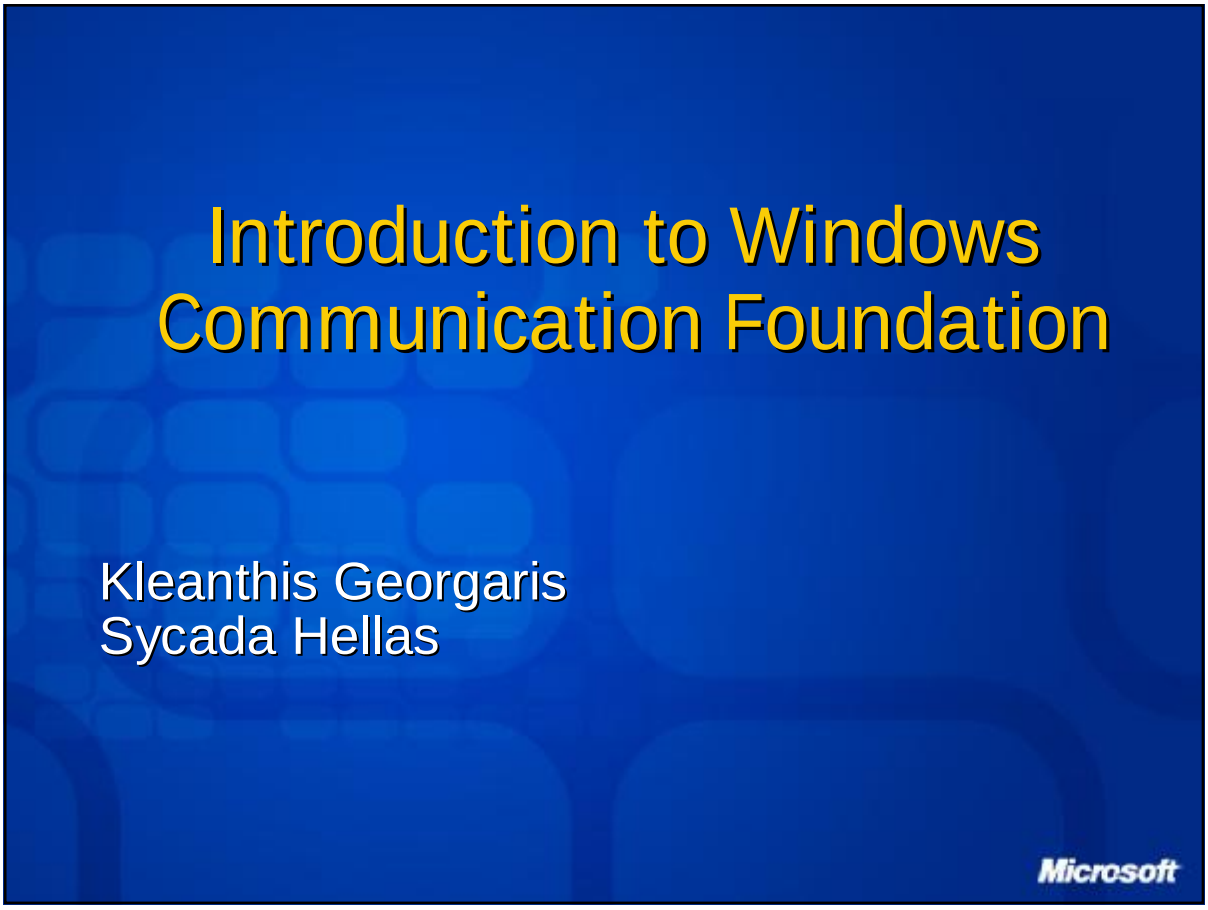

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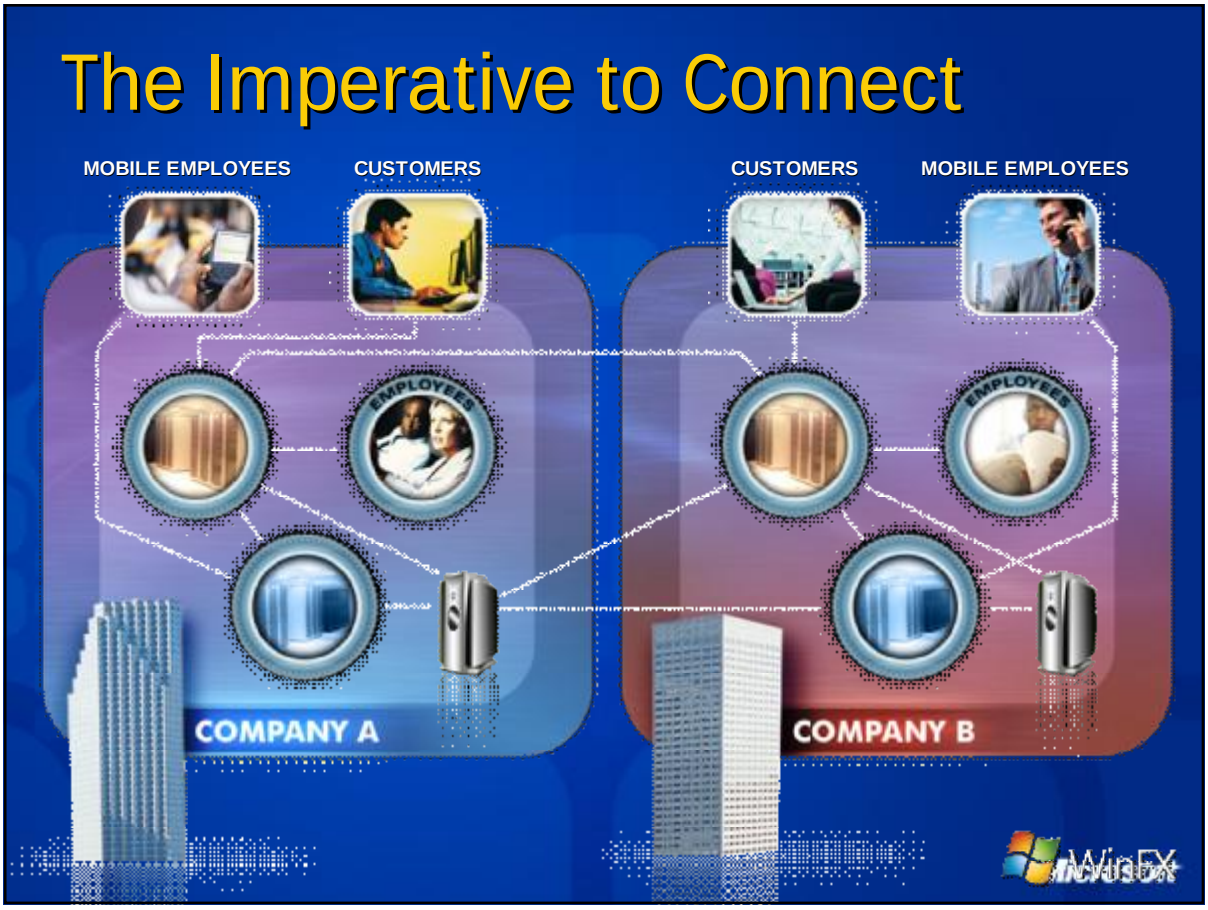

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What We Hear From You

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What is WCF?

The Unified Programming Model For Rapidly Building Service-Oriented Applications

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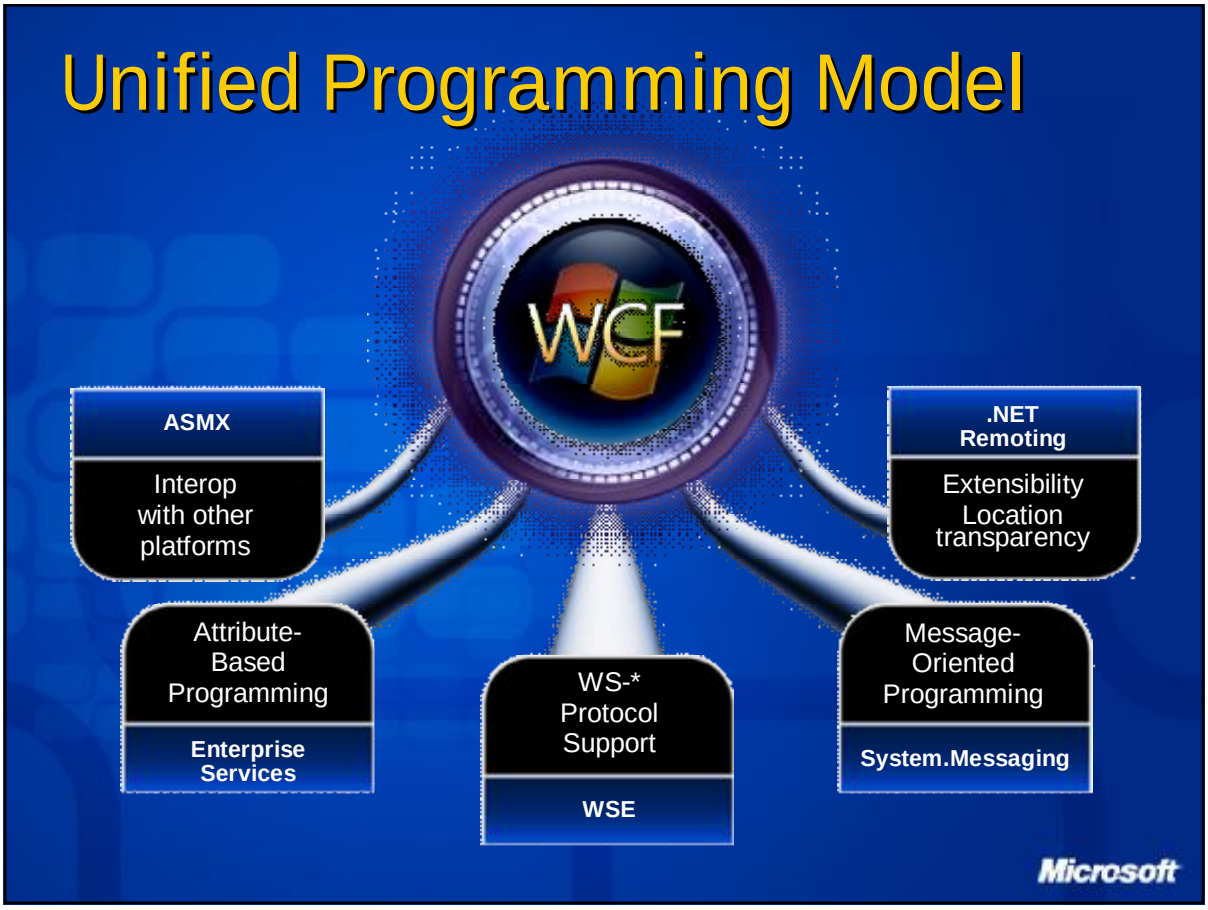

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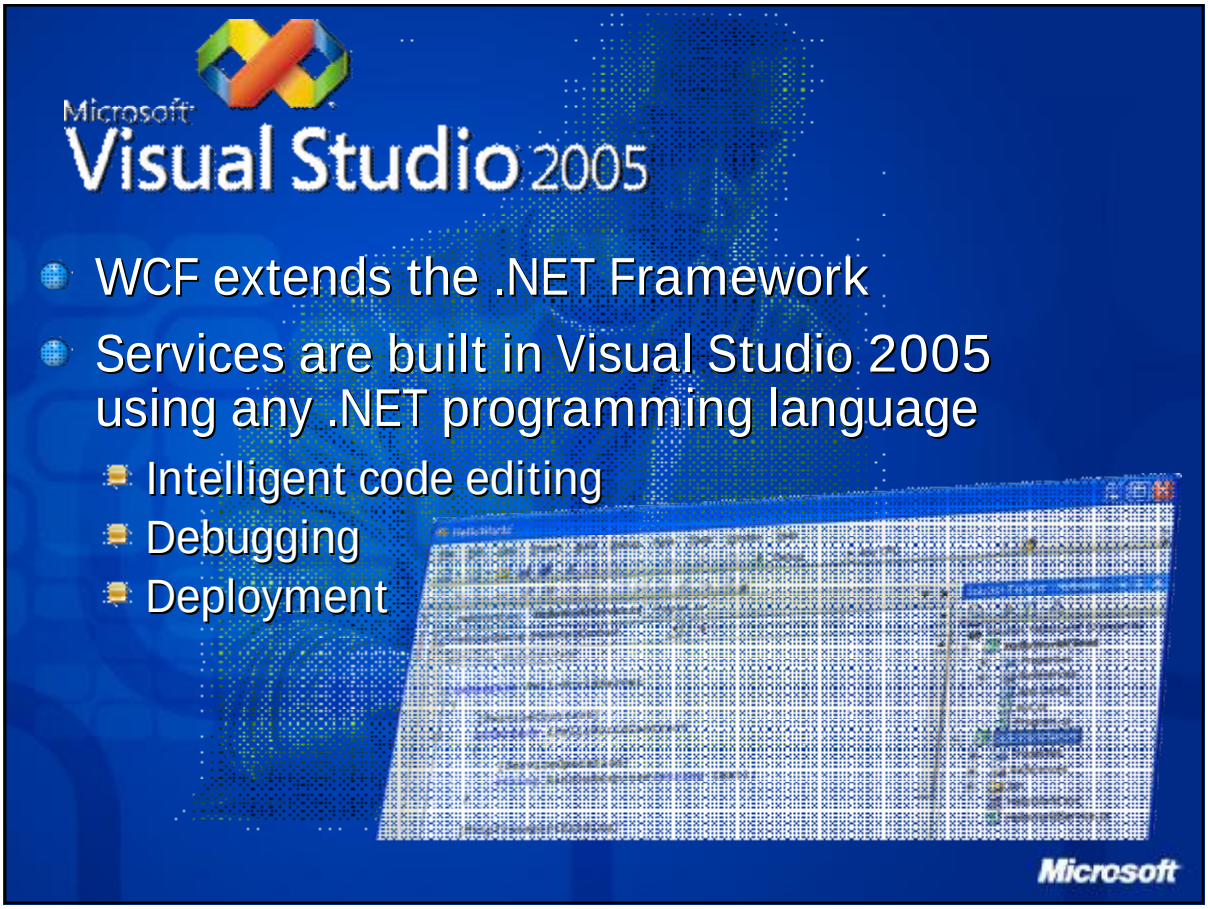

