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See Q&A on next pages

Best regards

Stefan Hoppe, OPC Foundation

Technology Introduction

Answerer	Question Asked	Answer Given
Technology - Introduction		
Uwe Steinkrauss	What is the OPC UA concept to publish information from a machine in a reliable way, so that information not get lost - even if the receiver (OPC Client) was stopped for several minutes?	Live answered: Heart beat and unique message id's allow the server to recognize an IT disconnection - the UA server can buffer date, including timestamp, and provide this to the client later on, once the IT connection is re-established. The client can configure the buffer depth and sampling rate for each variable. The buffer time (a few seconds or multiple minutes for e.g. distributed water treatment solutions) depends on the buffer of the UA server.
Uwe Steinkrauss	What are the plans for Alarms and Events in the OPC-UA Standard? I have not found any client other the uaexpert that supports OPC-UA's Alarm and Events standard. It is extremely difficult to bring in Alarms and Events from an OPC-UA Server into a OPC-UA client such as Wonderware or Ignition Designer by Inductive Automation	The Alarm and Events specification has been released for a long time, but, of course, it is enhanced and updated with new features as required. From the standards point of view, this is ready to be integrated into products. So, this very much depends on the needs of the end users asking for specific features to ensure a smooth integration into existing products. So, please ask your supplier when those features are being integrated and about upcoming features.
Uwe Steinkrauss	Is there a UML profile available with all the metatypes defined of OPC-UA Informationmodel? I do not want to use UML instead using UML profile mechanism to enhance a UML tool with additional OPC-UA types and new semantics like using a DSL for OPC-UA.	Eric Oursel has designed such a profile for Enterprise Architect. For more information please contact him directly at eric.oursel@capgemini.com
Uwe Steinkrauss	By having an UML profile of all the OPC-UA types in a UML tool like EA or Rhapsody, it can be used to generate Code e.g. C# Code out of the designed model. Of course one can use UAModeler but intention is to have the complete system models in one database and one design tool.	Yes, in theory, UML could be used, however, OPC UA has more capabilities than you can model with UML, hence, you may not be able to use all modeling capabilities of OPC UA if you limit yourself to UML only. The OPC Foundation does provided a machine readable definition of the information model in the so called NodeSet file, which is an XML file. This file is available for all companion specifications and a number of tools can consume this and generate code from them.
Uwe Steinkrauss	Time is essential for time stamps. Does the OPC UA specification require the use of time synchronization mechanisms?	This depends on the used scope of OPC UA. In an UA Client and Server, communication time is an important aspect, but not required to be in a very accurate sync. In any case, some synchronization mechanism is important to correlate information and, therefore, external time synchronization mechanisms are important. In the upcoming extensions for the field level devices, accurate timing is then important and required.
Uwe Steinkrauss	Why was there no mention of information modelling tools? It is really hard to find standardized information modelling tools that can produce models that are compatible with different SDKs	Most SDKs do provide their own modelling tools, which work well in combination with the SDK. But, of course, there are also modelling tools available which are not focused on a specific SDK, like SiOME from Siemens, to name one example. If you'd like to find more tools, please check the product catalog on the OPC Foundation website, where corporate members of the OPC Foundation can enter their products and tools for free.
Uwe Steinkrauss	OPC UA evolving was mentioned. Is backward compatibility maintained so that interoperability of different products is maintained?	When extending the technology, we are always doing our best to stay backward compatible.
Uwe Steinkrauss	What communication configuration would be preferably for Plug and Play: Client/Server or Pub/Sub in a Use Case Process Automation DCS to a Equipment Unit with controller?	On behalf of Plug & Play, there is not a big difference between Client/Server and Pub/Sub.
Uwe Steinkrauss	OPC-UA can do pub/sub and also only transfer data only on change to reduce network traffic?	There are different "profiles", typically used is the "cyclic fixed length". But there is initial and delta frame sending as well (which is the "on change" equivalent). As many implementers are looking at the "deterministic" TSN transport, the cyclic fixed is the most used, but other profiles will emerge in the market soon.
Uwe Steinkrauss	What are migration paths for OPC UA from OPC Classic which is currently used for SCADA ?	A lot of SCADA systems are already natively supporting OPC UA. If OPC UA is being supported on both sides, the best approach would be to reconfigure the system to use OPC UA, instead of OPC Classic. When OPC UA is not supported on both sides, a wrapper from OPC Classic to OPC UA would allow connecting both systems. While this does provide interoperability with legacy systems, only direct OPC UA connections provide the full feature of OPC UA.

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Uwe Steinkrauss	What is the difference between OPC information model and other industry specific information models such as the Common Information Model (CIM) of electric utilities?	The basic difference is probably the more "generic" approach of OPC UA. OPC UA defines basic rules (and some basic types) which can be used to describe even more than just electric utilities. The set of types, in OPC UA information model, can be extended by individual domains, but without changing the generic model, you can extend the model without loosing the generic access.
Uwe Steinkrauss	Is it possible to have an Server and an Client running on the same Device at the same time to send Data and receive it or how it can be realized?	The interfaces used depend on the use-cases of the product. Of course, you can run a Server and a Client on the same device in parallel. For example, a lot of PLC vendors did integrate the PLCopen Client FunctionBlocks in addition to an UA Server. This enables the PLCs to do horizontal communication using OPC UA.
Uwe Steinkrauss	Regarding PubSub model, is there providing service not only MQTT but also AMQP?	Yes, AMQP is also an option but, currently, we see more implementations with MQTT.
Uwe Steinkrauss	When you say >1000 connection will take low resources in pubsub model, does this means 1000 OPC UA servers connected to a client ?	In Client/Server communication, each connection (session) requires resource (memory, CPU). By this, the number of connections is limited by the memory of the device. So, if memory and implementation allows, you could run 500 or 1000 connections in parallel. In contrast, thereto in the PubSub communication, the Publisher can send one message to the network (broadcast/multicast), and the number of receivers (Subscribers) is not limited. Especially, it is limited by the memory/CPU of the Publisher, who is just sending once. This scales better on large numbers of receivers. When Publisher sends the message to a broker/middleware, it would even be decoupled completely from the numbers of receivers, even across network borders.
Uwe Steinkrauss	We are facing issues while subscribing to data change with say 5000 dynamic variables with frequency of 1 seconds, with say server keep alive 4 seconds & client keep alive 5 seconds. I want to know what is the relationship of these values with Sampling Interval defined for a variable ? Is there any relationship &/or some formulas defined to get their values ?	OPC UA has "sampling interval" (server samples the source) and the "publish interval" (server sends data to Client). With that, you can "sample" the data much faster than sending it. To not loose data, you can define data queue (holding multiple samples) and publish the complete queue. The keep-alive would only be triggered when no data has changed over a certain time. If data has changed, there is no need for keep-alive, By this, keep-alive does not use extra bandwidth. In your case, if dynamic data changes within one second, either you have set the publish rate of the subscription to 1000ms or your sampling rate is 1000ms (not getting the data faster from the source).
Uwe Steinkrauss	Is there in the session a possibility to ask something on unique features that you will not want to standardize so that they become available for everyone, and how to communicate these via OPC-UA?	There is authorization down to the single tag level defined in OPC UA. You can expose "private" information to a certain user group (or role). This private information not only means read-access, write-access, but also includes "visible" and "executable". By this, you could, for example, "hide" information behind some "advanced" method that can only be called with certain user rights.
Uwe Steinkrauss	What are the throughput limits of OPC-UA? How many messages or megabyte can you process per second? I guess this depends on the hardware and network? But is it more about kilobytes, megabytes, gigabytes per second?	The throughput depends on the hardware and the network speed. With OPC UA we can reach the megabyte and the gigabyte speed range, if network allows this speed. Of course there is an impact on speed depending on how the data is composed and packed into a message. So there will be a difference sending 10.000 single tags in one request, compared to sending 1 tag, which is an array of 10.000 elements; and, the worst you could do, sending 10.000 messages of one single tag each (which should be avoided). The binary encoding OPC UA has defined is the most compact format you can use and allows highest speed and throughput; it gives you the best compromise when sending data+meta data.
Uwe Steinkrauss	Is / should OPC-UA be used for all data from machines? Or is it just one of several interfaces? For example, should all low level log information also be transferred via OPC-UA, or do you continue to use a "lower-level protocol" for this?	From the capabilities of OPC UA, we envision that OPC UA could (and should) be the only communication path into the machine or device. This would eapecially simplify the security configuration, because there will be only one communication channel. However, each application must consider which data is to be exposed, and to whom. From a technical viewpoint, OPC UA can transport the "low-level" data, but also the high-level. OPC UA could even do "file-transfer" or "firmware-update" and engineering data.

