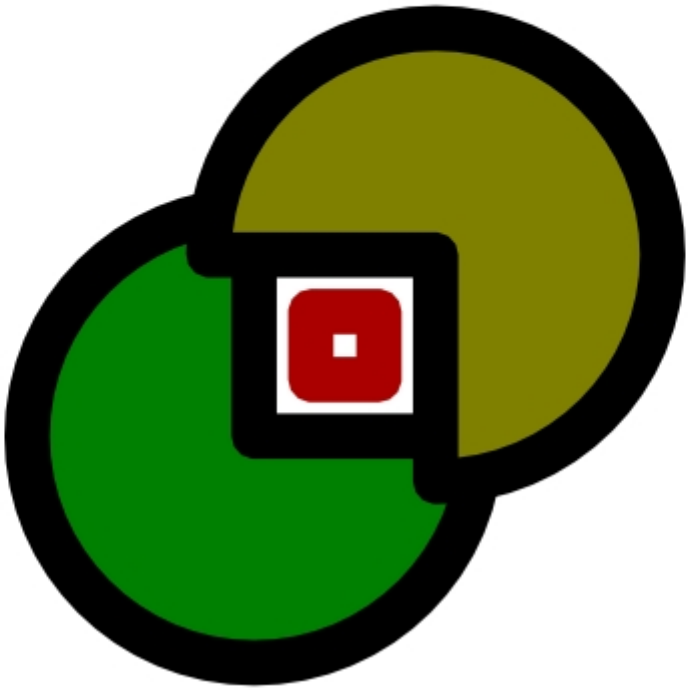

OPCWebExplorer

Internet browser based OPC client

SAE AUTOMATION, s.r.o.

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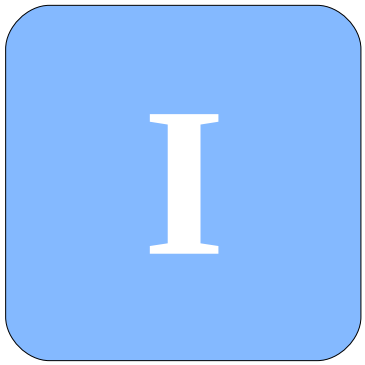
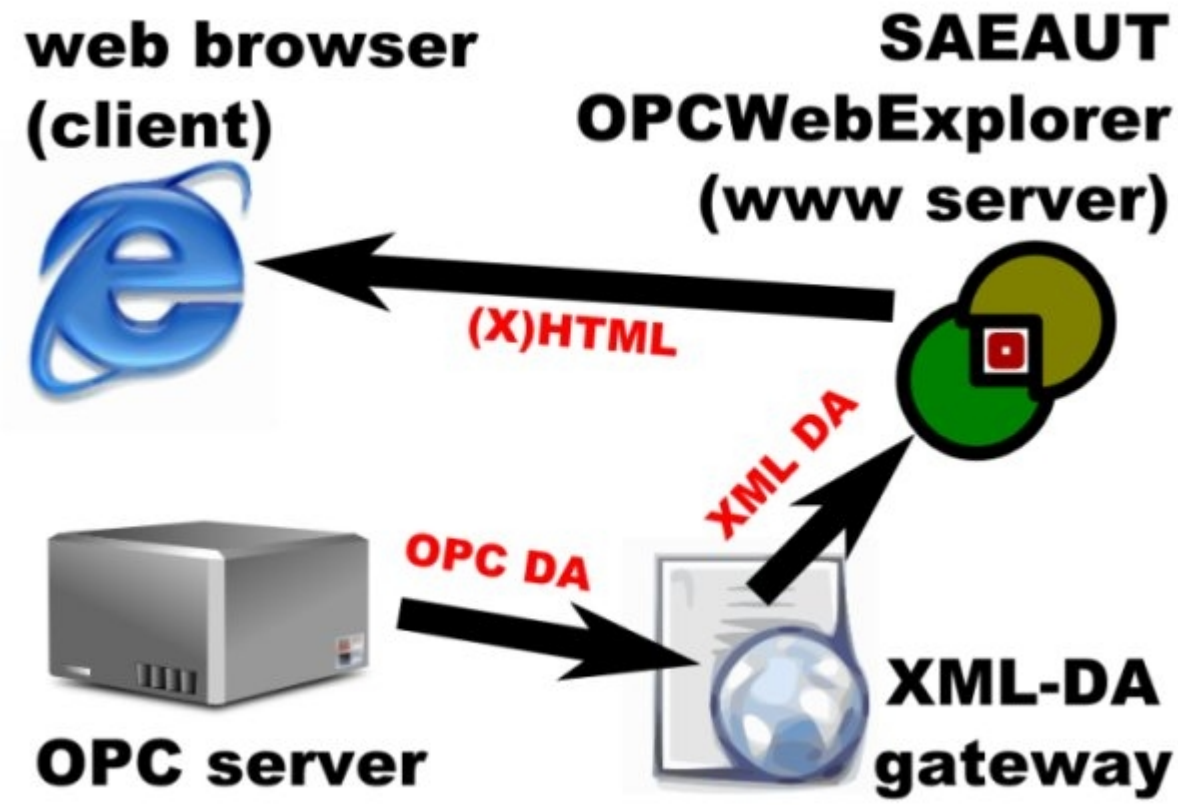


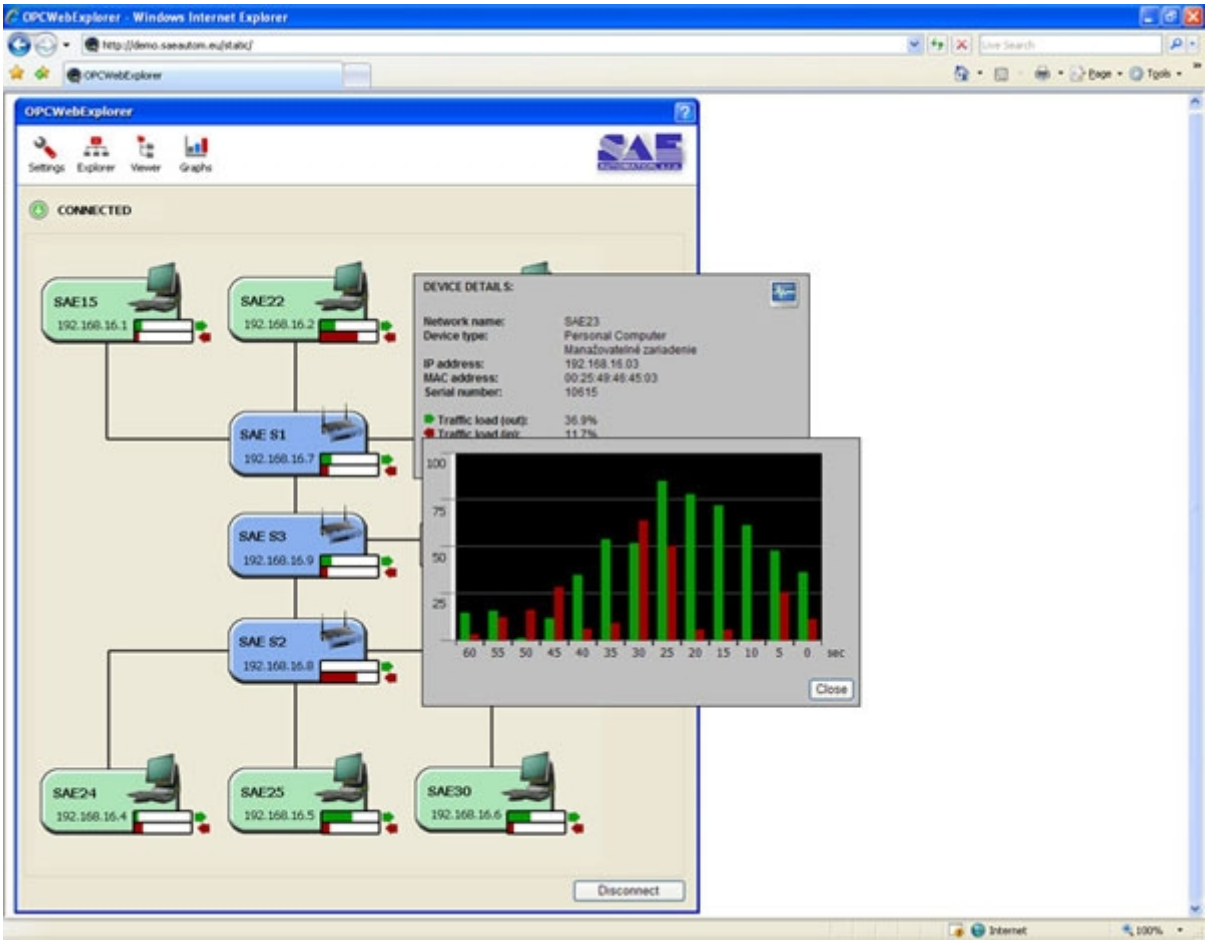
1 Welcome

SAEAUT OPCWebExplorer 1.0.0

web browser based OPC client & data visualization

- easy straightforward access to the data using one of two standard predefined views:
  a. not structured list of chosen data items
  b.tree view on chosen data items
- the creation of own visualization application using installed template. To create such an application it is possible to use arbitrary HTML editor. Your web application can encompass data presentation in the form of graphs, animations, various tables…
- read/write access to the devices data





Part II

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SOFTWARE is an upgrade, you have to transfer all previous versions, on which the upgrade was grant.

