


Windows Communication Foundation





Michele Leroux Bustamante
Chief Architect, IDesign
Microsoft Regional Director

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About Michele Leroux Bustamante

- IDesign Inc., www.idesign.net
- Microsoft Regional Director
- MVP – XML Web Services
- BEA Technical Director
- IASA - Board Member
- Published - MSDN, CoDe, TheServerSide.NET...
- International Speaker, INETA
- Program Advisor, UCSD Extension
- Web Services Track Chair, SD Expo
- www.dasblonde.net, www.thatindigogirl.com




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Agenda

- WCF Overview
- Contracts
- Bindings
- Hosting
- Security
- Reliability


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What is WCF?

- Windows Communication Foundation
- Distributed application platform and messaging subsystem for the .NET Framework 3.0
 - Formerly under the WinFX code name
- A single programming model for all
 - Unifies ASMX, .NET Remoting, and Enterprise Services stacks
 - Binding configuration drives protocol choices, message encoding, etc.


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What is WCF?

- Service-Oriented
 - Built for service-oriented system design
 - Simplifies how you approach SOA
- Loosely Coupled
 - Not bound to a particular protocol, encoding format or hosting environment
 - Everything is configurable

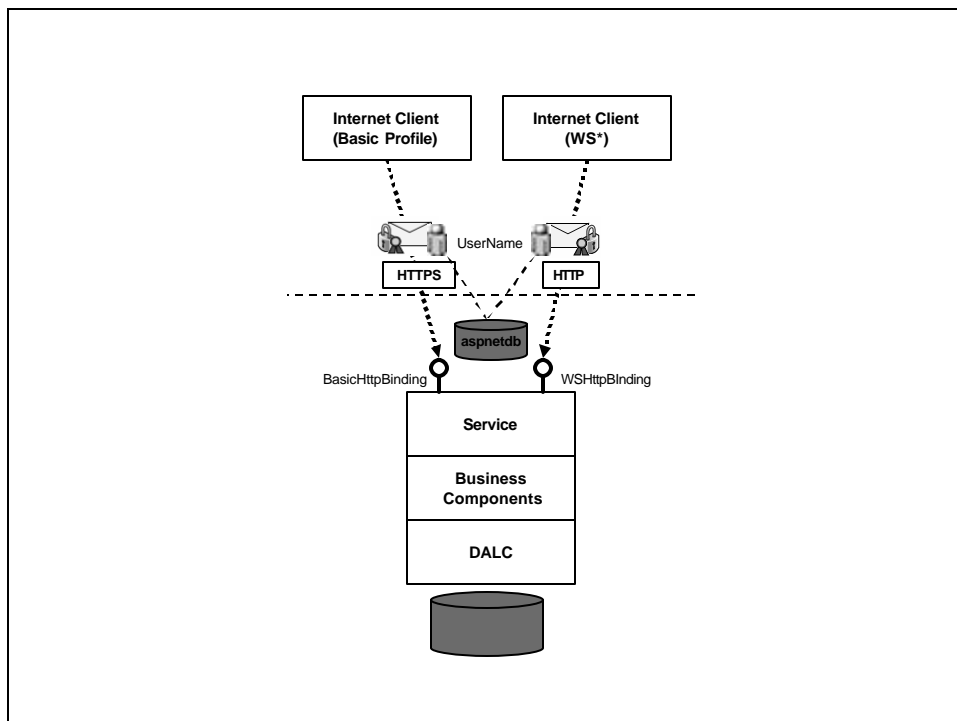
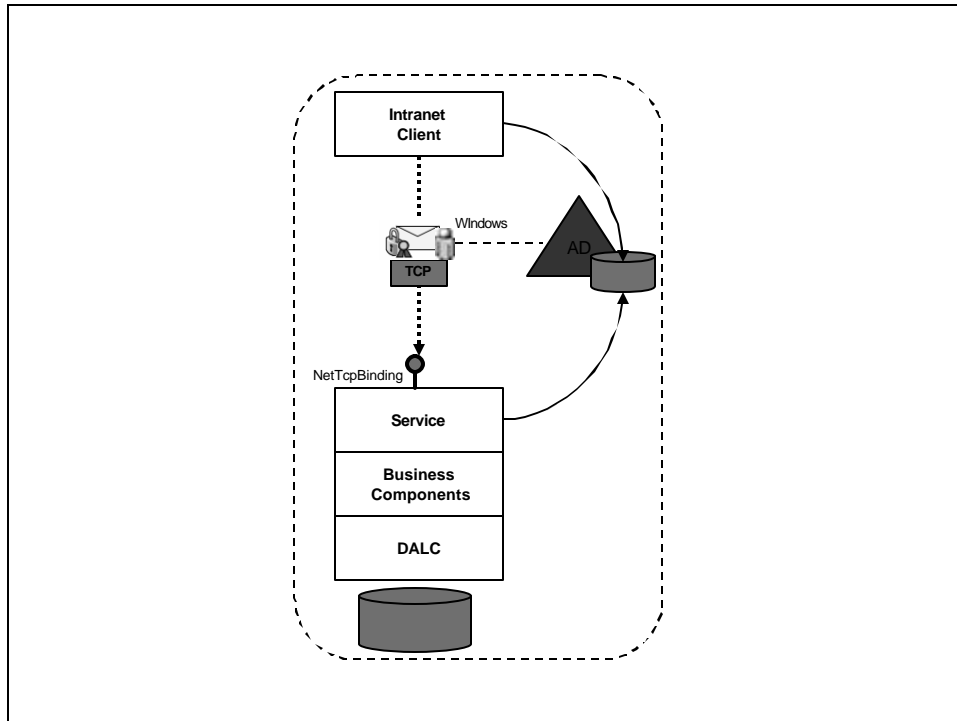
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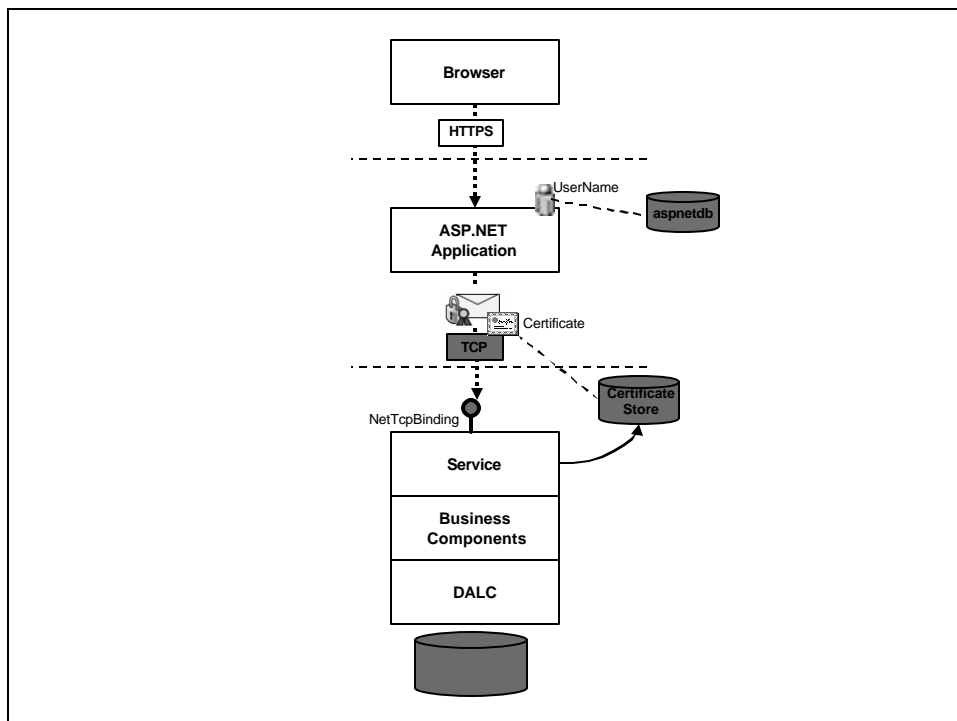
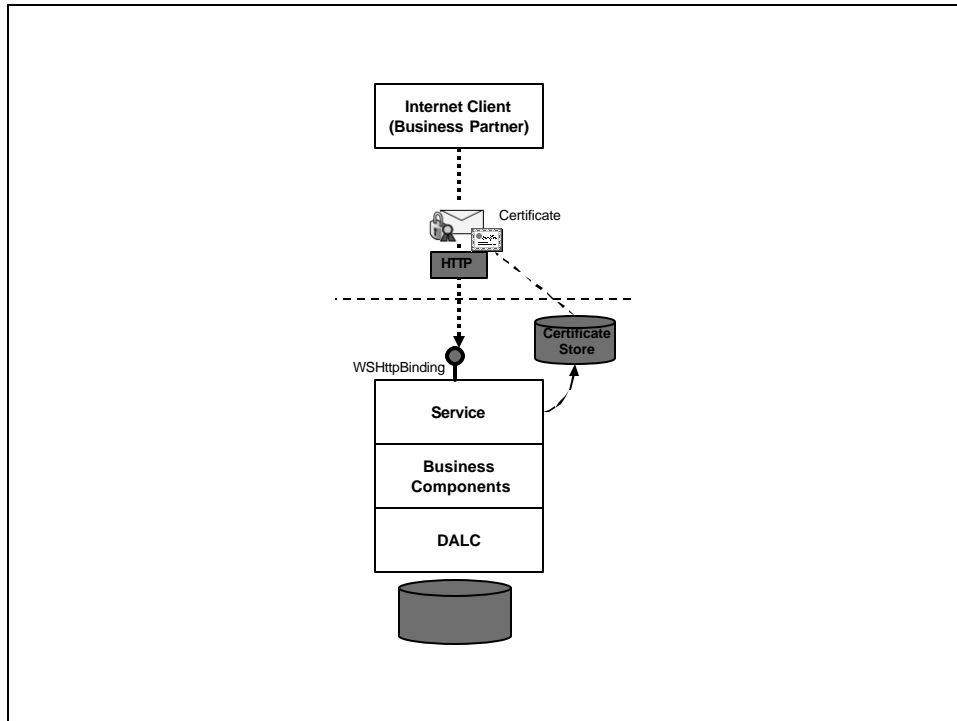