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Uwe Steinkrauss	What is the max sampling rates that can be achieved from OPC UA communication - as a best case?	The sampling rate depends on the way the server obtains the data from its source, and from the accuracy of its timer implementation that is triggering the access. The fastest sampling we can imagine is "0". That said the fastest sampling is directly firing the data from the source. However this requires that the data source has such capability. OPC UA technology has no limitation regarding the sampling rate (certain implementations may have).
Uwe Steinkrauss	We faced lot of issue regarding the response time considering total no. tags to be exchanged between two different control system. For example some DCS supplier say they can transfer only 4000 tags with 1 second response time. I hope this limitation is addressed in OPC UA.	The poor response time (4000/s) may have different reasons, but, for sure, this is not caused by OPC UA technology. Some DCS systems must (because of their internal architecture) operate on individual tags only, instead of packing/composing more tags into one request. Some other DSC constantly add/remove tags in the background (e.g. when switching pictures), and, by this, create a massive load on the UA Servers providing the data. The better approach is to add "all" the tags and ignore the data of those currently not needed for displaying. But again this "problem" is not related to OPC UA in particular, it would have happened with other communications as well. I have measured, for myself, 100.000 tags (UInt32) within 300ms, hence, the OPC UA can do it for sure.
Uwe Steinkrauss	Thanks for your answer. Can we use OPC UA for critical control application also? Because due to reliability issue generally OPC is used for only supervisory control and not for critical control like Hardwired control.	Yes, you can use OPC UA in critical control as well. Please consider the redundancy concepts of OPC UA: "transparent redundancy" and the "non-transparent redundancy" which will give you additional confidence when the connection breaks down and failover to a redundant set of alternative servers.
Uwe Steinkrauss	Are there any plans for a shared memory protocol mapping for PubSub? For communication between processes running on the same machine	OPC UA typically looks into "outside" communication over network; however, the PubSub allows for shared memory mapping, even though this was not the original intention.
Uwe Steinkrauss	What type of OT application should use pub/sub model over client-server? And is a broker needed for all pub-sub communication?	PubSub allows for broker and for broker-less communications. For OT applications, there is no this-or that answer. The expectation is that most OT applications (e.g. PLCs) will have both communication patterns implemented. Maybe as a simple rule: Whenever you expect "no loss of data" you would preferably use TCP/IP based Client/Server (sequence numbers, repeating data, data queues). However, if your application is only interested into the "last value" no matter what previous and all receivers are interested in same information, then you will probably take a close look at PubSub. But, again, most devices will do both; the use case decides (could do both in parallel).
Uwe Steinkrauss	Is it possible to have OPC UA brokers, like messaging queue brokers? Or will direct client/server connection always be required for security purposes?	Yes, the concept of brokers is part of the overall design. But with "end-to-end" security, you typically do not want the "man in the middle" to look into your data. We have "security key server" which can either be the sender/publisher itself, OR some extra key server where subscribers will get the key for decrypting the messages.
Uwe Steinkrauss	How much memory does OPC-UA server typically need?	This is hard to tell; it depends on the number of tags the server exposes. I have seen UA Server with 200 to 300 Kbyte. However, dynamic memory is required for every Clients that is connected in parallel, and how many tags these clients are monitoring. Here you must consider the profile you want to support, nano, micro, or embedded server -- or even the standard ua server profile (50 connections in parallel). The typical memory range is probably 5-20 Mbyte for a Server having 5.000 to 10.000 tags and be able to operate 5-10 connections in parallel.
Uwe Steinkrauss	Can I use OPC-UA (Security) in phone Apps? do I have to create an OPC-UA User/Server?	Yes, you could, as long as your phone app is OPC UA Client (typically would not be server). As long as the phone app is using any TCP/IP transport, all the security is included at the message level, therefore, we can use even non-secure transport, because we encrypt the message content.

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Uwe Steinkrauss	Hello. Great introduction. Security and Interoperability are key, can you provide some insights into overall performance? Regards.	Tough question when being asked so broad. OPC UA is extremely fast, when used correctly. Of course, there is an "overhead" with all the additional information you get compared to a "raw" data transmission. The UA Binary encoding is the most compact format you could use (even more compact that JSON). All OPC UA read/write and method calls are "multiple tag" operations, you could easily read 100.000 tags within 300ms, in one read operation. However, if you read individual nodes individually, it will get rather slow. For that reason we have the "monitoring" (instead of read) mechanism. The server monitors several thousand tags, but only notifies if data has changed (very low bandwidth required).
Uwe Steinkrauss	OPC-UA does pub/sub & also only transfer data on change to reduce network traffic	There are different "profiles", typically used is the "cyclic fixed length". But there is initial and delta frame sending as well (which is the "on change" equivalent). As many implementers are looking at the "deterministic" TSN transport, the cyclic fixed is the most used, but other profiles will emerge in the market soon.
Uwe Steinkrauss	Why is OPC-UA so much better than MQTT? Does OPC-UA do "single source of truth" where the configuration is done once in the field device?	OPC UA can do JSON encoded messages and send them via MQTT directly (with or without broker). Not saying "better", but there is a UA Binary encoding over MQTT which is even more compact (and faster) than the JSON. I would say OPC UA can cover more use cases than just the MQTT can do alone.
Uwe Steinkrauss	Can OPC UA communications be filtered to be read-only at the protocol level?	Not sure if I get the question correctly. OPC UA has roll-based access rights down to the individual node, not only read and write access, but also visible and executable. With that, you could "read only" all the nodes in your server. On the wire, you typically can not read anything useful, because it will be encrypted.
Uwe Steinkrauss	Is OPC UA a DSL or a programming tool?	OPC UA is a communication platform, combining data modeling and data transport capabilities.
Uwe Steinkrauss	Is there any communication case in industrial automation in which OPC UA is not recommended to use?	No!!! But, to be fair, if you have a single supplier only, and such supplier offers similar (security) features, there might be other (even proprietary) solutions that can handle similar task and have comparable features. However, if you have multiple different suppliers of equipment, OPC UA is the vendor neutral approach you should go for.
Uwe Steinkrauss	Do you have examples of OPC-UA installation showing large amount of I/O published and large number of client?	The current test scenarios I have seen so far are more on a demonstration level. However, technically, we have not seen any limitations in the number of receivers, because technology is similar to UDP multicast. The max tags we can put in a publish message is not limited because of chunking mechanism build in. However, current implementations mostly use the single UDP frame size only. But this is not a limitation of the technology, just a limitation/simplification of the specific implementation.
Uwe Steinkrauss	What's the difference between publisher/subscriber and server/client? are they equivalent terms?	No, they are different access types for accessing the "Information Model" (the data) of a server. The Client/Server is request-response (like private telephone call) and the PubSub is more broadcast-style (like webinar, one talking all others listening). BUT, good OPC applications are capable of doing both. The use case (the user) can decide which to use.
Uwe Steinkrauss	Term information model is used in both as a spec as well as a runtime model. Is there a specific term to distinguish between type model and instance model in OPC UA. ⬚	Yes, they have different entry point in the exposure of an OPC Server. You will find the instances under the "Objects" entry folder and you will find the type system under the "Types" entry node. The "Information Model" is the term mainly used for the Type System, and the term "Address Space" is mainly used for the concrete instances a server is exposing. However you can not completely separate the two.
Uwe Steinkrauss	What is minimum time resolution with which PLC can communicate to sensors on OPC UA?	That depends on the implementation. But I would consider OPC UA communication as being in the low nano second range, then, doing controller to device/IO using the PubSub cyclic fixed length over a deterministic network infrastructure (like the TSN).

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Uwe Steinkrauss	I would like to understand the added benefits of OPC UA which make it stand out as compared to conventional methods (for ex: A simple Ethernet Gateway vs A Ethernet GAteway with OPC Stack). Where can I get this info?	The gateways typically introduce three additional "problems". One is the additional latency, because of converting into different protocols. Second, is the consistency with the data source in case the source changes (add two tags) you must update the gateway configuration and keep in sync. Third, is the security aspect, which, on the "last meter" to the device, may lack for encryption and signing and authorization. For those reasons, we always suggest having OPC UA as close to the source of the data as possible

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Alexander Allmendinger	Are there any tools for transitioning from OPC DA to OPC UA?	For those so called Brownfield scenarios, where a OPC Classic (DA 2.05a, DA 3.0) product needs to be connected with an OPC UA enabled product, 3 product categories exist: Gateways, Tunnellers, and Wrappers. Please check the OPC Foundation product catalog for a list of appropriate products.
Alexander Allmendinger	Is there any support for python based OPC SDK?	There are python SDKs available e.g. from one of our members, OPC Labs. Please do get in contact with them directly to get more information about the python SDK.
Alexander Allmendinger	I notice that the value in the OpcServerLimit does not change from controller to controller. Has the feature been implemented?	In the object ServerCapabilities, OPCUA provides servers the opportunity to make clients aware of their limitations, like MaxNodesPerRead. The actual limit of course depends on the server hardware and implementation. Exposing those limits is an optional feature, so it is not required for servers to be supported, but most servers do. During certification, we do ensure that the exposed values are matching the truth, for non-certified products those limits might still be set to the SDKs default values and may not match the actual server implementation.
Alexander Allmendinger	Is OPC UA free test application with video available so as to get the feel of this technology with different features and actual configuration ?	The OPC Foundation provides an Open Source project which includes a free sample application to get used to the technology. Also, most SDK vendors are providing free-of-charge demo applications to get a feeling for the technology.
Alexander Allmendinger	Hello. Is there already a test server with JSON encoding? Thank you!	Since vendors are not required to report their products to the OPC Foundation, we are not aware of all the available demo applications. We do recommend to get in contact with the different SDK providers to ask if they do have a demo application already available.
Alexander Allmendinger	Where can I find, source code for , OPC UA compliance test tool ?	As the UACTT is being used to ensure compliance with the specifications, the OPC Foundation needs to ensure the UACTT always matches the specifications. Because of that, the UACTT is maintained directly from the OPC Foundation Compliance Working Group, which consists of several members working actively in the UA Working Group defining the standard. As a result of that, up-to-date compliance requirement the UACTT is not available as Open Source. If you have more questions about the UACTT, please address them to: *compliance@opcfoundation.org* .
Alexander Allmendinger	How to get all the Process Data from the Siemens CPU using Local Network LAN Cable ?	Siemens provides built in OPC UA servers in several of their PLCs like the S7-1500 for example. In those PLCs the OPC UA server is on-board of the main CPU and only needs to be configured using the appropriate programming tool. For other Siemens products there are additional plugin cards available. For further product specific information please contact Siemens representative directly.
Alexander Allmendinger	With OPC-DA the server did not create an item until the client asks for it. Is this possible with OPC-UA? If the OPC-UA server is aggregating a SCADA system, it would not make sense to model the entire system in the address space, but only add nodes when a client requests a data item.	In OPC UA, like in OPC DA, it depends on the application itself. The technology allows the creation of highly optimized concepts and dynamic address spaces. OPC UA also defines Services, which allow a client to modify the servers address space. So yes, the same concept can be implemented with OPC UA, but whether this feature is integrated or not, is up to the product itself.
Alexander Allmendinger	Yesterday it was mentioned that there is a way for an OPC UA server to indicate to client the default/suggested set of monitored items. Could you please give spec reference?	If you want to provide a subset of the address space of the server to a client, you can use the concept of Views, which is generically described in Part 1, 6.3.4.3 AddressSpace Views. The actual definition of this feature is specified in Part 3, 5.4 View NodeClass.
Alexander Allmendinger	Hi how are you sir,, I am new for OPC application,, can please send all the basics and webinar videos to understand,, I was working with Siemens plc and wincc scada	We are happy to hear that you are interested in the OPC UA technology. The **OPC Day,** you are currently attending, is designed to provide a good overview of the technology, its current state, and new developments. When you'd like to get further information, please check out our OPC Foundation Website, especially the Resource section where you'll find YouTube recordings (search for "TheOPCFoundation"), with technical introductions to the technology. Then, when you want to dive even deeper into the technology, you can attend development training sessions, which are offered by our members, especially the well known SDK vendors.
Erich Barnstedt	Will there be a .NET Standard implementation for OPC UA PubSub available? As nuget package?	Yes. We have a prototype but it has not been released/merged to master yet.
Jim Luth	Does the splitting of the Real Time data (critical data) and Non Real Time data (non-critical data) have to be done in the configuration of the software project or can be decided and changed at runtime (by an operator, via HMI)? Example of a temperature sensor: in configuration I decide that the current temperature is critical and I need of it asap. Other info like the sensor manufacturer, the min value, the max value, the average of the temperature are not critical. Then during runtime I need to also have the average of the temperature asap. Can I change the initial configuration at runtime?	Depending on many details, it may be fixed at configuration or it may be adjustable at runtime.
Jim Luth	Who determines what is a critical data and not, the publisher or the subscriber?	It is usually the configuration tool that configures both the publisher and the subscriber that would determine which data is critical.

