



Interoperability on the Next Level: OPC-Unified Architecture

JAI2010 18.11.2010 – Vigo

Stefan Hoppe
President OPC Europe
Stefan.Hoppe@opcfoundation.org

Agenda

- **Introduction OPC Foundation**
- **OPC UA details**
- **Advantages of Combined Standards**
- **Demo**

OPC Foundation

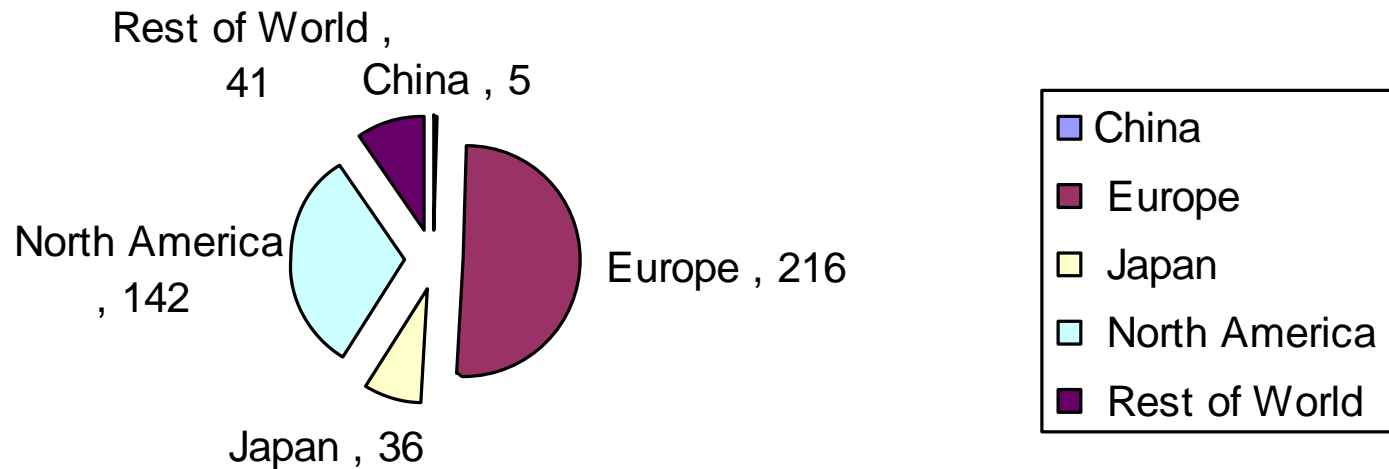
- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

- International Industry Standard Organization
 - 407+ Member Companies / 80+ end-users Members
 - 3500 + Total Companies Build OPC Products = 22000 + Products
 - Millions & Millions of OPC Installations
- The vision of OPC is secure reliable multi-vendor multi-platform interoperability
 - for moving information vertically from the data sources through the enterprise of multi-vendor systems (with stops in between...)
 - For moving information horizontally between data sources on different industrial networks from different vendors;
 - Not just data but information.....
- Reliable, Secure Interoperability is not an option
- Collaboration is key to incorporating many multiple “open” standards into an unified open platform architecture

World Membership Demographics

- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

OPC Members By Region



OPC Board of Directors

- OPC Foundation

- OPC Portfolio
- OPC UA details
- Cooperation

- Reinhold Achatz, Siemens

Reinhold has been on the OPC Board of Directors longer than any other board member, he is the founding member for Siemens on the Board of Directors (1997)

- Russ Agrusa, ICONICS
- Thomas Burke, OPC Foundation
- David Eisner, Honeywell
- Ken Hall, Rockwell
- Konishi Nobuaki, Yokogawa
- Dr. Grant Wilson, Emerson

OPC Europe Organization

OPC Europe Officers

Stefan Hoppe	OPC Europe President	<i>Beckhoff</i>	stefan.hoppe AT opcfoundation.org
Tino Hildebrand	OPC Europe Vice President	<i>Siemens</i>	tino.hildebrand AT siemens.com
Yvonne Neumann	Marketing	<i>MatrikonOPC</i>	yvonne.neumann AT matrikonopc.com
Matthias Damm	Technology	<i>ascolab</i>	matthias.damm AT ascolab.com
Juergen Lange	Marketing-	<i>Softing</i>	juergen.lange AT softing.com
Manny Mandrusiak	VP Marketing	<i>OPC Foundation</i>	manny.mandrusiak AT opcfoundation.com

OPC Europe Country Representatives

Germany	Stefan Hoppe	<i>Beckhoff</i>	stefan.hoppe AT opcfoundation.org	Germany Events
Austria	Michael Haas	<i>Certec</i>	michael.haas AT certec.at	Austria Events
Belgium	Dirk van der Linden	<i>Artesis University College of Antwerp</i>	dirk.vanderlinden AT artesis.be	www.webcom-eu.org & http://code.google.com/p/opc-ua/
Czech Republic	Zbynek Zahradnik	<i>OPC Labs</i>	zbynekz AT opclabs.com	Czech Events
Finland	Jouni Aro	<i>Prosys</i>	jouni.aro AT prosys.fi	Finland Events
France	Michel Condemine	<i>4CE Industry</i>	michel.condemine AT opcfoundation.org	OPC France Events
Ireland	Liam Power	<i>Embedded Labs</i>	liam.power AT embeddedlabs.com	Ireland Events
Italy	Claudio Fiorani	<i>Progea srl</i>	cfiorani AT progea.com	Italy Events
Poland	Dr. Marius Postol	<i>CAS</i>	mailto:mpostol AT cas.eu	Poland Events
Spain	Nacho Armesto	<i>University of Vigo</i>	nacho.armesto AT gmail.com	Spain Events

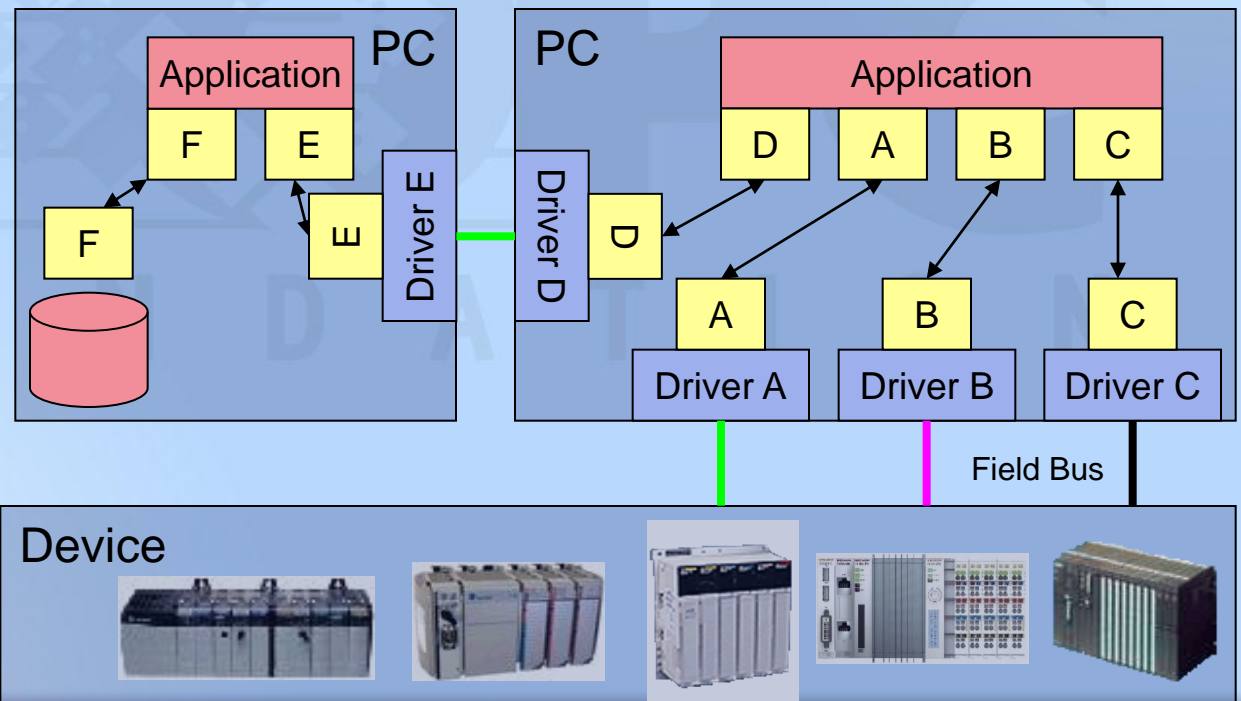
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The problem 15 years ago

