

# Creating Statistical Web Services Using ASP.NET

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# The Challenge

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Making statistical and graphical capabilities of STATGRAPHICS accessible by user-written web applications.

(STATGRAPHICS is a menu and dialog-box driven application written in C++ using MFC).

# Earlier Approach



Rewrite procedures in Java and expose routines as JavaBeans (“STATBEANS”).

```
import STATBEANS.FileDataSource;
fileDataSource1 = new FileDataSource();
fileDataSource1.setFileName("c:\\statbeans\\samples\\cardata.txt");

import STATBEANS.SimpleRegression;
simpleRegression1 = new STATBEANS.SimpleRegression();
simpleRegression1.setYVariableName("mpg");
simpleRegression1.setXVariableName("weight");

import STATBEANS.SimpleRegressionTable;
import STATBEANS.SimpleRegressionPlot;
simpleRegressionTable1 = new STATBEANS.SimpleRegressionTable();
simpleRegressionPlot1 = new STATBEANS.SimpleRegressionPlot();
simpleRegressionPlot1.setConfidenceLevel(99.0);

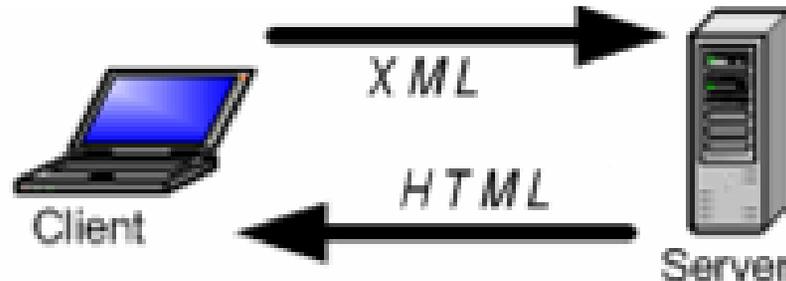
fileDataSource1.addDataChangeListener(simpleRegression1.listenerForDataChange);
simpleRegression1.addDataChangeListener(simpleRegressionTable1.listenerForDataChange);
simpleRegression1.addDataChangeListener(simpleRegressionPlot1.listenerForDataChange);

fileDataSource1.readData();
```

# Current Approach



Create an ASP.NET Web Service that interprets scripts created by web applications and returns results as HTML.



# ASP.NET Web Services



## Statgraphics.asmx:

```
<% @ WebService Language="C#" CodeBehind="~/App_Code/Statgraphics.cs"  
    Class="Statgraphics" %>
```

```
public class Statgraphics : System.Web.Services.WebService
```

```
{
```

```
    [WebMethod(Description = "Interprets an SG XML instruction file and returns name of  
    HTML output page.", EnableSession = true)]
```

```
    public string RunProcs(string InputFileName)
```

```
    {
```

```
        ...
```

```
    }
```

```
}
```

# SG XML Scripts - Layout



```
<statgraphics>
  <globals>
    <OutputLanguage>English</OutputLanguage>
    <SigDigits>6</SigDigits>
    <GraphWidth>4.0</GraphWidth>
    <GraphHeight>4.0</GraphHeight>
    <HTMLFileName>temp/myoutput.htm</HTMLFileName>
  </globals>
  <data>
    <FileName>temp/nonlin.xml</FileName>
    <DecimalSeparator>.</DecimalSeparator>
    <DateFormat>MM/DD/YYYY</DateFormat>
    <MissingValue>NA</MissingValue>
  </data>
  <proc>
    ...
  </proc>
</statgraphics>
```

# SG XML Scripts - Procedures



```
<proc name="SREG">
  <input>
    <Y>Chlorine</Y>
    <X>Weeks</X>
  </input>
  <options>
    <Model>Linear</Model>
  </options>
  <output>
    <table>Summary</table>
    <graph name="Model">
      <ConfLimits>Yes</ConfLimits>
      <ConfLevel>95</ConfLevel>
      <Limits>TwoSided</Limits>
    </graph>
  </output>
  <results>
    <Predicted>PREDICTED</Predicted>
    <Residual>RESIDUALS</Residual>
  </results>
</proc>
```

