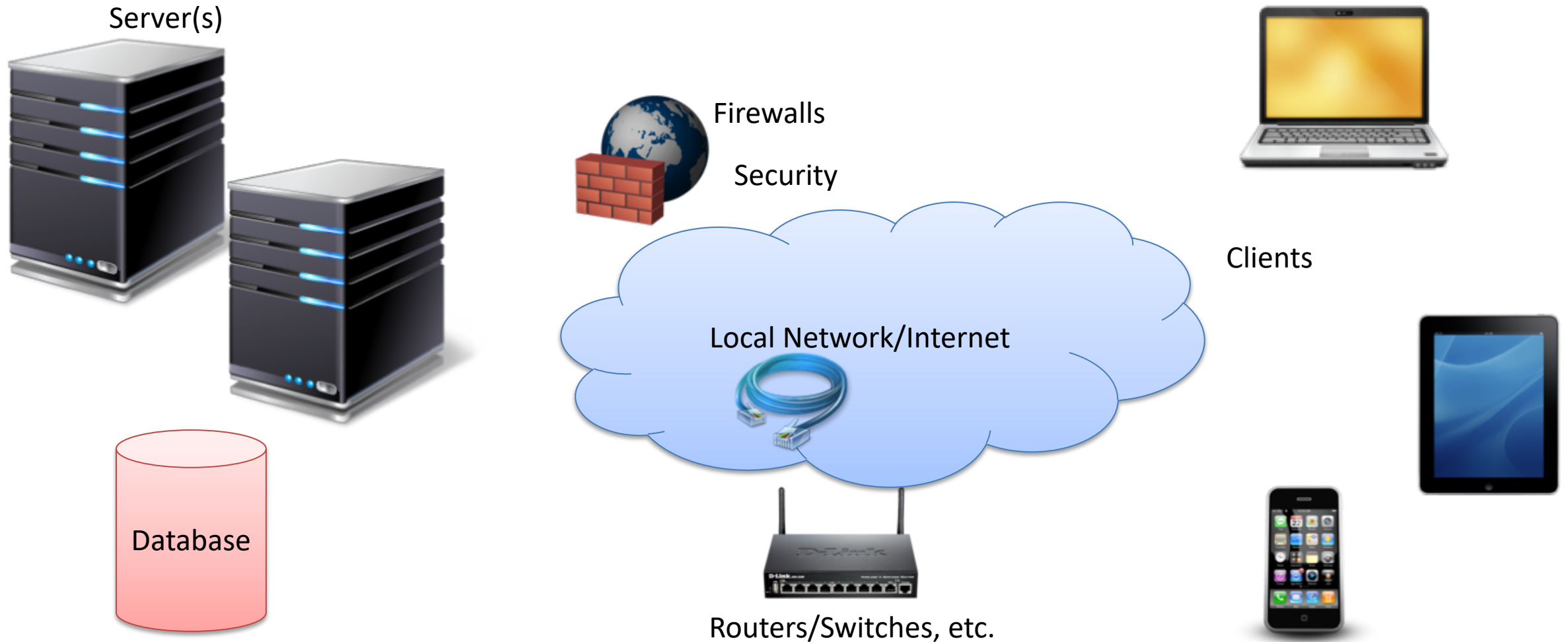




# Web Services

# Problem

How to Share Data between Devices in a Network?



# Problem

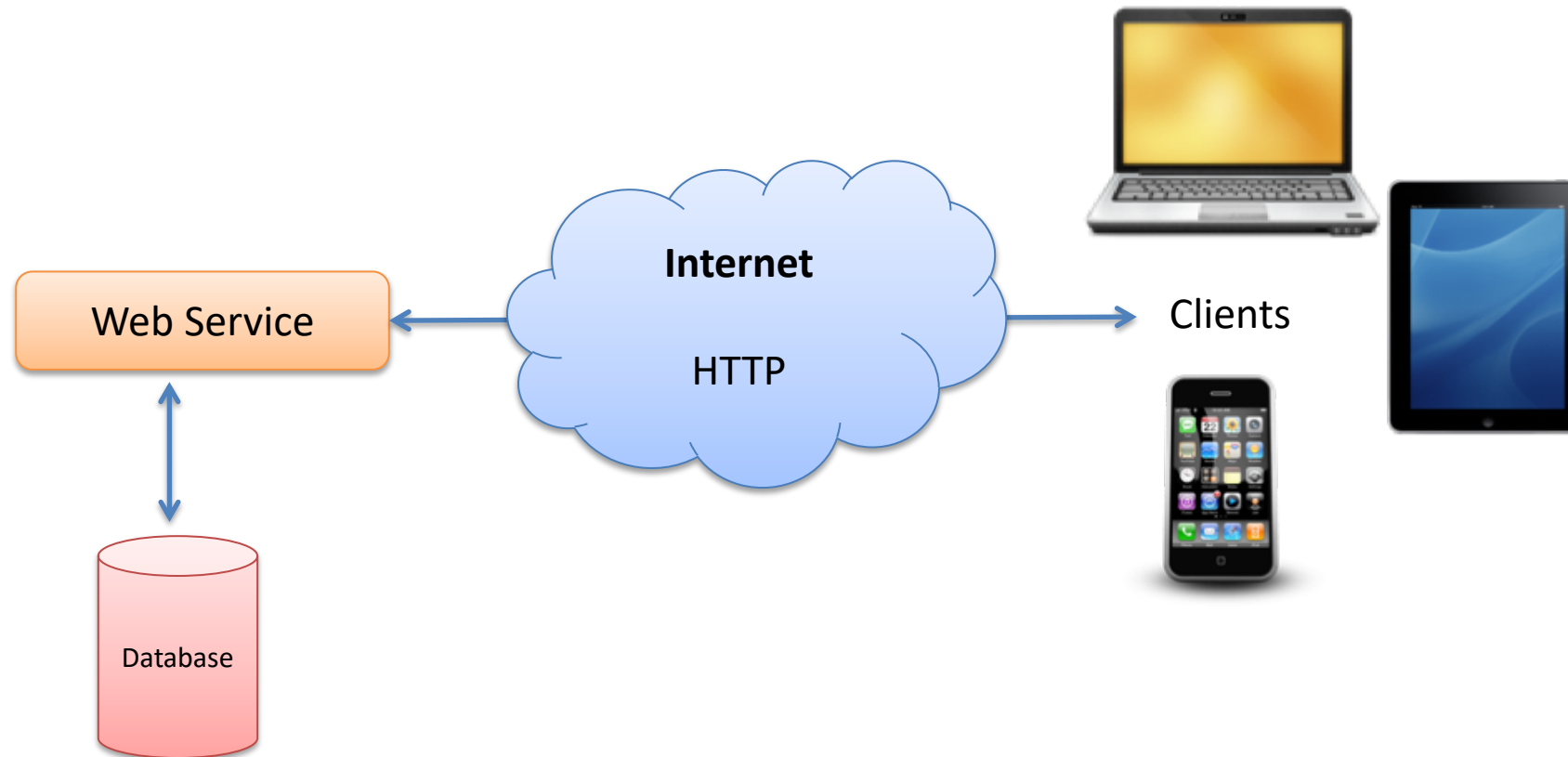
How to Share Data between Devices in a Network?