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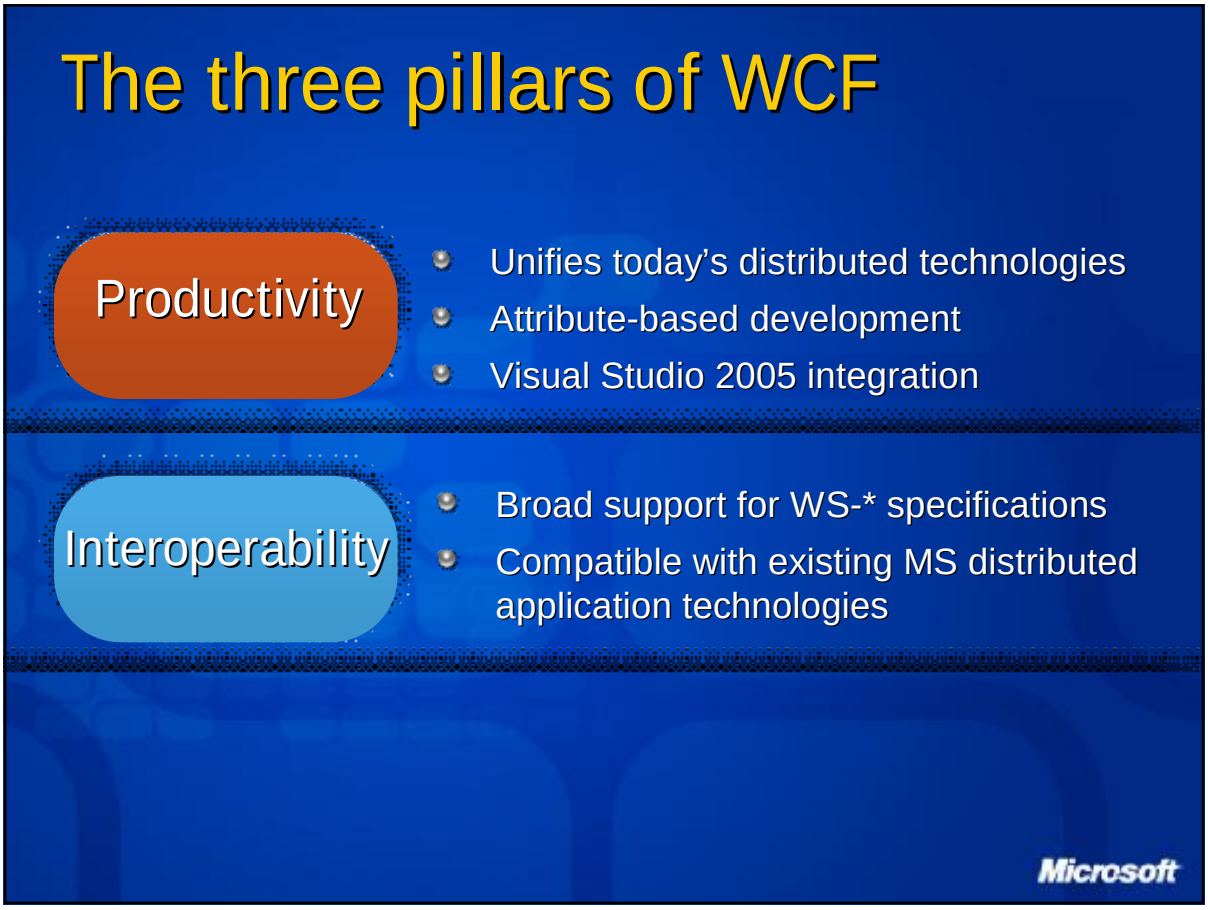

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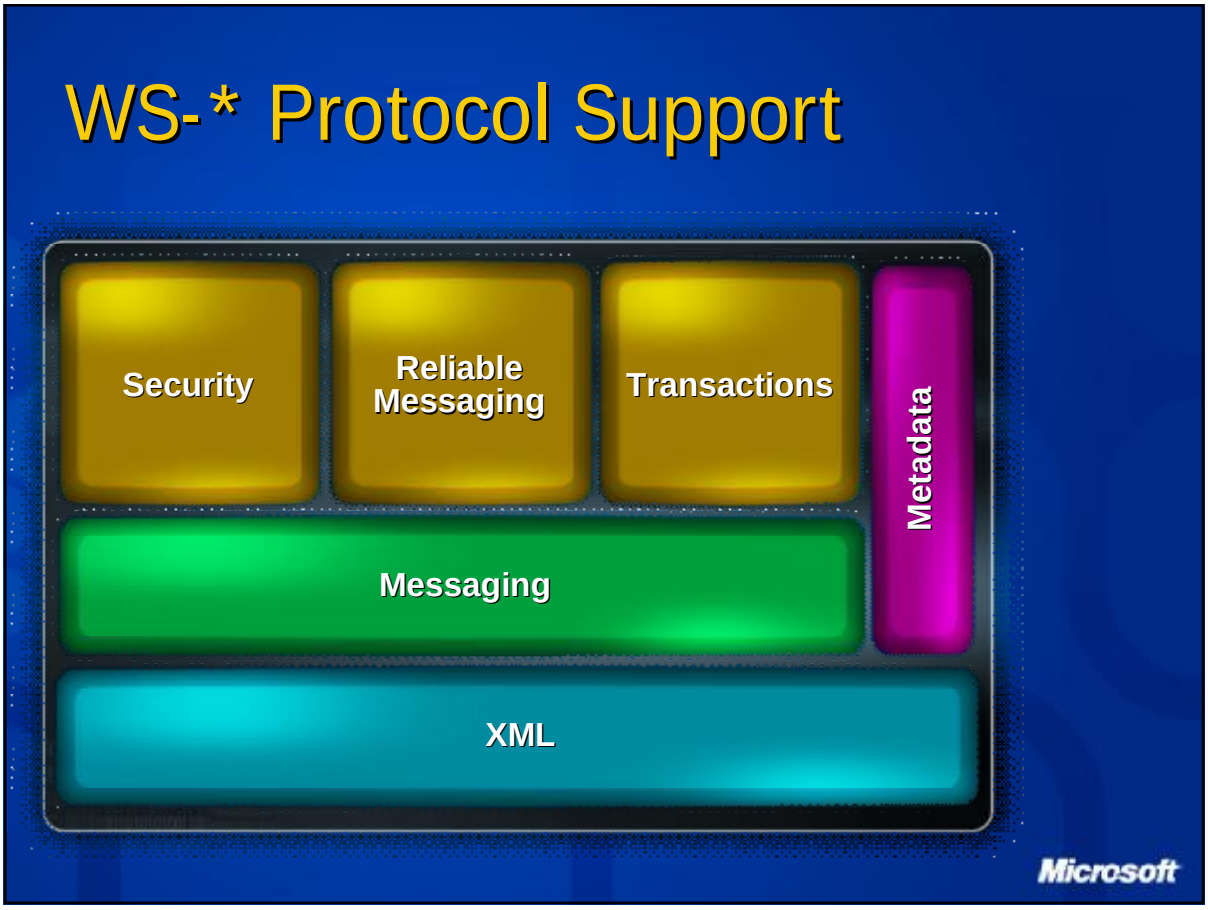

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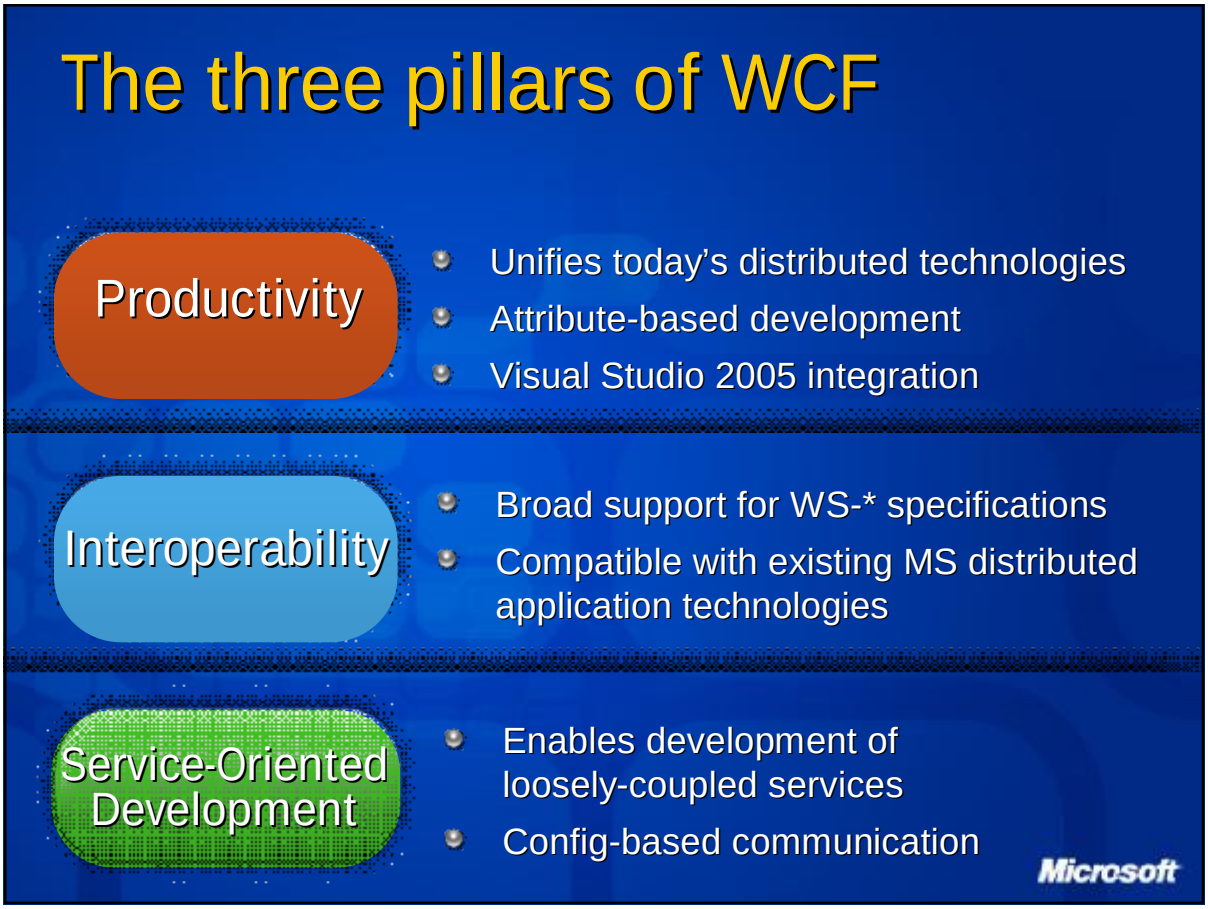

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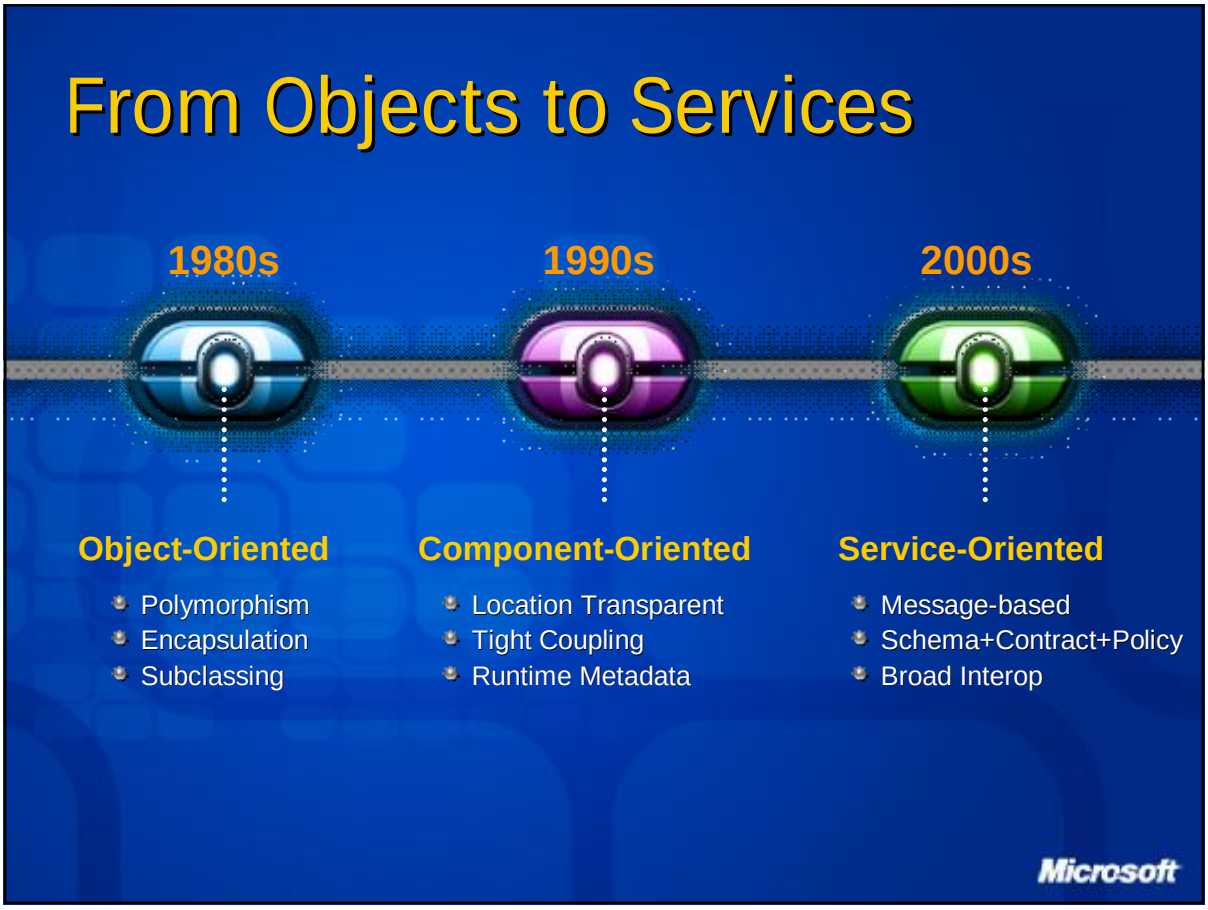

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Four Tenets of Service Orientation

Boundaries are Explicit	Developers opt-in to consuming, exposing, and defining public-facing service façade.
Services are Autonomous	Services and consumers are independently versioned, deployed, operated, and secured.
Share Schema & Contract, Not Class	Types are structural *or* behavioral, never both. Objects are a local phenomenon.
Policy-based Service Compatibility	Capabilities/requirements represented by name and used to establish service suitability.

