Web Services - Part 2

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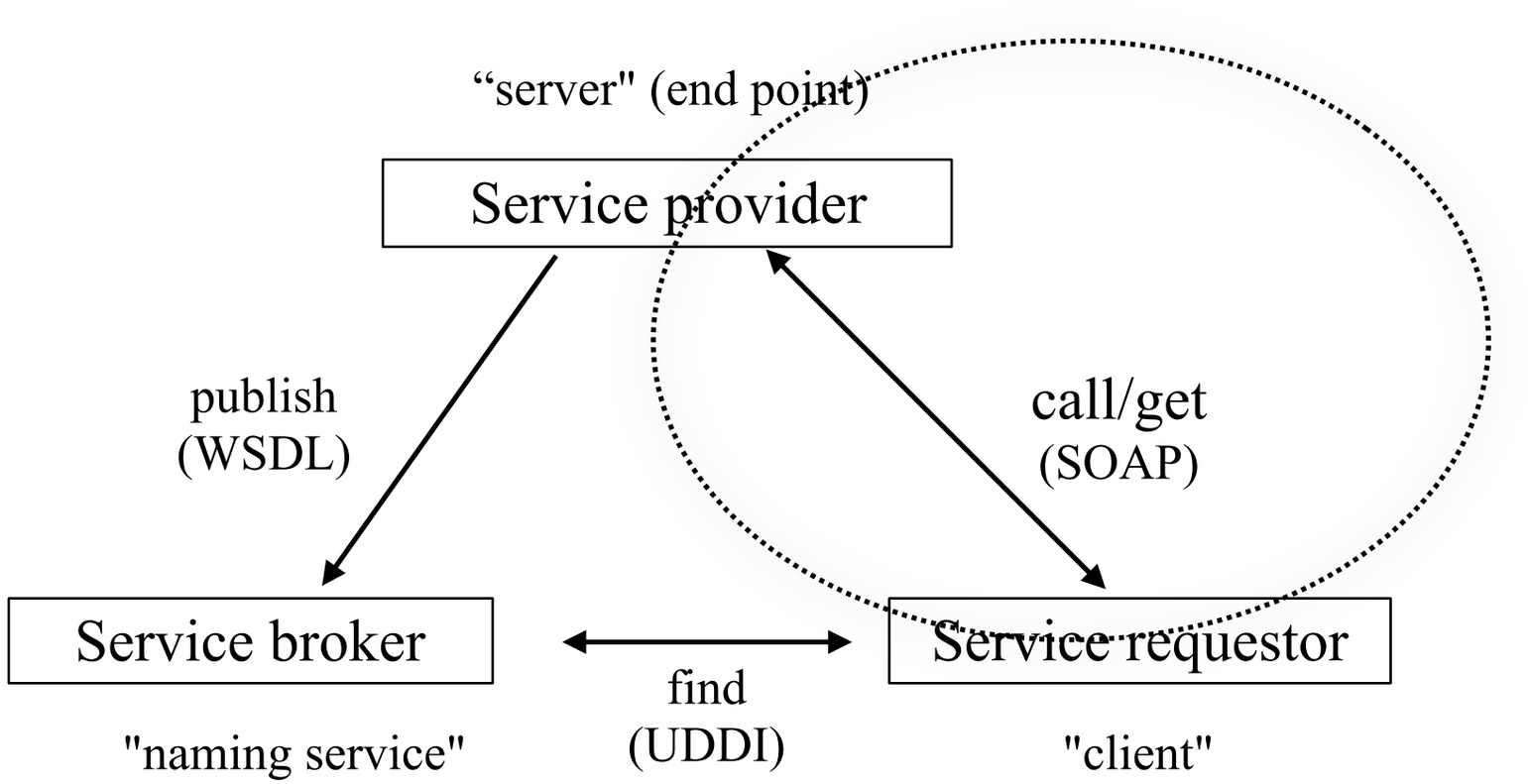
[Simple Object Access Protocol (SOAP)]

[Recall from Earlier]

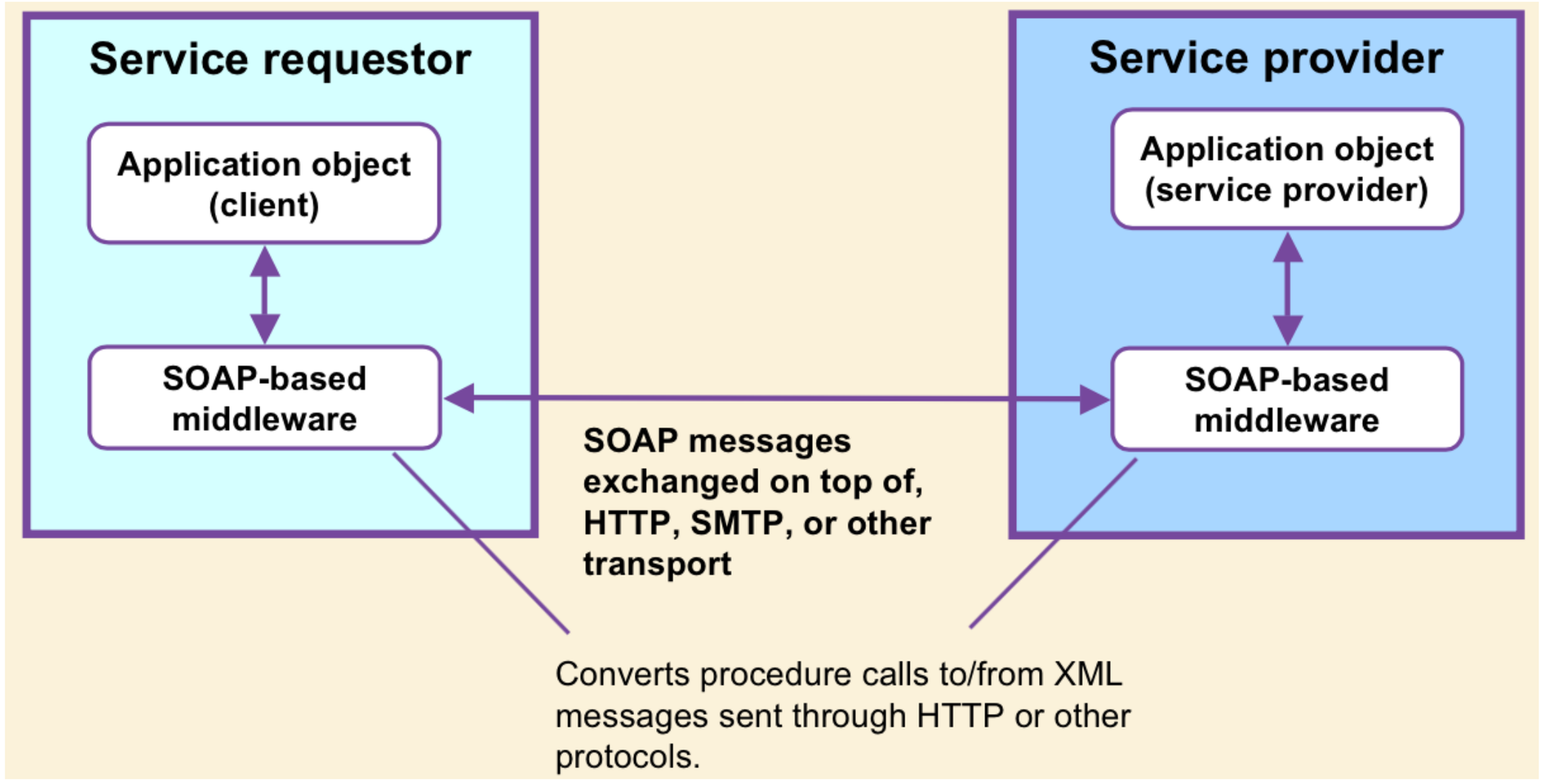
- Server (endpoint) can describe what it can do (through WSDL)
- But how a server execute the actions a client asked for: RPC