Direct Connection between the Database and the Clients that need the Data is normally not possible, due to security, compatibility issues, etc. (Firewalls, Hacker Attacks, etc.)

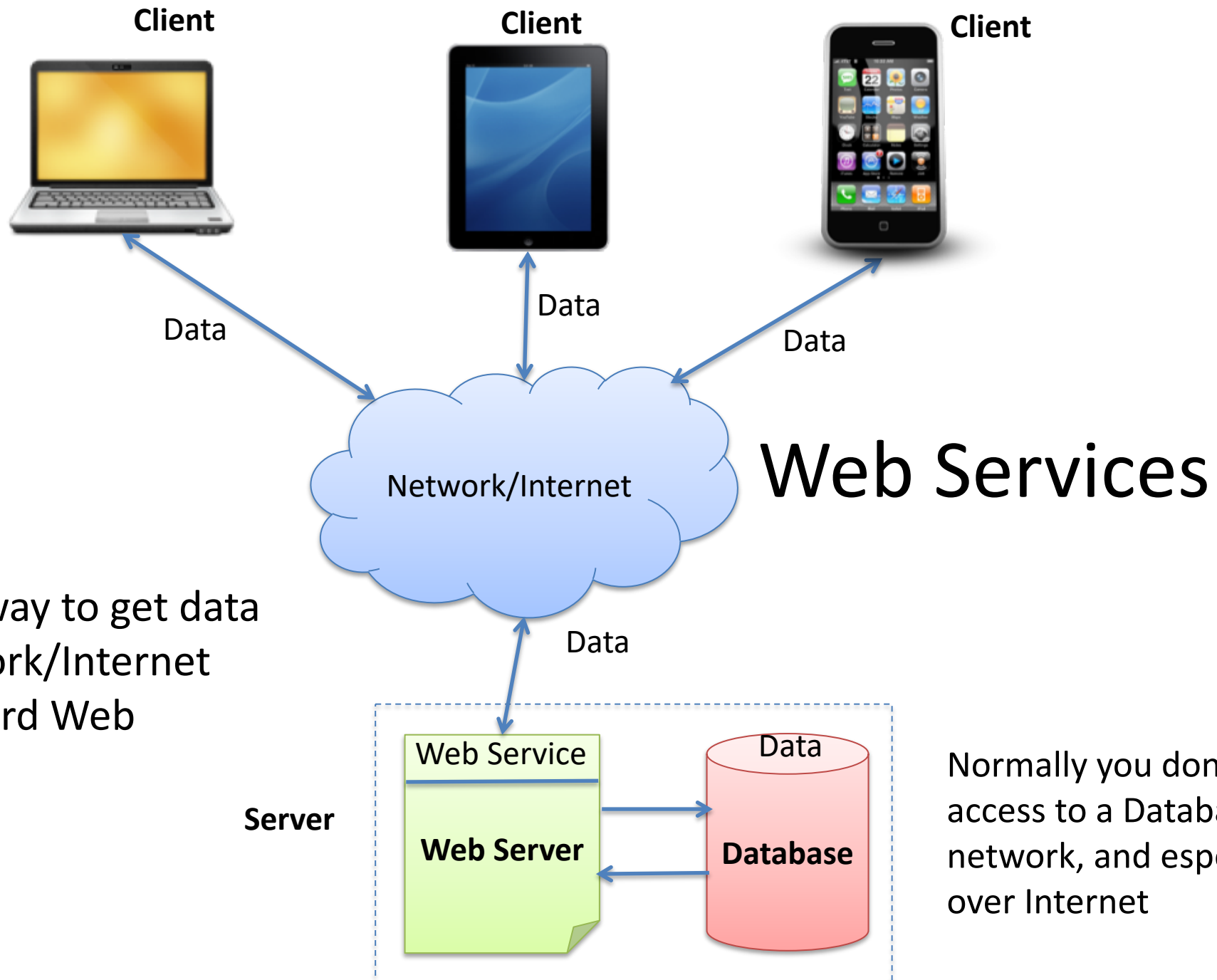
Direct Connection in a Local Network (behind the Firewall) is normally OK – but not over the Internet

# Solution: Web Service



Web Services uses standard web protocols like HTTP, etc.

HTTP is supported by all Web Browser, Servers and many Programming Languages



**Web Services:**

- A Standard way to get data over a network/Internet
- Using standard Web protocols

