

#### **Telemark University College**

Department of Electrical Engineering, Information Technology and Cybernetics



# Web Services

# with Examples

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# 1. Introduction

In addition to this written Tutorial, you will find additional resources here:

http://home.hit.no/~hansha/?tutorial=webservice

## 1.1. The Problem

Our problem is: How to Share Data between Devices in a Network?

### 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.



## 1.2. The Solution

Solution: Web Service. Web Services uses standard web protocols like HTTP, etc.

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



Today Web Services have been very popular. A Web service is a method of communications between two devices over the World Wide Web, and makes it easy to share data over a network or the internet.

## 1.3. Web Services Overview

A Web Service is

• A Web API

- A Standard defined by W3C
- Cross-platform and Platform-independent Communication
- Distributed Application Development

Web Services can be implemented and used in most Programming Languages (C#/ASP.NET, PHP, LabVIEW, Objective-C, Java, etc.)

Web Services uses standard Web technology (Web protocols) such as HTTP, REST, SOAP, XML, WSDL, JSON, etc.



Web Services technology used in Web Services:

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

A Web Service is typically deployed on a web server, similiar as ordinary web pages.



We have 2 different types of Web Services:

• Web Services 1.0: SOAP Web Services

"Complex"

- Web Services 2.0: REST Web Services
  - Lightwight and Flexible
  - A new and simpler version of WS
  - All major WS on the Internet today use REST

Below we summarize Web Services 1.0 vs. 2.0.

Below we see the different "layers" a "SOAP Web Service" consists of.



#### XML:

XML stands for eXtensible Markup Language. XML is designed to transport and store data.

Below we see an XML document example.

```
<?xml version="1.0"?>
<note>
<to>Tove</to>
<from>Jani</from>
<heading>Reminder</heading>
<body>Don't forget me this weekend!</body>
```

</note>

## 1.4. **REST Web Services**

Below we see the different "layers" a "REST Web Service" consists of.



# 2. Creating Web Services with Visual Studio

Visual Studio has powerful features for creating Web Services.

3 ways to do it:

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



# 3. ASMX Web Service

In this chapter we will go through the steps in order to create a ASMX/SOAP Web Service in Visual Studio.

New Project:

New Project				2 ×
▶ Recent		NET Framework 4.5 - Sort by: Default		Search Installed Templates (Ctrl+E)
<ul> <li>Installed</li> <li>Templates         <ul> <li>Visual C#</li> <li>Visual C#</li> <li>Other Langu</li> <li>Other Project</li> <li>Modeling Prospective</li> </ul> </li> <li>Modeling Prospective</li> <li>Samples</li> </ul>	ages t Types ojects	Image: Second	Visual C# Visual C#	Type: Visual C# Aproject template for creating ASP.NET applications. You can create ASP.NET Web Forms, MVC, or Web AP! applications and add many other features in ASP.NET.
Name:	CalculatorService			
Location:	C:\Work\Developm	ent\TFS\Development\Web Service\Server\Visual Studio	ASMX\	Browse
Solution name:	CalculatorService			Create directory for solution  Add to source control  OK Cancel

Select the "Empty" template:

EmptyC*C*C*EmptyWeb FormsMVCWeb APIC*C*FormsHVCSingle Page ApplicationFacebookH	An empty project template for creating ASP.NET applications. This template does not have any content in it. Learn more
Add folders and core references for:       Web Forms     MVC     Web API       Add unit tests     Add unit tests	Change Authentication Authentication: No Authentication

Select "Add New Item":



Installed	Sort by: Default	• # 🗉		Search Installed Templates (Ctrl+E)
▲ Visual C# Code	MVC 5 Partial	Page (Razor)	Visual C#	Type: Visual C#     A visually designed class for creating a
Data General	C* OWIN Startup	class	Visual C#	Web Service
▲ Web General	Site Map		Visual C#	
Markup MVC	WCF Data Ser	vice 5.6	Visual C#	
Razor Scripts	WCF Service		Visual C#	
SignalR Web API	WCF Service (	Ajax-enabled)	Visual C#	
Web Forms Windows Forms	Web Configur	ration File	Visual C#	
Reporting	Web Forms M	laster Page	Visual C#	
SQL Server	Web Forms M	laster Page (Nested)	Visual C#	
Online	Web Forms Sk	cin File	Visual C#	
	Web Forms U	ser Control	Visual C#	
	E Web Service (	ASMX)	Visual C#	
	S	lick here to go online and find	emplates.	v
lame: Calculat	orServicelasmx			

Select the "Web Service (ASMX)" item:

The deafult template looks like this:



