

Web Services and SOA

CS 237

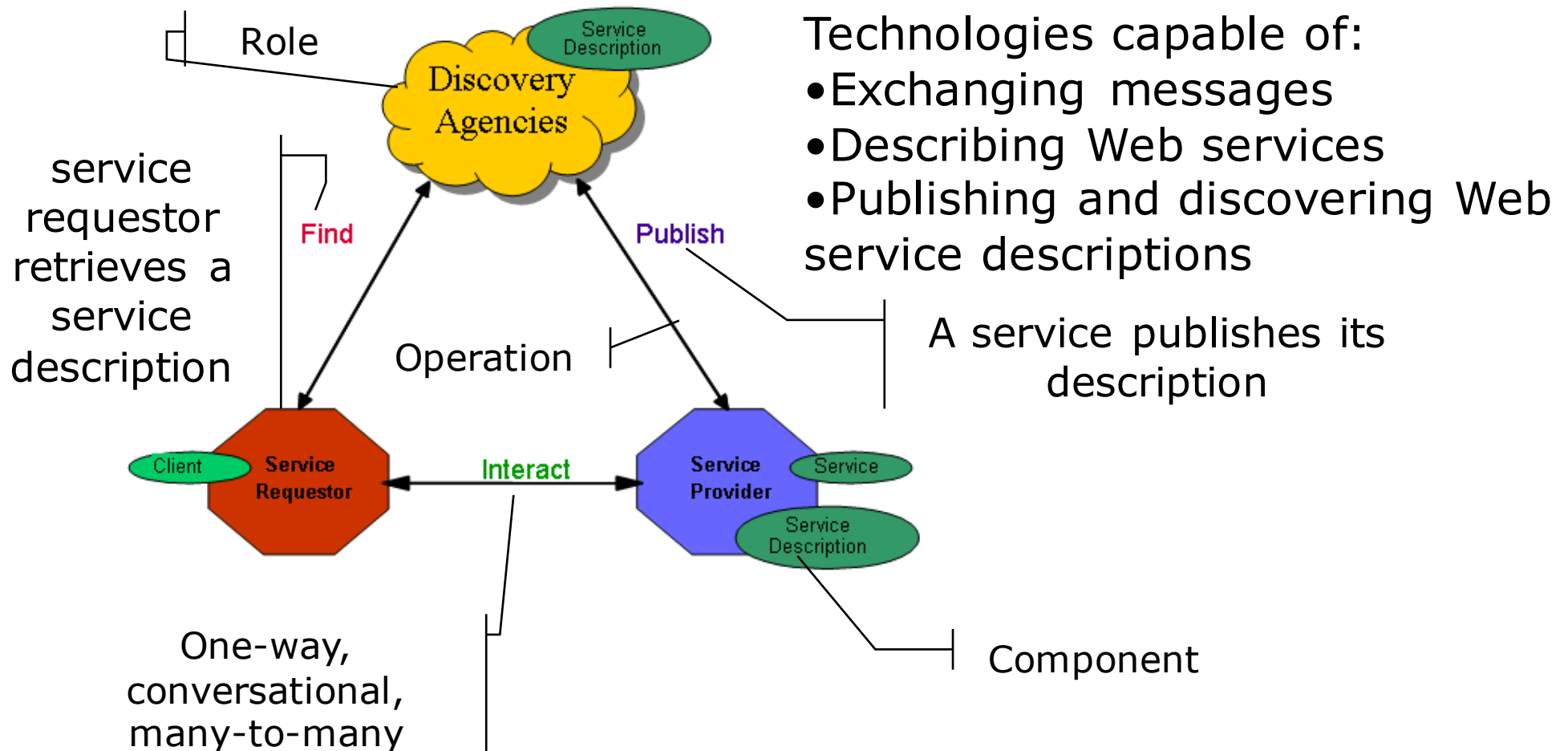
Prof. Nalini Venkatasubramanian

Web Services - Definition from W3C

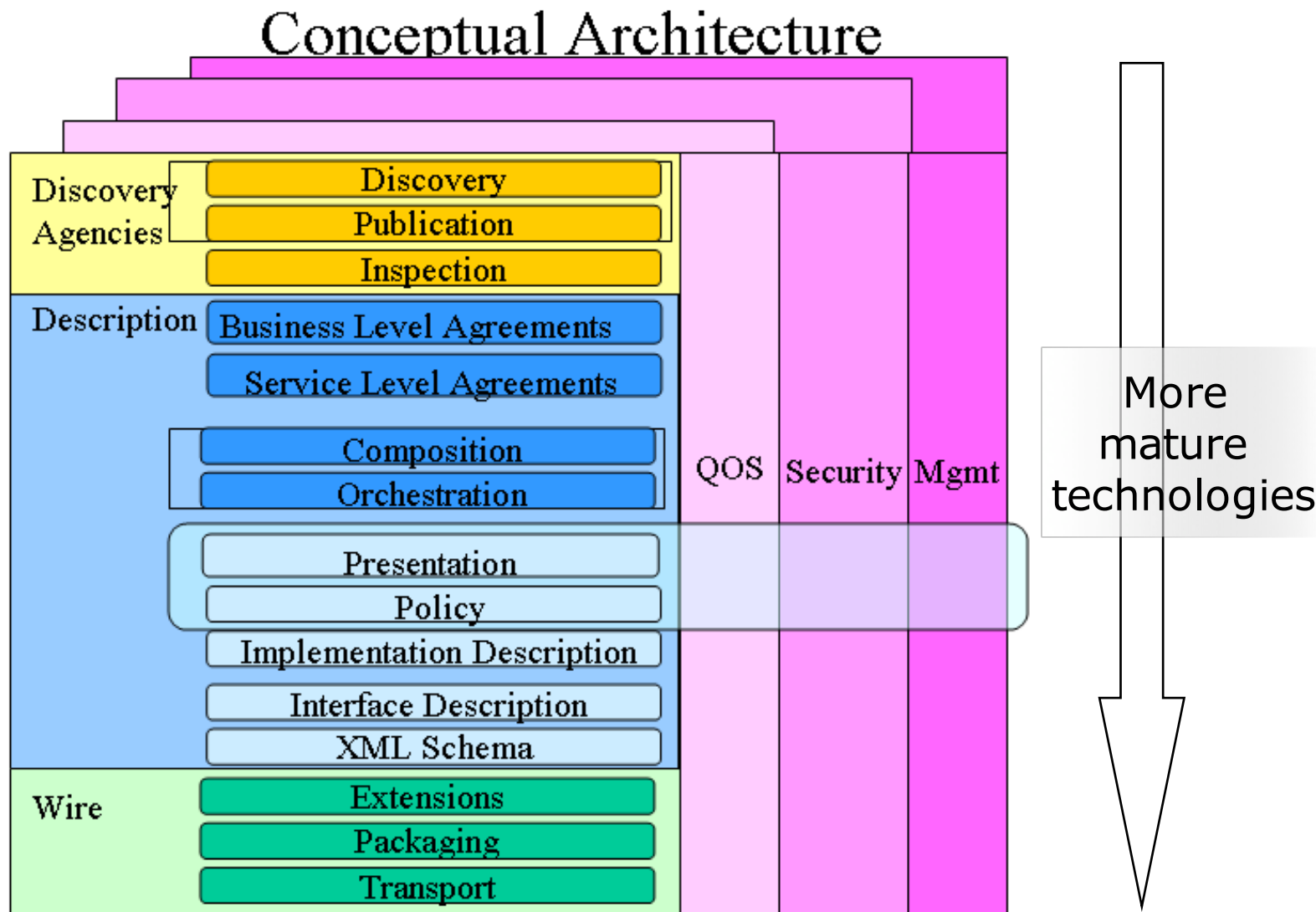
“ A Web service is a software system identified by a URI, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems may then interact with the Web service in a manner prescribed by its definition, using XML based messages conveyed by internet protocols.”

