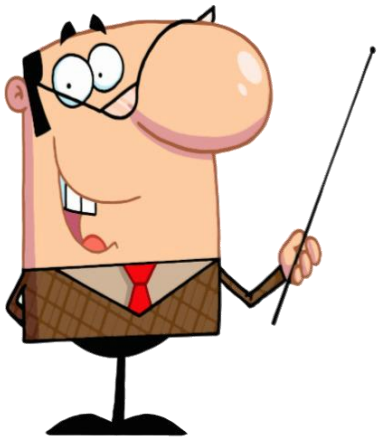
Web Services

10

Web Technology



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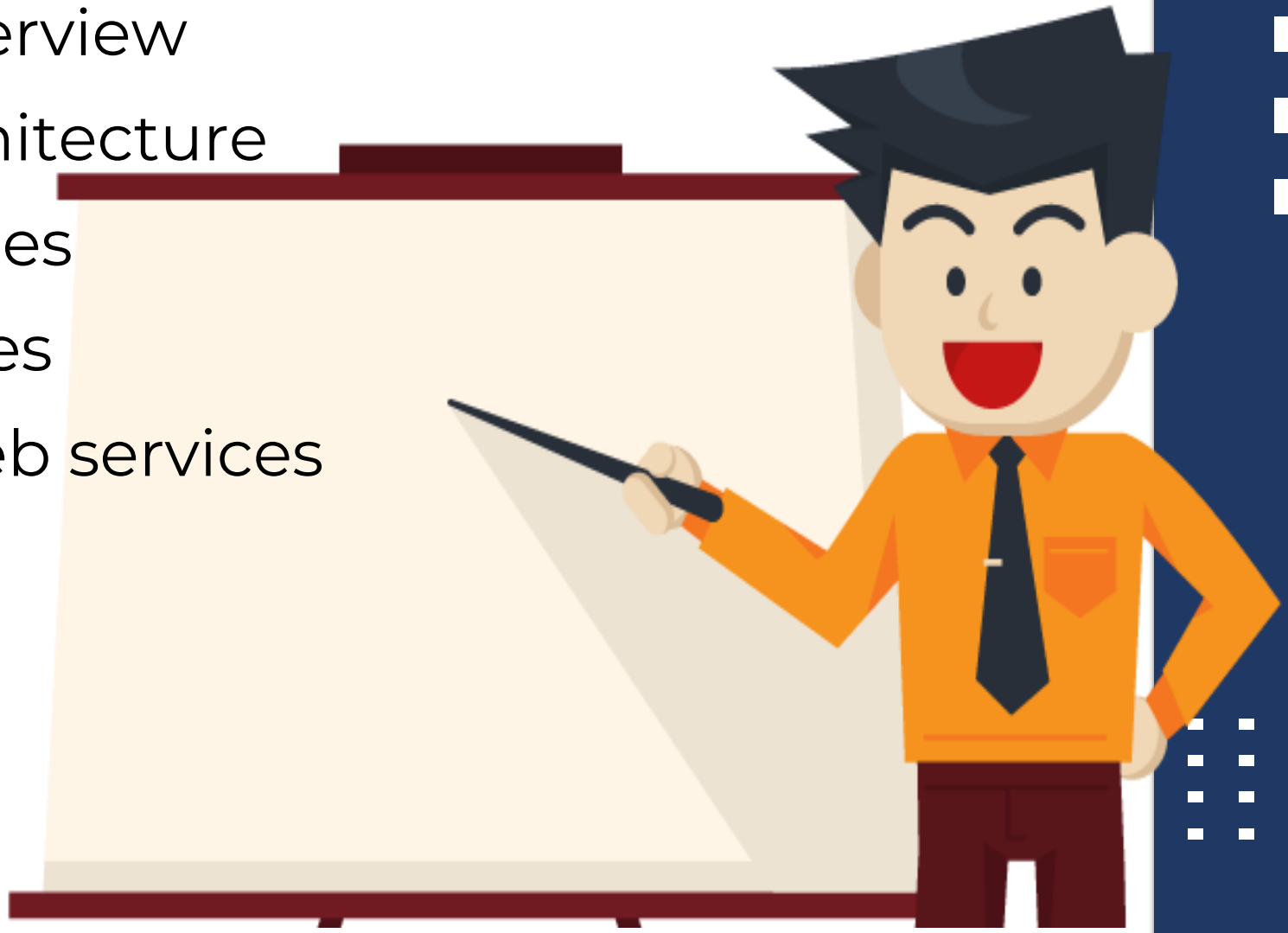
Outline