Test the built-in HelloWorld() method - F5

CalculatorService Webtjen X
← ⇒ C □ localhost32684/CalculatorService.asmx
CalculatorService
Operasjonene nedenfor støttes. Hvis du vil ha en formell definisjon, se <u>Tienestebeskrivelse</u> . • <u>HelloWorld</u>
Denne webtjenesten bruker http://tempuri.org/ som standard navneområde.
Anbefaling: Endre standard navneområde før XML-webtjenesten publiseres.
Hver XML-webtjeneste trenger et unikt navneområde for at klientprogrammer skal kunne skille tjenesten fra andre på weben. http://tempuri.org/ er tilgjengelig for XML- webtjenester som er under utvikling, men publiserte XML-webtjenester bør bruke et mer permanent navneområde.
XML-webtjenesten ber angis ev et navneområde du kontrollerer. Du kan for eksempel bruke selskapets Internett-domenenavn som en del av navneområdet. Selv om mange navneområder for XML-webtjenester ser ut som URL-adresser, trenger de ikke nødvendigvis peke til faktiske ressurser på weben. (Navneområder for XML-webtjenester er URIer.)
For XML-webtjenester som opprettes med ASP.NET, kan standard navneområde endres ved hjelp av egenskapen Namespace for WebService-attributtet. WebService-attributtet brukes for klassen som inneholder metoder for XML-webtjenestene. Nedenfor vises et kodeeksempel som angir navneområdet som http://microsoft.com/webservices/:
C#
[WebService (Namaspace="http://minrosoft.com/webservices/")] public class NyWebService (
Visual Basic
<webservice (namespace:="http://microsoft.com/webservices/" )=""> Fublic Class MyMebService ' implementering End Class</webservice>
C++
<pre>(WebService (Mannospace="http://microsoft.com/webservices/")1 public ref class WyMebService (</pre>
Hvis du vil ha mer informasjon om XML-navneområder, se W3C-anbefalingen på webområdet Namespaces in XML.
Hvis du vil ha mer informasjon om WSDL, se webområdet for WSDL-spesifikasjoner.
Hvis du vil ha mer informasjon om URIer, se <u>RFC 2396</u> .

## 3.1. Create a Web Method

Create a method that gets the current date and time:

```
[WebMethod]
public string GetTime()
{
    DateTime time = DateTime.Now;
    string dateformat = "yyyy.MM.dd HH:MM:ss";
    return time.ToString(dateformat);
```

•••

}

# 4. IIS Web Server

IIS – Internet Information Server

# 5. Web Service Client in Visual Studio

Walkthrough: Connecting to Data in a Web Service (Windows Forms):

http://msdn.microsoft.com/en-us/library/ms171891.aspx

## 5.1. Windows Forms

Create a New WinForm Project.

Select "Add Service Reference"

Solution Explorer		,	γų×
© ∩ 🟠 🖸	• ē	? Q 🗇 🕲 🗡 🗕	
Search Solution E	xplore	er (Ctrl+¨)	<u>ہ</u> م
+ <mark>⋈</mark> Solution 'Wi ▲ + C# <b>WinForm</b> ▷ + 🎤 Prope	nForr n <b>sWS</b> erties	nsWSClient' (1 project) <b>Client</b>	
🕨 🍽 Refer			
📕 Servi		Add Reference	
+ <b>γ</b> ⊡ App.₀		Add Service Reference	
▷ + 🖃 Form	苗	Manage NuGet Packages	
P + C# Progi		Scope to This	
	Ē	New Solution Explorer View	
	_		-

# 6. Get Data from a Temperature Device

In this chapter we will publish temperature data from a temperature device via a Web Service.

## 6.1. TC-01 Thermocouple Device

Below we see the TC-01 Thermocouple device from National Instruments:



TC-01 Web Site: http://sine.ni.com/nips/cds/view/p/lang/no/nid/208177

# Web Service with Data from a Database

The main purpose with a Web Service is to share data from a database 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.

## 7.1. Create Database

We are going to create the Database / Data Tier, including:

- Tables
- Views
- Stored Procedures

• etc.



We are going to create the following example database:



The database is designed using Erwin.

The Database is created and implemented using SQL Server Management Studio



You may download a Zip File with Tables, Views, Stored Procedures, etc. in order to create the Data Tier in SQL Server.

http://home.hit.no/~hansha/?tutorial=sql

# 7.2. Data Access Tier

We will create a project in Visual Studio where we create alle the logic/code that deal with the communication with the database.