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8. If any further cooperation or exploitation from third party software is needed for functionality of the SOFTWARE form SAE - Automation, s.r.o., you accept the responsibility for observation of license agreement of third party supplier, while it was not agreed differently by special agreement between you and SAE - Automation, s.r.o.
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Part III

3 Introduction

3.1 Features

- written in ASP.NET/C#
- easy configuration through a single XML file
- fetch data from **any OPC server** via READ or SUBSCRIBE method (to read items from OPC server)
- write data to OPC server (to write new OPC item values)
- data visualization and graphs
- cross-browser compatible
- easy straightforward access to the data using one of two standard predefined views (structured list of chosen data items or tree view)
- the creation of own visualization application using installed template; it is possible to create such an application by using arbitrary HTML editor, your web application can include data presentation in the form of graphs, animations, various tables…

SAEAUT OPCWebExplorer is not meant to be an all-in-one application. It is a technological demo application. Custom development and adding of new features, binding to SAE - Automation, s.r.o. products (SAEAUT SNMP OPC Server or OpcDbGateway), better data handling, visualization and allowing configuration of OPC servers is a subject of further development and will be implemented on demand. You are allowed to perform your own modifications to SAEAUT OPCWebExplorer. See topic Data visualization (graphs) for more details.

Please contact us immediately if this product is interesting for you and we will provide you with details about your custom changes together with estimated development costs and time schedule.

3.2 Technology

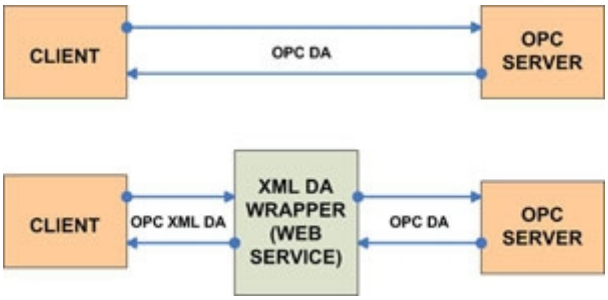
Web technologies offer easy access to OPC servers

Web based technologies and their simplicity find a way to more and more applications. Nowadays, browsers are capable to perform various tasks and web based applications are reaching the quality and behavior of standard desktop applications as known today. It is only a question of time when browsers emerge with desktop and take the place of an operating system and will able to perform all desktop tasks.

This model assumes there is a web service available that provides the access to a OPC server. The web service ensures the data exchange between the client (web browser) and OPC server. Retrieved data from the OPC server flow through the web service and are passed to the client browser that displays them in a HTML page. The communication between the web service and OPC server is based on the OPC DA protocol specification that ensures transparent data exchange between two OPC clients. The question was how to pass the data to a web based client in a suitable machine-readable form that complies with HTTP protocol. XML DA specification solved this problem and offered a solution how to exchange data between a web based client and a OPC server.

Communication model with the use of a web based client

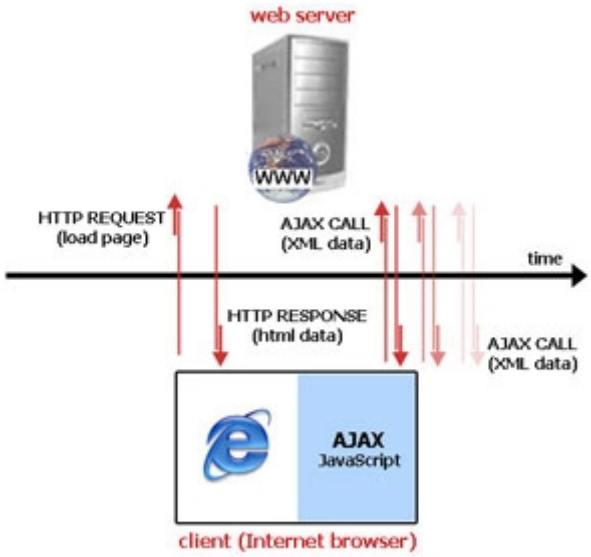
When using a web based client, the traditional server-client architecture can't be used anymore. A third element must be involved – a XML DA wrapper, web service (wrapper) that ensures the data exchange between OPC server and the client.



The wrapper serves as a proxy during the communication between the server and a web based client, it transforms data into readable form by the client and sends them over HTTP protocol. For this purpose the wrapper should comply with the XML DA specification as published by OPC Foundation to fulfill best practices and easy interoperability in data exchange.

Web 2.0 improves the Web based data exchange

With the upcoming, so called, Web 2.0 it is possible to create powerful Internet browser based application that offers better scalability and reduces the traffic while exchanging data between a client and a web server. This is possible via AJAX technology (Asynchronous JavaScript And XML). During a normal HTTP request-response communication entire web page and HTML is transferred from the server to the client. With the use of AJAX and XML it is possible to reduce the traffic and transfer only parts that need to be updated. In our case it means we only exchange the data that originate from an OPC server and pass through a XML DA web service.



Full HTML is loaded only at the very first time a user visits the web page. The HTML content is served in its full range. However, after the web page is displayed and structured, the AJAX engine inside a web browser takes place and makes calls back to the web server to fetch updated data and display them in the browser. This way we refresh only OPC data that changed, keeping old data intact and thus reducing the overall traffic that would take place in a standard synchronous request-response HTTP model.

Part

4 Installation

4.1 Requirements

Software prerequisites to use with SAEAUT OPCWebExplorer on the server:

- Microsoft IIS 5.0 or higher
- Microsoft .NET Framework 1.1 or higher
- OPC Foundation Core Components 2.00 Redistributable or higher (included in the installation)
- XML DA interface (e.g. ICONICS XML DA Wrapper - included in the installation.

ICONICS XML DA Wrapper is shipped also together with SAE - Automation SAEAUT SNMP OPC Server and OpcDbGateway.

Software prerequisites to use with SAEAUT OPCWebExplorer on the client:

- Internet browser (e.g. Microsoft Internet Explorer or Mozilla Firefox)

No other software is required to run SAEAUT OPCWebExplorer. From the client point of view there is no software installation needed because SAEAUT OPCWebExplorer runs in the browser on a demand - a user has just to visit a the SAEAUT OPCWebExplorer website on the web server.

4.2 How to install

1. Click on **setup.exe** to launch the installation of SAEAUT OPCWebExplorer.

1a. If no already installed, please install the OPC Core Components Redistributable first (the installation file is distributed with SAEAUT OPCWebExplorer). If unsure, just proceed with the installation of SAEAUT OPCWebExplorer. SAEAUT OPCWebExplorer will automatically detect if OPC Core Components Redistributable is installed on your computer and warn you otherwise.

2. The installation program will ask you about desired web server and virtual directory where to install SAEAUT OPCWebExplorer files. Note that for security reasons some files will be placed into Program Files\SAEAUT OPCWebExplorer folder on your system drive.

3. Now you have to adjust DCOM security settings in order to SAEAUT OPCWebExplorer to be able to access OPC servers. Allow local activation for user ASP.NET (or the account under which IIS server is running); see the guide below how to adjust DCOM settings.

4. You can now launch SAEAUT OPCWebExplorer from the Start Menu. Just look for the SAEAUT OPCWebExplorer folder - you find there 2 shortcuts: with or without the visualization demo. If you intend to use SAEAUT OPCWebExplorer with other OPC server, we recommend not to use the visualization demo as the application will produce errors. The visualization comes preconfigured with the OPC simulation server.

