

OPC Day Finland 2016



OPC UA Technical Update

Matthias Damm

Executive Director ascolab GmbH

matthias.damm@ascolab.com

Associate and Consultant Unified Automation

OPC Foundation Board of Directors

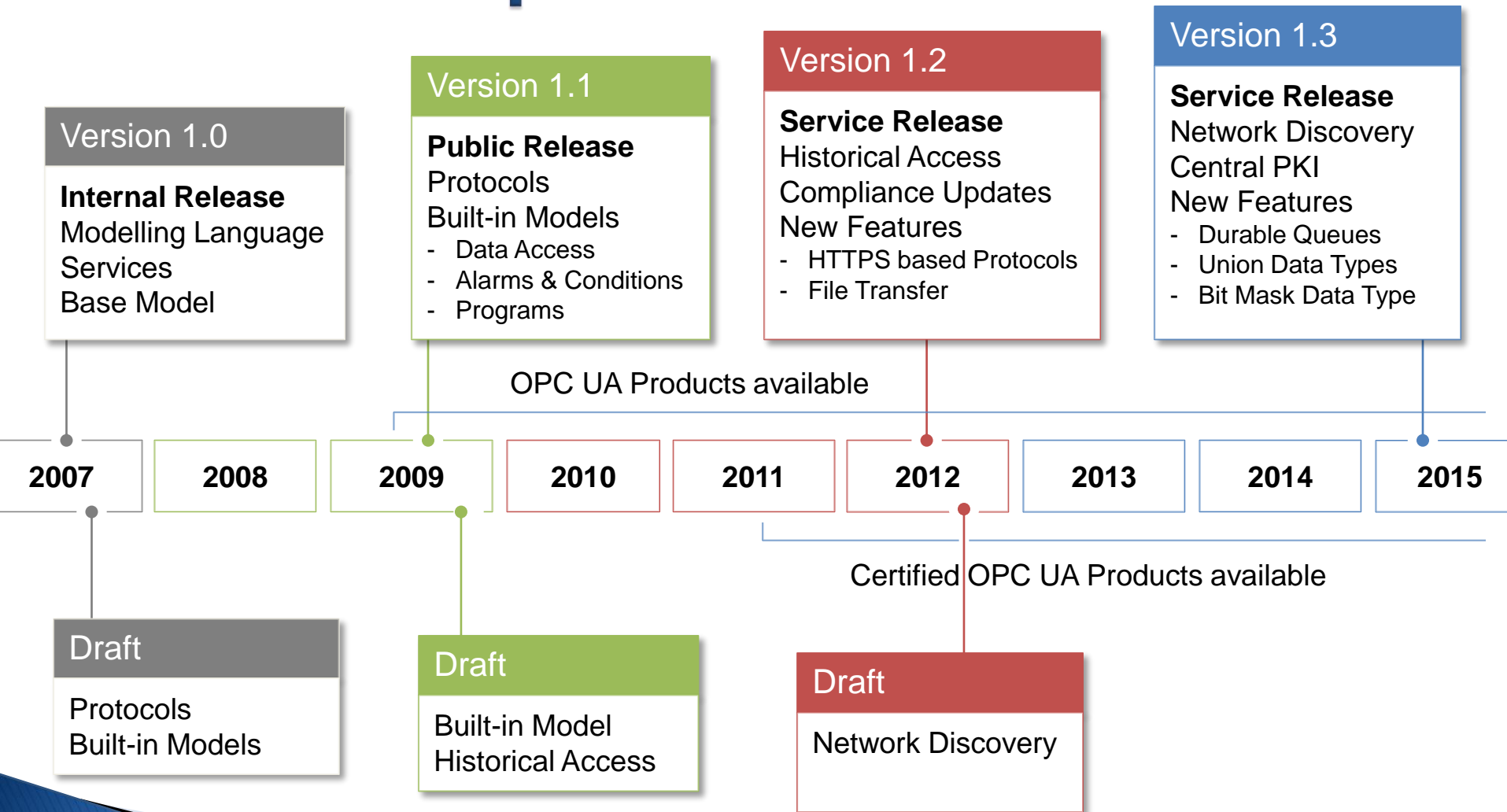
Editor OPC UA working group

Chairman DI, BACnet and PubSub working group

Agenda

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

OPC UA Specifications



IEC 62541

February 2010

Part 1 – Overview
Part 2 – Security Model

July 2012

Part 7 – Profiles
Part 9 – Alarms & Conditions
Part 10 – Programs

March 2015

Edition 2.0
Part 1 – 10
New – Edition 1.0
Part 11 – Historical Access
Part 13 – Aggregates

Edition 1.0/OPC UA 1.01

OPC UA 1.03

2010

2011

2012

2013

2014

2015

2016

October 2011

Part 3 – Address Space Model
Part 4 – Services
Part 5 – Information Model
Part 6 – Mappings
Part 8 – Data Access

