
CmpE 494: Service-Oriented Architectures and Web Services

Pinar Yolum

pinar.yolum@boun.edu.tr

Department of
Computer Engineering
Bogazici University

Part 7

Modeling and Representation

Based largely on

Service-Oriented Computing: Semantics, Processes, Agents

– Munindar P. Singh and Michael N. Huhns, Wiley, 2004

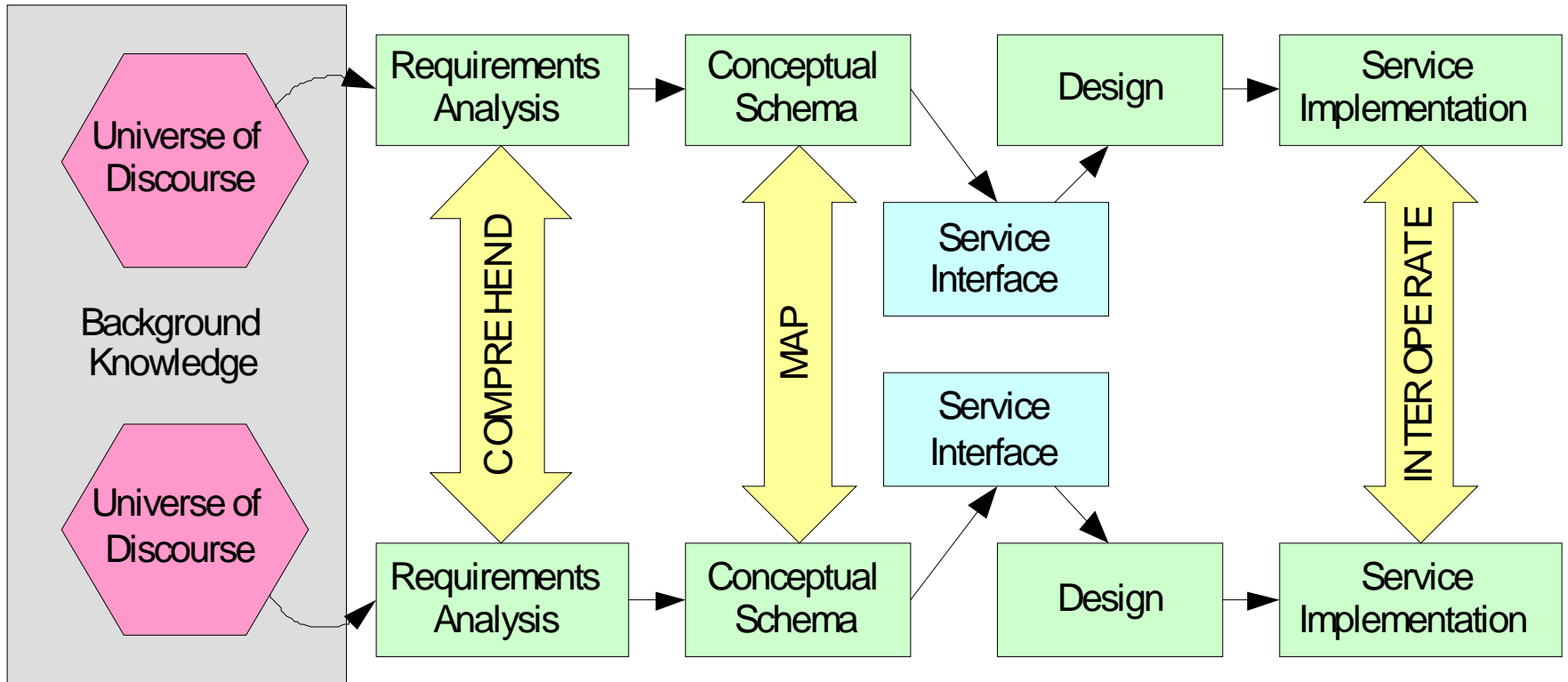
Highlights of this Chapter

- Integration versus Interoperation
- Common Ontologies
- Knowledge Representations
- Relations
- Hierarchies
- Modeling Fundamentals
- Unified Modeling Language (UML)