Answerer	Question Asked	Answer Given
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Jim Luth	In Pub/Sub network, which kind of hardware can be a broker? A dedicated gateway for example?	The broker in UA Pub/Sub can be a software entity or a dedicated piece of hardware. Sometimes the broker function is accomplished with standard hardware. For example using UDP and ethernet, the UA Pub/Sub broker is simply the ethernet switch.
Jim Luth	when is planned the release of v1.05?	Version 1.05 releases will begin later this year (2020). All 1.05 Parts will not be released at the same time and new Parts can be added to v1.05 any time in the future.
Jim Luth	Where can I find more information about "Device Provisioning"	Device Provisioning is new for version 1.05. It is still in draft within the OPC UA Working Group and the security sub-group. The way to get more information is to join the working group.
Jim Luth	Where does UA Working Group belong to?	The OPC UA Working group is a top level technical working group chartered by the OPC Foundation. See https://opcfoundation.org/about/working-groups/opcf-wg/
Jim Luth	What is the different between polling and subscription and Pub/Sub communication or is this the same?	The terms are confusing because in Client/Server we have "Subscriptions" and "Publish" calls but this is completely different than the Pub/Sub communication pattern. Please read Part 1 of the OPC UA Spec: https://reference.opcfoundation.org/v104/Core/docs/Part1/
Jim Luth	When we say Nodeset provides only structure information and NOT semantics but semantics is defined in a Companion Standard, can you please explain with an example to be clear if possible?	An example would be cardinality. The nodeset does not currently have a way to specify the count of things (e.g. a car needs to have 4 wheels). A nodeset for a car would specify the relation between the car and the wheels but not indication of how many are required or allowed.
Jim Luth	is OPCUA Foundation SDK can be use with ADA language ?	There are no known SDKs for ADA, but many languages can make calls to C libraries of which there are many for OPC UA.
Jim Luth	Commercial tool names should not appear in the OPC specs	MQTT is not a commercial tool. MQTT is a standard from OASIS and is internationally recognized as ISO/IEC 20922:2016.
Jim Luth	What are the mechanism to store server data, in case if server restarts it should contains all the previous records? Is there any DB support there to store the same?	It is expected that a Server remembers its configuration data between restarts, but not its live runtime data.
Jim Luth	Will support of pub/sub and samples will be implemented in the foundation's DotNet sample stack?	Maybe. There is a group of volunteers that maintain the .NET codebase. They prioritize their work base on their needs.
Jim Luth	Will the v1.05 specifications be compatible to the v1.04 specifications?	Yes, just as 1.04 is compatible with 1.03, 1.02 ...
Jim Luth	Where can I find information about LDS"local discovery"?	The LDS is described in OPC UA Part 12: https://reference.opcfoundation.org/v104/GDS/docs/
Jim Luth	Could you please clarify, is PubSub something that is configured in client-server session and lasts for one session, or is it configured persistently during device provisioning?	Pub/Sub is configured persistently, some time after device provisioning, and can sometimes be reconfigured dynamically at runtime.
Jim Luth	There was a whitepaper mentioned about OPC UA topologies including aggregation servers. Could you please elaborate on how devices are usually connected together?	The OPC Harmonization working group is working on a whitepaper "UA Application Hierarchies". The paper has not been published yet. You can find more information by joining the sub-group: https://sites.google.com/opcfoundation.online/opc-harmonization/applicationhierarchies
Jim Luth	Could we also have all the abbreviations defined on the slides or on an appendix sled at the end? OCL, UML, etc.?	Pub/Sub – Publisher/Subscriber TSN – Time Sensitive Networking OWL – Web Ontology Language SHACL – Shapes Constraint Language UML – Unified Modeling Language OCL – Object Constraint Language
Jim Luth	The uastack for C on the github will not be upgraded to version 1.05. Is this correct ?	Correct. The ANSI C stack from the OPC Foundation is legacy an will not receive any updates or enhancements.
Jim Luth	Question for Jim, I understand you are using OWL to detect semantic mistakes in OPC UA NodeSet models. Brilliant idea. But why not thinking to a migration of OPC UA models to an OWL syntax instead of the NodeSet2 format? There are many open ontologies tools (such as Berkeley protege) that can be used to design semantic models. I agree this is a breaking change but alignment with existing information modeling with ontologies would be nice. AutomationML is first an OWL ontology for example.	Migrating from Nodeset2 to OWL internally has not been considered to date. I will raise this possibility with the semantic validation sub-group.
Jim Luth	When version 1.05 will be officially released?	The v1.05 Parts will begin releasing this year (2020), but not all Parts will be released at the same time and new Parts can be added at any time in the future.
Jim Luth	Are there any UML design tool like borland together? that allow to make UML models for OPC architecture with code generator?	A google search for "UA Modeling Tools" will direct you to several commercial products for this purpose, although they are mostly not UML-based.
Jim Luth	Are their rules for the transformation from OPC UA metamodel to UML metamodel available? We are also working in this direction, maybe we can share thoughts.	OPC UA Part 3 Annex B describes the OPC UA Metamodel in UML. https://reference.opcfoundation.org/v104/Core/docs/Part3/B.1/
Jim Luth	Is there any way to synchronize two OPCUA servers within a few microseconds ? In that case the messages from Pub/Sub from two servers will be automatically synchronized.	This is a possible configuration when combining Pub/Sub with TSN.

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Jim Luth	Yes I asked the question this morning about OPCUA Synchronization but could not wait for the Q/A Session as I had an appointment. Thank you in advance for answering again today. I will wait.	Publishers can be synchronized using Pub/Sub with TSN.
Jim Luth	Is there an OPC UA binding over SOAP messages?	The SOAP binding for OPC UA was deprecated in Version 1.03 because WS-SecureConversation has not been widely adopted by industry.
Jim Luth	I noticed this questions earlier with plug and play and I was wondering will there be any problem with Hot Swapping with defective modules during a process. Will that be possible?	Hot swapping scenarios will be addressed by Device Provisioning and/or FLC.
Jim Luth	Which background do we have to have to be able to participate in an active way to a Working Group? Can you give some tips/tricks to catch up the knowledge/understanding gap?	Best is to get in touch with the chairperson of the group and figure out how you or colleague can participate in active contribution or more passive listening at beginning.
Jim Luth	How does an OPC Publisher pull information from an OPC UA Server which runs on the same device? Does it behave as an OPC UA Client?	How a UA Publisher gets its information to publish is implementation dependent and out of scope for the UA standard.
Jim Luth	What is the difference between the UDP UADP transport facet and the L2 UADP transport facet ?	The transport is different. With L2 the messages are packed in an ethernet frame. With UDP they are sent inside a UDP packet.
Jim Luth	What is the recommended time synch protocol for OPCUA?--SNTP or PTP(precision time protocol)	OPC does not recommend a particular time synch protocol
Jim Luth	Will the OPC Foundation provide a 'C' SDK again?	There are many commercial and open source OPC UA SDKs for 'C'. The OPC Foundation has no plans to provide another one.
Jim Luth	Is the UADP encoding developed by OPC Foundation ? Are there any test library projects only to try encoding, decoding, or parse the dataset ?	The UADP message mapping is defined in Part 14 of the OPC UA Specifications and is available from the OPC Foundation website. This is part of the PubSub architecture where the compliance group is currently working on testing for. As this is still work in progress, the testing for encoding/decoding is not yet available. Please contact the known SDK providers for their PubSub demo applications in order to do interoperability testing.
Jim Luth	Is the UADP Encoding more efficient in terms of transport as compared to JSON ?	UADP is optimized to use less space and require less processing to encode and decode than JSON. It should be the choice when performance is the primary concern.
Jim Luth	To = >Randy Armstrong Having a cloud relay between OPC servers and clients for communication to overcome firewall issues, will it slow down the communication (low performance)?	Yes. Engineering trade-offs always exist. If you have a restrictive firewall then a middle man is required.
Jim Luth	What cloud platforms are supported when it comes to OPC UA on edge devices ?	A number of edge gateways are available or under development. A talk on Azure gateway will follow mine.
Jim Luth	What is UACP in the slide?	UA Connection Protocol = the client-server handshake.
Jim Luth	If we utilize the pub-sub architecture, doesn't it restrict the real-time capability?	UDP pub-sub is the basis for FLC which is expecting high performance real time capabilities when combined with TSN. If you use a broker like MQTT then there will be unpredictable delays, so no real-time capability.
Jim Luth	Does device identity (certificates) apply to IoT devices? Also, do we have application identity (certificates) for applications?	The DeviceIdentity certificate identifies a device, which could be an IoT device. The ApplicationInstance certificate provides a unique identity for each application on the device.
Jim Luth	Is the defence in depth (as a topology-based approach) still a valid approach in our current digital world? Is it better to use policy-based approach instead (because no specific fixed boarders exist between the enterprise, its customers, its ecosystem and the IoT devices)?	OPC UA is one piece of a security solution. Owner-Operators are responsible for choosing their security framework. OPC UA works with either approach.
Jim Luth	Will terms like master/slave be removed from OPC-UA specifications and standards - https://www.eetimes.com/its-time-for-ieee-to-retire-master-slave/#	The terms are not used outside of examples in the OPC UA specifications. We will review these examples.
Jim Luth	ECC itself has low requirements on computing power, but PFS (perfect forward security) requires key generation on the device. Is this considered in the specification?	Yes, the ECC mapping requires that devices generate ephemeral keys. If this is too much for a device then pub sub with out-of-band key distribution may be a better option.
Jim Luth	Would an IETF transport layer security (e.g. TLS, future QUIC) be used as security method for OPC UA device, especially for devices with embedded profile implemented compared to UASC? What is the primary reasons/advantages of using UA-specific UASC security mechanism compared to IETF TLS/QUIC?	UA-SC exists today and we know it meets all OPC UA requirements. QUIC/HTTPS3 is new and we will need to figure out where it fits and what the pros and cons are.
Jim Luth	Are the nodeset.xml files the machine readable part of (companion) specifications?	NodeSets describe the STRUCTURE. i.e. A Motor has a Variable representing power consumption. The Semantic model describes the SEMANTICS which state things like a Property Node has a TypeDefinition of PropertyType and a target of HasProperty.
Jim Luth	There may be better tools available than MQTT?	MQTT is one of many options for broker based communication
Jim Luth	Does OPCUA support MQTT with TLS support? Where can I found the documentation for the same? Also how to decode the json message using MQTT pubsub mechanism ?	The MQTT mapping assumes TLS. See http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html and https://reference.opcfoundation.org/v104/Core/docs/Part14/