# Web Application Client

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SGNETDemo.aspx:

```
private static localhost.Statgraphics mySvc = new localhost.Statgraphics();
```

```
String HTMLFileName = mySvc.RunProcs((string)Session["XMLScriptFileName"]);
```

# Sample Web Application



Enter Data - Windows Internet Explorer

http://localhost:1160/SGNETDemo/DataEntry.aspx

statgraphics  
.NET web services demo

Welcome  
**ENTER DATA**  
[Set Global Options](#)  
[Select Procedure](#)  
[Specify Procedure Inputs](#)  
[Calculate](#)

Previous Next

Enter your data in the data table below and assign each column a meaningful name. Or leave the datasheet empty and press **Next** to run the procedures using automatically selected datasets.

Clear Datatable Edit Column Names Clipboard Paste

Row	Make	Model	Type	Min Price	Mid Price	Max Price	MPG City	MPG Highway	Air Bags	Drive Train	Cylinders	Ex S
1	Acura	Integra	Small	12.9	15.9	18.8	25	31	0	front	4	1.
2	Acura	Legend	Midsized	29.2	33.9	38.7	18	25	2	front	6	3.

# System Globals



System Options - Windows Internet Explorer

http://localhost:1160/SGNETDemo/DataEntry.aspx

statgraphics  
.NET web services demo

Welcome  
Enter Data  
**SET GLOBAL OPTIONS**  
Select Procedure  
Specify Procedure Inputs  
Calculate

Previous Next

The following options apply to all statistical procedures:

**System Options**

Significant digits: <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input checked="" type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	Rows to display in tables: <input type="text" value="1000"/> Table width in characters: <input type="text" value="100"/> Graph width: <input type="text" value="600"/> pixels Graph height: <input type="text" value="400"/> pixels Function resolution: <input type="text"/>	Output language: <input checked="" type="radio"/> English <input type="radio"/> French <input type="radio"/> German <input type="radio"/> Spanish StatAdvisor: <input type="radio"/> Tables <input type="radio"/> Graphs	Date separator <input checked="" type="radio"/> slash (/) <input type="radio"/> period (.) <input type="radio"/> dash (-) Date format <input type="radio"/> m d yy <input checked="" type="radio"/> m d yyyy <input type="radio"/> d m vv
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# Procedure Selection

A screenshot of a Windows Internet Explorer browser window. The title bar reads "Untitled Page - Windows Internet Explorer". The address bar shows "http://localhost:1160/SGNETDemo/SystemOptions.aspx". The page content includes the "statgraphics" logo and ".NET web services demo". A navigation menu on the left lists: "Welcome", "Enter Data", "Set Global Options", "SELECT PROCEDURE" (highlighted in a dark red box), "Specify Procedure Inputs", and "Calculate". To the right of this menu are "Previous" and "Next" buttons. Below the menu, a yellow banner contains the text "Select any of the following STATGRAPHICS procedures:". A list of 14 radio button options is displayed in two columns:

- Data - Display Data Table
- Plot - X Plot
- Plot - X-Y Plot
- Plot - X-Y-Z Plot
- Plot - Matrix Plot
- Plot - Multiple X-Y Plot
- Plot - Multiple X-Y-Z Plot
- Plot - Frequency Table
- Plot - Contingency Table
- Compare - Two Sample Comparison
- Compare - Paired Sample Comparison
- Compare - Multiple Sample Comparison
- Compare - Oneway ANOVA
- Compare - Multifactor ANOVA
- Relate - Simple Regression
- Relate - Multiple Regression
- SPC - X Chart
- SPC - X-bar or Median Chart