Service Oriented Architectures

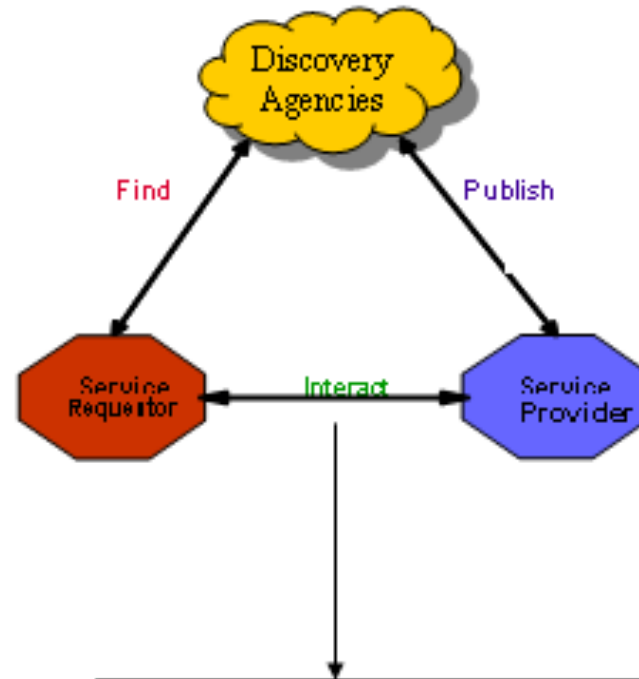
Service Oriented Architecture



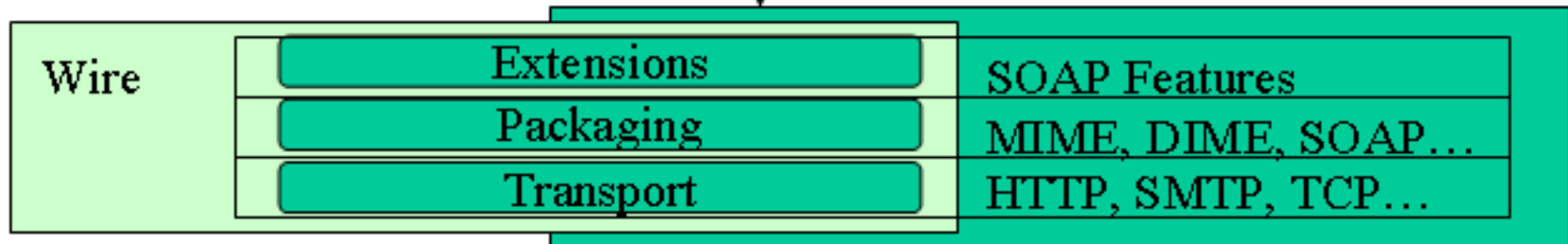
The Complete Web Services "Stack"



