Lecture 13 Web Service Architecture

- Web Service Definition
- Web Service Architecture
- Protocol Stack
- Web Service Implementation

Web Service 架构

Web Service Definition

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network.

--- *www.W3.org*

Web Services are self-contained, modular applications that can be described, published, located, and invoked over a network, generally, the Web.

--- *IBM*

Web Service 架构

W3C’s definition on Web Service

- A software system for cross-network operations by using respective ports, SOAP messages and pre-defined interchange services
- A distributed computing system that integrates the applications on distributed servers interconnected via Intranet or Internet
- A distributed computing framework based on network

Web Service 架构

Web Service Core Technology：

- XML (eXtensible Markup Language) as a base
- WSDL (Web Services Description Language) for service description
- Service publishing and discovery at the registration center by a standard protocol
- Unified Web protocols and data format such as HTTP、XML and SOAP (Simple Object Access Protocol) for service access

Web Service 架构

Two Perspectives of Web Service：

- A technical standard for software components that eases the development and maintenance by assembly of functional components across network
- Also a class of software components that can be accessed through network and supports interaction between the applications under the same set of protocols

Web Service 架构

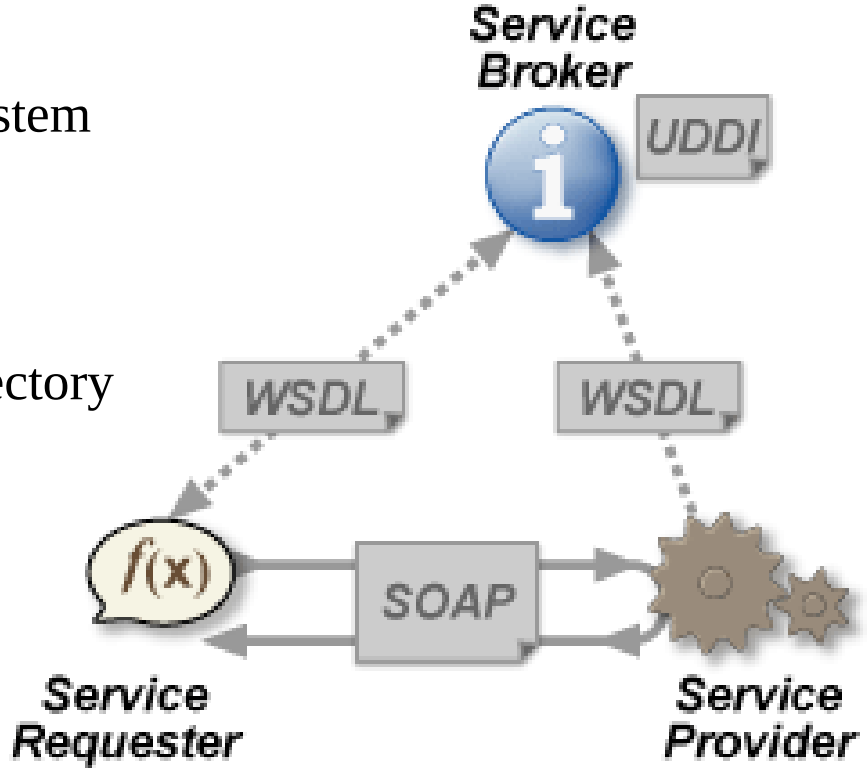
Web Service Types

- Business-oriented Web service， used for enterprise applications
- Consumer-oriented Web service， used for the B2C portals on Internet
- Device-oriented Web service， used for the network connecting hand-hold electronic devices and home facility
- System-oriented Web service, used to implement the communication architecture in distributed systems