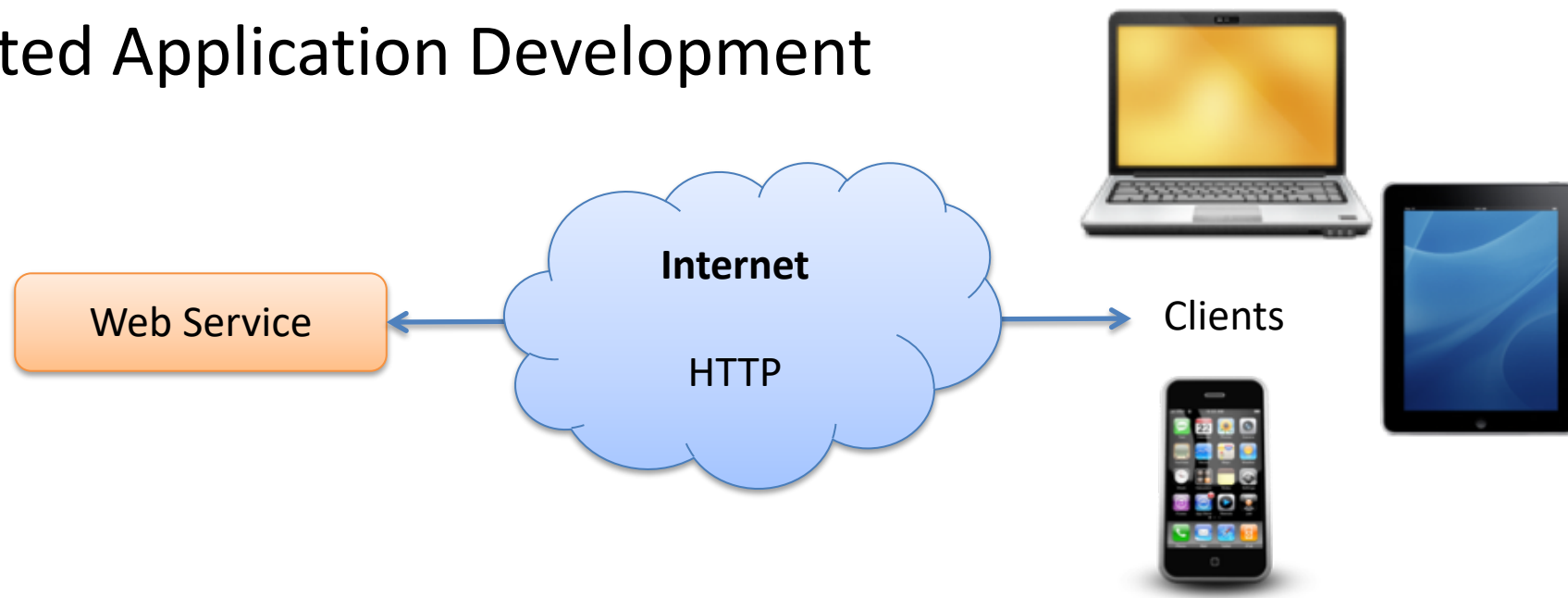
Normally you don't have direct access to a Database over a network, and especially not over Internet

# Web Services

- A Web service is a method of communications between two devices over the World Wide Web.
- Web API
- Standard defined by W3C
- Cross-platform
- Web Services can be implemented and used in most Programming Languages (C#/ASP.NET, PHP, LabVIEW, Objective-C, Java, ...)
- Uses standard Web technology (Web protocols)
  - HTTP, REST, SOAP, XML, WSDL, JSON, ...

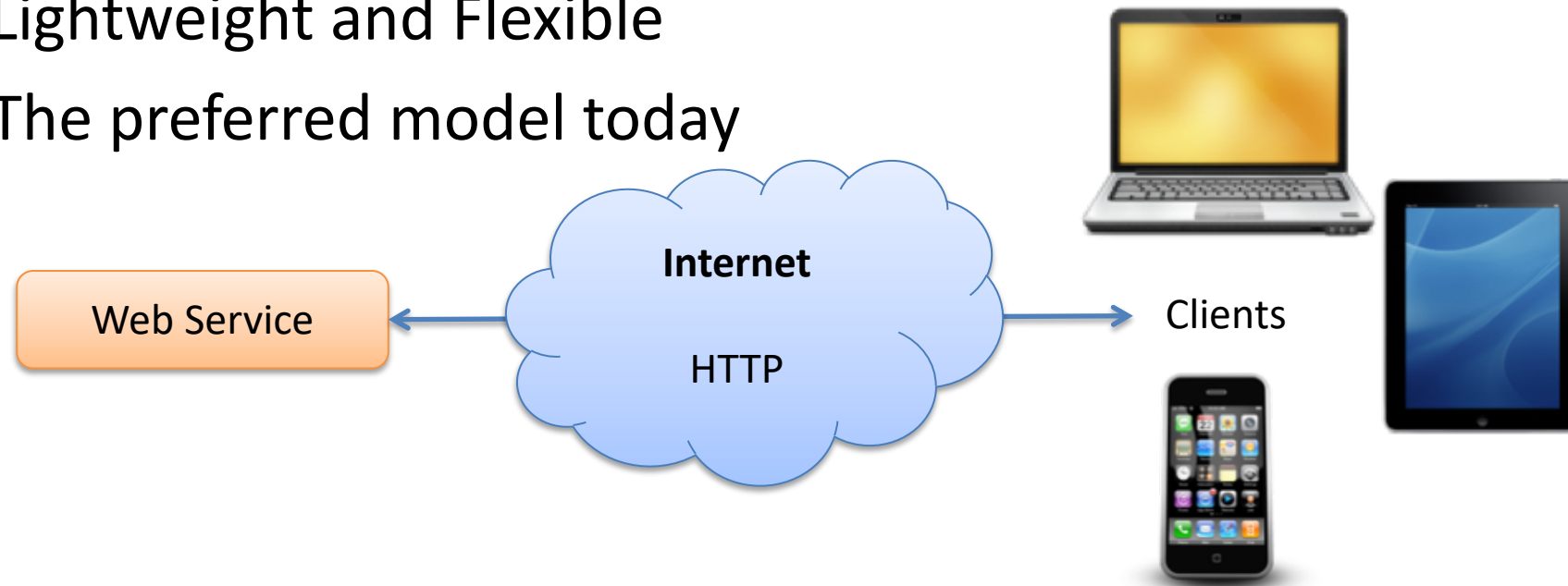
# Why Web Service?

- Today Web Services have been very popular
- Easy Data sharing over Internet
- Platform-independent Communication
- Makes it possible of integration of different systems and platforms
- Distributed Application Development