The Wire Stack

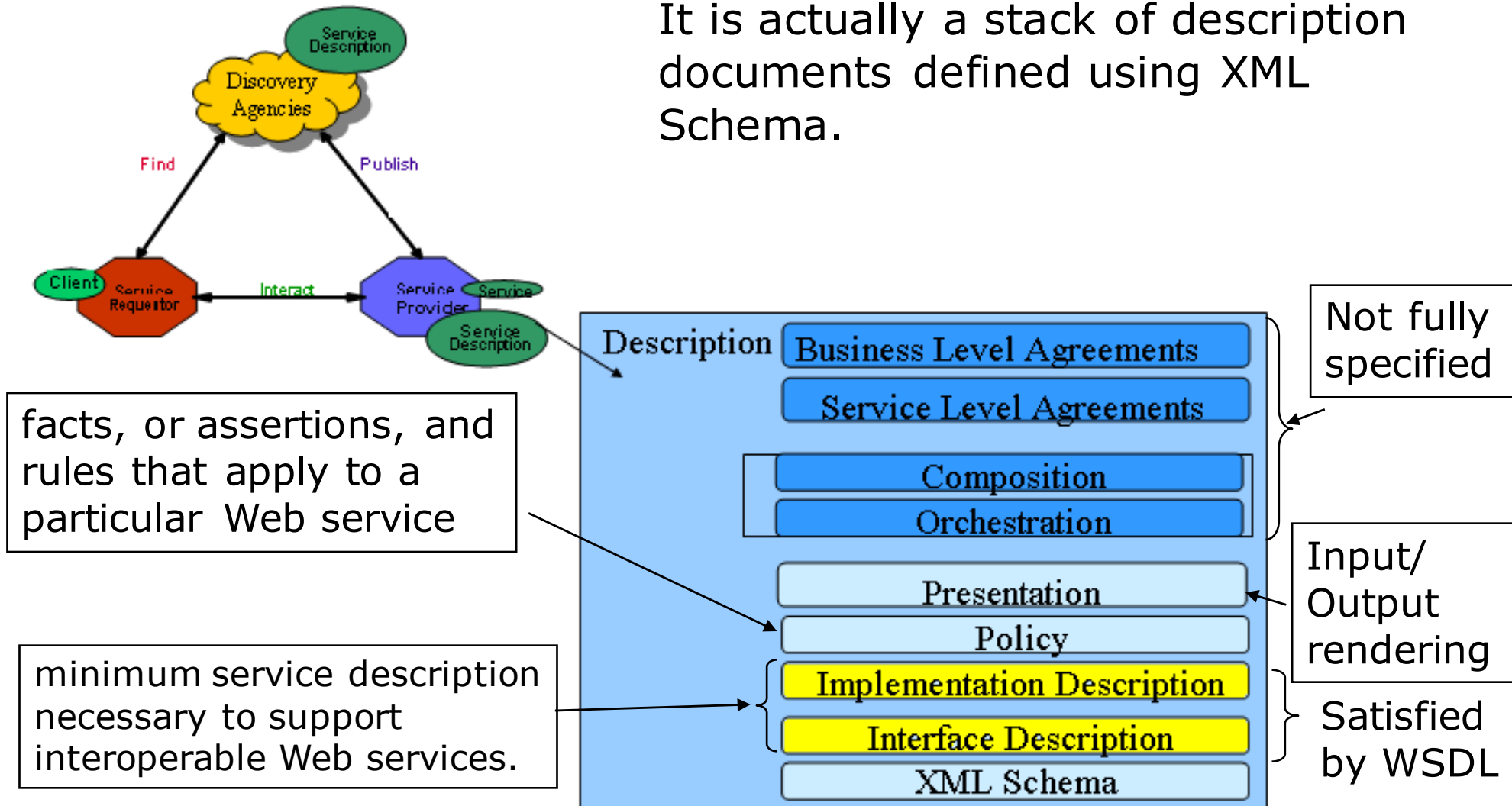


- Transport: HTTP is the de facto, other may be supported.
- Packaging: SOAP is the de facto standard for XML messaging.
- Extensions : Additional information attached to web services messages.

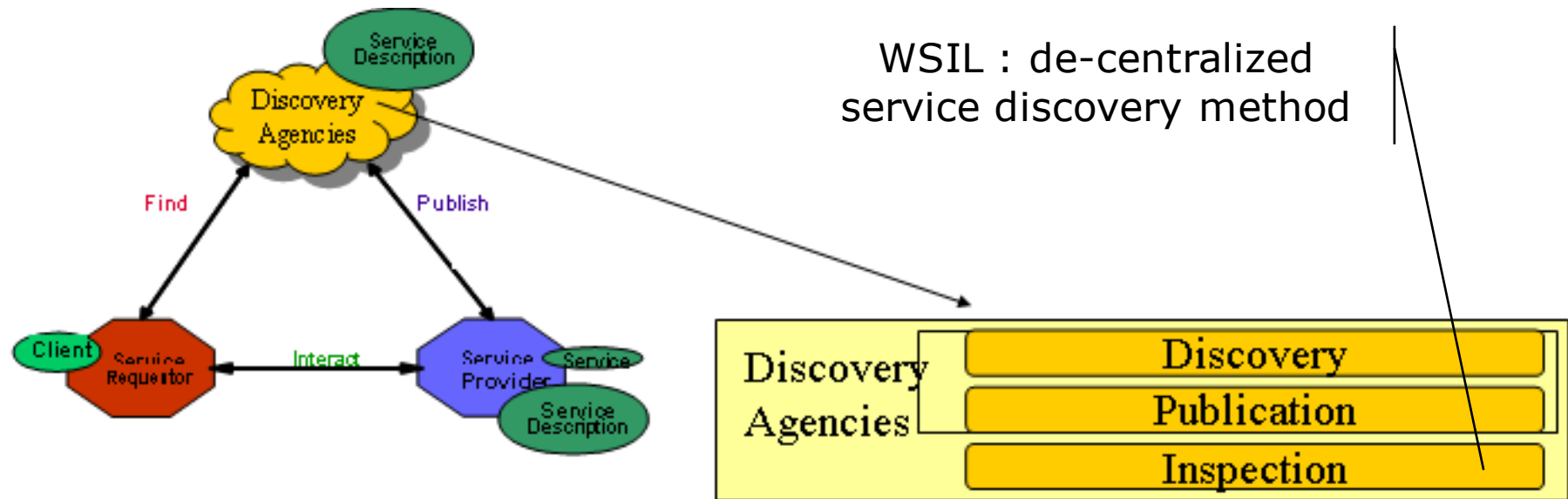


The Description Stack

It is actually a stack of description documents defined using XML Schema.



