



# Semantic Web Processes: Semantics Enabled Annotation, Discovery, Composition and Orchestration of Web Scale Processes



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# What are Web Processes (1)?



- **Web Processes** are next generation workflow technology to facilitate the interaction of organizations with markets, competitors, suppliers, customers etc. supporting enterprise-level and core business activities
  - encompass the ideas of both intra and inter organizational workflow.
  - created from the composition of Web services
- When all the tasks involved in a Web process are semantically described, we may call such process as **Semantic Web Processes**

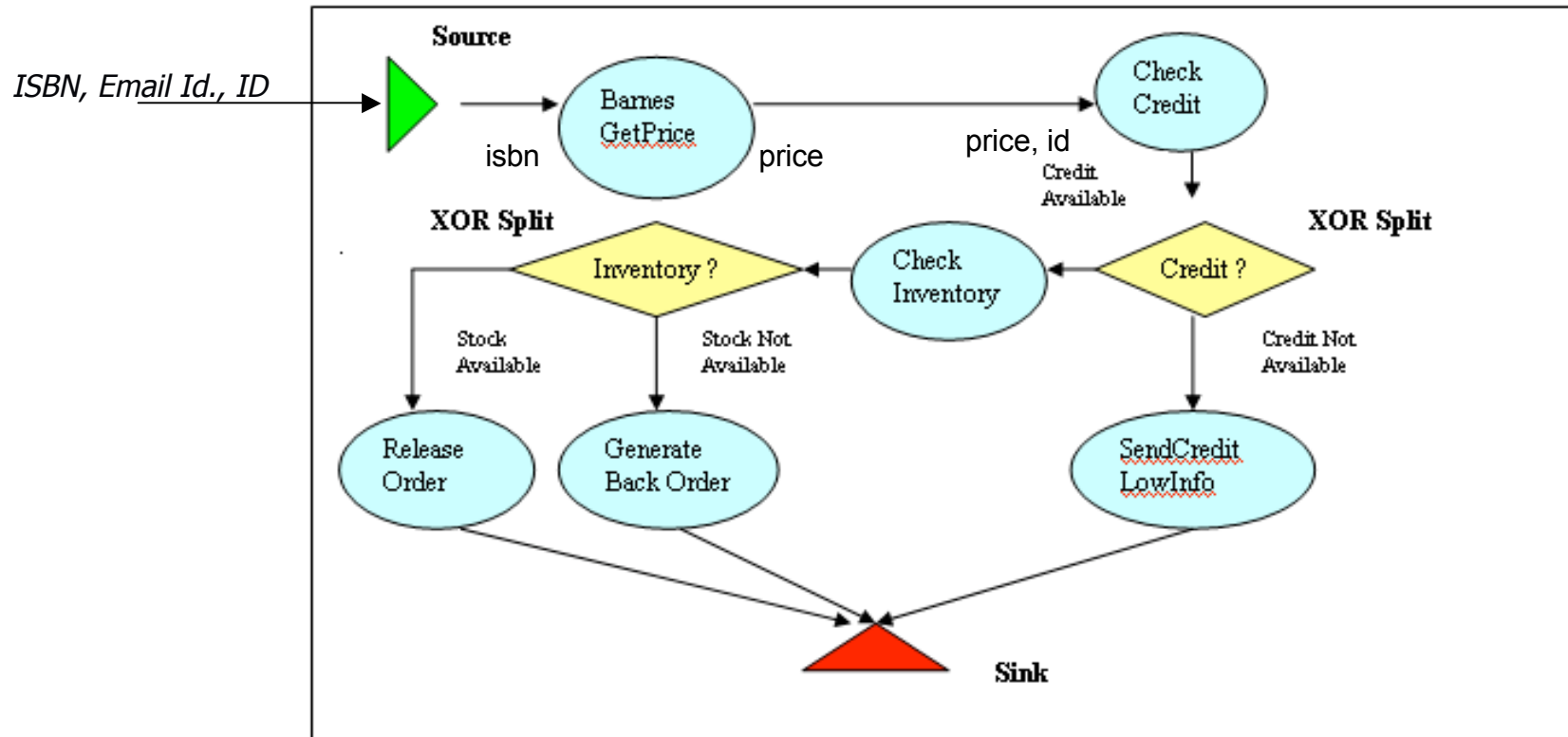
# Web Process

## An Example



### Web Processes

- Graphical example of a web process

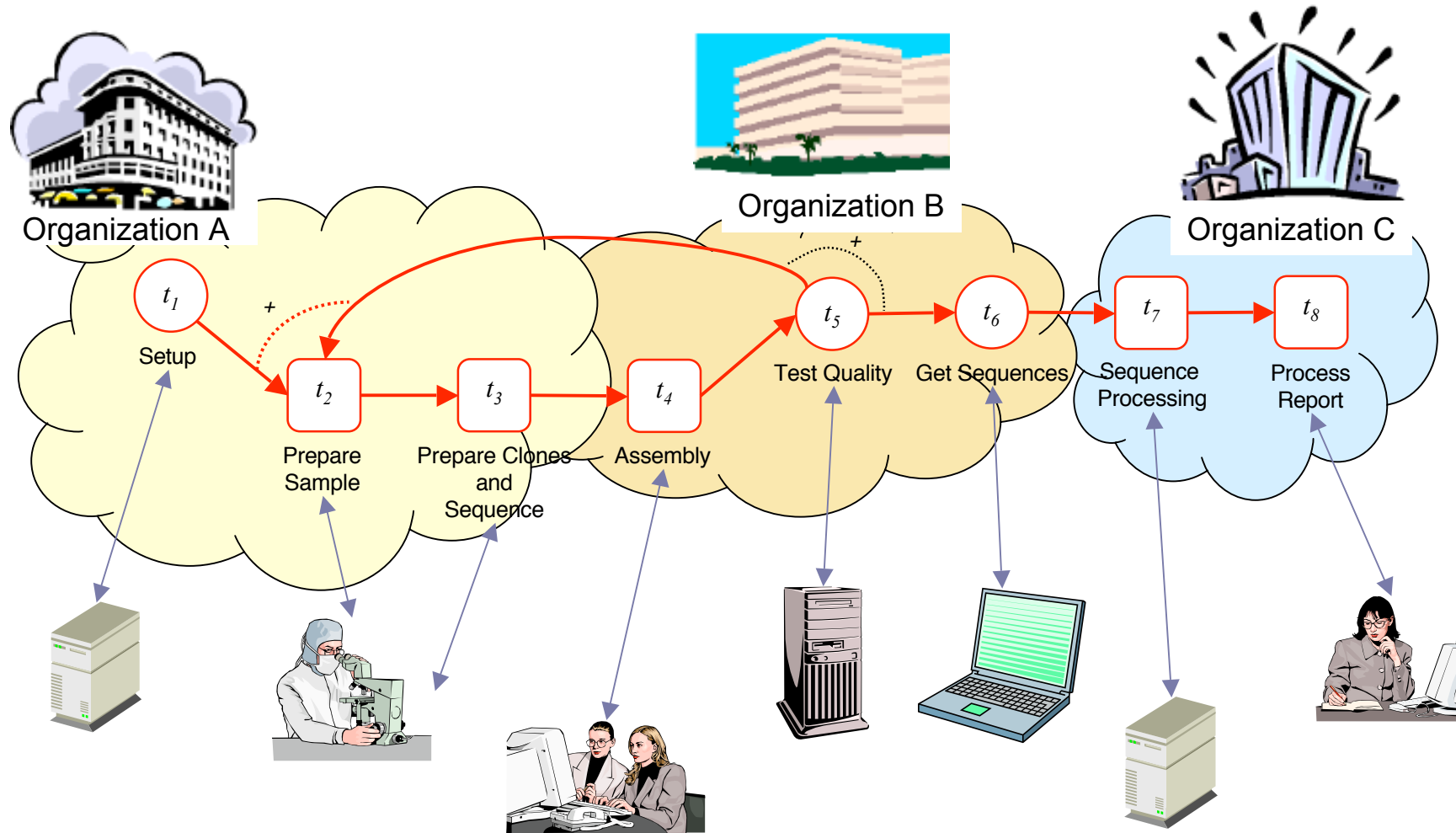


The BarnesBookPurchase process

# Web Process Another Example



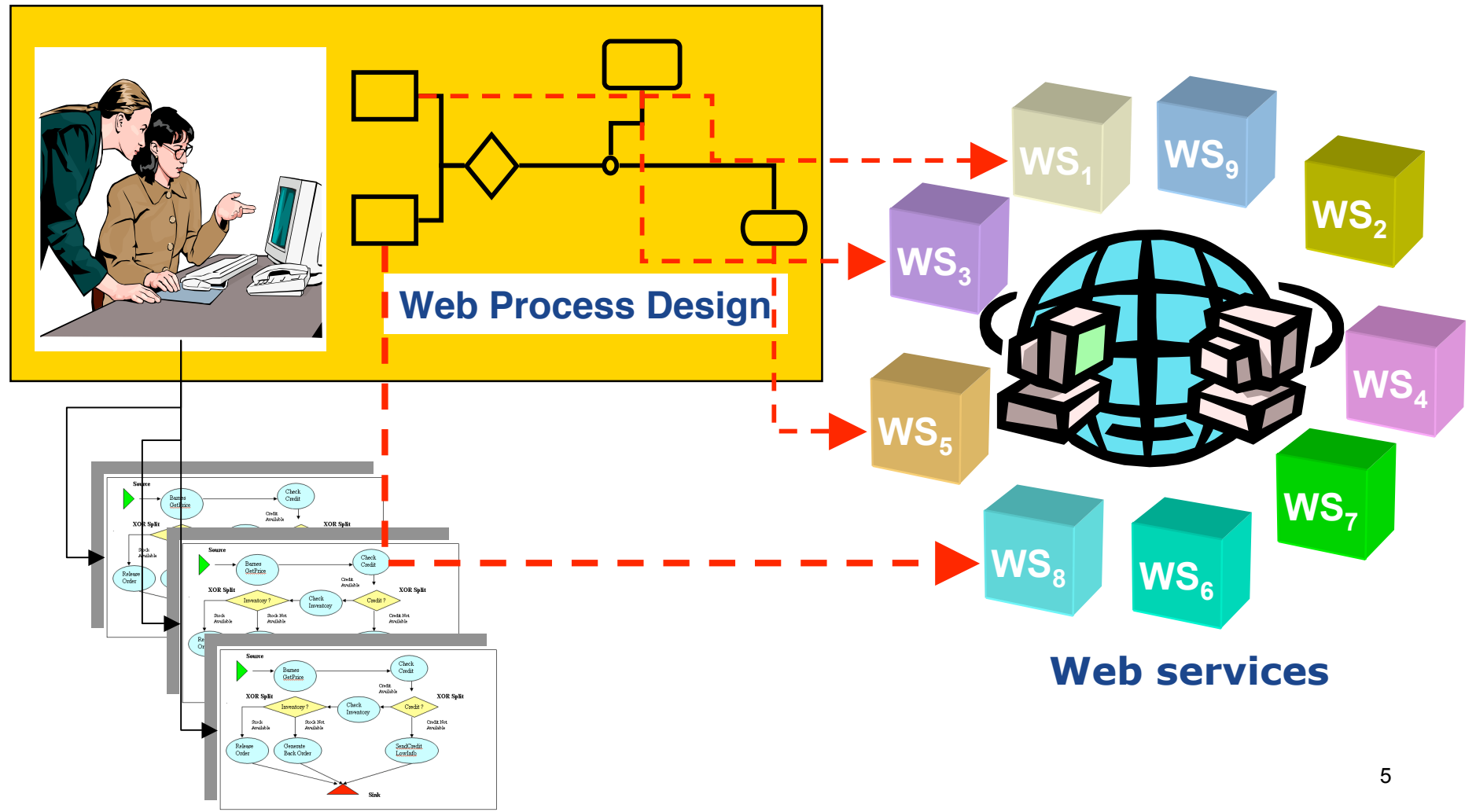
