

INDUSTRY 4.0

Freelance OPC Server and Matrikon OPC Client

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INDUSTRY 4.0: the fourth industrial revolution

Industry 4.0, or as it even is called, the fourth industrial revolution, is engaged in the changes in society, the technologies, the structures and the markets with respect on the industry. [8] Based on the first industrial revolution, when using of steam and hydro mechanical production equipment were operated, for second industrial revolution, when using electrical energy a mass production been possible up to the third industrial revolution, made possible by electronics and IT automation of production, is now possible, CPS (*Cyber Physical Systems*) and IoT (*The Internet of Things*) to realize (see Fig. 1). [5]

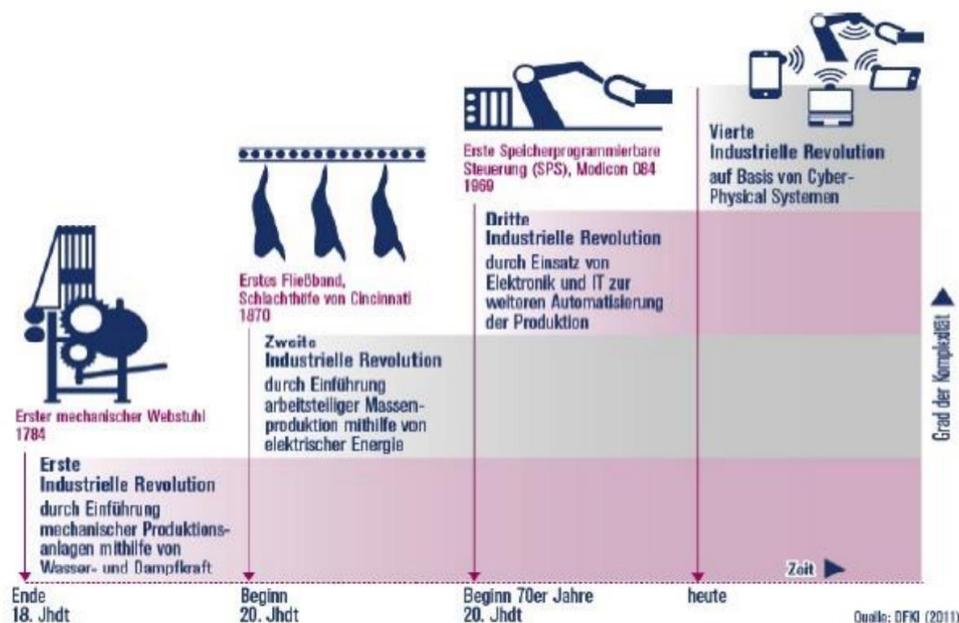


Figure 1: From industry to industry 4.0 (Source: DFKI 2011)

The IoT consists among others of the networking of machines, computers and people. It made possible to get a variable output product by intelligent industrial control. [4] This is a cost-effective production without letting produce the product as a commodity. Through the combination of hardware and software will be achieved a high availability to networked data.

The goals of the Industry 4.0 are [1]:

1. Individualizing of products
2. Reduction of resources
3. Increase of flexibility , security and efficiency
4. Minimize of failure
5. Shorten of development and design times
6. Improve of the usability

Historical review

To the beginning of the OPC technology it was called *OLE for Process Control*. The OLE (Object Linking and Embedding) technology has been developed in the nineties years of Microsoft and as a protocol used. This protocol allows the cooperation between different OLE enabled applications, creating a heterogeneous composite documents. The OLE includes a wide range of interfaces, which can be edited.

An uniform, multi-vendor solutions for communication, called OPC, was developed instead of OLE. The first meeting for it took place in May 1995. A year later, the first specification of the OPC technology, the Data Access 1.0, was introduced, and the OPC Foundation was grounded. Over the long development period five different specifications were developed: Data Access (1996), Alarms & Events (1999), Historical Data Access (2001), XML Data Access (2003), Commands (2004). They all were summarized and build the classical OPC.