The Discovery Stack



- Service can be published using a variety of mechanisms:
 - ▣ Direct publish: description sent directly to requestor;
 - ▣ WSIL : HTTP GET retrieves descriptions from URL;
 - ▣ **Universal Description, Discovery and Integration** (UDDI) registries: a Web-based distributed directory.
- Service requestors can retrieve a service description at design time (search by interface) or runtime (by communication and QoS) from a Web page (URL), a service description repository, a simple service registry or a UDDI registry. Discovery depends on how services are published;

The technology so far

The WS technology is completely based on XML.
Therefore, both the data format and the interaction protocols are XML-based:

- customized XML -> data format
- SOAP -> communication protocol
- WSDL -> the Interface definition language
- WSIL/UDDI -> standards for services discovery

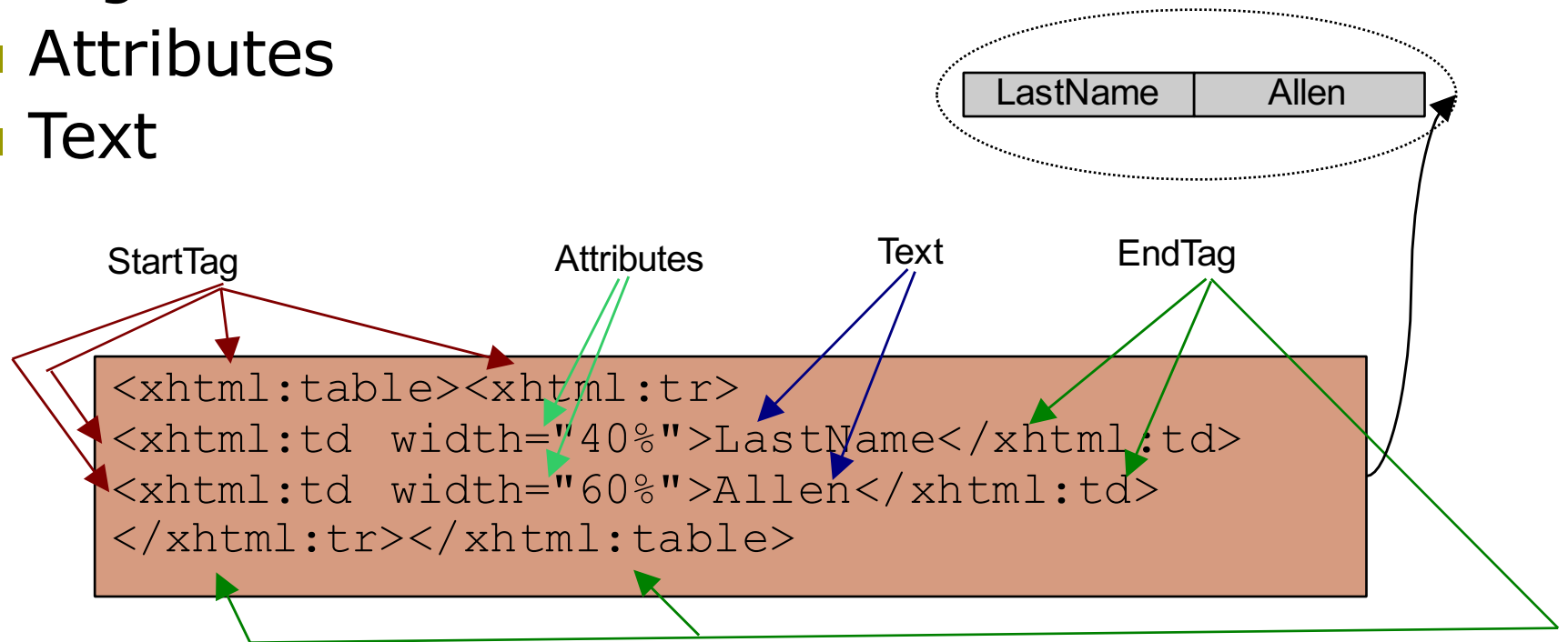
The lowest-level layers (the transport layer)
should exploit some existing Internet
protocols, like HTTP or SMTP

What is XML

XML is a simple tag-based language for describing information in a structured way.