1. Web services Overview
2. Web Service Architecture
3. SOAP Web services
4. REST Web services
5. Accessing the web services



Web Services

A **web service** is a network accessible interface to application functionality, built using standard Internet technologies.

- Clients of web services do NOT need to know how it is implemented.
- A web service is a set of methods exposed through a web interface.
- Service model assumes services are always available
- Web services facilitate the automated transfer of information from Computer-to-Computer using the XML language.

Service Oriented Architecture(SOA)

- Framework provides a set of fundamental operations via web services
  - May also provide local services using Windows services
- All applications based on that framework share the common services
  - Don’t have to recreate the same functionality for each new application
- Can provide those same services to Partner businesses, suppliers, and customers.

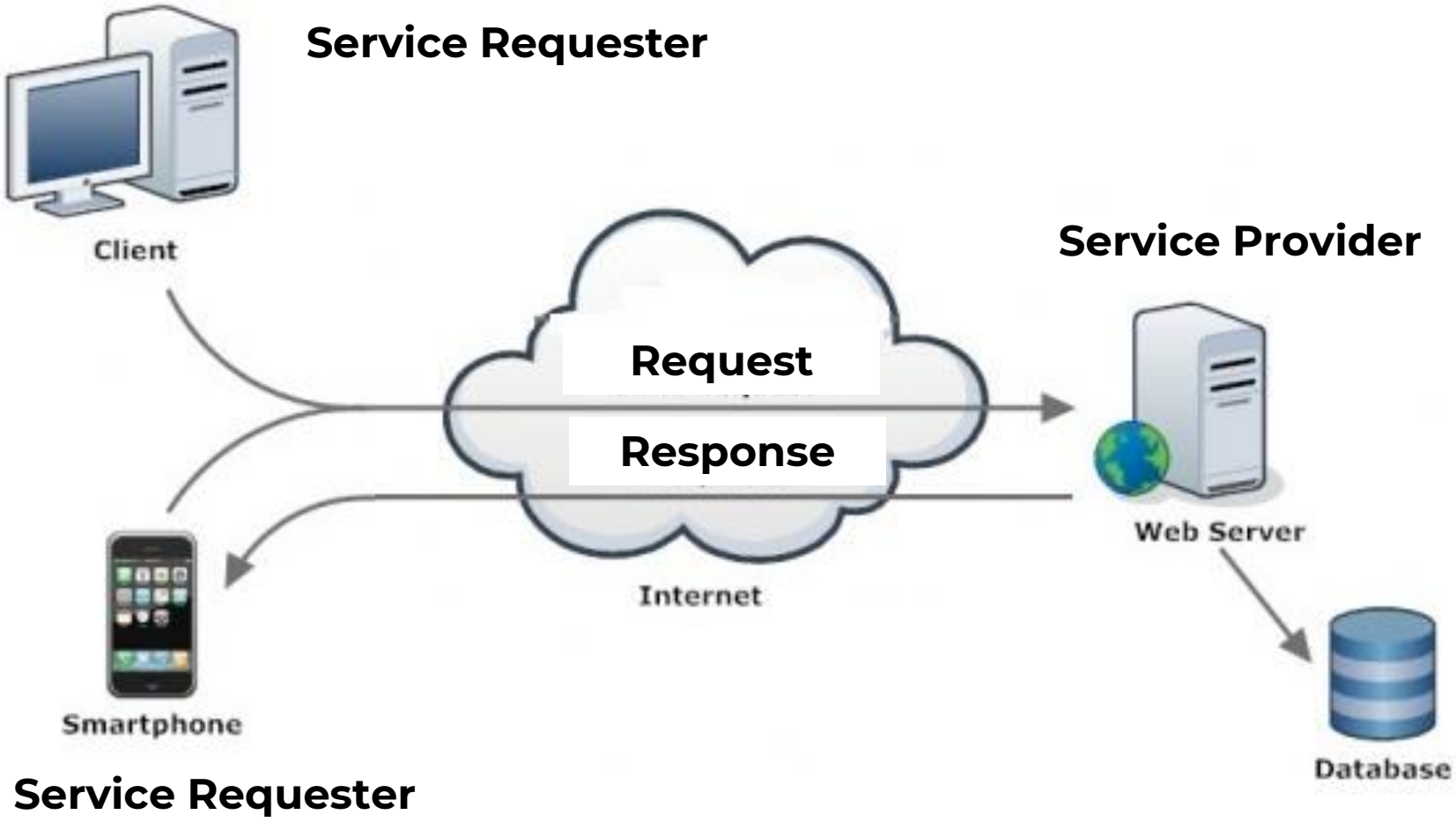
Web Service Architecture

The Web Services architecture is based upon the interactions between three roles:

- **Service provider** implements the service and makes it available on the Internet.
- **Service requestor** utilizes an existing web service by opening a network connection and sending an XML request.
- **Service registry** provides a central place where developers can publish new services or find existing ones. It serves as a centralized trade center for their services.