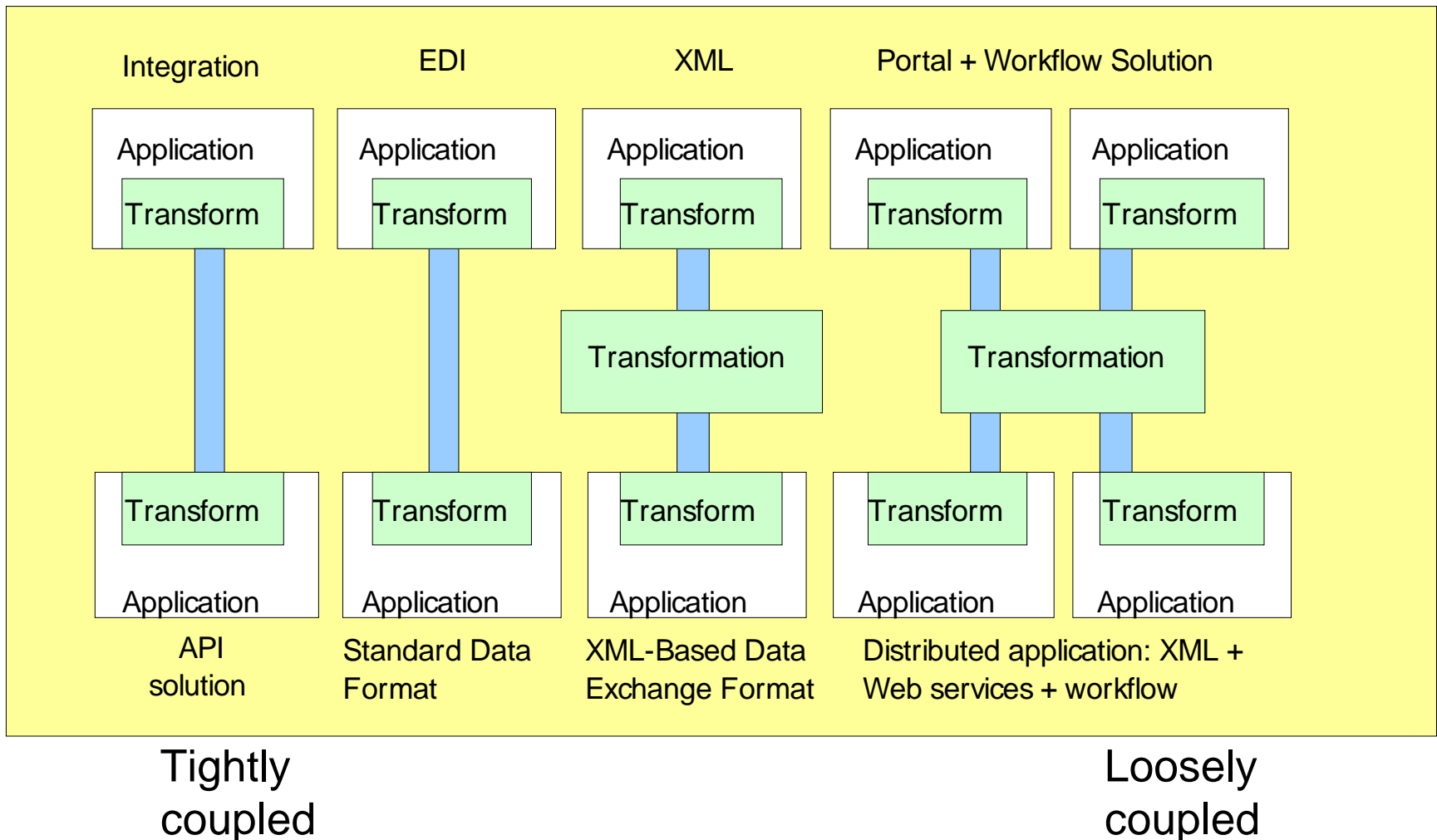
Working Together

- Universe of discourse
 - Knowledge of the domain
- Focus on schema of the service
 - Service models should be interrelated
- Integration
 - Putting concepts together as a whole
 - Difficult to achieve and maintain
- Interoperation
 - Work by sharing messages

Modeling and Composing Services



Integration versus Interoperation



Dimensions of Abstraction: 1

Kinds of knowledge that are relevant for interoperation

Information resources are associated with abstractions over different dimensions. These may be thought of as constraints that must be discovered and represented

- Data
 - Domain specifications, e.g., int, String
 - Value ranges, e.g., Price ≥ 0
 - Allow/disallow null values

Dimensions of Abstraction: 2

- Structure (as in taxonomies)
 - Schemas and views, e.g., securities are stocks
 - Specializations and generalizations of domain concepts, e.g., stocks are a kind of liquid asset
 - Value maps, e.g., S&P A+ rating corresponds to Moody's A rating
 - Semantic data properties, sufficient to characterize the value maps, e.g., some stock price databases consider daily averages; others closing prices
 - Integrity constraints, e.g., each stock must have a unique SEC identifier

Dimensions of Abstraction: 3

- Process
 - Procedures, i.e., how to process information, e.g., how to decide what stock to recommend – details may be proprietary
 - Preferences for reads and updates in case of data replication (based on recency or accuracy of data)
 - Preferences to capture view update semantics
 - Contingency strategies, e.g., whether to ignore, redo, or compensate
 - Contingency procedures, i.e., how to compensate transactions
 - Flow, e.g., where to forward requests or results
 - Temporal constraints, e.g., report tax data every quarter

Dimensions of Abstraction: 4

- Policy
 - Security, i.e., who has rights to access or update what information? (e.g., customers can access all of their accounts, except blind trusts)
 - Authentication, i.e., a sufficient test to establish identity (e.g., passwords, retinal scans, or smart cards)
 - Bookkeeping (e.g., logging all accesses)

Knowledge Representation

- Interoperability levels
 - Syntactic: parse
 - Semantic: understand
- Procedural (how) versus declarative (what)
 - Declarative pros: enables standardization, optimization, improved productivity
 - Declarative cons: nontrivial to achieve and causes short-term loss of performance
 - Trade-offs shifted by Web to favor declarative modeling, because of heterogeneity and scale