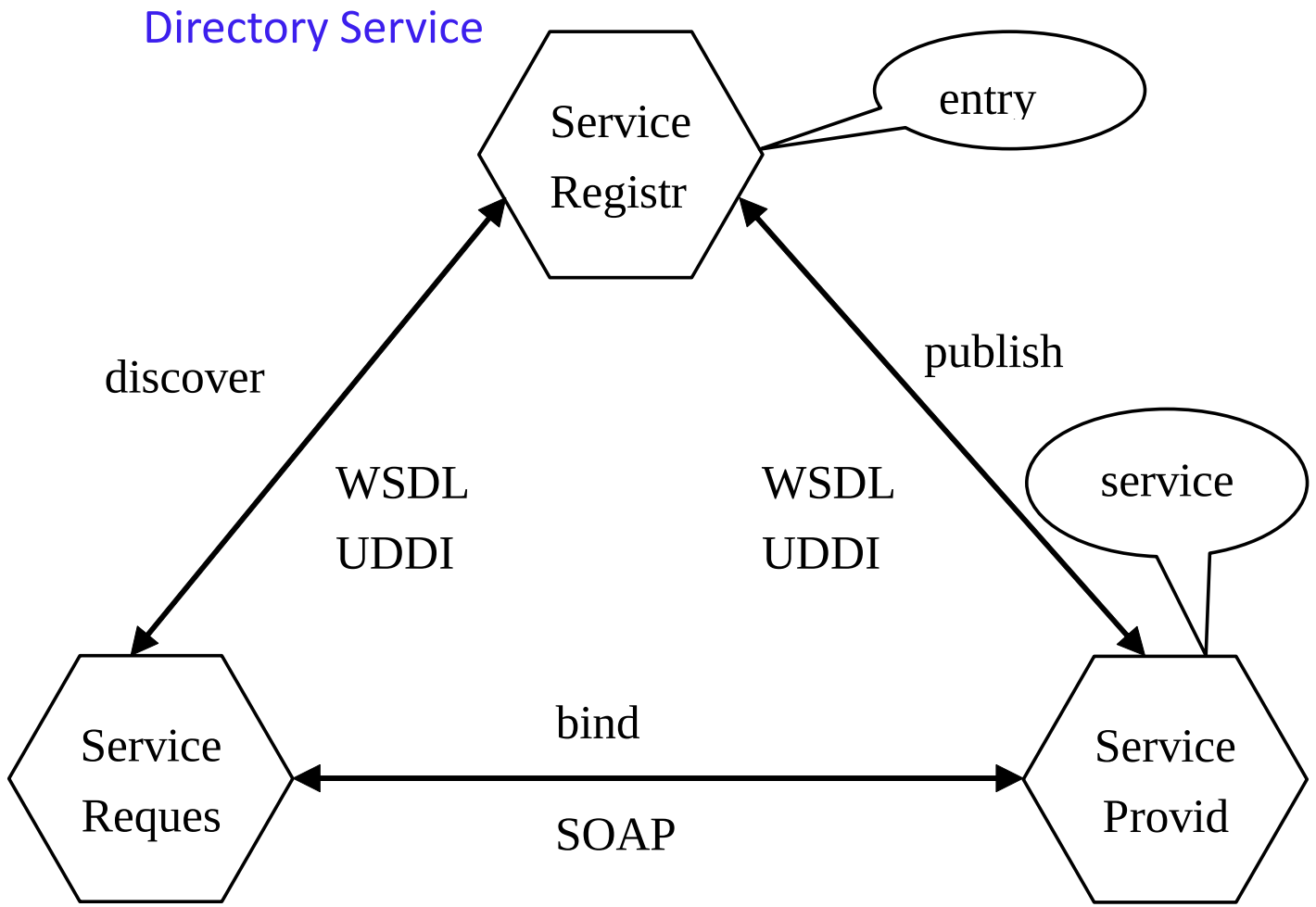
Web Service 架构

Web Service Architecture

- a type of distributed computing system
- service model:
  - service requester
  - service provider
  - service broker/directory
- basic operations:
  - publish
  - find
  - bind
- a set of artifacts:
  - service description/interface
  - service contract/agreement



Web Service 架构



Web Service 架构

- Three Operations defined by Web service system
  - ✓ Discovery service
  - ✓ Publishing service
  - ✓ Binding service
- Three Roles in Web service service
  - ✓ **Service Requester**

    sends a request to the registration center for specific services that meet its needs, and, upon the service is found, directly connects to the service provider to obtain the service