# Procedure Options



The screenshot shows a Windows Internet Explorer browser window titled "Simple Regression - Windows Internet Explorer". The address bar displays the URL "http://localhost:1160/SGNETDemo/SelectProcedure.aspx". The browser's search bar contains the word "Google". The page content includes the "statgraphics" logo and the text ".NET web services demo". A navigation menu on the left lists: "Welcome", "Enter Data", "Set Global Options", "Select Procedure", "SPECIFY PROCEDURE INPUTS" (highlighted in a dark red box), and "Calculate". To the right of this menu are "Previous" and "Next" buttons. The main content area has a yellow background and is titled "Simple Regression Procedure". It contains the text: "This procedure fits a linear or nonlinear model relating a dependent variable Y to an independent variable X. [Documentation](#)". Below this, there are two dropdown menus: "Dependent variable (Y):" with "MPG City" selected and an "Edit" button; and "Independent variable (X):" with "Weight" selected and an "Edit" button. At the bottom, there is a "(Select):" label, an empty text input field, and a "Help" button. The "Model:" section is partially visible at the very bottom of the page.

# Output (Tabular)



STATGRAPHICS Output - Windows Internet Explorer

http://localhost:1160/SGNETDemo/SystemOptions.aspx

STATGRAPHICS Output

**STATGRAPHICS Web Services**  
Generated: 7/27/2007 9:23:21 AM

**Data file: 93cars.xml**

**Simple Regression - MPG City vs. Weight**  
Dependent variable: MPG City  
Independent variable: Weight  
S-curve model:  $Y = \exp(a + b/X)$

**Coefficients**

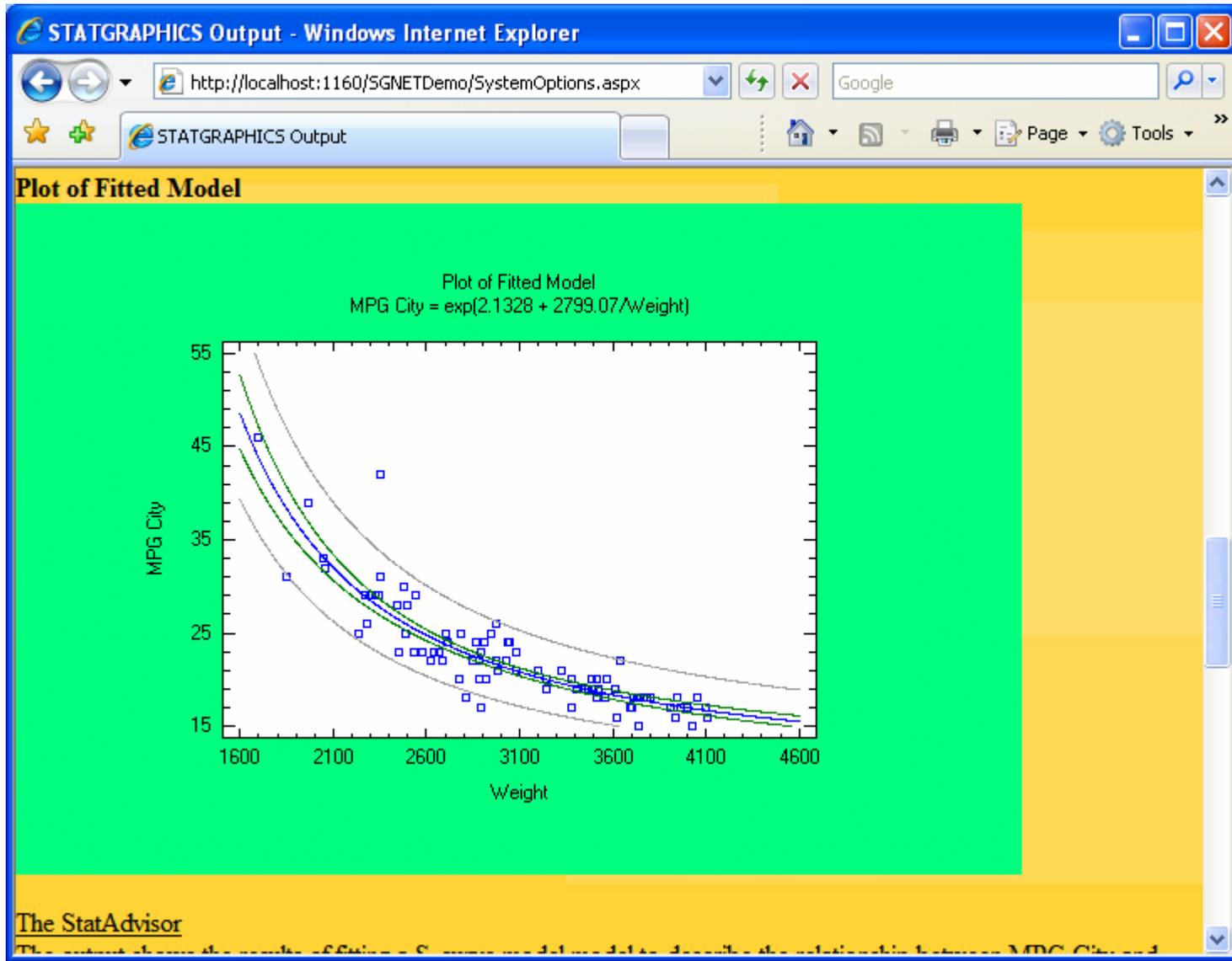
	<i>Least Squares</i>	<i>Standard</i>	<i>T</i>	
<i>Parameter</i>	<i>Estimate</i>	<i>Error</i>	<i>Statistic</i>	<i>P-Value</i>
Intercept	2.1328	0.0487371	43.7614	0.0000
Slope	2799.07	140.752	19.8865	0.0000