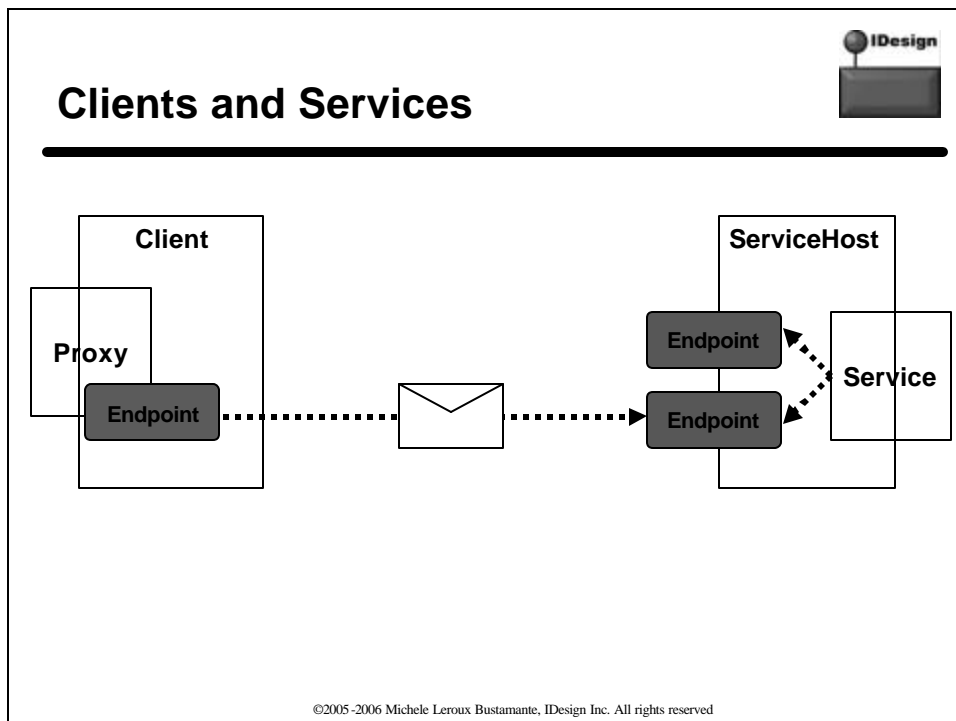
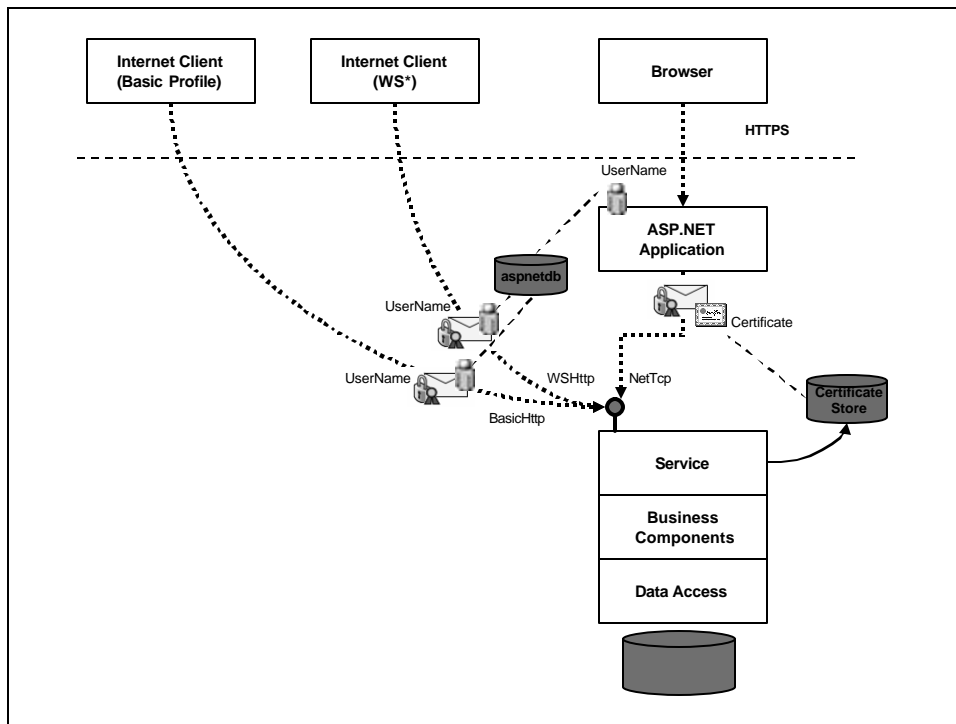
What is WCF?

