Web Technology Concept

- Internet is a global system of interconnected computer networks that connect various Domain Name System (DNS) servers, web hosting servers, home and business users, etc. Internet is a network of networks.

- Computers are connected together via a network or transmission line

- The objective of the ARPAnet project was to investigate the development of a *decentralized computer network*, The network then became known as the *Internet*

- It has since adopted a suite of protocols called the **Internet Protocol Suite or as more commonly known** as **TCP/IP**

- Now, the Internet has grown to encompass a huge number of autonomous networks

Protocols

▶ Protocols exist at several levels in a telecommunication connection. For example, there are protocols for the data interchange at the hardware device level and protocols for data interchange at the application program level.

▶ Some of the important protocols of internet are:

▶ **TCP** (Transmission Control Protocol),

▶ **IP** (Internet Protocol),

▶ **UDP** (User Datagram Protocol),

▶ **HTTP** (Hypertext Transfer Protocol),

▶ **FTP** (File Transfer Protocol) and

▶ **SMTP** (Simple Mail Transfer Protocol).

- **Transmission Control Protocol (TCP)** is a connection-oriented protocol that provides reliable, ordered, error-checked delivery of packets.

- **Internet Protocol (IP)** has the task of delivering packets from the source host to the destination host solely based on the IP addresses in the packet headers.

- **UDP** is a connection-less protocol that does not provide reliability, order or error-checking. UDP messages are referred to as datagrams and a datagram is defined as a basic transfer unit associated with a packet-switched network in which the delivery, arrival time, and order of arrival are not guaranteed by the network.

- **HTTP** is the protocol to exchange or transfer hypertext. Hypertext is structured text that uses logical links (hyperlinks) between nodes containing text.

- The **World Wide Web** (abbreviated as WWW or W3) or the web is a system of interlinked hypertext documents accessed via the Internet. With a web browser, one can view web pages and navigate between them via hyperlinks.

- **FTP** is a standard network protocol used to transfer files from one host to another host over a TCP-based network.

- **SMTP** is an Internet standard for electronic mail (e-mail) transmission across Internet Protocol (IP) networks.

Service Oriented Architecture

▶ SOA is an architectural pattern in software design.

▶ SOA application components provide services to other components via a communications protocol, typically over a network.

