OPC Unified Architecture

Creating a Common Object Model for IEC 61131-3 Applications

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20 Years Experience in Automation

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OPC History

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1996 OPC DA (Data Access)

- OPC „classic“ based on Microsoft COM/COM Technology
- DCOM status „frozen“ by Microsoft
- operates on „tags“

Various Other OPC Specifications based on COM/DCOM

- OPC HDA (historical data access)
- OPC AE (alarms & events)
- OPC Complex Data
- …

2001 OPC-XMLDA

- „web based access“, SOAP/HTTP
- somewhat platform-neutral
- in practice too slow (even much slower than OPC DA)

OPC Unified Architecture

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2003 Start Specification of OPC UA

- Unified Architecture
- intended to run on PLC
- platform neutral
- custom binary protocol, security

2006 Release of OPC UA Specifications

2008 Joint Working Group of PLCopen and OPC Foundation

- define common data model for IEC 61131-3 applications
- „more than just tags“ – function block types, program types
- suited for larger applicattions – configurations and resources

2009 logi.cals OPC UA Server

- Windows NT/2000/XP/Vista, Windows CE (various CPUs)
- Linux/µCLinux (various CPUs)
- VxWorks (2010)

OPC UA: Technology

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Platform (Operating System) and CPU independent

- avoids DCOM
- offers direct communication via TCP / HTTP
- fewer platform dependencies because of own communication protocol

Protocols

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

OPC Foundation

- provides a UA protocol stack for its‘ members
- C protocol stack available
- C++ protocol stack available
- .NET protocol stack available
- Java protocol stack is planned

OPC UA: Technology

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Security

- security layers are mandatory, use is optional
- authentification, encryption and data integrity (signatures)

Technical potential

- Support for redundancy
- Heartbeat for connections in both directions
- Buffering of data and acknowledgements of transmitted data
- Lost connections don‘t lead to lost data

Advantages

- can run on PLC (*no need for a Windows PC for the OPC server!*)
- single server can handle everything
- clean way to add system data (e.g. IP address, CPU name,…)

Object-oriented Approach

- a function block type becomes an OPC UA type
- a function block instance becomes an object (type reference!)

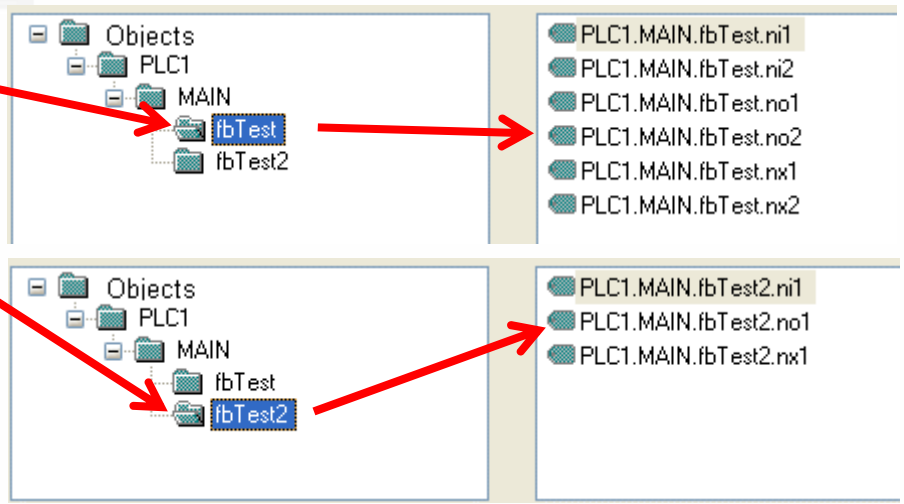
logi.RTS OPC UA Server

- UA Server runs on the device (Windows XP, Windows CE, (µC)Linux, VxWorks,…)
- Fully integrated with logi.RTS
- No specific OPC UA configuration required
- Configuration of adressspace done in logi.CAD („VISUALIZE“/OPC Visible)
- Fully integrated with logi.CAD
- *Configuration is part of the PLC code*
- Adressspace of PLC and OPC-UA are *(always!)* consistent
- UA server is reload-enabled („hot-update“)
- Supports multiple Resources on a single CPU/PLC