- Interoperable
 - Supports core Web Services standards
 - ▲ Ratified and not-yet-ratified
 - ▲ Extensibility to quickly adapt to protocol changes
 - XML message representation at the core
- Integration
 - Integrates with earlier stacks
 - ▲ COM, Enterprise Services, MSMQ


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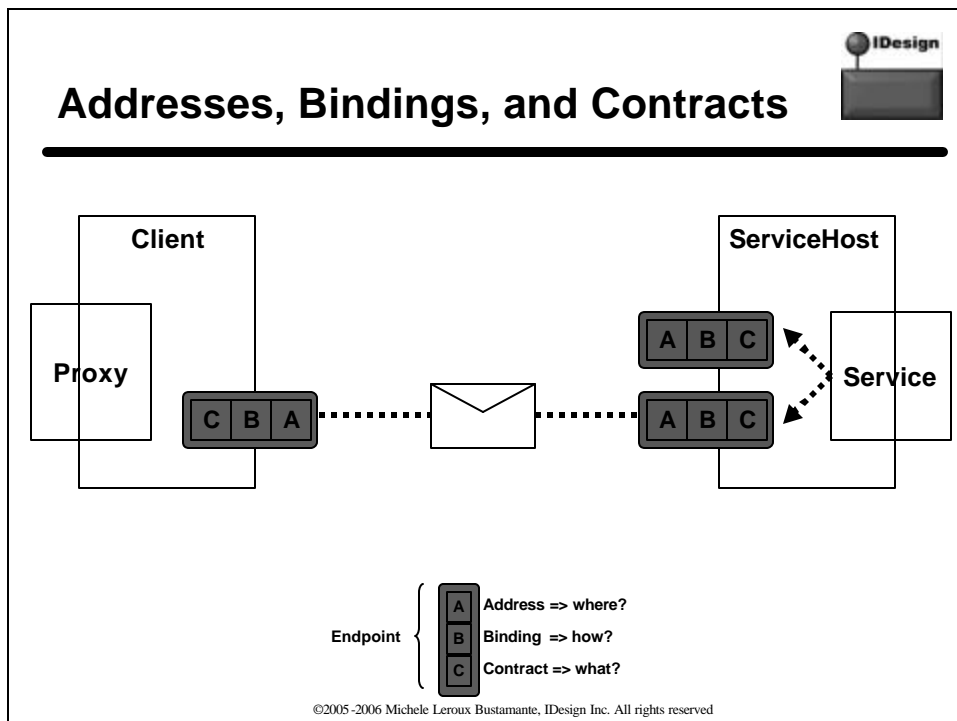