[Simple Object Access Protocol (SOAP)]

- What is SOAP?
  - ✓a standard (W3C) messaging protocol for inter application communication
- SOAP codifies request and response (with XML) using HTTP as a means of transport (but can run over others as well e.g. SMTP)
- More powerful than XML-RPC
  - ✓user-defined data types
  - ✓ability to specify specific recipient
  - ✓message specific processing control
- Its a standard, thus:
  - ✓every one uses it
  - ✓Inter communication between proprietary systems running on heterogeneous infrastructures

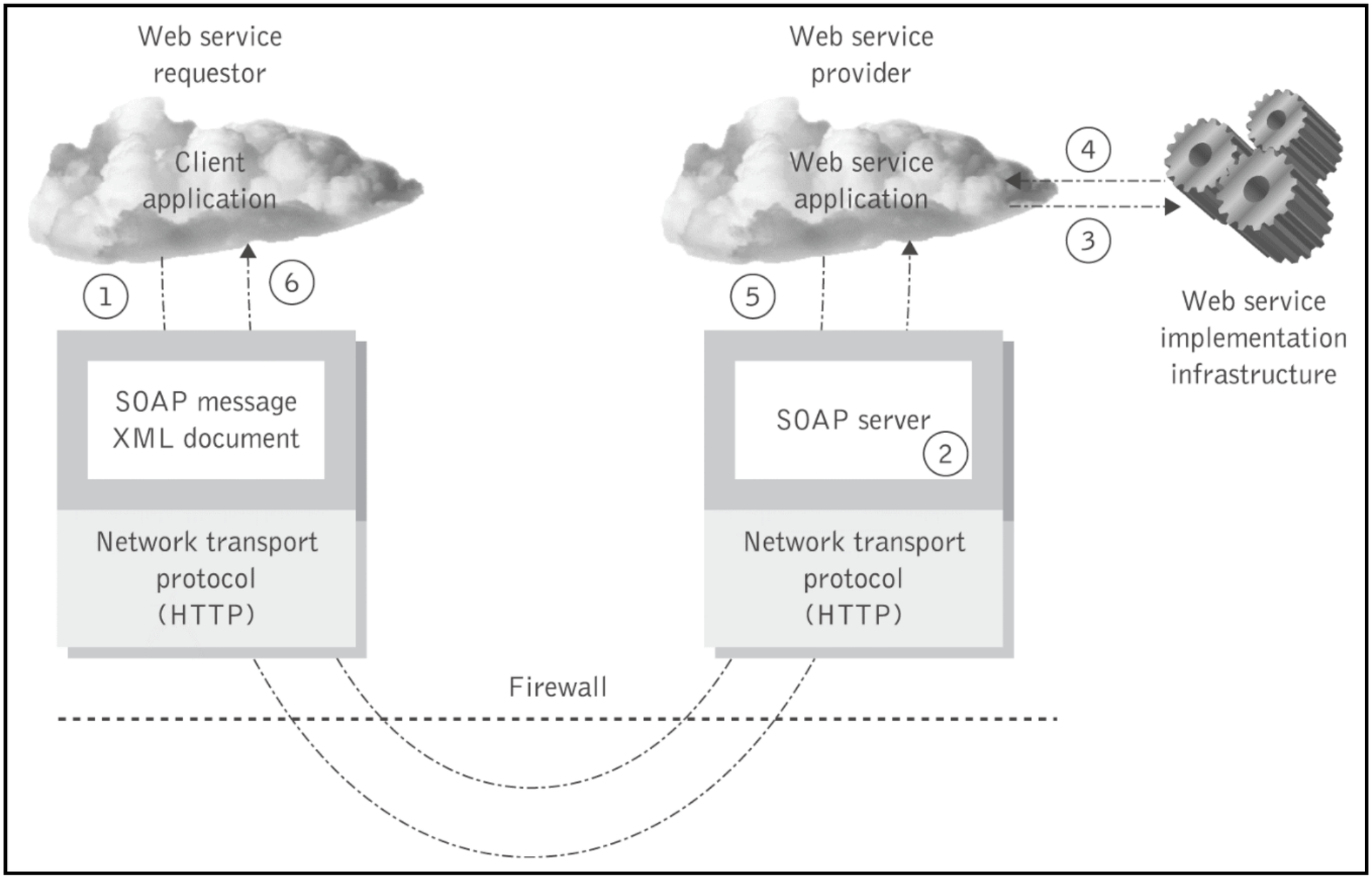
[Simple Object Access Protocol (SOAP)]