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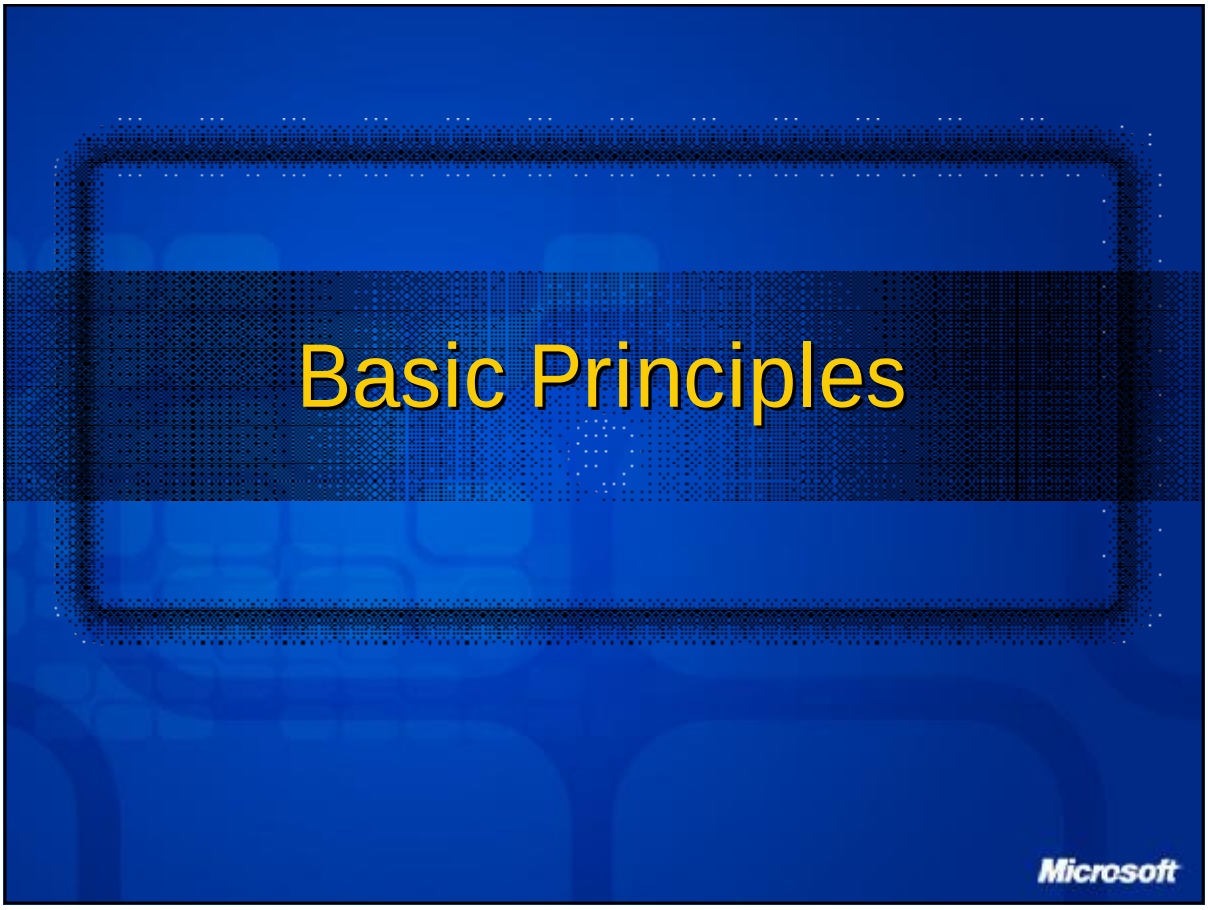

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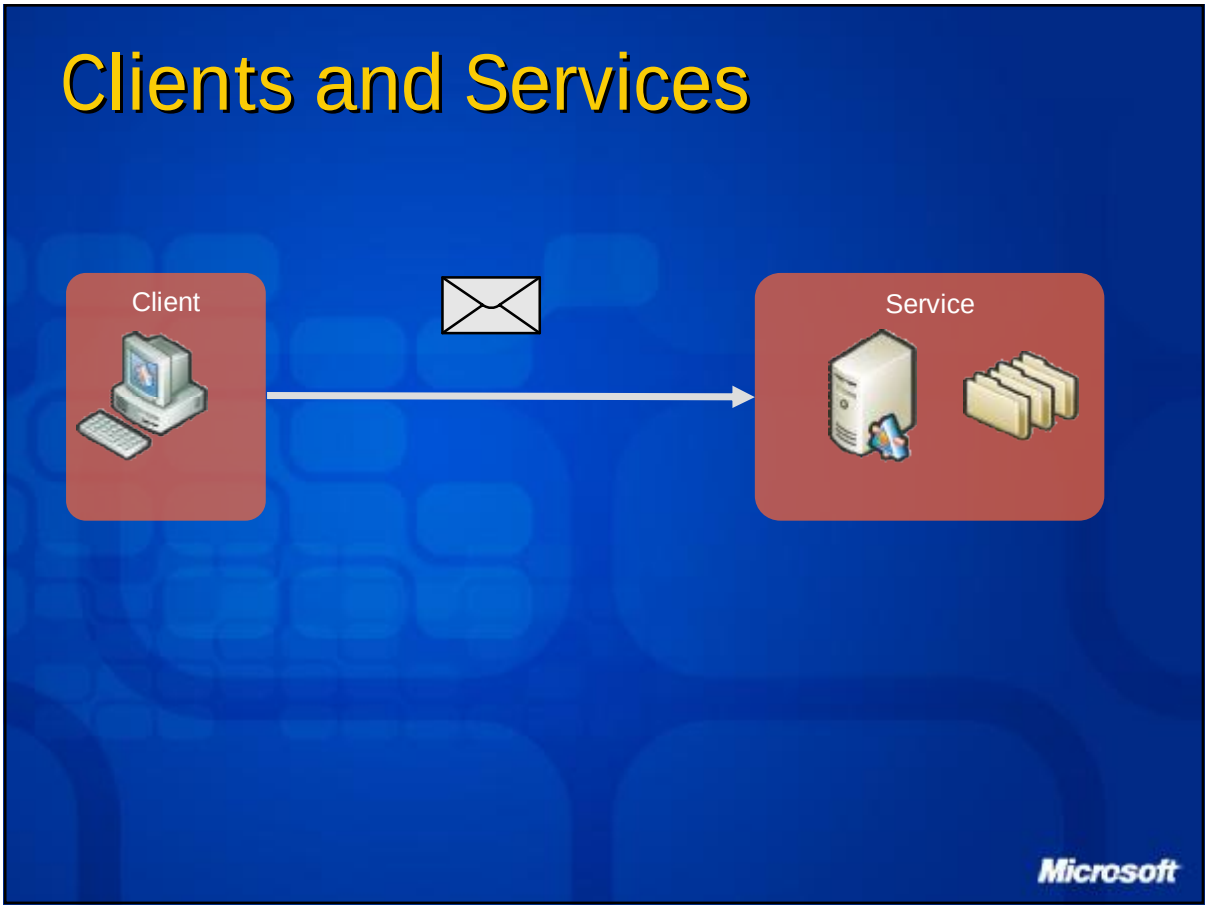

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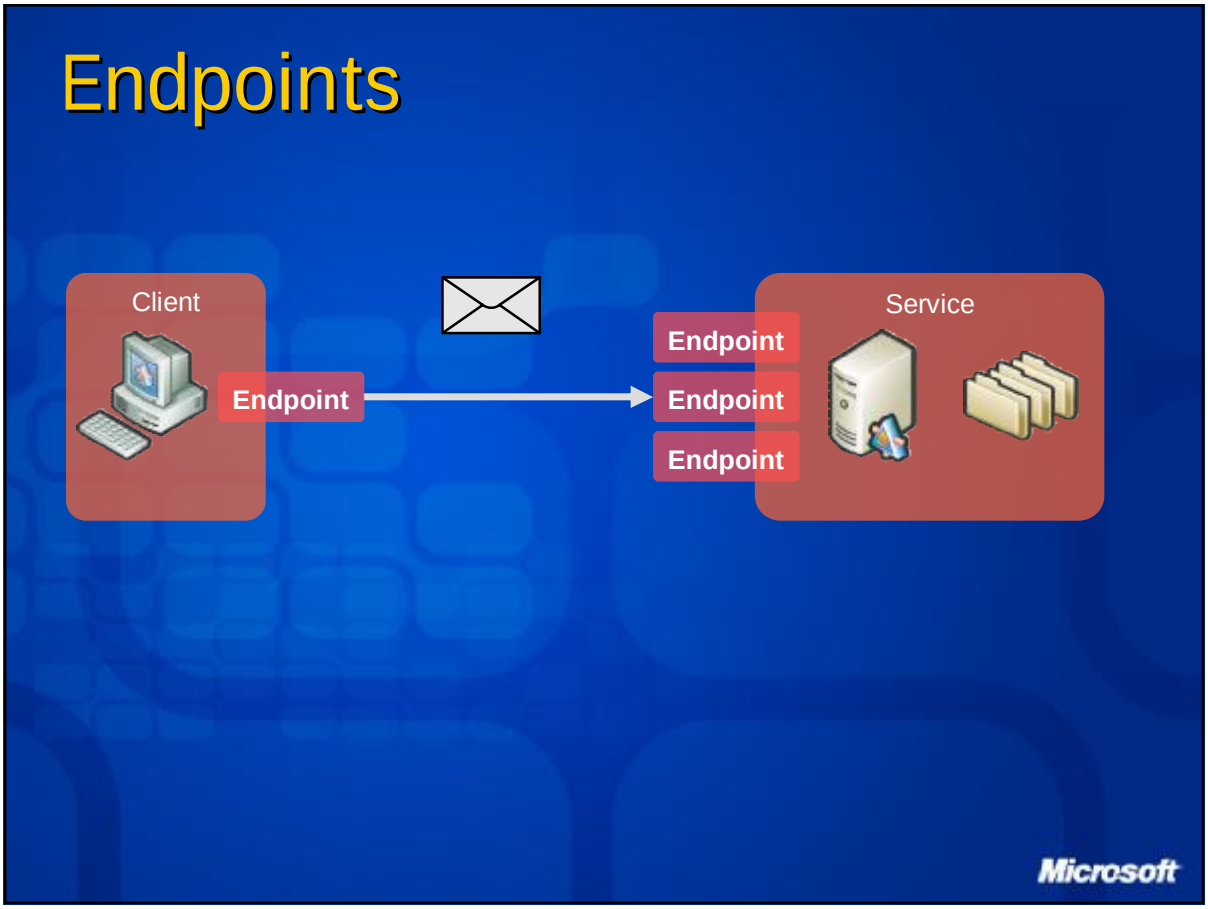

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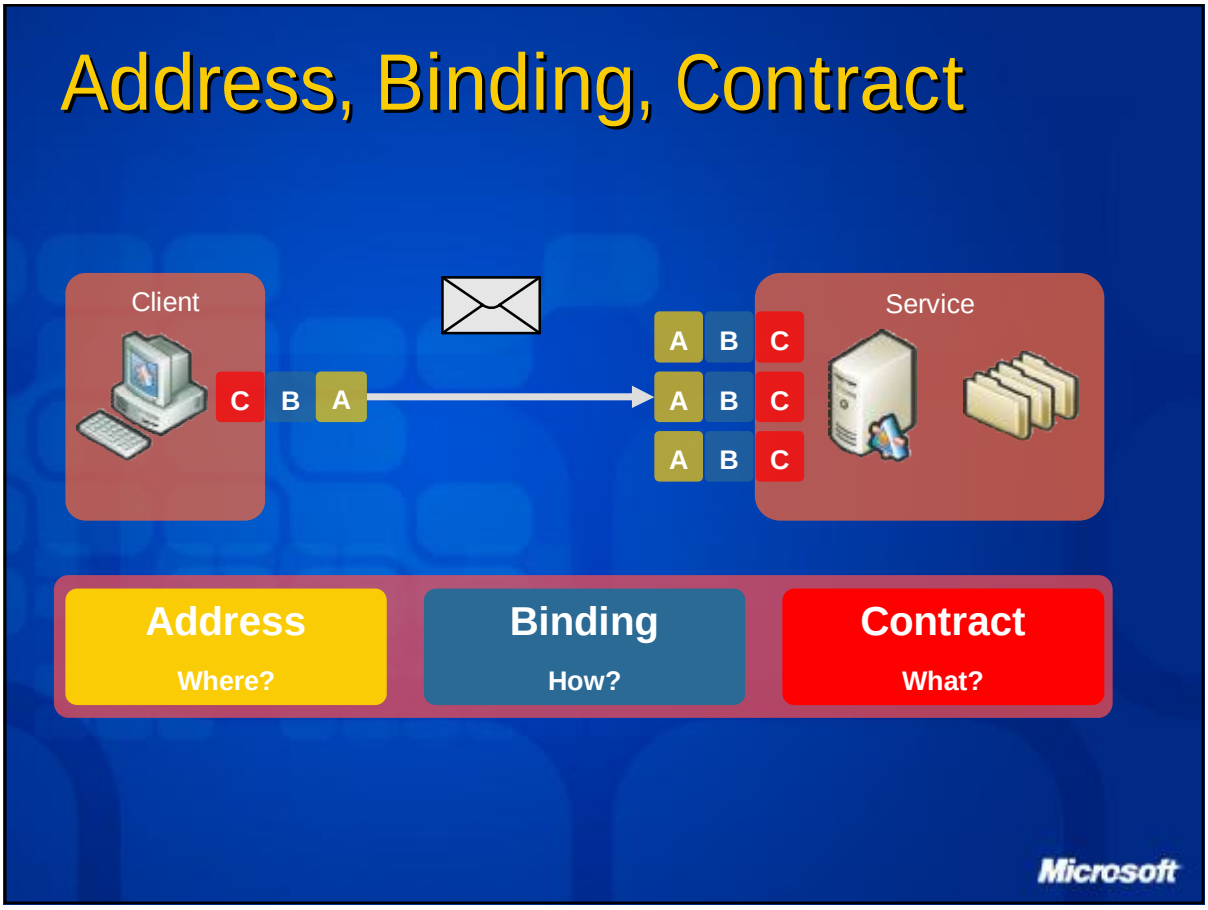