Create an empty Solution in Visual Studio:

					New Project		? 🗙
Recent		.NET F	ramework 4.5	- Sort by	Default	- # E	Search Installed Templates (Ctrl+E)
<ul> <li>Installeci</li> </ul>			Blank Solution			Visual Studio Solutions	Type: Visual Studio Solutions
<ul> <li>Templates</li> <li>Visual C#</li> <li>Window</li> <li>Window</li> <li>Web</li> <li>Visua</li> <li>Cloud</li> <li>Reportin</li> <li>Silverligh</li> <li>Test</li> <li>WCF</li> <li>Workflox</li> <li>TypeScript</li> <li>Other Langu</li> <li>Other Projec</li> <li>Setup an</li> <li>Visual St</li> <li>Semples</li> </ul>	s Store s d Studio 2012 g t t t t t t Types t d Deployment udio Solutions						Create an empty solution containing no projects
⊅ Online			<u> </u>	lick here to g	o online and find t	templates.	
Name:	MySoftware						
Location:	C:\Work\Develo	opment\Ti	FS\Development	\Tier Archite	cture\	•	Browse
Solution name	MySottware						Create directory for solution Add to source control
							OK Cancel

Add Project for Data Access Tier:

		Add New Pro	oject	? ×
Recent		NET Framework 4.5    Sort by: Default	- II' 🖽	Search Installed Templates (Ctrl+E)
4 Installed		Windows Forms Application	Visual C#	* Type: Visual C#
✓ Visual C≠ Windows Store Windows ▷ Web Cloud Reporting Silverlight Test WCF		WPF Application	Visual C#	A project for creating a C# class library (.dll)
		Console Application	Visual C#	
		ASP.NET Web Application	Visual C#	
		Class Library	Visual C≠	
Workflow TypeScript		Portable Class Library	Visual C#	
<ul> <li>Other Language</li> <li>Other Project</li> </ul>	ges Types	Blank App (XAML)	Visual C#	
▶ Online		Grid App (XAML)	Visual C#	
		Hub App (KAML)	Visual C#	
		Silverlight Application	Visual C≠	
		Split App (XAML)	Visual C≇	
		Silverlight Class Library	Visual C#	*
		Click here to go online and fi	nd templates.	
Name	LogicTier			
Location	C:\Work\Develo	pment\TFS\Development\Tier Architecture\MySoftw	are 🔹	Browse

Add a New Class to the Project:

	Add New Iter	n - LogicTier	¥
Installed	Sort by: Default 🔹 🔢	E Search Installed T	Templates (Ctul+E) 🛛 🔎
✓ Visual C# Items Code	NI DAQ Component	Visual C# Items Type: Visual C#	f Items definition
Data General	Ni Instrument Driver	Visual C# Items	
Web Windows Forms	Cless	Visual C# Items	
Reporting	••O Interface	Visual C# Items	
Graphics	Windows Form	Visual C# Items	
Online	User Control	Visual C# Items	
	Component Class	Visuel C≢ Items	
	User Control (WPF)	Visual C≠ Items	
	About Box	Visual C# Items	
	ADO.NET Entity Data Model	Visual C# Items	
	Application Configuration File	Visual C# Items	
	Application Manifest File	Visual C# Items	
	Assembly Information File	Visual C# Items	
	<b> _ _ _ _ _ _</b>	10 (me )	
Jame: StudentD	lata cs		

#### Create the Code, e.g., like this:



Make sure to import the necessary Name Spaces. You should also create a proper Name space for the Class file.

Create a proper name for the Assembly (.dll File):

luild			
uild Events	Assembly name:	Defa	ault namespace:
ebug	Tuc.School.LogicTier	Tuc	.School.LogicTier
esources	Target framework:	Out	put type:
ervices	.NET Framework 4.5	Clas	ss Library 🗸 🗸
ettings	Startup object:		
eference Paths	(Not set)	•	Assembly Information
ode Analysis			
ode Analysis	<ul> <li>Specify how application resources will be managed</li> <li>Icon and manifest         <ul> <li>A manifest determines specific settings for an a your project and then select it from the list below loon:</li> </ul> </li> </ul>	plicatior v.	n. To embed a custom manifest, first add it to
ode Analysis	<ul> <li>Specify how application resources will be managed</li> <li>Icon and manifest</li> <li>A manifest determines specific settings for an a your project and then select it from the list below Icon:</li> <li>(Default Icon)</li> </ul>	plicatior v.	n. To embed a custom manifest, first add it to
ode Analysis	<ul> <li>Specify how application resources will be managed</li> <li>Icon and manifest         <ul> <li>A manifest determines specific settings for an a your project and then select it from the list below loon:</li></ul></li></ul>	plicatior v.	n. To embed a custom manifest, first add it to
de Analysis	<ul> <li>Specify how application resources will be managed</li> <li>Icon and manifest         <ul> <li>A manifest determines specific settings for an a your project and then select it from the list below Icon:</li></ul></li></ul>	plicatior v.	n. To embed a custom manifest, first add it to v I

Then Build your Project (hopefully with no errors). This will be the Assembly for your Data Acces (Logic) Tier, that can be imported and used in other projects. Create once – use it many times!!

# 7.3. Create the Web Service

Now we will create the Web Service that is the connection between the Data Access (Logic) Tier and the Device that is going to communicate wit hthe database.

