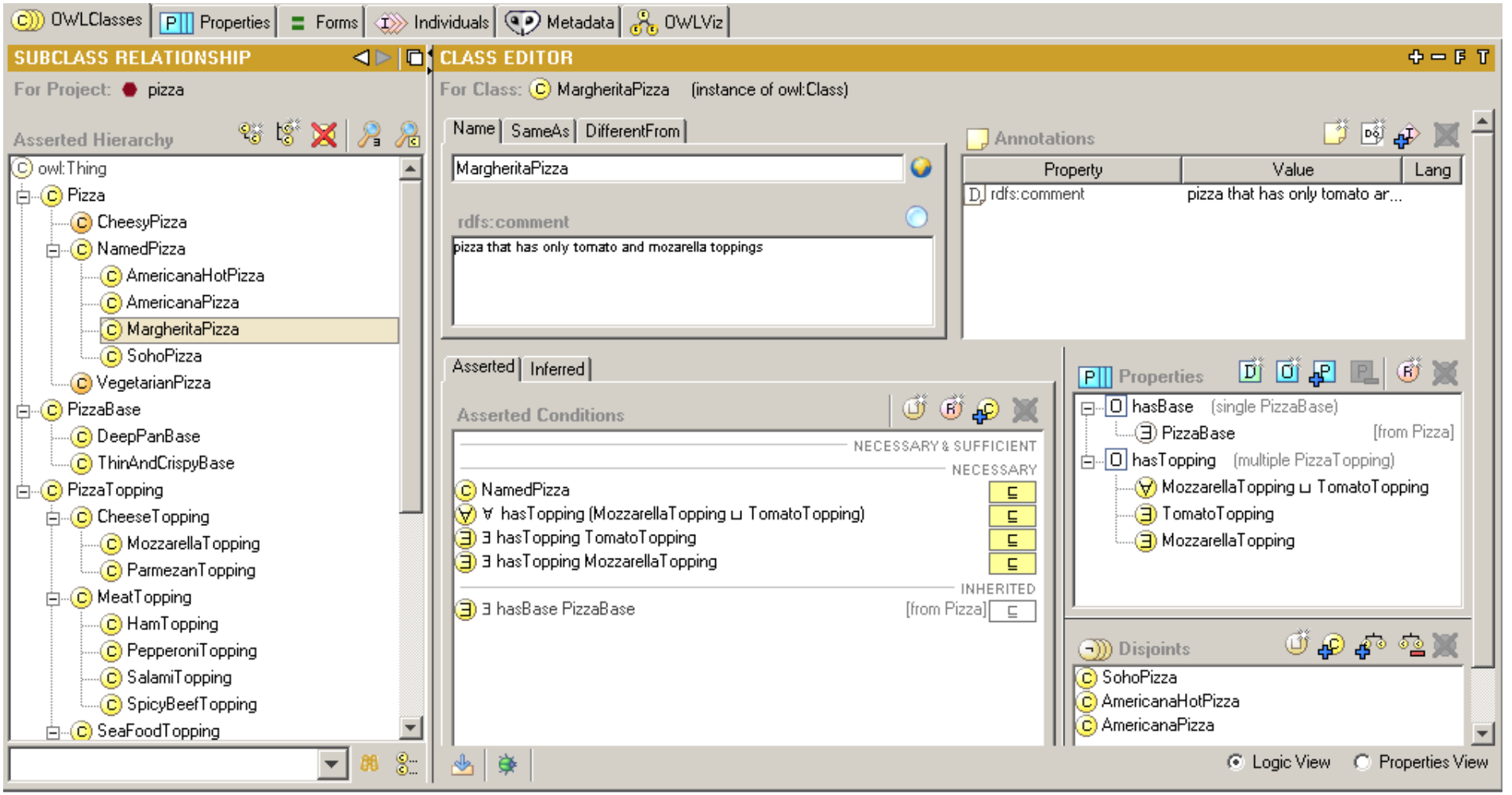
# OGSA

- Open Grid Services Architecture defined by Global Grid Forum
- WS-Resources for lifecycle and state
- security using PKI, X509 and proxy certificates
- described on syntactic level only (WSDL)
- must know exact names of services, operations, data types

# Semantic web and ontologies

- semantics (meaning) defined by ontologies
- ontology captures knowledge about some domain, using a taxonomy and inference rules (next slide)
- standard OWL – Web Ontology Language defined by W3C, based on XML, 3 versions - Light, DL, Full
- classes, properties, individuals referenced by URIs
- OWL ontologies can be composed from smaller parts
- OWL DL allows automated reasoning (RACER)

# Ontology example



# Semantic web services

- each grid service is a web service
- semantic web techniques can be applied
- semantic web services described by
  - Data semantics (I/O data)
  - Functional semantics (operations)
  - QoS semantics (price, availability, ...)
  - Execution semantics (preconditions, ...)
- not yet standardized, OWL-S vs. WSDL-S