Web Service Architecture

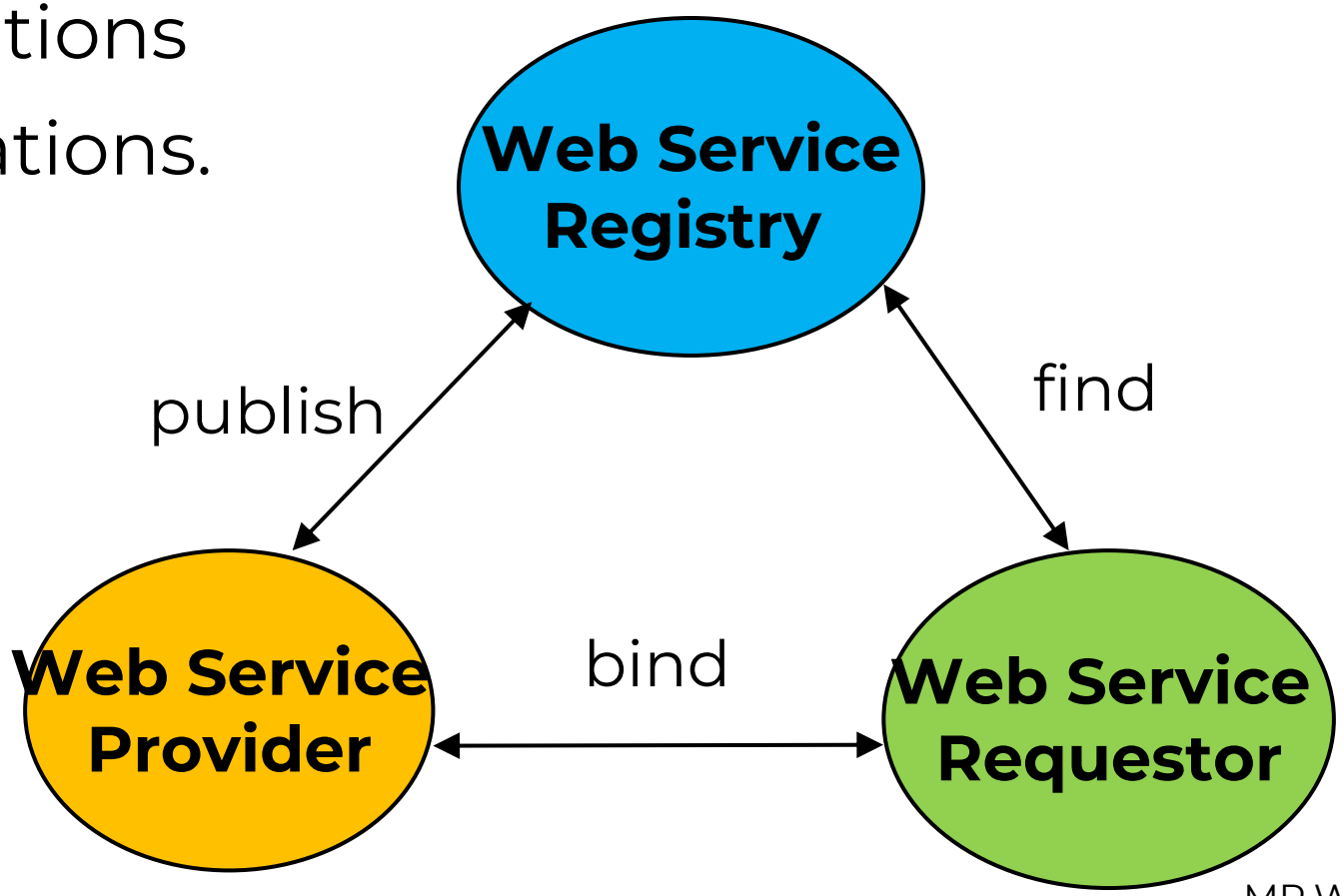
Web Service Architecture



Web Service Architecture

The interactions involve the:

- Publish operations
- Find operations
- Bind operations.



Web Service Architecture

The Web Services architecture.

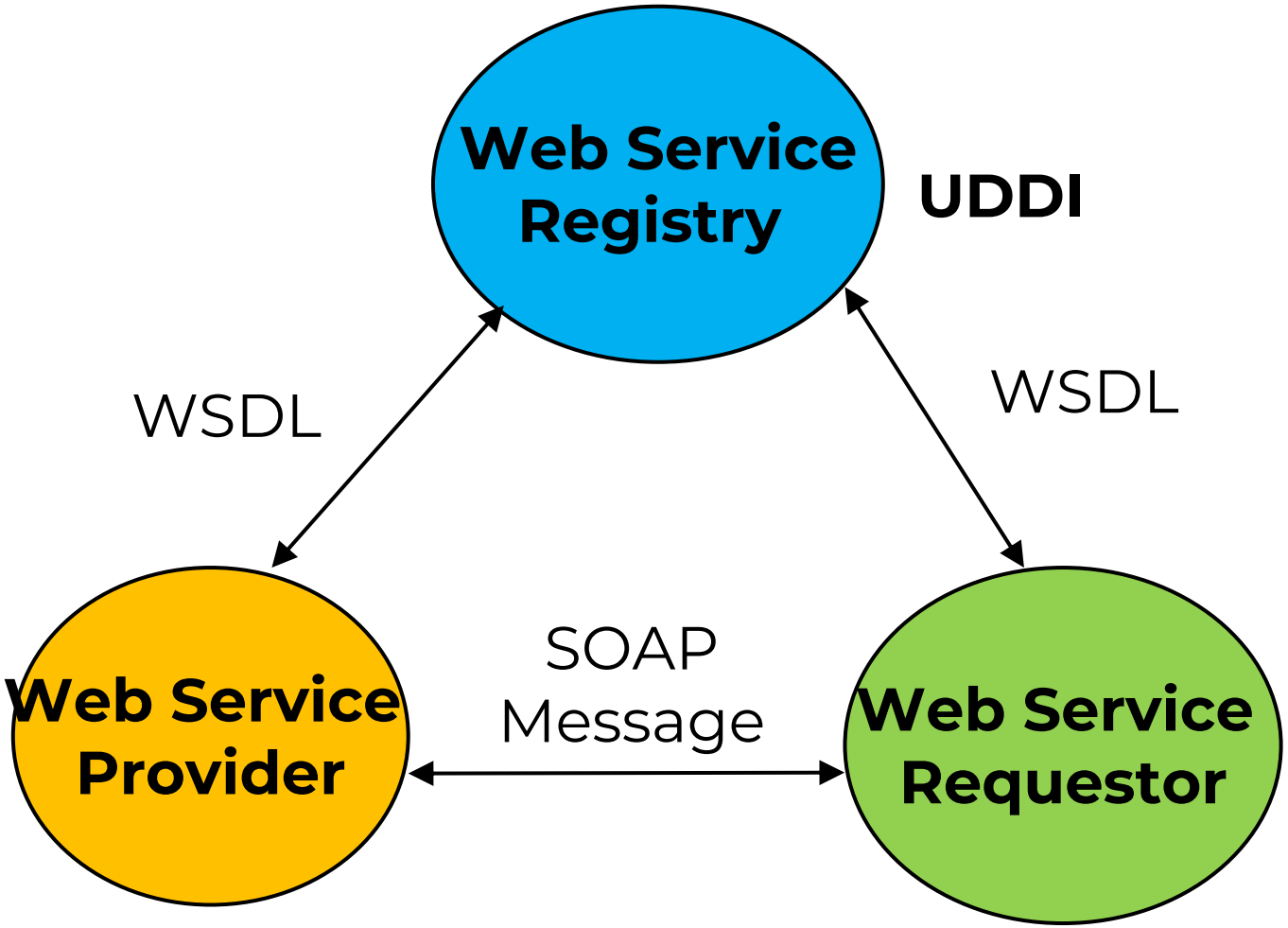
1. Service providers **publish** services by advertising service descriptions in the registry such as UDDI, and WSDL.
2. Service requestors use **find** operation to retrieve service descriptions from the service registry and show operations to see their details to assess their appropriateness.
3. Service requestors **bind** to service providers using binding information found in service descriptions to locate and invoke a service.