▶ The principles of service-orientation are independent of any vendor, product or technology.
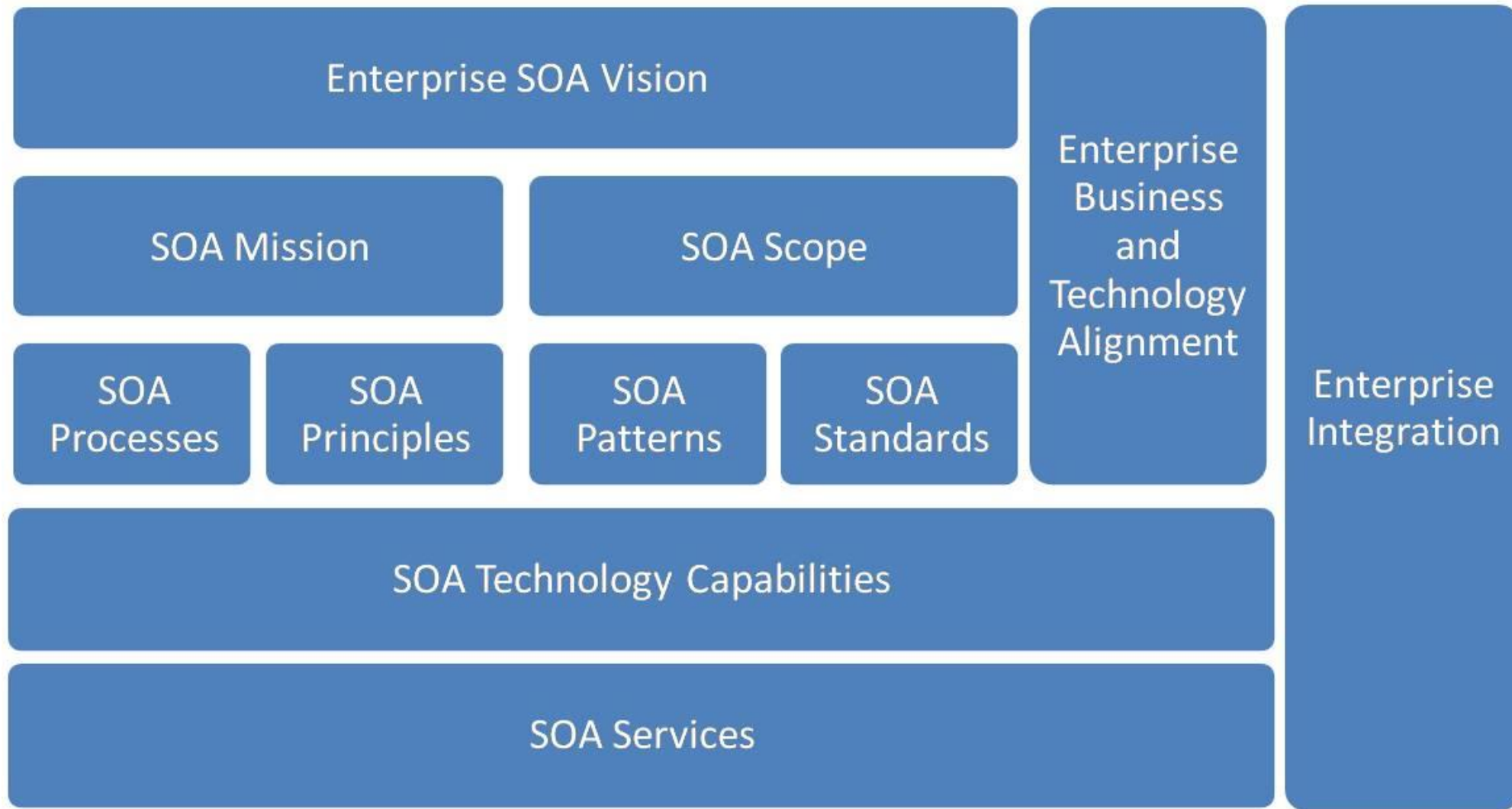
SOA Concepts and Principles

▶ Design Concept

  ▶ SOA is based on the concept of a service.

  ▶ Depending on the service design approach taken,

  ▶ Each SOA service is designed to perform one or more activities by implementing one or more service operations.

  ▶ SOA defines how to integrate widely disparate applications for a Web-based environment and uses multiple implementation platforms. Rather than defining an API, SOA defines the interface in terms of protocols and functionality.

Types of SOA services

- There are several types of services used in SOA systems.
  - Business services
  - Entity services
  - Functional services
  - Utility services

SOA benefits

- Ability to build business applications faster and more easily
- Easier maintenance / update
- Business agility and extensibility
- Lower total cost of ownership

- Architectures can operate independently of specific technologies and can therefore be implemented using a wide range of technologies, including:

- Web services based on WSDL and SOAP

- Messaging, e.g., with ActiveMQ, JMS, RabbitMQ

- RESTful HTTP, with Representational state transfer (REST) constituting its own constraints-based architectural style

- OPC-UA

- WCF (Microsoft's implementation of Web services, forming a part of WCF)

- Apache Thrift

- SORCER

Data Exchange Format
XML

▶ The eXtensible Markup Language (XML),

▶ Derived from the Standard Generalized Markup Language (SGML),

▶ Was originally envisioned as a language for defining new document formats for the World Wide Web