OPC UA 1.02

Companion

Part 100 – Devices

February 2016

Part 12 – Discovery
New work item
approved by IEC

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

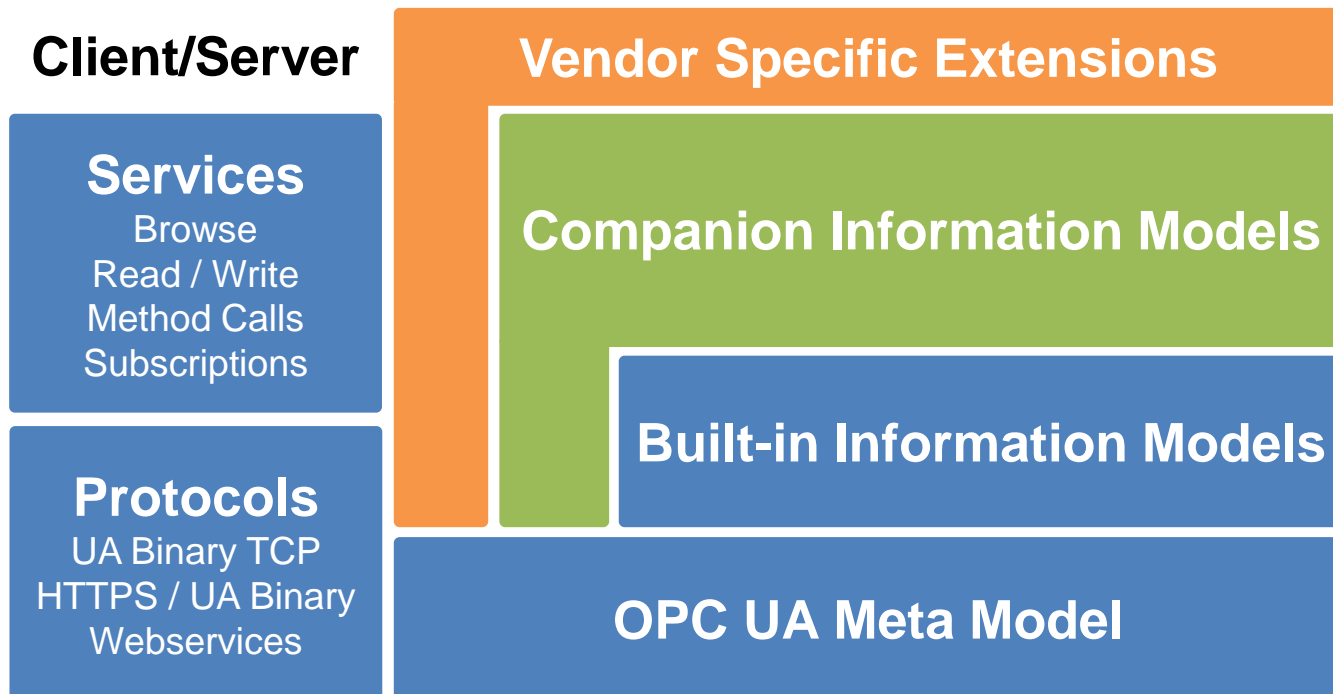
Built-in Information Models

OPC UA Meta Model

OPC Unified Architecture

OPC UA Client/Server Communication Model

- ▶ Client friendly API to access information in the server

