PV178: Programming for .NET Framework

Windows Communication Foundation

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Distributed Applications

- Applications composed of several processes.
- Processes usually communicate via a network.

- Java RMI, .NET Remoting, Web services. . .
- Each technology has slightly different purpose.
- The technologies are not compatible.
- Migrating from one technology to another requires a lot of effort.

Service Oriented Architecture

- Method of development in which systems provide functionality as **loosely coupled services**
  - Service – mechanism providing access to one or more capabilities using a prescribed interface and consistent constraints and policies
- Each service implements one action (get a weather forecast, book a hotel room, get latest blog posts,. . .)
- Services communicate using predefined protocols.

Basic inter-process communication

- named and anonymous pipes, mailslots
- rpc, lpc, apc...
- files
- memory mapped files

Message Queuing

- public, private queues
- implemented via filesystem
- accesible by name e.g. `pocitac\jmeno`
- methods Send, Peek, Receive
- all have asynchronous versions

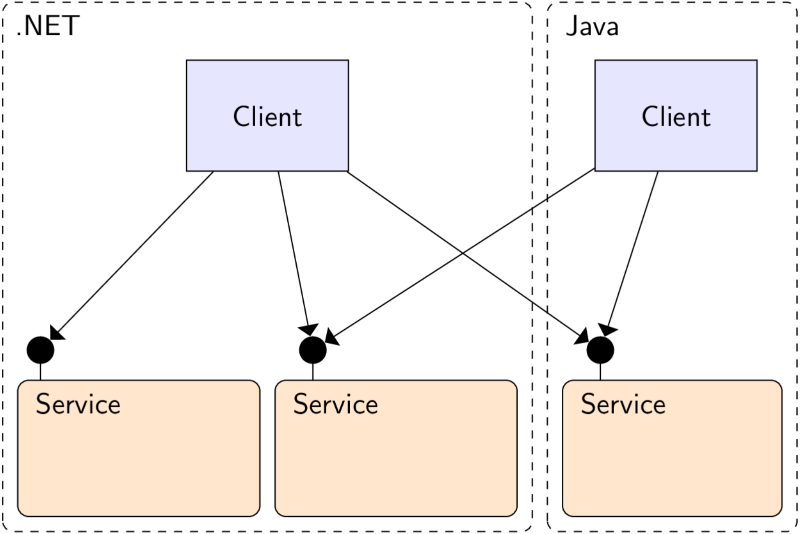
.NET Remoting

- Allows creation of object shared by several applications
- Platform specific
- Similar to Java RMI

Web Services

- Services communicating over standard internet protocols
- Exact behaviour described by standards (SOAP, REST, WSDL, UDDI,. . .)
- Messages are mostly passed as XML files
- Communication between different languages and/or platforms

Service Oriented Architecture – Diagram



Windows Communication Foundation

- Framework for building applications that inter-communicate.
- From .NET 3.0, under development in Mono.
- Follows principles of SOA.
- The underlying architecture may not be hard-coded, can be changed using config files.
- Namespace `System.ServiceModel`.

WCF Service

- Service is a CLR type that exposes a functionality via a set of methods accessible by remote clients
- **Endpoints** – Specify the way in which service communicates with clients
  - **Address** – URI
  - **Binding** – protocols supported
  - **Contract** – functionality supported (methods, types)

Address

- Says **where** the service is available.
- Address at which the service awaits incomming messages
- `<scheme>://<domain>[:port]/[path]`
  - Examples:

    ```
    http://example.com/ServiceA
    net.msmq://localhost
    ```
- Every endpoint must have unique address

Binding

- Says **how** the service can be accessed
- **Transport protocol** – TCP, HTTP, named pipe, MSMQ,. . .
- **Message encoding** – XML, binary
- **Other protocols** – for security, reliability.

Binding cont.

- WCF provides classes for most commonly used binding types

- Web services – `BasicHttpBinding`, `WSHttpBinding`, ...
- Binary – `NetTcpBinding`, `NetNamedPipeBinding`,...

Service contract

- Says **what** the service provides
- Set of operations that the service exposes
- Provided via a class marked with `ServiceContractAttribute` and its methods with `OperationContractAttribute`.

Proxy

- Used by clients to communicate with services
- Hide process of serialization from the client.
- Based on the service contract.

Channels

- Facilitate the communication between proxy and service
- Channel stack – transport channel, message encoding channel, channels for security,. . .

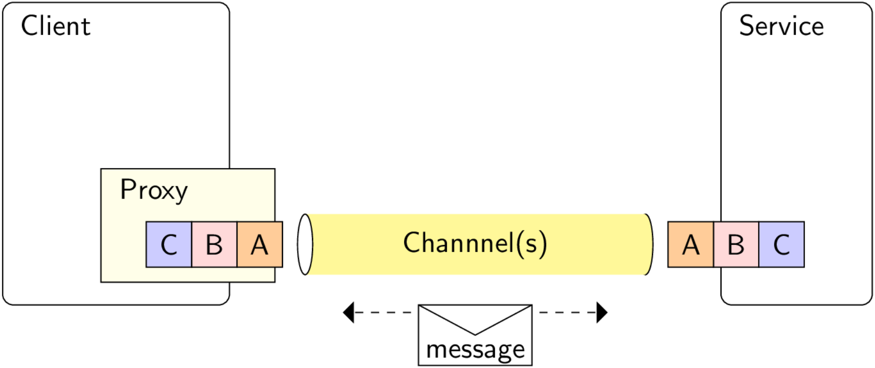
Service hosting

- Service is made available through a host process
  - Internet Information Services
  - Windows Activation Services
  - Windows service
  - Windows Form
  - Console

ServiceHost class

- Used to host services not hosted by IIS
- Type of a service is passed in constructor
- Endpoint are created by `AddServiceEndpoint` method, or created from config file.
- `Open` and `Close` methods start and stop listening on the endpoint.

WCF – Structure



Example

- SimpleWebService

Data Contracts

- The methods described by service contract may need to use “complex” types.
- Data contract describes how a complex type is serialized.

- `DataContractAttribute` is applied to the complex type to be serialized.
- `DataMemberAttribute` is applied to the serialized members.

WCF in Visual Studio

- Rich design time support
  - Editing of config files
  - Proxy generation
  - Service Testing
- Example