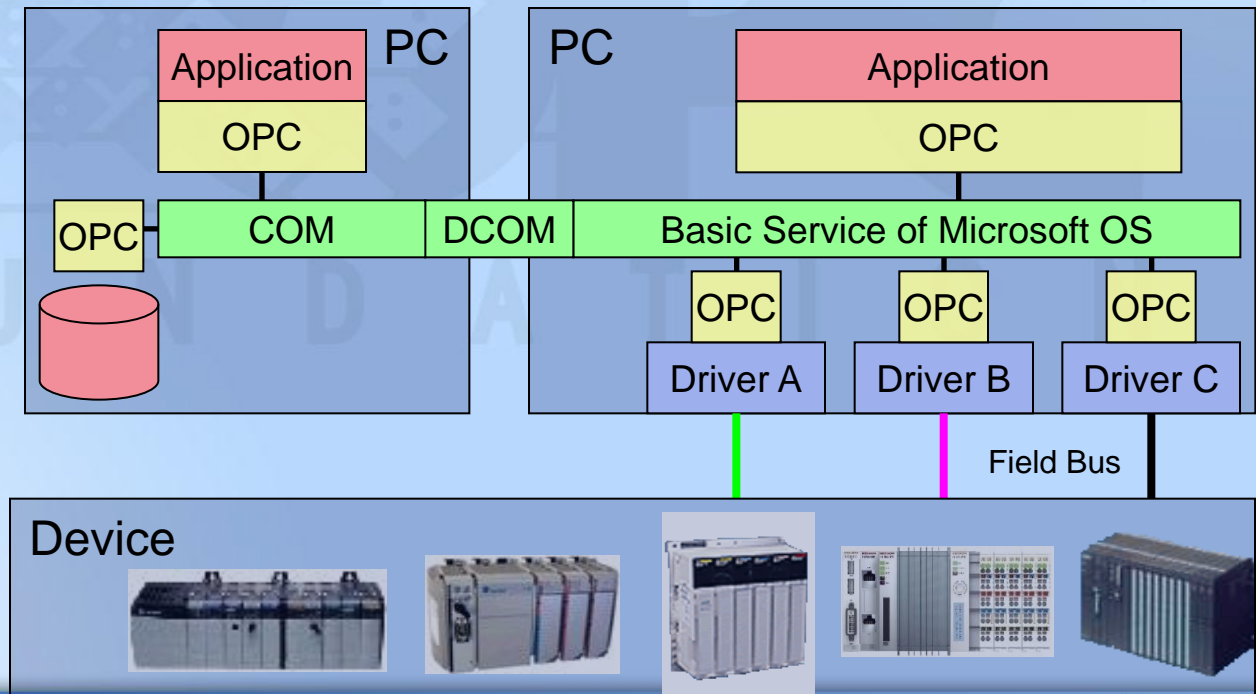
- PC based software products become part of Automation Systems
- Devices are connected via different bus systems and protocols to the PC
- Network interface cards have vendor specific programming interfaces
- Large number of proprietary interfaces required high development and maintenance costs for applications

- OPC (DA) was designed to solve this problem



The Solution

- OPC Foundation defines APIs to access different types of process data
- Special OPC interfaces for current process data, for events and process alarms and for historical data
- OPC interfaces uses Microsoft Windows base technology COM / DCOM
- Hardware vendors can provide OPC Servers as standard driver and software vendors must implement only one driver as OPC Client to access process data

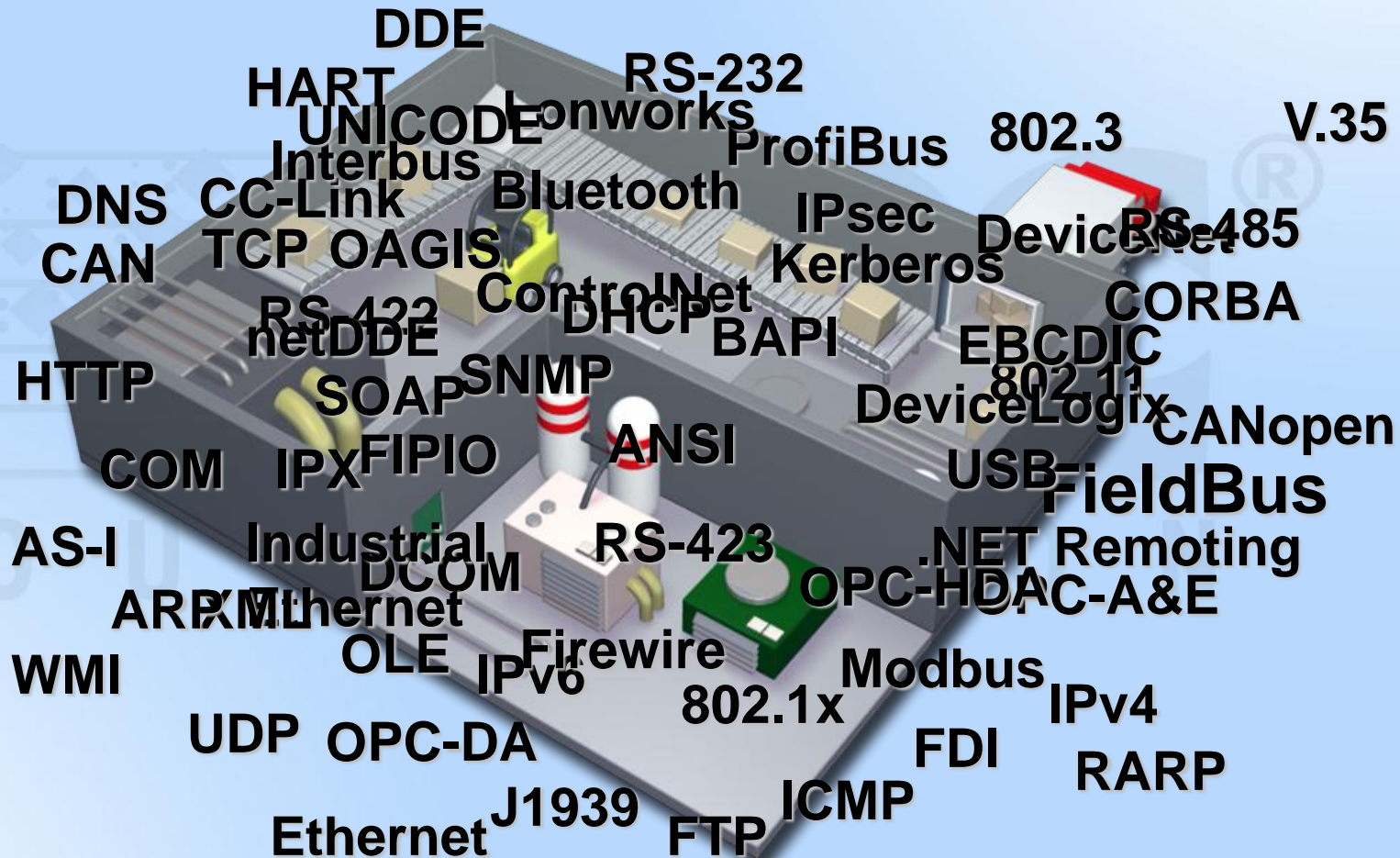


The Problem today (1)