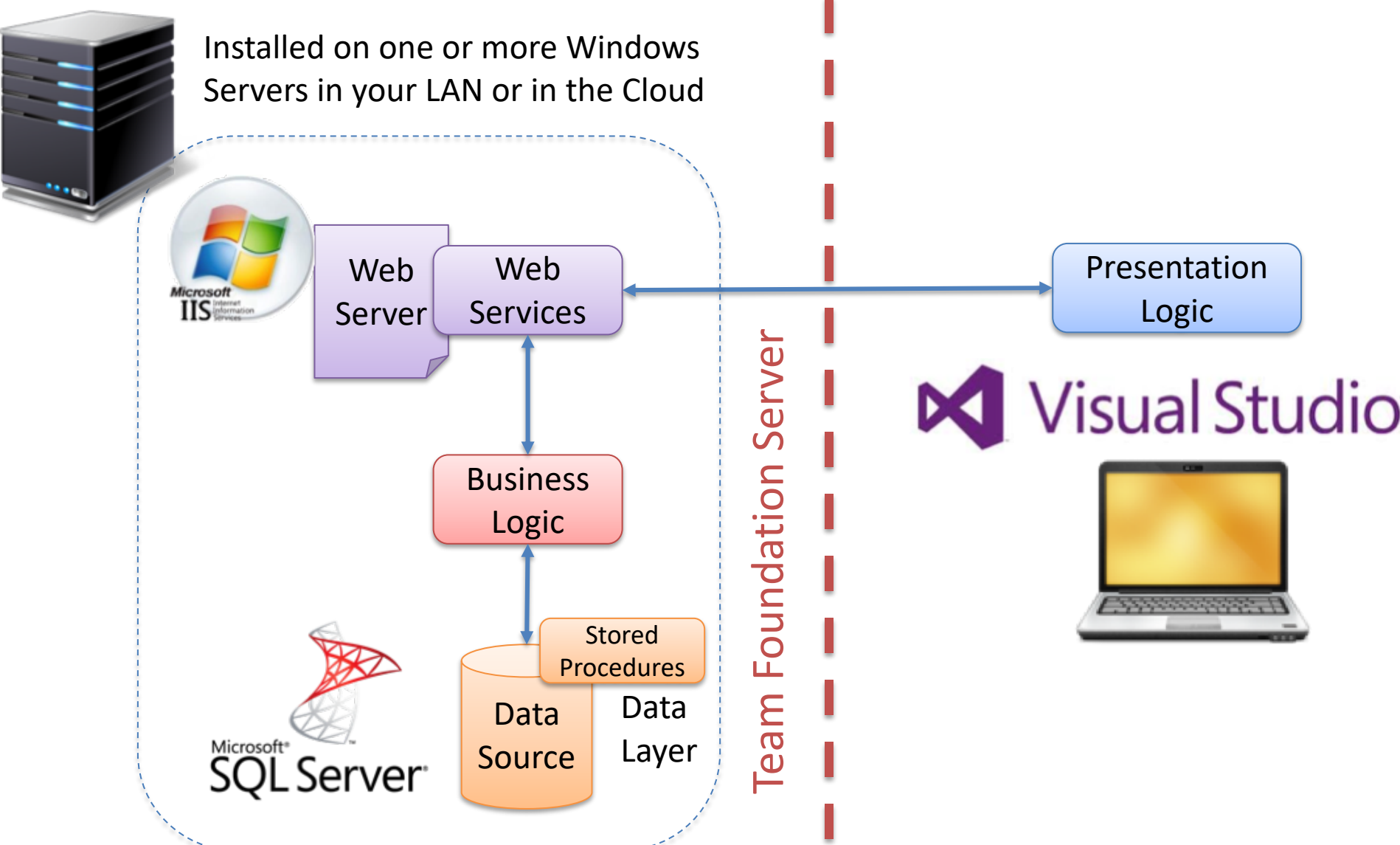
# Web Services

- Web Services 1.0: Uses SOAP
  - “Complex”
- Web Services 2.0: Uses REST
  - Less Complex than using SOAP
  - Lightweight and Flexible
  - The preferred model today





# 3-tier+WebService Architecture - Example





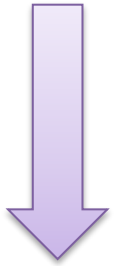
# Web Services

## Details

Hans-Petter Halvorsen

# Web Services

Web Services 1.0



Web Services 2.0

- “SOAP Web Services”
- Using the **SOAP** protocol (Simple Object Access Protocol)
- **XML** (Extensible Markup Language)

Visual Studio: [ASP.NET ASMX Web Service](#)

- “RESTful Web Services”
- Using the **REST** protocol (Representational State Transfer)
- Uses standard **HTTP** methods (GET, PUT, POST, DELETE)  
(HTTP: Hypertext Transfer Protocol)
- Uses **JSON** (JavaScript Object Notation) or XML
- [Visual Studio: ASP.NET Web API](#)

# SOA

- Service Oriented Architecture
- Distributed Application Development
- Typical example: Web Services

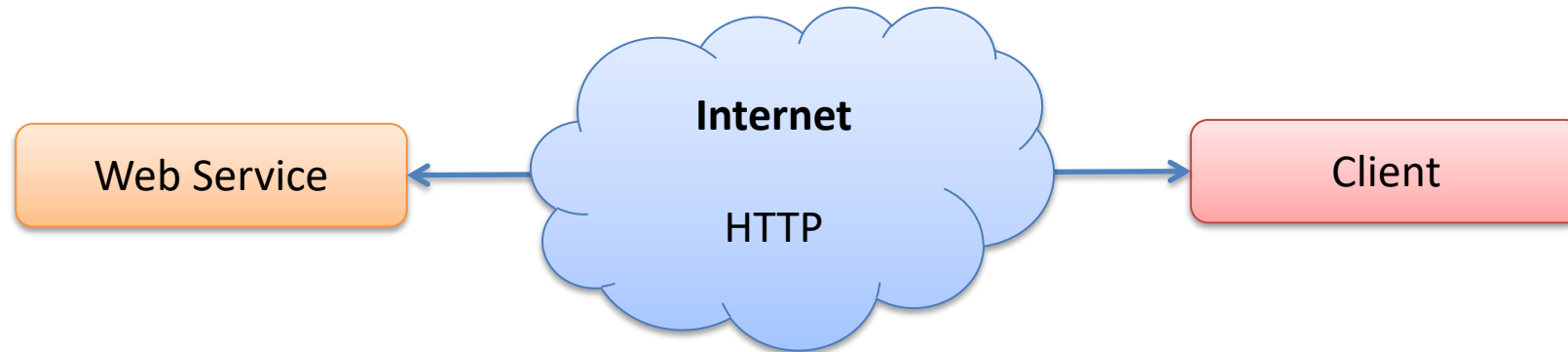
# Web Services

- A method of communication between two applications or electronic devices over the World Wide Web (WWW)
- Web Service is an API
- Makes it possible of integration of different systems and platforms
- Distributed Application Development
- Web services are web application components.
- Data is transmitted over a standardized interface (such as HTTP)

Web services can be published, found, and used on the Web.

- SOAP Web Services (SOAP - Simple Object Access Protocol)
- REST Web Services (REST - Representational State Transfer)
  - A new and simpler version of WS
  - All major WS on the Internet today use REST?