Example: IEC 61131 in OPC UA

```
PROGRAM MAIN
VAR
    fbTest    : FB_BLOCK1;    (* ~ (OPC : 1 : bla ) *)
    fbTest2   : FB_BLOCK1;
END_VAR
```

```
FUNCTION_BLOCK FB_BLOCK1
VAR_INPUT
    ni1   : INT;    (* ~ (OPC : 1 : bla ) *)
    ni2   : INT;
END_VAR
VAR_OUTPUT
    no1   : INT;    (* ~ (OPC : 1 : bla ) *)
    no2   : INT;
END_VAR
VAR
    nx1   : INT;    (* ~ (OPC : 1 : bla ) *)
    nx2   : INT;
END_VAR
```



SCADA Communication OPC DA vs. OPC UA

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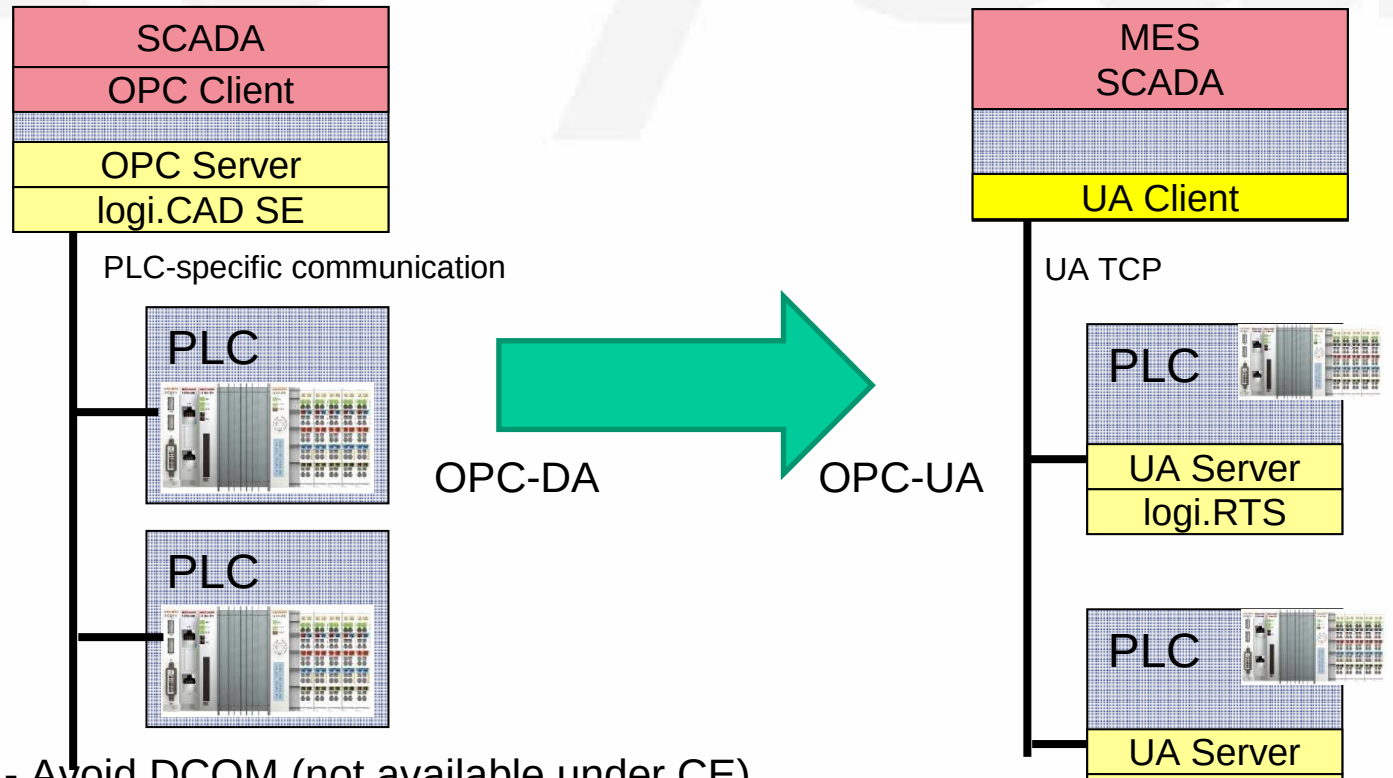
Network and configuration: OPC-DA vs. OPC-UA