Create an ASP.NET Project:

				Add	New Project		7	×
Recent		NET F	amework 4.5	* Sort by: Def	ault	• # E	Search Installed Templates (Ctrl+E)	p.
<ul> <li>Installed</li> </ul>		51	ASP.NET Emp	ty Web Applicatio	Π.	Visual C#	Type: Visual C#	
▲ Visual C# Windows Store Web ▶ Office Cloud Measurement Studio		5	ASP.NET Web	Forms Application	n	Visual C#	An empty project for creating an application with a Web user interface	
		e SP.NET MVC 3 Web Applicati d ASP.NET MVC 3 Web Applicati		3 Web Applicatio	n	Visual C#		
				4 Web Applicatio	n	Visual C#		
Reporting SharePoint		Ð	ASP.NET Dyna	amic Data Entities	Web Application	Visual C#		
Silverlight Test		Ð	ASP.NET AJAX	X Server Control		Visual C#		
WCF Workflow		Ð	ASP.NET AJAX	(Server Contro) Ex	tender	Visual C≠		
<ul> <li>Other Language</li> <li>Other Project</li> </ul>	ges Types	御	ASP.NET Serve	er Control		Visual C≠		
Online								
Namer	SchoolWS					]		
Location:	C:\Work\Deve	lopment\T	S\Developmen	t\Tier Architecture	\MySoftware		Browse	
							OK Cance	el 🛛

#### Add Web Service:

	- SchoolWS	7	
▲ Installed	Sort by: Default 🔹 👯	Search Ins	talled Templates (Ctrl+E) 🛛 🖌
∡ Visual C# Code Data	ASP.NET Server Control	Visual C# <b>Type:</b> V A visual Visual C# Web Ser	isual C# y designed class for creating a vice
Web Windows Forms WPF	Browser File	Visual C#	
Reporting Silverlight Workflow	Domain Service Class	Visual C# Visual C#	
▶ Online	Generic Handler	Visual C#	
	Global Application Class	Visua <mark>l</mark> C≠	
	Site Map	Visual C#	
	Skin File	Visual C#	
	WCF Data Service	Visual C#	
	WCF Service	Visual C#	
	Web Configuration File	Visual C#	
	3 Web Service	Visual C≢	
Name: SchoolW	/Slasmx		

#### Web Service Code:



#### The Database ConnectionString is located in Web.config:



#### Test the Web Service:



Deploy/Publish Web Service to IIS. Copy Web Service Files to default IIS Directory: C:\inetpub\wwwroot.

Eg	Internet Information Services (IIS) Manager	
Fix View Help		particular and an
Connections	Default Web Cita Llama	Actions
MACWINE (MACWINE).Hens-Petter)     A Sedectors Rest:	Fite: - T Go - Co Show All Stroughts Area - III-	H Explane Edit Permissions
Application Pois     A      Application Pois     A      A      Defa     A      Defa     A      Defa     A     A      A	ADE/NET AFT SAFT SAFT SAFT SAFT SAFT SAFT SAFT S	Edit Site Eindings Basic Settings View Applications View Writed Directories
Add Virtual Directory Edit Bindings Menage Website	See Control Series Seri	Manage Website
Katrish     Kanama     Kanama     Switch to Content View	Default Directory Unor Proces Handler HTTP GAPTINES     SAPTINES	Browne Website
	Logang MME Type Module Cooke Request 551 Settings Cooking Request 551 Settings Management	Lints
Reate	Teatmes View	

	Add Application	? ×
Site name: Default Web Site Path: /		
Alias:	Application pool:	
SchoolWS	DefaultAppPool	Select
Physical path: C:\inetpub\www.root\SchoolWS		
Pass-through authentication		
Connect as Test Settings		
Enable Preload		
	ОК	Cancel

# 7.4. Using the Web Service

We will use Web Service in a WinForm Application.

#### Create New WinForm Project:

		Add New Pr	oject	? 🗙
D Recent		NET Framework 4.5 + Sort by: Default	· # 🗉	Search Installed Templates (Ctrl+E)
4 Installed		Windows Forms Application	Visual C#	Type: Visual C#
▲ Visual C# Windows S Windows	itore	WPF Application	Visual C#	A project for creating an application with a Windows Forms user interface
Web Ø Office		Console Application	Visual C#	
Cloud Measurem	ent Studio	Closs Library	Visual C#	
Reporting SharePoint		Portable Class Library	Visual C#	
Silverlight Test		WPF Browser Application	Visual C#	
WCF Workflow		Empty Project	Visual C#	
<ul> <li>Other Languag</li> <li>Other Project 7</li> </ul>	ges Types	I Windows Service	Visual C#	
Þ Online		WPF Custom Control Library	Visual C#	
		WPF User Control Library	Visual C#	
		Windows Forms Control Library	Visual C#	
Name:	WinFormApp	WSClient		
Location:	C:\Work\Dev	elopment\TFS\Development\Tier Architecture\MySoft/	ware *	Browse
				OK Cancel