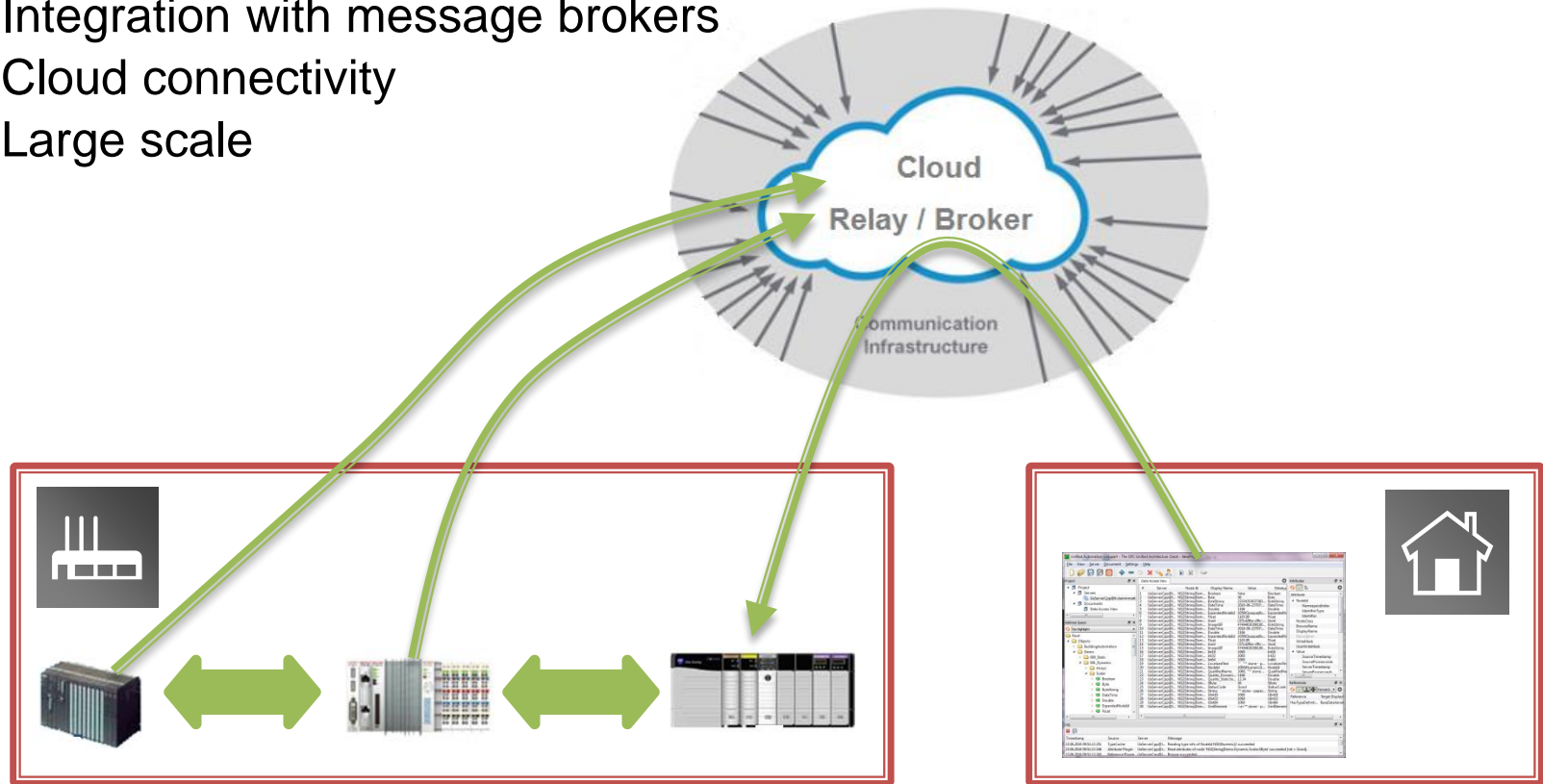


Agenda

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

New Use Cases

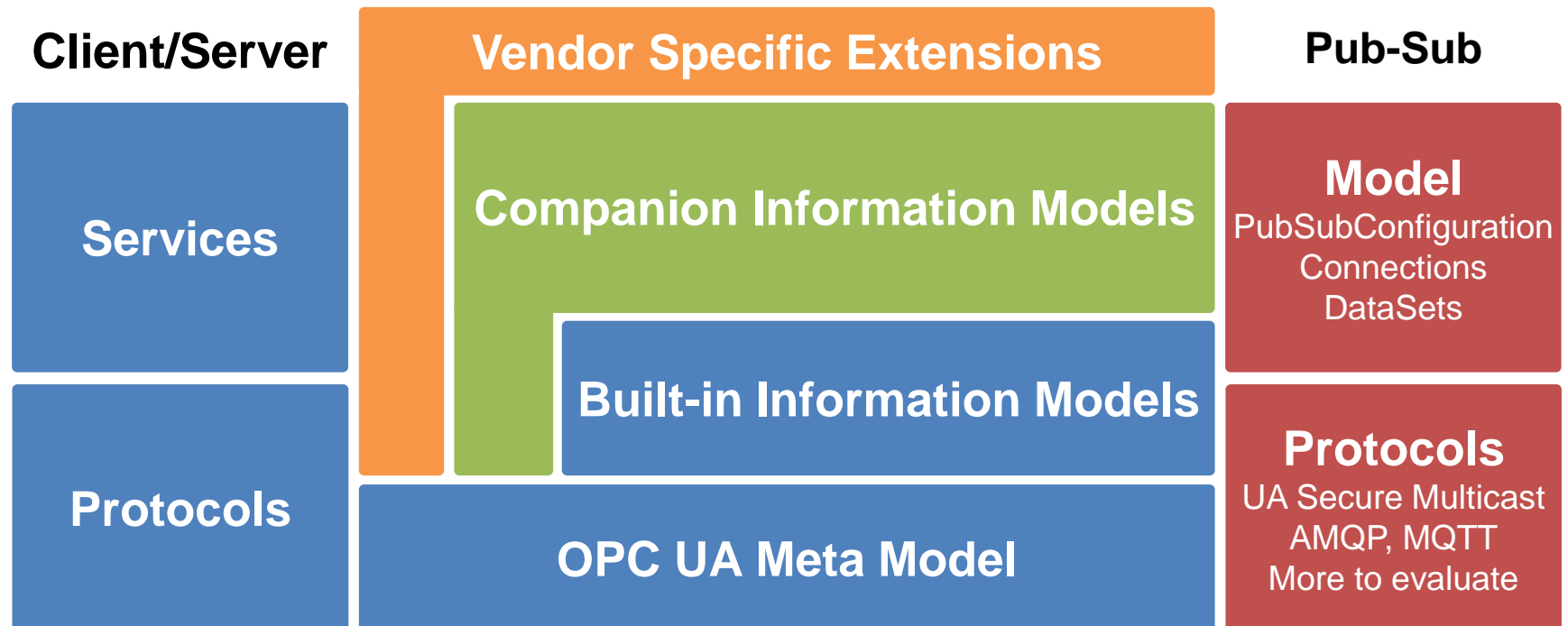
- ▶ Clients and Servers behind firewalls (Relay)
- ▶ Controller to controller communication
- ▶ Integration with message brokers
- ▶ Cloud connectivity
- ▶ Large scale