An important milestone was the specification of the OPC XML Data Access. It is a web service-based tool of communication. Since the introduction of the concept of OPC XML the OPC is called as Openness, Productivity and Collaboration. In 2006 the current option of OPC, so called OPC UA, was first introduced and since then continuously developed to the current fourth version. The communication basis for data exchange data by OPC provides the *Component Object Model (COM)* and *Distributed Component Object Model (DCOM)* Technology. The difference between these technologies is that COM will be used for communication of local networks and DCOM for across different networks.

OPC server

The OPC servers are software applications or drivers of the OPC specifications. They include a word server, which refers not on the used type of computer, but has the relationship with the counterpart, namely, with the OPC client. The most important task of the server is to translate the transmitted data in OPC format. An example of the OPC Server is OPC Matrikon. The application areas of Matrikon Server extend over a very wide range of products. Thus, there are solutions for PLC of chemical industry, but also for the buildings automation.

OPC client

The OPC Client is a software application that is designed to interact and to communicate OPC servers. The technical complexity of the OPC client is considerably less as of the OPC server. The OPC communication is shown in Figure 4

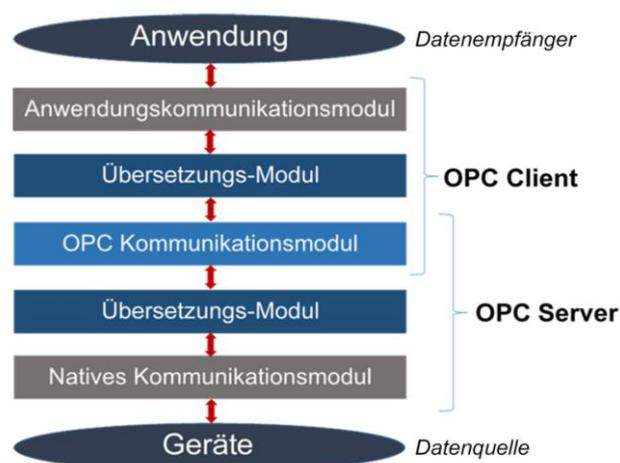


Figure 4: OPC Communication

Tasks and Contents of the Project

1. PLC Freelance of ABB

1.1 Freelance Engineering

Freelance Engineering is a software tool for configuring, operating and documenting of user programs. In the engineering station there are two main modes: the configuration mode and the startup mode.

In the configuration mode any changes to the project elements will be made. The program guide takes the form of a project tree. This project tree functions are clearly displayed. The project elements are structured according to IEC. Beginning with the configuration (CONF), which summarized all project elements the stations, task lists, tasks, program listings and function blocks (FBS).

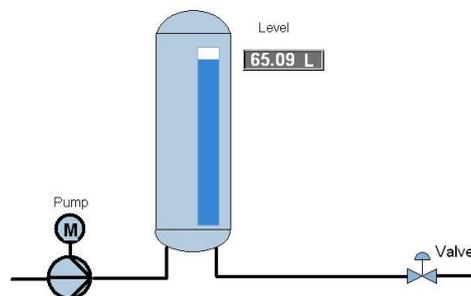
1.2 Freelance Operations

Freelance Operations is the control station of the Freelance software package. In Freelance-Operations are configured and structured graphics, trends, SFC, figures and protocols. It is a graphical user interface to operate and to monitor the process.

