Web Services Advanced Topics

Where things are now and where they are going …

Version 9

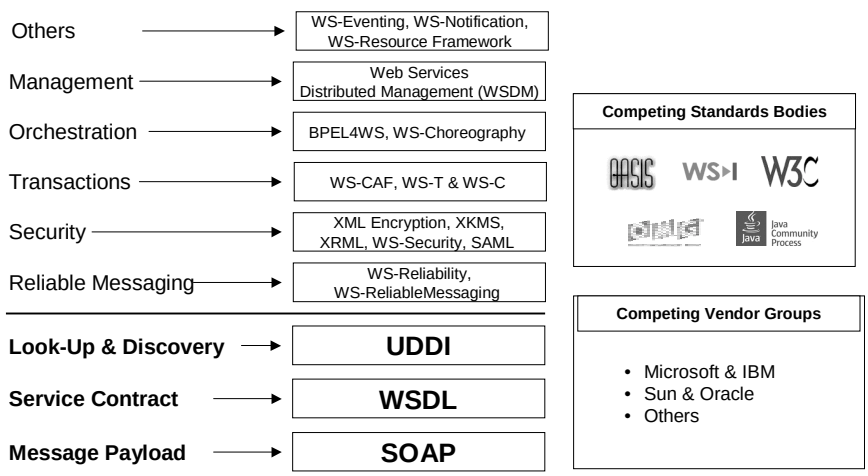
Web Services – Advanced Topics

- Enterprise Web Services
- Industry trends and organizations
- Security and Reliability
- Transactions
- Choreography and Orchestration
  - Composite web services
- Interoperability Requirements
  - Encoding discussion
- Futures

Enterprise Web Services

- Extending WS throughout the enterprise and among enterprises ⇒ greater emphasis on Qualities Of Service (QoS)
  - Security, Reliability, Transactions, Scalability
  - Systems Management
  - Interoperability
- It's also important to allow it to be used over more transports(other than SOAP over HTTP)
  - IIOP (CORBA)
  - MQ Series messaging
  - TIBCO Rendezvous
  - Tuxedo
  - SOAP over FTP
  - JMS (J2EE)

Enterprise Standards are Evolving



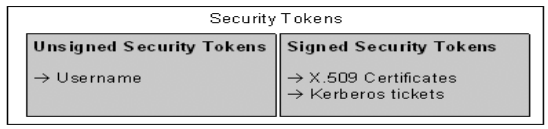
Industry organizations

- Helping to develop the necessary web services related standards
  - W3C
    - SOAP (XMLP working group), WSDL, WS Architecture, WS Choreography
  - OMG
    - IDL to WSDL, WSDL to IDL (WSDL 1.1), WSDL to C++
  - OASIS
    - UDDI, WS-Security, WS-Reliability, WS-CAF, etc.
  - JCP (Java Community Process)
    - JAX-RPC, JWSDL, JAXM, JAXR, …
  - Others
    - WS-I, etc.

Security

- Confidentiality – no one can see my data
- Integrity – my data gets there in one piece
- Authentication – a user or program is confirmed to be who they say they are
- Authorization – ensuring access to services and data only by those who are supposed to access them
- No overall architecture yet defined
  - May include firewalls, proxies, security servers, and identity management
- WS-Security is a well-agreed framework (OASIS)

SOAP Header example (WS-Security)