# Web Service



- HTTP - Hypertext Transfer Protocol.
- The protocol used throughout the Internet for transactions between Web servers and clients.
- It is simple, tested, and supported by libraries in every modern programming language.
- HTTP includes methods supporting all of the necessary actions for a server/client transaction

# SOAP Web Services

**WSDL** (API Description)

**SOAP** (Messaging)


**XML** (Data)

**HTTP** (Transport)

- WSDL - Web Services Description Language
- SOAP - Simple Object Access Protocol
- XML – Extensible Markup Language
- HTTP - Hypertext Transfer Protocol

# RESTful Web Services

Completely optional  
and rarely used



WADL (API Description)

REST (Messaging)

JSON/XML (Data)

HTTP (Transport)

- WADL – Web Application Description Language
- REST - Representational State Transfer
- XML – Extensible Markup Language
- JSON - JavaScript Object Notation
- HTTP - Hypertext Transfer Protocol



# SOAP vs. REST

## SOAP:

- A service architecture
- XML based
- Runs on HTTP but envelopes the message
- Slower than REST
- Very mature, a lot of functionality
- Not suitable for browser-based clients
- More complicated

WSDL (API Description)

SOAP (Messaging)

XML (Data)

HTTP (Transport)

WADL (API Description)

REST (Messaging)

XML/JSON(Data)

HTTP (Transport)

## REST:

- A service architecture
- Uses the HTTP headers to hold meta information
- Can be used with XML, JSON or whatever necessary
- Usually used with JSON due to the easily parsable content
- Faster than SOAP