XML Document

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<order id="1234" date="05/06/2013">
    <customer first_name="James" last_name="Rorrison">
        <email>j.rorri@me.com</email>
        <phoneNumber>+44 1234 1234</phoneNumber>
    </customer>
    <content>
        <order_line item="H2G2" quantity="1">
            <unit_price>23.5</unit_price>
        </order_line>
        <order_line item="Harry Potter" quantity="2">
        <unit_price>34.99</unit_price>
        </order_line>
    </content>
    <credit_card number="1357" expiry_date="10/13" control_number="234" type="Visa"/>
</order>
```

XML Terminology

Terminology	Definition
Unicode character	An XML document is a string of characters represented by almost every legal Unicode character
Markup and content	The Unicode characters are divided into markup and content. Markups begin with the character < and end with a > (<email>) and what is not markup is considered to be content (such as j.rorri@me.com)
Tag	Tags come in three flavors of markups: start-tags (<email>), end-tags (</email>) and empty-element tags (<email/>)
Element	An element begins with a start-tag and ends with a matching end-tag (or consists only of an empty-element tag). It can also include other elements, which are called child elements. An example of an element is <email>j.rorri@me.com</email>
Attribute	An attribute consists of a name/value pair that exists within a start-tag or empty-element tag. In the following example item is the attribute of the order_line tag: <order_line item="H2G2">
XML Declaration	XML documents may begin by declaring some information about themselves, as in the following example: <?xml version="1.0" encoding="UTF-8" ?>

XML Binding in Java

JAXB: Java Architecture for XML Binding
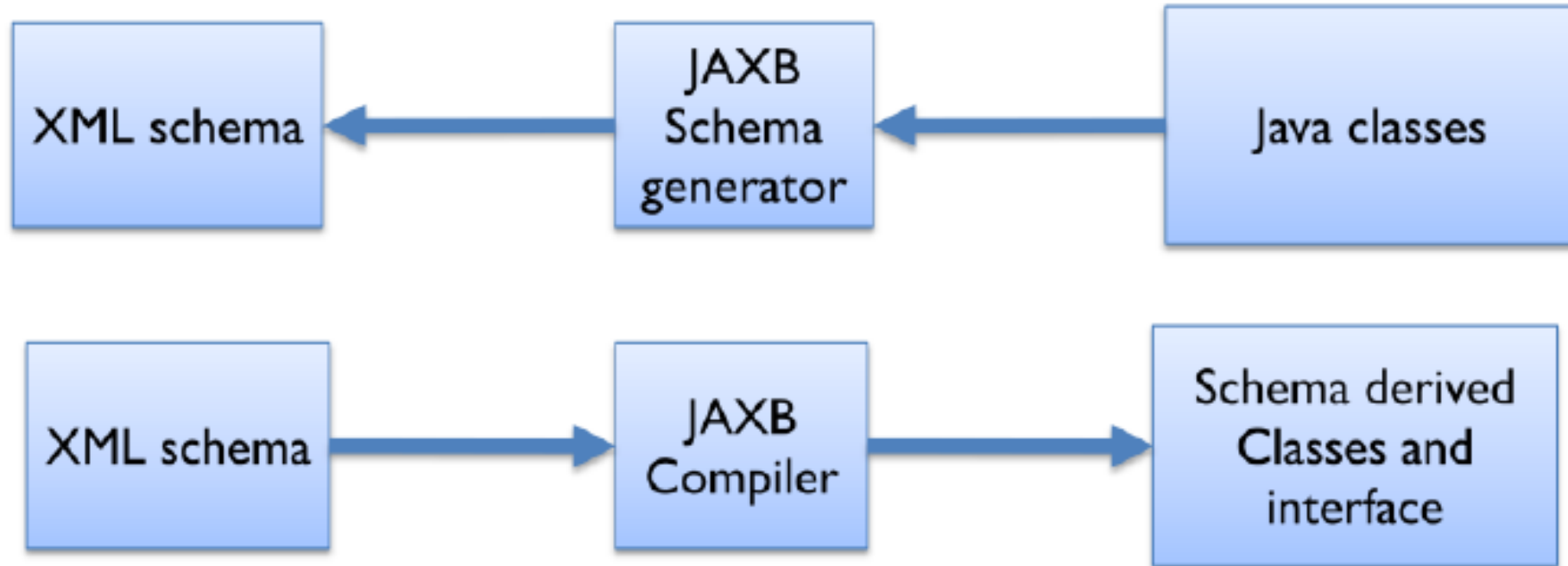
Marshalling and un-marshalling
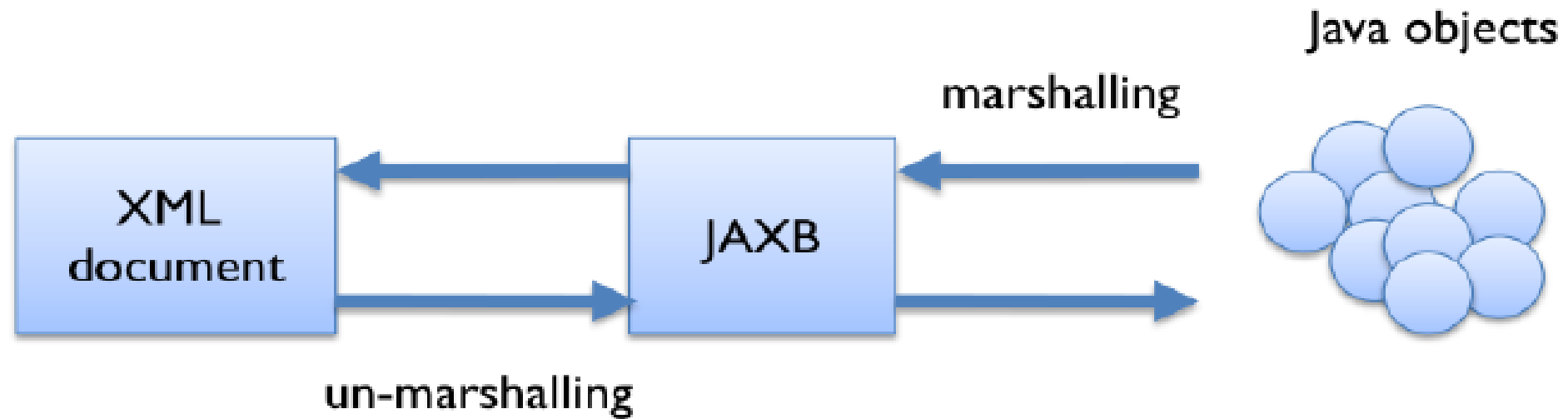
JSON

- JSON: **J**ava**S**cript **O**bject **N**otation.
- JSON is a syntax for storing and exchanging data.
- JSON is text, written with JavaScript object notation.

Exchanging Data

- When exchanging data between a browser and a server, the data can only be text.
- JSON is text, and we can convert any JavaScript object into JSON, and send JSON to the server.
- We can also convert any JSON received from the server into JavaScript objects.
- This way we can work with the data as JavaScript objects, with no complicated parsing and translations.

Why Json?

- Since the JSON format is text only, it can easily be sent to and from a server, and used as a data format by any programming language.
- JavaScript has a built in function to convert a string, written in JSON format, into native JavaScript objects:
- JSON.parse()
- So, if you receive data from a server, in JSON format, you can use it like any other JavaScript object.

Sending Data