Answerer	Question Asked	Answer Given
Technology		
Jim Luth	Can I use custom generated certificate .pem file for server certificate? How do we use that with client application?	Yes. All OPC UA applications are required to allow import of custom certificates. Whether PEM Is specifically support depends on the vendor.
Jim Luth	Regarding PubSub security between controller, what is the implementation in prototyping work group, e.g. is the CoAP/DTLS adopted?	UA PubSub is designed to meet a wide range of requirements, including multicast and TSN communication. UA PubSub has its own security mechanism that is common across all use cases. COAP and DTLS is point to point and would only work for a subset of applications. We have not done the work to determine what the use cases are and whether there is a benefit over UA PubSub,
Jouni Aro	Are there demo servers online accessible that implement some of the companion specifications?	OPC Foundation does not provide any official listing, but there is a list maintained by an external party at: https://github.com/node-opcua/node-opcua/wiki/publicly-available-OPC-UA-Servers-and-Clients
Jouni Aro	What are the development languages supported to develop end user application?	OPC Foundation supports .NET, Java, and C/C++ stack level. These are available free of charge under the GPL license from https://opcfoundation.org/developer-tools/samples-and-tools-unified-architecture . Implementations for Python and Node.js are provided by other organizations, but they are not listed by the OPC Foundation.
Jouni Aro	what about OPC UA Modeler? do you have a toolkit to developpe it?	The OPC Foundation does not have any modeler, but there are commercial applications available in the market.
Jouni Aro	Here is this link https://github.com/OPCFoundation/UA-Java-Legacy/ OPC-F said there will be not further updates for OPC Java stack. If there is any application which is built on this stack then how they will get newly added features &/or updates/fixes in OPC Specification?	OPC Foundation has decided to discontinue the active development of the Java stack, but it is available as an open source project, so anyone is free to continue the development and share their contributions in return. OPC Foundation is continuing to fix security related issues in the Java stack, as well.
Jouni Aro	AppScanner has identified few vulnerability in our client code due to Java OPC UA Stack Jars 1.4 , i.e. on class org.opcfoundation.ua.transport.security.PrivKey , CWE 327	OPC UA defines several alternative security policies from which the users can choose when defining secure connections. The original policies defined in OPC UA 1.01 include security policies called Basic128Rsa15 and Basic256. Both of these were deprecated in OPC UA version 1.04, due to the possible security risks that have been exposed. The stack implementations will keep supporting the deprecated policies and it is the responsibility of the application administrators and users to decide whether these policies are enabled by the applications in practice.
Matthias Damm	I am implementing a session-less REST based OPC-UA server which uses JSON and utilizes the NodeManagement service set for address space modeling. Is there a part of the specification which covers the requirements for an OPC-UA address space modeler?	REST-like API is already part of OPC UA 1.04 spec. The basic rules for OPC UA address space are defined in OPC UA Part 3.
Max Walter	Is OPC UA Safety TUV certified?	Yes, the certification by TUV is ongoing and an approval of the safety protocol is expected soon.
Max Walter	What does the middleware mean in the safety layer model? Is it also some kind of safety implementation or a communication middleware?	With the exception of the OPC UA mapper, the middleware, implementing OPC UA Safety, has to be realized in a safety-related manner, i.e. the implementation must be according to IEC61508.
Max Walter	Will the OPC UA Safety profile be backward compatible with old device's safety profiles ?	Yes, this will be addressed in the legacy services provided by OPC UA Safety to support migration from "old" safety profiles.
Max Walter	When do we say there is loss of data w.r.t. Monitoring Number & Timeout with receipt ? How is an end-user notified about a data loss ?	OPC UA Safety notifies its safety application about any communication error occurring. In addition, fail-safe substitute values are delivered instead of process values. Moreover, the device will present a diagnostic message to the end user.
Max Walter	How SIL safety integrity level function as per IEC 61508 /61511 shall be taken care for this devices?	OPC UA Safety addresses functional safety for communication. Together with safety-related implementation of the automation components, a safety function according to the IEC standards can be built. The SIL achieved of the safety function depends on the SIL of the automation components.
Max Walter	Is OPC UA Safety based on Ethernet TSN or is it independent of underlying network?	OPC UA Safety is independent ("black channel") of the underlying transport. However, Ethernet TSN is an important technology for safety functions that require determinism (hard real-time).
Max Walter	Is there an international standard used for the state machine as base of the design of OPC UA Safety?	The OPC UA Safety specification is making use of UML (Unified Modeling Language) state machines (ISO/IEC 19505).
Max Walter	Is it possible to use OPC UA FLC to ensure that communications to a safety controller are read-only?	Yes. For instance, if you only deploy a SafetyProvider on a controller, safety data can be read, but not changed.
Max Walter	Will OPC UA Safety replace PROFIsafe, FSoE or OpenSafety?	OPC UA Safety is a safety protocol that is not bound to a specific underlying communication protocol but instead is transport-agnostic. Therefore, we can expect that OPC UA Safety replaces existing safety protocols mid-to-long-term - similar to OPC UA replacing conventional fieldbuses and Real-Time Ethernet protocols mid-to-long term.
Paul Brooks	Does FLC already include "Controller to field device" or will this be covered later?	In the first specification release, FLC is focussing on the "controller-to-controller" use case. In the second specification release, additional features for the use cases "controller-to-device", including "device-to-device", will be added. However, the basic concepts and mechanisms for the different use cases are all the same.

Answerer	Question Asked	Answer Given
Technology		
Paul Hunkar	Are there any Experion solution for IIOT Integration of third party sensors?	I assume you are talking about the product Experion from Honeywell. In this case, I need to send you to your Honeywell contact, as we are experts for the technology and do not know about all product activities of our member companies. If you are looking for general information about OPC UA and sensors, the definition of a sensor can vary between markets, but, in general, OPC UA can run in very small devices. for example e.g. 36kb RAM and 240kb FLASH . you can also integrate sensors using gateways to connect existing sensors/sensor networks.
Paul Hunkar	How OPC-UA, in practice, answer the requirements related to IEC/62443 security level3, that define zones and require central users management across devices Base on a the context OPC-UA clients can be in different zones ?	IEC 62443 - is a large standard. It include much more then just communication. It includes certification of the development process, the facility that is performing the development, and, even though not listed in -3, it does reference and require certified developers. OPC UA is a key part of 62443 certification, but it is only a key piece. OPC provides central role management and you can listen to the session from Randy Armstrong for more information about security concepts in OPC UA.
Paul Hunkar	is there any relation of OPC UA with IEC 62443 Cyber security in process industry ?	There are a number of efforts, in progress, that describe the mapping of IEC 62443 requirements to OPC UA-provided functionality. A key point is that 62443 describes security for a complete system, while OPC UA provides and describes security for components that are part of a larger system. We describe security for communication and applications. We describe user access and security related to it, but 62443 also includes security related to the development process, the administration of a system, and generally covers all aspects of security that might apply in a facility (entire system). OPC UA is a key part to the overall System Security that is described by 62443.
Paul Hunkar	Can OPC UA meet the technical requirements in ISA/IEC-62443-3-3?	Yes, it has been taken the effort to generate a mapping to ensure OPC UA meets the requirement for which it applies in this specification. As stated in one of the other question, IEC 62443 has requirements for an entire system and OPC UA is just one key component in an entire system.
Paul Hunkar	What is the difference between OPAS component & non-OPAS component platform ?	This is not a very simple question - it could be a full hour long session. The Open Group has released the first version of their O-PAS model. In the initial version, O-PAS defined a basic information model, which is communicated via OPC UA and also a system management interface, which utilizes DMTF Redfish. Release 1 was about interoperability. Release 2, which will be out shortly, is about configuration interchange. Release 3 will be about application portability. Starting in release 2, they include description of Hardware. O-PAS will require certification based on profiles, so an O-PAS component is really about the profile that it supports. Profiles can be software and hardware, so I think the question does not really have a straight forward answer. If you would like to discuss it more please feel free look at the Open Group site or contact me if you would like Paul.Hunkar@dsinteroperability.com
Paul Hunkar	If anything is deprecated in v1.04 specification e.g., security policies, when (which version of specs) it will be completely unsupported in OPC Product or considered as non compliant to OPC specification considering an OPC client/server has that feature implemented ?	We deprecate a security policy when they have exploits that compromise them. Product certification will keep checking them (we don't remove them from testing), we just check that, if they are supported, they are disabled by default. Even though a security profile has been shown to have an exploit, it might be required for communication for a legacy device. It would be up to the end user that is deploying the device to determine if it might judge the risk of the exploit (and if there are other work arounds that could mitigate the risk) to allow the device communication using the older deprecated communication.
Paul Hunkar	To ensure High available in OPC products with PubSub model, is it necessary to have support for Transfer Subscription or there can other way to achieve it ?	Transfer subscription is a Client/Server service and applies to client/server subscription which is different then a Publish Subscriber. PubSub is a different communication paradigm. In client/server the client controls what is being set. Whereas, with pubSub, the publish controls what is being set. The information model that is available is the same for both forms of communication. FLC will utilize PubSub in its initial release, which should trigger fairly high availability of PubSub Communication.