Web Service 架构

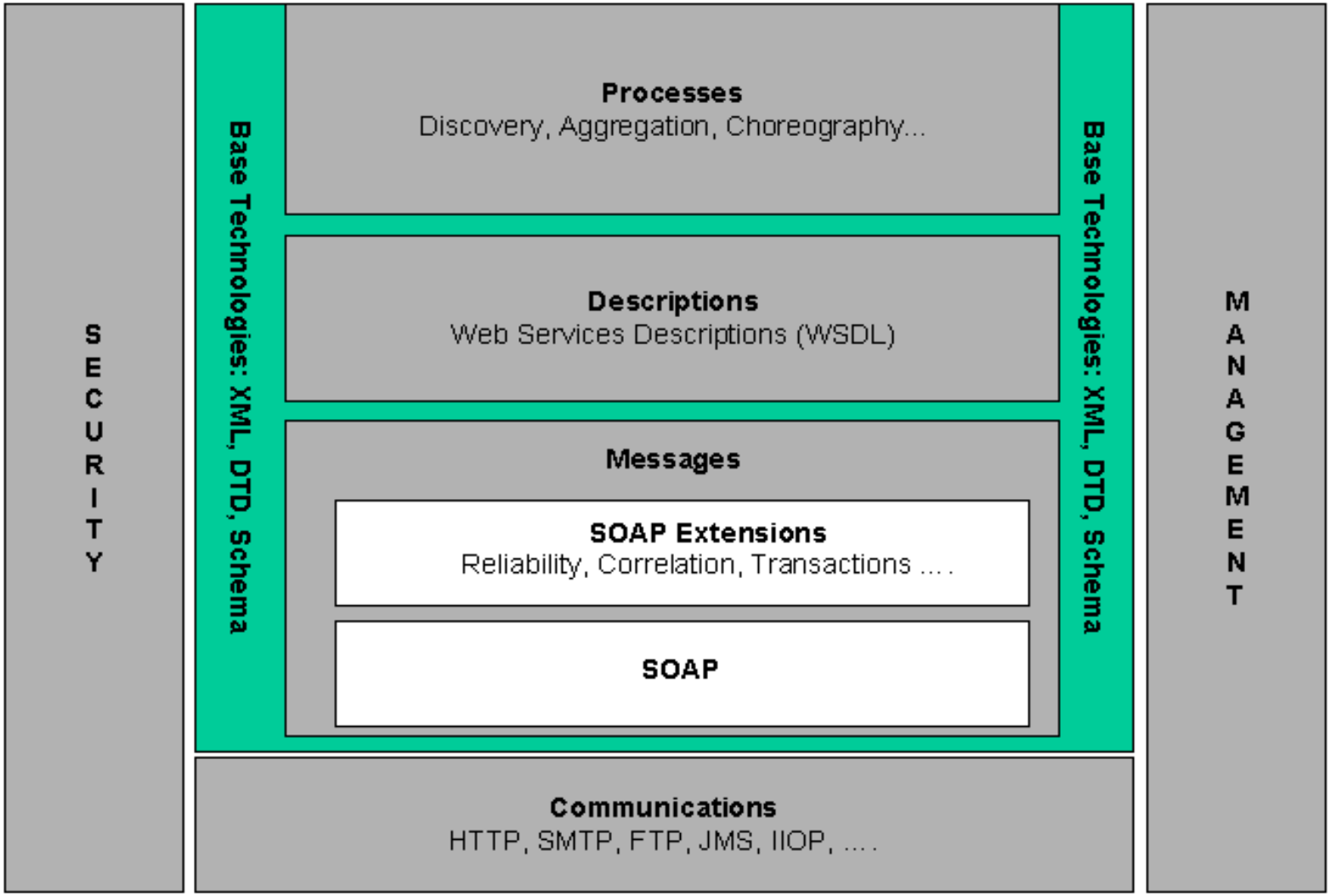
- ✓ **Service Broker**

  provides registration and discovery services to the requester while provides publishing function to the provider so that the service or function can be retrieved in a distributed environment

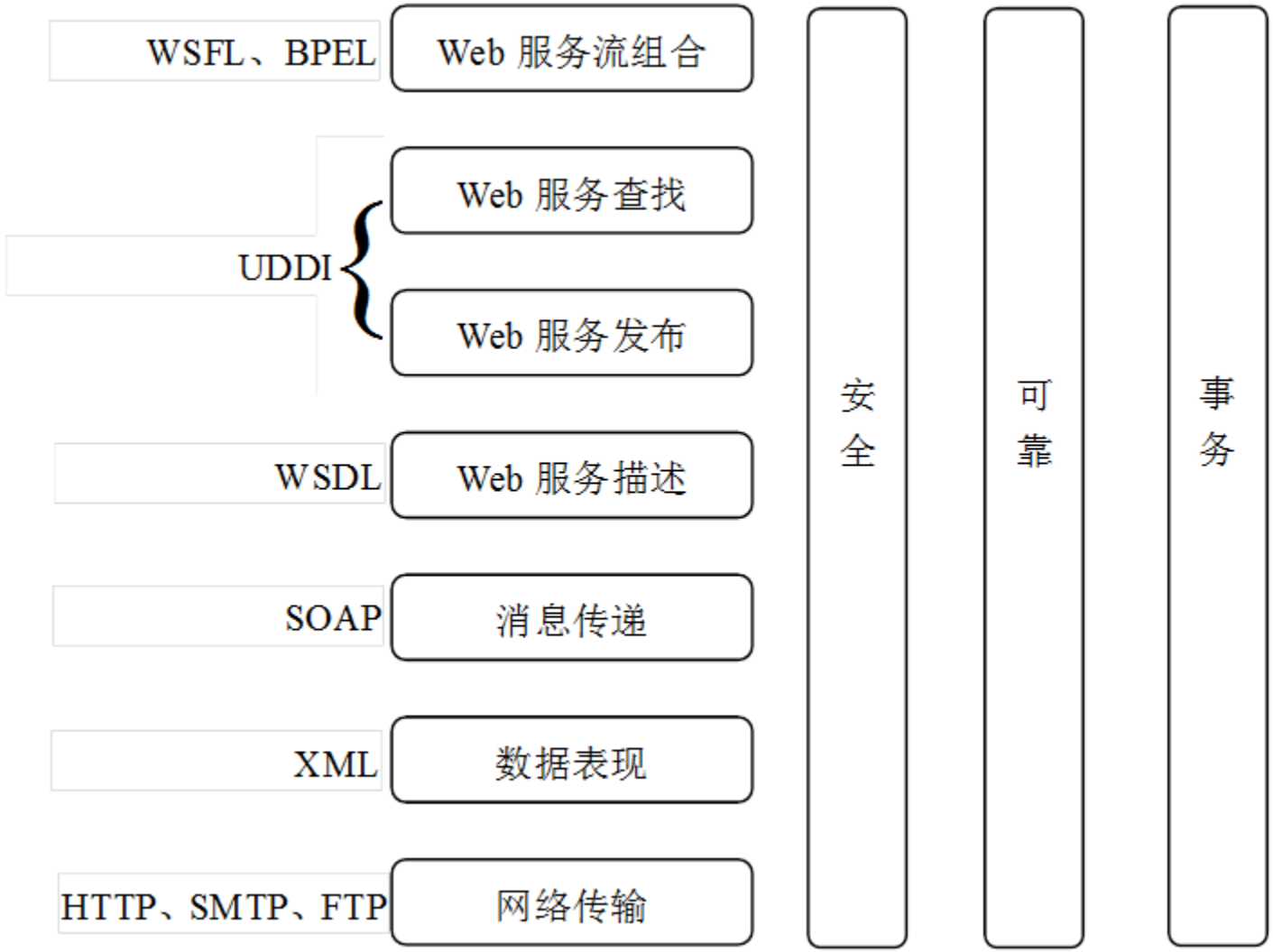
- ✓ **Service Provider**

  also the service owner, i.e. it can provide the software component that can be accessed through network to meet the requester's needs for particular services

Web Service Protocol Layers



Web Service 架构



Web Service 架构

Network Transmission Layer

- The foundation of Web Service protocol stack is the IP-based network protocols such as HTTP (Hypertext Transfer Protocol), SMTP (Simple Mail Transfer Protocol) and FTP (File Transfer Protocol)