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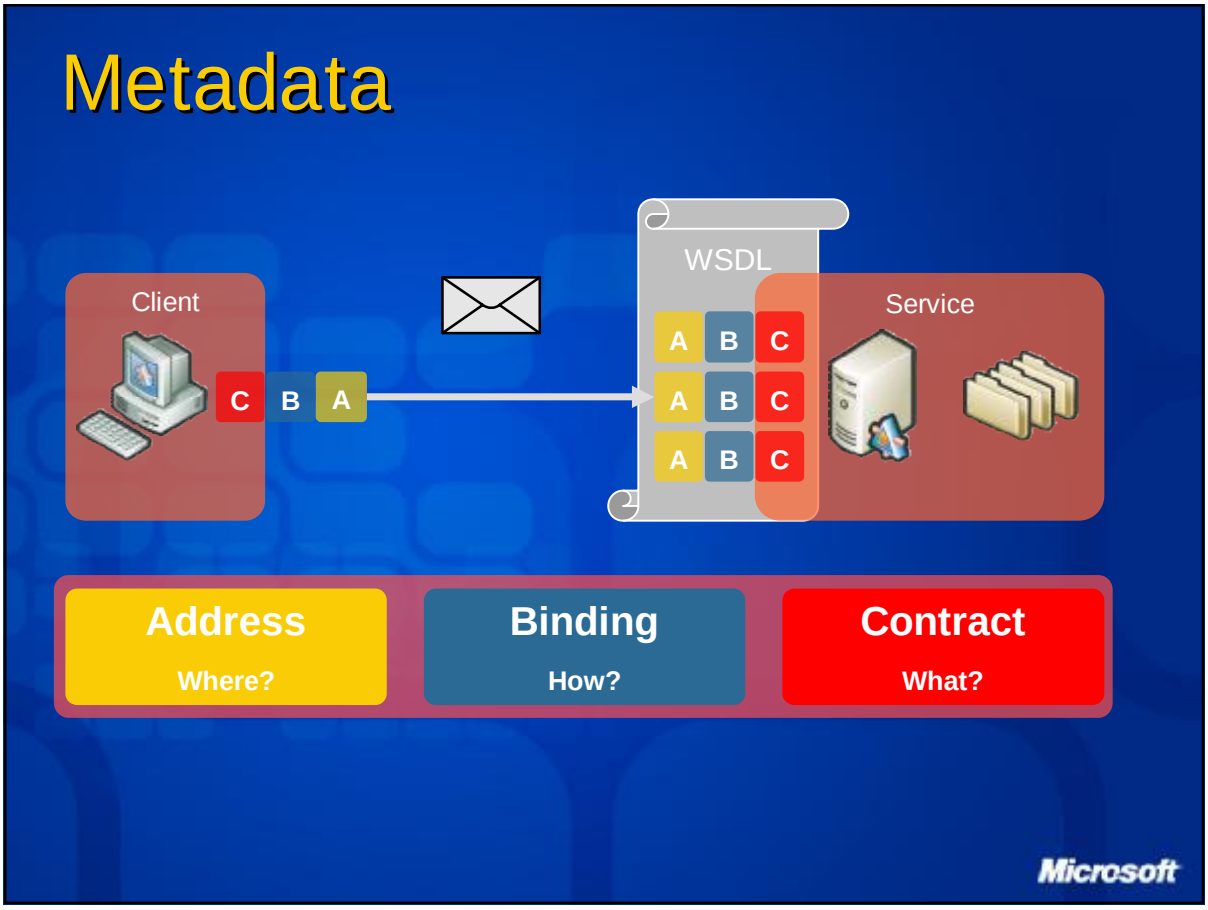

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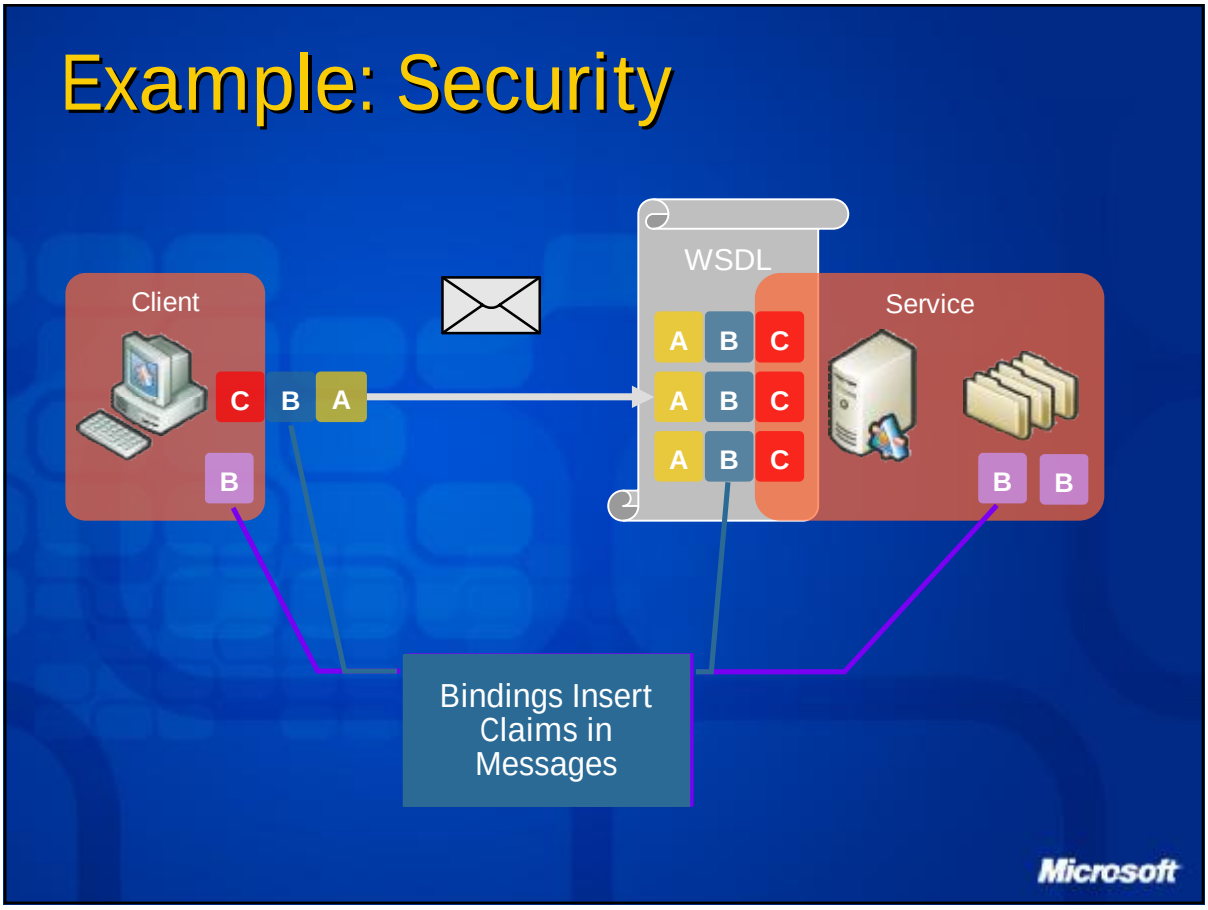

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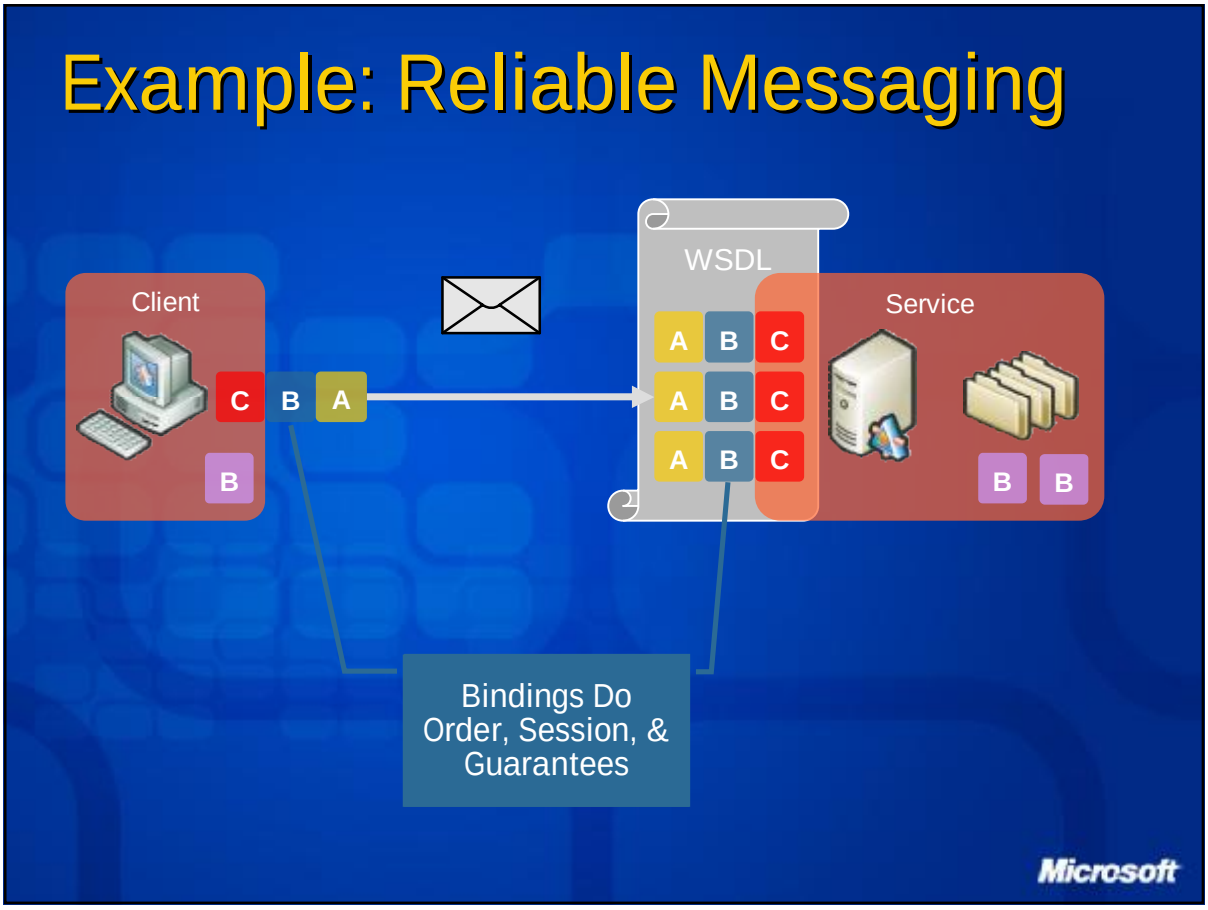
Example: Reliable Messaging



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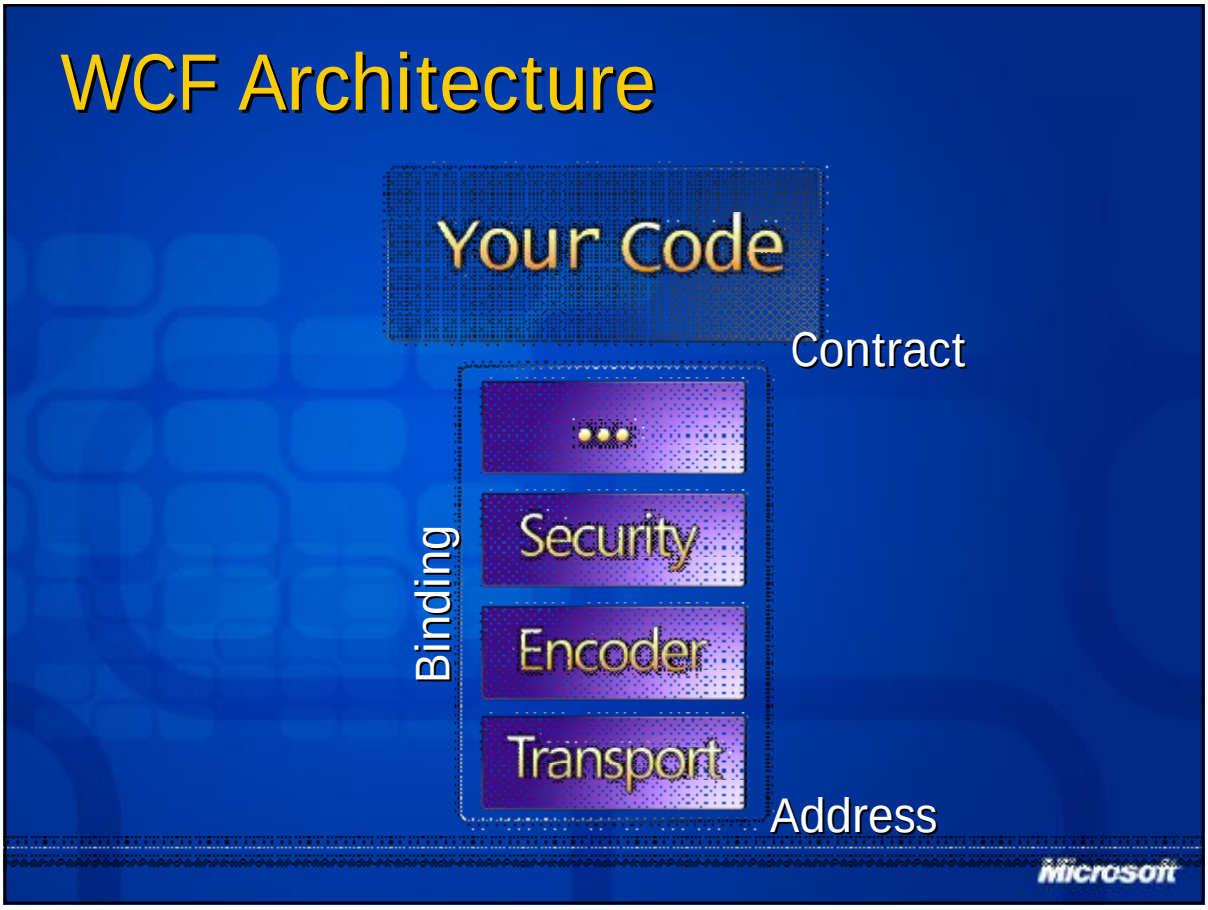