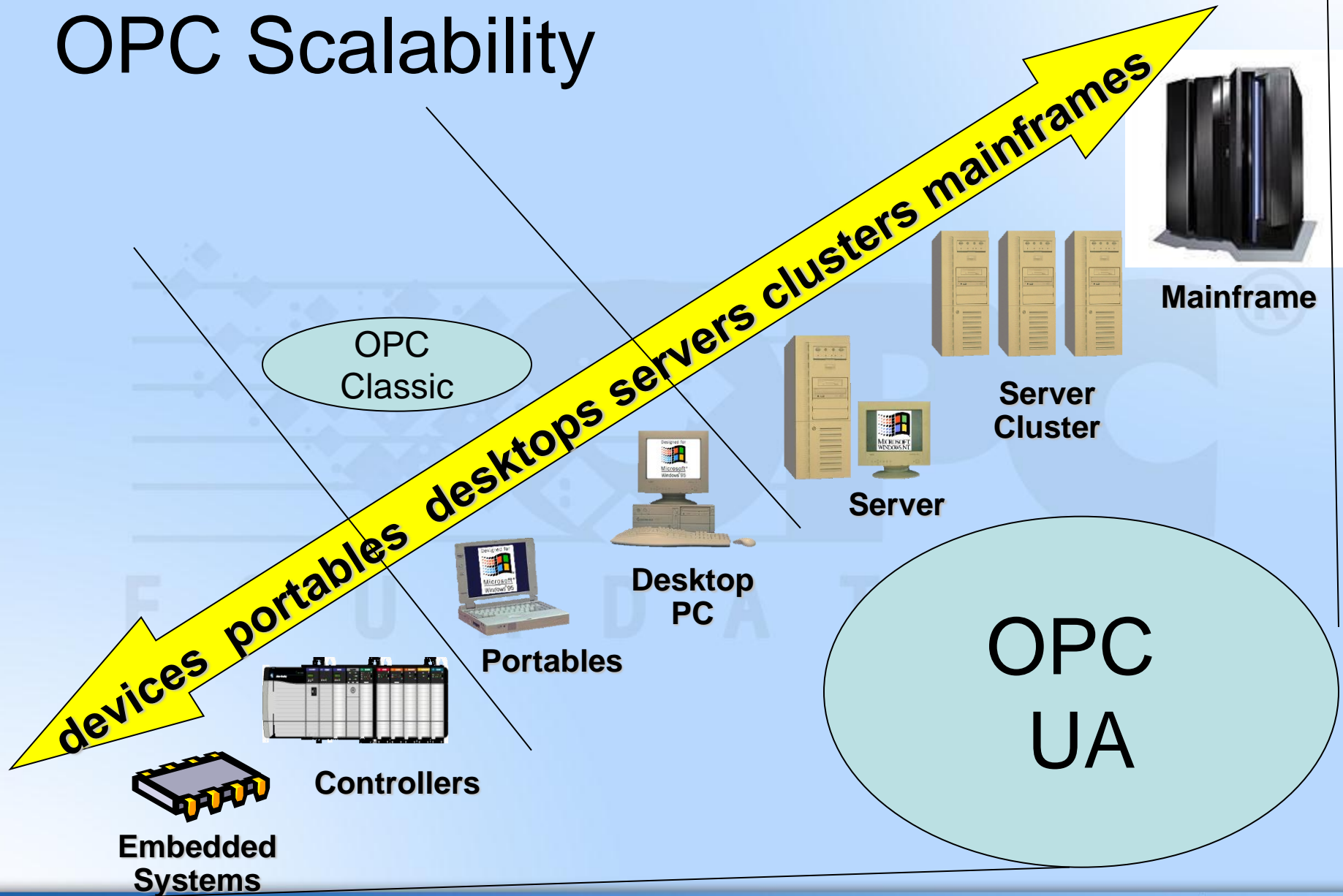
- COM based OPC is used in applications it was not designed for
 - Embedded devices
 - Limitations on Windows CE e.g. no DCOM support
 - Requirements to implements a standard like OPC on other embedded OS
 - MES and ERP systems
 - These system require combinations of complex data, methods and events
 - These information types are not adapted or not defined and cannot be combined in one API
- Open issues in distributed systems
 - DCOM timeouts, DCOM configuration, limited security, reconnect
 - Missing features in APIs for robustness and reliability
- Common features implemented by products but not standardized by OPC
 - Redundancy
 - Server chaining ...

Numerous incompatible protocols

- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

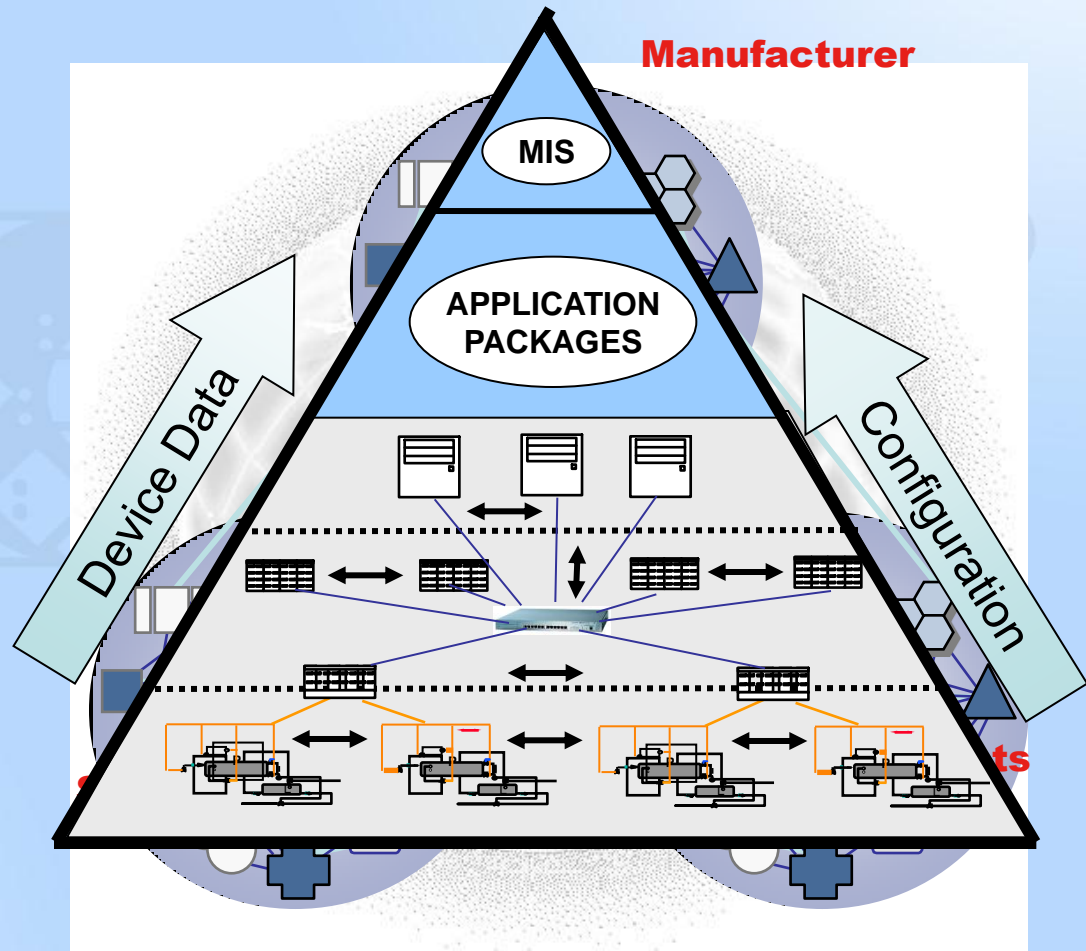


OPC Scalability



The Problem today (2)

- The Inter-Enterprise Nightmare
- The Problem
 - Many different vendors
 - Custom made solutions
 - Proprietary technologies
 - Point-to-point Integration
 - Limited “real-time” information
 - Maintenance nightmare
 - Multiple dependencies
- Solution
 - **OPC Unified Architecture**



OPC-UA Technical Overview

- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

OS platform independent: Windows, WinCE, Linux, Euros, QNX, VX-Works...

- avoid DCOM, offers direct communication via TCP / HTTP
- allows to integrate UA products directly into controllers

Protocols/Bindings

- Binary: best performance, one single TCP port 4840
- Web service (SOAP): firewall friendly (e.g. port 80/443)

OPC Foundation

- providing an SDK containing UA stacks and sample code
C/C++ stack / .NET stack / JAVA stack

Security (mandatory implemented in UA stack, optional use)

- Authentication via x509 certificate, SSL-encryption and data integrity

Technical potential:

- Support for redundancy, Sequence numbers, keep-alive, resyncing
- Heartbeat for connections in both directions
- Buffering of data and acknowledgements of transmitted data
Lost connections don't lead to lost data

OPC-UA Base

- OPC Foundation
- OPC Portfolio
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- **Architecture**

- Integration of DA, A&E, Commands, Complex Data, and Object Types

- **Designed for Federation**

- abstract data/ information from the plant floor, through information models, and up to enterprise systems

- **Information Modeling**

- development and deployment of standard information models to address industry domains specifics

- **Complex Data**

- OPC Standard & Domain & vendor specific.....