Basic elements:

- Tags
- Attributes
- Text



How to work on XML

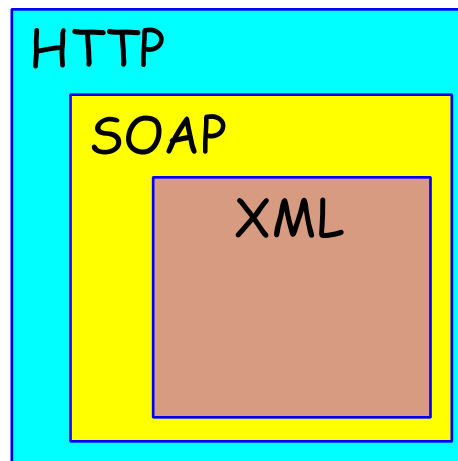
The tree-like structure of XML makes developers life hard.

In practice there is not a standard way for editing and analyzing, but the best method depends on your need. Just choose among:

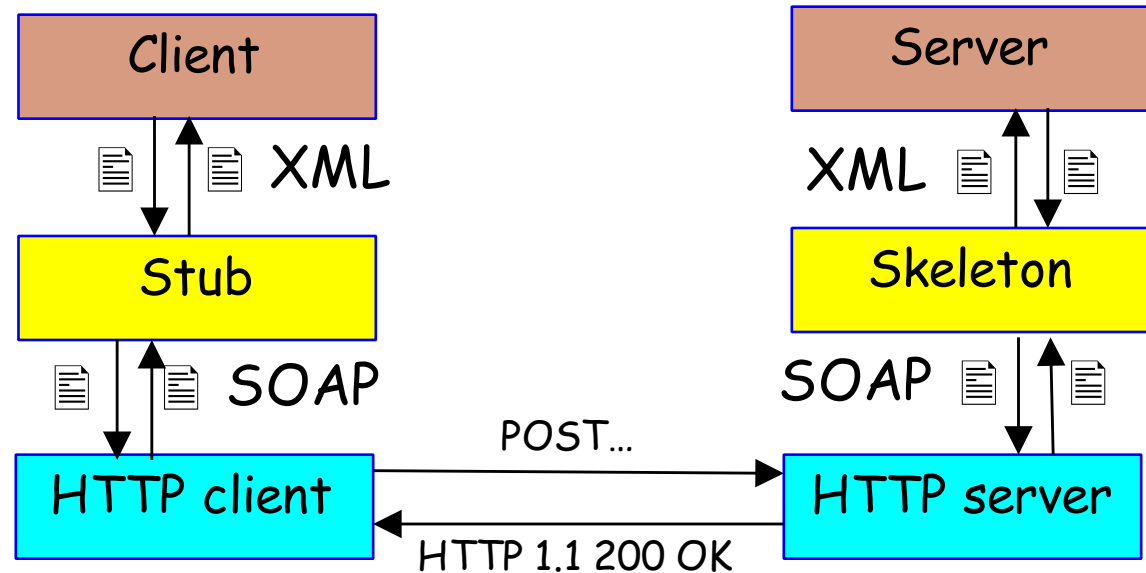
- SAX -> callback-based parser
- DOM -> tree representation
- XSLT -> "XML to XML" conversion
- XPATH -> queries
- XML Binding -> transparent conversion to objects

Simple Object Access Protocol

SOAP is a technology to support the exchange of XML-coded messages over a transport protocol, such as HTTP and SMTP. (*wire stack*)