5. When SAEAUT OPCWebExplorer starts, just press the Connect button to connect to OPC server.

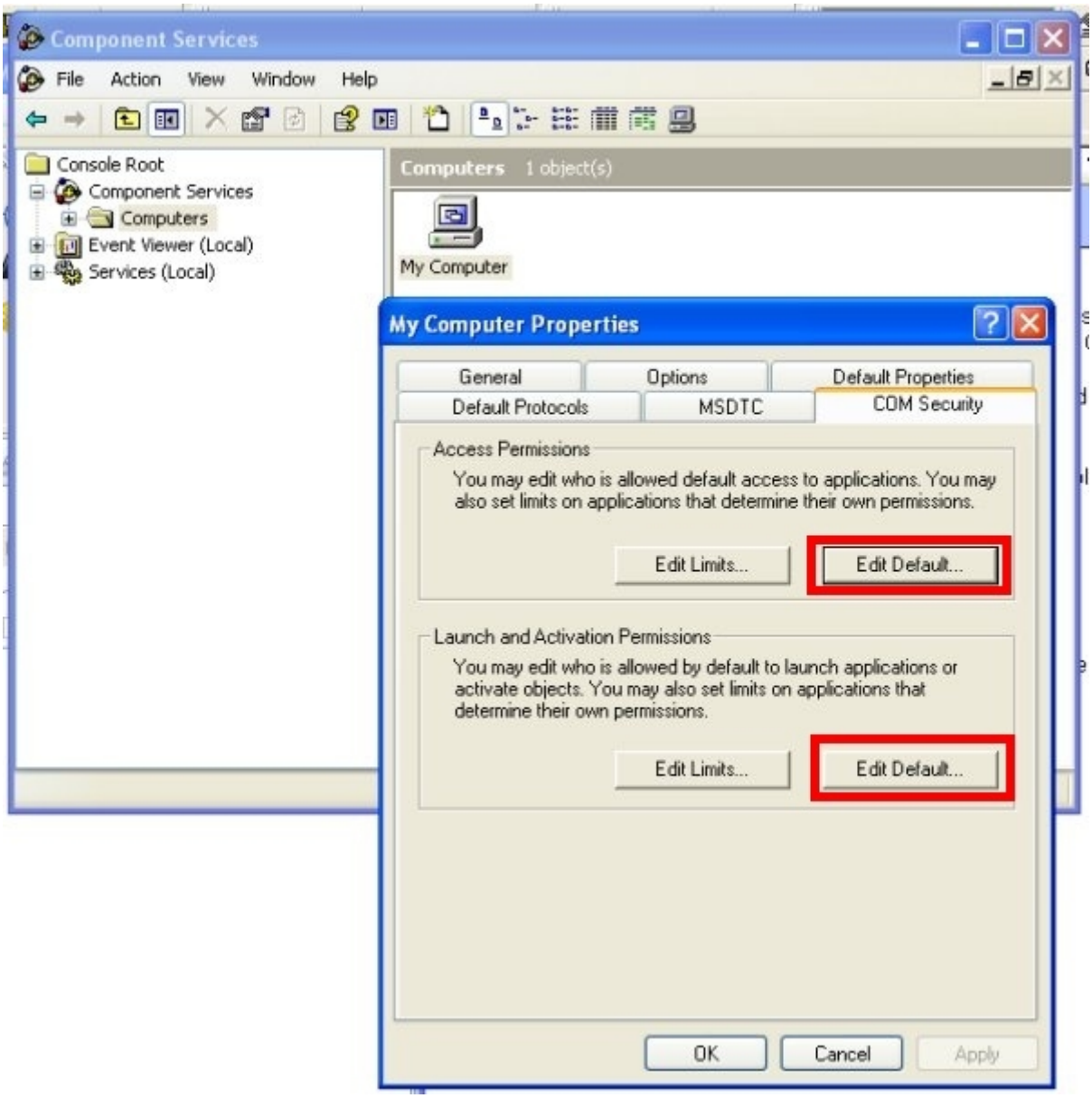
The installation program may fail with "Installation Incomplete" message on Windows Vista systems. Please install IIS 6 compatibility pack (IIS 6 Metabase Compatibility Support) to fix this issue.

How to adjust DCOM security settings in Windows XP:

1. Go to Control Panel (click Start Menu -> Control Panel).
2. Click Administrative Tools.

3. Click Components Services shortcut and a new window appears.
4. On the new window choose Components Services for the tree menu on the left. Then double-click on Computers.
5. Right click on My Computer and from the menu choose Properties.
6. Click on the COM Security tab and then Edit Defaults button. You have to add account ASP.NET and allow Local activation for both Access Permissions and Launch and Activation Permissions.
7. Now SAEAUT OPCWebExplorer should be able to access OPC servers. You can click OK and close all windows.

How to adjust DCOM security settings in Windows Vista:
Run "dcomcnfg" command from the command-line to open the Component Services window (works also in Windows XP) and proceed with step 4 above.



4.3 Accessing OPC servers

SAEAUT OPCWebExplorer is able to access any OPC server. SAEAUT OPCWebExplorer includes XML DA interface that translates the communication between your OPC server and SAEAUT

OPCWebExplorer in the web browser.

If you want to access your own OPC server do following steps:

1. Locate the SAEAUT OPCWebExplorer virutal directory under IIS and go to **XML-DA** directory. There you can find several .asmx files. Copy and/or rename one of the .asmx files to ProgID:OPCserver.asmx, eg. OPC Simulation Server's ProgID is **SAEAutomation.OPCSimDA.3** so rename it to **SAEAutomation.OPCSimDA.3.asmx**. The filename must match your OPC server name, otherwise the XML DA interface will not work.

   Example 2: Accessing OPCDbGateway OPC server
   OPCDbGateway's ProgID is SAEAutomation.OpcDbGatewayDA.3 so we will rename the .asmx file to SAEAutomation.OpcDbGatewayDA.3.asmx.

   To find out your OPC server ProgID check it with your favorite OPC client or through Component Services console found in the Control Panel (or run "dcomcnfg" command from the command-line).

2. Start SAEAUT OPCWebExplorer and on the Settings tab point the Service URL to the new .asmx file, eg. http://localhost/oexplore/XML-DA/SAEAutomation.OPCSimDA.3.asmx

3. Confiugure items you want to read to match the items in your OPC server.

4. Click on the Connect button.

If you configured XML DA interface for your OPC server this way you will be able to use the interface with any XML DA client.

4.4 Configuration

To configure SAEAUT OPCWebExplorer click on the **Settings** button. The configuration is saved in **config.xml** file that can be modified also manually.
Configuration options are explained below.

Service URL
URL to web service with XML DA compliant interface.

Connection mode
Read - use Read method to retrieve data from OPC server.
Subscribe - use Subscription method to retrieve data from OPC server (default).

Note that subscription method is less resource demanding than the Read method. We recommended to use the Subscription method.