Data Presentation Layer

- XML is used as the standard and fundamental technology for data exchange and service implementation in the Web Service architecture

Web Service 架构

Message Passing Layer

- SOAP (Simple Object Access Protocol), a platform-independent message passing protocol, is used to support data exchange between heterogeneous platforms in the service binding process

Service Description Layer

- An XML-based language, WSDL (Web Service Description Language), is used to describe the abstraction of Web services

Web Service 架构

Service Publishing Layer

- The UDDI (Universal Description, Discovery and Integration) protocol is used to implement the service publishing function
- UDDI is a set of standards and protocols prompted by OASIS (Organization for Advancement of Structured Information Standards) for publishing, discovery and access to services

Service Discovery Layer

- The UDDI protocol is used to implement the service discovery function

Web Service 架构

Business Process Layer

- The WSFL (Web Service Flow Language) and BPEL (Business Process Execution Language) are used
- Assembly a series of operations and services to support business processes or models by using above two protocols

Web Service 架构

Core Technologies for Web Service

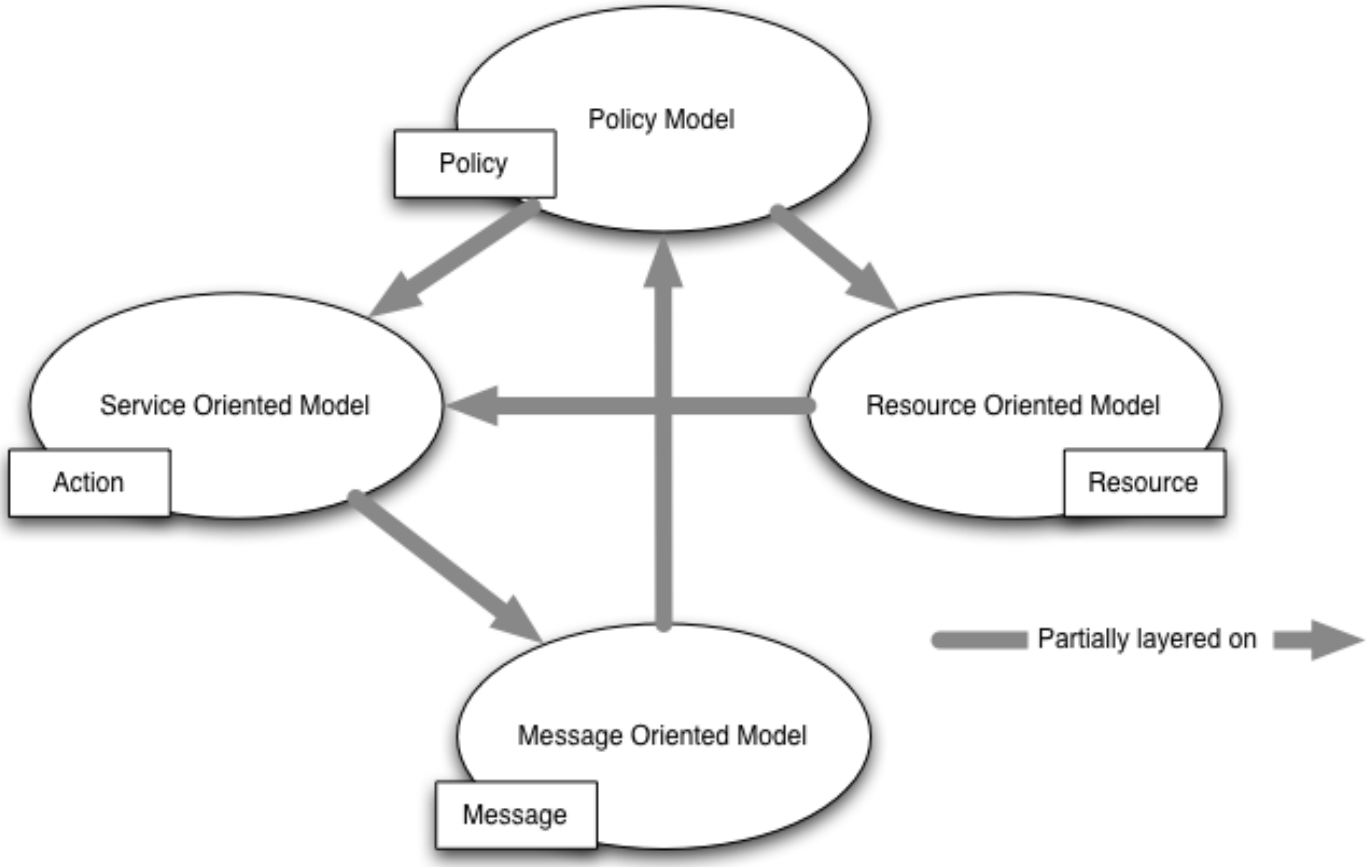
- ✓ 可扩展标记语言 XML
- ✓ 简单对象访问协议 SOAP
- ✓ Web Service描述语言 WSDL
- ✓ 统一描述、查找和集成协议 UDDI
- ✓ Web Service流程语言 WSFL
- ✓ 业务流程执行语言 BPEL

Web Service Architectural Models

- **message-oriented model**: focuses on message, message format, message transport and how to use messages to implement services
- **service-oriented model**: focuses on service, meta-data, and actions on how to implement and use the services
- **resource-oriented model**: focuses on the resources that can be identified, owned, and accessed through the Web as well
- **policy-oriented model**: focuses on constraints on the behavior of agents and services.