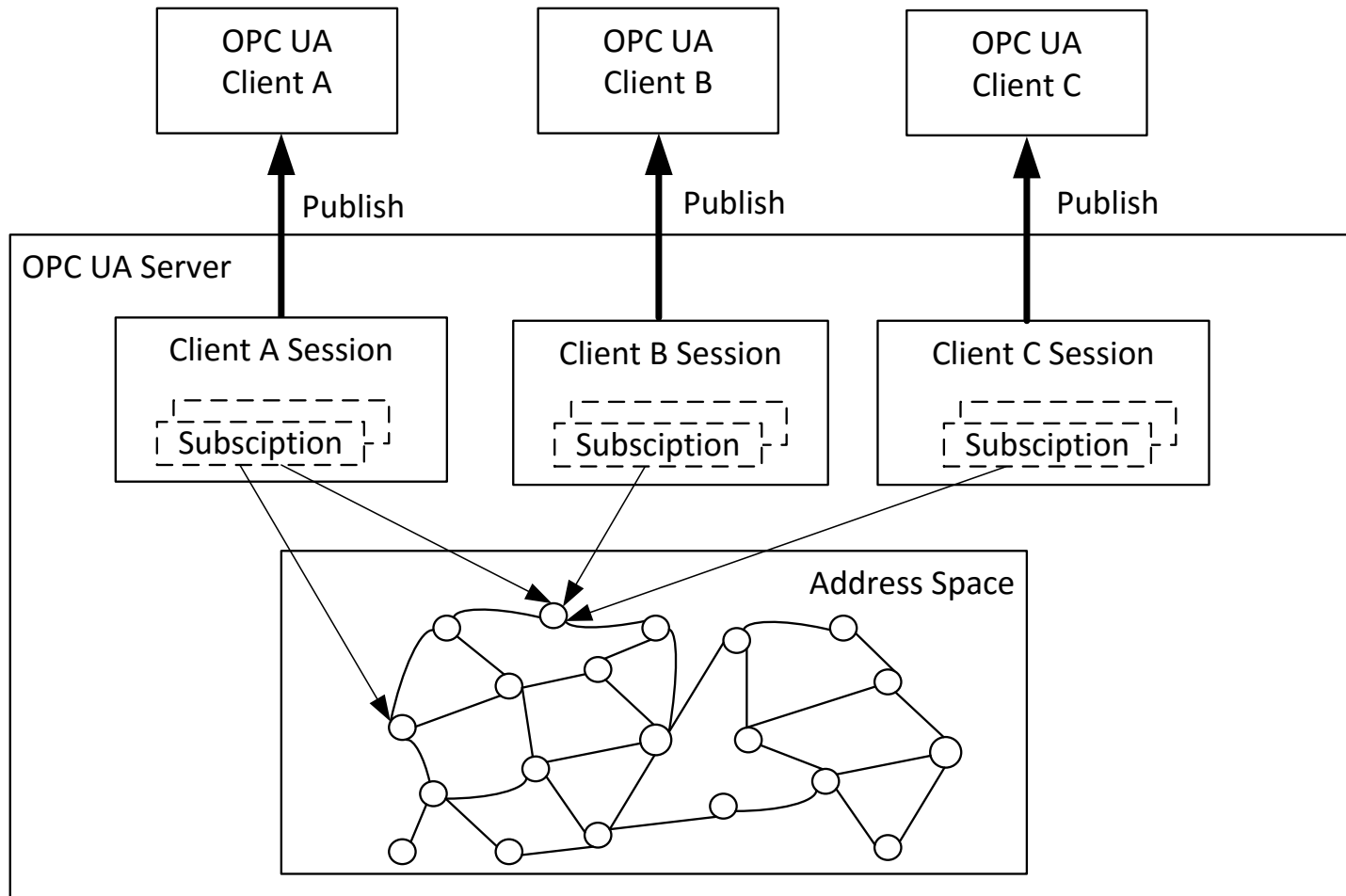
OPC Unified Architecture

OPC UA Publish/Subscriber Communication Model