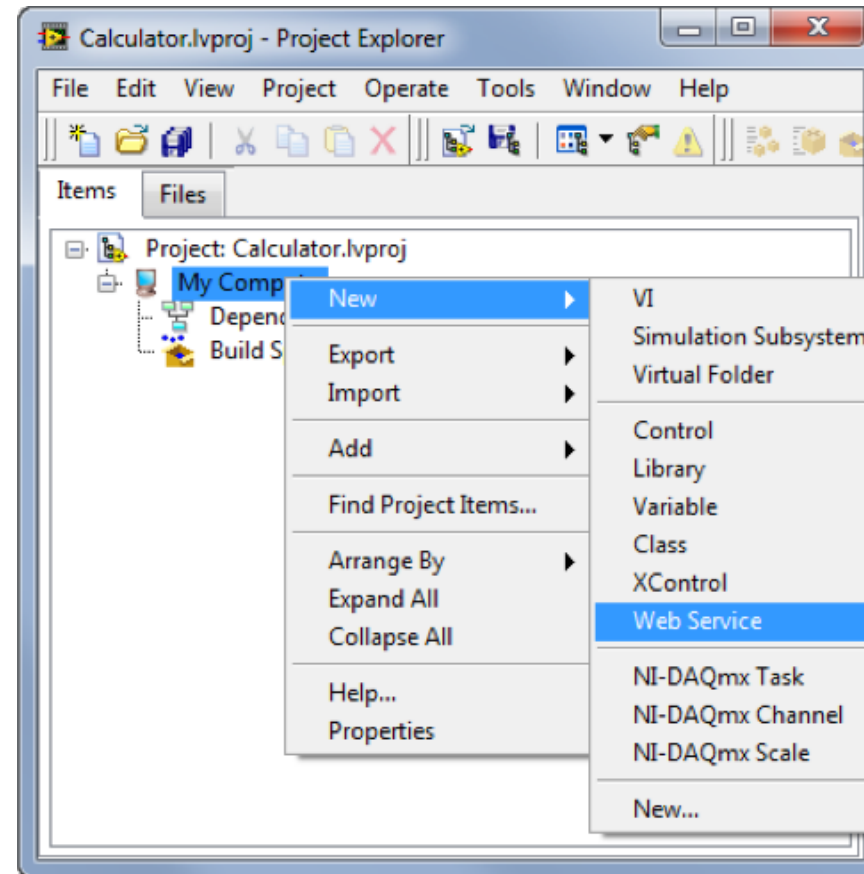


# Web Services

## Some Basic Examples

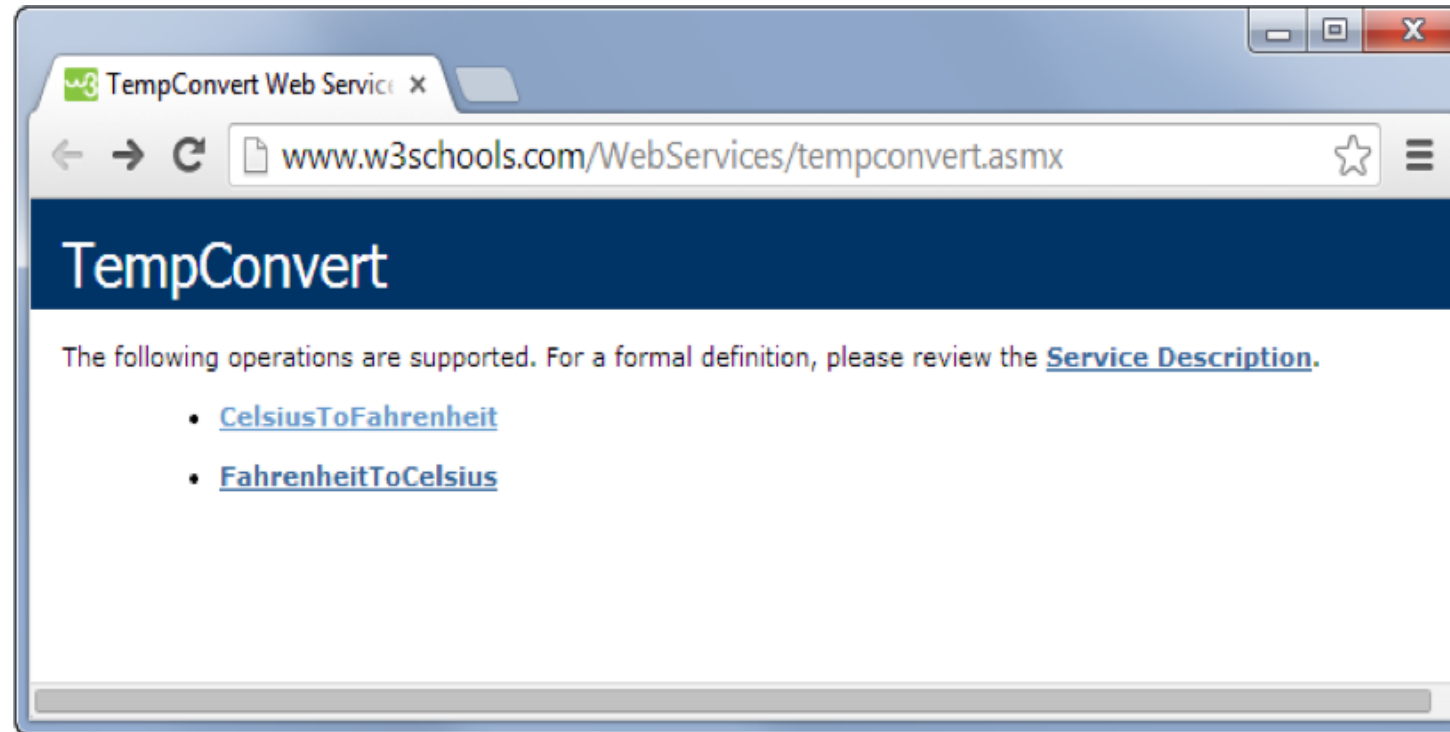
Hans-Petter Halvorsen

# Creating Web Service in LabVIEW

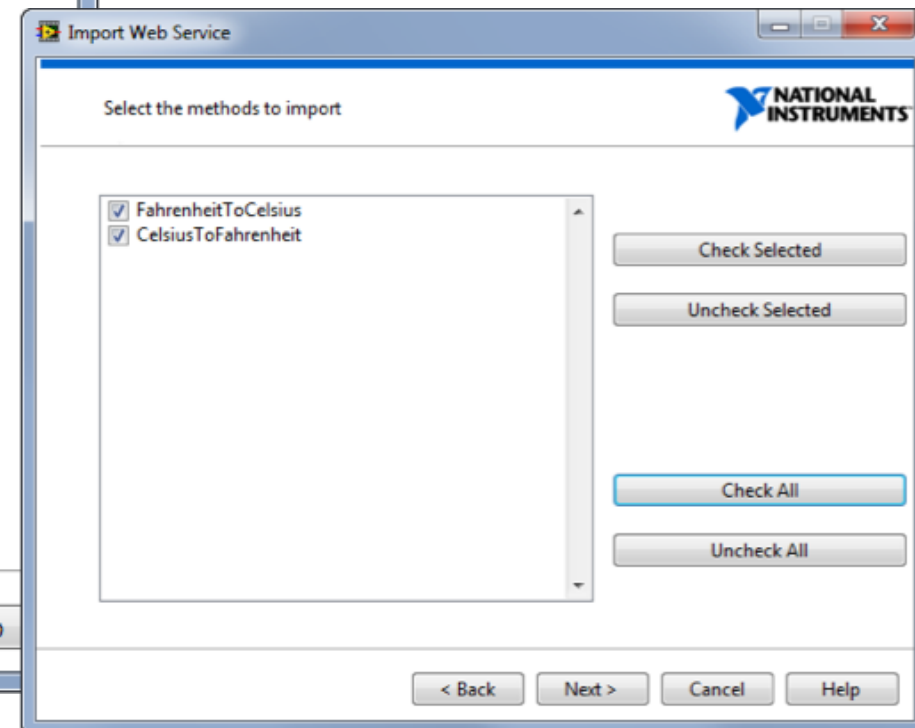
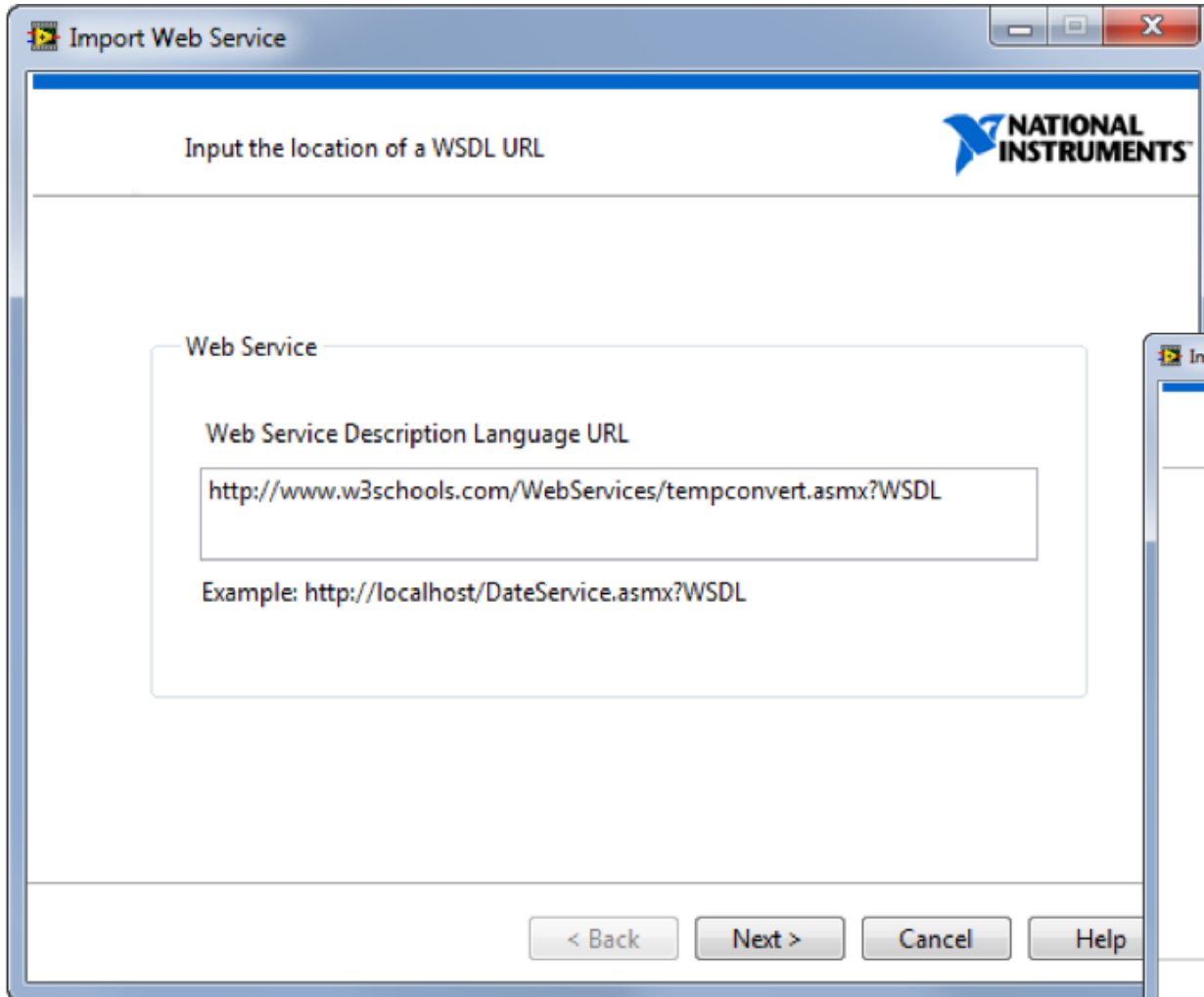