OPC-UA Base

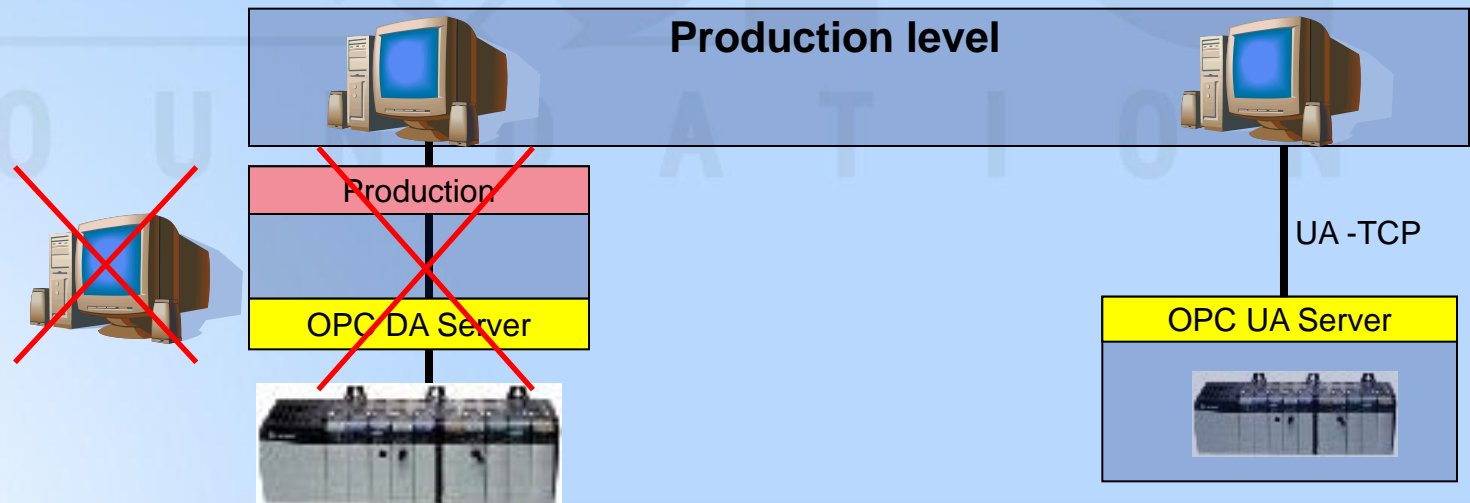
- OPC Foundation
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- **Security**
 - Collaboration, Development & Reference
- **Enterprise Integration**
 - OPC UA standard messaging system
- **Robustness / Reliability Designed & Built in....**
 - NO Failures
 - Sequence numbers, keep-alives, resyncing, and support for redundancy
- **Commands**
- **Companion Standards**
 - industry groups define content (“what”)
OPC Unified Architecture provides the transports (how”)

Elimination of OPC-Gateway-PC

- OPC Foundation
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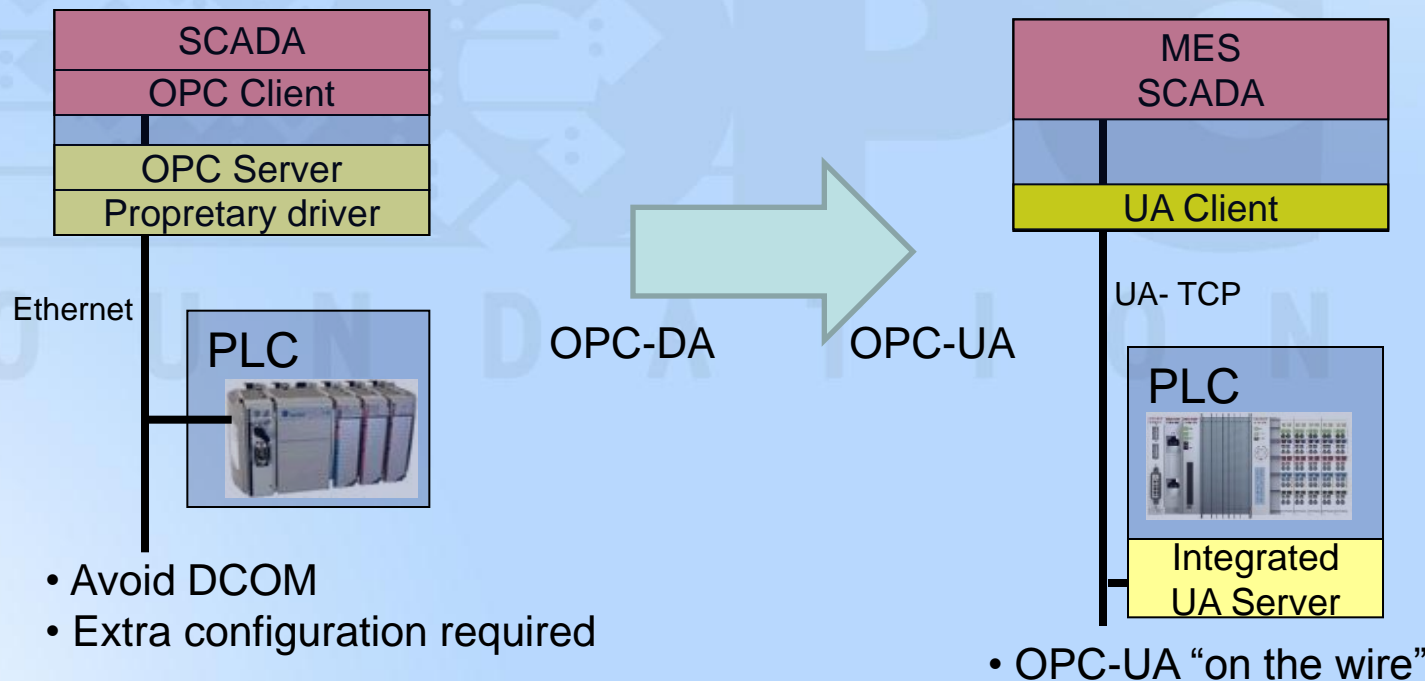
- Problem:
 - OPC DA require Windows COM/DCOM
 - Non Windows-systems require a Win-Gateway-PC
The „OPC-PC“ to be connected remotely via OPC
- Solution:
 - Integration of UA into the controller



From COM/DCOM to TCP/HTTP

- OPC Foundation
- OPC Portfolio
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- OPC DA: Based on COM/DCOM technology
Availability on Windows-OS-Systems
- OPC UA: Based on TCP/HTTP
Availability on various platforms: Microsoft / Linux / Euros / VxWorks