[What is SOAP (continued)]

- SOAP covers the following four main areas:
  - ✓**a message format** for one-way communication describing how a message can be packed into an XML document
  - ✓**a description of** how a SOAP message should be transported using HTTP (for Web-based interaction) or SMTP (for e-mail-based interaction)
  - ✓**a set of rules** that must be followed when processing a SOAP message and a simple classification of the entities involved in processing a SOAP message
  - ✓ **a set of conventions** on how to turn an RPC call into a SOAP message and back

[Distributed Messaging using SOAP]



[SOAP Messages]

SOAP messages are seen as envelopes where the application encloses the data to be sent

<Envelope>

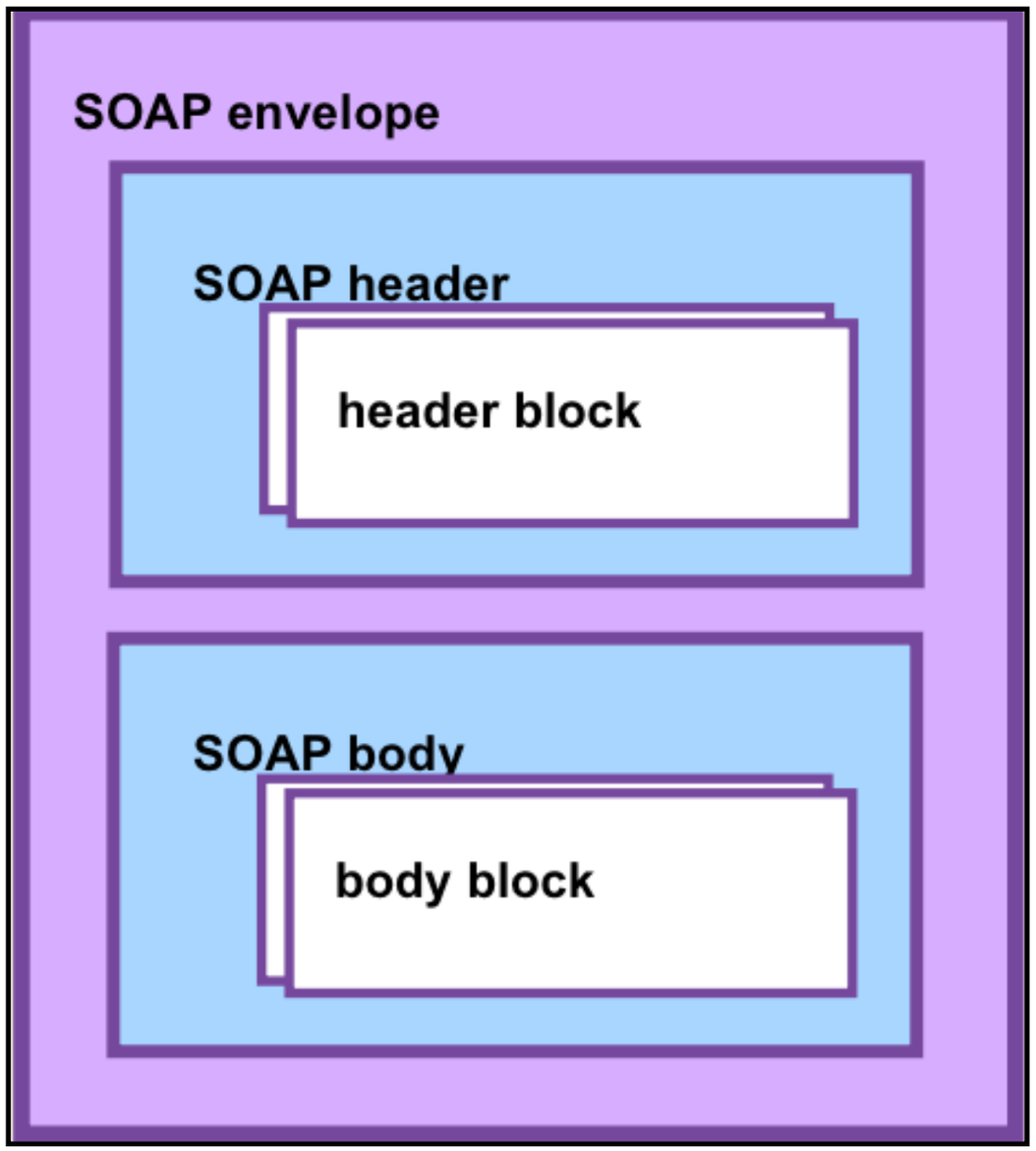
<Header>

</Header>

<Body>

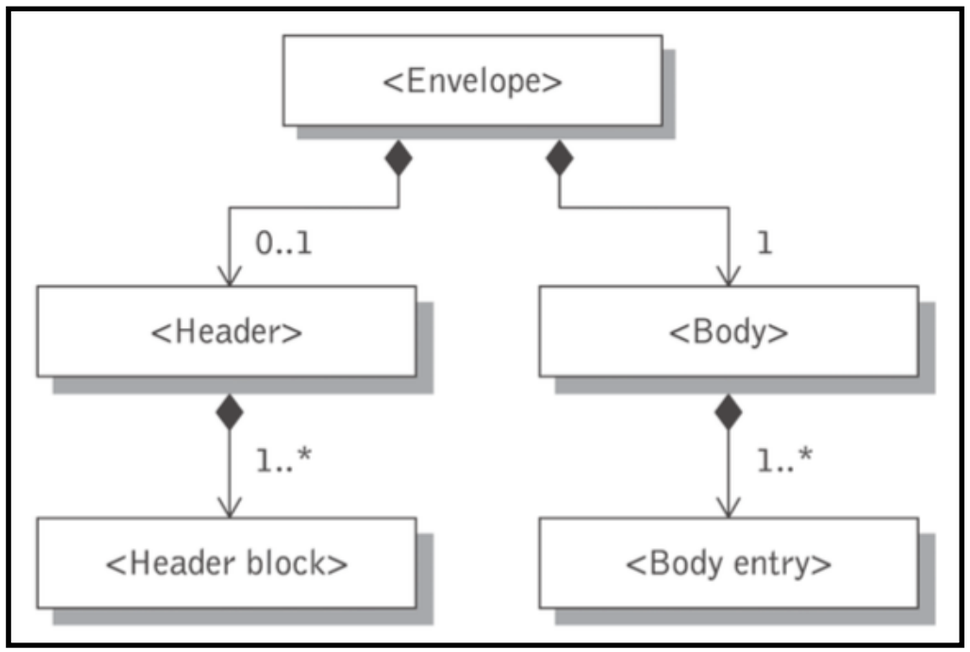
</Body>

</Envelope>



*Headers are optional

[SOAP Messages]



- **Envelope**: a root element
- **Header**: contains blocks of information how the message is to be processed (message is for application or directly for the SOAP engine)
- **Body**: main end-to-end information is conveyed, the method class, parameters, etc.

[SOAP Messages: Example]

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

<env:Envelope xmlns:env="http://www.w3.org/2002/06/soap-envelope" >

 <env:Header>
  <t:transactionID
          xmlns:t="http://intermediary.example.com/procurement"
          env:role="http://www.w3.org/2002/06/soap-envelope/role/next"
          env:mustUnderstand="true" >
          57539
  </t:transactionID>
 </env:Header>


<env:Body>
  <m:orderGoods
      env:encodingStyle="http://www.w3.org/2002/06/soap-encoding"
      xmlns:m="http://example.com/procurement">
   <m:productItem>
         <name>ACME Softener</name>
   </m:productItem>
   <m:quantity>
      35
   </m:quantity>
  </m:orderGoods>
 </env:Body>