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Creating a Service

1. Define Contract(s)
2. Implement Contract(s)
3. Define Endpoint(s)
4. Host & Run Service (F5)

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Service Contracts

- Define Set of Related Messages

```
// using interface
[ServiceContract]
public interface IOrderProcessingService
{
       [OperationContract(IsOneWay = true)]
       void ProcessOrder(OrderDetail detail);
}

// using class (when a service implements one contract)
[ServiceContract]
public class OrderProcessingService
{
       [OperationContract(IsOneWay = true)]
       void ProcessOrder(OrderDetail detail) { }
}
```

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Data Contracts

- Define Message Content

```
[DataContract]
public class OrderDetail
{
    [DataMember]
    public string ItemName { get; set; }

    [DataMember]
    public Guid ItemId { get; set; }

    [DataMember]
    public double ItemPrice { get; set; }
}
```

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Implementing Contracts

- A Service is a CLR Class that Implements One or More Service Contracts

```
[ServiceContract]
public interface IOrderProcessingService
{
    [OperationContract(IsOneWay = true)]
    void ProcessOrder(OrderDetail detal);
}

class OrderProcessingService : IOrderProcessingService
{
    public void ProcessOrder(OrderDetail detail) { ... }
}
```

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Defining Endpoints

1. Defines *What* to Expose (Contract)
2. Define *How* to Expose (Binding)
3. Define *Where* to Expose (Address)

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Bindings

	Interop	Security	Session	Transactions	Duplex	Streaming	Queueing
BasicHttpBinding	BP 1.0	T					
WsHttpBinding	WS	T | S	X	X			
WsDualHttpBinding	WS	T | S	X	X	X		
NetTcpBinding	.NET	T | S	X	X	X	O	
NetNamedPipeBinding	.NET	T | S	X	X	X	O	
NetMsmqBinding	.NET	T | S	X	X			O
CustomBinding	*	*	*	*	*	*	*

T = Transport Security | S = WS-Security | O = One-Way Only

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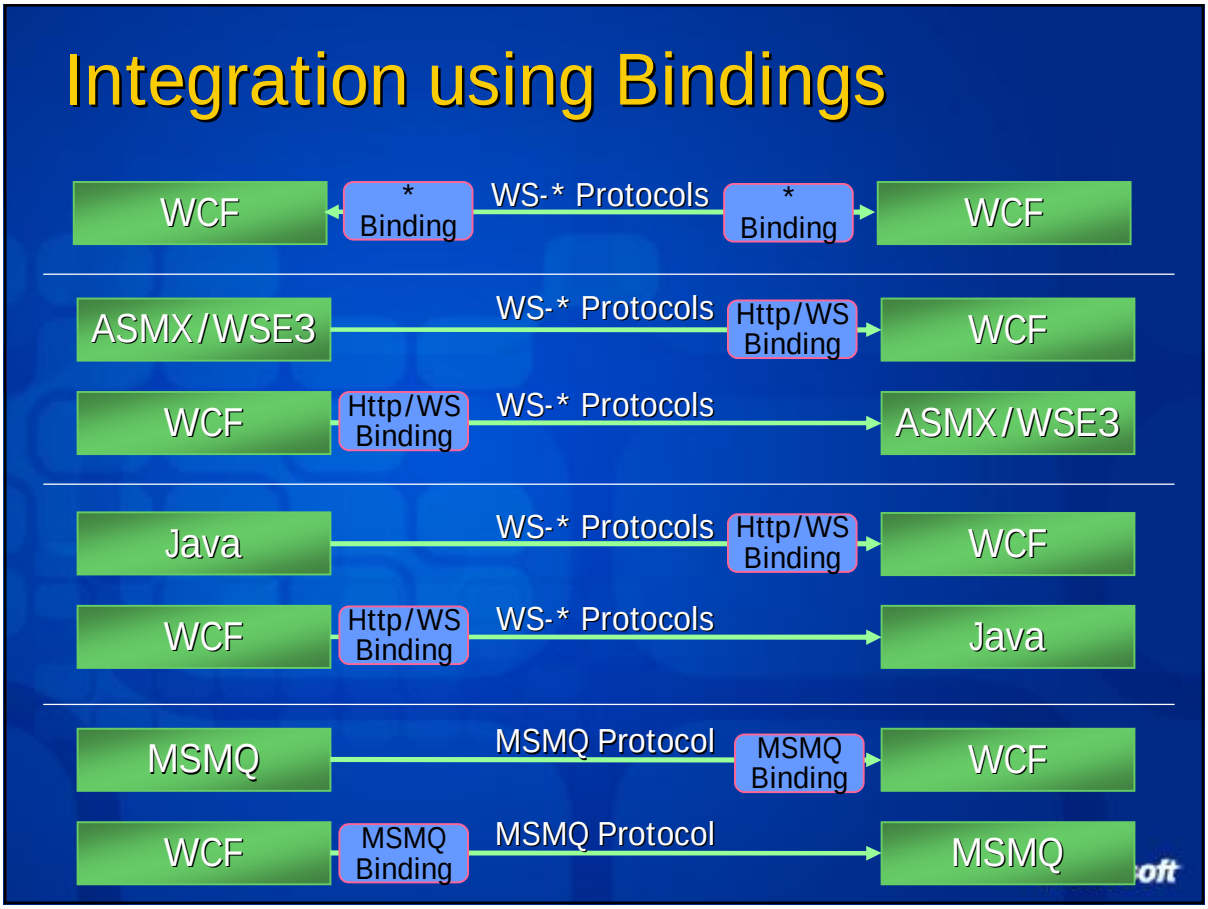

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Bindings: Config

```
<configuration>
   <system.serviceModel>
      <bindings>
         <basicHttpBinding>
            <binding name="Secure"
               securityMode="Https" />
         </basicHttpBinding>
      </bindings>
      <services>
         <service serviceType="Math">
            <endpoint
               address="BpEndpoint"
               binding="basicHttpBinding"
               bindingConfiguration="Secure"
               contract="IOrderProcessingService" />
         </service>
      </services>
   </system.serviceModel>
</configuration>
```

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Bindings: Code

```
[ServiceContract]
public class OrderProcessingService
{
    [OperationContract(IsOneWay = true)]
    public void ProcessOrder(OrderDetail detail) { }
}

public static void Main(string[] args)
{
    ServiceHost host =
        new ServiceHost(typeof(OrderProcessingService),
        “http://localhost/OrderService/”);

    BasicHttpBinding binding = new BasicHttpBinding();
    binding.SecurityMode = BasicProfileSecurityMode.Https;
    host.AddEndpoint(typeof(OrderProcessingService),
        binding, “BpEndpoint”);

    host.Open();
}
```

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Addresses

```
http://microsoft.com:80/OrderService/WS
https://microsoft.com:443/OrderService/BP
net.tcp://microsoft.com:808/OrderService/TCP
net.pipe://microsoft.com/OrderService/NP
```

Scheme	http, https, net.tcp, net.pipe
Host Name	microsoft.com
Port (Optional) *	80, 443, 808
Base Path	/OrderService/
Endpoint Address	WS, BP, TCP, NP

* - Port Does Not Apply to Named Pipes

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ServiceHost

- Allows a WCF Service to be Hosted in Any AppDomain
  - EXE, NT Service, WinForms, Avalon, etc.

```
public static void Main(string[] args)
{
    ServiceHost host = new ServiceHost(
        typeof(OrderProcessingService);

    host.BaseAddresses.Add(
       new Uri("http://localhost/OrderService/"));

    host.Open();
}
```

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Creating a Client

1. Generate Proxy from Metadata
2. Implement & Run Client (F5)

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Consuming Metadata

```
svcutil.exe (mex address | ?wsdl address)
```

- Retrieves Service Metadata
- Generates Code and Config
  - Addresses and Bindings Go in Config
  - Contracts Go in Code

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Generated Proxy

```
// autogenerated by Visual Studio “Add Reference”

public partial class OrderProcessingServiceProxy :
    ClientBase<IOrderProcessingService>, IOrderProcessingService
{
    public OrderProcessingServiceProxy()
    { ... }

    public OrderProcessingServiceProxy(string configurationName)
    { ... }

    public OrderProcessingServiceProxy(EndpointAddress address,
        Binding binding)
    { ... }

    public void ProcessOrder(OrderDetail detail)
    { ... }

    // rest of operations
}
```

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Generated Config

```
<!-- autogenerated by Visual Studio “Add Reference” -->

<system.serviceModel>
    <client>
        <endpoint
            name=“IOrderProcessingService"
            address="http://localhost/OrderService/"
            bindingSectionName="basicProfileBinding"
            contractType=“IOrderProcessingService" />
    </client>
</system.serviceModel>
```

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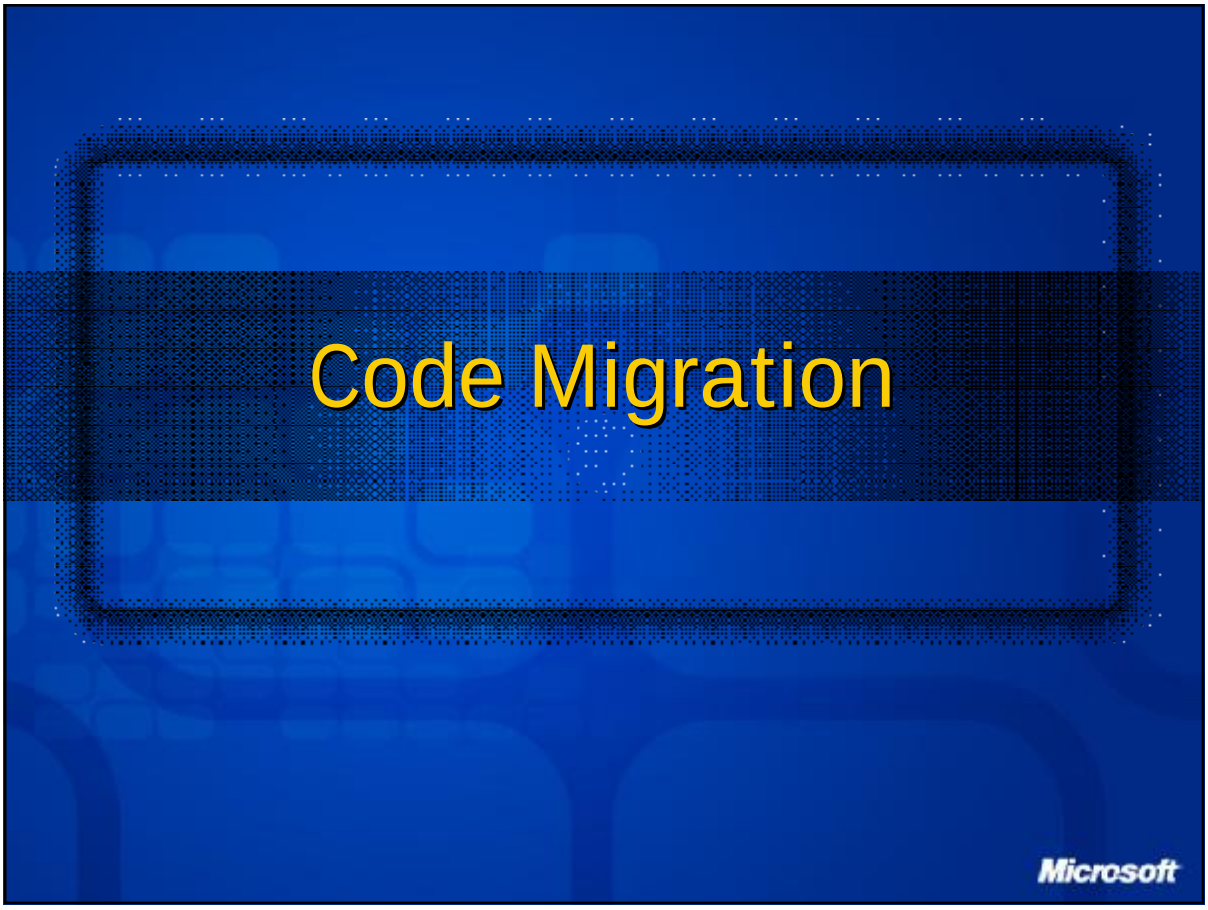

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ASMX to WCF

```
using System.Web.Services;
using System.ServiceModel;
public class AccountingOperation
{
    public string AccountName;
    public long Amount;
}


[ServiceContract(FormatMode=ContractFormatMode.XmlSerializer)]
public class Accounting
{
    //
    [OperationContract]
    [WebMethod(TransactionOption=TransactionOption.RequiresNew)]
    public int AddEntry(AccountingOperation debit,
                        AccountingOperation credit)
    {
        // Add entry to internal accounting book
        // return id.
    }
}
```

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Enterprise Services to WCF

```
using System.EnterpriseServices;
using System.ServiceModel;
[ComponentAccessControl]
[SecureMethod]
[Transaction(TransactionOption.Required)]
[ServiceContract]
public class Accounting : ServicedComponent
{
  [OperationContract]
  [OperationBehavior(AutoEnlistTransaction=true)]
  [PrincipalPermission(SecurityAction.Demand, Role="Managers")]
  [SecurityRole("Manager")]
  public void AddCreditEntry(string creditAccount, int creditAmount)
  {

  }
}
```

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WSE to WCF

```
//using Microsoft.Web.Services3;
using System.ServiceModel;

//[WebService]
[ServiceContract]
class HelloWorld
{
    [OperationContract]
    [PrincipalPermission(SecurityAction.Demand, null,
    "BUILTIN\Administrators")]
    //[WebMethod]
    public string Hello (string text)
    {
     //MessageSignature signature = (MessageSignature)
     // RequestSoapContext.Current.Security.Elements[0];
     // if (!signature.SigningToken.Principal.IsInRole
     //    ("BUILTIN\Administrators"))
     //      throw new AuthorizationException("Access denied");

        return String.Format("Hello, {0}", text);
    }
}
```