#### Add Web Service Reference:

To see a list of available services on services, click Discover.	Add Service Reference a specific server, enter a service URL a	ind click Go. To browse	? ×
Address: http://localhost/SchoolWS/		✓ Go	Discover -
Services:	Operations:		
	<ul> <li>♀ GetStudent</li> <li>♀ HelloWorld</li> </ul>		
1 service(s) found at address 'http:// Namespace: SchoolWSReference	/localhost/SchoolWS/'.		
Advanced		ОК	Cancel

27

#### Create GUI:



#### Create Code:

FormWSClient.cs 😐 🗙 FormWSClient.cs [Design]	
🐄 WinFormAppWSClient.FormWSClient	+ 🗣 FormWSClient_Load(object sende
<pre>□using System; using System.Collections.Generic; using System.ComponentNodel; using System.Data; using System.Dawing; using System.Linq; using System.Text; using System.Threading.Tasks; using System.Windows.Forms;</pre>	
<pre>namespace WinFormAppWSClient {     public partial class FormWSClient : Form     {         public FormWSClient()         {             InitializeComponent();         } </pre>	
<pre>private void FormWSClient_Load(object sender, EventArgs e) {     FillStudentGrid(); }</pre>	
<pre>private void FillStudentGrid() {     DataSet ds = new DataSet();     SchoolWSReference.SchoolWSSoapClient schoolWs = new SchoolWSRef     ds = schoolWs.GetStudent();     dataGridViewStudentInformation.DataSource = ds.Tables[0];</pre>	erence.SchoolWSSoapClient();

#### Test it:

E	Barak Obama					
		3333	TUC	SCE2	0	-
	Jens Stoltenberg	2222	TUC	SCE1	5	_
J	John Cleese	1111	TUC	SCE1	4	_
1	Kurt Nilsen	4444	TUC	SCE2	3	_

It works!

# Web Services in LabVIEW

## 8.1. Web Service

Tutorial: Creating and Accessing a LabVIEW Web Service:

http://zone.ni.com/reference/en-XX/help/371361K-01/lvhowto/build\_web\_service

Create a new LabVIEW project:

ile Edit View Proj i Control	ect Operate Tools	Wir	adow Help ▼ 📽 <u>1\</u>     🍰 🎯 👔	
🖃 👪 Project: Calcula	ator.lvproj			
🗗 🛃 My Comp	New	•	VI	
Build S	Export Import	•	Simulation Subsyste Virtual Folder Control Library Variable	
	Add	×		
	Find Project Items			
-	Arrange By Expand All	•	Class XControl	
	Collapse All		Web Service	
-	Help Properties		NI-DAQmx Task NI-DAQmx Channel NI-DAQmx Scale	
		1	New	

The Project Explorer should now look like this:



Create a Web Service Method (SubVI):

Add.vi	
File Edit View Project Operate Tools Window Help	2
LabVIEW Web Service Request	^
Number1	E
Number2	
Calculator.lvproj/My Computer] *	

Below we see the Web Services palette in LabVIEW

Web Services			X
Cr Searc	h <sub> </sub> Customiz	e*	
	<b>****</b> ***		*@ &&
Read Form D	Read All For	Read Upload	Read Postdata
100 - 100 -	*@)) &&		** • E
Read Reques	Read All Req		Service
Sessions	Output	Security	Conversion

Create the following block diagram:

Add.vi Block Diagram				X
File Edit View Project Opera	te Tools Window	Help	[	<mark>?</mark>
Numb 1081 Mumb 1081 M	er1 er2	Answer		
LabVIEW Web Service Request	Query String 💌		value Pibc	H
Calculator.lvproj/My Computer ∢		m		+

Test it:

HTTP Method URL		
Available Servers		
8001 - Local Debugging		
HTTP Method URL		
http://127.0.0.1:8001/Calculator/Add?Number2	2={value}&Number1={value}	•
		*
	Copy URL Close	Help

In the Web browser it should look like this:

Bad Request × 127.0.0.1:8001/Calculator/ ×	
← → C 🗋 127.0.0.1:8001/Calculator/Add?Number2=2&Number1=3	☆ =
This XML file does not appear to have any style information associated with it. The document tree is shown below.	
<pre>*<response>  *<terminal>  <name>Answer</name>  <value>5</value>  </terminal>  </response></pre>	

## 8.2. LabVIEW Client

### 8.2.1. Temperature Conversion

We will get data from a Web Service using LabVIEW.