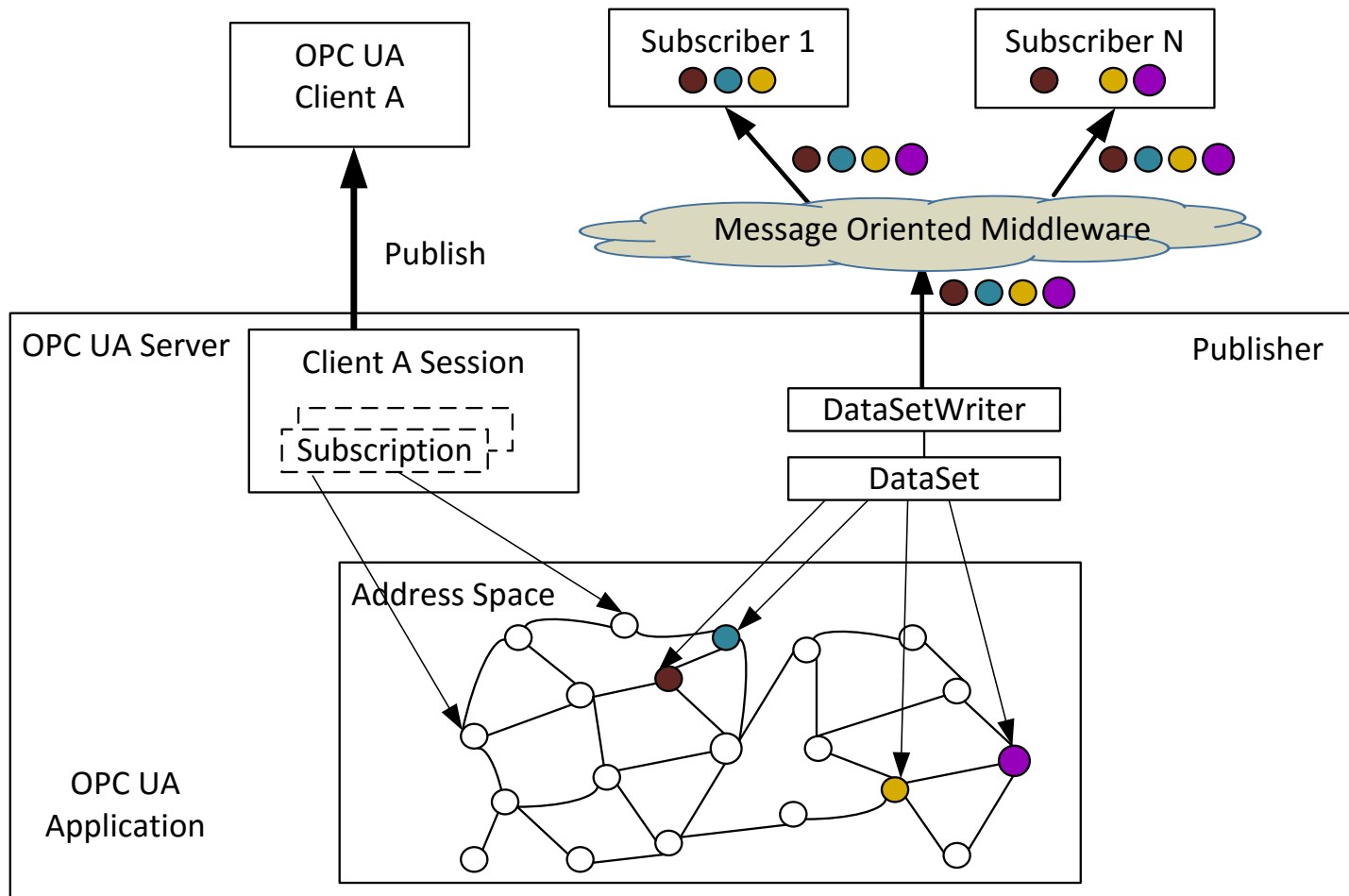
- ▶ Generic Pub-Sub Information Model
- ▶ Initial protocols selected, evaluation of other protocols ongoing