Certification

Answerer	Question Asked	Answer Given
Certification		
Alexander Allmendinger	What changes are allowed at the certified product (bug fixes, small feature-extensions) before losing the certification?	Minor changes like bugfixes and enhancements for logging and configuration will not result in losing the certification. However, when introducing new features, updates to SDKs (or Stack), or doing major rework of the architecture, the resulting version is not allowed to be marked as certified.
Alexander Allmendinger	If products are non officially certified by OPC UA e.g. Softing data feed .. is it still safe to use for production environment?	You can use uncertified products in production systems, but the certification program of the OPC Foundation is the only reliable quality statement for OPC technology. Because of that the OPC Foundation highly recommends to use only certified products.
Alexander Allmendinger	Certification question: If an OPC UA server uses a "driver model" with core OPC UA functionality and interchangeable, device-specific driver modules, is certification then required for each driver module?	In such cases, where the product uses different drivers to collect data, which are then exposed via an OPC UA Server, it is not required to test every possible combination. Certification testing will focus on the 3 most common drivers to verify correct mapping of the values and connection states.
Alexander Allmendinger	For deeper understanding, are there any examples for testing OPC UA with any software in these seminars?	Due to the limited time we were not able to do a live demo on how to use the UACTT. But there are recordings available which explain the usage on YouTube e.g. CTT Training 01: https://www.youtube.com/watch?v=EP4C9l4JMR8
Alexander Allmendinger	On the list of the certificated PLCs, Siemens is not there . I can not understand why . Is it missing or effectively not certificated?	When looking in the normal product catalog you'll also find the certification history of a product, which certification has expired. Looking at the S7-1500 you'll notice that the certification just expired in March. Sometimes, especially when new features are being introduced, vendors are deciding to hold back certification information for marketing activities at bigger trade shows.
Alexander Allmendinger	What is the minimum number of client items/tags needed to be supported by OPC Client in order to pass the certification ⬚	The minimum number of items to be supported are defined by the desired profiles. In general there is no real minimum requirement for clients, as this always depends on the use cases supported by the product.
Alexander Allmendinger	How is load testing performed in terms of support for tags or monitored item for OPC certification	A detailed description how the efficiency test is executed can be found at https://opcfoundation.org/certification/how-to-certify/
Alexander Allmendinger	What needs to be done at the client level to ensure no data loss, Can someone please address the below CTT requirement and expectation TestCase007: Verify the clients use of the parameters do not cause a potential loss of data, for example: requestedPublishingInteral=100msec. maxNotificationsPerPublish=1 requestedLifetimeCount=30. QueueSize (monitoredItem) = 1. Expected Result: If Clients user interface or configuration allows for this, then the end-user must be notified by some form of warning or message that explains the potential for data loss.	The test case is checking whether the client does provide additional guidance for the end user on behalf of configuration of connection settings. We do recommend to help the user of the product by warning for problematic setting combinations.
Alexander Allmendinger	Does the current CTT support PubSub ?	PubSub is work in progress and has not yet been released.
Alexander Allmendinger	When can we expect PubSub support on CTT ?	An initial public Beta for PubSub testing is targeted for later this year.
Alexander Allmendinger	When will the PubSub test cases be included in the CTT?	An initial public Beta for PubSub testing is targeted for later this year.
Alexander Allmendinger	Hi, thank you for the Conference. I would like to know if it's possible to certify an application built on open source SDK for example : eclipse milo in Java. Thank you	Any product using the OPC technology can be certified. This includes PLCs, HMI, Loggers, Condition Monitoring, Sensors, Historians, ... Whether the product has been built using an open source or purchased SDK, it doesn't make a difference. Although using an SDK, which already has proven to be used when building certifiable products, will reduce the effort for getting certified.
Alexander Allmendinger	I am implementing OPC UA Server into a CNC, if I need to get certified, shall I ship the CNC controller to the lab get certified ? Shall I need to come to the lab ?	This depends on how OPC UA is being integrated into the CNC system. But in most cases it is sufficient to provide the OPC UA interface (software or hardware based) as well as a simulated data source for the product (e.g. S7 with appropriate configuration to simulate the CNC). Then we can test the product as well as the mapping of the connection state of the data source, which is sufficient for certification testing. An in-person visit during the certification process is not required, but a developer should be available for questions, investigations, and bug fixing.
Alexander Allmendinger	I used Rockwell Rslinx as an OPC server. Is Rslinx OPC server now OPCUA Compliant	In general you'll find all certified products listed in the product catalog on the OPC Foundation website. But to answer your questions directly, RSLinx is currently not on the list of certified products.

Answerer	Question Asked	Answer Given
Certification		
Alexander Allmendinger	Can we issue digital certificates for IoT devices (like what we can do now for computers)? To what extend this practice is common in the industry today? Also, can we issue a digital certificate for a software application (like what we can do now for computers)? Will this help to secure our industrial automation software when it is deployed on the cloud?	In order to use the security mechanisms defined in OPC UA, every OPC UA application is required to have an own, so called Application Instance Certificate, and is required to handle certificate authorities for trust relationships. So on behalf of OPC UA products it is very common that digital certificates are being issued and used. Of course this helps in securing the communication between the on-premise and cloud systems.
Alexander Allmendinger	As part of OPC Certification, are we also perform "Security Testing" like Penetration Testing, etc.?	We are planning on including basic penetration testing but, in general, extensive penetration testing will not be included or required in OPC certification.
Alexander Allmendinger	Regarding the certification test: The resource efficiency is only tested for the running OPC process (client or server) and not any other or background processes of an operating system?	During the efficiency test, the laboratories will also monitor the general consumption of CPU, Memory, and other key information. As a result most of the leaks in a background process would also be noticed and reported to the vendor.
Alexander Allmendinger	When we test an OPC client or OPC server for compliance & Interoperability, is it required that it is to be tested with Licensed products or testing with Simulation Server/clients is fine ?	There is no requirement for testing your product with a specific set of other applications during your own testing. But, we do recommend to test your product with a set of demo applications of the different SDKs and programming languages to reduce interoperability issues. If you'd like to test your product against other commercial products, please check out our interoperability workshops -- so called IOP Workshops -- where different vendors get to together and test their products for interoperability. During certification testing, your products will be tested against a random set of reference products available in the Certification Test Lab, which will include licensed products of other vendors.
Alexander Allmendinger	Where is it possible to find certification process information and cost?	All information about the certification process and costs are described on the OPC Foundation website, at: https://opcfoundation.org/certification You can also listen to the recordings of our sessions regarding certification on YouTube at: https://www.youtube.com/watch?v=aS_nhjotTwA&list=PLROM1mLWekVDqbLyAZeJK__B2HZUmZehy for the Pre Conference and: https://www.youtube.com/watch?v=ikKuL28i9bE&list=PLROM1mLWekVBXVlqgAuyIZih-KA_wcX_I for the main conference.
Alexander Allmendinger	How long does a product certification last? Must it be renewed annually? Does the renewal involve retesting.	Certifications are valid for 3 years and can then be extended if the product didn't change. If the product changed, especially when introducing new OPC UA features, retesting is required.
Alexander Allmendinger	Is there any Certifications for OPC UA? Not certifications for applications, but certifications for persons. Upon completing a course they are now an OPC UA certified expert or similar?	As of today there is no certification program available for persons. But there are training courses available from SDK vendors, some of which provide an attestation.
Alexander Allmendinger	How can I very if the supplier of the OPC UA Server software is Certified ?	Currently, niether companies nor persons can be certified. But, if you want to check if a specific product from a vendor has been certified, please check the products listed in the product catalog of the OPC Foundation website which is available here: https://opcfoundation.org/products
Alexander Allmendinger	Is the OPC UA certification mandatory to be able to commercialize a product or just strongly recommended?	That depends; OPC UA does not require certification of commercial products, but highly recommends it. For the deterministic extension of OPC UA, on which the FLC initiative is currently working, certification will be mandated. Also, multiple companion specifications, like O-PAS and MDIS, require certification to ensure an easy integration.
Alexander Allmendinger	How long is the certification process? 6 months? 1 year?	Typically certification takes 3-7 days for a server and 7-10 days for a client. Adding an information model certification can add additional 3-7 days of testing, depending on the integrated features. This is the actual days of testing effort, they may be spread out over a longer period of time, since testing of a product can be paused if a product has problems which need to be fixed.
Alexander Allmendinger	Robustness testing : Is it about only underlying network test or OPC server restart and client recovering connection after this restart is also considered in this testing	Yes, restart of the server and client is part of the testing, but it is rather part of the compliance section.
Alexander Allmendinger	how do I get know my implementation for Pub Sub is CTT complaint? Is there any CTT test cases provided by CTT tool for PubSub Model?	PubSub test cases, and the test tool, is currently a work in progress.