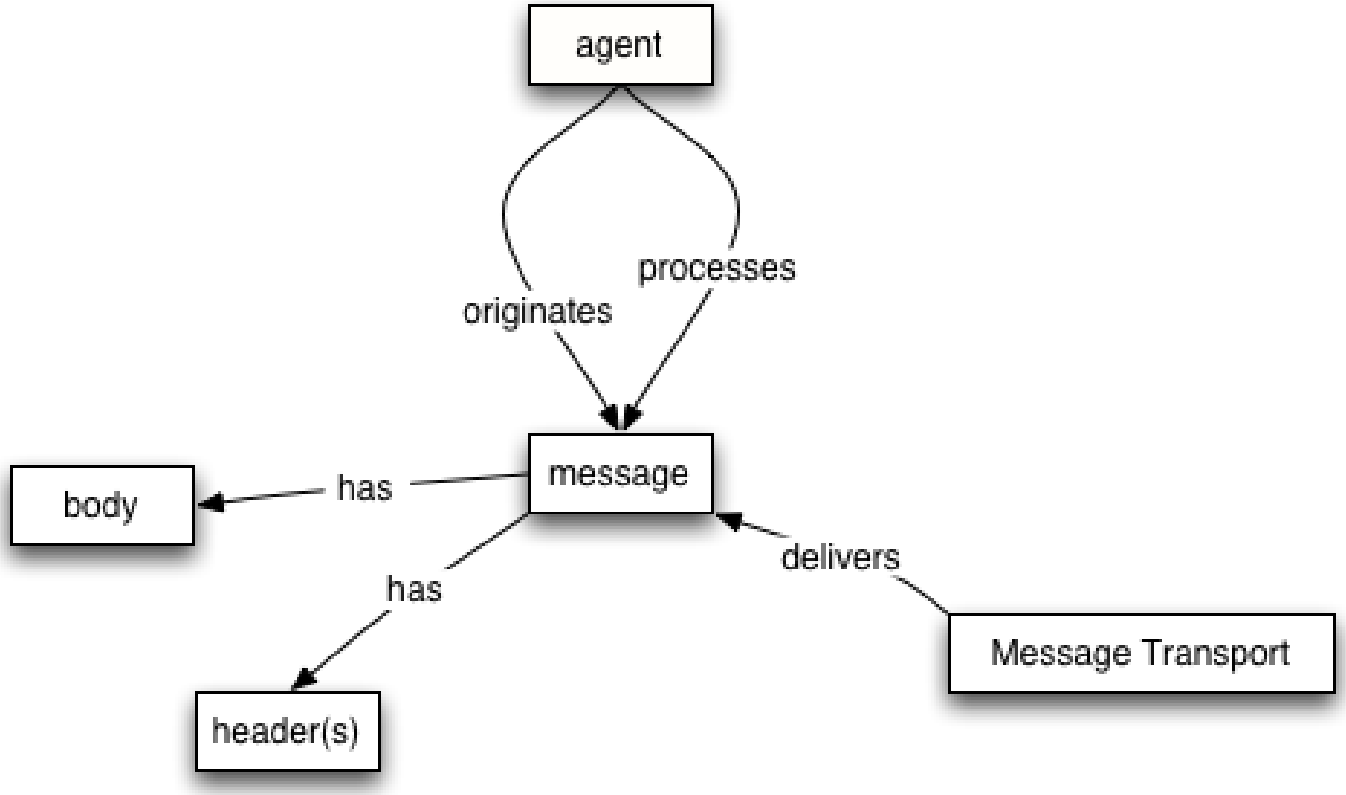
Web Service 架构

Web Service Meta Model



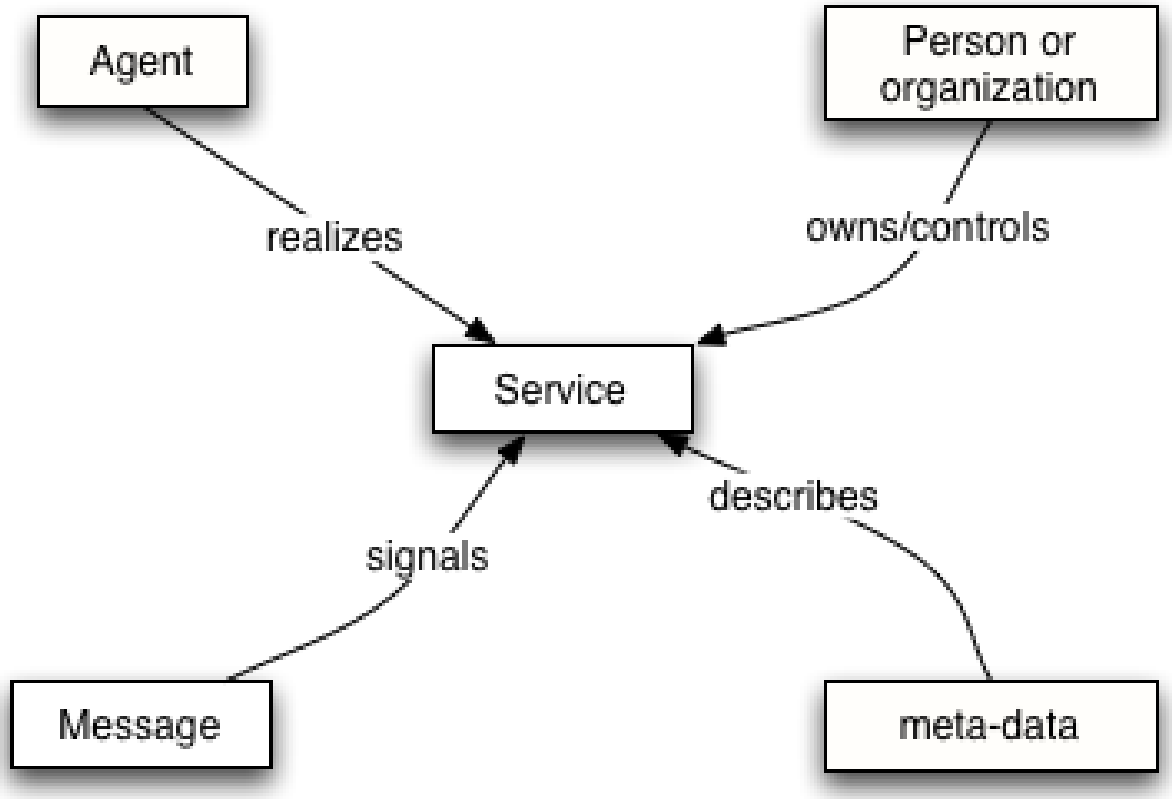
Web Service 架构

Simplified Message-oriented Model

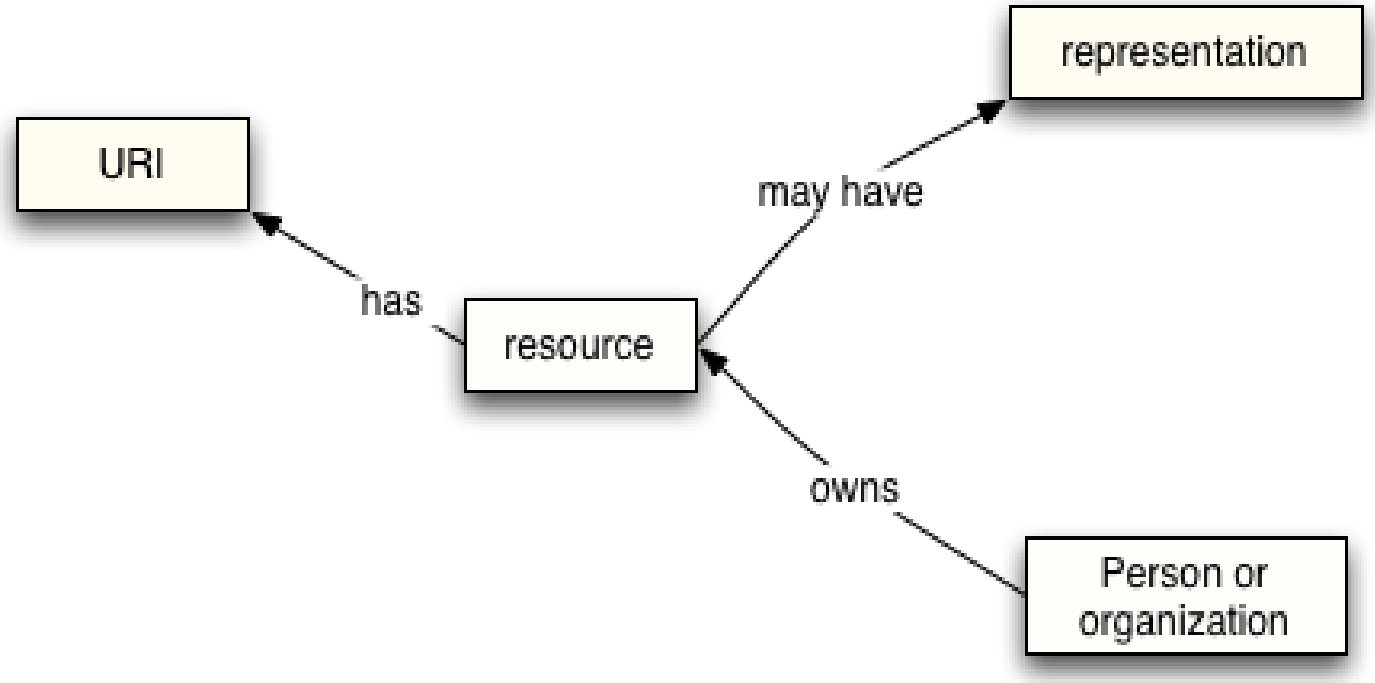


Web Service 架构

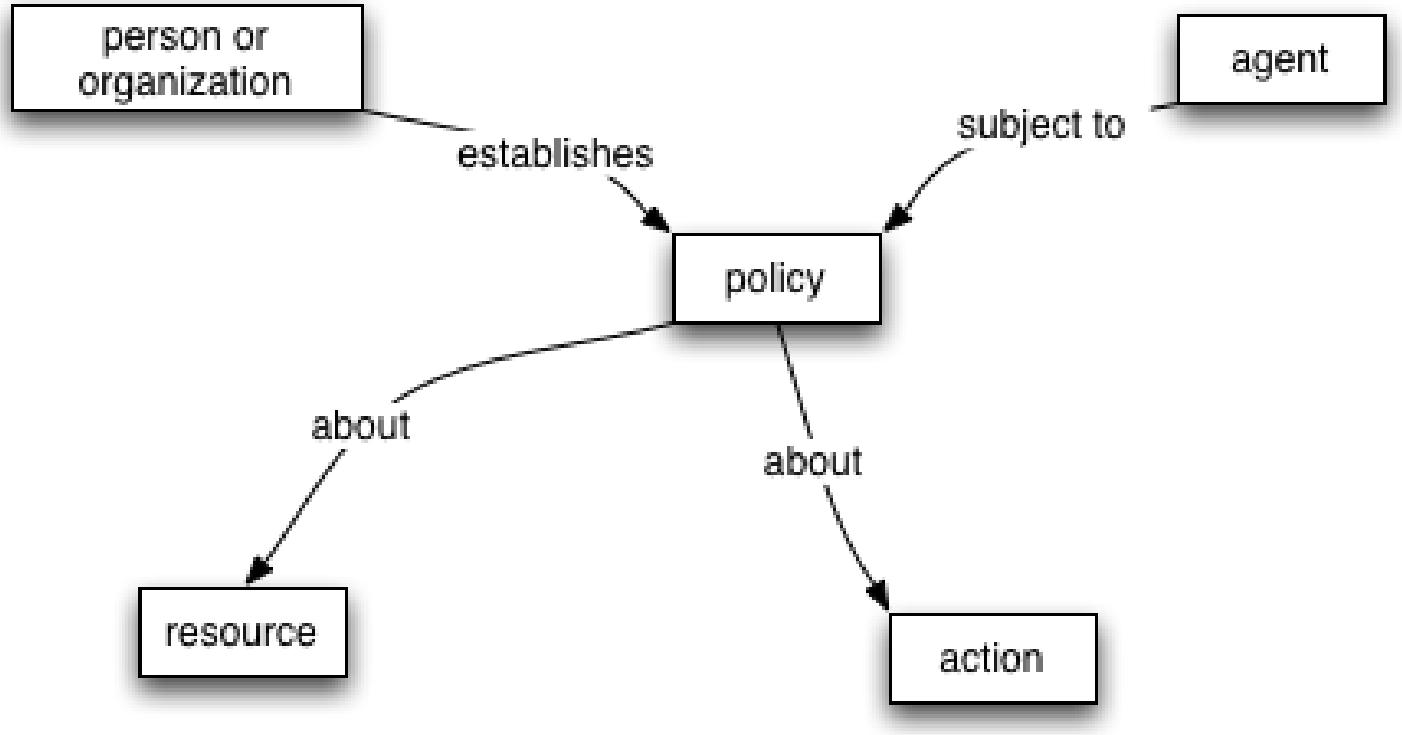
Simplified Service-oriented Model



Simplified Resource-oriented Model



Simplified Policy-oriented Model



Web Service 架构

Web Service Interface

- service definition
- service description
- service semantics
- service task
- service role
- service policy

Web Service 架构

Service Definition

A service is an abstract resource that represents a capability of performing tasks that represents a coherent functionality from the point of view of provider entities and requester entities. To be used, a service must be realized by a concrete provider agent.

- represents a type of resource
- performs a particular function
- has attributes such as description, semantics, identifier, and policies, etc.
- owned by service provider and used by service consumer

Web Service 架构

Service Description

A service description is a set of documents that describe the interface to and semantics of a service.

- is a machine-processable description of the service's interface
- includes a description of the service's semantics
- contains a machine-processable description of the messages that are exchanged by the service
- is expressed in a service description language (WSDL)

