OPC Day Finland 2016

OPC UA Technical Update

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Agenda

- OPC UA Specification Status Update
- OPC UA Work Items
- OPC UA Sub Working Groups
- OPC UA PubSub Roadmap
OPC Unified Architecture

OPC UA is an information centric layered architecture

- Secure
- Platform Independent
- Scalable
- Vendor Interoperability
- Object Oriented

OPC UA is much more than a protocol

Built-in Information Models
Base, DA, AC, HA, Prog, DI

OPC UA Meta Model
Basic rules for exposing information with OPC UA
OPC Unified Architecture

OPC Foundation collaborations with organizations and domain experts
- OPC UA defines HOW
- Domain experts define WHAT

Companion Information Models
PLCopen, ADI, FDI, FDT, BACnet, MDIS, ISA95, AutomationML, MTConnect, AutoID, VDW, IEC 61850/61400, ODVA/Sercos and more coming

Built-in Information Models

OPC UA Meta Model
OPC Unified Architecture

OPC UA Client/Server Communication Model
- Client friendly API to access information in the server

Client/Server

Services
- Browse
- Read / Write
- Method Calls
- Subscriptions

Protocols
- UA Binary TCP
- HTTPS / UA Binary
- Webservices

Vendor Specific Extensions

Companion Information Models

Built-in Information Models

OPC UA Meta Model
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New Use Cases

- Clients and Servers behind firewalls (Relay)
- Controller to controller communication
- Integration with message brokers
- Cloud connectivity
- Large scale
OPC Unified Architecture

OPC UA Publish/Subscriber Communication Model
- Generic Pub-Sub Information Model
- Initial protocols selected, evaluation of other protocols ongoing
OPC UA Client Server Model

- OPC UA Client A
- OPC UA Client B
- OPC UA Client C

OPC UA Server

Client A Session
- Subscription

Client B Session
- Subscription

Client C Session
- Subscription

Address Space

Publish

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OPC UA Server and Publisher

OPC UA Server

OPC UA Application

Client A Session

Subscription

Address Space

Publisher

Message Oriented Middleware

Subscriber 1

Subscriber N

OPC UA Client A

Publish

DataSetWriter

DataSet
Publishing with different protocols

OPC UA specific selection of events or life data to be included in messages

Messaging protocol specific encoding and transport

Different protocols can be supported e.g. AMQP, MQTT
Pub-Sub with UDP Secure Multicast

OPC UA Subscriber

Message 276

Publisher

Connection

Group

DataSetWriter

UDP Multicast Group 224.0.5.1

Subscriber

Connection

Group

DataSetReader

OPC UA Subscriber

Message 276

OPC UA Subscriber

Message 276

OPC UA Subscriber

Message 276

OPC UA application

OPC UA application

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Pub-Sub with Broker

Supports connectivity between OPC UA applications that reside in different networks, or where data shall be published to Clients that reside “in the Cloud”, as well as network topologies where relays, brokers, or event hubs enable the data transmission. It can connect any number of Servers with any number of Clients.

AMQP 1.0 chosen as the technology to use (also used by MS Azure and others)
Initial prototype will use JSON for topic communication and UA Binary for Queues.
PubSub Security

- **Client/Server Security**
  - PKI and asymmetric algorithms to exchange session keys
  - Session keys are used for communication with symmetric algorithms
  - Session keys are frequently rotated

- **PubSub Security (end to end security)**
  - Session keys must be shared between Publishers and Subscribers
  - Keys are managed for a security group
  - Messages are sent in the context of a security group
  - Key distribution is done with OPC UA Client/Server security
  - Authentication and Authorization during access to security group at key server
Controller to Controller

- Existing OPC UA Server can be extended
- Configuration through OPC UA Clients

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- Configuration through OPC UA Clients

OPC UA Client

UA TCP / UA Binary

Configure

OPC UA Server

Product specific address space and data integration

Publisher

Send

UA UDP Multicast

Subscriber

Receive

OPC UA Server

Product specific address space and data integration
Controller to Controller real-time?

- UDP Multicast provides
  - Thin and efficient protocol stack for message handling
  - Allows cyclic data exchange
  - Base for device side real-time handling

- Standard Ethernet is not real-time capable

- TSN (Time Sensitive Network) can solve this
  - IEEE 802 working group – will be part of standard Ethernet
  - Time synchronization
  - Guaranteed bounded latency
  - Path redundancy for reliability
  - Low latency (cut-through and preemption)
  - Bandwidth (Gb+)
Other features in work

- Relay protocol binding for Client/Server
  - Encoding: UA Binary
  - Message Security: UA Secure Conversation
  - Transport: AMQP
- New user token type based on OAuth 2.0
- Standard user authorization configuration for OPC UA Server address space
- Simplified and optimized meta data access for structure data types
- Extension to file transfer functionality
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OPC UA Security Working Group

- Sub Group of OPC UA Working Group

- Started end of 2014 as permanent WG
  - Dedicated group of security experts
  - Review results of OPC UA security reviews by organizations like NIST or BSI
  - Review OPC UA security research papers
  - Propose security related enhancements to UA WG
  - Documented BSI results available: https://opcfoundation.org/security/
PubSub Prototyping

- Sub-Group of UA WG
- Kick-off on June 8, 2015
- Over 70 WG members
- Wireshark available
- First demo finished
**TSN Evaluation**

- Sub-Group of UA Working Group
- Kick-off on June 8, 2015
- Over 60 WG members
- TSN Evaluation
  - TSN is a standard real-time extension for Ethernet
  - Collection of use cases and requirements finished
  - Communication parameters and OPC UA requirements already defined and integrated in PubSub definition
  - Configuration model discussion started
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OPC UA PubSub Roadmap

- **UA WG**
  - Use Cases collected
  - First Draft
  - Stable Draft
  - Release Candidate
  - PubSub
  - Stable OPC UA TSN Draft

- **2014**
  - Prototyping: First sample applications available

- **2015**
  - Prototyping: Fist multivendor demo at Hannover Fair

- **2016**
  - Prototyping: Enhanced multivendor demo at SPS/IPC/Drives

- **2017**
  - Prototyping: Complete PubSub implementations

- **Main definition phase**

- **Prototyping**
  - PubSub Prototyping
OPC UA Pub-Sub

- OPC UA – communication platform for information models (HOW)
- Domain experts define information models (WHAT)
- OPC Foundation extends communication with Pub-Sub
- Information Models are not affected
- OPC UA Applications just update SDKs and Stacks