We will use the TUC Weather station Web Service as example:

http://www.w3schools.com/WebServices/tempconvert.asmx

TempCon	Ivert Web Service ×	
← → C	[] www.w3schools.com/WebServices/tempconvert.asmx 값 =	
The following	g operations are supported. For a formal definition, please review the <u>Service Description</u> . <u>CelsiusToFahrenheit</u> <u>FahrenheitToCelsius</u>	

#### WDSL:

http://www.w3schools.com/WebServices/tempconvert.asmx?WSDL

LabVIEW:

/eb Service	
Input the location of a WSDL URL	NATION
Web Service	
Web Service Description Language URL	
http://www.w3schools.com/WebServices/tempcom	wert.asmx?WSDL
Example: http://localhost/DateService.asmx?WSDL	

Select which of the availible Web Methods you want to import:

Select the methods to import	<b>NATIO</b> INSTRU
<ul> <li>FahrenheitToCelsius</li> <li>CelsiusToFahrenheit</li> </ul>	Check Selected
	Uncheck Selected
	Check All
	Uncheck All

The Project Explorer should look like this:

File Edit Viev	v Project	Operate	Tools	Window	Help
	XDO	X  ] 🖫		🛄 🕶 🌈	1 1 1 1 1 1
Items Files					
🖃 📴 Project:	Temperatur	re Convert	.lvproj		
Ξ 🔒 T	emperature	Convert.lv	lib		
	Celsius To	Fahrenheit	t.vi		
	Close Web	Service.vi			
	Open Web	Service.vi	5.VI		
	ependencie	5			
L. 📸 B	uild Specific	ations			

Create a simple example:

Example.vi Block	Diagram Broject Operate Tools Window Help	
다 cuit view	III @ 🛱 🏎 🗗 🗗 15pt Application Font 🔹	· ₽• •
	Open Web Service.vi Celsius To Fahrenheit.vi	Close Web Service.vi
Celsuis	Number To Fractional String	p String To Number Fahrenheit
•	III	

#### Front Panel:

😰 Example.vi Front Panel
File       Edit       View       Project       Operate       Tools       Window       Help
Celsuis Fahrenheit 71
K M N

## 8.2.2. Weather Station Example

We will get data from a Web Service using LabVIEW.

We will use the TUC Weather station Web Service as example:

http://128.39.35.252/WebApi/WebService.asmx

🗅 WebService Web Service 🔹 👝	
← → C D 128.39.35.252/WebApi/WebService.asmx	\$ <u>^</u> ;} ≡
WebService	
The following operations are supported. For a formal definition, please review the Service Description.	
<ul> <li>GetBackgroundImage This functions is for the Windows store app. The function returns the name of an image in thr App folder</li> </ul>	
<ul> <li>GetDailyAverage This function takes a parameter name as input and returns dealy average for the past 30 days Example: GetDailyAverage(umtTemp1')</li> </ul>	
GetFirstLnfg This functions is for the Windows store app. The function returns XML data for the live tiles	
<ul> <li><u>GetHourlyAverage</u> This function takes a parameter name as input and returns hourly average for the past 24 hours Example: GetHourlyAverage(umtTemp1')</li> </ul>	
<ul> <li><u>GetLatestData</u> This function takes a parameter name as input and returns its latest recorded data Example; GetLatestData['umiTemp1']</li> </ul>	
GetLatestMeasurements     This functions is for the Windows store app. It returns the latest temperature, rain, and wind speed measurements in XML format for the live tiles	
<ul> <li><u>GetMaxMin</u></li> <li>GetMaxMin(string parameterName,string period,string mode) This function takes a parameter name, period and mode(max or min) as input and returns the may data of the selected parameter in the selected period, available periods are:1DayApo,1WeetApo,1MeetApo,1YeerApo Example: GetMaxMin(umTemp1;1Dey/ data of the selected parameter in the selected period, available periods are:1DayApo,1WeetApo,1MeetApo,1YeerApo Example: GetMaxMin(umTemp1;1Dey/</li> </ul>	ximum or minimumrecorded Ago',/min')
<ul> <li>GetMaxMinData This functions is for the Windows store app. The function returns max/min XML data for the live tiles</li> </ul>	
GetNewsTable This functions is for the information website. The function returns all the data in the NEW table	
<u>GetSecondInfo</u> This functions is for the Windows store app. The function returns XML data for the live tiles	
<u>GetSelectedLatestData</u> This function takes an array of parameter names as input and returns their latest recorded data Example: GetSelectedLatestData(arrayOFParameternames)	
<u>GetSelectedMaxHinData</u> GetSelectedMaxHinData     GetSelectedMaxHinData     GetSelectedMaxHinData(sing) parameterName,string period,string mode) This function takes an erray of parameter names, period and mode(max or min) as     maxdmum or minimum valuesfor the selected parameters in the selected period,available periods are: 1DayAgo,1WeekAgo,1MonthAgo,1YeerAgo Example:     GetSelectedLestSelecter30metername*; WeekAgo*; Wee	input and returns the
<ul> <li>GetSelectedWeatherItemsData This function takes an array of parameter names and a period as input and returns their recorded data in the enetered period. Example: GetWeatherItemData(a 00 / 302-21-03)</li> </ul>	arrayOfaParameters, '2012-11-
<ul> <li><u>GetWeatherData</u> This function takes a period as input and returns recorded data for all parameters in this period, the input period can be: HourAgo, IDeyAgo, IWeekAgo, IMonth/ GetWeatherData(1WeekAgo)</li> </ul>	Ago,1YearAgo Example:
<ul> <li>GetWeatherIcon This functions is for the Windows store app. The function returns the name of an image in thr App folder</li> </ul>	
<ul> <li>GetWeatherItemData         This function takes a parameter name and a period as input and returns the recorded data of this parameter in the enetered period. Example: GetWeatherItem102;7012-01-03     </li> </ul>	Date('umtTemp1','2012-11-
<ul> <li>GetWeatherParameters         This function returns all the data Inside WEATHER_PARAMETER table in the Weather station database     </li> </ul>	
GetYrData     This functions is for the Windows store app. The function returns yr data for the live tiles	
<ul> <li>add/texts</li> <li>This functions is for the information website. The function is used be the website to add, edit or delete information</li> </ul>	