Service Semantics

A service semantics is the contract between the provider entity and the requester entity concerning the effects and requirements pertaining to the use of a service.

- describes the intended effects of using a service
- is about the service tasks that constitute the service
- should be identified in a service description
- may be described in a formal, machine-processable language

Service Task

A service task is an action or combination of actions that is associated with a desired goal state. Performing the task involves executing the actions, and is intended to achieve a particular goal state.

- is an action or combination of actions
- is associated with one or more intended goal states (user defined states)
- is performed by executing the actions associated with the task
- has a service interface

Service Role

A service role is an abstract set of tasks that is identified to be relevant by a person or organization as service provider. Service roles are also associated with particular aspects of messages exchanged with a service.

- is a set of service tasks
- may be defined in terms of particular properties of messages
- may be established by a service owner

Service Policy

A service policy is a constraint on the behavior of agents as they perform actions or access resources

- a policy description is a machine-processable description of a policy or set of policies

- a policy guard is a mechanism that enforces one or more policies. It is deployed on behalf of an owner

- logically, we identify two types of policy: permissions and obligations

Web Service 架构

Service Interface

A service interface defines the different types of messages that a service sends and receives, along with the message exchange patterns that may be used.

- is the abstract boundary that a service exposes. It defines the types of messages and the message exchange patterns that are involved in interacting with the service, together with any conditions implied by those messages.

Development Tools of WS Applications

- XML
  - ✓ Three key features： Schema,XSL(eXtensible Schema Language) and XLL (eXtensible Link Language)
    - Schema defines the logic scheme of an XML file and describes its element attributes as well as their relationships
    - XSL provides the CSS (Cascading Style Sheet)，by which the developer may construct a CSS-styled Web page

Web Service 架构

SOAP

- ✓ In a loosely distributed environment, SOAP is a lightweight protocol for structured data exchange based on XML
- ✓ The service requester may make a remote function call to the service provide through SOAP
- ✓ SOAP provides a communication architecture between two applications to allow them to transfer XML-formatted data

Web Service 架构

- SOAP is a platform-independent message passing protocol
- SOAP consists of Envelop, Encoding Rules, RPC Presentation and Binding
- SOAP = RPC + HTTP + XML