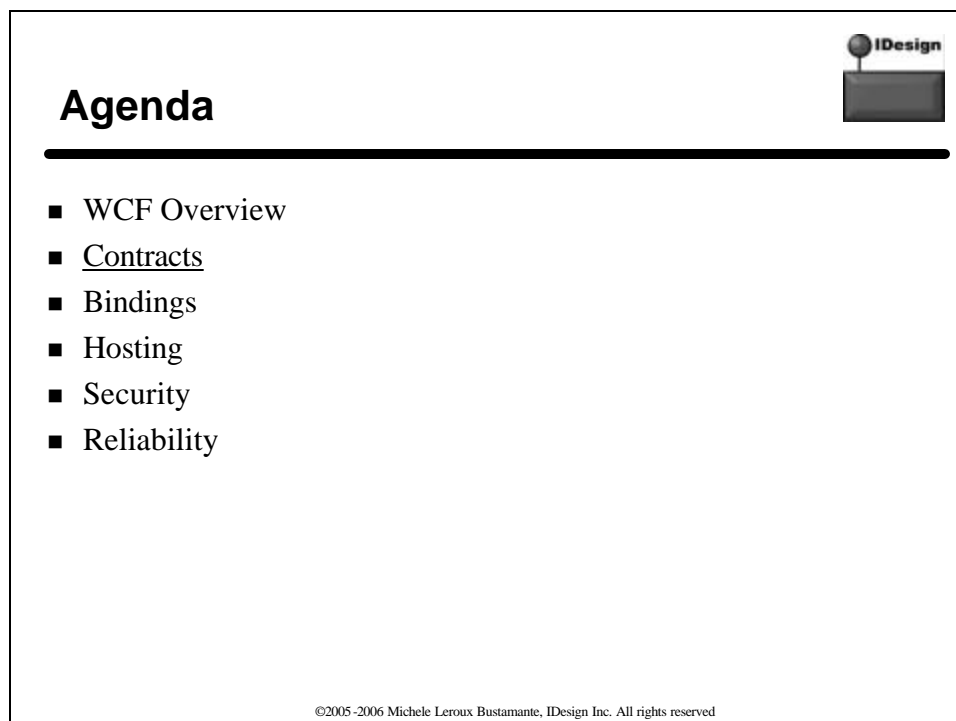
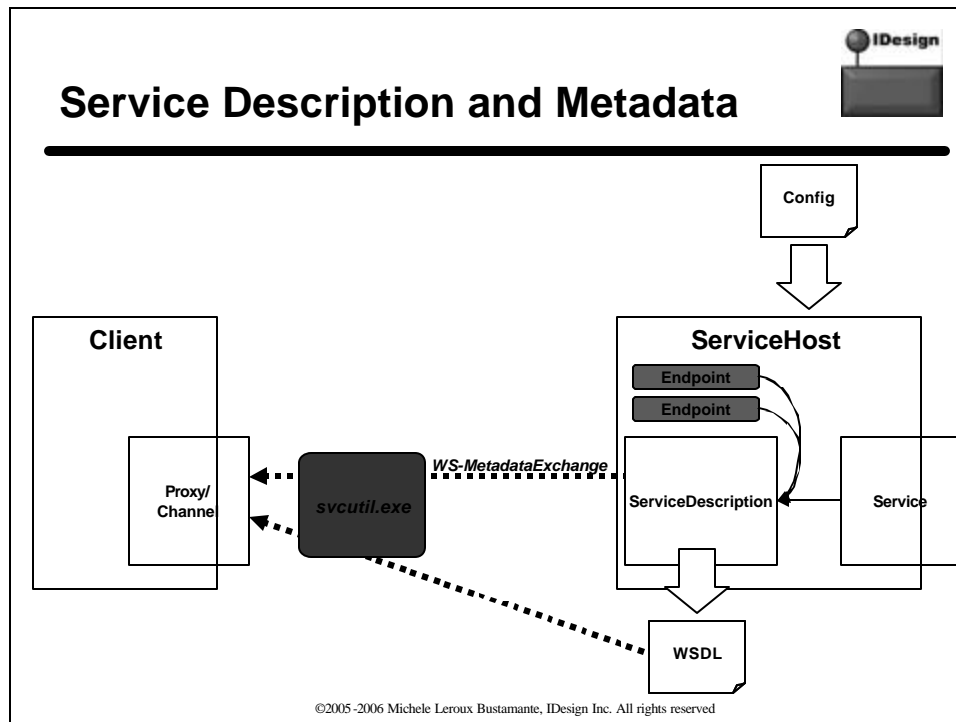
DEMO



- Creating and consuming a service

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Service Contracts

- Service Contract
 - ServiceContractAttribute
 - Describe service operations
 - Signatures, namespaces, message exchange pattern (MEP), fault contracts, known types

```
[ServiceContract(Namespace=
"http://www.thatindigogirl.com/samples/2006/06")]
public interface IHelloIndigoService
{
    [OperationContract]
    string HelloIndigo(string inputString);
}
```

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Service Contracts

- Operation Contract
 - OperationContractAttribute
 - Methods exposed as part of the public service contract
 - Opt-in to service contract

```
[ServiceContract(Namespace=
"http://www.thatindigogirl.com/samples/2006/06")]
public interface IHelloIndigoService
{
    [OperationContract]
    string HelloIndigo(string inputString);
}
```


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Data Contracts

- Data Contract
 - `DataContractAttribute`
 - Mechanism for describing CLR types in schema format
 - WCF preferred support for complex types in a service contract
- Data Member
 - `DataMemberAttribute`
 - Identify members to serialize along with the data contract
 - Applied to fields or properties
 - Opt-in

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DEMO

- Data contracts

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```
[DataContract(Name="LinkItem",Namespace="http://schemas.thatindigogirl.com/samples/2005/12/LinkItems")]
public class LinkItem
{
    // fields

    [DataMember(IsRequired = true, Order = 3)]
    public DateTime DateStart
    {
        get { return m_dateStart; }
        set { m_dateStart = value; }
    }

    [DataMember(IsRequired = true, Order = 2)]
    public string Description
    {...}