Decentralized: SCADA and PLC on different devices



- Avoid DCOM (not available under CE)
- logi.cals OPC server on (every!) Scada-PC
- logi.CAD SE managing the communication
- PLC-specific communication on the network

- OPC-UA-TCP on the wire

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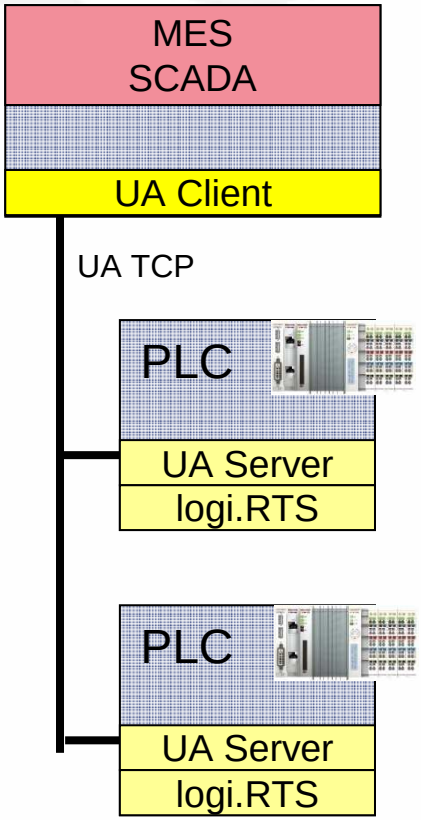
logi.cals OPC UA Server

Functionality



logi.CAD

- Access PLC variables
- Browse the type system
  (program types, function block types)

Device-Diagnostics now possible

- CPU temperature
- MAC-ID, free space on HDD
- Timezone
- …

Device-Setup now possible

- Timezone / Screenresolution
- IP-Adress
- ...

Working Group on IEC 61131-3

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PLCopen

for efficiency in automation

OPC FOUNDATION

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PLCopen TC4: Communication

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- OPC UA allows different information models to be defined (and implemented)
- PLCopen and OPC Foundation haved formed a joint working group
  - To define a single information model for IEC 61131-3
- Many PLCopen and OPC Foundation members are part of this working group
  - logi cals
  - ABB
  - Beckhoff
  - 3S
  - KW-Software
  - …

PLCopen TC4: Communication

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- IEC 61131-3 information model
  - All vendors of OPC UA servers for IEC 61131 should implement this
  - Set of rules on how to represent a PLC application in an OPC UA server
  - Types (Data Types, Function Block Types, Program Types)
  - Instances (Objects)
  - Resources and Configurations

- **No matter which PLC is used, the object model in the OPC UA server will always be the same for the same application!**

- SCADA software can use object- and component-oriented concepts (easier and faster engineering of the HMI pages)

First Presentation of Results

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- Visit the PLCopen/OPC Foundation booth at SPS/IPC/Drives 2009 in Nuremberg
- Multiple SCADA and HMI software products
  - logi.cals (logi.VIS)
  - Certec
  - Iconics
- will show access to different PLCs
  - logi.cals / MicroSys
  - Beckhoff
  - Phoenix
  - Siemens

Thank you for your attention!

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Thomas Baier
mailto:thomas.baier@logicals.com
http://www.logicals.com/

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