Integration of Industrial Application Servers to Engineering Education

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Abstract

During studying courses and from the further experience with teaching the subject Process Systems we were facing problems of how to present processing industry and process systems to students efficiently and within the time period limited by number of weeks of the semester. Process Systems subject is one of the parts of engineering study aimed on industrial visualization software where we need to present how can be industrial information provided to an operator of an industrial system. From the very first look, the lessons seem to deal with classical ICT and computer's education, but problems appear, when we need to simplify the distribution of prepared software applications on a network and to computer classrooms, because it is usually time consuming to maintain them after each lesson and for each computer. This paper describes ways of how to secure the applications to prevent them from damage by unqualified learners and how to provide the applications with changes made by a teacher in the real-time. One of the solutions described here is usage of an industrial application server, which can cover described problems. Another goal of this paper is to show the possibilities of usage of an industrial application server for distribution of applications, control of user rights and application data deployment within the scope of engineering education and the Process Systems subject.

Introduction

In educating students in the subject Process Systems we are trying to present to them how can processes be controlled in real industrial practice via visualization software. We faced several problems with security access to our real models and with the efficiency of lessons. One of the points of improving education was the usage of Industrial Application Server. The application server is a type of a network server that provides end users with a running application and can control network data traffic. It can be usually found between a database and a client application for the data presentation. The main tasks of an application server are executing the application logic, controlling data storage in a database and providing data to client applications. This type of server is also very often used in industrial practice, which is different compared to other training and educational environments.

Industrial application servers and provided services

There are a very specific group of servers with specific characteristics based on requirements of real industrial environments. The main difference from other application servers is that an Industrial Application Server (IAS) is working in an environment controlled by events with very fast changes instead of transactions. This fact means that IAS must fulfill the following requirements:

- Working in real-time
- Monitoring and reacting quickly to an extremely large amount of data and events (even thousands per second)
- Supporting a client-server and peer-to-peer network systems to simplify cooperation of thousands of equipment on a process level and to provide access to applications from different locations (locally or remotely)
- Executing actions in a defined order
- Facilitating immediate usage of information from a currently executed process

The above mentioned requirements mean that IAS must be able to provide services, such as an environment for a central configuration supporting teamwork of human operators, the central application control, a unified address space for an entire application, the management of events, scripting, alarming and historization, and global security management. IAS must also support different network types and must be independent from a control system to be

able to communicate with different automation software.

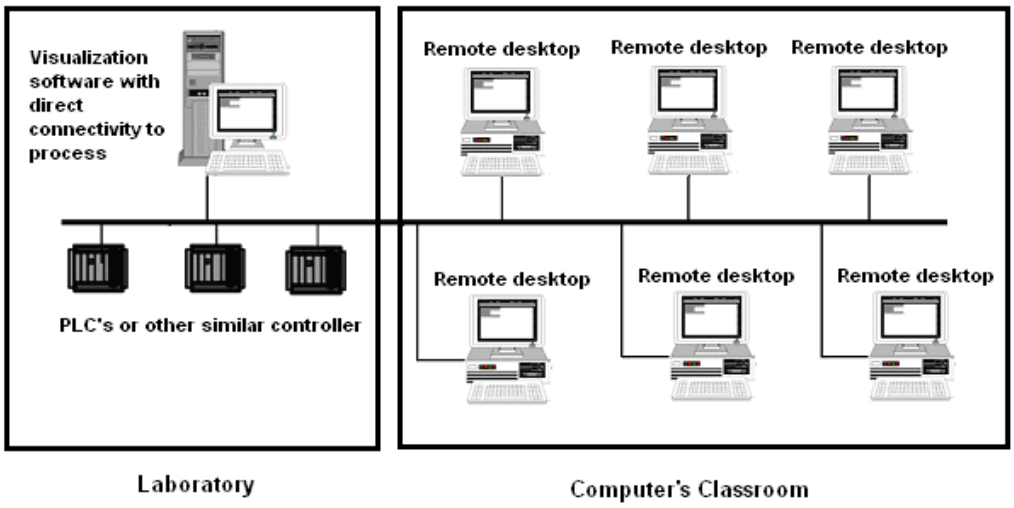
Analysis of the current education system

The subject Process Systems is aimed on the education of future engineers of process control using visualization software. We have used two methods how to demonstrate and provide the means for the control of a process through process visualization to our students.

The first method was that we prepared a visualization application with simulated process inputs. In this case, a teacher must copy the application on all computers in the computer classroom and it has several disadvantages – a part of the lesson is spent by making sure the application is always provided to all student computers in the same way, because students are changing applications during lessons and it is necessary to maintain one version of application unchanged before each lesson. The problem also is that if the lesson requires changes in application configurations, it is necessary to make a change in each application and for every student during the lesson in case that student is not able to do the change himself and asks for teacher's help and an individual intervention for each student computer requiring help.

The second method is improving a visualization of a real process and can be demonstrated in an example from our laboratory. This case is shown in the following figure:

Figure 1: Scheme of the currently used system for education of Process Systems



The real process in a laboratory is controlled by PLC's connected to the computer in the computer network. Visualization software which is running on the computer is getting data from PLC's. Students in the computer class are able to connect to a computer via remote desktop and watch the process or even control it. Also this system has several disadvantages. The main problem is that a student can damage some of the devices in the laboratory by an involuntary action through visualization software. We can avoid this by setting some security restrictions to the application, but with direct access to a computer there is still the possibility that it could happen. Students can also damage the application itself or some of the important computer setting or can simply turn off the computer. Another problem is that too many remote sessions cause a high performance load on the computer.