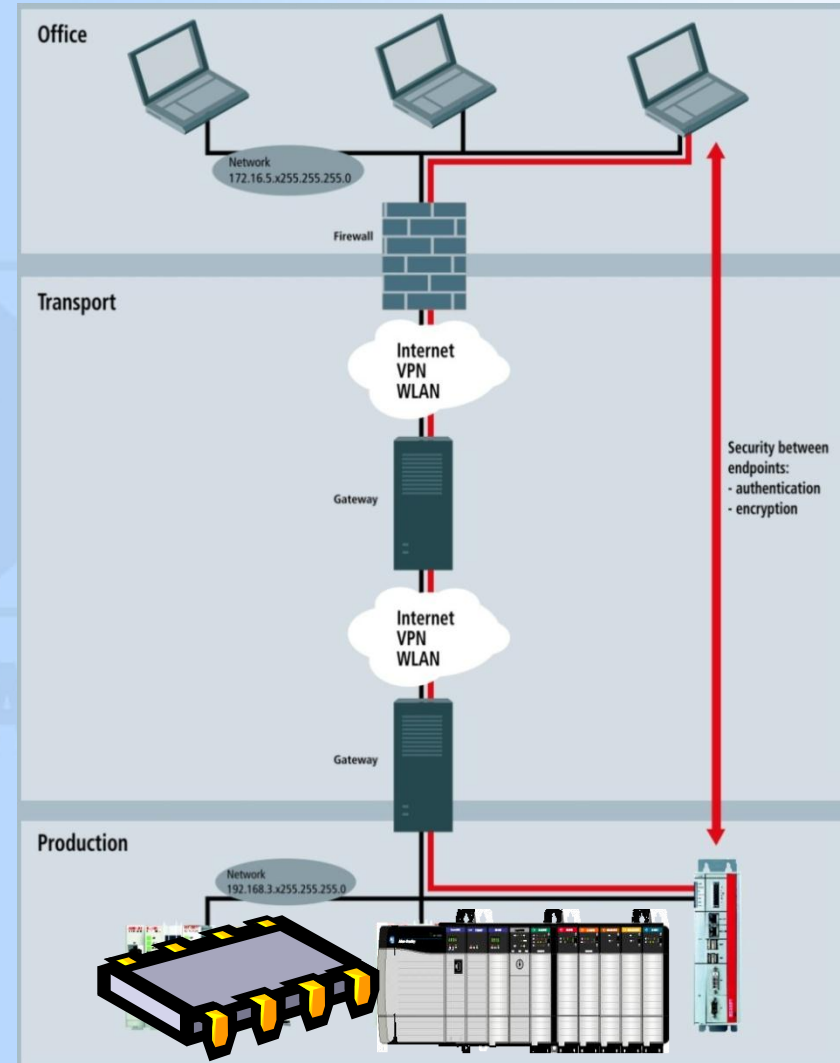


OPC-UA Security

- Implemented in UA-stack
- Optional use
 - Authentication via x509 certificates
 - SSL encryption between endpoints

Benefit:

- Allows secured communication through unsecured environment
- From office through gateways into production

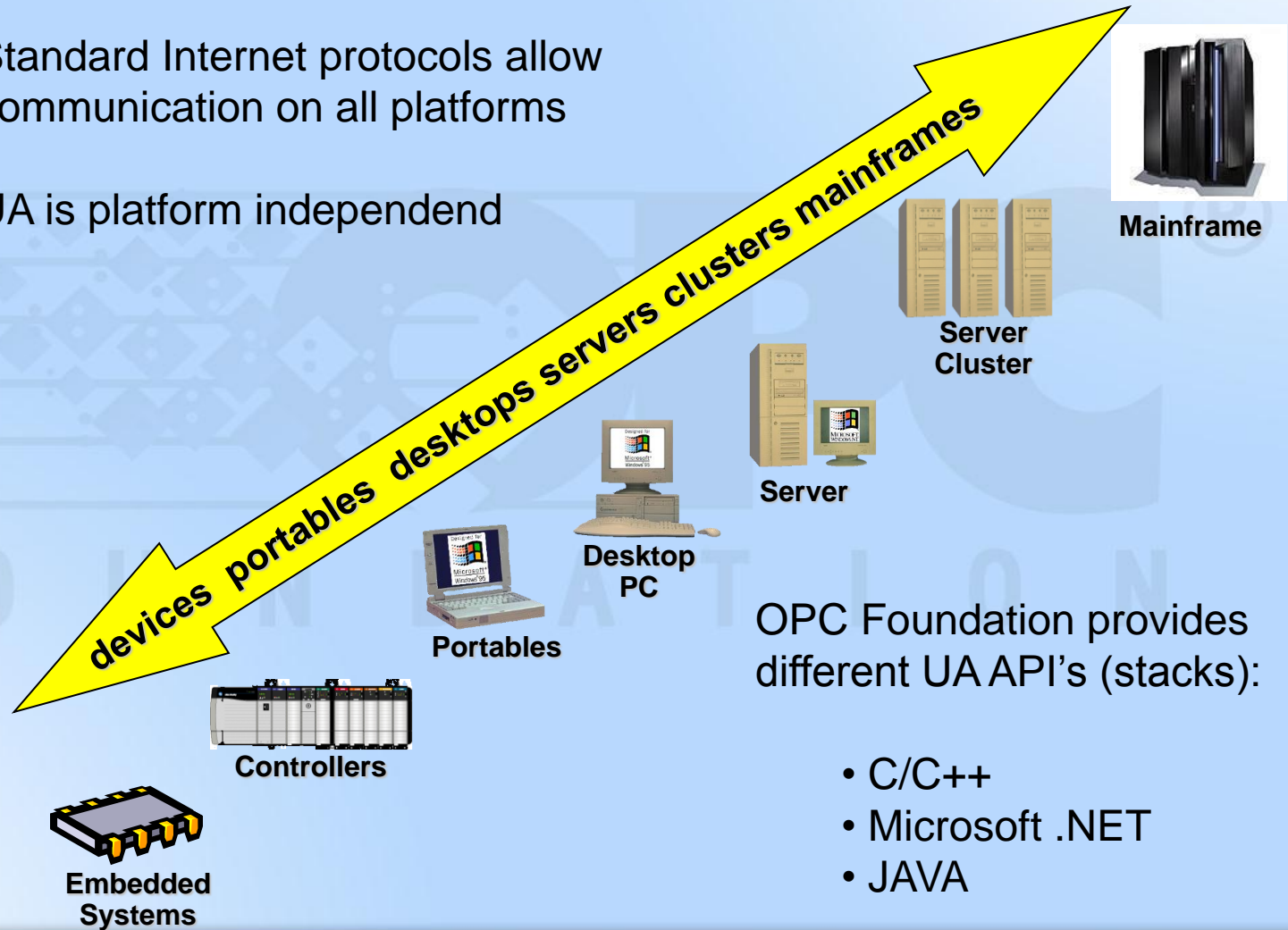


UA Scalability / Transport

- OPC Foundation
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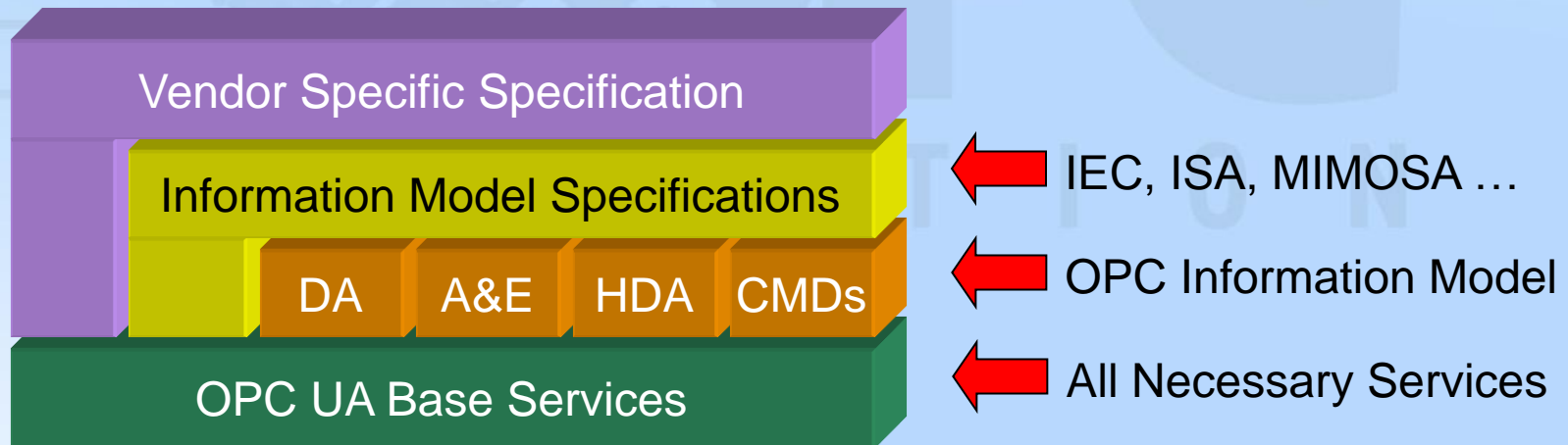
Standard Internet protocols allow communication on all platforms

UA is platform independent



Specification Layering

- Other organizations define „WHAT“ will be exchanged
 - Orgs like ISA, IEC, MIMOSA, EDDL define information models
- OPC Foundation defines „HOW“ information must be exchanged
 - Search object instances and types in Address Space, modeling rules
 - Read and Write Data
 - Subscriptions
 - Methods



Clients written to just the base can still discover and access all data from the derived layers!