# Web Service Client in LabVIEW

Web Service Example: <http://www.w3schools.com/WebServices/tempconvert.asmx>



# Web Service Client in LabVIEW





# Web Services in Visual Studio

Examples





**API**  
(Methods used by your Applications)

**Web Service**

SOAP WS

REST WS

ASP.NET

ADO.NET

Stored Procedures

SQL

SQL Server

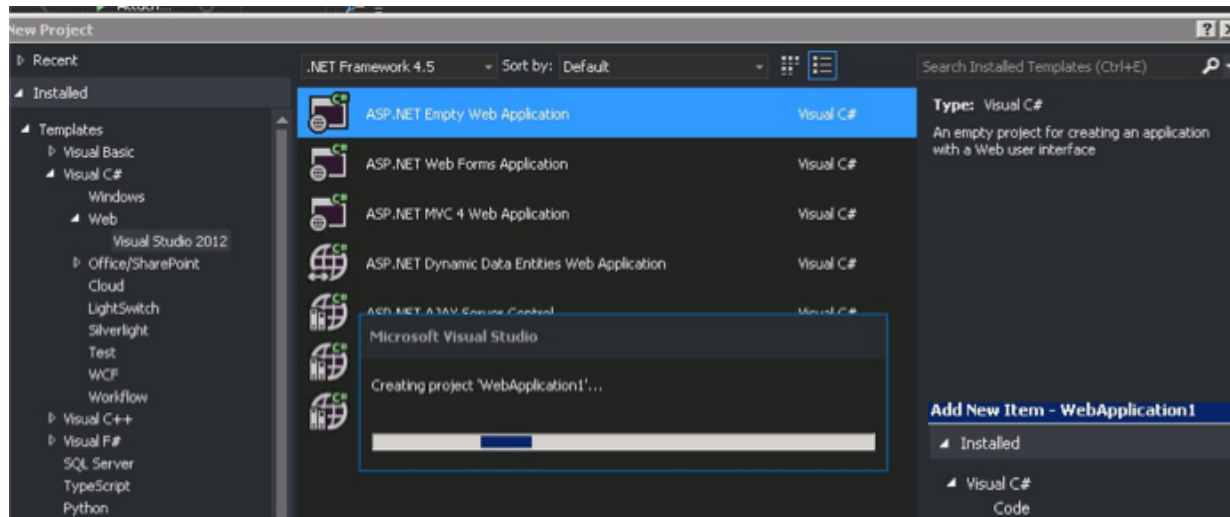
# Web Services using Visual Studio

3 ways to do it:

- 1. ASMX Web Service** (Traditional Web Service using SOAP)
- 2. WCF Service**
  - A general approach used to create all kind of communication including web services, both SOAP and REST
- 3. ASP.NET Web API** (The modern Web Service using REST, Web 2.0)