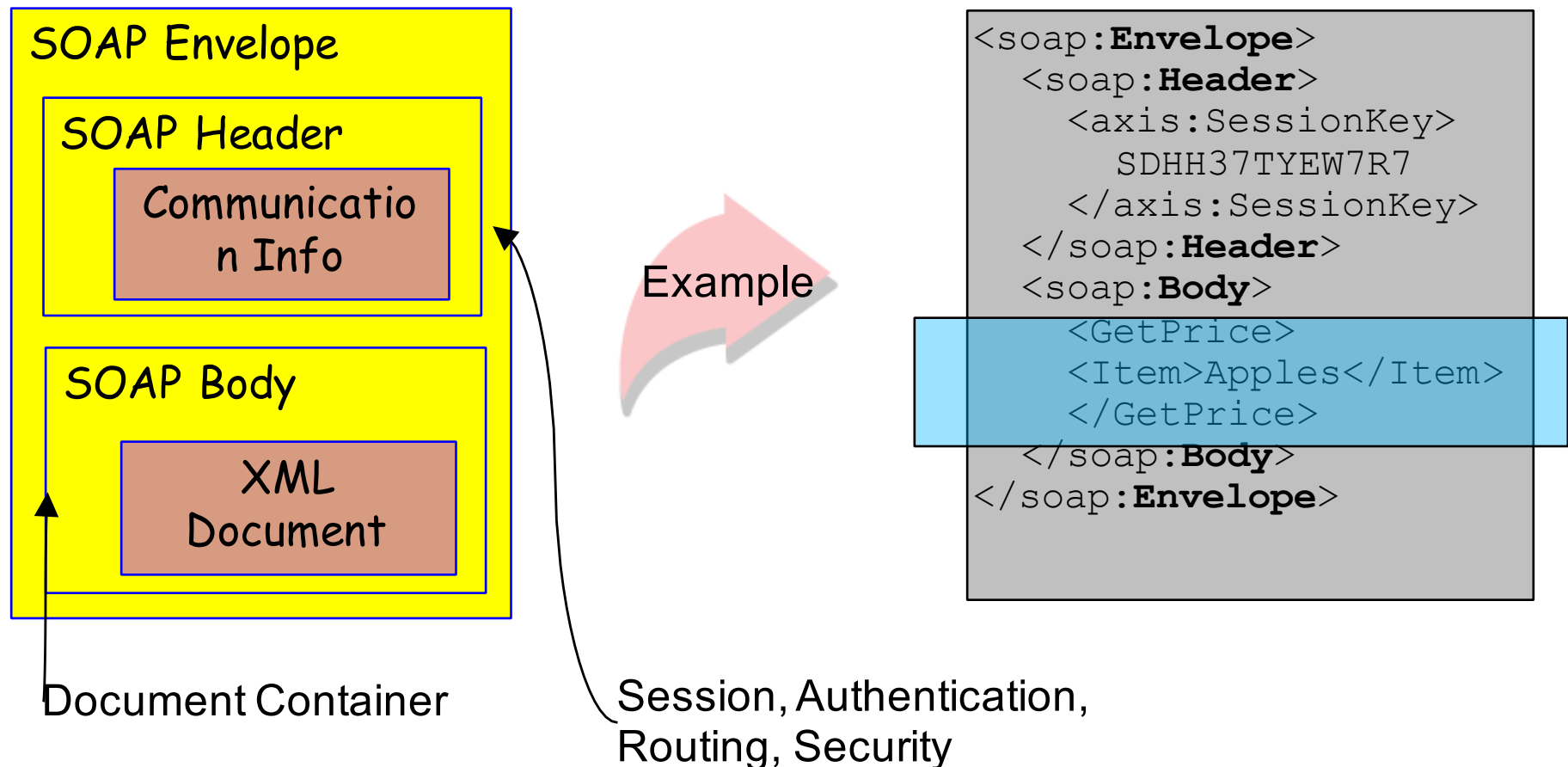
Protocols Folding



SOAP basic mechanism

Simple Object Access Protocol

A SOAP runtime engine basically adds a XML envelope to an existing XML document



SOAP Encoding

Dealing directly with XML messages is not easy.
Therefore, SOAP provides a “RPC emulation”
technology

The result: developers work with web services like
with traditional RPC (e.g. CORBA, DCOM, DCE)