UA extended for Informationmodels

- OPC Foundation
- OPC Portfolio
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- Device Integration (DI)
 - Initiative of EDDL Consortium, standardisation for field-devices
 - Released 2009
- Field Device Integration (FDI)
 - EDDL and FDT Consortium, Read and write of data
 - Release 2010
- PLCopen
 - Released 2010
- Upcomming UA-Informationmodels
 - Analyzer Device Integration (ADI)
 - MIMOSA
 - IEC61850 CIM
 - ProdML
 - ISA-95 and ISA-88

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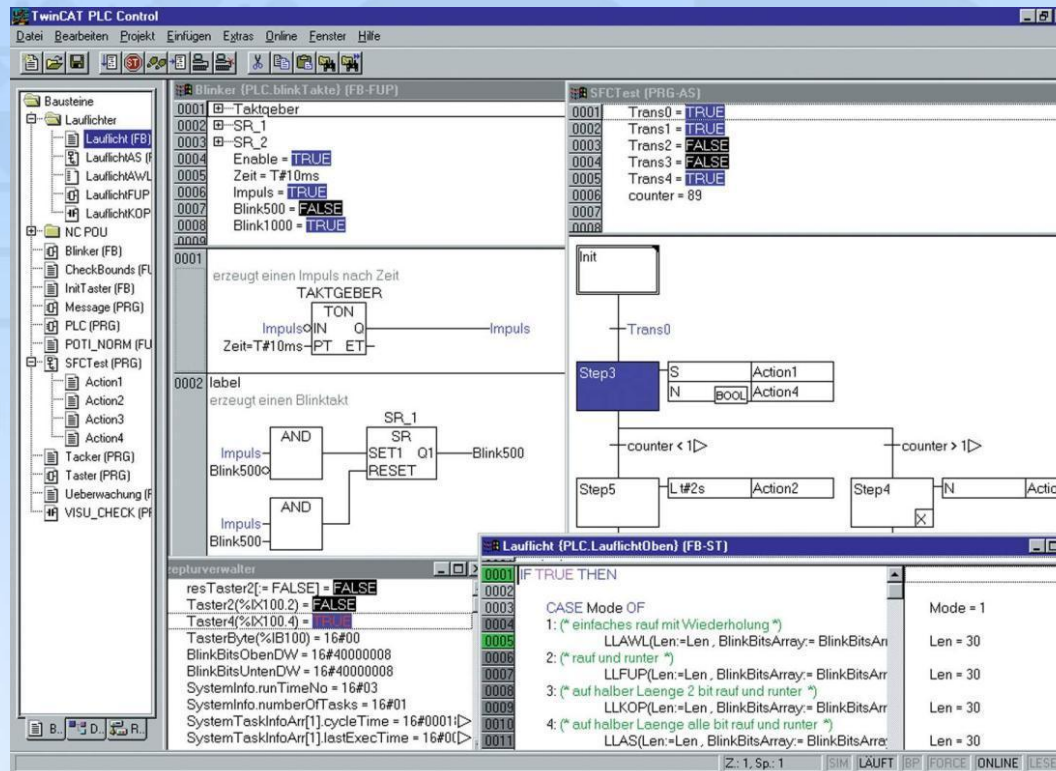
PLCopen Overview

- OPC Foundation
- OPC Portfolio
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- Cooperation

PLCopen : www.plcopen.org

IEC6-1131-3

- Globale standard for Industrial Control Programming
- Languages: ST, IL, LD, FBD



PLCopen

motion control

PLCopen

safety

PLCopen

Benchmarking

PLCopen



EXTENSIBLE
< MARKUP >
LANGUAGE

PLCopen Motivation

- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

- Data exchange
 - Vertical: between Scada/MES/ERP to PLC
 - Horizontal: between PLC to PLC
- Issues:
 - different data types, different elementary data types
e.g. INT, DT (DayTime)
 - no descriptions of complex data
 - engineering efforts when switching vendors
- Summary:
 - Common information model required
“Mapping of the IEC 61131-3 Software Model to
OPC United Architecture Information Model and Namespace”

PLCopen and OPC group: Timeline

- OPC Foundation
- OPC Portfolio
- OPC UA details
- Cooperation

2008 October: Kick off meeting common group

- Chairman Stefan Hoppe (Beckhoff)
 OPC Author Matthias Damm (Ascolab)
 PLCopen Author Prof. Rene Simon (ifak)
- Goal 1: Common Namespace for
 IEC61131-3 Information model
- Goal 2: PLCopen-OPC-UA functionsblocks and services

2009 November: Release Candidate available

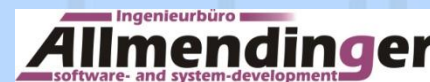
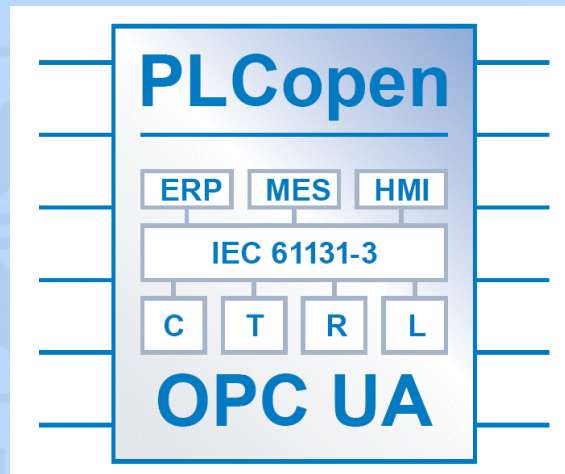
- Live demo on SPS/IPC/Drives 2009

2010 March: Released from both organisations

- multi vendor demo on Light&Building and Hanover Fair

PLCopen and OPC: Team members

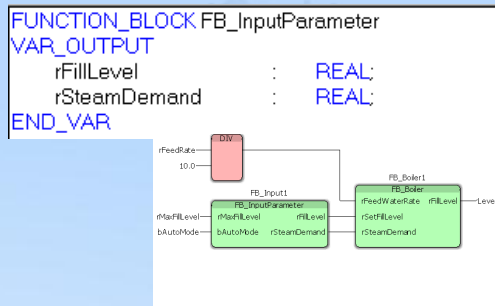
- PLCopen: IEC61131-3 vendors and users
- OPC-Foundation: SCADA vendors, UA experts



PLCopen and OPC: Results

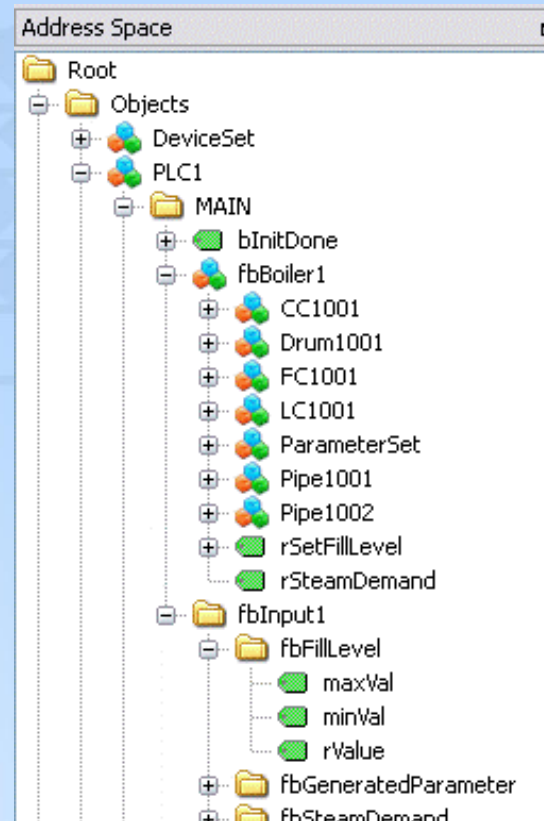
PLCopen:

Content „WHAT“



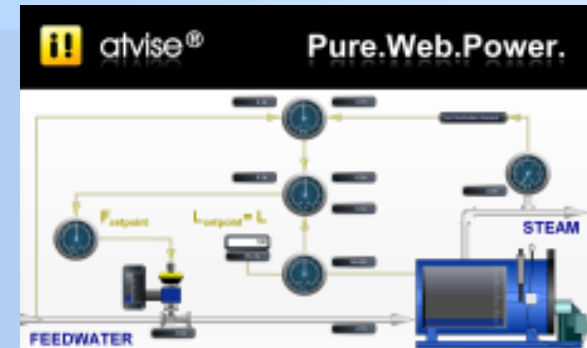
OPC-UA-Server:

Communication „HOW“



UA-Clients: SCADA/MES/ERP

Presentation



All information about
IEC61131-3 project:

- FB's
- POU's
- Structures
- Tasks / Resources..