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System.Messaging to WCF

```
using System.Messaging;
using System.ServiceModel;

[ServiceContract]
class MyQService
{
  //public void ReceiveOrders()
  //{
    //MessageQueue Queue = new MessageQueue(@".\private$\Books");
    //XmlMessageFormatter formatter = new XmlMessageFormatter(
                      new Type[] { typeof(System.Data.DataSet)});
    //Queue.Formatter = formatter;
    //System.Messaging.Message msg = null;
    //while((msg= Queue.Receive()) != null)
    //{
    //   DataSet booklist = (DataSet) msg.Body;
    //   ProcessOrders(booklist);
    //}
  //}
    [OperationContract(IsOneWay = true)]
    Public void ProcessOrder(DataSet BookList) { ... }

}
```

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.NET Remoting to WCF

```
using System.Runtime.Remoting;
using System.ServiceModel;
[Serializable]
public class AccountingOperation
{
    public string AccountName;
    public long Amount;
}
[ServiceContract]
public class Accounting : MarshalByRefObject
{
   [OperationContract]
   public int AddEntry(AccountingOperation debit,
                       AccountingOperation credit)
    {
        // Add entry to internal accounting book
        // return id.
    }
}
```

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Introduction to Windows Communication Foundation

Kleanthis Georgaris
Sycada Hellas

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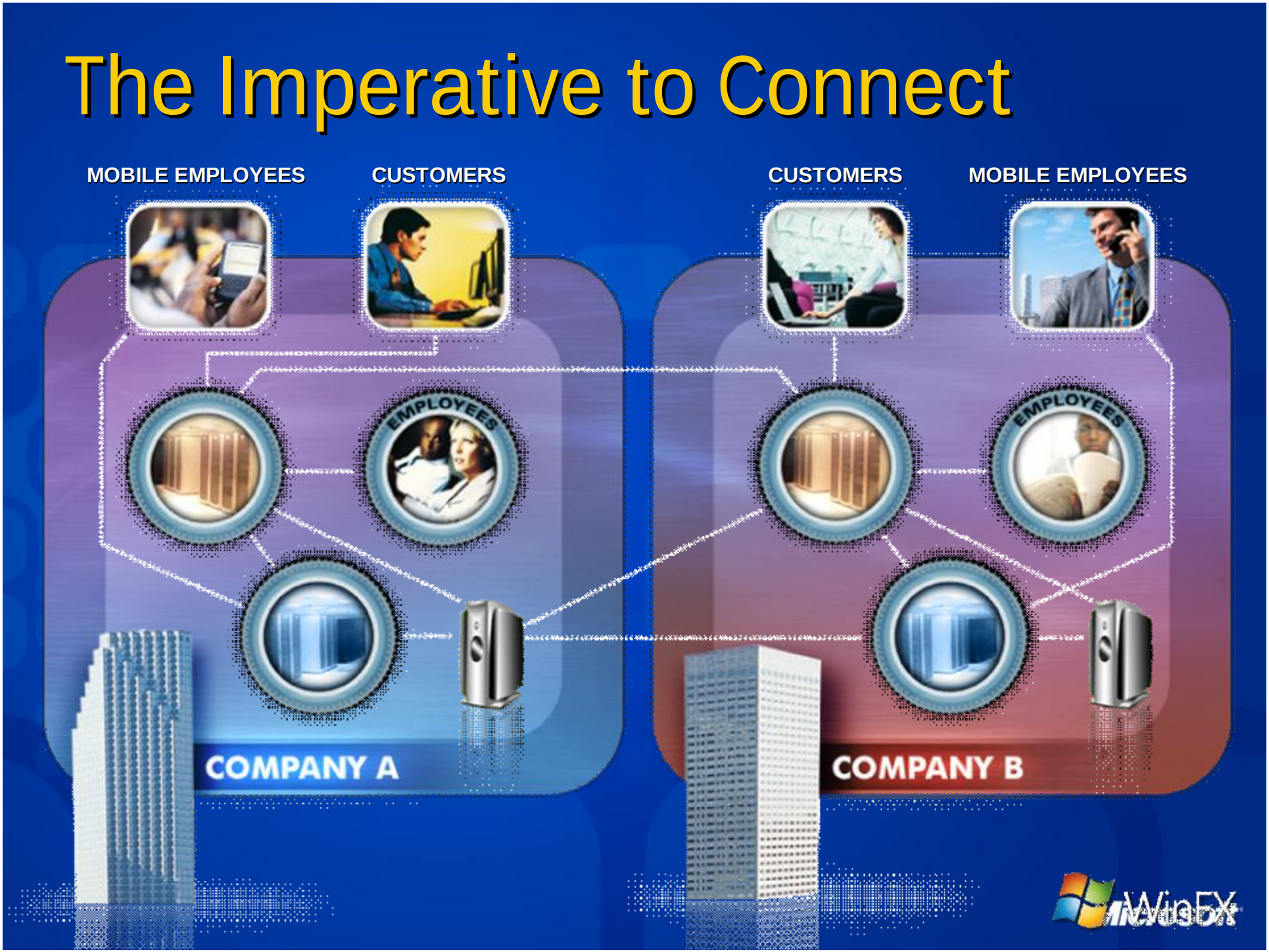
The Imperative to Connect



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What We Hear From You

"How do I build service-oriented systems?"

"How do I develop interoperable applications?"

"How can I send messages securely & reliably?"

"What API should I use?"

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What is WCF?

The Unified Programming Model For Rapidly Building Service-Oriented Applications

WinFX

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The three pillars of WCF

Productivity

- Unifies today's distributed technologies
- Attribute-based development
- Visual Studio 2005 integration

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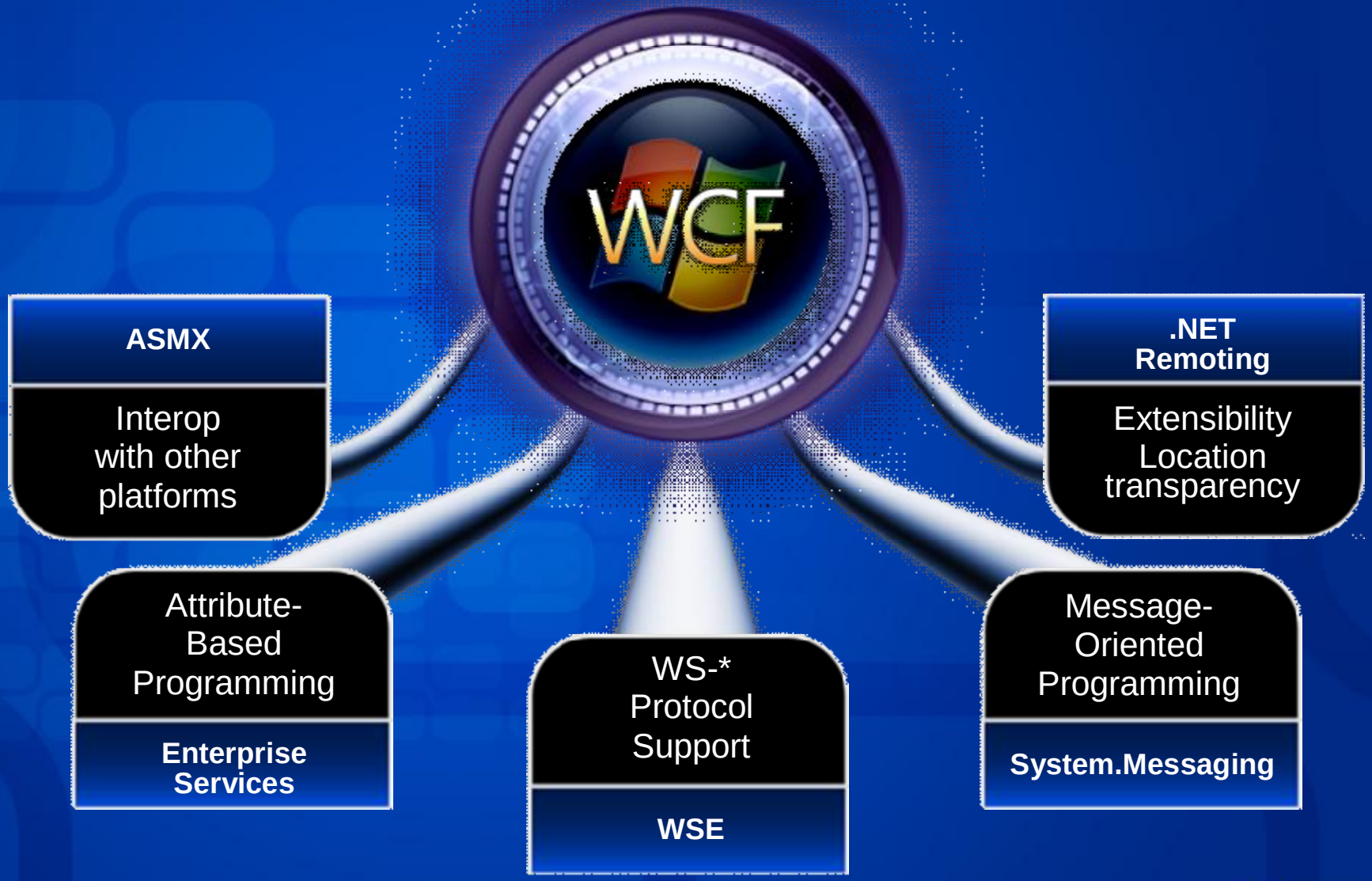
Unified Programming Model



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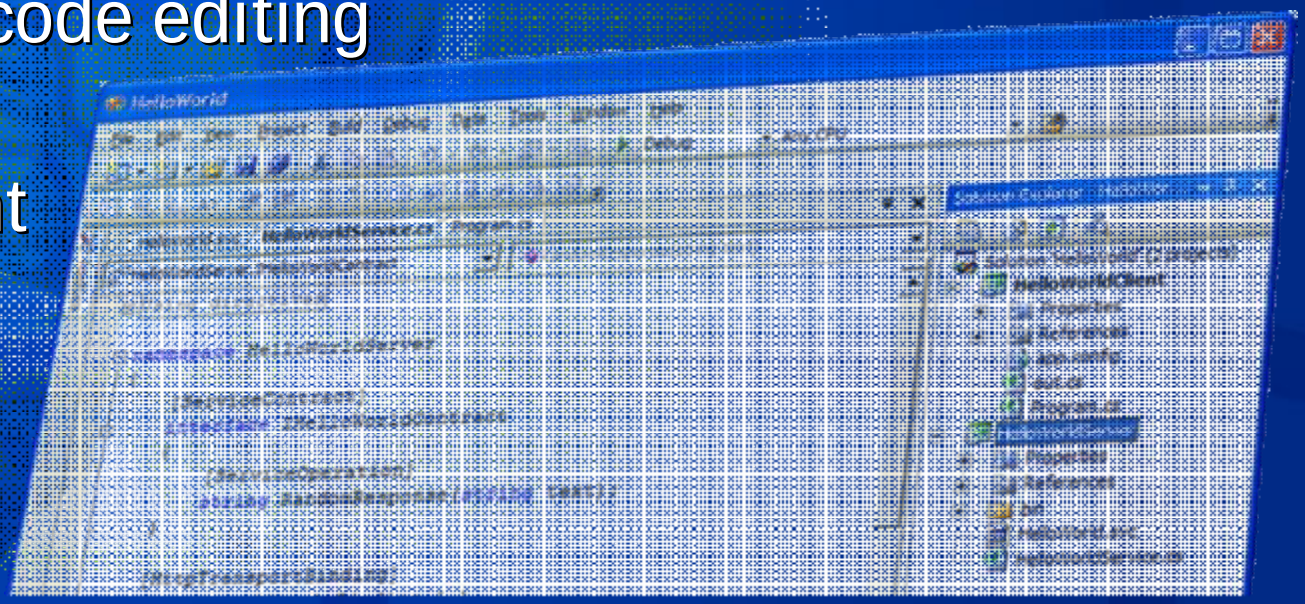
Microsoft Visual Studio 2005

- WCF extends the .NET Framework
- Services are built in Visual Studio 2005 using any .NET programming language
  - Intelligent code editing
  - Debugging
  - Deployment



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The three pillars of WCF

Productivity

- Unifies today's distributed technologies
- Attribute-based development
- Visual Studio 2005 integration

Interoperability

- Broad support for WS-* specifications
- Compatible with existing MS distributed application technologies

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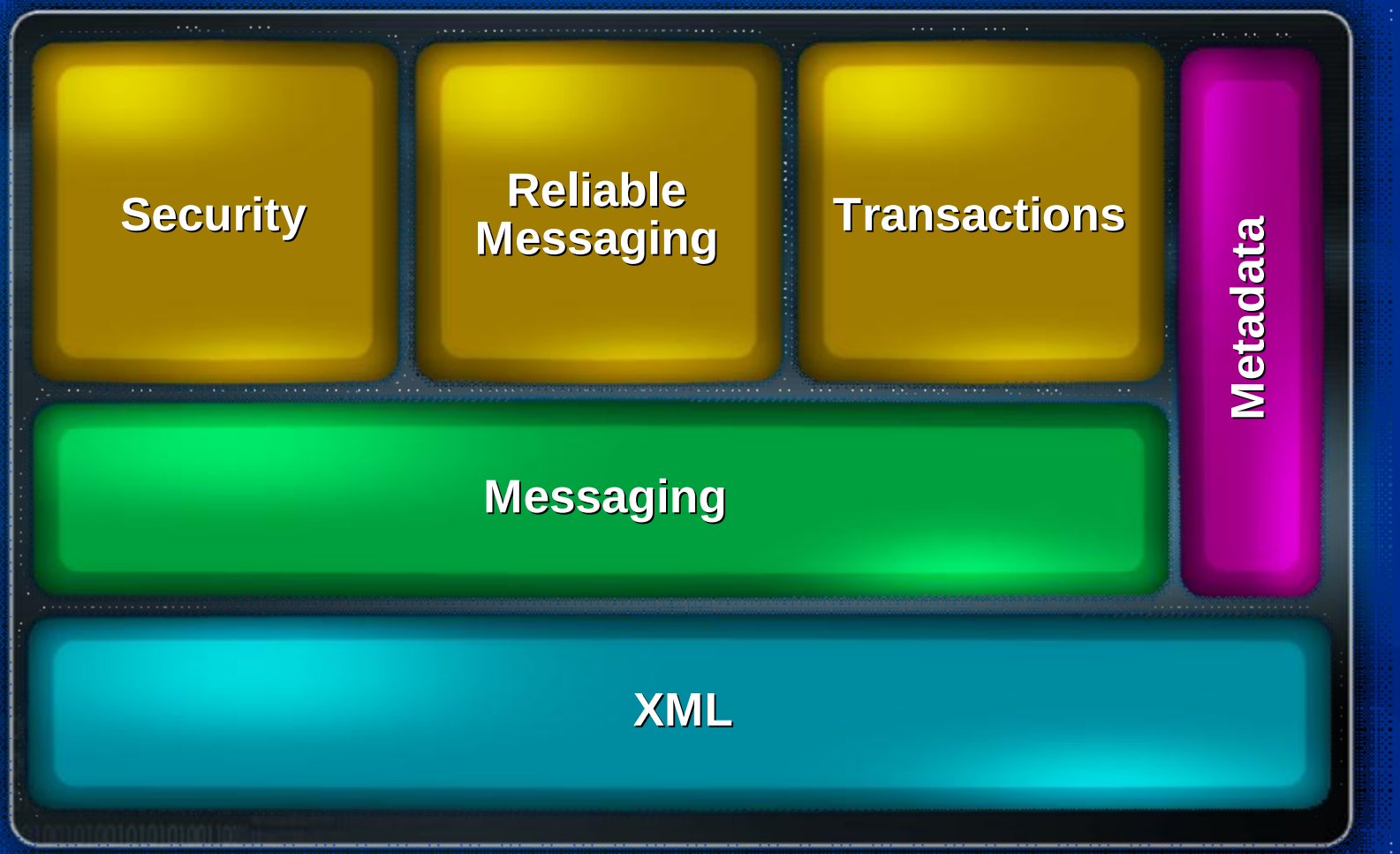
WS-* Protocol Support



