Inside WCF

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Inside Windows Communication Foundation, by Justin Smith, Microsoft Press, 2007
Overview

• History and Motivations
• HTTP and XML
• Service Orientation
• Messages
• SOAP Envelopes
• MTOM
History and Motivations

• Many companies needed to connect different systems in two important ways:
  – platform-independent
  – vendor-neutral

• Existing solutions relied on specific vendor protocols, and required a specific OS.
  – Examples: CORBA, RPC, RMI, COM+, DCOM, .NET Remoting
Breakthrough: HTTP and XML

- Internet standards provided vendor and platform neutral ways to:
  - transmit data
  - execute remote methods and pass parameters
  - communication about data types
  - provide secure communications
Interoperability Defined

(...in a Service Orientation context)

*The ability for a system to change hardware, operating system, or platform without affecting the other participants in a distributed scenario.*
An architectural style in which distributed application components are loosely coupled through the use of messages and contracts.
Why is Service Orientation Good?

• It provides a conceptual model for application-to-application and application-to-enterprise connectedness.
  – simplifies and streamlines the work required to connect, version, and replace applications
  – allows use to reuse existing components
• Dark side: dependence on the service
  – what if it changes?
Focusing on Messages

*(not the implementation or platform)*

• Critical element of Service Orientation
  – *Challenge*: how can a distributed application make messages understood by all?
Anatomy of a Message

• Traditional mail example:
  – address of recipient, postage in specific location, return address (sender)
  – passed between many different stations
  – each recipient can specific markings

• Service Orientation (SO) messages are more flexible
  – but they have a structure based on standards
  – Usually built from SOAP envelopes
SOAP Envelopes

- **Simple Object Access Protocol**
  - A protocol for exchanging XML-based messages over computer networks (specification at w3c.org)
  - SOAP envelope

- A SOAP envelope contains
  - body
  - header
Sample SOAP Envelope

<?xml version='1.0' ?>
<env:Envelope xmlns:env=http://www.w3.org/...">
  <env:Header>
    . . .
  </env:Header>
  <env:Body>
    . . .
  </env:Body>
</env:Envelope>

Think of WCF as a toolkit for creating, sending, and parsing SOAP messages with many different behaviors.
SOAP Header and Body

• Header – security information, context, requests for receipt confirmation, etc.
  – Intermediaries can add their own headers to the message

• Body – message content, possibly encrypted.
  – not supposed to be read by any but the final recipient.
Transporting the Messages

• SOAP does not specify how a message is to be transported
  – to do so would create inflexibility, and make it hard to reroute messages
  – it contains address information, allowing the transport layer the flexibility to determine how the message will be delivered.
Message Encodings

- Text-encoded XML is portable and easy to use
  - but slow
- Binary-coded XML (such as xs:Base64Binary) is even slower!
- MTOM (Message Transmission Optimization Mechanism) – fast!
WSDL

Web Services Description Language

• XML format for describing network services as a set of endpoints operating on messages
• Describes services, types, messages, operations, and bindings

```xml
<wsdl:service name="ClassRollService">
<wsdl:types>...
<xsd:schema>
<wsdl:message name="GetStudentList_InputMessage">
<wsdl:operation name="GetClassAverage">
<wsdl:binding
   name="BasicHttpBinding_IClassRollService"
<wsdl:port name="...">
```

Endpoints

- Describes an address, a binding, and a contract
  - **address**: location where the service is listening
  - **binding**: transport protocols, encoding method
  - **contract**: specifies the format of messages (function calls) arriving at the services
What's a Binding?

- Defines a message format, encoding type, and transport protocol details
- Message format (binary, text, MTOM.)
- WCF Binding Types:
  - BasicHttpBinding, NetTcpBinding, NetNamedPipesBinding (on local machine)

Examples from a WSDL file:

```xml
<wSDL:binding name="BasicHttpBinding_IClassRollService">
  <soap:binding transport="http://schemas.../http" />
</wSDL:binding>
```
Sample SOAP Envelope

A request that includes authentication credentials (username and password) and a session type of *None*, which closes the session after the response is sent out:

```xml
<soap:Envelope
   xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header>
    <UsernameToken
      xmlns="http://siebel.com/webservices">
      user
    </UsernameToken>
    <PasswordText
      xmlns="http://siebel.com/webservices">
      hello123
    </PasswordText>
    <SessionType
      xmlns="http://siebel.com/webservices">
      None
    </SessionType>
  </soap:Header>

  <soap:Body>
    <!-- data goes here -->
  </soap:Body>
</soap:Envelope>
```