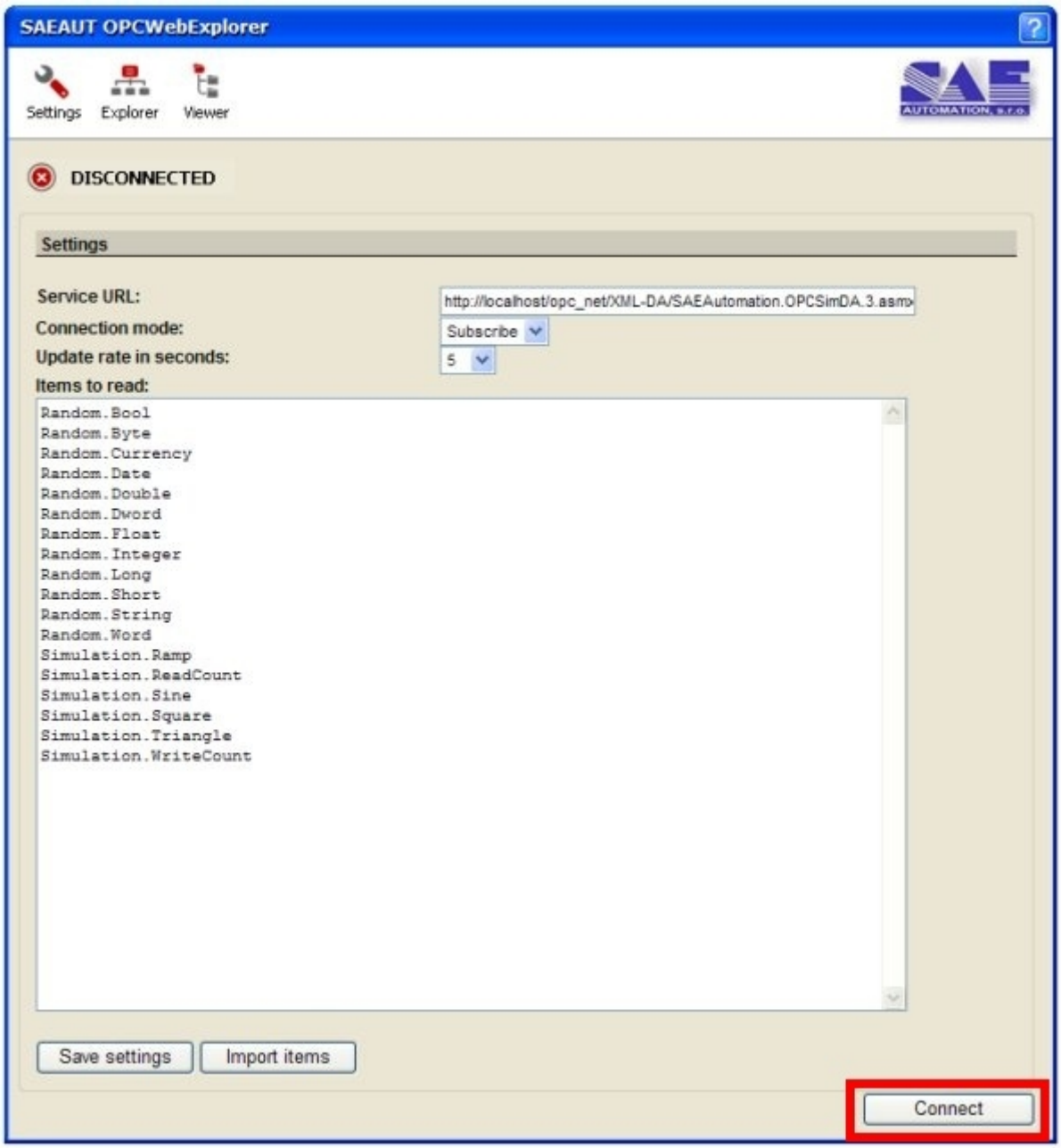
Update rate in seconds
Update rate defines how often in seconds to poll server to update data.

Items to read
List of all OPC items (with full path and name) that should be updated. Each item must be on a single line.

Save settings
To preserve your current configuration click on the **Save settings** button. Note that this configuration is server-wide and affects all clients that use SAEAUT OPCWebExplorer.

Import items
If you use SAEAUT SNMP OPC Server or OpcDbGateway you can import the OPC server's address space directly into SAEAUT OPCWebExplorer. Just click on the **Import items** button and locate SAEAUT SNMP OPC Server's or OpcDbGateway's configuration file in XML format (you have to

export your OPC configuration as XML file). All items from the configuration file will be then imported into SAEAUT OPCWebExplorer.



4.5 Known issues

SAEAUT OPCWebExplorer returns "Invalid subscription ID"

This issue may occur when OPC server has not yet been started and is accessed via XML DA interface for first time. Just press the **Connect** button again to reconnect and the error message should not appear again.

Installation on Windows Vista fails

The installation program may fail with "Installation Incomplete" message on Windows Vista systems. Please install IIS 6 compatibility pack (IIS 6 Metabase Compatibility Support) to fix this issue.

Part V

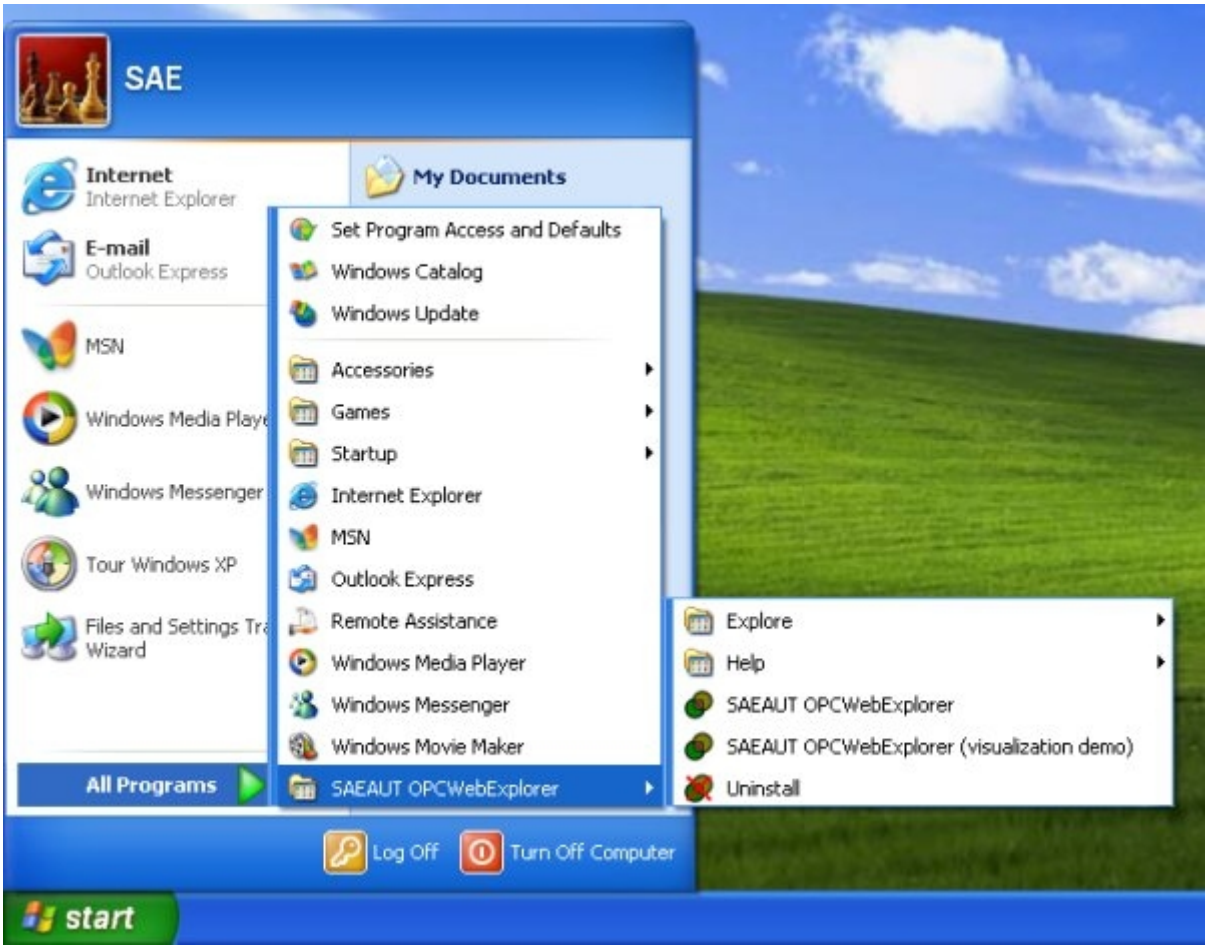
5 How to use...

5.1 How to start

To start SAEAUT OPCWebExplorer click on the Start Menu. You can start SAEAUT OPCWebExplorer in two ways:

1. **Without visualization demo -** this is the main application to use with **any OPC server**. Just enter the URL of XML DA interface, configure items and press the Connnect button to connect to OPC server. For more details how to configure SAEAUT OPCWebExplorer see topic Configuration.

2. **With visualization demo** - this is a preconfigured visualization demo to use with OPC Simulation Server. It's purpose is to demonstrate visualization capabilities and you cannot change any settings. For more details see the topic Data visualization (graphs).



5.2 Toolbar and windows

SAEAUT OPCWebExplorer consists of 4 separate windows that can be accessed through the toolbar menu on the top of the window.

1. **Settings** - configuration window to set various application settings.
.
2. **Explorer -** on this window you can browse all configured items using a transparent tree view that consists of expandable nodes. Note that the tree list doesn't match exactly OPC server's adress space but your configured items. To see details of a particular item, click on a tree node to

expand its items and then click on the item name you want to see.

3. **Viewer -** this is a list of all items ordered alphabetically from the top to the bottom. You can switch between values and quality/timestamp details by clicking on the "Switch view" button.