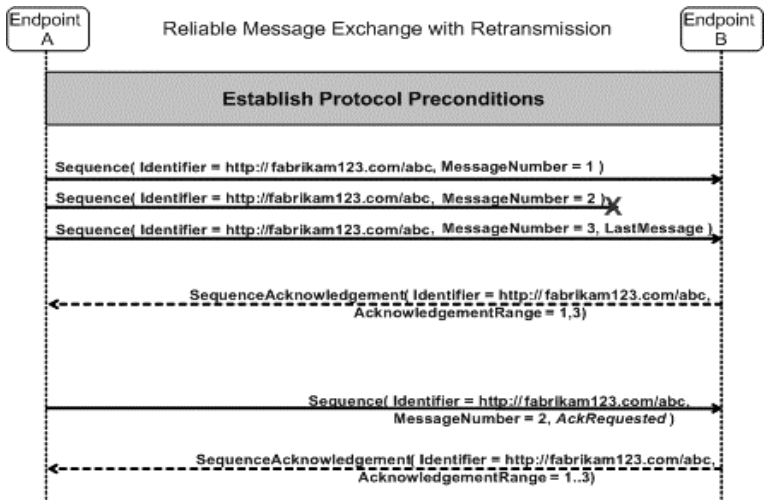

```
<S11:Envelope xmlns:S11="..." xmlns:wsse="..." xmlns:wsu="..." xmlns:ds="...">
  <S11:Header>
    <wsse:Security  xmlns:wsse="...">
      <fabtok:CustomToken wsu:Id="MyID"  xmlns:fabtok="http://fabr123/token" />

      <ds:Signature>  . . . </ds:Signature>
      <ds:SignedInfo> . . . </ds:SignedInfo>
    </wsse:Security>
  </S11:Header>
...
</S11:Envelope>
```


Reliability requirements

- Reliability of message delivery is critical to many applications
  - Guarantee of message delivery (both request and response)
    - At least once (duplicates are allowed)
    - At most once (“best effort”, ok to drop some messages)
    - Once and only once – the toughest to guarantee!
  - Eliminate duplicates (if any)
  - Preserve message ordering (when important)
- Some of these features are provided as standard when WS are carried on a connection-oriented protocol
  - The “sessions” and correlation IDs of the connection-oriented protocol ensures features such as ordering
  - But some QoS must still be added (e.g., store-and-forward to allow clients to send messages even if a server isn’t running)

Example message flow (WS-ReliableMessaging)



Web Services: Implications for TP

- Persistent sessions are missing from HTTP
  - Need to define a common context sharing mechanism
  - Transport “agnostic” means LCD
    - It’s difficult to write a new WS spec that assumes a more sophisticated protocol than HTTP
- Need a solution that is also suited for document-oriented transactions
  - Compensation, transactional “queues” needed
  - Reliable messaging needed
- Business process orchestration
  - Cancel/adjust transactions in long-running flight
  - Mixture of existing and new technologies