Answerer	Question Asked	Answer Given
Certification		
Alexander Allmendinger	If I purchased a certified OPC UA SDK and developed my OPC UA Server, does my OPC UA server also need to be tested in the lab in order to gain OPC UA certification ?	As a rule of certification, SDKs cannot be certified directly; as a result, there are no certified SDKs. But, SDK vendors can get a demo application certified, which is required to be available to their customers as source. The goal here is to allow the SDK vendors to prove that it is possible to build a certifiable product with their SDK and provide an example/reference on how this can be done. This certified demo application does not grandfather its certification to other applications built with the SDK, as those products can miss required features or behavior. But, using an SDK, where the demo application has been certified, usually leads to a smaller effort on behalf of certification. In the end, all products need to be certified separately to ensure the behavior required on the application level is following the specification.
Alexander Allmendinger	I know there is the product finder on your site, but, as far as I know, it does not allow to filter by compliance to companion specifications. Is there a way to find solutions complying to a certain companion specification?	The product catalog does allow you to do a text search, which includes the product description provided by the vendors. As a result, when the vendors are describing the supported Companion Specifications, they will be displayed. That said, we are also working on enhancements to the product catalog, wherein this opportunity will be added.
Alexander Allmendinger	for the moment is there a possibility to test OPC in the cloud?	This question can be interpreted in two ways so I'll try to answer both. 1. If you are asking whether you can test your developed OPC application online the answer is yes and no. What we are currently working on is providing an Online Testbed for OPC Application developers to enable them to test their own applications with products from other vendors, so called Interoperability Testing. This is a work in progress and if you are interested in the outcomes here, please contact us at compliance@opcfoundation.org. For testing the compliance with the specification of a product, we do have our Compliance Test Tool (UACTT) which is available in the certification section on the OPC Foundation website. 2. If you are asking whether you can look at an implementation of OPC UA in a cloud as it was demonstrated by Randy Armstrong, yes this is possible. You'll find the example here: https://prototyping.opcfoundation.org/
Alexander Allmendinger	In developing devices with OPC UA Safety in future, which test lab can we take a CT, OPC UA test lab or Tuv-sud?	Certification of safety relevant products requires higher pre-requirements e.g. the lab staff need to be Safety certified. OPCF Lab staff are not Safety certified. OPCF will cooperate with other organizations running successfull Safety labs (like PNO and others). It is important to know that OPCF will aim to accredit a lab in order to establish a one-stop-shop certification, since no one wants to send their device to multiple labs.
Alexander Allmendinger	As a system integrator, how helpful would it be to become OPC certified. How much would it cost to be certified?	To date, it is only possible to certify products. Certification of persons, as OPC UA experts, is not possible. When you are interested in getting a product certified, please visit the certification section on the OPC Foundation website at: https://opcfoundation.org/certification
Alexander Allmendinger	Is the CCT already prepared for OPC UA PubSub?	The CTT, in its currently released version, only supports testing of Client and Server applications. But, the definition of PubSub test cases, as well as extension of the test tool, have already begun. If you are interested in contributing to this effort, please contact the Compliance Working Group.
Alexander Allmendinger	There is a test case for OPC UA client which says client should be smart enough to identify data loss which may lead due to the value provided for requested publishing interval, queue size &/or requested lifetime counter. How can a client be aware of scenario for this ?	For questions about specific test cases, or desired behavior of OPC products, please utilize the OPC Foundation Forum where our compliance experts are happy to answer all test and certification related questions.
Alexander Allmendinger	What is the script language used for the test? Is that extensible by the developer?	The programming language being used in the test scripts of the CTT is JavaScript. Yes, you can extend the test scripts in the CTT with vendor specific test scripts.
Alexander Allmendinger	While working with CTT scripts, sometime it gets crashed, is there any logging &/or audit mechanism by which we can check reason for crash & report them to OPC-F ?	Of course, the CTT should not crash. The CTT is well tested before we release a new version, but all products do behave slightly differently and, therefore, there may still be some rare cases which may not be handled correctly. If you happen to see such a case, please report it to the developers, including the steps necessary to reproduce the error. Please use the bug tracking system: https://apps.opcfoundation.org/mantis

Answerer	Question Asked	Answer Given
Certification		
Alexander Allmendinger	Regarding CTT results, the video available on YouTube don't have steps on how to get/view results of CTT scripts in Results Tab. I didn't find anything in the documentation. Are we going to update video &/or documentation on How to get the Results (Steps) in Results tab ?	For server testing, the results are displayed in the result tab, automatically. For Client testing, the CTT cannot decide whether a test case succeeded, or not, as this needs to be verified in the client application. For example, when the test case is to inject a Bad_XXX StatusCode to a variable to ensure the client is not using the value for calculations, the CTT can't check if the product used the value. This needs to be done manually by the user of the CTT. Therefore, there are no results displayed when testing UA Clients.
Alexander Allmendinger	Current CTT version only have support for security None & to check for other security policies WireShark is getting used. Is there any plan to add support for other security policies as a part of CTT or WireShark is the preferred/recommended one ?	The current CTT for servers, provides support for all of the released security policies, not just policy NONE? For clients, it requires mapping to a server that provides the appropriate Security policy (and assigning appropriate certificate configurations). Wireshark does not provide support for encrypted data - in that it does not have access to keys and, thus, can not decode the encrypted data.
Alexander Allmendinger	There are no CTT test cases for security profile. Is there any plan to incorporate them in future releases ?	Security testing is currently available for all security communication profiles. We are still working on the Role based User Authentication testing, but that is a newer feature. We watch when SDK's provide support for functionality and try to have testing available in a similar time line.
Alexander Allmendinger	What are all the companion Specifications currently available with OPC-UA ?	The OPC Foundation maintains a list of Companion Specification working groups which is available here: https://docs.google.com/spreadsheets/d/10SOpad6uu7JA5ZSpccVyqaqkyhYBilXqNus28-1cJtU/edit#gid=1248333029 In addition, the release specifications are available here: https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models
Alexander Allmendinger	Is CTT able to generate automatically the test cases for a information Model?	The CTT is not able to automatically generate test cases or scripts for an information model. This is primarily because test scripts are based on test cases, and those test cases should not only validate an information model in the address space, but also the behavior defined for the elements defined within it. This cannot be generated automatically, as the specification needs to be interpreted for it. But, the Compliance Working Group is happy to help when you'd like to get started defining the test cases.
Alexander Allmendinger	Is there a list of the API included in the CTT?	In the Documentation of the CTT, there are coding guidelines and some basics for script development defined. Generically speaking, there is, most likely, a test case for the core specification which is testing a similar thing. I would recommend using a test script, which already exists, as a starting point, if you are not yet familiar with the script library. If you need more assistance please contact the compliance working group.
Alexander Allmendinger	Do the test cases provide more details about the expected behavior or modelling in specific situations than the specification (documents)? Because for some situations the specification does not provide enough details how a server should behave e.g. regarding file system access and file transfer.	The test cases defined for certification are only exercising what is defined in the specifications. Test cases should never add new requirements. But, often, they do provide more guidance or explanation, which might be defined in another part of the OPC UA specification. If a behavior is not precisely defined, you can always ask in the OPC Foundation Forum to get help from OPC Experts.
Alexander Allmendinger	I was searching for package OPC, there are many types of it. How can I choose them to match with security's auditability?	When you are talking about the Auditing feature, defined in the OPCUA specification, you'll need to search for products supporting the "Auditing Server Facet" or the "Auditing Client Facet".
Paul Hunkar	Where and how to get the CTT?	The CTT is available via the OPC Foundation web site - https://opcfoundation.org/developer-tools/certification-test-tools
Paul Hunkar	Is there any plan to add test cases for Alarms & Events for OPC Client ?	Yes, Alarm test cases will be available 3rd quarter this year; initially Server testing then Client testing.
Paul Hunkar	What are the cost implications to become a member in order to gain access to the certification test tools?	The OPC Foundation offer all tools and certification to Corporate member(paid) and to Logo members(free). See all the details (benefits and fees) to become a member here: https://opcfoundation.org/membership/benefits/ and see the certification detail here: https://opcfoundation.org/certification/overview-benefits/ The key point is that certification tools are free to corporate member, but can be purchased by logo members. Logo members are only required to sign an agreement.

Answerer	Question Asked	Answer Given
Certification		
Paul Hunkar	Is the CTT free for Open Source projects?	The CTT is free of charge for Corporate (paying) members - it's also available for small fee for non-OPC Members (non paying members, but registered as free of charge logo members). We don't care how you implement your product (toolkit or based on open source) - so you can get the CTT to increase the quality of your product
Paul Hunkar	What are the test case available for server certificates?	All test cases are available online via the OPC Profile tool. To find a specific test case, please find the appropriate profile and conformance unit - the test cases are linked to each conformance unit. Profiles are available here: https://apps.opcfoundation.org/ProfileReporting/
Paul Hunkar	Does currently CTT is supported for PubSub Model ? Like It is there for Client-Server.	Support for PubSub communication in the CTT is in progress, but has not yet been released. We are targeting certification to be available near the end of the year.
Paul Hunkar	1.03 compliant server can pass 1.04 CTT except for pub/sub?	The OPC UA working group has done a great job of ensuring that each release adds new functionality and is backward compatible. If you have a product that is compliant to 1.03 and you did not add functionality for 1.04, it is likely that your application will pass 1.04 testing. [Note: 1.04 added more functionality than just PubSub. It also clarified some issues]. The test cases improve with each version - so additional test cases may be added between versions, but typically for a well implemented Server they do not cause a failure.
Paul Hunkar	Companion Standard 10040 (IEC61850). When is it planned to be released ?	Please navigate to: https://opcfoundation.org/markets-collaboration/ and look for landing page of IEC61850 - you'll find basic information and the contact to the chairperson - please re-ask the group directly. The OPC Foundation prefers that all companion specification have at least one implementation before they are released. This ensures that any modeling problems in a companion specification are identified while it is a release candidate.. Some Companion Specifications may sit at RC for a while while waiting for an initial implementation.
Paul Hunkar	If now the v1.05 is improved at any time, how a user know if a server certified is up to date with the specification ?	The specification will still maintain a version number - it might just be a point number 1.05.01, so we will still be able to identify what version of a specification someone was tested against, but the version number does not matter that much, since testing is against profiles and conformance units. Profile and conformance units typically do not change between versions. Additional profiles and conformance units are added. The user just needs to check what profiles a server (or Client) supports.
Paul Hunkar	The test cases for AddReferences and DeleteReferences are missing within the Node Management Server Facet on the online profile reporting web page. When will these test cases be made available?	We have seen no demand for that functionality, thus it has been a low priority to add. As soon as we see or receive requests for the functionality we will add test cases. Is this something you need? If you need support for this functionality, please let us know via email - compliance@opcfoundation.org
Paul Hunkar	I'm currently developing an OPC-UA Modeler, which requires the entire Node Management service set for address space modelling, having the test cases available for Add and Delete references would be extremely helpful in aiding implementation	I guess we will need to move up the priority - since we now have someone making use of it, but again we have not seen server provided support for it, so hopefully your modeller tool is not looking for server to support this functionality. If you would like to discuss this further please email us at compliance@opcfoundation.org
Paul Hunkar	Is there a working group for electronic test for MES systems - I'll try to clarify … We are implementing a system that will monitor the testing of 200+ products. When the test is complete the results will be retrieved by an iTac MES system. A PC will implement an OPC-UA server. Implementing this is very new to us and we believe the approach will be to create profile for each product being tested. So, I guess I am asking if there is a companion specification for MES systems.	There are a number of OPC UA Models that could assist you in building a system as you described. The ISA-95 OPC UA companion specification provides a manner of expressing the testing of both logical equipment and physical asset. This would allow you to define the testing the equipment would undergo and provide a standardized manner of collecting the results. There are also other project in progress that could provide (or assist) you with the information model you might need (you would have to describe what the 200+ products that are being monitored actually represent.