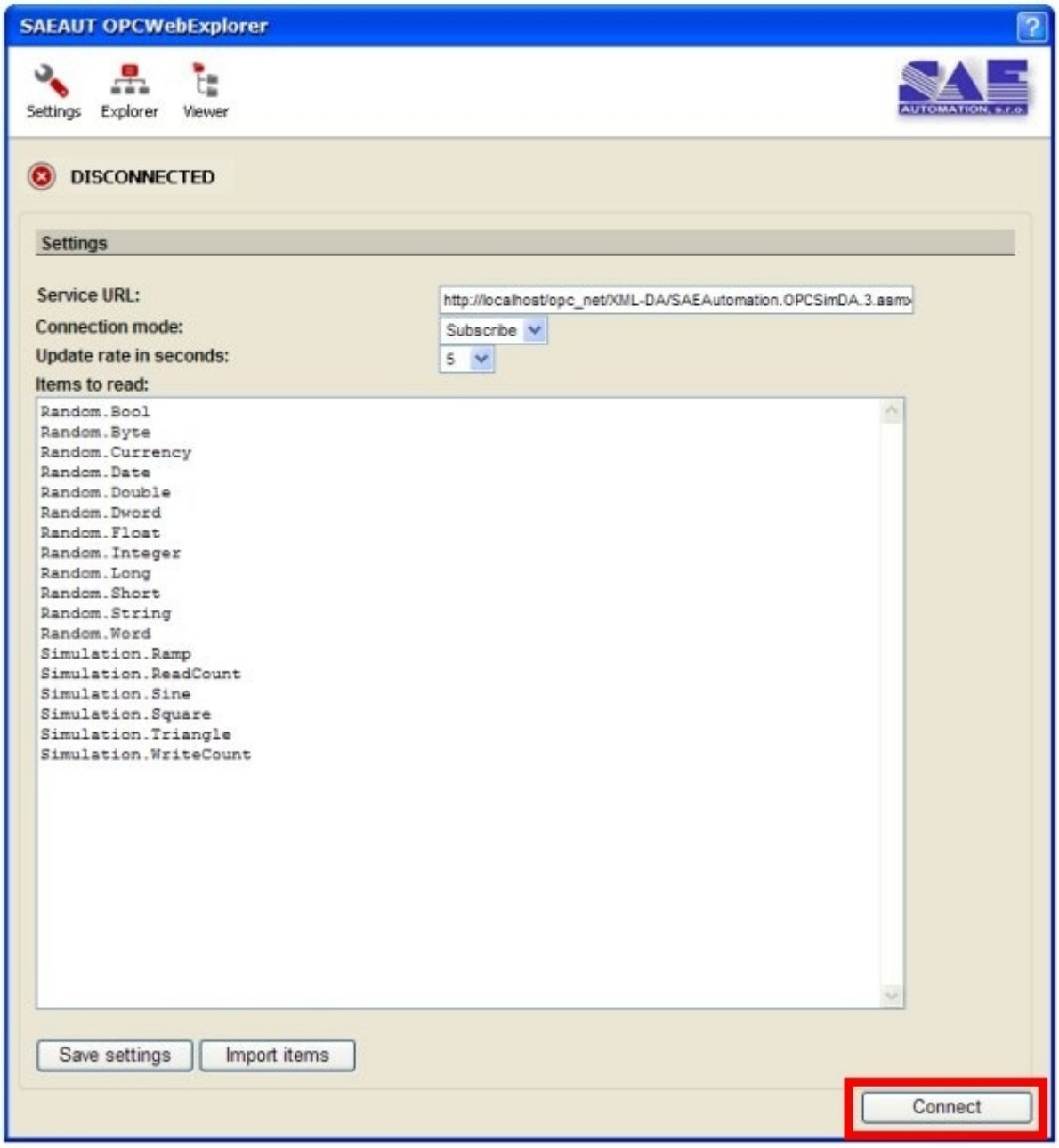
4. **Graphs (optional)** - this the window with graphical components, eg. graphs and bars. This tab is available only when you launch SAEAUT OPCWebExplorer with the visualization part.

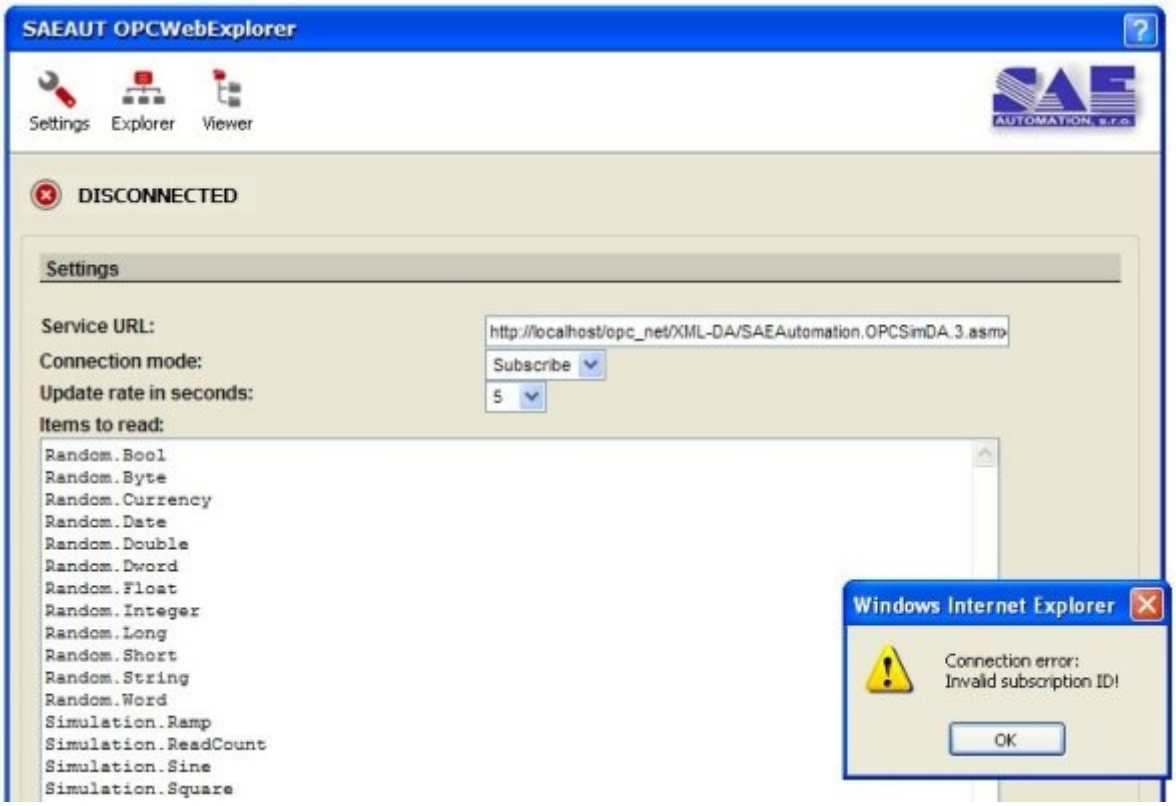
5.3 Connect to OPC server

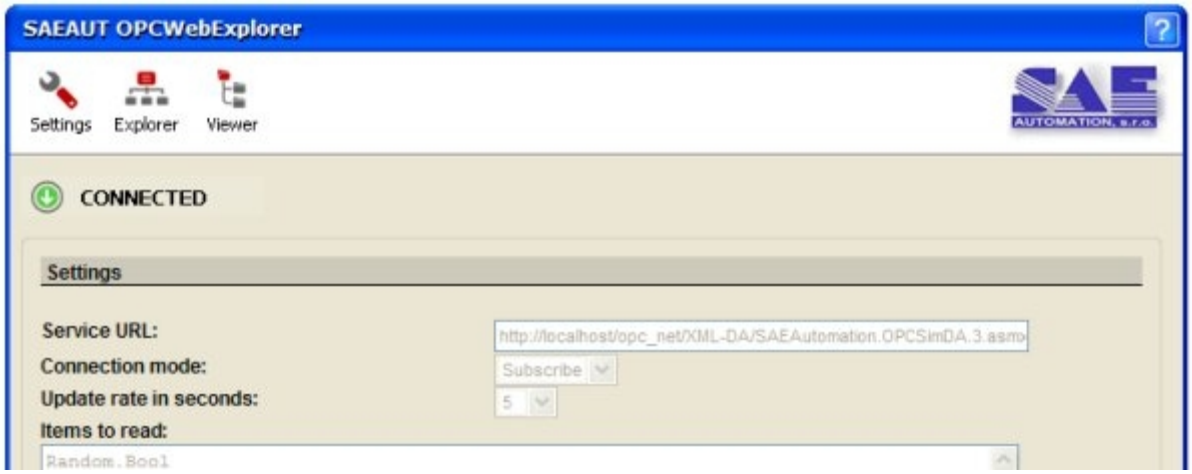
The connection to OPC server (web service) is easy. After you configured SAEAUT OPCWebExplorer just press the **Connect** button at the bottom of the window at the **Settings** tab. You can see the current connection status below toolbar menu (see pictures below).