NOTE: intercept =  $\ln(a)$

**Analysis of Variance**

<i>Source</i>	<i>Sum of Squares</i>	<i>Df</i>	<i>Mean Square</i>	<i>F-Ratio</i>	<i>P-Value</i>
Model	3.74905	1	3.74905	395.47	0.0000
Residual	0.862676	91	0.00947996		
Total (Corr.)	4.61173	92			

# Output (Graphical)



# Numerical Results



```
http://localhost:1160/sgnetdemo/temp/p1lwvboxsznqsl55kzzfi245_$g$_results.xml - Windows Int...
http://localhost:1160/sgnetdemo/temp/p1lwvboxsznqsl55kzzfi2
Google
http://localhost:1160/sgnetdemo/temp/p1lwvboxsznq...
<?xml version="1.0" standalone="yes" ?>
- <dataSet xmlns="NetFramework">
- <table>
  <Row>1</Row>
  <PREDICTED>23.7499</PREDICTED>
  <LOWERPLIMS>28.853</LOWERPLIMS>
  <UPPERPLIMS>19.5494</UPPERPLIMS>
  <RESIDUALS>1.25008</RESIDUALS>
  <SRESIDUALS>0.528135</SRESIDUALS>
  <LEVERAGES>0.0127527</LEVERAGES>
</table>
- <table>
  <Row>2</Row>
  <PREDICTED>18.5238</PREDICTED>
  <LOWERPLIMS>22.5148</LOWERPLIMS>
  <UPPERPLIMS>15.2403</UPPERPLIMS>
  <RESIDUALS>-0.523846</RESIDUALS>
  <SRESIDUALS>-0.29579</SRESIDUALS>
  <LEVERAGES>0.0177467</LEVERAGES>
</table>
- <table>
  <Row>3</Row>
  <PREDICTED>19.3396</PREDICTED>
  <LOWERPLIMS>23.4991</LOWERPLIMS>
  <UPPERPLIMS>15.9165</UPPERPLIMS>
  <RESIDUALS>0.660353</RESIDUALS>
  <SRESIDUALS>0.345683</SRESIDUALS>
```