</env:Envelope>
```

Envelope

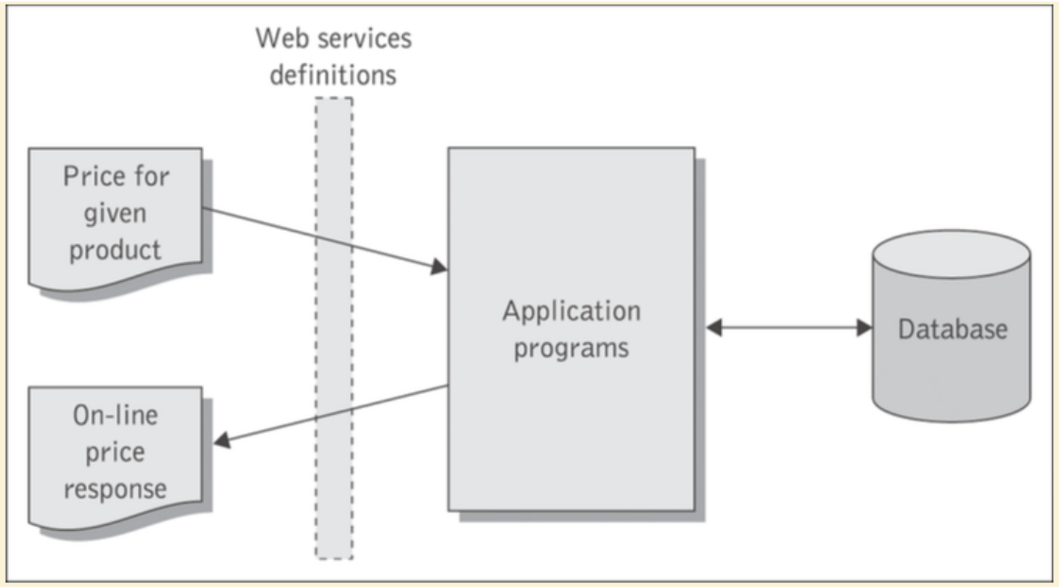
Header

Blocks

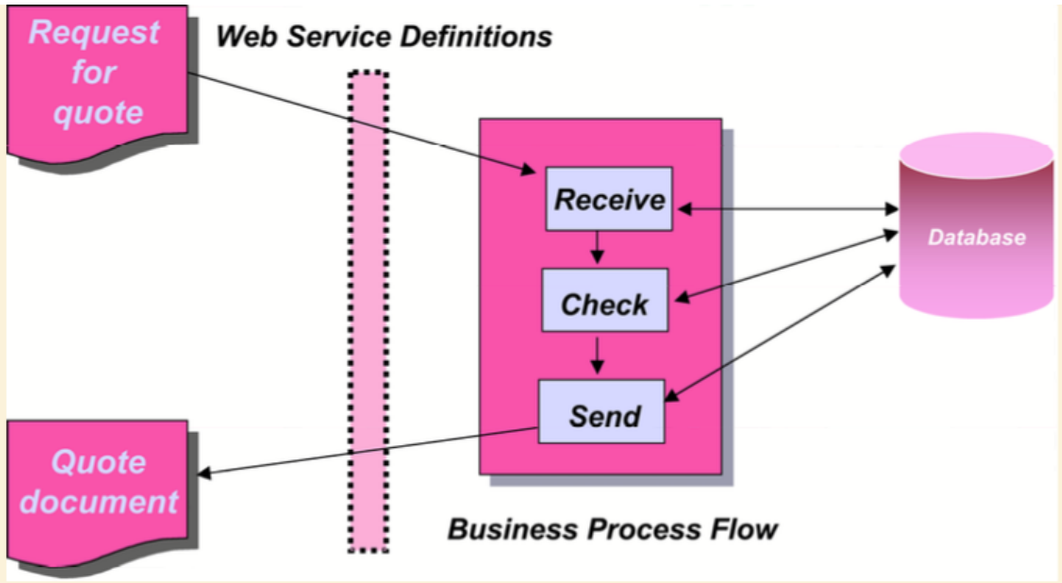
Body

[The SOAP Communication Model]

- SOAP supports two possible communication styles:
  - ✓Remote Procedure Call (RPC)
  - ✓Document (or simple messages)



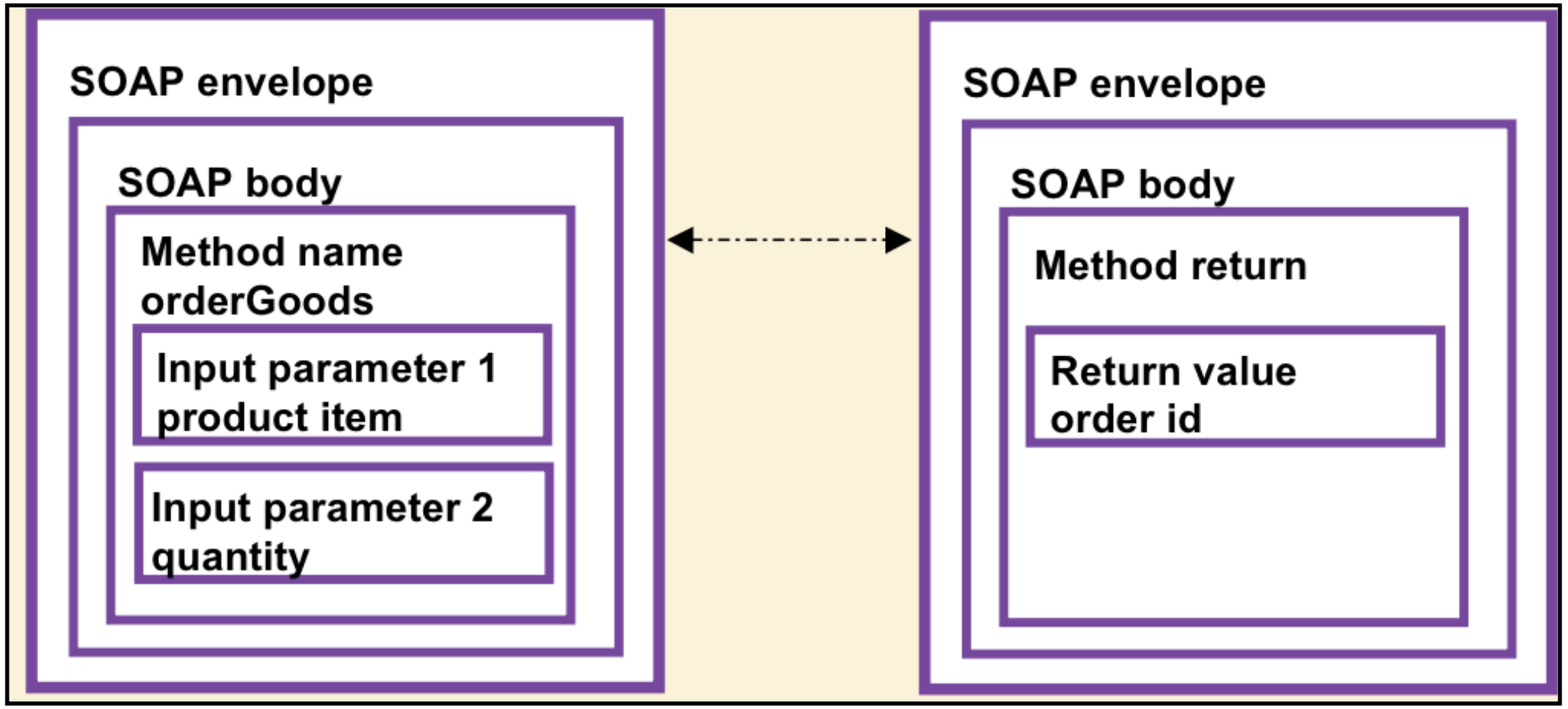
RPC-style interaction



Document-style interaction

[RPC-style SOAP Services]

- RPC-style web service appears as remote object to client
- RCP-style web services centre's around a service-specific interface
- Client express their requests as a method call with a set of arguments
- service returns a response containing a return value