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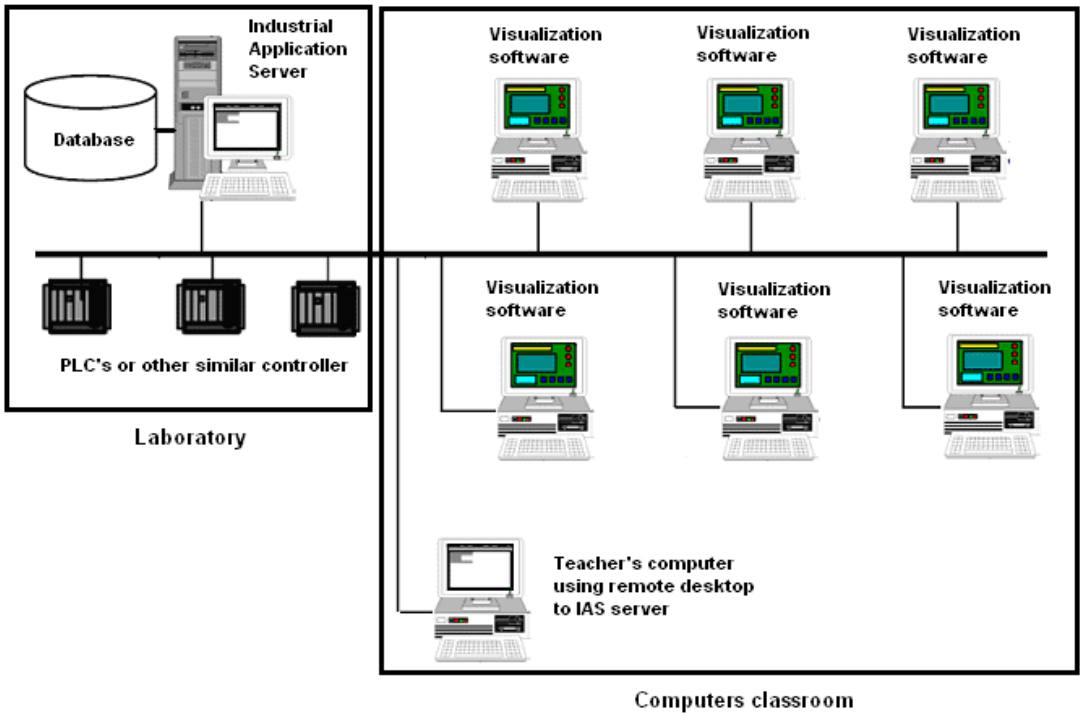
IAS can cover both ways of education of Process Systems mentioned above and is able to solve the mentioned problems. The network architecture with implemented IAS is shown in the following figure:

Figure 2: Scheme of a network structure for Process Systems education with implemented IAS



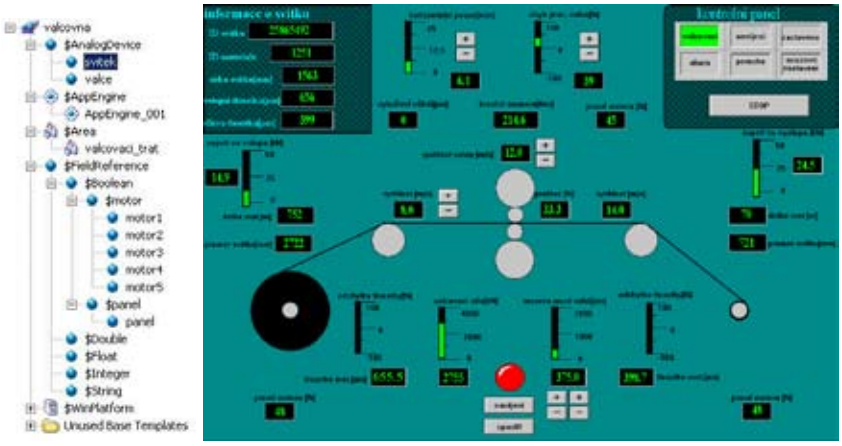
In this case the real process in a laboratory is controlled again by PLC's and these PLC's are connected to a computer. The difference is that the visualization software is not installed on this computer; the IAS is used instead. All data from a real process are controlled by IAS and a teacher has direct access to the server via remote desktop, where he/she is able to control the process completely. On the other computers in a computer class room the visualization software is installed, so they serve as clients for IAS. These clients allow students to see and control a process in the same way as they would do directly without IAS with a direct remote connection. But a teacher is able to apply the necessary security restrictions to all visualization clients and to protect a real-time process from changes and possible damage. Also, a computer with IAS installation is protected from damage as well, because students do not have direct access to this computer.

The above structure can be also used in case of simulated process. The only difference is that IAS is not connected to technology and instead of that has some simulated data using scripts or external sources like excel sheets with data. The big advantage of this solution is that the teacher is able to deploy changes in the application to all the clients in the runtime. It means that the ineffective time during the copying of the application to student computers or during setting changes manually to each single computer is completely eliminated.

Conclusion

Usage of IAS in teaching the subject Process Systems can substantially improve the efficiency of lessons in engineering education, because it complements the theoretical parts of education by demonstrating real-time applications and improves the security access to laboratory processes running in real-time. We tested the IAS software on simulated process of a cold rolling mill. The following figure visualizes the process in IAS software as a structured configuration tree and as an application in visualization software:

Figure 3: Simulated process – overview in the structured tree of IAS environment and its visualization in the application of visualization software



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