    [DataMember(IsRequired = false, Order = 0)]
    public long Id
    {...}

    [DataMember(IsRequired = true, Order = 1)]
    public string Title
    {...}

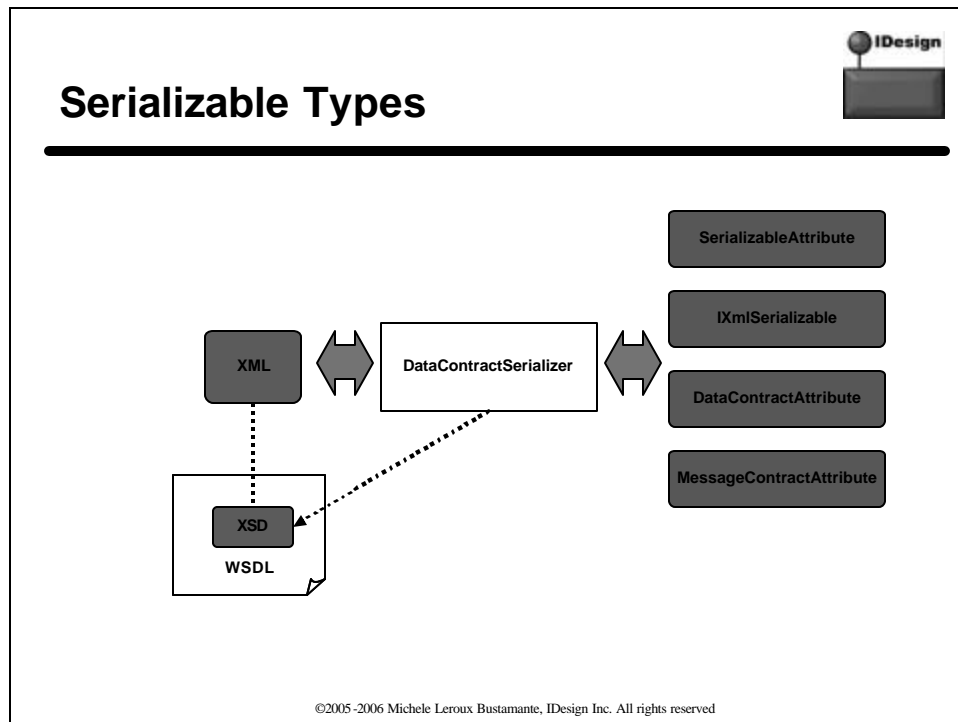
    // other properties
}
```

Serializable Types




- Data Contracts
- Serializable Types
 - SerializableAttribute, ISerializable
- XmlSerializer
 - Public members serialized
 - XmlXXXAttribute support to control serialization
- IXmlSerializable
 - Full control over serialization of type, supply schema
 - Requires deep knowledge of XML!

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- ## IDesign
- # Agenda
-
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 - Security
 - Reliability
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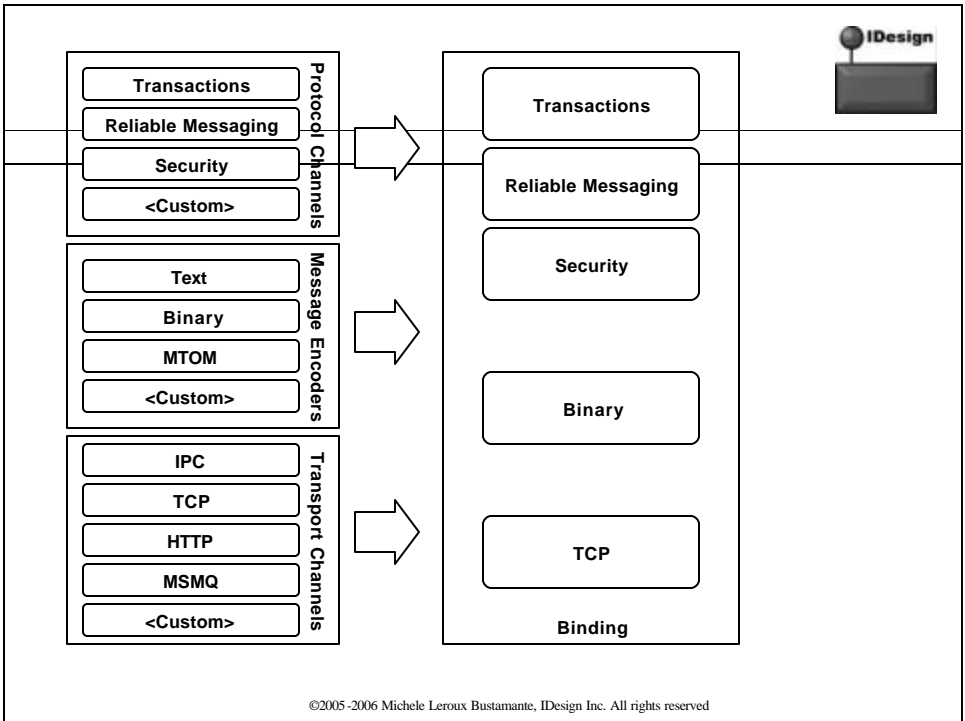



What is a Binding?

- Bindings are how we configure the communication channel
- Bindings are made up of binding elements
- Each binding element configures a part of the channel stack
- Protocol, transport, message encoder