Knowledge Representation

- Keywords
- Thesauri
 - Arrange related concepts in terms of similarity; broadness; relatedness
- Taxonomies
 - Add power of inheritance
- Ontologies
 - More precise domain models

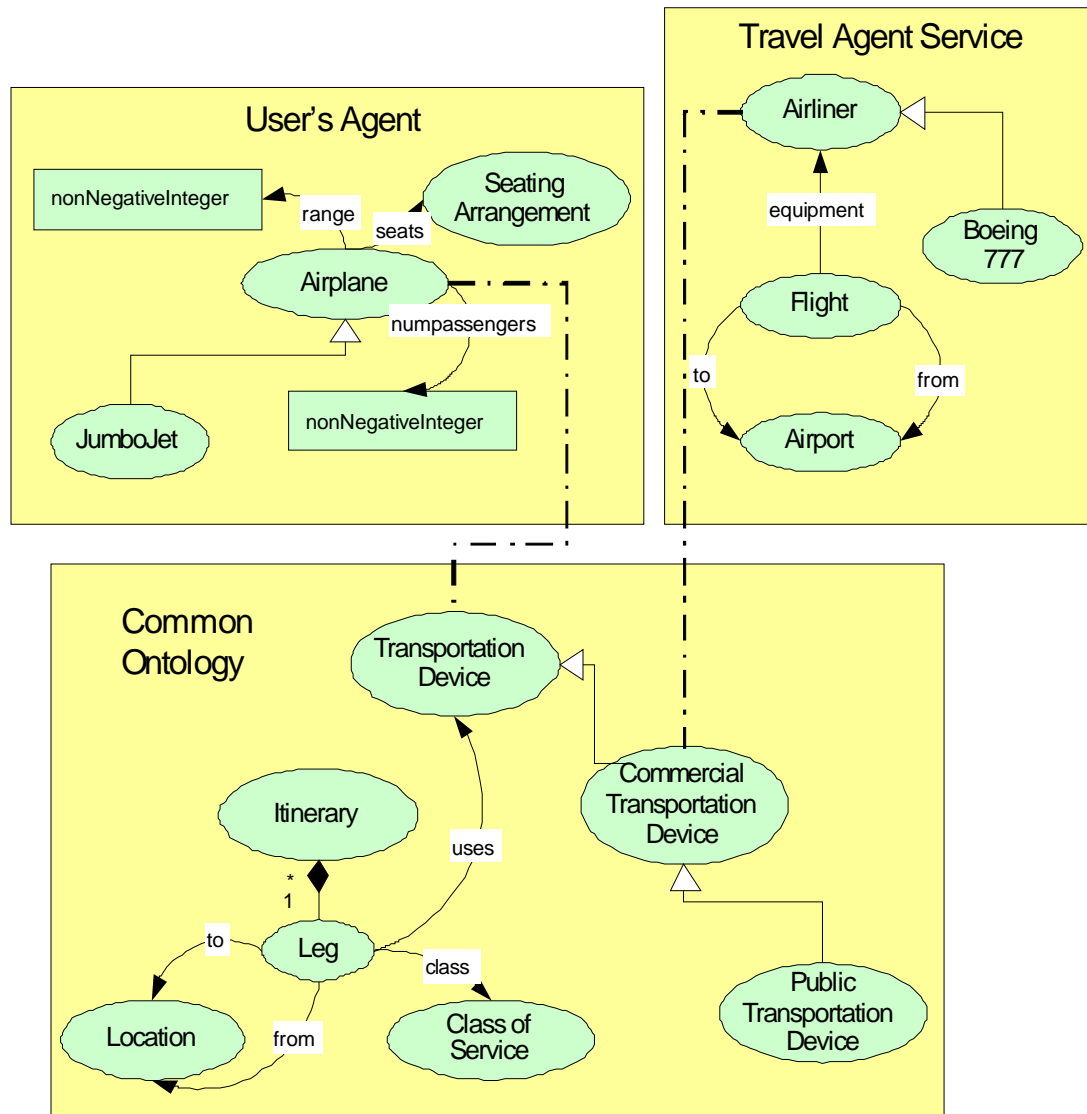
Ontology

- A specification of a conceptualization or a set of knowledge terms for a particular domain, including
 - The vocabulary: concepts and relationships
 - The semantic interconnections: relationships among concepts and among relationships
 - Some simple rules of inference and logic
- Some representation languages for ontologies:
 - Uniform Modeling Language (UML)
 - Resource Description Framework Language Schema (RDFS)
 - Web Ontology Language (OWL)
- Some ontology editors: Protégé, Webonto, OilEd

Common Ontologies

- A shared representation is essential to successful communication and coordination
 - For humans: physical, biological, and social world
 - For computational agents: common ontology (terms used in communication)
- Representative efforts are
 - Cyc (and Opencyc)
 - WordNet (Princeton)
 - Several *upper-level* ontologies

Ontologies and Articulation Axioms



Unified Modeling Language (UML) for Ontologies