# Semantic Web

- “extension of the current Web in which information is given a well-defined meaning”

# Semantic Grid

- “extension of the current Grid in which information and services are given a well-defined meaning”

# Biomedical grid

- project MediGrid (CESNET, Faculty Hospital Motol, Masaryk Hospital in Ústí nad Labem)
- the goal is biomedical grid for collaboration of specialists from various areas
- grid deals with heterogeneity, security
- semantics used for modularity and services composition

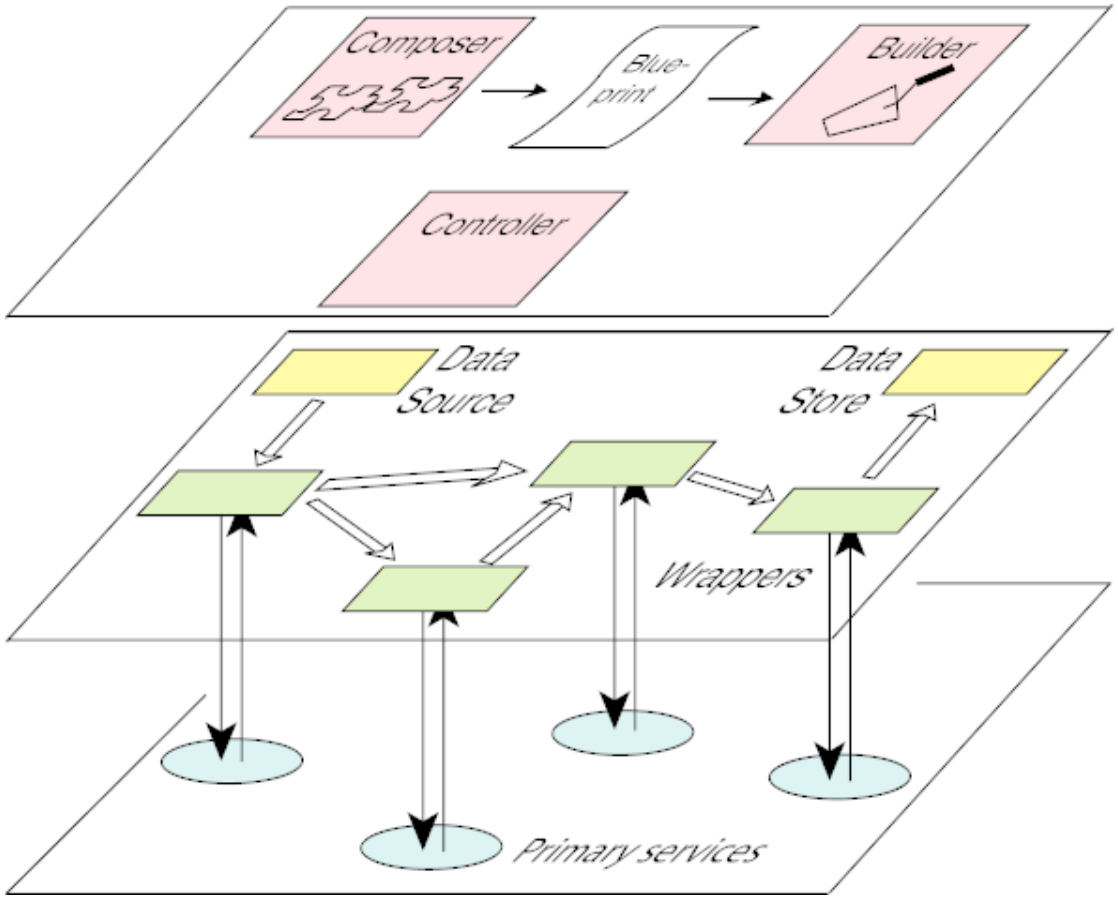
# SEAGRIN

- Semantic Adaptive Grid Infrastructure
- Primary Services – semantic web services
- semantic descriptions of input and output data types used for composing workflows
- output of some services used as input of other services
- workflow is decentralized
- each primary service has a Wrapper Service – grid service

# SEAGRIN (2)

- communication is among Wrappers
- Wrapper adapts data for its service
  - translation – syntactic transformation (tag names)
  - conversion – for example imperial/SI units
  - merging of multiple input data into one message
  - splitting of output data into multiple messages

# Overlay grid



# SEAGRIN (3)

- more Infrastructure Services
  - Composer – creates blueprints for workflows
  - Builder – instantiates workflows
  - Controller – runs workflows
  - Nest – creates Wrappers on demand
  - Data Source, Data Store

# Conclusions

- Semantic grid is a grid with well-defined meaning of information in machine-understandable form
- utilizes advances in semantic web and semantic web services
- in biomedicine can help collaboration among specialists

# Thank you

- Questions ?