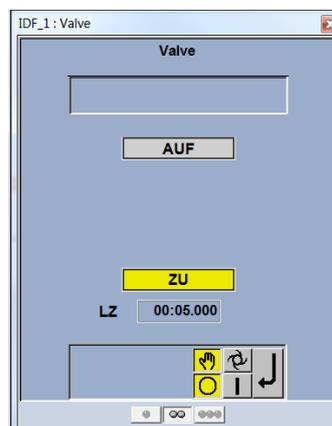
Another important function of the software is the change from the control station in the operating system, as long as no two are separate screens present. Once the software is opened, access is completed on the operating system. The access can be reactivated and

2. Tank-Level-Control with PLC Freelance of ABB

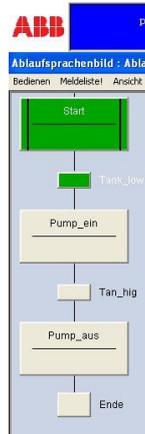
2.1 Build a model of the tank with a pump and a valve



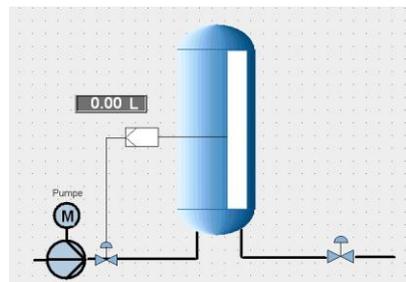
2.2 Control the tank manually (z_Aufgabe_5)



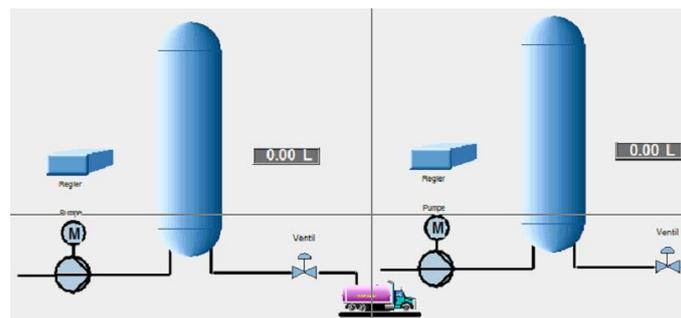
2.3 Control tank automatically with the SFC



2.4 Control the tank level with a controller (z_Aufgabe_7)



2.5 Build a model of two tanks and control it



2. OPC Server of Freelance of ABB

2.1. Install and use the OPC Server

The server in the project presents Freelance in the form of OPC gateway. It works on basis of the OPC specification DA. The aim of the server is to build the connection to the client. Through this connection, it should be possible to access to variable values the Freelance program.

Netzwerk-Konfiguration

Hardware-Knoten		Ressource			Linie A		Linie B	
Typ	Name	Typ	Name	ID	IP-Adresse 1	IP-Adresse 2	IP-Adresse 1	IP-Adresse 2
Engin. PC	Freelance Engineering	D-ES		21	local			
EMULATOR	EMULATOR1	D-PS	ps01	1	✓ 127.0.0.1			
GWY	GWY2	D-GS	OPCG	19	✓ 127.0.0.1			
VIS	VIS1	D-LS	os01	22	✓ 127.0.0.1			

3. OPC Client of Matrikon

3.1. Install and use the OPC Client

An OPC client used in the project is the OPC Client Matrikon. Its task is the access to the variables that represents the Freelance Server. In addition to this the user interface can be observed and parameterized.

The screenshot shows the MatrikonOPC Explorer interface. On the left, a tree view shows the network structure, including 'Localhost' and 'Freelance2000OPCAEServer. 19. 1'. The main pane displays the 'Contents of 'Comeon.' table:

Item ID	Access Path	Value	Quality	Timestamp	Status
Behalte...		45,0930709838867	Good, non-specific	03.16.201...	Active
Pumpe/O...		False	Good, non-specific	03.16.201...	Active
Ventil/OUT		True	Good, non-specific	03.16.201...	Active

Below the table, there are sections for 'Server Info' and 'Group Info'. The 'Server Info' section shows details for 'Freelance2000OPCAEServer. 19. 1', including its state (Running) and connection status. The 'Group Info' section shows details for the 'Comeon.' group, including its active status and update rates.

4. Implementation

4.1 Data Acquisition with OPC Freelance

4.2 Control of the Tank with OPC Matrikon

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