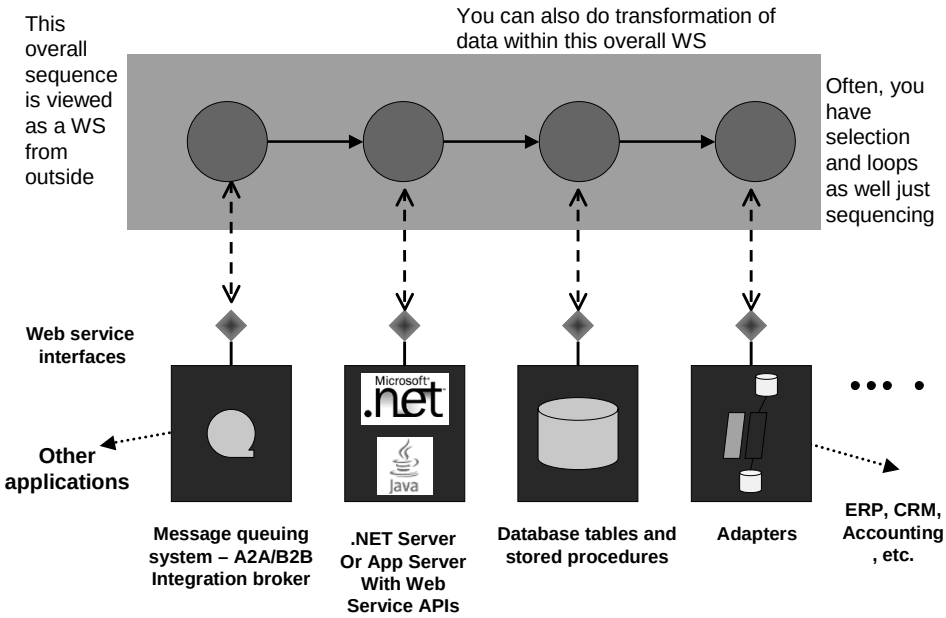
Current status of standardization

- First attempt – SOAP-TIP (Transaction Internet Protocol)
  - Didn't work because it assumed persistent sessions (and these aren't provided by HTTP)
- BTP not widely implemented
  - A bit complex and hard to map to existing systems
- WS-Coordination and WS-Transaction not open
  - Difficult to implement because they are under-specified
  - and it's not very interoperable
- WS-Composite Application Framework (WS-CAF)
  - Current proposal at OASIS
  - Is able to co-ordinate between different transaction systems
    - Resolves the differences in the co-ordinator, not in the end-points

Web Services Composition

- Once you have a "critical mass" of Web services, you may want to:
  - link them together to create (composite) complex Web services
  - implement whole business processes based on those services
- Of course you can "hard-code" this, but the result will be
  - inflexible (hard to maintain)
  - proprietary, not explicit (business logic will be buried in code)
- Better: Standardized high-level mechanisms for defining business processes
  - Standardized declarative, non-programmatic way to compose sequences of web service calls to accomplish a business function
- Efforts ongoing to provide
  - WS-BPEL (seems to be winning at present) for run-time
  - WS-Choreography (more B2B oriented) between partners

Orchestration Architecture



Interoperability Requirements

- Within the enterprise and among enterprises
  - Across hardware platforms, operating systems, programming languages, middleware and component technologies
- SoapBuilders and WS-I have been working to correlate the many WS standards into more interoperable configurations. E.g.,
  - Defining a consistent selection of standards
  - Subsetting (“profiling”) a standard
- Ensuring compatible message *encoding* is another key part of interoperability
  - As discussed in the new few slides

You have a choice of the encoding for complex data in msgs

- The recommendation is *literal*
  - This uses XMLSchema in the normal way
    - The message references a schema that defines the elements and types for formatting arrays, sequences, records/structures, and other complex types
    - The message uses these elements and types
- The alternative is SOAP *encoded*
  - This defines a set of elements that can be used for complex data
    - Mostly, these elements were good at formatting data that typically arises in RPC calls
  - It was first introduced before XMLSchema was available
    - Newer versions (SOAP 1.2) use XMLSchema.
      - The difference then between it and *literal* is that SOAP *encoded* fixes the set of tags/types. This has advantages and disadvantages.
  - Many existing Web Services use SOAP *encoded*, but *literal* is recommended by WS-I for SOAP 1.1
    - WS-I hasn't yet profiled SOAP 1.2, so it is silent on whether SOAP encoding is OK in SOAP 1.2

You also have a choice between two message styles

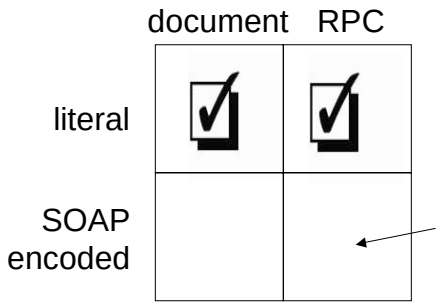
- The choice is *rpc* or *document*
  - *document* style is recommended by WS-I for SOAP 1.1 (albeit most existing Web services examples use *rpc* style)
- Recall that each operation has an input and an optional output message
  - In *rpc* style, each message can have zero or more parts

```
<message name="getQuoteRequest">
  <part name="symbol" type=s:string">
  <part name="date" type="s:string>
</message>
```

  - In *document* style, each message can have at most one part (and this needs to be an XML element, not a type).

WS-I has yet to profile SOAP 1.2

Combining these two choices:



This combination is used by many existing services.

Futures – Quickly !!

- Advances in Standards
  - Ratification of newer versions of standards (SOAP, WSDL, etc.)
  - Emergence of newer standards to support the evolution of WS into enterprise environments (WS-CAF, etc.)
- Advances in deployment support
  - Additional availability of transports/protocols for greater penetration within enterprises without requiring infrastructure changes
- Interoperability advances
  - More shake-out of interoperability issues
  - More adoption of recommendations from WS-I, OASIS, etc