## Web Processes



# Web Processes Composition



## Web Processes

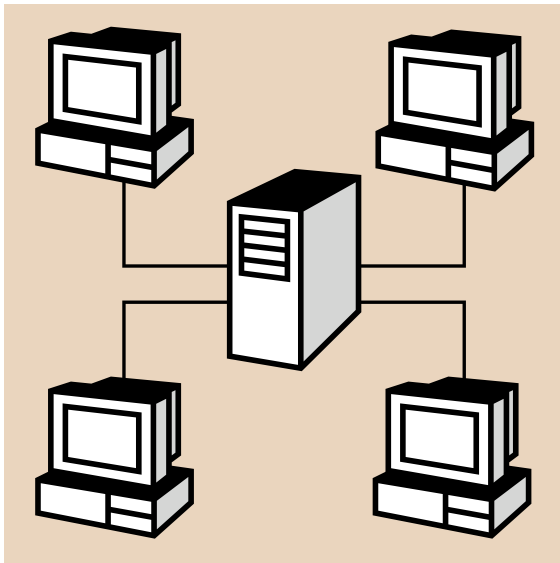


# Globalization of Processes



B2B

E-Services



Workflows



Distributed Workflows



Web Processes

Enterprise

Inter-Enterprise

Global

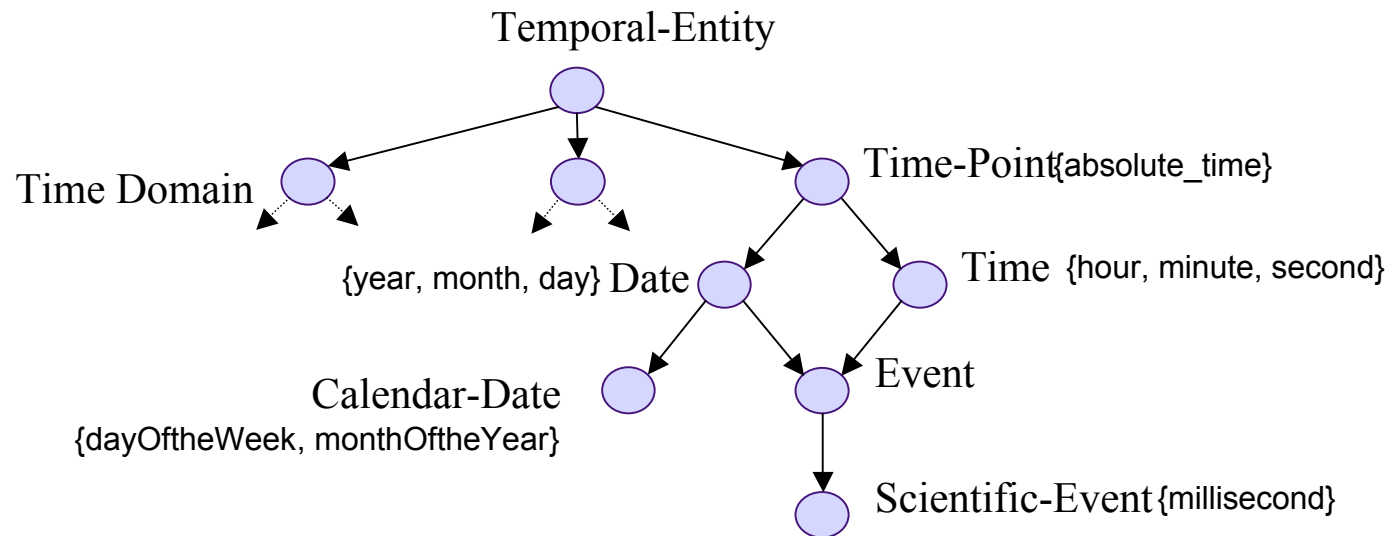
# BIG Challenges



- **Heterogeneity and Autonomy**
  - Syntactic, semantic and pragmatic
  - Complex rules/regulations related to B2B and e-commerce interactions
  - Solution: Machine processable descriptions
- **Dynamic** nature of business interactions
  - Demands: Efficient Discovery, Composition, etc.
- **Scalability** (Enterprises → Web)
  - Needs: Automated service discovery/selection and composition

Proposition: **Semantics** is the most important enabler to address these challenges

# What are Semantics and Ontologies?



- An ontology includes a **vocabulary of terms**, and some **specification of their meaning**.
- The goal is to create an **agreed-upon vocabulary** and semantic structure for exchanging information about that domain.