[RPC-style SOAP Services]

Example of RPC-style SOAP body

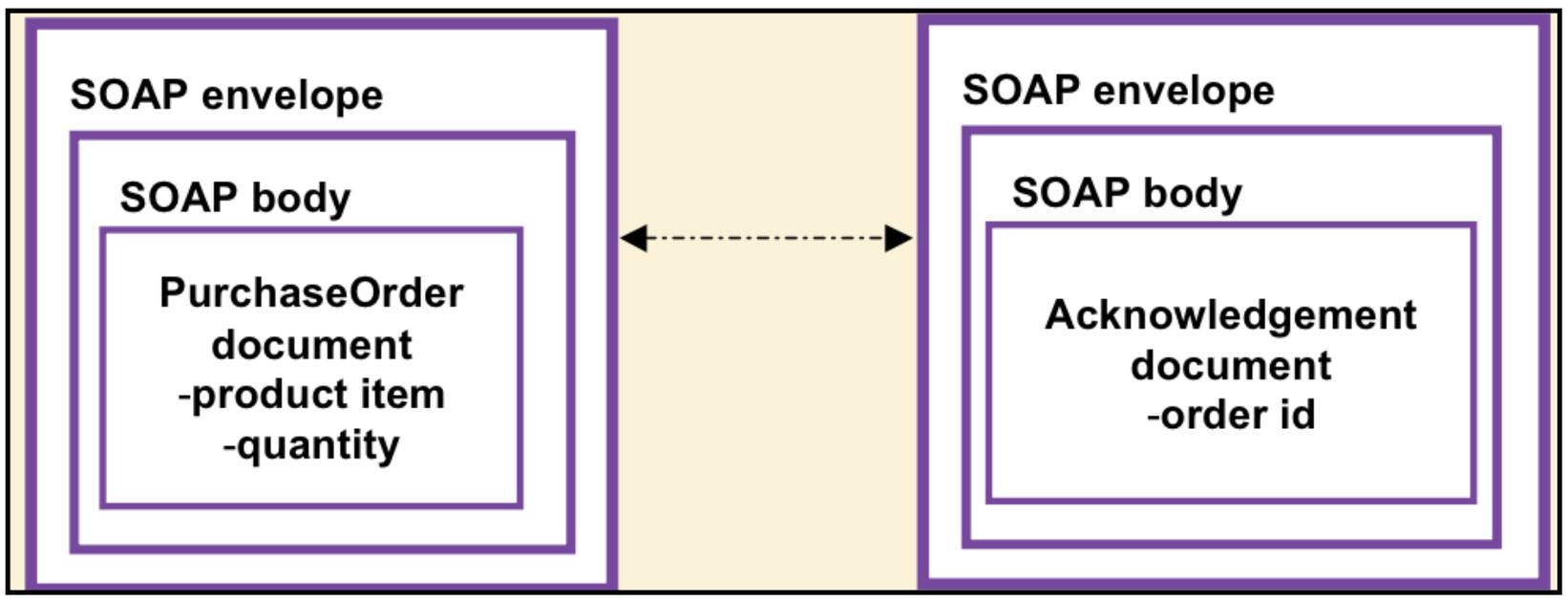
```
<env:Envelope
 xmlns:SOAP="http://www.w3.org/2003/05/soap-envelope"
 xmlns:m="http://www.plastics_supply.com/product-prices">
    <env:Header>
            <tx:Transaction-id
           xmlns:t="http://www.transaction.com/transactions"
                env:mustUnderstand='1'>
               512
            </tx:Transaction-id>
    </env:Header>
    <env:Body>
            <m:GetProductPrice>
               <product-id>  450R6OP  </product-id >
            </m:GetProductPrice >
    </env:Body>
</env:Envelope>
```

Example of RPC-style SOAP response message