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Investment Protection

SIDE-BY-SIDE

UPGRADE

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The three pillars of WCF

Productivity

- Unifies today's distributed technologies
- Attribute-based development
- Visual Studio 2005 integration

Interoperability

- Broad support for WS-* specifications
- Compatible with existing MS distributed application technologies

Service-Oriented Development

- Enables development of loosely-coupled services
- Config-based communication

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From Objects to Services

Object-Oriented

- Polymorphism
- Encapsulation
- Subclassing

Component-Oriented

- Location Transparent
- Tight Coupling
- Runtime Metadata

Service-Oriented

- Message-based
- Schema+Contract+Policy
- Broad Interop

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Four Tenets of Service Orientation

Boundaries are Explicit	Developers opt-in to consuming, exposing, and defining public-facing service façade.
Services are Autonomous	Services and consumers are independently versioned, deployed, operated, and secured.
Share Schema & Contract, Not Class	Types are structural *or* behavioral, never both. Objects are a local phenomenon.
Policy-based Service Compatibility	Capabilities/requirements represented by name and used to establish service suitability.

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Basic Principles

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Clients and Services

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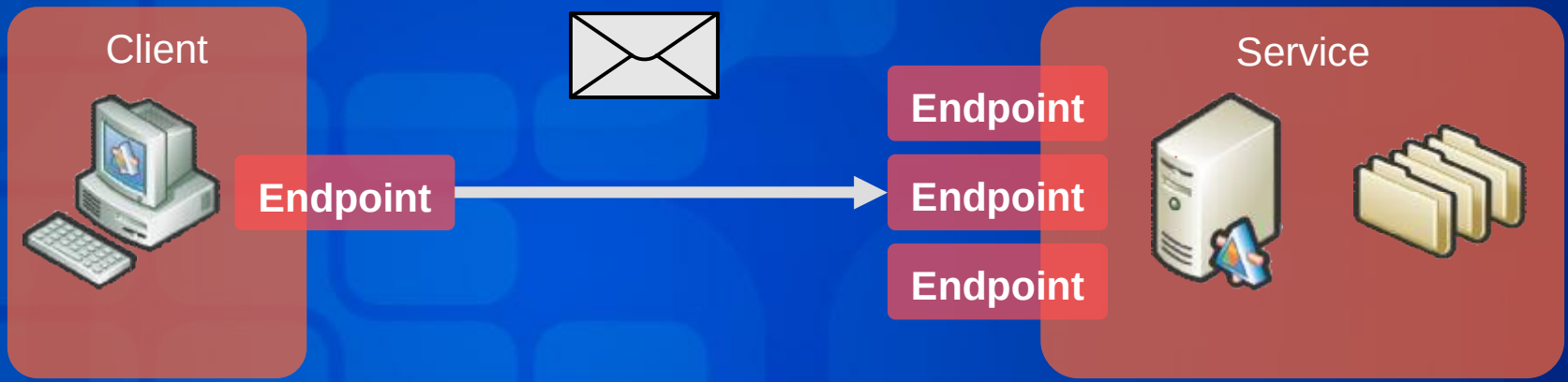
Endpoints



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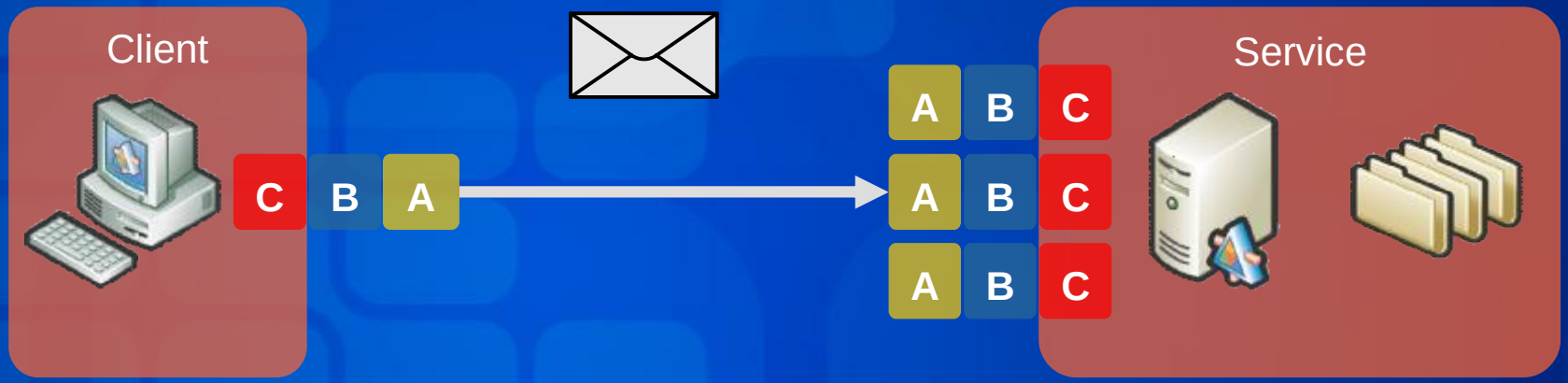
Address, Binding, Contract



Address

Where?

Binding

How?

Contract

What?

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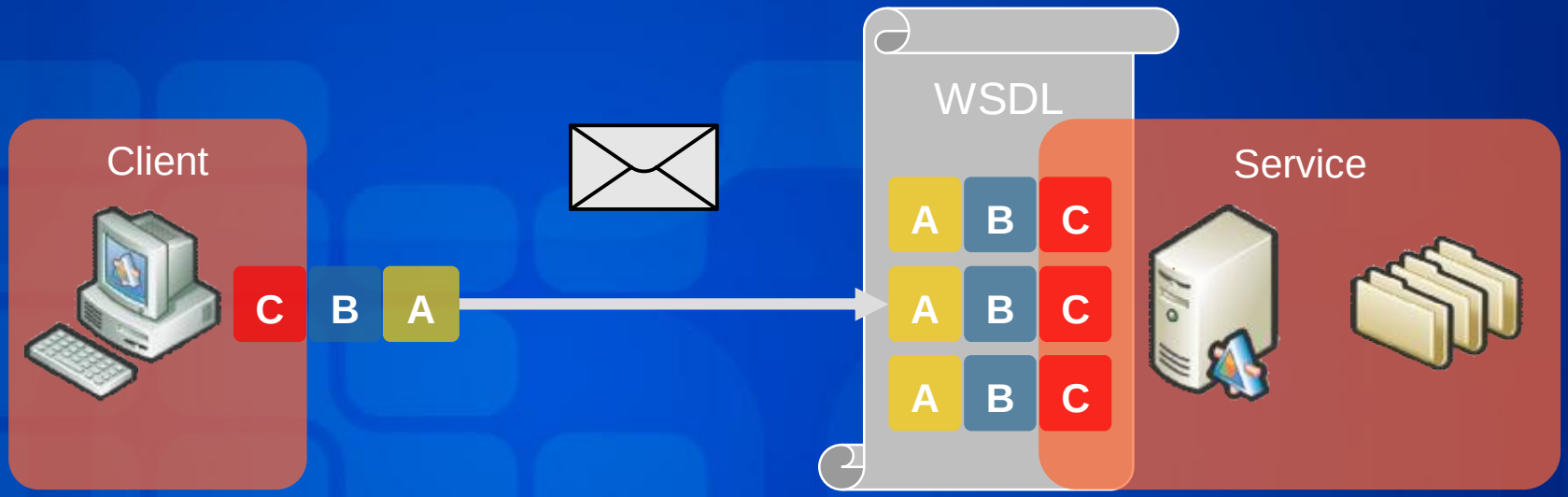
Metadata



Address
Where?

Binding
How?

Contract
What?

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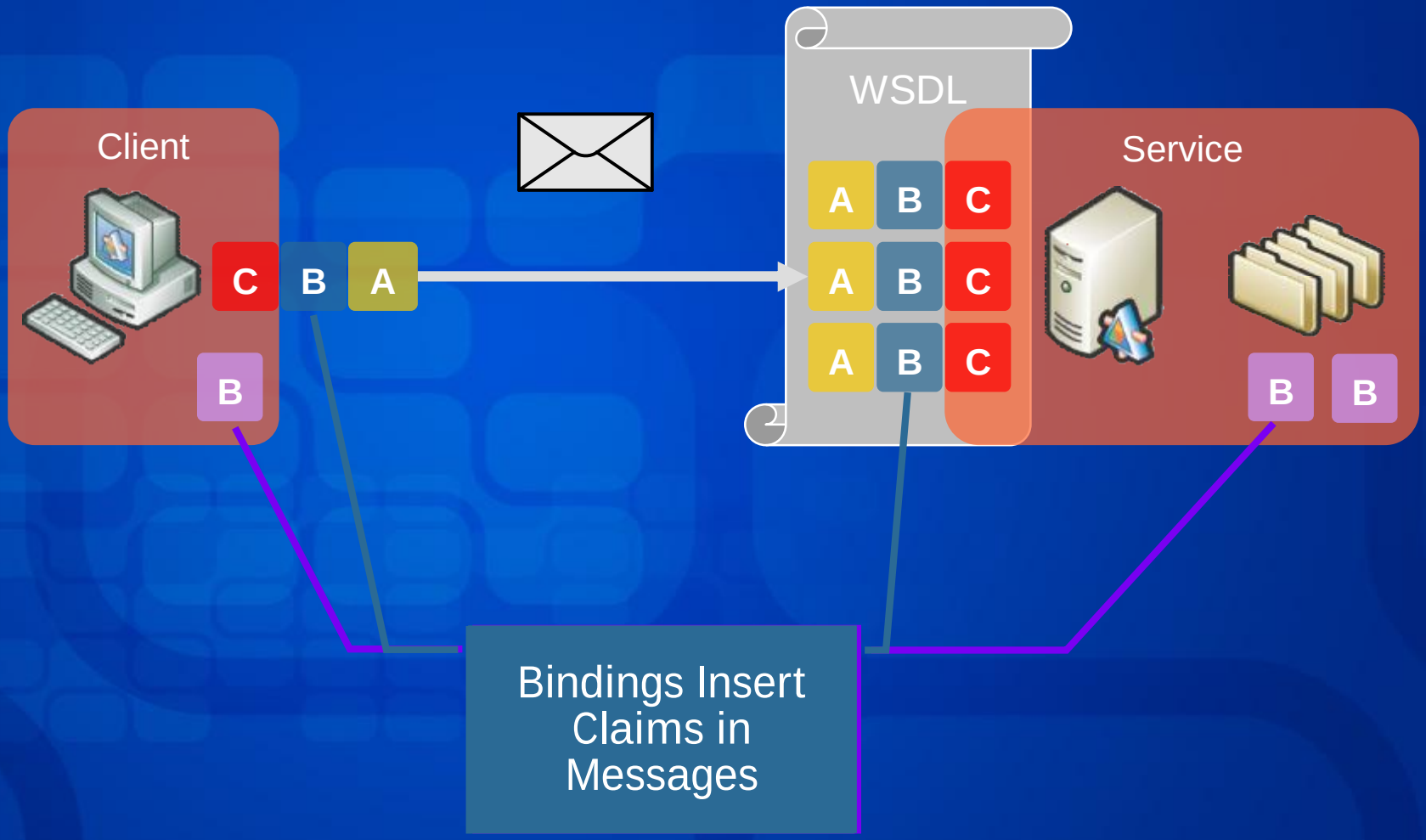
Example: Security