SAEAUT OPCWebExplorer can connect to any OPC server even without XML DA interface. See topic Accessing OPC servers for more details how to access any OPC server.

Note that you may get a "Invalid subscription" error when the OPC server has not been initialized and being is accessed via XML DA interface for first time. Just connect to OPC server again and the error should not appear anymore.



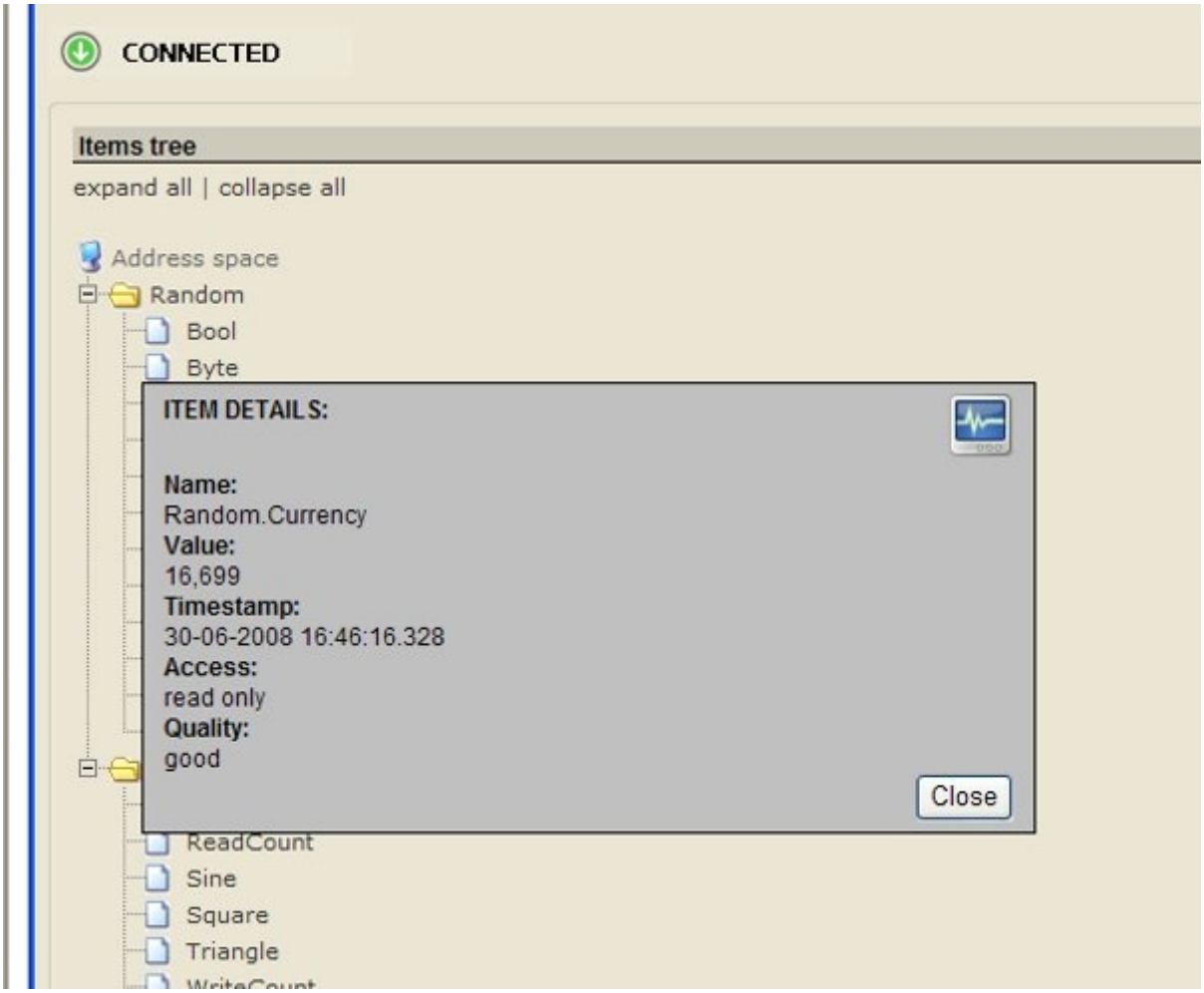




5.4 Browse items

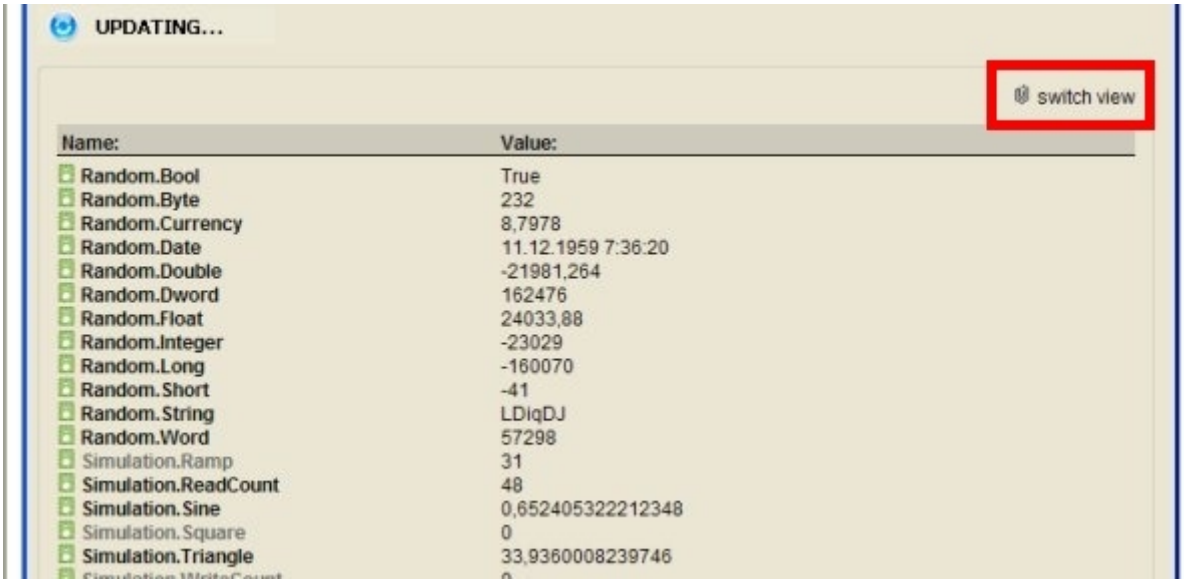
For better transparency, SAEAUT OPCWebExplorer contains a tree of configured OPC items (**Explorer** tab). The tree is built dynamically based on the configured OPC items and does not necessary matches OPC server's address space. To browse items just click on **Explorer** button from the toolbar.

Item details may be not shown (question marks will be shown instead) if SAEAUT OPCWebExplorer is not connected to a OPC server.



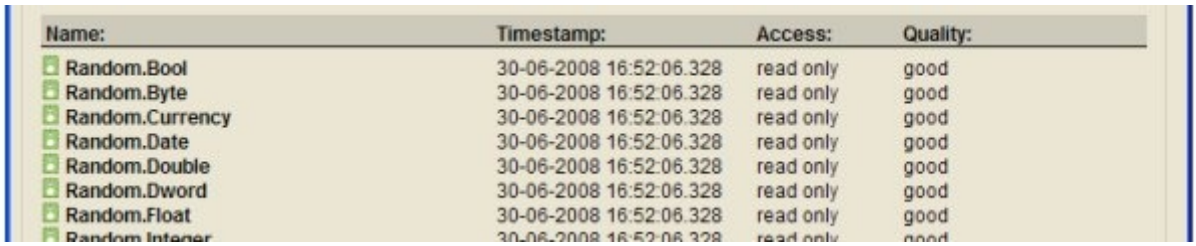
5.5 View items

To view item value, access property, quality and timestamp click on **Viewer** button. You will see full list of configured items and their values ordered alphabetically from the top to the bottom. To see item's quality and timestamp click on the **switch view** button (see pictures below).