```
<system.serviceModel>  
  <services>  
    <service name="HelloIndigo.HelloIndigoService">  
      <endpoint  
        contract="HelloIndigo.IHelloIndigoService"  
        binding="netTcpBinding" />  
    </service>  
  </services>  
</system.serviceModel>
```

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Standard Bindings

- **BasicHttpBinding** for SOAP 1.1 compatibility
- **WSHttpBinding** for SOAP 1.2 with WS*
- **WSDualHttpBinding** for callbacks over HTTP
- **WSFederationHttpBinding** for single sign-on (SSO) scenarios
- **NetNamedPipeBinding** for in-process or same machine calls
- **NetTcpBinding** for same machine or cross machine calls
- **NetPeerTcpBinding** for peer-to-peer mesh
- **NetMsmqBinding** reliable/transacted over MSMQ
- **MsmqIntegrationBinding** for MSMQ interop
- Create custom bindings to tailor beyond this list


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Customizing Standard Bindings

```
<system.serviceModel>
  <services>
    <service name="HelloIndigo.HelloIndigoService" >
      <endpoint binding="netTcpBinding"
        bindingConfiguration="netTcp"
        contract="HelloIndigo.IHelloIndigoService" />
    </service>
  </services>
  <bindings>
    <netTcpBinding>
      <binding name="netTcp"
        maxReceivedMessageSize="5000000" >
        <security mode="Message">
          <message clientCredentialType="Windows" />
        </security>
      </binding>
    </netTcpBinding>
  </bindings>
</system.serviceModel>
```


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Creating a Custom Binding

```
<system.serviceModel>
  <services>
    <service name="HelloIndigo.HelloIndigoService" >
      <endpoint binding="customBinding"
        bindingConfiguration="custom"
        contract="HelloIndigo.IHelloIndigoService" />
    </service>
  </services>
  <bindings>
    <customBinding>
      <binding name="custom">
        <security authenticationMode="SspiNegotiated">
          <localServiceSettings detectReplays="true" />
        </security>
        <textMessageEncoding />
        <httpTransport maxReceivedMessageSize="5000000" />
      </binding>
    </customBinding>
  </bindings>
</system.serviceModel>
```


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Hosting Options

- Self Host
 - Console application, Windows application, Windows service
 - HTTP, TCP, IPC, MSMQ
 - The only option today for non-HTTP services
- IIS/ASP.NET
 - HTTP only
 - The best choice today for HTTP services
- Windows Activation Service (WAS)
 - HTTP, TCP, IPC, MSMQ
 - The ultimate choice, use when possible

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ServiceHost

- Regardless of hosting environment, there is always a ServiceHost for each type

```
Uri baseAddress = new
Uri(Properties.Settings.Default.baseAddress);

using (ServiceHost host = new
ServiceHost(typeof>HelloIndigo.HelloIndigoService),
baseAddress))
{
    host.Open();
    Console.WriteLine("Press <ENTER> to terminate Host");
    Console.ReadLine();
}
```

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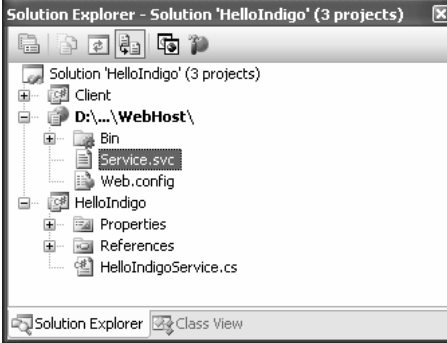


IIS Hosting


- Requires a .svc endpoint for IIS to map requests