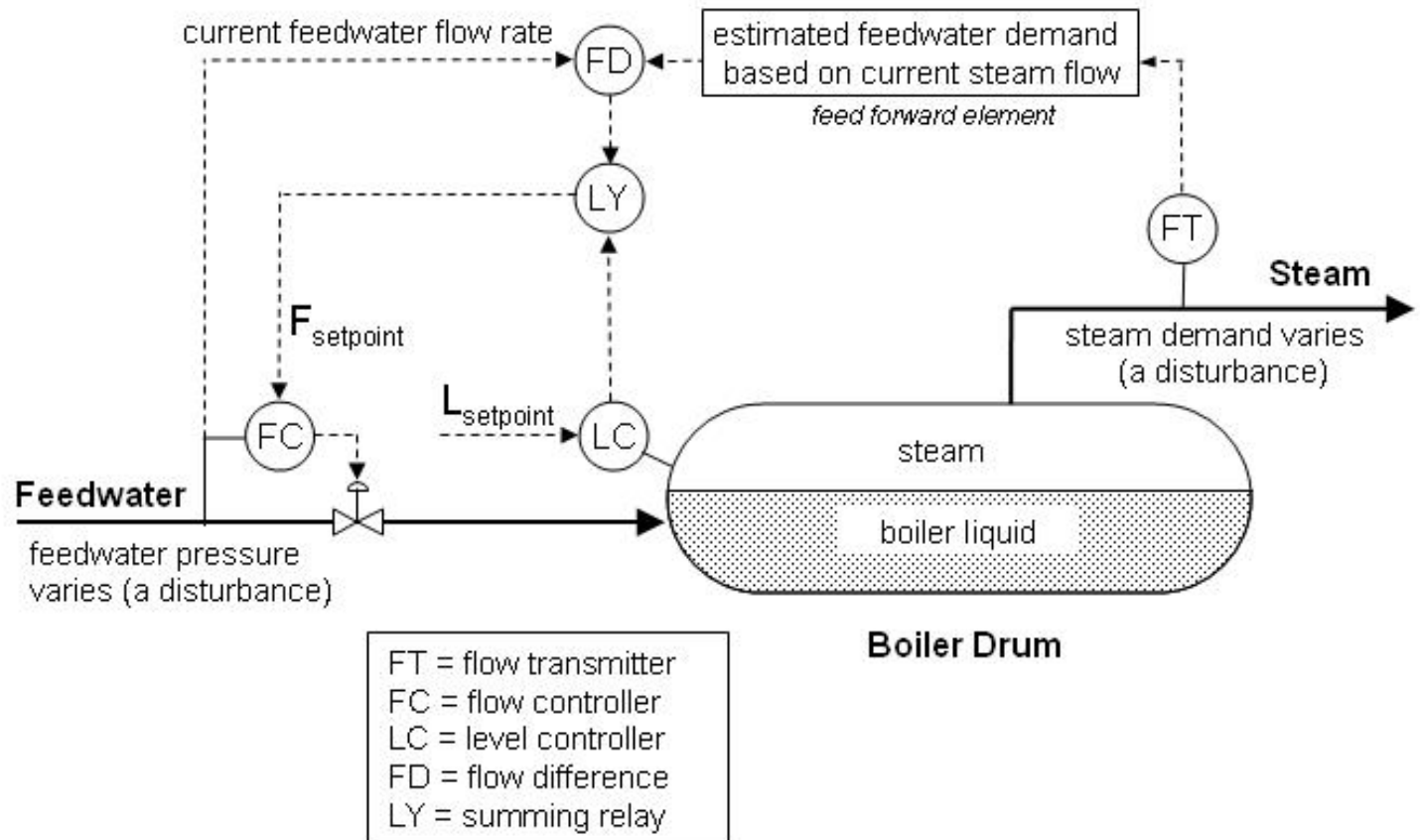
- Standardized UA access
- Identical namespace
- Complete information model

Advantages:

- Re-useable HMI Faceplates“
- Rapidly engineering
- Transparent PLC controller

PLCopen and OPC: Demo

- OPC Foundation
- OPC Portfolio
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PLCopen and OPC: Demo

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PLCopen
for efficiency in automation

PLCopen
OPC UA

OPC FOUNDATION

CERTEC
Vendor: Certec EDV GmbH
Product: atvise
Description: Fully featured web HMI in pure web technology

Allmendinger
Vendor: Allmendinger
Product: Add-on for SIMATIC WinCC
Description: OPC-UA Client Channel for SIMATIC WinCC

iconics
Vendor: ICONICS Inc.
Product: GENESIS4
Description: Microsoft .NET based, web-enabled, OPC based 64-bit HMI/SCADA Suite

ascalab
Vendor: ascalab GmbH
Product: OPC UA Services
Description: OPC UA Consulting, Training and Development Services

COPADATA
Vendor: COPA-DATA GmbH
Product: zenon
Description: OPC UA Client solution for zenon

VisiWinNET
Vendor: INSOFT GmbH
Product: VisiWinNET
Description: HMI/SCADA Software Microsoft .NET based HMI/SCADA Software with support for Visual Studio and Expression Blend

BECKHOFF
Vendor: Beckhoff Automation
Product: CX1010-0111
Hardware: 500MHz X86 CPU, 512MB RAM
Description: IPC with PLC controller and OPC-UA server/client

Rexroth Bosch Group
Vendor: IntraQPS
Product: Instalogix
Hardware: 1GHz X86 CPU, 512MB RAM
Description: controller based PLC with integrated OPC-UA server

ifak
Vendor: ifak e.V.
Product: OPC UA Generic Server
Hardware: SIMATIC 57300
Description: Server adaptable to dienet data sources

KW software
Vendor: Phoenix Contact
Product: VALUELINE IPC
Hardware: Core2™ Duo 1.5 GHz
Description: IPC with ProConOS embedded CLR SoPPLC and OPC UA communication

logi.cals
Vendor: logi.cals/MicroByte
Product: logi.PLC S200
Hardware: 400MHz Freescale MPC5200 CPU Power Architecture, 128MB RAM
Description: PLC controller / OEM PLC

Unified Automation
Vendor: Unified Automation GmbH
Product: OPC UA Server SDK
Description: Office server for PLC address space and Server development tools

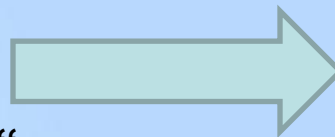
PLCopen and OPC: Future

- OPC Foundation
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Adaption in other vertical markets

- Building Automation: BACnet
- Remote Control (IEC61850)
 - Defines general transmission protocol for protective and control equipment in medium and high voltage electrical substations
 - Different Data Models are defined
 - ⇒ Substations / ⇒ Wind turbines / ⇒ Fuel cells
 - ⇒ Hydro electric power plants