OPC UA Client Server Model



OPC UA Server and Publisher

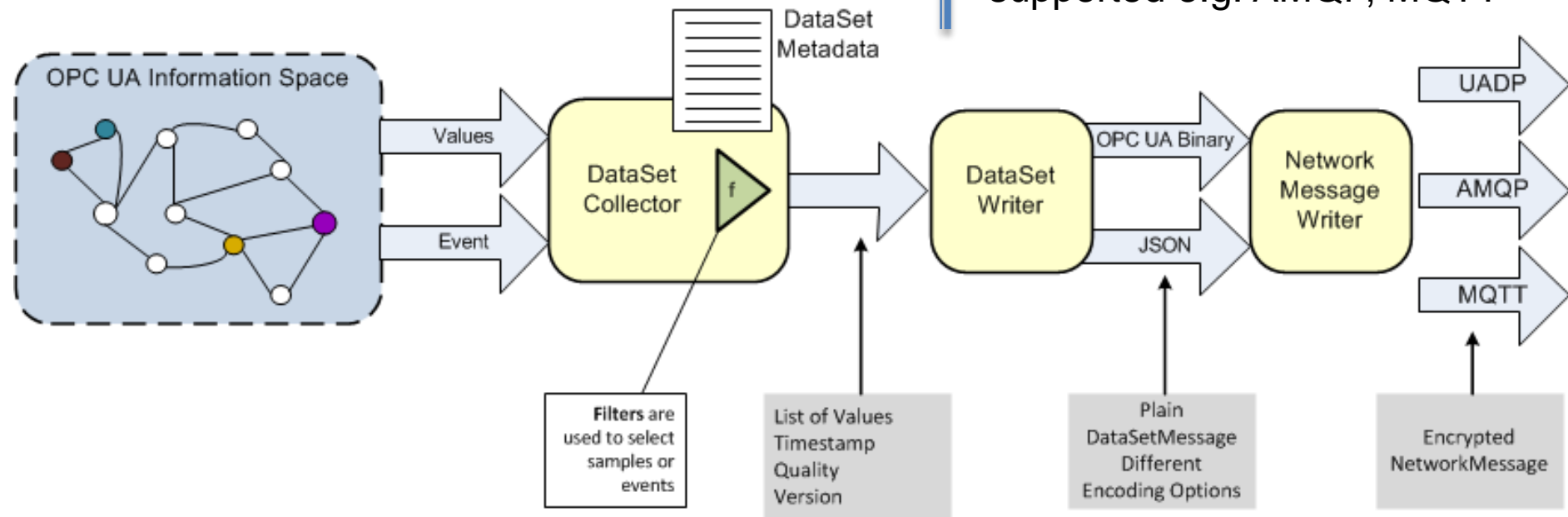


Publishing with different protocols

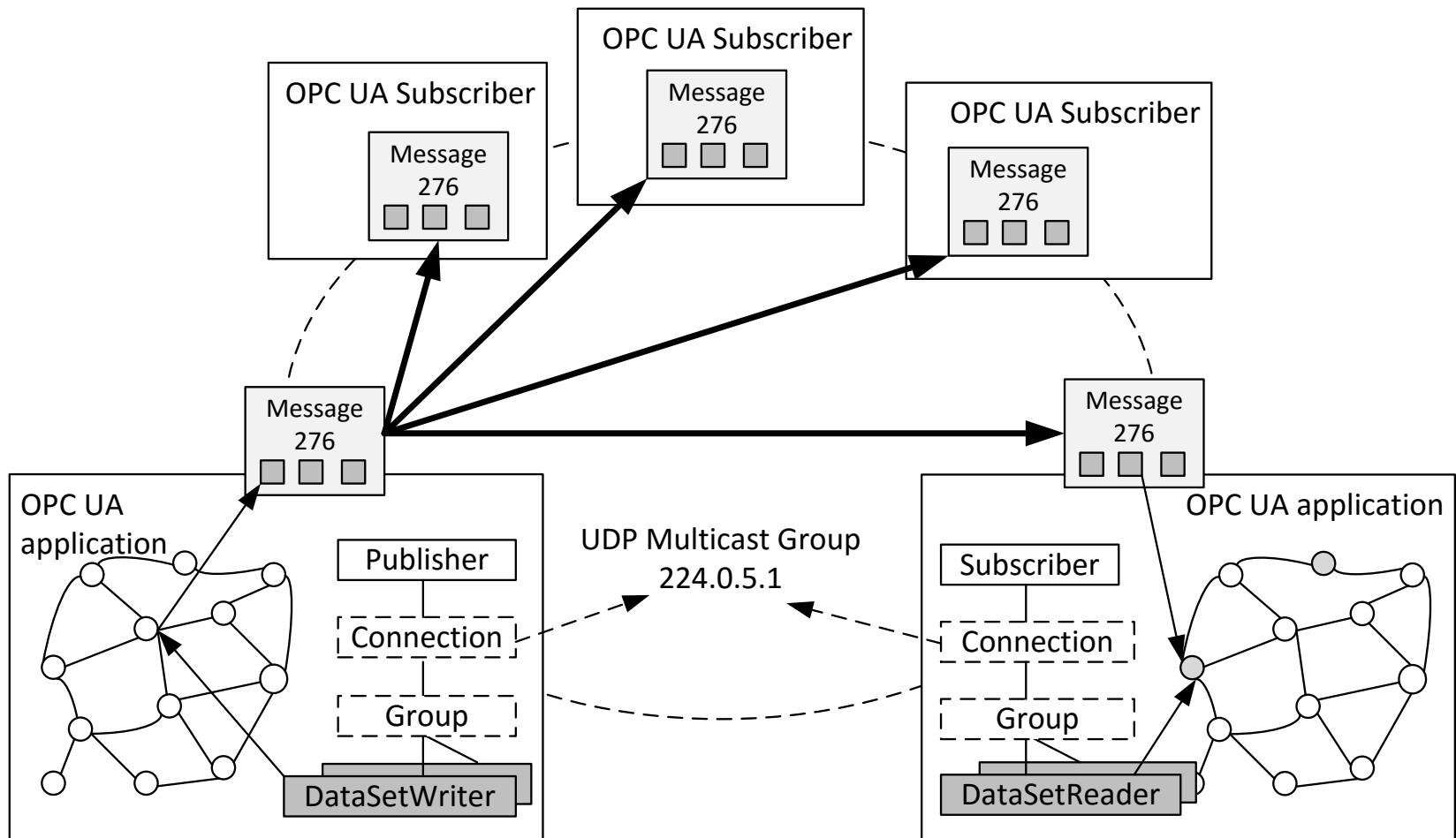
OPC UA specific selection of events or life data to be included in messages

