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GRAPHIC DATA DISPLAY FROM MANUFACTURING ON WEB PAGES

GRAFICKÉ ZOBRAZENÍ DAT Z VÝROBY NA WEBOVÝCH STRÁNKÁCH

### Abstract

Industrial data can be displayed in graphical form which is usually used by three types of users. The first, nonstop users, most frequent operational engineer, who checking actual displayed values and then intervene in operation. The second are occasional users who are interested in historical data e.g. for servicing reason. The last users' types are tradesmen and managers. State comparison few days or months ago helps as decision-making support. Graph component with web application, which provides data as XML document, was designed for second users group. Graph component displays historical data. Students can fully understand all the problems go along with web application creation in ASP.NET, which provides data in XML document, as well as graph component creation in integrated development environment Flash, thanks in detail described solution using ActionScript.

### Abstrakt

Grafického zobrazení dat z průmyslových aplikací využívají tři typy uživatelů. Prvními jsou nonstop uživatelé, kteří kontrolují aktuální zobrazené hodnoty a podle nich zasahují do provozu, druhým jsou občasní uživatelé, které zajímají historická data, např. z důvodu údržby. Posledním typem uživatelů jsou obchodníci a manažeři, kterým pomáhá např. srovnání stavu před několika dny nebo měsíci jako podpora při rozhodování. Grafová komponenta spolu s webovou aplikací, poskytující komponentě data v podobě XML dokumentu, byla navržena pro druhou skupinu uživatelů. Zobrazuje tedy historická data. Díky detailně popsanému řešení mohou studenti plně pochopit celou problematiku tvorby webové aplikace sloužící pro přípravu dat v podobě XML dokumentu v prostředí ASP.NET a také tvorbu samotné grafové komponenty v integrovaném vývojovém prostředí Flash s využitím ActionScriptu.

## 1 INTRODUCTION

Industrial data can be displayed in a graphical form, which are usually used by three types of users. The first type of users are 24/7 users, most frequently the operational engineers, who are checking actual and displayed values and then intervene in the process or production. The second are occasional users who are interested in historical data e.g. for service and maintenance reason. The last type of users is sales people and managers. The status comparison of the few last days or some months ago helps them to make decision.

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At present, there is a group of users who are equipped with Supervisory Control and Data Acquisition – Human Machine Interface (SCADA/HMI) or other especially developed and customized client applications. But the trend is to provide data in much easier way – by a web browser. Except the financial aspects it is also advantageous that data can be read by users not only at work, but in every location, where the internet is provided.

Thanks detail described solution students can fully understand all problems around web application creation which is providing data in XML document form in ASP.NET and so graph component creation in integrated development environment Flash with using ActionScript 2.0.

## 2 GRAPHIC DATA DISPLAY PROPOSAL

Goal of this project was to design a suitable solution for a data display in understandable way. In project the effort was put on partial problems, which students can solve in graphic data display design.

In graphic data display design we focused on most used technologies in concrete JavaScript, .NET, PHP, Flash and Silverlight and we described main differences between graphic data displays created by mentioned technologies, where we put the accent on data link load, interactive elements possibilities and their implementation, understanding displayed data and multiplatform utilization.

Thanks to .NET or PHP technologies it is possible to create graph in an image form, which is generated on servers side and then they are sent to a client side. The web application is gathering data from database through SQL queries. In next step these data are compiled, evaluated and using System.Drawing (.NET) or Graphic (PHP) classes or other drawing classes these objects are drawn into the images or more precisely into the graphs. Disadvantage of this technology is the relatively big data amount linked to the load and the impossibility to implement interactive elements, which would allow end users to understand data in easier way.

Compared to mention technology, which product non-interactivity and needless big images is standing Flash and Silverlight technology with the aid of you can create interactive graph component. Silverlight technology same as Flash technology is providing the vector oriented graphic output and allowing to work with XML data (generated on server side) but it is a new technology and there for it is not supported by all web browsers.