WSDL & UDDI

- **WSDL (Web Services Description Language)** is an XML vocabulary for describing Web services. It allows developers to describe Web Services and their capabilities, in a standard manner. **WSDL** describes message contents, WSDL defines where the service is available and what communications protocol is used to talk to the service.
- **UDDI (Universal Description, Discovery and Integration)** is a directory for storing information about web services , like yellow pages. **UDDI** is a directory of web service interfaces described by WSDL.

Web Service Model

Web service interactions

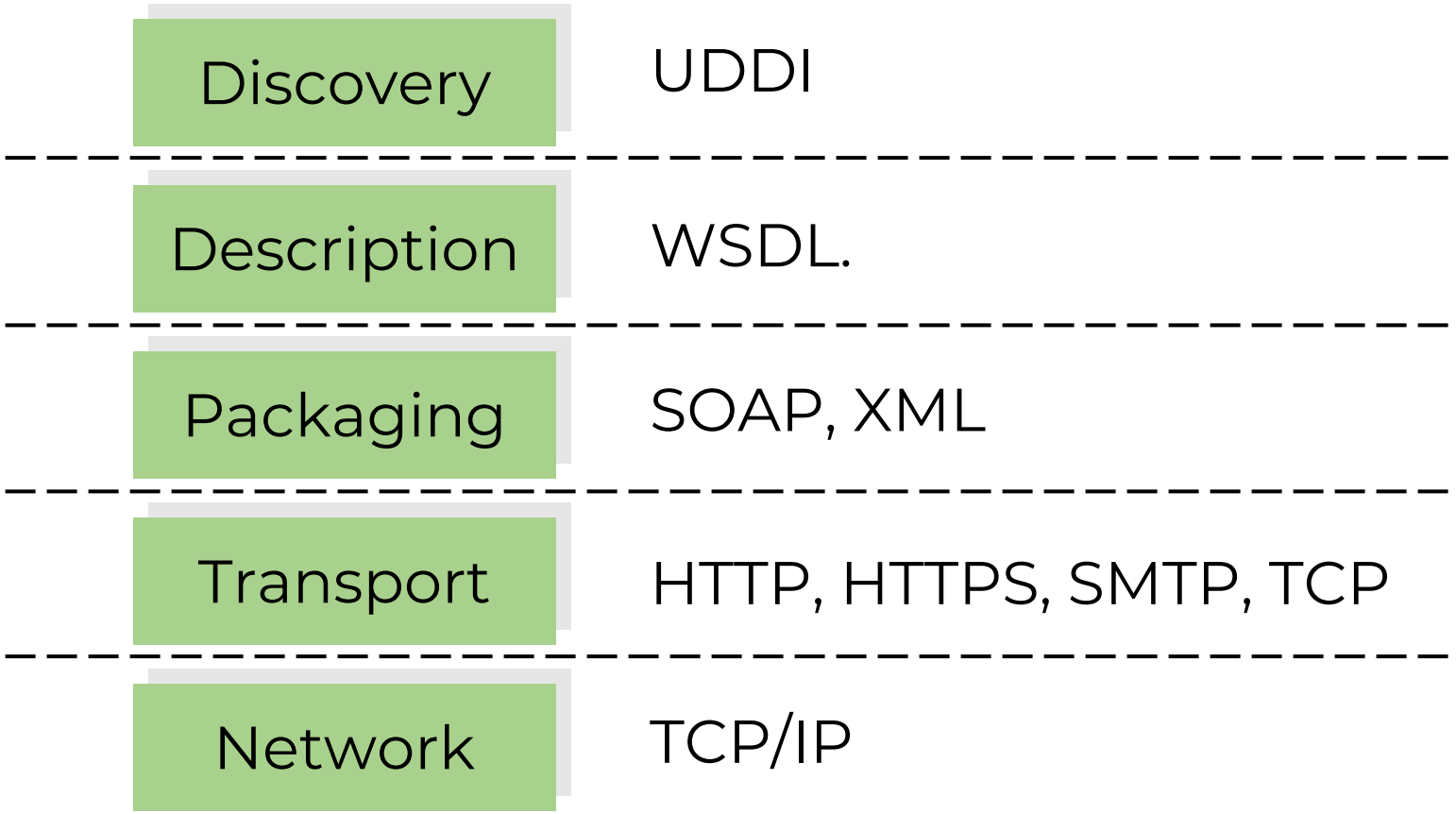


WSDL example

```
<message name="GetStockPriceRequest">
  <part name="stock" type="xs:string"/>
</message>
<message name="GetStockPriceResponse">
    <part name="value" type="xs:string"/>
</message>
```

```
<portType name="StocksRates">
      <operation name="GetStockPrice">
          <input message="GetStockPriceRequest"/>
          <output message="GetStockPriceResponse"/>
      </operation>
</portType>
```

Web Service Technology Stack



Web Service Protocols

Web services are based on four protocols:

1. Web Service Description Language (WSDL) specifies the interface of the Web service.
2. Discovery Protocol (DISCO)
    - Pointer to all web services on a particular web site.
    - Defines a discovery document format and a protocol for retrieving the discovery document, enabling developers to discover services at a known URL.

Web Service Protocols

Web services are based on four protocols(cont.):

3. Extensible Markup Language (XML) defines complex data structures.
4. Universal Description, Discovery, and Integration (UDDI)
    - Central repository of web service descriptions.
    - Define a registry service for Web services.

Web Service Approaches

- There is a division in the web community about the best method for accessing resources over the internet.
- The two leading methods are
  - **SOAP**, a standards-based approach.
  - **REST**, a non standards-based approach.