Cloud

Answerer	Question Asked	Answer Given
Cloud		
Erich Barnstedt	Hi. It would be interesting to get some more information on the "UA-.NETStandard" code at https://github.com/OPCFoundation/UA-.NETStandard. At github it is described as "Fully ported Core UA stack and SDK". From the presentation it was my impression that this code was intended only as low-level stack. Is it a high-level SDK, low-level stack, or something in between?	It is a high-level SDK. In fact, there are several open-source samples in the UA-.NETStandard-Samples repo accompanying it. The "SDK" can be found in UA-.NETStandard/tree/master/Libraries. The stack is also certified for compliance by the OPC Foundation test labs, and it is in use in several commercial products, including many from Microsoft. It is super popular (we see over 1000 visits per day) and it is the second most popular OPC UA stack on GitHub, overall, and the most popular implemented in a modern programming language.
Erich Barnstedt	Is there any relationship between OPCF and Microsoft and the Open Manufacturing Platform?	Well, in relation to OPCF and Microsoft only, Microsoft is a board member of the OPC Foundation. OPCF is open and appreciate a closer relationship with OMP
Erich Barnstedt	Ok, to rephrase my question about the Open Manufacturing Platform: Are there any future plans from OPCF to collaborate with the OMP initiative?	Nothing that we can share at this stage.
Erich Barnstedt	Erin - can government agencies participate in your working group for the world ua info model?	Only though CESMII or OPCF membership.
Erich Barnstedt	For the purposes of UA Cloud library, would it be possible to borrow a similar structure used for WSDL for discovering web services?	Sure. We will evaluate several technologies.
Erich Barnstedt	Where would this information model library be hosted? How is it assured that no country can limit access to it?	This hasn't been decided yet, but anyone can host the library. There will probably be multiple instances and data will be replicated automatically among instances.
Erich Barnstedt	For Dashboard; Is Power BI the platform for Microsoft?	It's one of them, correct.
Erich Barnstedt	MS Power BI seems like more towards Business Analytics; What Microsoft is foreseeing for the Industrial Analytics and Dashboards?	PowerBI is expanding into the industrial analytics space. But, we also have the Time Series Insights app and, of course, homegrown dashboards, which most folks stand up in a few days.
Erich Barnstedt	Azure Cloud: Is there also a cloud connection planned for the OPC UA Subscriber? So that process values â€‹â€‹can be written directly to the PLC? Is this a future use case?	This exists today through the OPC Twin micro-service. It has a REST interface and a companion Edge service which establishes the actual UA session with the UA server.
Erich Barnstedt	Using a Client/Server connection or a PubSub connection (Part 14) between the Azure and the OPC UA server?	The OPC Twin uses a client/server connection to the UA server. The OPC Publisher uses a client/server connection to the UA server but then converts the data read into an OPC UA PubSub message and sends it to the cloud.
Erich Barnstedt	In the IIoT I have seen some kind of war between MQTT and OPC UA, OPC UA has any advantage over MQTT?	OPC UA *uses* MQTT, there is a protocol binding to it! :-)
Erich Barnstedt	How is the interaction between the OPC UA and MQTT there is any documentation related to this?	It's in part 14 of the spec.
Erich Barnstedt	InfoModelDatabase: Is the opc ua query service used for running queries against the database? Is the info model database a graph database? then maybe sparql, or a cypher based query language can used	Yes, the queries run against the database and most likely the database will be a graph database, but this is TBD by the joint working group.
Erich Barnstedt	Where can I find some further guidance on mapping of OPC-UA Node Classes and Service Request and Response objects to JSON?	The mapping is defined in part 6 of the UA spec.
Erich Barnstedt	Is that Info Model Database also going to be available on the AZURE Stack?	Yes, of course! :-)
Erich Barnstedt	In a decoupled cloud architecture where edge devices may be offline, what is the easiest quickest way to export information model and instances from opc ua servers for cloud discovery purposes and cloud browsing in times when edge devices are offline?	Check out the Command Line Interface for OPC Twin, it supports info model extraction: https://github.com/Azure/Industrial-IoT/blob/f17bbf256930eb31e1ba479fd0625eb449fc7954/components/opc-ua/src/Microsoft.Azure.IIoT.OpcUa.Testing/cli/Program.cs#L194
Erich Barnstedt	Is the current Microsoft OPC publisher based on OPC ua pub/sub or MQTT pub/sub ?	It supports both UA binary and JSON from V2.6 onwards.

Answerer	Question Asked	Answer Given
Cloud		
Erich Barnstedt	What are the components to convert a OPC local network to a OPC cloud network?	We use OPC Publisher to convert from OPC UA client/server to OPC UA PubSub. We use OPC Twin to access (browse/read/write/method call) local OPC UA servers from the cloud and give offline access to the OPC UA information model from the cloud.
Erich Barnstedt	So To convert a local OPC network to a Cloud based the only Need is a IOT platform Access? What are the Costs?	You need an edge gateway (hardware and OS), the rest running on the Edge is free. The accompanying cloud micro-services are also free, but you need to run them somewhere, e.g. you can use Azure App Service or Azure Kubernetes Services, for which there is a monthly charge - check out Azure pricing calculator. There is also a free SKU of IoT Hub, which sits in-between.
Erich Barnstedt	Does any of the Azure OPC modules include a global discovery server?	Yes, the OPC Vault
Erich Barnstedt	Did you consider leveraging Azure Digital Twins service for OPC UA twins?	Yes, although the mapping from OPC UA information models to Digital Twin Definition Language (DTDL) information models (which is what Azure Digital Twins service uses), is lossy. We may use the Azure Digital Twins service for factory/plant hierarchies, through, and combine it with the OPC Twin.
Erich Barnstedt	Did you consider leveraging Azure Cosmos DB service for OPC UA twins?	Yes, this is what we use.
Erich Barnstedt	Here is the question to the Gentleman from Beckhoff, which there is demo to collect the data to the cloud. My question is what does the OPC publisher connects to on the cloud. Does the OPC Publisher connects to IoTHub on the Azure ?	Yes, it does.
Erich Barnstedt	Is the Cloud gateway on the Azure the IoTHub or some software in the github I can get to build on the VM ?	It is IoT Hub.
Erich Barnstedt	Does OPC Twin connects to IoTHub ? Can I use it to connect the application on the VM ?	Yes, via IoT Hub methods.
Erich Barnstedt	How do you think about Global Discovery Server is not a bottle neck/ dependency in industrial automation domain? with respect to negative scenarios	You can have multiple GDS server and also daisy-chain them, so no, they are not a bottleneck.
Erich Barnstedt	Does OPC UA PubSub over JSON supports the Azure Digital Twins concept?	No, Azure Digital Twins is a separate service with a different data model, so it is not needed for our Industrial IoT asset models, which is OPC UA. We will use the Digital Twin for modelling the plant/factory hierarchy, i.e. which OPC UA assets belong to which production line, etc.
Erich Barnstedt	What is the line of sight of OPC being playing a role in AI and Machine Learning space?	You can leverage AI/ML with OPC UA PubSub telemetry today, especially now that Azure Time Series Insights V2 is generally available. This is easier than ever, as Spark and ML can access the Azure Data Lake used for long-term OPC UA PubSub telemetry storage directly.
Jim Luth	why should commercial tools like MQTT figure in the OPC specification? This is commercializing a product thru OPC which is against the principles of vendor neutral organization!	MQTT is not a commercial tool. MQTT is a standard from OASIS and is internationally recognized as ISO/IEC 20922:2016.
Jim Luth	In my opinion MQTT is propitiatory protocol developed (invented!) by some individuals and cannot become a standard protocol to be mentioned in a PubSub specification.	MQTT is a standard from OASIS and is internationally recognized as ISO/IEC 20922:2016.
Randy Armstrong	Is it possible to add decision make module with AI to enable autonomous systems to work with Big Data support?	This is possible but not something that affects the UA standard. Major cloud vendors have solutions that integrate OPC UA information into their analytics engines.