The item's quality is also indicated by the green or red icon next to the item's name as show on the picture below. Green icon means good quality, red icon is shown otherwise.

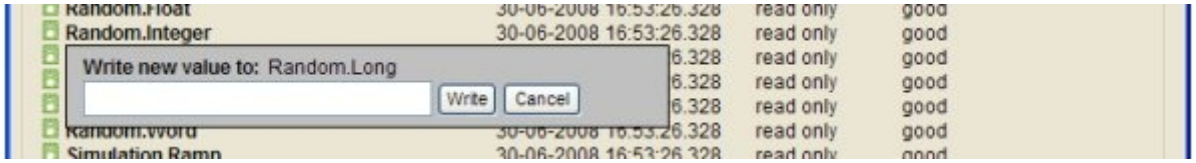
For better transparency, the age of item is indicated by the item's name color. If the item has been updated (item's value has changed) in the last performed update then the item name will become black, the item stays gray otherwise (see picture below).

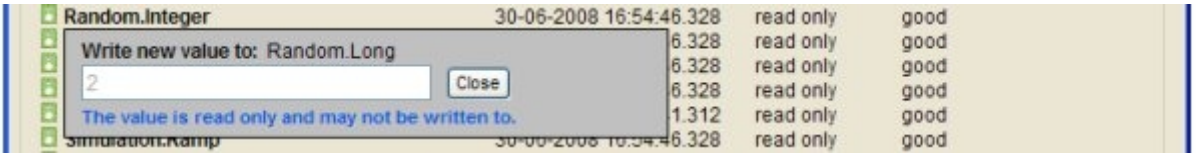


5.6 Update items (Write)

To update items and write new values just click on the particular item's name. A small dialog window will popup where you can enter the new desired value that should be written and sent to the OPC server.

After the write is performed, a message with the write result status will be shown (**Done** if write was successful, **error message** with reason why the action was not performed otherwise).





5.7 Data visualization (graphs)

The data visualization engine is a subject of SAEAUT OPCWebExplorer modification and is not shipped by default. You can do your own custom modifications to SAEAUT OPCWebExplorer in your favorite HTML editor, for this you just need the knowledge of HTML and JavaScript.

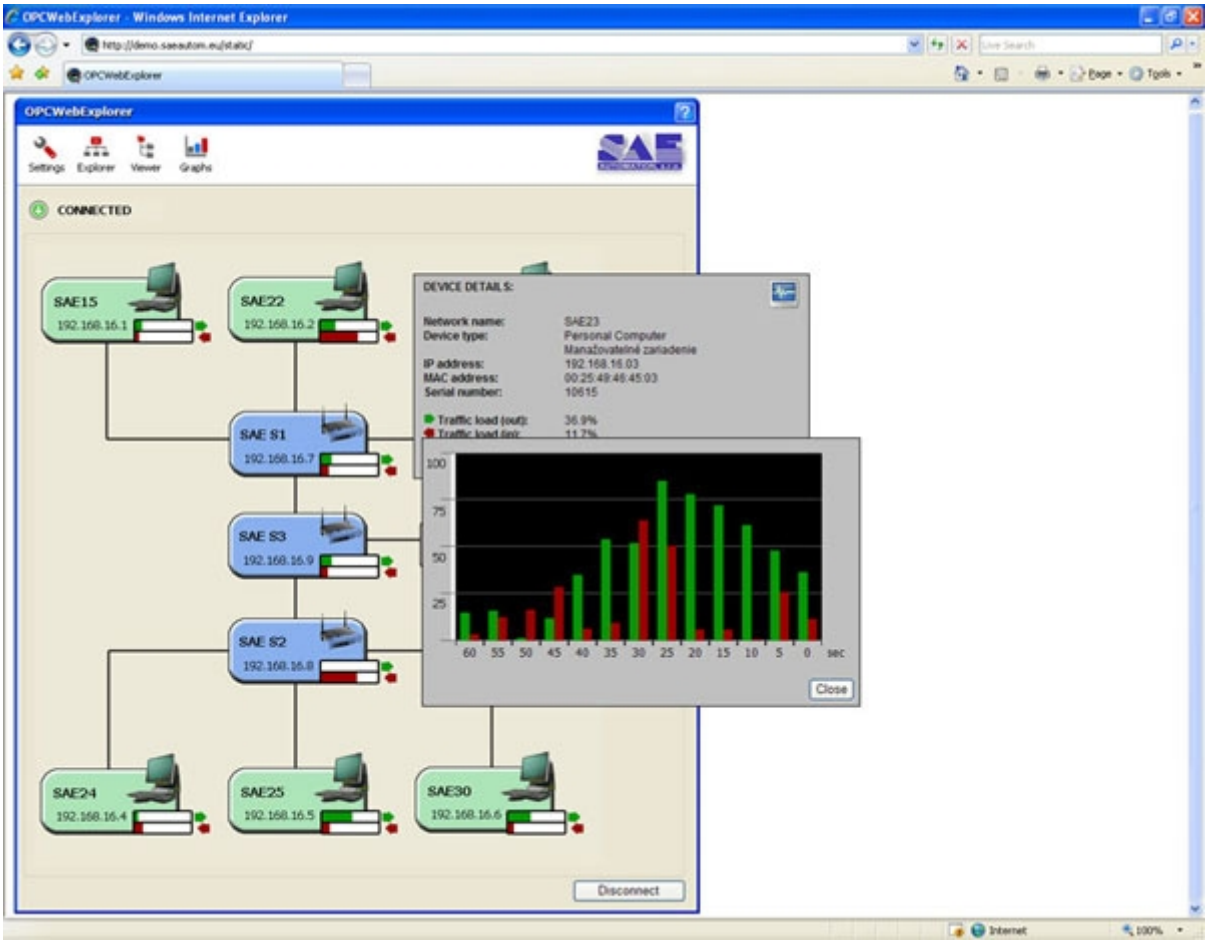
Structure of files for custom development:

- **/index.aspx**
  This is the main page that displays SAEAUT OPCWebExplorer window. Inside you can find the HTML code used to display the main window.
- **/services.aspx**
  This is SAEAUT OPCWebExplorer web service. You cannot modify this file, it contains only code required to run.
- **/include/controls.js**
  This is a JavaScript file that controls all parts of the page including data visualization, data refresh and all other aspects. The functions here use jQuery library for rapid JavaScript deployment. Visit http://jquery.com for more details about the jQuery framework.

Compare /index.aspx vs. /visualdemo.aspx and /include/controls.js vs. /visualdemo/controls.js files to find out more about the customizations and how they can be done. Check the source code of these files for more details and documentation to particular web components.

Example data visualization is shown at the picture below. In this case the visualized data represent the bandwidth usage between computers and routers. This way a operator can easily detect unusual network behavior. Of course, the visualization styles can be modified in various ways to fit one's needs and wishes. See example case study for more details.

SAE - Automation modifies SAEAUT OPCWebExplorer according to individual demands and needs. Please contact us immediately if this product is interesting for you and we will provide you with details about your custom changes together with estimated development costs and time schedule.