```
var myObj = { "name":"John", "age":31, "city":"New York" };
    var myJSON = JSON.stringify(myObj);
    window.location = "demo_json.php?x=" + myJSON;
```

Receiving Data

- var myJSON = '{ "name":"John", "age":31, "city":"New York" }';
  var myObj = JSON.parse(myJSON);
  document.getElementById("demo").innerHTML = myObj.name;

RDF(**R**esource **D**escription **F**ramework)

▶ RDF is a framework for describing resources on the web

▶ RDF is designed to be read and understood by computers

▶ RDF is not designed for being displayed to people

▶ RDF is written in XML

Example of use

▶ Describing properties for shopping items, such as price and availability

▶ Describing time schedules for web events

▶ Describing information about web pages (content, author, created and modified date)

▶ Describing content and rating for web pictures

▶ Describing content for search engines

▶ Describing electronic libraries

RDF Resource, Property, and Property Value

▶ A **Resource** is anything that can have a URI, such as "https://www.abc.com/rdf"

▶ A **Property** is a Resource that has a name, such as "author" or "homepage"

▶ A **Property value** is the value of a Property, such as "Jan Egil Refsnes" or https://www.abc.com

```
<?xml version="1.0"?>

<RDF>
  <Description about="https://www.abc.com/rdf">
    <author>Jan Egil Refsnes</author>
    <homepage>https://www.abc.com</homepage>
  </Description>
</RDF>
```

How Do Web Services Work?

▶ A Web service enables this communication by using a combination of open protocols and standards, chiefly XML, SOAP and WSDL.

▶ A Web service uses XML to tag data, SOAP to transfer a message and finally WSDL to describe the availability of services.

Web Services Terminologies

▶ Hypertext transfer protocol [HTTP]

▶ Extensible Markup Language [XML]

▶ Web Services Description Language [WSDL]

▶ SOAP

Web Services

► Web service is a realization of SOA.

► It is important to note that the SOA is an architectural model that is independent of any technology platform and Web Services the most popular SOA implementation.

► As the name implies, web services offers services over the web. This is not surprising as the choice of the Internet it already connects many different systems from all over the world.

SOAP (Simple Object Access protocol)

▶ It is a protocol specification for exchanging structured information in the implementation of web services in computer networks.

▶ It uses XML Information Set for its message format, and relies on other application layer protocols, most notably Hypertext Transfer Protocol (HTTP),

▶ or Simple Mail Transfer Protocol (SMTP), for message negotiation and transmission.
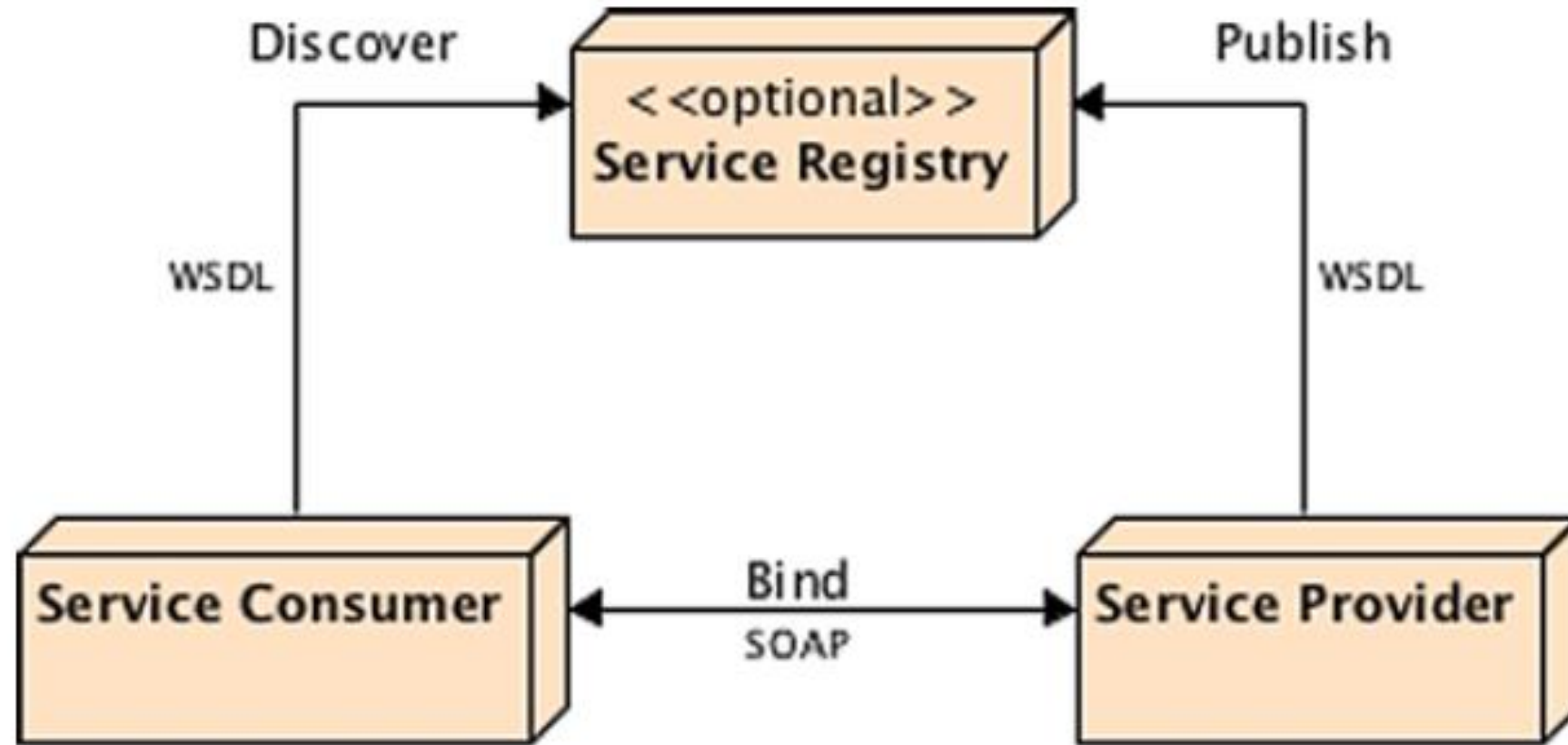
SOAP Elements and Attributes

Element	Description
Envelope	Defines the message and the namespace used in the document. This is a required root element
Header	Contains any optional attributes of the message or application-specific infrastructure such as security information or network routing
Body	Contains the message being exchanged between applications
Fault	Provides information about errors that occur while the message is processed. This element is optional

SOAP Request