PLCopen:
Content „WHAT“



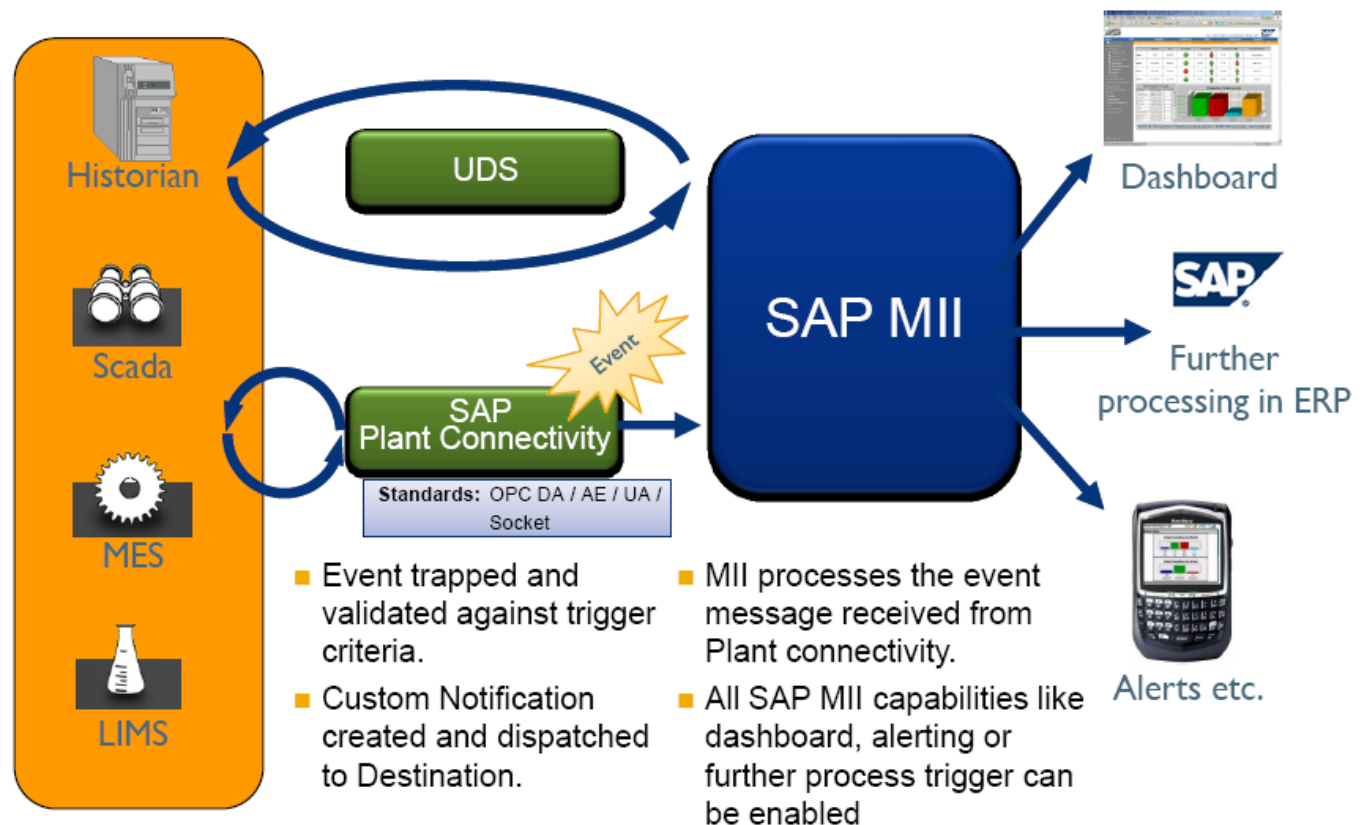
OPC-UA:
Communication: „HOW“

SAP support UA: The Perfect Plant

Harmonizes Complex Manufacturing Network Interdependencies

- OPC Foundation
- OPC Portfolio
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Process Flow



SAP support UA: The Perfect Plant

Harmonizes Complex Manufacturing Network Interdependencies

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SAP product „SAP Plant Connectivity“ provides OPC-UA



„OPC UA allows a platform independent, easy and secure connection between SAP business systems with distributed shop floor data even on smallest embedded devices“

Dr. Arne Manthey, Product Manager, SAP AG

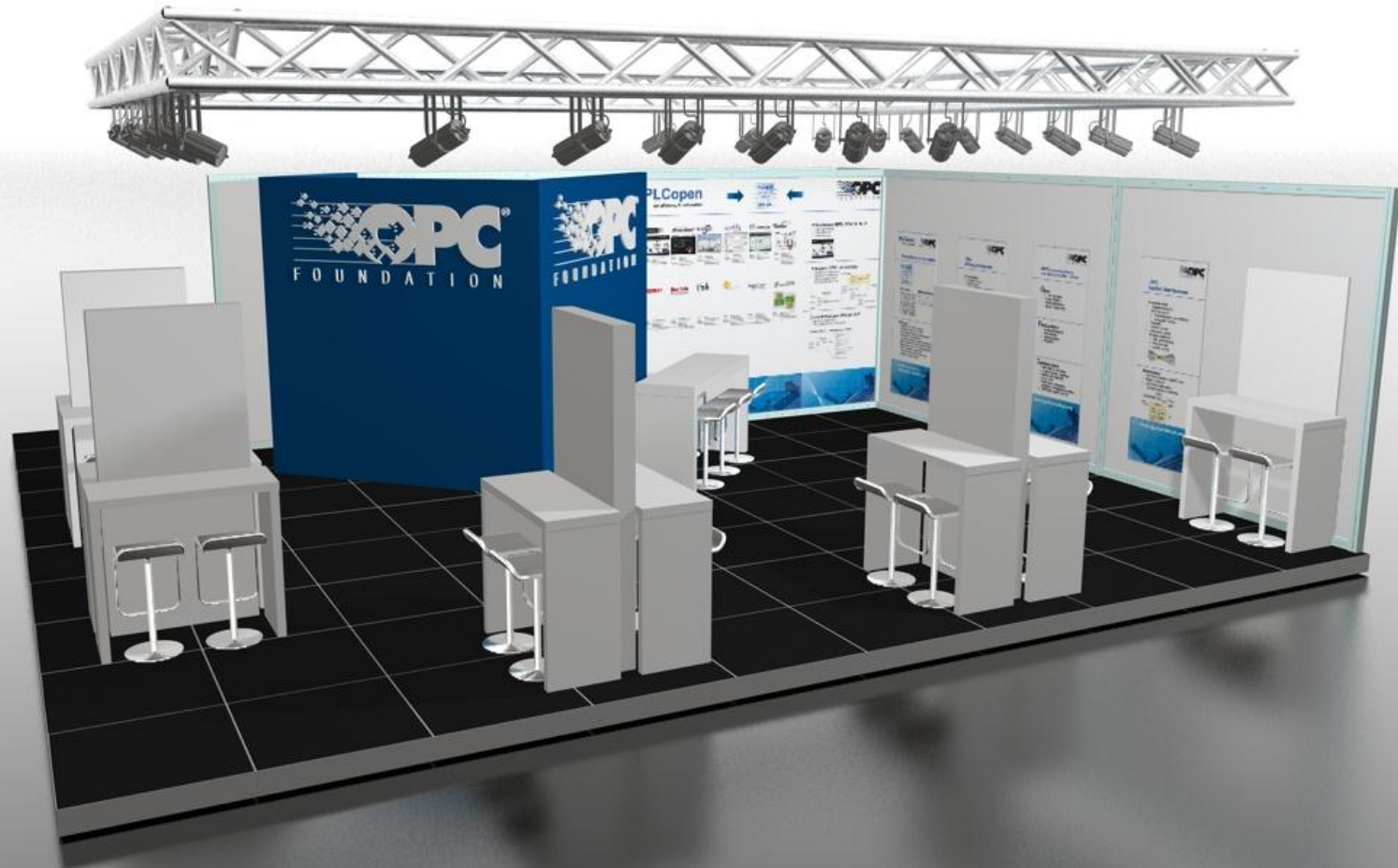
Summary: OPC / OPC-UA

- OPC Foundation
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- OPC is THE standard for data exchange of process data
 - Solves interoperability issues in industrial automation
 - Widly accepted, de facto standard, thousands++ of OPC products
 - Enables data exchange from sensor up to ERP level
- OPC Unified Architecture
 - Platform independed, allows to provide OPC everywhere
Perfectly also for smal embedded systems
 - Optimized access for requirements from ERP level
Complex data, commands, events
 - Provides opportunities for rich information model
 - Is an internationale IEC Norm IEC62541
 - Provides international security standards „out of the box“
(integrated into stack)

Impressions : SPS/IPC/Drives, Nov 23rd – 25th, OPC booth hall 7 – 190

OPC-UA: From controller into the cloud



OPC-UA: From Controller into the cloud

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- Multibrid 5000 wind turbine (Alpha Ventus)



OPC-UA: From Controller into the cloud

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- OPC-UA: designed to be integrated into embedded devices





Interoperability on the Next Level: OPC-Unified Architecture

November 18 2010 – JAI2010 - Vigo

Thanks ! - Questions ?