SOAP

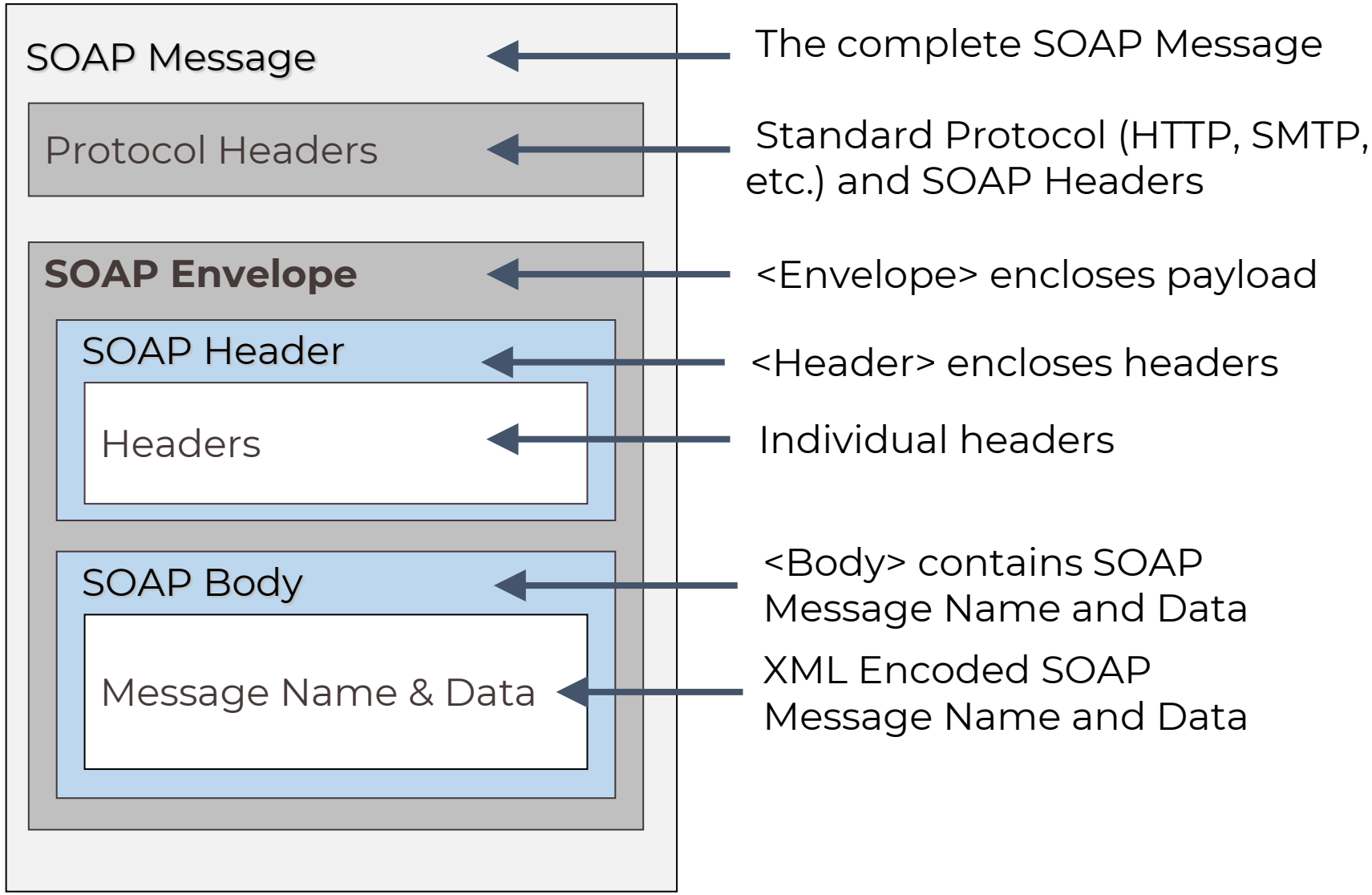
Simple Object Access Protocol (**SOAP**) is a Standards Web Services that expose useful functionality to Web users through a standard Web protocol.

- SOAP encoding is done in XML, using XML Schema and relying heavily on XML namespaces.
- SOAP uses mainly HTTP as a transport protocol. That is, HTTP message contains a SOAP message as its payload section.
- Works with any operating system, any programming language, and any platform.

SOAP

- SOAP is used for passing documents, Electronic Document Interchange (EDI), and Remote Procedure Calls (RPC).
- SOAP is an envelope that a request for resources is packaged in. It includes a header and body.
  - The header can include information about security, recipients, handling, routing, etc.
  - The body includes a standard XML request

What is a SOAP Message?



Simple SOAP Request

POST /StockQuote HTTP/1.1
Host: www.stockquoteserver.com
Content-Type: text/xml
Content-Length: 323
SOAPAction: “www.stockquoteserver.com/GetLastTradePrice”

HTTP Request

```
<?xml version=“1.0” encoding=“utf-8”?>

<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">

  <SOAP-ENV:Body>
    <m:GetLastTradePrice xmlns:m="Some-Namespace-URI">
      <symbol>DIS</symbol>
    </m:GetLastTradePrice>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Simple SOAP Response

HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8

Content-Length: nnnn

HTTP Response

```
<?xml version="1.0" encoding="utf-8"?>

<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
SOAP-
ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">

 <SOAP-ENV:Body>
  <m:GetLastTradePriceResponse
        xmlns:m="Some-Namespace-URI">
   <Price>24.5</Price>
  </m:GetLastTradePriceResponse>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

REST

> **REST**(Representational State Transfer) is intended to evoke an image of how a well-designed Web application behaves: a network of web pages, where the user progresses through an application by selecting links, resulting in the next page being transferred to the user and rendered for their use.