```
POST /InStock HTTP/1.1

Host: www.bookshop.org

Content-Type: application/soap+xml; charset=utf-8

Content-Length: nnn

<?xml version="1.0"?>

<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"

soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

<soap:Body xmlns:m="http://www.bookshop.org/prices">

  <m:GetBookPrice>

    <m:BookName>The Fleamarket</m:BookName>

  </m:GetBookPrice>

</soap:Body>

</soap:Envelope>
```

SOAP Response

POST /InStock HTTP/1.1

Host: www.bookshop.org

Content-Type: application/soap+xml; charset=utf-8

Content-Length: nnn

```
<?xml version="1.0"?>

<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

<soap:Body xmlns:m="http://www.bookshop.org/prices">

  <m:GetBookPriceResponse>

    <m: Price>10.95</m: Price>

  </m:GetBookPriceResponse>

</soap:Body>

</soap:Envelope>
```

WSDL

▶ WSDL stands for Web Services Description Language

▶ WSDL is used to describe web services

▶ WSDL is written in XML

Element	Description
<types>	Defines the (XML Schema) data types used by the web service
<message>	Defines the data elements for each operation
<portType>	Describes the operations that can be performed and the messages involved.
<binding>	Defines the protocol and data format for each port type

- <definitions>

  <types>
    data type definitions........
  </types>

  <message>
    definition of the data being communicated....
  </message>

  <portType>
    set of operations......
  </portType>

  <binding>
    protocol and data format specification....
  </binding>

  </definitions>

UDDI(Universal Description, Discovery, and Integration)

- **UDDI** is an XML-based standard for describing, publishing, and finding web **services**.

- **UDDI** uses Web Service Definition Language(WSDL) to describe interfaces to web **services**

- UDDI is often compared to a telephone book's white(basic info), yellow(details about the company), and green pages(technical information). The project allows businesses to list themselves by name, product, location, or the Web services they offer.

- UDDI can communicate via SOAP, CORBA, Java RMI Protocol.

- UDDI uses Web Service Definition Language(WSDL) to describe interfaces to web services.

- UDDI is seen with SOAP and WSDL as one of the three foundation standards of web services.

- UDDI is an open industry initiative, enabling businesses to discover each other and define how they interact over the Internet.

ebXML(Electronic Business XML)

► It is a modular suite of specifications that gives businesses of any size the ability to conduct business over the Internet.

The features of ebXML are as follows:

► ebXML is an end-to-end B2B XML framework.

► ebXML is a set of specifications that enable a modular framework.

► ebXML relies on the Internet's existing standards such as HTTP, TCP/IP, MIME, SMTP, FTP, UML, and XML.

► ebXML can be implemented and deployed on virtually any computing platform.

► ebXML provides concrete specifications to enable dynamic B2B collaborations.