# Roadmap



Annotation of Web Services

Web Process  
Composition

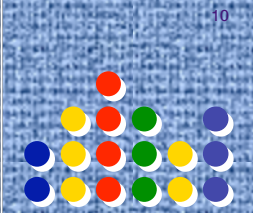
# Semantic Web

Web Service  
Discovery

Web Processes Quality of  
Service



# Semantics for Web Processes



- **Data/Information Semantics**
  - **What:** Formal definition of data in input and output messages of a web service
  - **Why:** for discovery and interoperability
  - **How:** by annotating *input/output data* of web services using ontologies
- **Functional/Operational Semantics**
  - Formally representing capabilities of web service
  - for discovery and composition of Web Services
  - by annotating *operations* of Web Services as well as provide *preconditions* and *effects*;
- **Execution Semantics**
  - Formally representing the execution or flow of a services in a process or operations in a service
  - for analysis (verification), validation (simulation) and execution (exception handling) of the process models
  - using *State Machines*, *Petri nets*, *activity diagrams* etc.
- **QoS Semantics**
  - Formally describing operational metrics of a web service/process
  - To select the most suitable service to carry out an activity in a process
  - using *QoS model* [Cardoso and Sheth, 2002] for web services

# Semantic Annotation of Web Services

## Annotation of Web Services



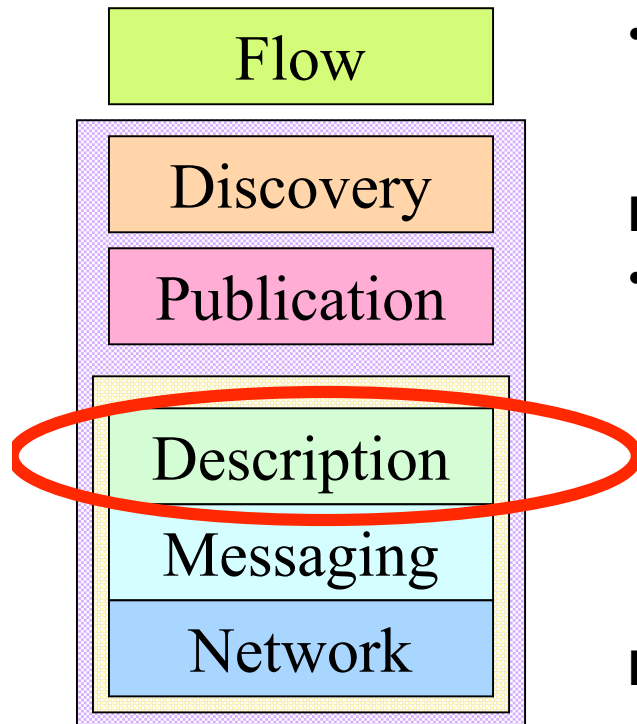
- To enhance the discovery, composition, and orchestration of Web services, it is necessary to increase the description of their interfaces.
- One solution is to annotate WSDL interfaces with semantic metadata based on relevant ontologies.

An ontology is a specification of a representational vocabulary for a shared domain of discourse.

# Semantics at Description Layer



## Description Layer:



### Why:

- Unambiguously understand the **functionality** of the services and the semantics of the operational **data**

### How:

- Using Ontologies to semantically annotate WSDL constructs (conforming to extensibility allowed in WSDL specification version 1.2) to sufficiently explicate the semantics of the
  - **data types** used in the service description and
  - **functionality** of the service

### Present scenario:

- WSDL descriptions are mainly syntactic (provides operational information and not functional information)
- Semantic matchmaking is not possible