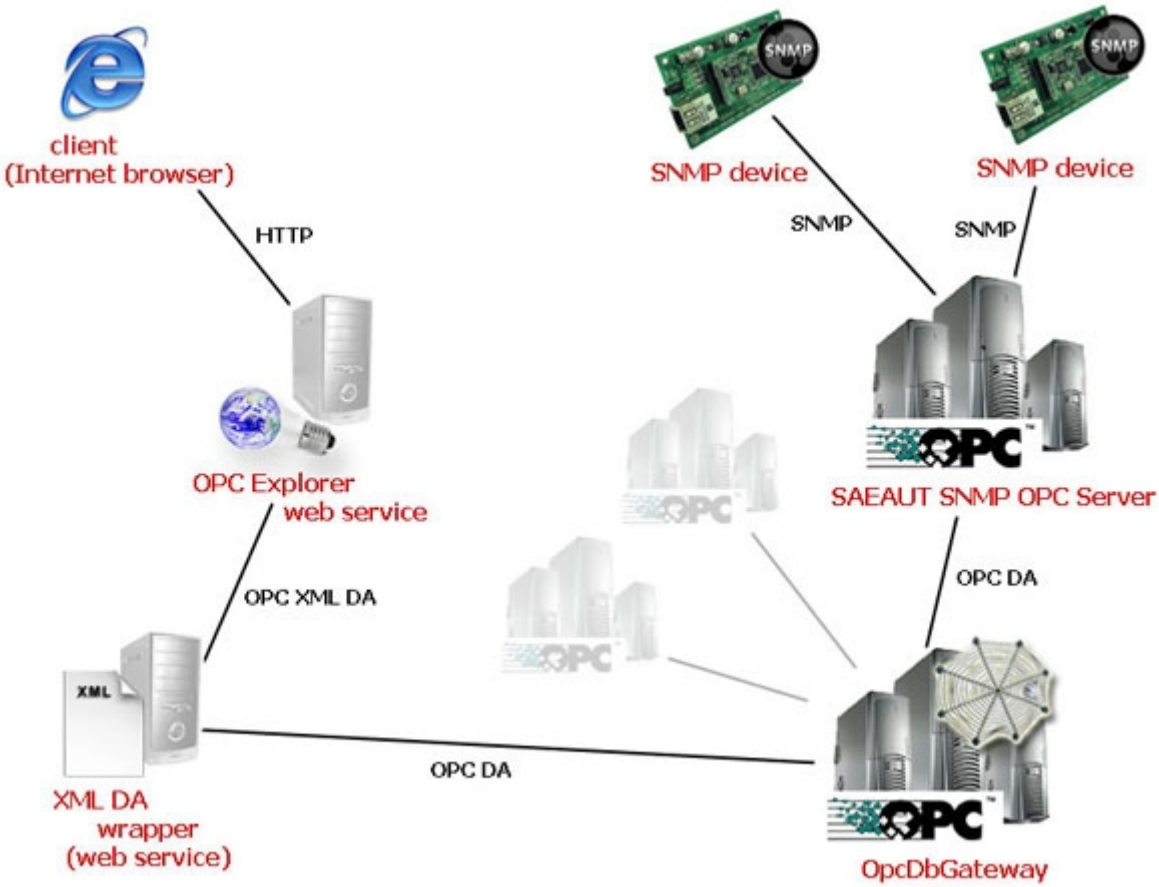
Part VI

6 Case study

6.1 Network monitoring

In our example we used model as follows:

- several SNMP devices send various data about their status and operation via SNMP protocol
- our own product SAEAUT SNMP OPC Server receives the data sent from SNMP devices and processes them into OPC items
- our another product OpcDbGateway that collects data from several OPC servers (in our case, it collects data just from 1 server but it is possible to attach OpcDbGateway to more OPC servers so a very complex architecture can be created) - this way we created just one single interface, that we will access later, and thus simplified the process of data exchange between XML DA web service and OPC servers
- XML DA wrapper/web service (we used ICONICS XML DA wrapper) is connected to OpcDbGateway and provides a web based access to OPC servers
- the client (Internet browser) receives the data and displays them as HTML document, the browser doesn't connect directly to XML DA wrapper but to SAEAUT OPCWebExplorer web service that transforms all response data to a simpler form and reduces the HTTP traffic

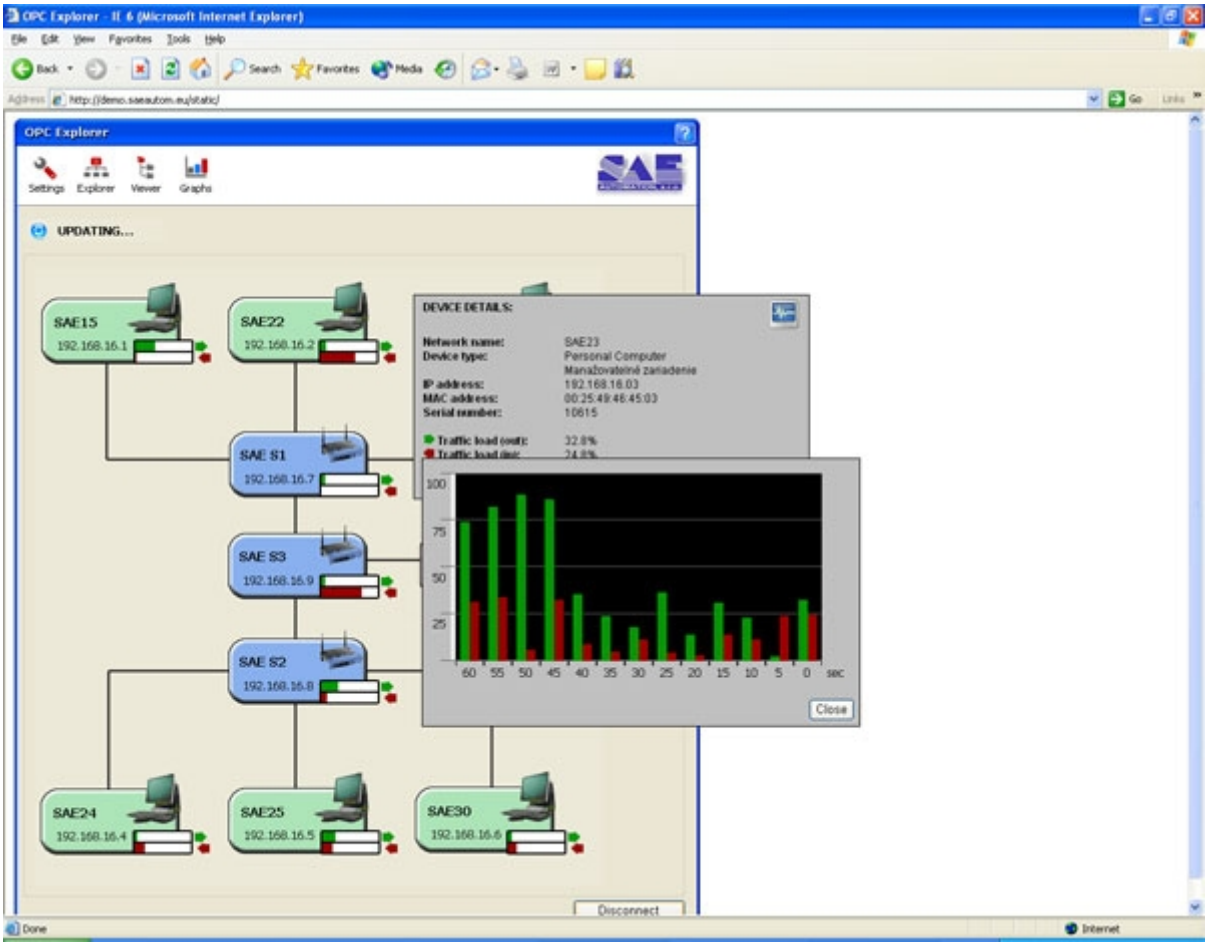


What is exactly happening?

1. A user starts his favorite web browser and visits SAEAUT OPCWebExplorer website.
2. The browser sends a request to the SAEAUT OPCWebExplorer web service.
3. SAEAUT OPCWebExplorer web service reads the data, wraps them into a XML formed document (as defined in the XML DA specification) and passes them to the XML DA wrapper.
4. XML DA wrapper sends a request to OpcDbGateway and performs all steps that are necessary to take place (eg. read data, write data, get server status, etc.)
5. Updated data from OpcDbGateway are passed back to the XML DA wrapper. XML DA wrapper

sends them back to SAEAUT OPCWebExplorer web service as a XML DA formed document.

6. SAEAUT OPCWebExplorer web service unwraps received data and formats them into a simple XML document that is easily readable by the web browser. The data are then sent to the browser.
7. The browser displays the data as HTML.



6.2 Considerations

To achieve less traffic in the communication between the client and the OPC server we use another proxy - SAEAUT OPCWebExplorer web service. If both web services (SAEAUT OPCWebExplorer and XML DA wrapper) are hosted on the same server, less traffic occurs in the entire communication between the client and the OPC server. The traffic reduction is more significant when transferring large set of data. However, as capabilities of browsers grow constantly, the need of SAEAUT OPCWebExplorer web service as a proxy will cease in the future and this part will be implemented directly in the web browser. We expect to loose the proxy in new release of SAEAUT OPCWebExplorer.

While developing SAEAUT OPCWebExplorer we considered cross-browser compatibility issues and developed a cross-browser compatible product. Web browser based OPC client requires only a web browser - no other software is required to install. Software upgrades may be performed just on the server without the need of any client installation or configuration.