The WSDL:

http://128.39.35.252/WebApi/WebService.asmx?WSDL



#### Lets start creating the the Web Service client in LabVIEW:

Untitled 1 Front Panel			
File Edit View Project Operate	Tools Window Help		_
💠 🐼 🔘 🛿 15pt Applic	Measurement & Automation Explorer		
	MathScript Window	_	
	Compare	•	
	Merge	•	
	Profile	►	
	Security	►	
	User Name		
	Build Application (EXE) from VI		
	Convert Build Script		
	Source Control	•	
	LLB Manager		
	Import	•	.NET Controls to Palette
	Shared Variable	►	ActiveX Controls to Palette
	Distributed System Manager		Shared Library (.dll)
	Find VIs on Disk		Web Service

Type the Web Service path/URL:

Web Service	
Web Service Description Language URL http://128.39.35.252/WebApi/WebService.asmx?WSDL	
Example: http://localhost/DateService.asmx?WSDL	

Input the authentication inform	nation	NATIO
Authentication		
🕅 Web service requires auth	nentication	
User name*	Password	
Domain		
Proxy Server		
🔲 Use a proxy server for you	ur LAN	
Name/Address*	Port	D
Proxy service requires	authentication	
User name*	Password	
Domain		
* Marked items are required	when the option is enabled.	

•••

Input the project library and destination directory Project Library Name (.Ivlib) Weather System	<b>NATIONAL</b> INSTRUMENTS
Project Library Name (.Ivlib) Weather System	
Weather System	
Destination Directory	
C\Work\Development\TFS\Development\Web Service\Clients\ LabVIEW\Weather System	
C Back Not N	Cancel
	Destination Directory C\Work\Development\TFS\Development\Web Service\Clients\ LabVIEW\Weather System < Back Next >

•••

Select the methods to import	INSTRU
GetMaxMin GetLatestData GetSelectedMaxMinData GetSelectedLatestData GetHourlyAverage GetDailyAverage GetWeatherItemData GetWeatherItemData GetWeatherData GetWeatherData	Check Selected
GetWeatherParameters     GetFirstInfo     GetSecondInfo     GetMaxMinData     GetLatestMeasurements     GetBackgroundImage     GetWeatherIcon	Check All

Summary	NATIO
Web Service URL:	
http://128.39.35.252/WebApi/WebService.asmx?WSDL	
Web Service Name:	
WebService	
Library Name:	=
Weather System	
Location:	
C:\Work\Development\TFS\Development\Web Service\Clients\	
LabVIEW\Weather System	1
Imported Methods:	
GetLatestData	
GetSelectedLatestData	
GetHourlyAverage	
GetDailyAverage	

Import Web Service		
Completed		
Web Service succe	essfully imported.	
☑ Open importe	ed project library	
	< Back Ne	xt Finish Help



Weather Parameters.vi Block Diagram on Weather S	ystem.lvproj/My Computer	
File Edit View Project Operate Tools Windo	w Help Application Font v Por v v Close Web Service.vi Unbundle By Name arrayOfDescription arrayOfDes	Veather Parameters
Weather System.lvproj/My Computer 🕢		

Final results:

athar Daramaterr		1 1 1				WHEN A WAY	
athar Darameterr							
-						-	
Parameter Ga	ain (	DPC Tag	Modbus Register	Offset	ParameterName	Source	Unit
Time of last measurement 1		opc://localhost/Kepwi	1	0	umtLastMeas lime	Modbus	limestamp
Wind speed 0,4	448 0	opc://localhost/Kepwi	5	0	umtWindSpeed	Modbus	m/s
Wind direction-unadjusted 1	4	opc;//localhost/Kepwi	9	0	umtRawWindDir	Modbus	
Wind direction 1	6	opc;//localhost/Kepwi	13	0	umtAdjWinDir	Modbus	- *i
Relative humidity 1		opc://localhost/Kepwi	17	0	umtRelHumidity	Modbus	%
Barometric pressure - unadju 33,	1.85		21	0	umtRawBaromPress	Modbus	hPa
Barometric pressure 33,	(,85 d	ope://localhost/Kepwi	25	0	umtAdjBaromPress	Modbus	hPa
Electronic compass wind dire 1	0	opc://localhost/Kepw:	29	0	umtTrueNorthOffset	Modbus	•
Last reported time of rainfall 1	and the second se	opc://localhost/Kepwi	33	0	umtLastRain	Modbus	Timestamp
Air temperature 0,5	5555556	opc://localhost/Kepwi	37	-17,7777	umtTemp1	Modbus	°C
Wind chill 0,5	555556	opc://localhost/Kepwi	41	-17,7777	umtWindChill	Modbus	°C
Heat index 0,5	555556 (	opc://localhost/Kepwi	45	-17,7777	umtHeatIndex	Modbus	*C
Dew Point 0,5	555556 0	opc://localhost/Kepwi	49	-17,7777	umtDewPoint	Modbus	.c
Density Altitude 0,3	3048 0	opc://localhost/Kepw;	53	0	umtDensityAltitude	Modbus	m
3-sec avg of wind speed 0,4	448 /	opc://localhost/Kepw:	57	0	umt3SecRolIAvgWindSpeed	Modbus	m/s
3-sec avg of wind direction 1		opc://localhost/Kepw:	61	0	umt3SecRollAvgWindDir	Modbus	•
2-min avg of wind speed 0,4	448 0	opc://localhost/Kepwi	65	0	umt2MinRollAvgWindSpeed	Modbus	m/s
2-min avg of adjusted wind c 1	1	opc://localhost/Kepwi	69	0	umt2MinRollAverageWindDir	Modbus	•
10-min avg of wind speed 0,4	448 (	opc://localhost/Kepwi	73	0	umt10MinAverageWindSpeed	Modbus	m/s
10-min avg of adjusted wind 1	1	opc://localhost/Kepwa	77	0	umt10MinRollAvgWindDir	Modbus	
10-min wind direction at ma: 1		opc://localhost/Kepwi	81	0	umt10MinWindGustDir	Modbus	
10-min max wind speed 0,4	448		85	0	umt10MinWindGustSpeed	Modbus	m/s
Time of 10-min max wind sp 1	1	opc://localhost/Kepw;	89	0	umt10MinWindGustTime	Modbus	Timestamp
		(0) 11 1.04	03	0	KOLC NC 10 ID.		1

# 9. Data Dashboard for LabVIEW

The Data Dashboard for LabVIEW app lets you create a custom dashboard that can remotely control and monitor running NI LabVIEW applications using Web Services.





The App is available for IOS, Android and Windows 8 (Windows Store App).

Download Dashboard App for iPad here: https://itunes.apple.com/us/app/data-dashboard-for-labview/id481303987?mt=8

Getting Started with the Data Dashboard for LabVIEW:

http://www.ni.com/white-paper/13757/en/



A premaid Data Dashboard for the Weather system at telemark University College is shown below:

Download premade Dashboard here: <u>http://home.hit.no/~hansha/?page=weather</u>

The Data Dashboard for the Weather system is using the following web service: http://128.39.35.252:8080/TUCweather/WebServices

We will use this Web Service in order to create a simple example (using an iPhone).

Download and open the LabVIEW for Data Dashboard App:

•••• N Telenci	\$	18:06	100	56
	Da	shboard		Run
	+	Add		
	C	d d		

#### Connect to the Web Service:

13	
•••••• N Telenor 🗢 13:06 100 % 🔲	•••••• N Telenor 😙 13:07 100 %
Select a server	Connect to server
Servers Cancel	Servers
Demo variables	Server name or IP: Port:
Shared Variable Servers	128.39.35.252 8080
+ Connect to shared variable	Connect
No recent servers	Server Connection Help
Web Servers	
+ Connect to web service	1 2 3 4 5 6 7 8 9 0
No recent servers	@ & % ? , = [ ]
	#+= _ : - + 🛛
	ABC 🌐 🔒 / .no retur

Seelct one of the available web methods:

••••••• N Telenor 🗢 13:09 100 % 🗪 Select a variable	•••০০ N Telenor কি 13:09 Select an indi	cator	سمده N Telenor ຈ 13:09 1:00 % ■ Dashboard Eate
TUCweather /WebServices Cancel RainthisMonth Numeric	WebServices Rainthis	eYear Cancel	RainthisYear
RainthisWeek Numeric Humidity Numeric WindDir Numeric Windspeed	String	Gauge	215.39
Numeric WindChill Numeric Temperature	°₀₀ Chart	_	¢
		5.1	al and a state of

Available Methods in the Web Service

Try some of the other available Methods as well

# 10. Python

...

# 11. MATLAB

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