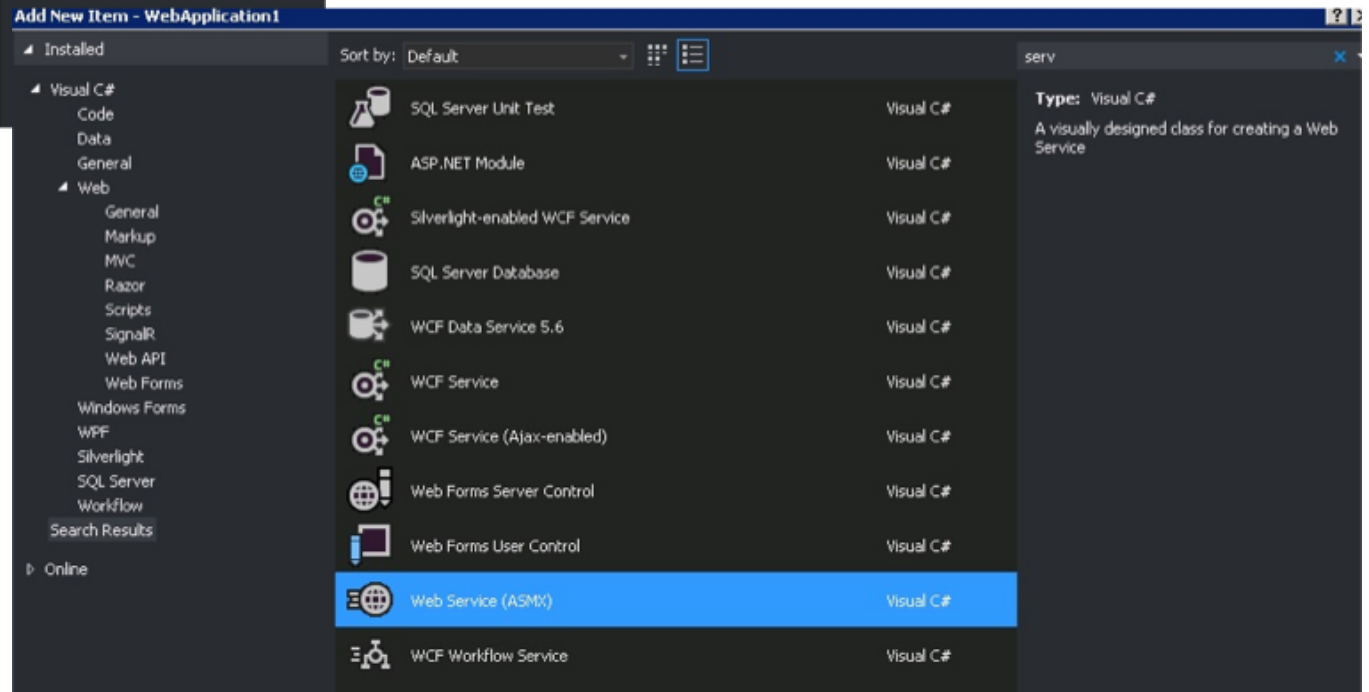


# ASMX Web Service in Visual Studio



Create Empty  
ASP.NET  
Project

Add Web Service(asmx)  
to your project



```
CalculatorService.asmx.cs  X
CalculatorService.CalculatorService  HelloWorld()

using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.Services;

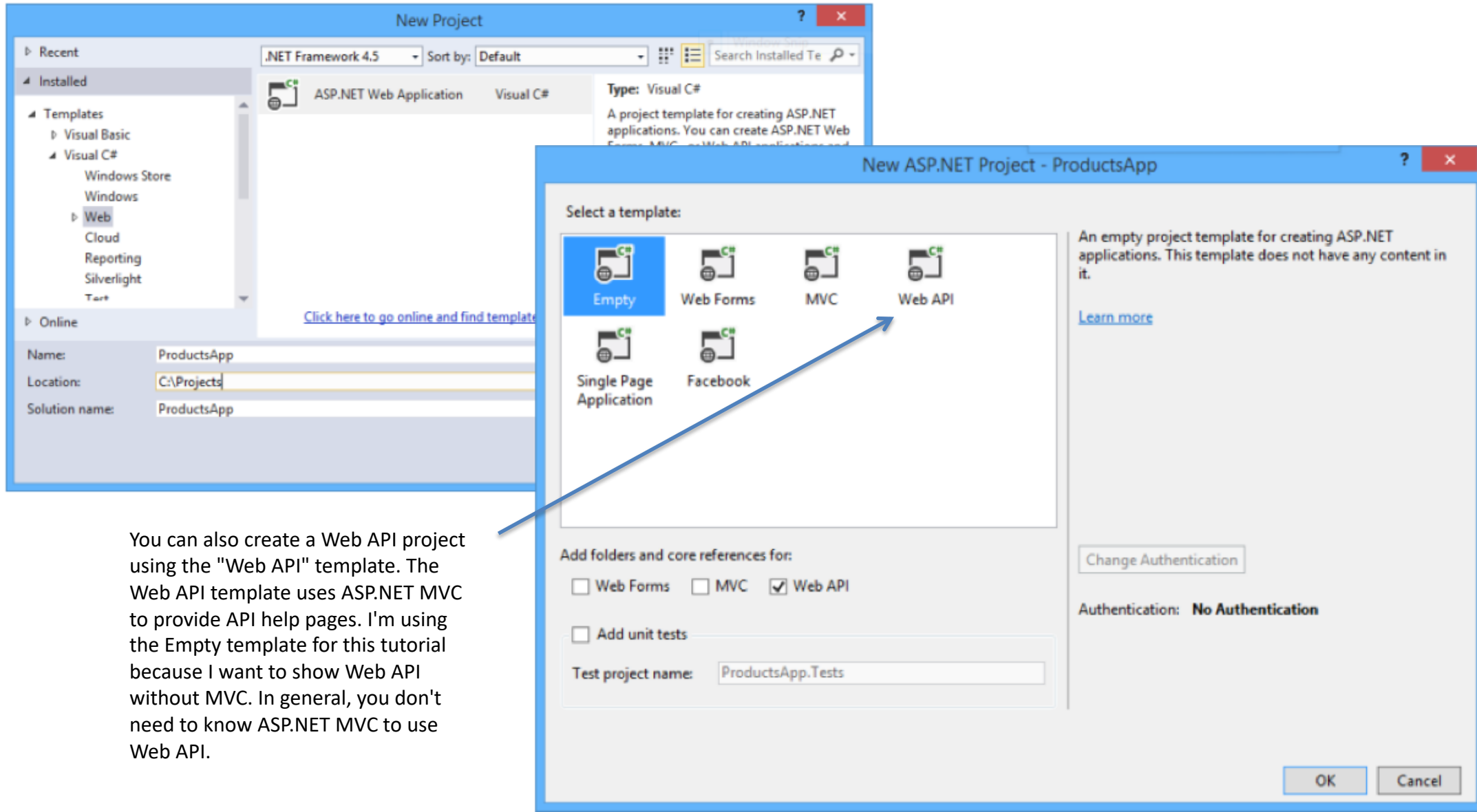
namespace CalculatorService
{
    /// <summary>
    /// Summary description for CalculatorService
    /// </summary>
    [WebService(Namespace = "http://tempuri.org/")]
    [WebServiceBinding(ConformsTo = WsiProfiles.BasicProfile1_1)]
    [System.ComponentModel.ToolboxItem(false)]
    // To allow this Web Service to be called from script, using ASP.NET AJAX, uncomment the following line.
    // [System.Web.Script.Services.ScriptService]
    0 references
    public class CalculatorService : System.Web.Services.WebService
    {
        [WebMethod]
        0 references
        public string HelloWorld()
        {
            return "Hello World";
        }
    }
}
```

Test the built-in HelloWorld() method – F5

# ASP.NET Web API

- Web API = Web Service, Web 2.0
- Application Programming Interface that can be accessed via HTTP requests
- ASP.NET Web API is a framework that makes it easy to build HTTP services that reach a broad range of clients, including browsers and mobile devices.
- ASP.NET Web API is an ideal platform for building RESTful services on the .NET Framework.

# ASP.NET Web API in Visual Studio



The image shows two overlapping dialog boxes in Visual Studio. The background dialog is 'New Project', showing a tree view of templates under 'Visual C# > Web'. The foreground dialog is 'New ASP.NET Project - ProductsApp', showing a 'Select a template:' section with 'Web API' selected. Below this, the 'Add folders and core references for:' section has 'Web API' checked. The 'Authentication:' section is set to 'No Authentication'.

You can also create a Web API project using the "Web API" template. The Web API template uses ASP.NET MVC to provide API help pages. I'm using the Empty template for this tutorial because I want to show Web API without MVC. In general, you don't need to know ASP.NET MVC to use Web API.

# ASP.NET Web API Example

## – Step by Step

<http://www.asp.net/web-api/overview/getting-started-with-aspnet-web-api/tutorial-your-first-web-api>

# References



- SOAP vs. REST Challenges: <http://www.soapui.org/The-World-Of-API-Testing/soap-vs-rest-challenges.html>
- Web Service: [http://en.wikipedia.org/wiki/Web\\_service](http://en.wikipedia.org/wiki/Web_service)

# Hans-Petter Halvorsen

University of Southeast Norway

[www.usn.no](http://www.usn.no)

E-mail: [hans.p.halvorsen@usn.no](mailto:hans.p.halvorsen@usn.no)

Web: <https://www.halvorsen.blog>