  HTTP – transmission protocol

  RPC - remote call process and synchronization

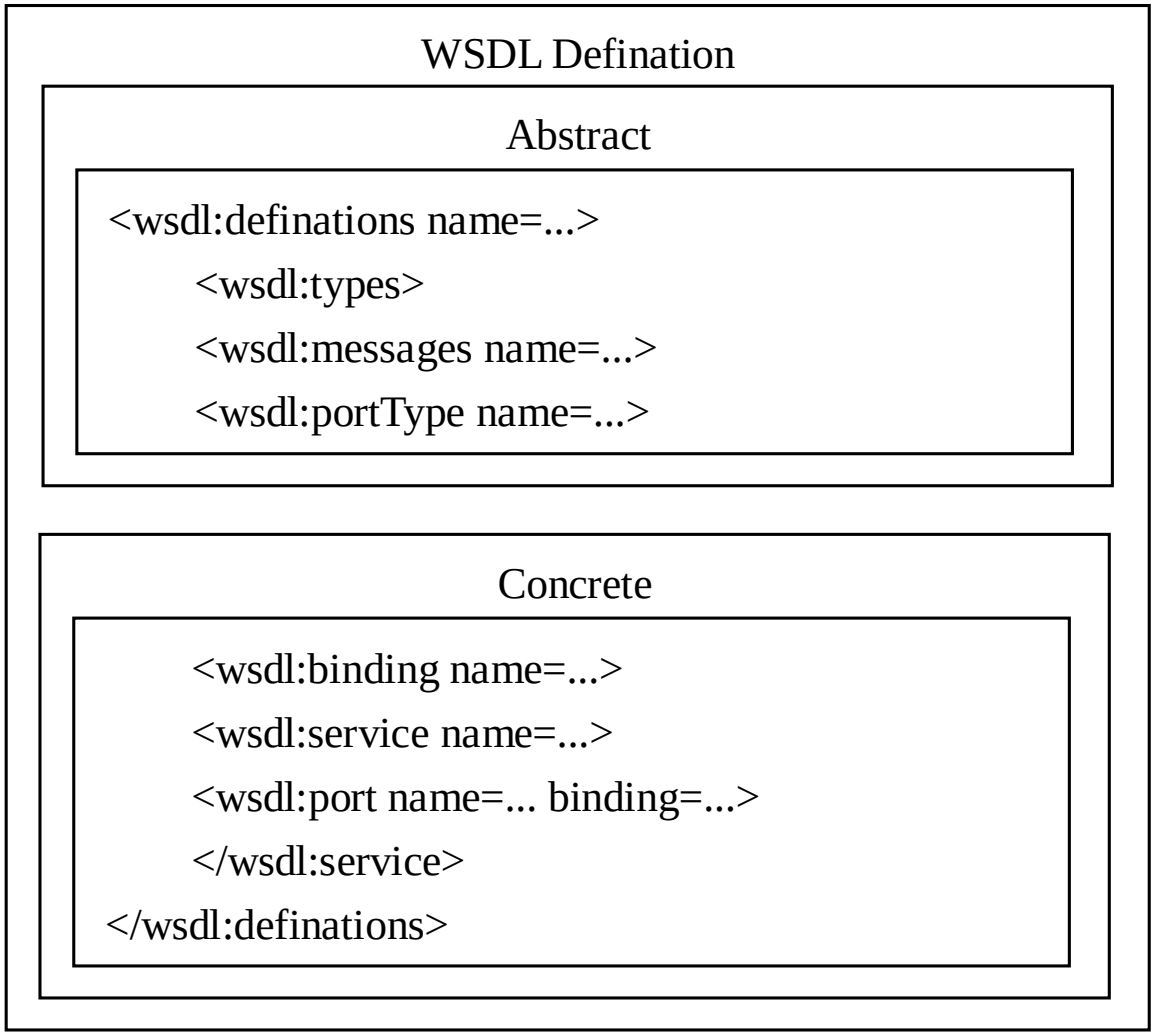
  XML - data format for transmission

Web Service 架构

WSDL

- ✓ Uses a set of XML schema to describe the Web Service as an assembly of service ports
- ✓ Decoupling service port and message schema from service implementation and message binding, respectively, so the interface of service and message can be implemented in different ways
- ✓ Two sections of WSDL file： abstract of service, concrete binding

Web Service 架构



Web Service 架构

WSFL

- ✓ Models the business processes by an assembly of Web services under certain application scenarios
- ✓ WSFL is such an XML-formatted business flow description language that defines the execution order in the process
- ✓ WSFL is used to model the business process in which the Web service is used to provide communication channels between various service units and interactions

Web Service 架构

- BPEL
  - ✓ A business process extraction language that describes the work flow against services
  - ✓ Assembly a group of Web services under business rules to provide service integration
  - ✓ BPEL defined business process can be executed and imported in a BPEL environment

Web Service 架构

Web Service Discovery

- **Discovery**

  Discovery is the act of locating a machine-processable description of a Web service-related resource that may have been previously unknown and that meets certain functional criteria.

- **Service Discovery**

  A discovery service is used to publish and search for descriptions meeting certain functional or semantic criteria. It is primarily intended for use by requester entities, to facilitate the process of finding an appropriate provider agent for a particular task.

Three Major Types of Service Discovery

- **Registry** - a centralized approach, UDDI
  Publishing a service description requires an active step by the provider entity: it must explicitly place the information into the registry before that information is available to others.
- **Index** - such as Google's indexing system
  An index is a compilation or guide to information that exists elsewhere. It is not authorative and does not centrally control the information that it references.
- **Peer-to-Peer (P2P)**
  Provides an alternative that does not rely on centralized registries; rather it allows Web services to discover each other dynamically

End of Lecture

Thanks!