```
<% @ServiceHost Language=C# Debug="true "  
Service="HelloIndigo.HelloIndigoService" %>
```

- Service type is found through @Service attributes
- ServiceHost instantiated for service type




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DEMO

- Hosting in IIS


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Hosting Features

- Basics
 - Process and application domain
 - External service configuration
- Extended Features
 - Service activation
 - Health monitoring and recycling
 - Management tools
 - Only provided by IIS/WAS

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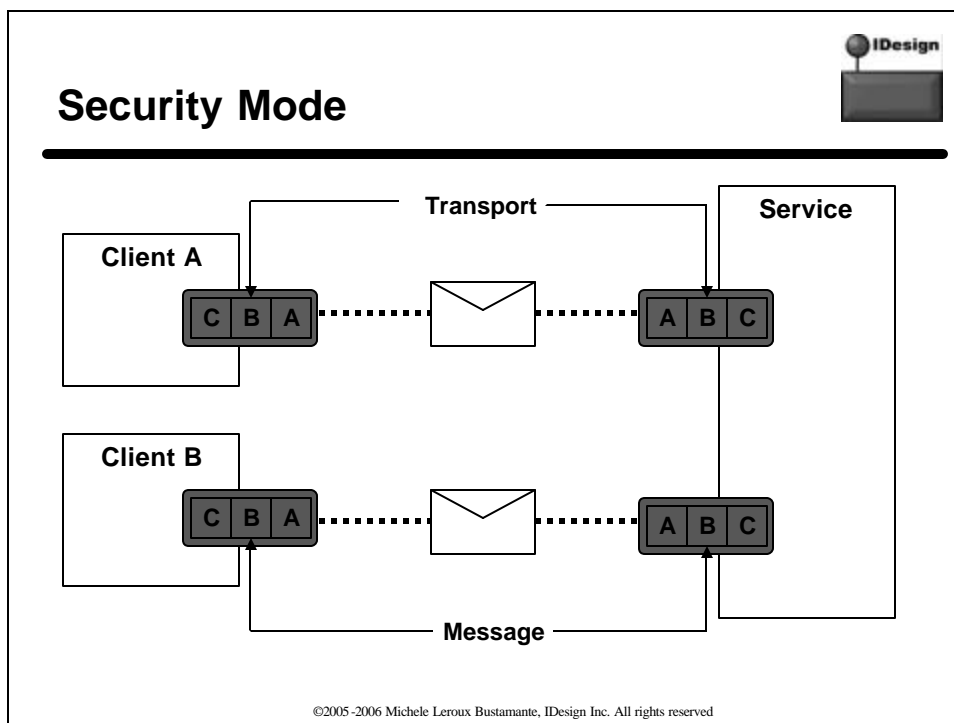
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IDesign

Security Goals

- Mutual Authentication – means for sender and receiver to verify who they are communicating with
- Confidentiality – encoding messages so that only the intended recipient can decode it, using encryption
- Message Integrity – to ensure messages are not altered between points, using digital signatures
- Message Reliability – preventing message replay and denial of service (DoS)

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Security Mode

- Transport Security

```
<netTcpBinding>  
  <binding name="netTcpTransportSecurity">  
    <security mode="Transport">  
      <transport  
clientCredentialType="Windows " />  
    </security>  
  </binding>  
</netTcpBinding>
```

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Security Mode

- Message Security

```
<wsHttpBinding>  
  <binding name="wsHttpMessageSecurity">  
    <security mode="Message">  
      <message  
clientCredentialType="UserName " />  
    </security>  
  </binding>  
</wsHttpBinding>
```


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Authentication

- WCF is a claims-based system
- Credentials include claims
 - Username and password
 - Windows credentials
 - X.509 certificates
 - Issued SAML tokens (including CardSpace claims)
- Tokens are used to present claims
 - Binary or XML


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Message Protection

- Can sign and/or encrypt communications
 - At transport or message level
 - Can still use transfer credentials in message while using transport level protection
- Configurable
 - Algorithms
 - Signing tokens
 - Encryption tokens
 - Secure sessions


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Reliability Features

- Transactions
- Reliable message queue
- Reliable Messaging (RM)

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Transactions

- WCF supports distributed transactions
 - OleTransactions: cross process and network boundaries
 - WSAAtomicTransactions: cross service boundaries over HTTP
 - ▲ OASIS specification WS-TX, not yet ratified

```
<netTcpBinding>
  <binding name="netTcpTransactions "
transactionFlow="true "
transactionProtocol="OleTransactions">
  </binding>
</netTcpBinding>
```


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Transactions Configuration

- Service and operation level behaviors also control transaction features such as:
 - Isolation level
 - If the caller must flow a transaction
 - If the operation will require/use a transaction
- TransactionScope (.NET 2.0 feature) can be used by clients to flow transactions to services


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Messaging Queuing

- Message queues (MSMQ) increase system availability and scale-out potential
 - Reliability and replay
 - Asynchronous messaging
 - Distributed queue readers
- Transactional queues
 - Participate in distributed transaction
 - Guaranteed message received
- Admins should handle dead letter queue accordingly
- NetMsmqBinding

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Reliable Messaging

- Creates a reliable session (disabled by default)
- Provides messaging guarantees
 - Deliver exactly once, deliver in order, delivery notification
- Missing acknowledgements trigger retry
 - Resiliency to transient communication failure

```
<bindings>
  <wsHttpBinding>
    <binding name="wsHttpBindingRM">
      <reliableSession enabled="true"
ordered="true" inactivityTimeout="00:10:00" />
    </binding>
  </wsHttpBinding>
</bindings>
```


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DEMO

- Reliable messaging


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Local WCF Events

- October 3 – San Diego .NET Developers Group
 - Service Design, Contracts and Versioning
- October 9-10 – LA .NET 3.0 Road Show with IDesign
- October 28 – Full Day WCF Hands-On in LA
- November 13-15 – WCF Hands-On 3 days at UCSD Extension
- See www.dasblonde.net for links

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Resources

- My Book
 - Learning Windows Communication Foundation, 2006, O'Reilly
 - Available online now: <http://www.thatindigogirl.com>
- My Blog
 - <http://www.dasblonde.net>
- IDesign
 - <http://www.idesign.net>

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