```
<env:Envelope
 xmlns:SOAP="http://www.w3.org/2003/05/soap-envelope"
 xmlns:m="http://www.plastics_supply.com/product-prices">
    <env:Header>
            <--! – Optional context information -->
    </env:Header>
    <env:Body>
            <m:GetProductPriceResponse>
               <product-price>   134.32  </product-price>
            </m:GetProductPriceResponse>
    </env:Body>
</env:Envelope>
```

[Document(Message)-style SOAP Services]

- Document-style of messaging, the SOAP <Body> contains an XML document fragment. The <Body> element reflects no explicit XML structure
- The SOAP run-time environment accepts the SOAP <Body> element as it stands and hands it over to the application it is destined for unchanged. There may or may not be a response associated with this message



[Document(Message)-style SOAP Body: Example]

```
<env:Envelope
 xmlns:SOAP="http://www.w3.org/2003/05/soap-envelope">

    <env:Header>
            <tx:Transaction-id
           xmlns:t="http://www.transaction.com/transactions"
                env:mustUnderstand='1'>
               512
    </env:Header>
    <env:Body>
            <po:PurchaseOrder oderDate="2004-12-02"
           xmlns:m="http://www.plastics_supply.com/POs">
           <po:from>
             <po:accountName>   RightPlastics   </po:accountName>
                  <po:accountNumber>   PSC-0343-02  </po:accountNumber>
           </po:from>
           <po:to>
             <po:supplierName>  Plastic Supplies Inc.  </po:supplierName>
             <po:supplierAddress>  Yara Valley Melbourne  </po:supplierAddress>
           </po:to>
           <po:product>
               <po:product-name> injection molder </po:product-name>
               <po:product-model> G-100T </po:product-model>
               <po:quantity> 2 </po:quantity>
           </po:product>
            </ po:PurchaseOrder >
    </env:Body>
</env:Envelope>
```

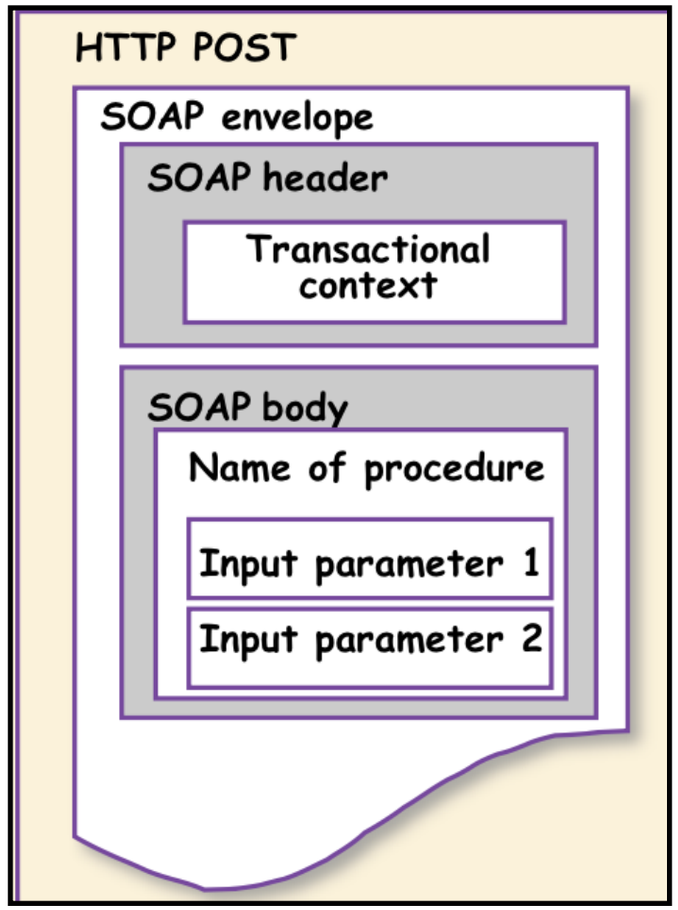
[SOAP Fault Element]

- SOAP provides a model for handling faults (e.g. entries do not exists in the database)
- The SOAP body contain the fault message

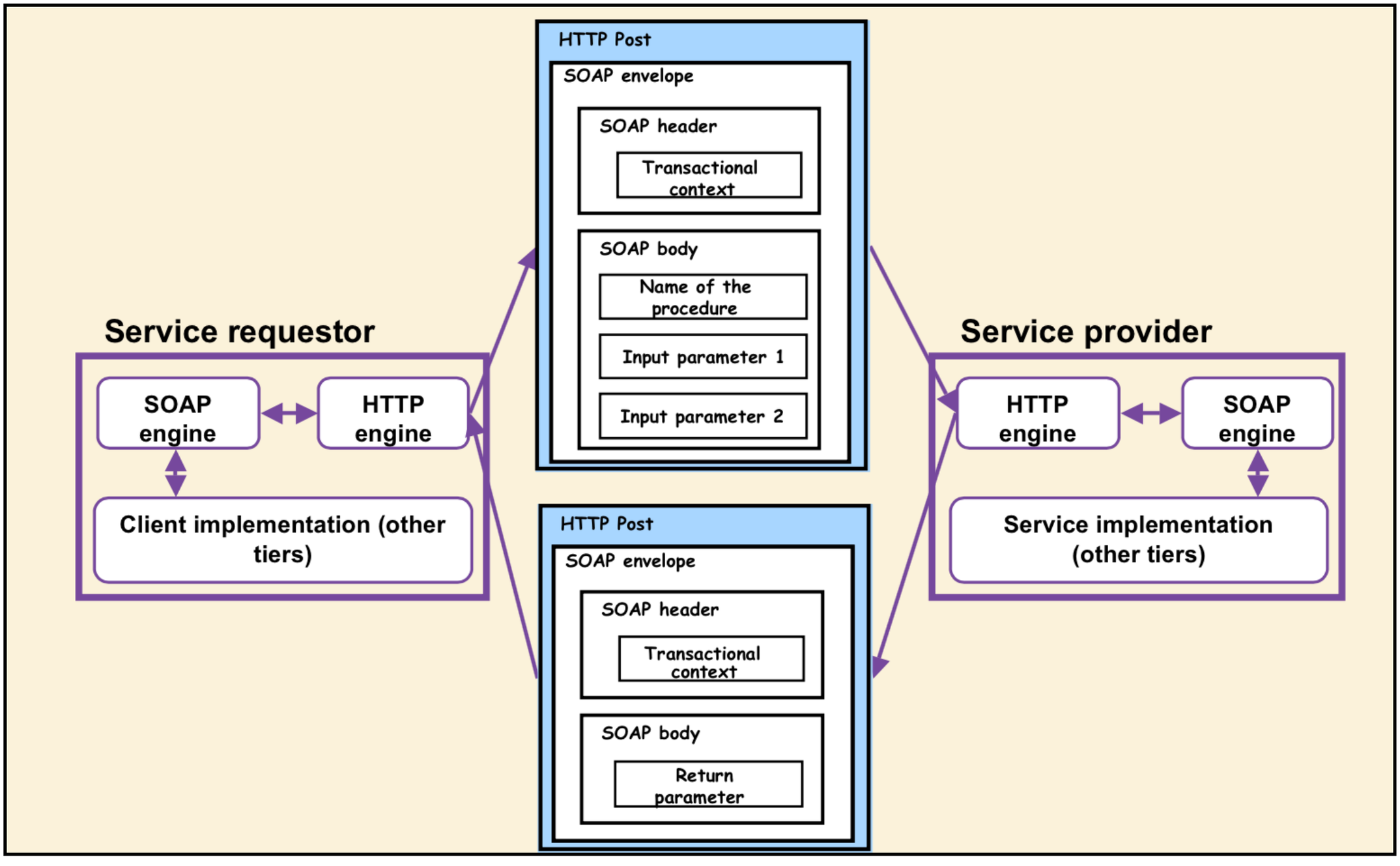
```
<env:Envelope
 xmlns:SOAP="http://www.w3.org/2003/05/soap-envelope"
 xmlns:m="http://www.plastics_supply.com/product-prices">
    <env:Header>
              <tx:Transaction-id