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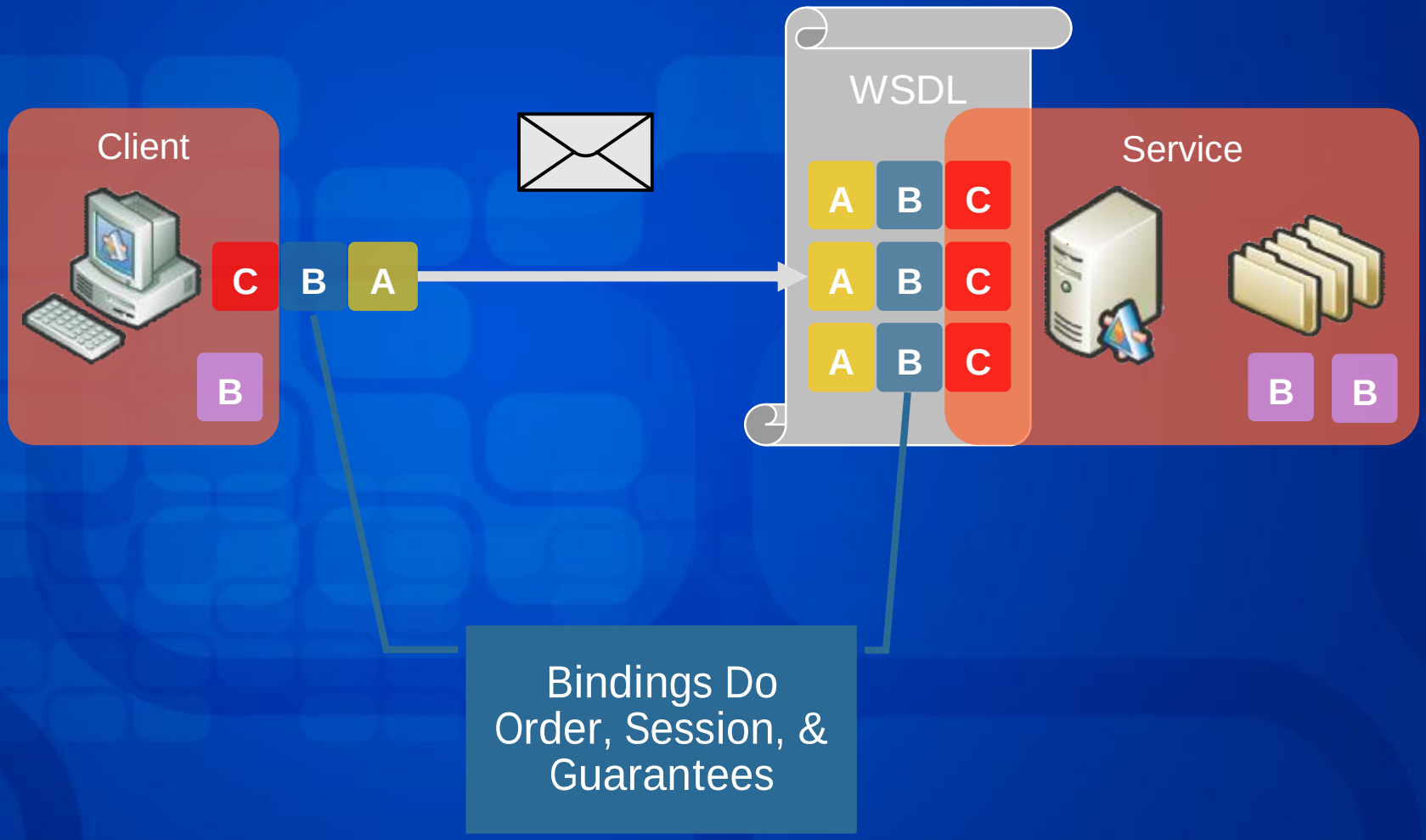
Example: Reliable Messaging



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WCF Architecture

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Creating a Service

1. Define Contract(s)
2. Implement Contract(s)
3. Define Endpoint(s)
4. Host & Run Service (F5)

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Service Contracts

- Define Set of Related Messages

```
// using interface
[ServiceContract]
public interface IOrderProcessingService
{
      [OperationContract(IsOneWay = true)]
      void ProcessOrder(OrderDetail detail);
}

// using class (when a service implements one contract)
[ServiceContract]
public class OrderProcessingService
{
      [OperationContract(IsOneWay = true)]
       void ProcessOrder(OrderDetail detail) { }
}
```

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Data Contracts

- Define Message Content

```
[DataContract]
public class OrderDetail
{
    [DataMember]
    public string ItemName { get; set; }

    [DataMember]
    public Guid ItemId { get; set; }

    [DataMember]
    public double ItemPrice { get; set; }
}
```

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Implementing Contracts

- A Service is a CLR Class that Implements One or More Service Contracts

```
[ServiceContract]
public interface IOrderProcessingService
{
    [OperationContract(IsOneWay = true)]
    void ProcessOrder(OrderDetail detal);
}

class OrderProcessingService : IOrderProcessingService
{
    public void ProcessOrder(OrderDetail detail) { ... }
}
```

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Defining Endpoints

1. Defines *What* to Expose (Contract)
2. Define *How* to Expose (Binding)
3. Define *Where* to Expose (Address)

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Bindings

	Interop	Security	Session	Transactions	Duplex	Streaming	Queueing
BasicHttpBinding	BP 1.0	T					
WsHttpBinding	WS	T | S	X	X			
WsDualHttpBinding	WS	T | S	X	X	X		
NetTcpBinding	.NET	T | S	X	X	X	O	
NetNamedPipeBinding	.NET	T | S	X	X	X	O	
NetMsmqBinding	.NET	T | S	X	X			O
CustomBinding	*	*	*	*	*	*	*

T = Transport Security | S = WS-Security | O = One-Way Only

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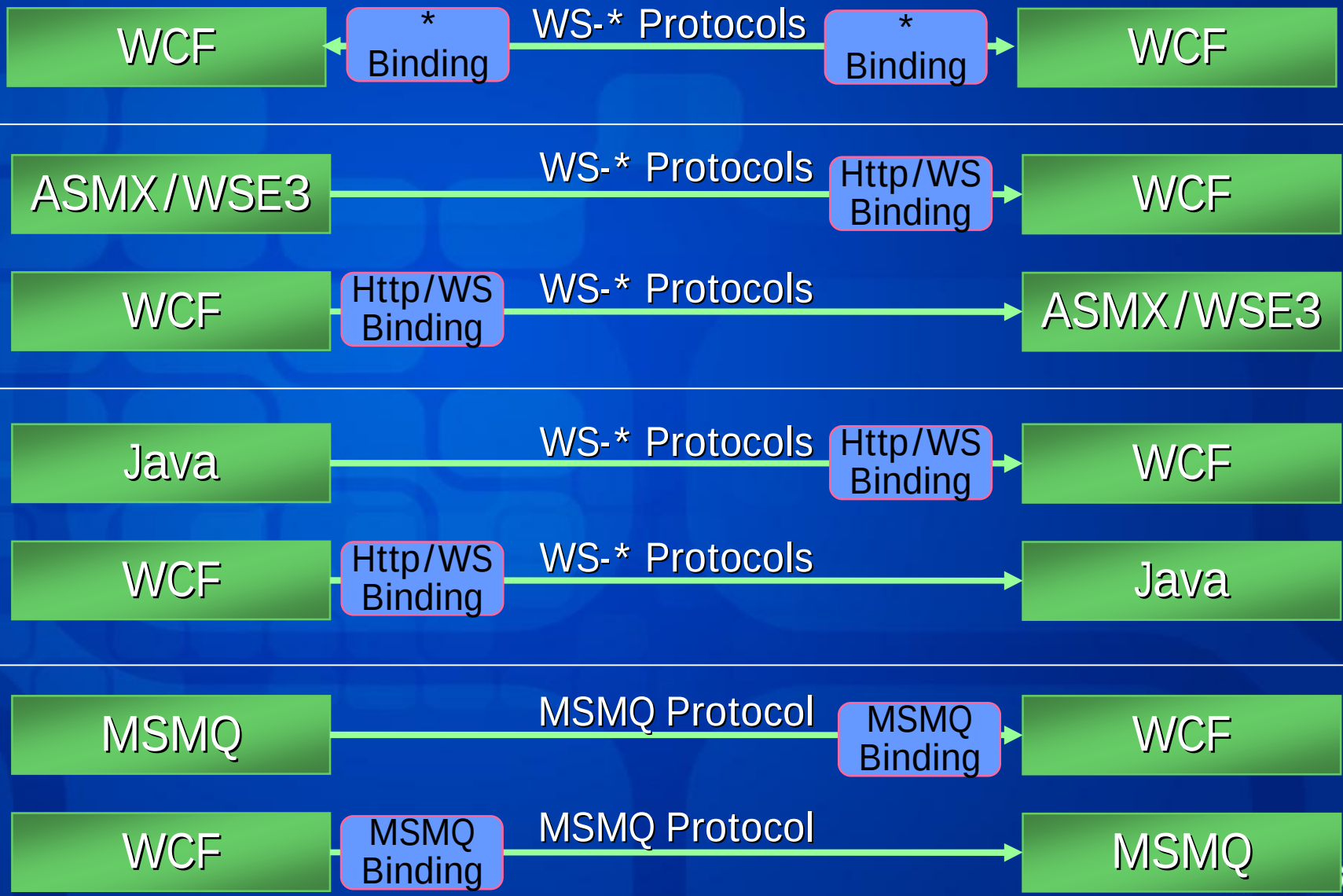
Integration using Bindings



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Bindings: Config

```
<configuration>
   <system.serviceModel>
      <bindings>
         <basicHttpBinding>
            <binding name="Secure"
               securityMode="Https" />
         </basicHttpBinding>
      </bindings>
      <services>
         <service serviceType="Math">
            <endpoint
               address="BpEndpoint"
               binding="basicHttpBinding"
               bindingConfiguration="Secure"
               contract="IOrderProcessingService" />
         </service>
      </services>
   </system.serviceModel>
</configuration>
```

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Bindings: Code

```
[ServiceContract]
public class OrderProcessingService
{
    [OperationContract(IsOneWay = true)]
    public void ProcessOrder(OrderDetail detail) { }
}

public static void Main(string[] args)
{
    ServiceHost host =
        new ServiceHost(typeof(OrderProcessingService),
        “http://localhost/OrderService/”);

    BasicHttpBinding binding = new BasicHttpBinding();
    binding.SecurityMode = BasicProfileSecurityMode.Https;
    host.AddEndpoint(typeof(OrderProcessingService),
        binding, “BpEndpoint”);

    host.Open();
}
```

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Addresses

```
http://microsoft.com:80/OrderService/WS
https://microsoft.com:443/OrderService/BP
net.tcp://microsoft.com:808/OrderService/TCP
net.pipe://microsoft.com/OrderService/NP
```

Scheme	http, https, net.tcp, net.pipe
Host Name	microsoft.com
Port (Optional) *	80, 443, 808
Base Path	/OrderService/
Endpoint Address	WS, BP, TCP, NP

* - Port Does Not Apply to Named Pipes

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ServiceHost

- Allows a WCF Service to be Hosted in Any AppDomain
  - EXE, NT Service, WinForms, Avalon, etc.

```
public static void Main(string[] args)
{
    ServiceHost host = new ServiceHost(
        typeof(OrderProcessingService);

    host.BaseAddresses.Add(
       new Uri("http://localhost/OrderService/"));

    host.Open();
}
```

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Creating a Client

1. Generate Proxy from Metadata
2. Implement & Run Client (F5)

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Consuming Metadata

```
svcutil.exe (mex address | ?wsdl address)
```

- Retrieves Service Metadata
- Generates Code and Config
  - Addresses and Bindings Go in Config
  - Contracts Go in Code

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Generated Proxy

```
// autogenerated by Visual Studio “Add Reference”

public partial class OrderProcessingServiceProxy :
    ClientBase<IOrderProcessingService>, IOrderProcessingService
{
    public OrderProcessingServiceProxy()
    { ... }

    public OrderProcessingServiceProxy(string configurationName)
    { ... }

    public OrderProcessingServiceProxy(EndpointAddress address,
        Binding binding)
    { ... }

    public void ProcessOrder(OrderDetail detail)
    { ... }

    // rest of operations
}
```

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Generated Config

```
<!-- autogenerated by Visual Studio “Add Reference” -->

<system.serviceModel>
    <client>
        <endpoint
            name=“IOrderProcessingService"
            address="http://localhost/OrderService/"
            bindingSectionName="basicProfileBinding"
            contractType=“IOrderProcessingService" />
    </client>
</system.serviceModel>
```

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Code Migration

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ASMX to WCF

```
//
using System.Web.Services;
using System.ServiceModel;
public class AccountingOperation
{
    public string AccountName;
    public long Amount;
}


[ServiceContract(FormatMode=ContractFormatMode.XmlSerializer)]
public class Accounting
{
    //
    [OperationContract]
    [WebMethod(TransactionOption=TransactionOption.RequiresNew)]
    public int AddEntry(AccountingOperation debit,
                        AccountingOperation credit)
    {
        // Add entry to internal accounting book
        // return id.
    }
}
```

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Enterprise Services to WCF

```
//using System.EnterpriseServices;
using System.ServiceModel;
//[ComponentAccessControl]
//[SecureMethod]
//[Transaction(TransactionOption.Required)]
[ServiceContract]
public class Accounting : ServicedComponent
{
  [OperationContract]
  [OperationBehavior(AutoEnlistTransaction=true)]
  [PrincipalPermission(SecurityAction.Demand, Role="Managers")]
  //[SecurityRole("Manager")]
  public void AddCreditEntry(string creditAccount, int creditAmount)
  {

  }
}
```

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WSE to WCF

```
//using Microsoft.Web.Services3;
using System.ServiceModel;

//[WebService]
[ServiceContract]
class HelloWorld
{
    [OperationContract]
    [PrincipalPermission(SecurityAction.Demand, null,
    "BUILTIN\Administrators")]
    //[WebMethod]
    public string Hello (string text)
    {
     //MessageSignature signature = (MessageSignature)
     // RequestSoapContext.Current.Security.Elements[0];
     // if (!signature.SigningToken.Principal.IsInRole
     //    ("BUILTIN\Administrators"))
     //      throw new AuthorizationException("Access denied");

        return String.Format("Hello, {0}", text);
    }
}
```

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System.Messaging to WCF

```
//using System.Messaging;
using System.ServiceModel;

[ServiceContract]
class MyQService
{
  // public void ReceiveOrders()
  // {
    // MessageQueue Queue = new MessageQueue(@".\private$\Books");
    // XmlMessageFormatter formatter = new XmlMessageFormatter(
                        new Type[] { typeof(System.Data.DataSet)});
    // Queue.Formatter = formatter;
    // System.Messaging.Message msg = null;
    // while((msg= Queue.Receive()) != null)
    // {
    //    DataSet booklist = (DataSet) msg.Body;
    //    ProcessOrders(booklist);
    // }
  // }
     [OperationContract(IsOneWay = true)]
     Public void ProcessOrder(DataSet BookList) { ... }

}
```

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.NET Remoting to WCF

```
//using System.Runtime.Remoting;
using System.ServiceModel;
[Serializable]
public class AccountingOperation
{
    public string AccountName;
    public long Amount;
}
[ServiceContract]
public class Accounting //MarshalByRefObject
{
   [OperationContract]
   public int AddEntry(AccountingOperation debit,
                       AccountingOperation credit)
    {
        // Add entry to internal accounting book
        // return id.
    }
}
```

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