For graphic data display Flash technology was chosen, which allows creating vector oriented graphics. This output is the same size as images produced by .NET and PHP technologies, but on the top of it, the vector oriented graphic allows you to extend the graph with zooming function, interactive legend or filters. This component is downloading data in XML document form, what is the next advantage compared to classic images. End user downloads the component only once and next data, intended for display, are downloading only XML documents amount few bites.

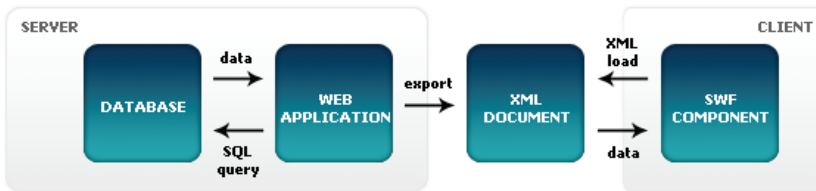


Fig. 1. Graphic data display proposal diagram

At proposal of graphical data display solution an accent was put at:

- data link load (data link load must be as small as, to don't get data link overload)
- solution must be on a multiplatform to use graphical data display on PC with different operating systems and multiplatform to providing data for display

- data display possibilities (more graph lines display, autoscale, graph grid, axes description, legend etc...)
- implementation of interactive component possibilities, which allows better orientation in displayed data for users

### 3 NECESSARY CONDITIONS FOR GRAPHIC DATA DISPLAY IMPLEMENTATION

In order to implement a newly developed component some steps must have been done regarding the development environment.

For graph component development the Flash technology was chosen and the necessary conditions are:

- To have installed integrated development environment Flash. Methods for data load from XML document are included in Flash version 7 and higher.
- To export SWF component to this version. For graphical data display on mobile equipment to export SWF component to Flash Lite version 2.0 or higher.
- To display this component in a web browser and to have installed ActiveX component, this allows displaying SWF component.

For web application creation, which is providing data in XML document, it is necessary to have installed Visual Studio, which allows you to create web application on .NET platform. And for web application implementation on a server it is necessary to have correctly installed operation system on this server and a correct configuration of ASP.NET, IIS and .NET Framework.

### 4 A GRAPH COMPONENT

Main component stage in integrated development environment Flash consists of few instances, graphic elements (background, graph mask, graph border), graph (graph grid, displayed values), axis descriptions ( $x$  and  $y$  axis descriptions), control elements (zoom in  $x$  and  $y$  direction, sliding buttons, reset button and zooming by dragging mouse), interactive legend (on/off graph line, interactive coordinates values, mathematical functions) and informative area (zoom values in  $x$  and  $y$  directions, actual mouse cursor position and actual coordinates of active point).

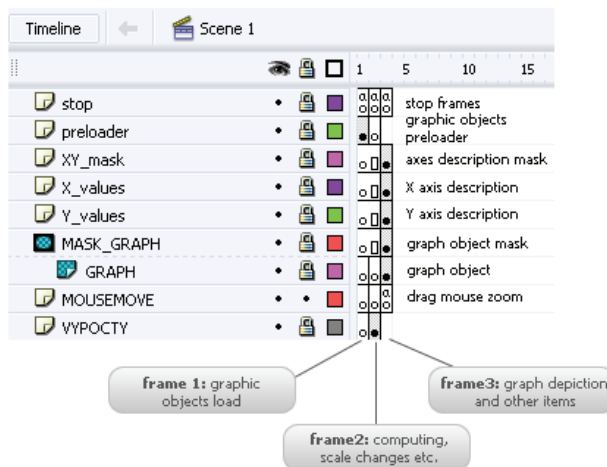
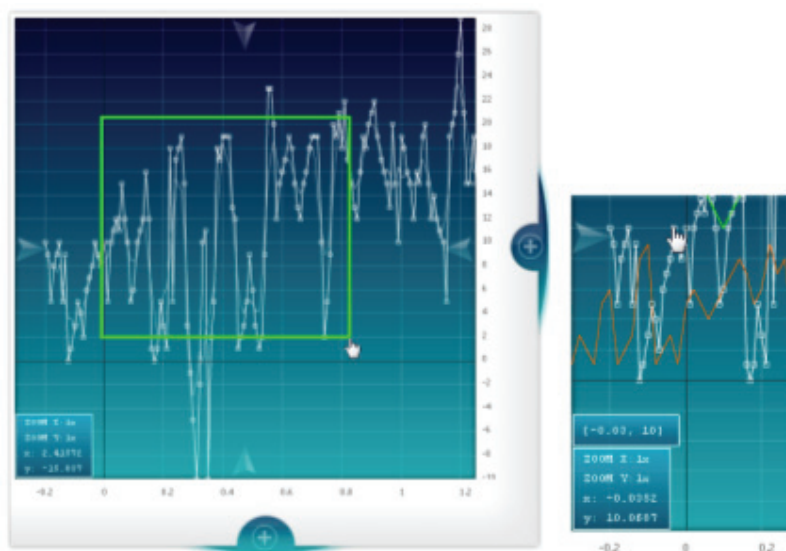