          xmlns:t="http://www.transaction.com/transactions"
                env:mustUnderstand='1'>
              512
              </tx:Transaction-id>
    </env:Header>
    <env:Body>
       <env:Fault>
          <env:Code>
             <env:Value>env:Sender</env:Value>
             <env:Subcode>
                <env:Value> m:InvalidPurchaseOrder </env:Value>
             </env:Subcode>
          </env:Code>
          <env:Reason>
             <env:Text xml:lang="en-UK"> Specified product did not exist </env:Text>
          </env:Reason>
          <env:Detail>
            <err:myFaultDetails
               xmlns:err="http://www.plastics_supply.com/faults">
              <err:message> Product number contains invalid characters </err:message>
              <err:errorcode> 129 </err:errorcode>
            </err:myFaultDetails>
          </env:Detail>
       </env:Fault>
    </env:Body>
</env:Envelope>
```

[SOAP Over HTTP]

- Typical binding for SOAP is HTTP
- A binding of SOAP to a transport protocol os a description of how a SOAP message is to be sent
- SOAP can use GET and POST of HTTP
- With GET the request is not a SOAP message but the response is
- With POST both request and response is SOAP message (use of POST is recommended over HTTP)



[RPC call using SOAP over HTTP]



[Advantages/Disadvantages of SOAP]

- Advantages:
  - ✓much more flexible and powerful than XML-RPC
  - ✓portable
  - ✓firewall Friendly
  - ✓use of open standards
  - ✓Interoperability
  - ✓universal acceptance (W3C standard)

- Disadvantages
  - ✓too much reliance on HTTP
  - ✓stateless
  - ✓serialisation (marshalling) by value not reference

[Other RPC Protocols]

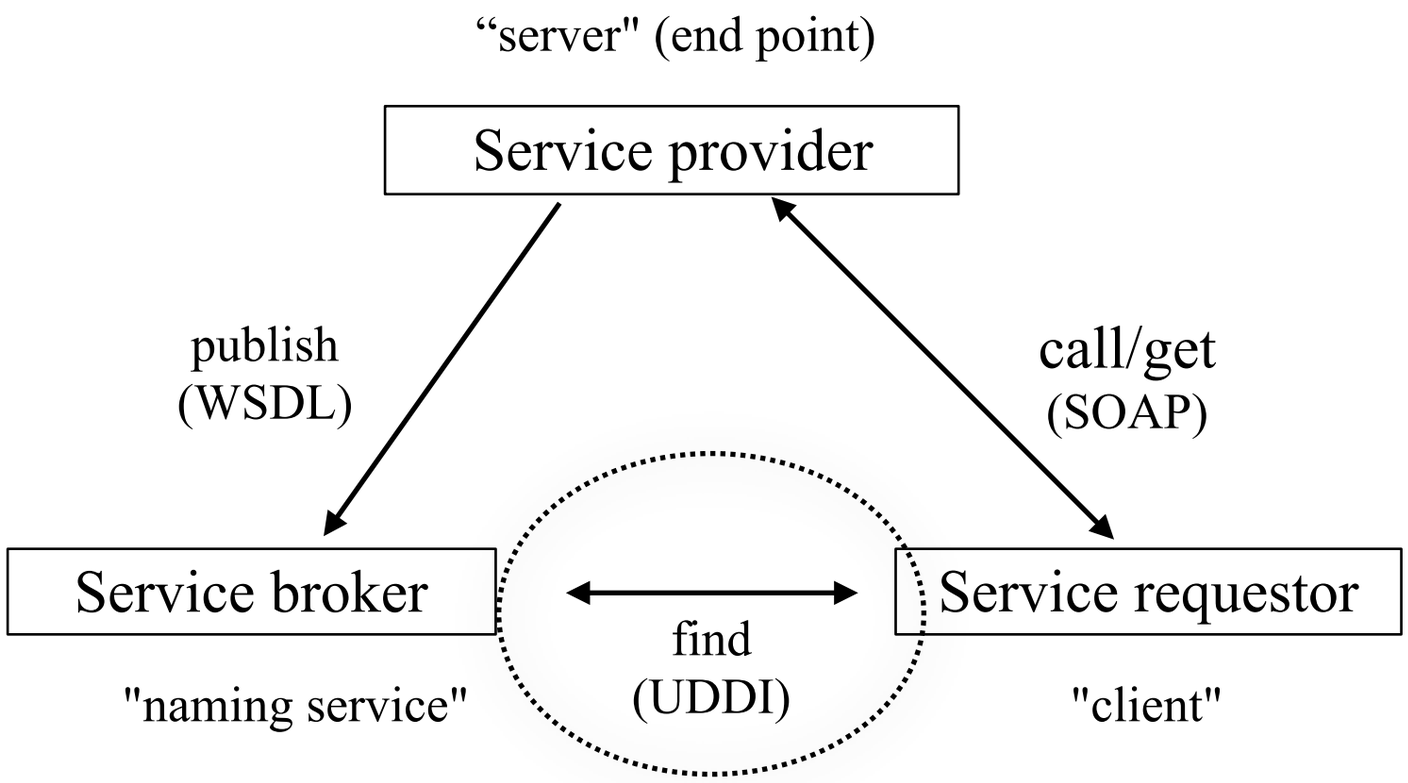
- Not discussed
  - ✓CORBA, COM (usually for distribution of data)
  - ✓Protocol Buffers, Thrift (by Google and Facebook, and lighting fasts, use JSON)

They are evolved from SOAP, so study it by yourself

[RPC Summary]

- Its the backbone of the Web Services
- RPC technology focuses on programming use and aims to:
  - ✓make distributed communication similar to local calls
  - ✓support protocol evolution
  - ✓make it hard to get it wrong
- Semantics are challenging:
  - ✓can’t really hide the network and make it look like local
- Performance is the Key