Messaging protocol specific encoding and transport

Different protocols can be supported e.g. AMQP, MQTT

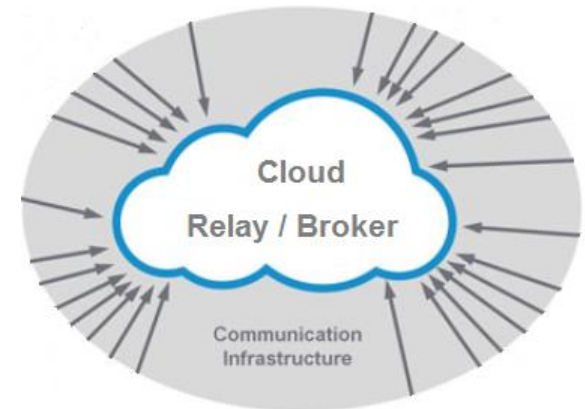


Pub-Sub with UDP Secure Multicast



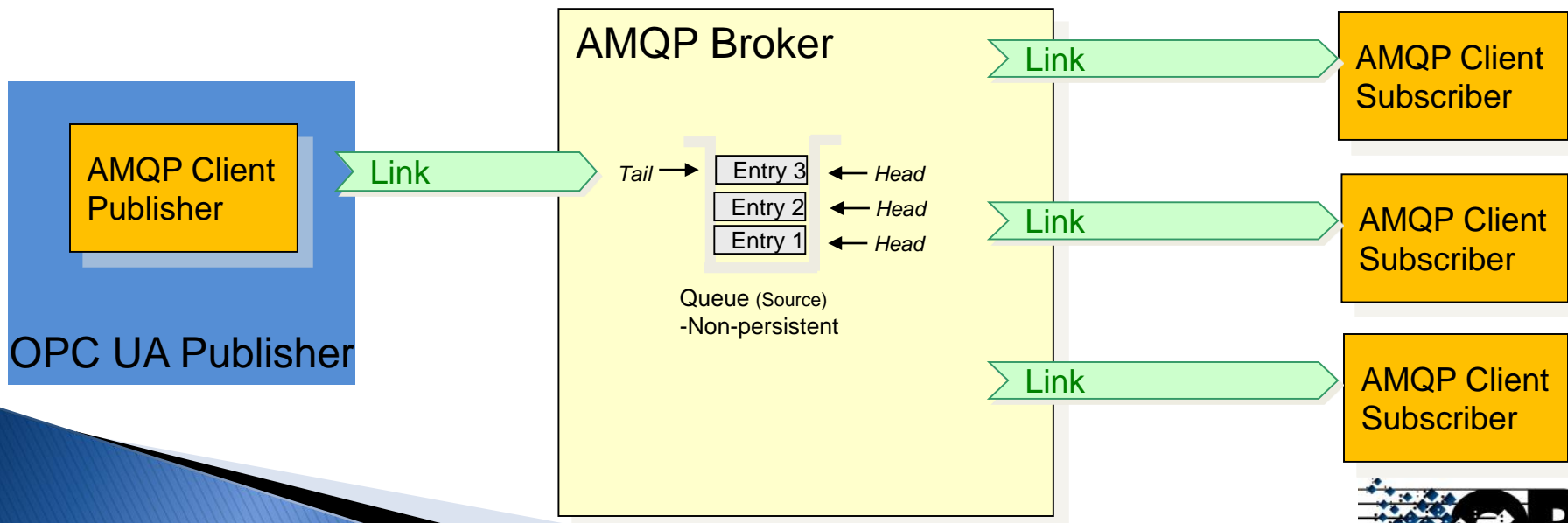
Pub-Sub with Broker

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.