Fig. 2. Component parts timeline in integrated development environment Flash

By the first input this component recognizes coordinates; if on  $x$ -axis will be time display or real values, and with this information it will display data in appropriate format.

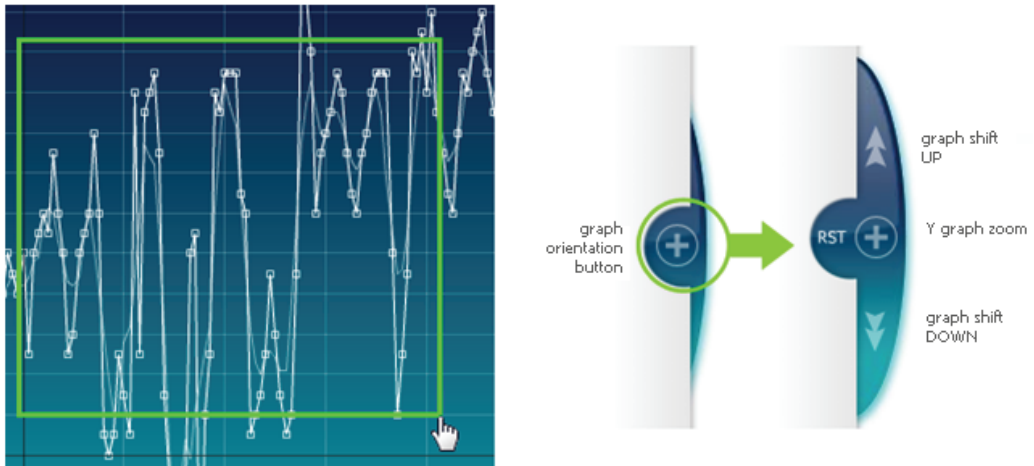


**Fig. 3.** Graph component design

## 5 CREATION OF A GRAPH COMPONENT

By creating graph component students can get familiar with integrated development environment Flash and with creating all graphic objects, which are relating with component by MovieClip and TextField objects. Creation of graph component is divided into few parts:

- XML document load
- Data preparation
- Gauges definition
- Depiction of axis and graph grid
- Depiction of descriptions
- Depiction of big size of data
- Depiction of graph lines
- Graph zooming and related elements
- Other interactive elements



**Fig. 4.** Zooming in graph by the help of mouse dragging and navigation buttons

## 6 CONCLUSIONS

Graph component with web application, which process and provide data through XML document, was created and documented for mentioned second users group – occasional users, which are interested in historical data. This thesis is intended for educational reasons. Students can familiarize with graphic data display design and necessary conditions for web application and graph component creating.

### Graph component characteristics:

- Graph component requires to download ActiveX component for playing SWF files
- Graph component is created in Adobe Flash 8 using ActionScript 2.0
- Allows to display data on x, y axes and x- axis with time
- Component is multiplatform
- Autoscale, automatic graph grid
- Allows to display random number of graph lines
- Displays big size of data
- Axes description
- Interactive elements – graph zooming (by dragging mouse, by navigation buttons), interactive points, interactive legends (filters for displaying graph lines)
- Possibility for mathematical function implementation

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