- You have learned about few technologies which you might use in the future

[Last Point]


“server" (end point)
Service provider
publish
(WSDL)
call/get
(SOAP)
Service broker
find
(UDDI)
Service requestor
"naming service"
"client"

[Universal Description Discovery and Integration (UDDI)]

[UDDI]

- Basic idea of UDDI:
  - ✓UDDI was conceived as a universal business registry similar to search engines (Google et. al.), where services can be located based on different criteria
- Servers that provide public UDDI registry and lookup service are called nodes
- UDDI s a technical specification for building a distributed directory of businesses and web services
  - ✓uses XML
  - ✓Includes APIs for searching existing data and creating new

The vision was that service consumers would be linked to service providers through a public brokerage system

[UDDI]

- UDDI business registration provides 3 distinct sets of information

White Pages: General information about a specific company: address phone number etc.

Yellow Pages: Classification data for either the company or the service offered. This data may include industry, product, or geographic codes based on standard taxonomies

Green Pages: Technical information about a web service, an address for invoking the web service.

[The reality of UDDI]

- UDDI did not gain widespread use as yet even though it had the backing of large companies like IBM and Microsoft

- UDDI is mostly used in limited environments (inside companies). For that purpose, UDDI is too complicated and most of the data provided by UDDI is not needed

- Microsoft, IBM and SAP shut down their public UDDI nodes (servers) in 2006

[Concluding Remarks]

- Web services are every where, and Today's world can't be realised without them
- Three main components of web services are WSDL, SOAP and UDDI
- SOAP is mainly adopted due to its flexibility and efforts of W3C
- These days its more about the performance than flexibility (thats why Facebook and Google has its own protocols)
- Its time to move to next phase of the Web, the Web 2.0
- Web 2.0 includes the semantics and the data structure that is able to interpret and reason about the selection and orchestration of the web services

[Fin]

Acknowledgment: Michael P. Papazoglou, Web Services, 1st Edition, © Pearson Education Limited 2008