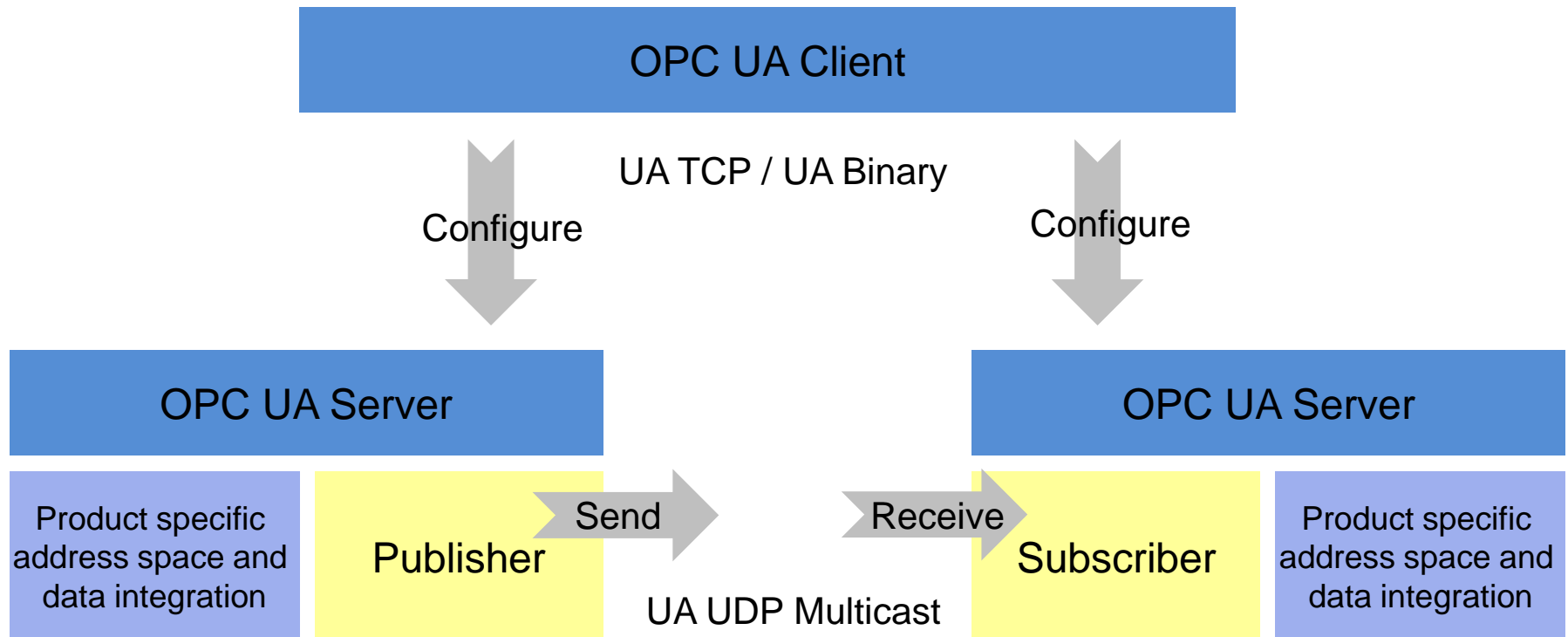


PubSub Security

- ▶ 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



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

Agenda

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

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



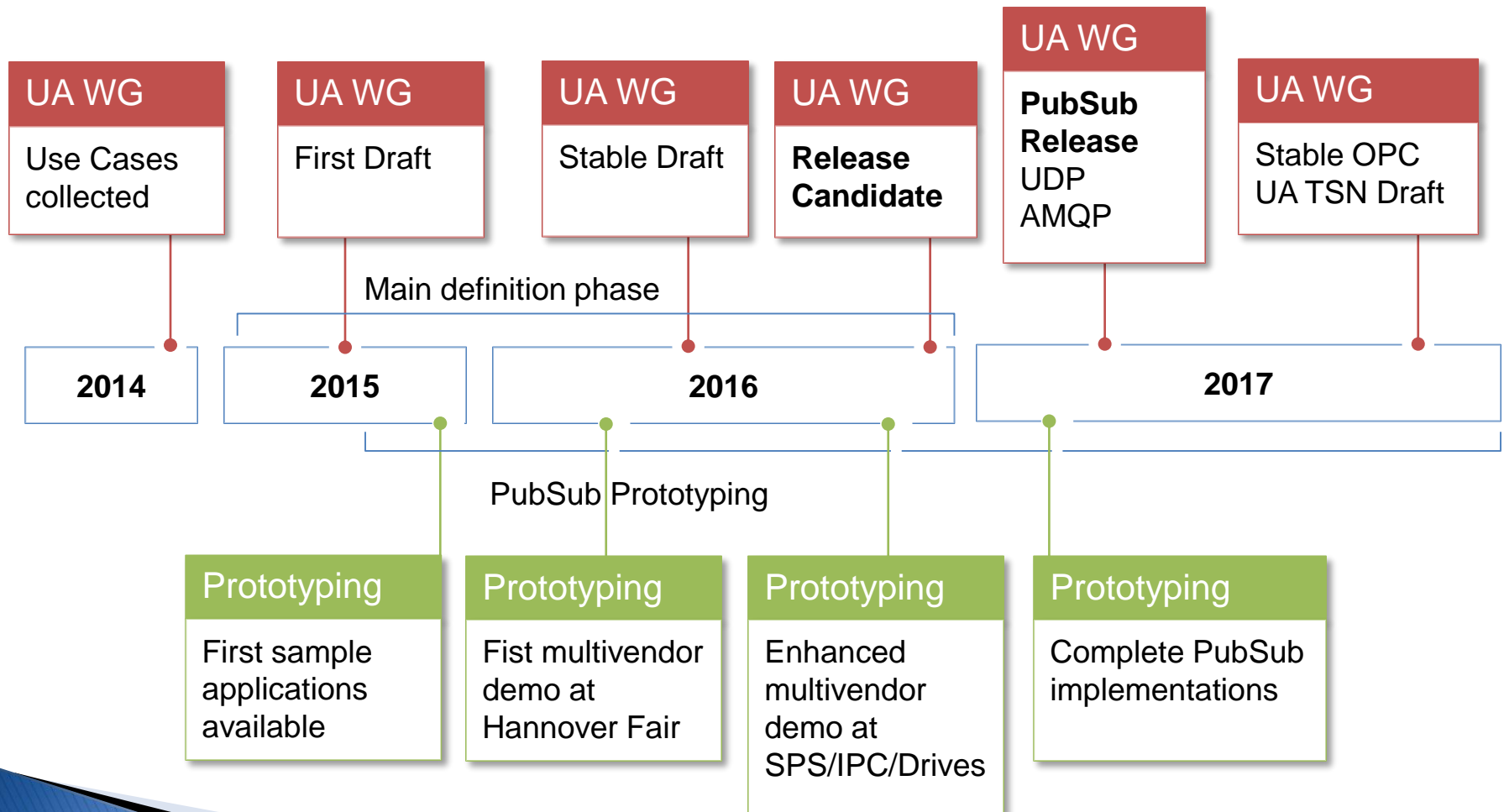
TSN Evaluation

- ▶ 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

Agenda

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

OPC UA PubSub Roadmap



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