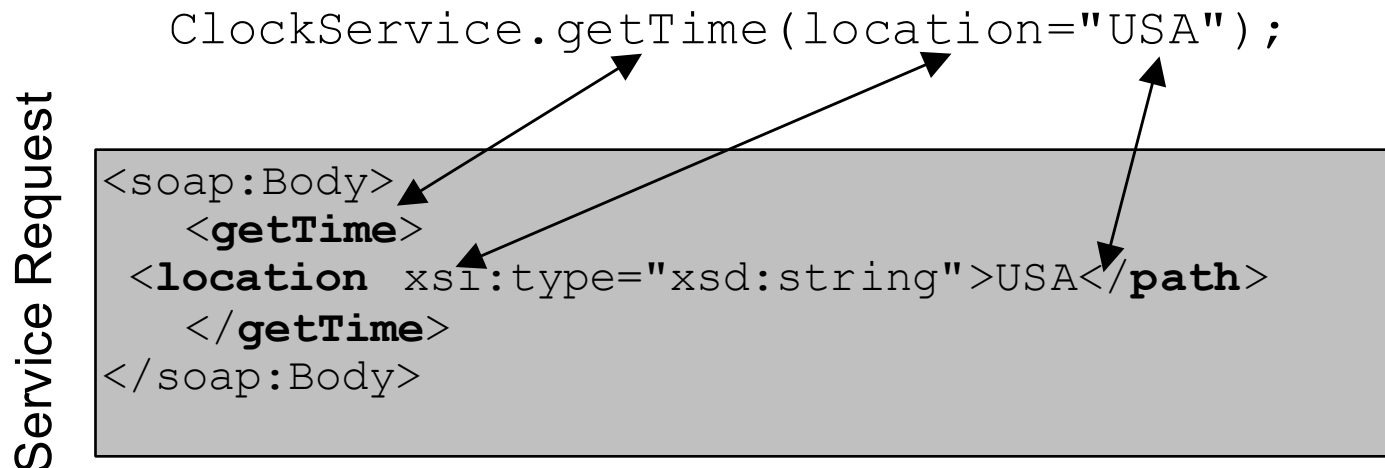
The “RPC emulation” is named SOAP encoding.

Fundamentally it is a set of rules to map a
procedure invocation to a XML document.

SOAP Encoding

The rules:

- method name -> first level element in the SOAP Body
- arguments identifiers -> second level elements
- arguments values -> third level elements
- arguments types -> attribute xsi:type



Web Service Description Language

WSDL is a standard format to describe a Web Service (*description stack*)

A WSDL document is composed by two sections:

- An abstract interface section -> like in traditional IDL, it defines the signatures of procedures (RPC-style) or messages (document-style)
- A deployment section -> it defines the service location and the supported transport protocols

Fundamentally a client uses the WSDL to create the stub or to dynamically decode messages.

Web Service Introspection Language

WSIL and UDDI are the standard way to search Web Services. (*Discovery stack*)

WSIL is the decentralized approach.

Fundamentally a WSIL document contains a directory of the Web Services deployed on a server.

It is analogous to the index.html document for web pages.

In the future, specific crawlers will browse the Internet looking for WSIL documents, like Google does today for web pages.

Web Service Introspection Language

```
<inspection>
  <abstract>Acme Industries Public Web Services</abstract>
  <service>
    <name>Store Finder Service</name>
    <abstract>
      A service to perform a geographical search of Acme stores.
    </abstract>
    <description
location="http://example.org/services/storefinder.wsdl"/>
  </service>
  <link location="http://example.org/services/ecommerce.wsil"/>
</inspection>
```

Service name

Service location and description

Link to an other WSIL page

UDDI

(Universal Description, Discovery and Integration)

UDDI is a complimentary approach for searching based on a centralized repository.

The repository is an “electronic yellow pages” for firms that offer web services online. Besides the names of services and their WSDL descriptors, firms can add a description of their business, phone numbers, addresses...

UDDI repositories are offered by many agencies - e.g. IBM, Microsoft and HP.

Web Services – Architectural Extensions

- Incorporates additional features and functionality by extending technologies and components defined within the basic architecture, such as:
 - Asynchronous messaging
 - Attachment – typical usage : associating binary data with SOAP messages.
 - Caching
 - Message exchange pattern (MEP) - Describes a generalized pattern of message exchange between two services. e.g. : one-way, request/response, publish/subscribe, and broadcast.
 - Reliable message - implementation of Reliable Messaging one MEP is a series of requests between two nodes with an acknowledgement SOAP Module.
 - Message confidentiality – Can transmit the message via SSL or TLS, or have a SOAP Module provides for encryption and decryption.
 - Message integrity – Can have a SOAP Module use digital signature.
 - Session

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