- REST is a Non-Standards Based Approach.
- REST is an architectural style for accessing distributed media or resources.

REST style

- REST architectures consist of clients and servers.
  - Clients initiate requests to servers who process these requests and return responses based on these requests.
  - These requests and responses are built around the transfer of representations of these resources.
- Each resource is first identified using a URL and a new resource for every service required is created. The data returned by the service must be linked to the other data.

REST style

- An application or architecture considered RESTful or REST-style is characterized by:
  - State and functionality are divided into distributed resources.
- Every resource is uniquely addressable using a uniform and minimal set of commands (typically using HTTP commands of GET, POST, PUT, or DELETE over the Internet)
- The protocol is client/server, stateless, layered, and supports caching

Implementation details

There are several key implementation details with HTTP that you should be aware of :

1. **Resources** – REST uses addressable resources to define the structure of the API. These are the URLs you use to get to pages on the Web.
   - Resources are first-class objects, so “object” is a subtype of “resource”.
   - Resources are retrieved not as character strings but as complete representations
   - A web page is a representation of a resource.

Implementation details

There are several key implementation details with HTTP that you should be aware of (cont.):

2. **Request Verbs** – These describe what you want to do with the resource. A browser typically issues a GET verb to instruct the endpoint it wants to get data, however there are many other verbs available including things like POST, PUT and DELETE.

REST and HTTP

- REST is a post hoc description of the Web
- HTTP 1.1 was designed to conform to REST
- Its methods are defined well enough to get work done
- HTTP is the most RESTful protocol
- It's possible to apply REST concepts to other protocols and systems.

Summary of REST and SOAP

SOAP	REST
▪ Messages are represented in a standardized XML SOAP "envelope" .	▪ Messages are represented in plain XML / JSON.
▪ Can be bound to various protocols including HTTP and SMTP .	▪ HTTP is used for the transfer protocol.
▪ Access to and manipulation of data are application specific.	▪ HTTP verbs are used for access/manipulation commands.
▪ Security is not described by SOAP and is to be provided by the developer.	▪ URIs are used to uniquely identify resources in message.
▪ XML schemas or DTD are used to define the contract between client and service.	▪ HTTP authentication provides security.
	▪ There is no formal method for expressing the interface contract.

Accessing the web services

- REST is a way of accessing the web services. REST as an architecture style does not require processing and is simpler and more flexible than SOAP.
- **REST API** is used to fetch or give some information from a web service.
- The REST based web services can give output in any format like CSV, JSON, XML and RSS. JSON is the most common output format of REST API in a form that's easy to parse within the language for the application.

Accessing the web services

- In RESTful services, URIs are used to access the resources. So, data and functions are called resources in the RESTful glossary.
- To get the book details.

https://openlibrary.org/api/books?bibkeys=ISBN:0452278902&format=json

Response

{"ISBN:0452278902": {"bib_key": "ISBN:0452278902", "preview": "borrow", "thumbnail_url": "https://covers.openlibrary.org/b/id/8231558-S.jpg", "preview_url": "https://archive.org/details/greenmilenovelin00king", "info_url": "https://openlibrary.org/books/OL658734M/The_green_mile"}}

How useful are Web Services?

Web services: Some possibilities

- ❑ Financial information (e.g., stock quotes)
- ❑ Sports information
- ❑ Weather information
- ❑ News
- ❑ Delivery status
- ❑ Tax and shipping calculations
- ❑ Any data that is relevant to the client

More Information

- http://www.w3schools.com/
- http://uddi.microsoft.com/Default.aspx
- http://www.developer.com/services/article.php/2195981
- Web service https://en.wikipedia.org/wiki/Web_service

- Many more on the Web…