Field

Answerer	Question Asked	Answer Given
Field		
Alexander Ziegler	How to ensure time synchronization across different networks and devices in TSN?	OPC TSN will make use of the Mechanisms provided by IEEE for Time Synchronization. (e.g. IEEE802.1AS Rev). But, in general, OPC does not mandate any specific TimeSync Protocol.
Alexander Ziegler	How is this "Concept for OPC and QoS" is different from the ieee/iec 60802 specification?	OPC QoS is using the OPC specific parameters and aspects to express QoS requirements (PublishingInterval, PublishingOffset Min Max PubSub Payload Sizes). The TSN subgroup defines the mappings on the IEEE specific parameters.
Alexander Ziegler	A TSN Isochronous application may need to react to time synchronization events like the loss of the grandmaster or the offset exceeding a given threshold. Is this within the scope of the OPC UA over TSN interface?	In the UA Information Model, we do not (yet) model dedicated sync state machines. But, we provide TSN-Stream State machines, describing the lifecycle of each Stream. This STM describes the configuration state and the sync state of a stream. Applications could use this STM to be triggered in case of a sync-loss.
Alexander Ziegler	In OPC UA PubSub + TSN how the application QoS will be mapped to network QoS(IEEE)? in my opinion the application QoS does not have to worry about the network QoS?	"Application QoS" is the term we use for OPC specific QoS Parameters (e.g. Number of NetworkMessages per PublishingInterval). This OPC will be mapped to application agnostic network specific parameters.
Alexander Ziegler	When using TSN as the MAC protocol, which type of session layer protocol should be used? E.g. MQTT, UDP or just we can use the TSN CUC control layer?	OPC UA PubSub in combination with TSN is typically mapped on pure Ethernet. Mapping on UDP in combination with TSN is also possible.
Alexander Ziegler	Which are TSN standards used in OPC UA PubSub over TSN? (802.1AS-Rev, Qbv, Qbu, Qcc, ... etc.)	In the first place, as a Base UA WG, we do not restrict any TSN feature to be used for OPC over TSN, in general. But IEC/IEEE60802 will give us a set of TSN mechanisms we will preferably support.
Alexander Ziegler	Are there tools available to monitor latency when using Pub/Sub between two devices and track data loss?	As far as I know, the TSN Test labs (IIC and LNI4.0) have tools for monitoring latency.
Alexander Ziegler	Is there any limitation from hardware front (ex: memory, processing capability) to implement OPC UA over TSN ?	Depending on the quantity structure and the communication speed of your solution, TSN can be implemented on a broad spectrum of HW platforms. Of course, end-to-end latency depends on the real-time behaviour of all components in the data path, including NICs, Network-Stack, and OS. In comparison to the PubSub Stack, in general, TSN should not significantly increase memory requirements.
Alexander Ziegler	Does OPC UA TSN specification consider QoS and configuration of inter TSN domain communication?	Yes, there are discussions within the OPC FLC (TSN Expert WG --> lead by René Hummen) and in the IEC/IEEE6802 WG.
Alexander Ziegler	Is there an approximately timeline for the OPC UA TSN sub-group by when they are going to release their add ons to the PubSub spec?	We are aiming to release these together with the FLC Release Candidates, which are planned for Q4 2020.
Alexander Ziegler	Does TSN devices redistricts the interoperability with non-TSN devices ?	Yes, the TSN industrial Automation Profile (IEC/IEEE60802) allows non TSN and TSN devices to share one network infrastructure and so does OPC over TSN. For information exchange between two devices, both must use the same technology (TSN-Stream, classic Ethernet)
Alexander Ziegler	Do you use the classifications of OPC Application in Urgent, High, and Low only due to IPv4 or do you support IPv6 as well?	The mentioned labs only are examples. They are meant to work with IPv6 and IPv4. In Detail, we aim to have a mapping table containing the abstract QoS-Labels in one column and the dedicated DSCP Values / PCP values in the other columns. This table will be configurable with OPC UA means.
Jim Luth	Will FLC be new specification to be added or as part of existing OPC UA set of 22 Parts?	The FLC specifications will have a series of Part numbers higher than 22.
Jim Luth	Does TSN/QoS apply to OPC-UA Pub/Sub only? Or the same concerns in terms of (sending/receiving data with some deterministic behaviour) can be applied to client/server sessions?	The current focus is applying TSN to Pub/Sub, but using TSN in conjunction with OPC UA Client/Server will be addressed in the future.
Jim Luth	What is relationship between OPC UA TSN and IEEE/IEC 60802 joint group? ⏎	OPC has liaison status with IEEE/IEC 60802.
Jim Luth	Does OPC UA TSN only consider the FLC application (whether is it only mapped to Ethernet like 60802 or also potentially to support others like 5G) or also cover DetNet application.	5G and DetNet will be addressed as future topics, but most of the UA QoS constructs designed for TSN will be portable and reusable with 5G and DetNet.
Jim Luth	For the previous speaker (Schneider Electric) re:OPCTSN: What product is that being released to? is that the FDC280? or other(s)?	I am not allowed to provide product release plans on behalf of Schneider Electric.
Peter Lutz	Are there currently OPC UA protocols which are based on Time Sensitive Networking? ⏎	There is a protocol binding for PubSub which is doing a direct mapping of UADP (UA Binary) to Layer-2 (Ethernet and Ethernet TSN). This is important for the FLC use cases Controller-to-Controller and Controller-to-Device. However, FLC is also supporting UADP (UA Binary) transport via UDP/IP.
Peter Lutz	Which QoSs are planned to be setup by the FLC?	FLC uses different QoSs for the various requirements for FA and PA applications: cyclic data with deadline, cyclic data with bounded latency, "non real-time" data with guaranteed bandwidth, "non real-time" data without any specific QoS. These application-specific QoSs are then mapped to the underlying transport mechanism, e.g. transport over UDP/IP, transport via Direct Layer-2 mapping to TSN, in future: transport via 5G/WiFi-6.

Answerer	Question Asked	Answer Given
Field		
Peter Lutz	What are the advantages and benefits of OPC UA communication directly to field devices?	The advantage of a direct communication/access to a field device via OPC UA is that there is no need for any conversion of the information (semantic) and/or the protocol (transport). In addition, controllers today provide only limited access to information that originates from the devices connected to the controller. This is also limited because of performance limitations. Direct connectivity provides full access to the information with one consistent industrial communication standard and a common information modelling standard. Finally, using OPC UA as a common and consistent standard provides much higher connectivity flexibility.
Peter Lutz	Does "Field Level Communication" mean that OPC-UA is used for control as well or is it just limited to data exchange/acquisition?	Field Level Communication (FLC) also includes control functionality like cyclic transmission of process data (with deadline, with bounded latency), e.g. motion control. That's why FLC is also defining semantics for motion devices and functional safety in order to support the control of safety-critical applications.
Peter Lutz	Are there any MCU vendors involved to FLC development?	Yes. Intel is member of the FLC Steering Committee and involved in the FLC development. However, there are no plans to develop a specific chip for FLC. Instead all MCUs that comply with the respective IEEE standards (Ethernet, Ethernet TSN, and in future 5G, Wi-Fi-6, ...) can be used.
Peter Lutz	Is OPC-UA FLC (Field Level Communications) complementary to the FDT-Group standard or does it replace the need for what the FDT-Group has developed?	FLC is defining a basic concept for offline configuration. FDT is a complementary technology for device integration that builds upon the mechanisms that FLC specifies.
Peter Lutz	Will Fieldbuses be replaced with OPC UA communication gradually down the line?	OPC UA Field Level Communications Initiative is not targeting to create a fieldbus or fieldbus replacement. However, by extending OPC UA to include the requirements of applications in FA and PA, OPC UA becomes an attractive alternative to traditional fieldbuses, especially since it provides a complete and comprehensive communication solution (transport plus information modelling) to fully scale from sensor to cloud and vice versa. Furthermore, it includes features such as determinism, functional safety, etc. which will allow users thie option to replace today's fieldbuses mid- to long-term.
Peter Lutz	Does OPC bring back the status of the HART or FIELDBUS devices back to the SCADA?	OPC UA can be used to bring back the status of HART/FIELDBUS devices. For this you need a mapping from the HART/FIELDBUS protocol & status data into the OPC UA Information model. You typically use a gateway or a controller that acts as a "converter". With FLC you bring OPC UA directly to the field, so there will be no need to convert protocol/semantics. You will have direct access to the field device information, locally or remote, via OPC UA.
Peter Lutz	What is the difference between Ethernet APL and Single Pair Ethernet?	Single Pair Ethernet (SPE) is a physical layer standardized by IEEE that allows high-speed and long distance connections for Ethernet (twisted pair, 2-wire, data + power). APL (Advanced Physical Layer) is a variant of SPE with extensions for hazardous areas.
Peter Lutz	What is special about Ethernet APL apart from being the part of IEEE802.3? Does it also have anything to do with deterministic networking?	Ethernet APL is only related to the physical layer and therefore is independent of whether the communication is deterministic or not. Determinism is supported by Layer 2 protocols (IEEE 802.3+IEEE 802.1).
Peter Lutz	What is PA & FA in FLC architecture ?	FA stands for Factory Automation. PA for Process Automation. The Field Level Initiative (FLC) is developing a common architecture for field level communications in FA and PA.
Peter Lutz	Difference between Ethernet APL and TSN?	Ethernet APL (Advanced Physical Layer) is part of the Ethernet Physical Layer (IEEE802.3), whereas TSN (Time-Sensitive Networking) is a Layer 2 protocol (IEEE 802.1) that extends traditional Ethernet (IEEE802.3) with mechanisms to support deterministic data transmission. You can combine for example Ethernet TSN with Ethernet APL to have deterministic transmission over APL.
Peter Lutz	Who collaborative stakeholders for development of OPC UA for 5G?	The FLC Steering Committee is having close contact to several companies that are engaged in 5G as technology providers and adopters. Some of these companies are also member of the FLC Steering Committee. FLC first focuses on creating a solution for Ethernet and Ethernet TSN, but the solution is created in a way that it can easily be mapped to 5G, Wi-Fi 6 and whatever important standard is coming up in the future.
Peter Lutz	What types of controllers are considered by the FLC initiative?	Controller is a generic term that we use which stands for different types of control devices. So it can be a PLC, a DCS, a CNC, a Motion Controller, a Robot Controller and so on - depending on the application.
Peter Lutz	Can you explain how does the Ethernet TSN (directly layer 2 mapping) work further?	We are using the UADP protocol (UA binary) and map this directly (without any additional intermediate protocol, such as UDP, IP) to Layer 2. This is to achieve the best possible protocol efficiency so that short update rates (cycle times) can be achieved.
Peter Lutz	IEC61850 uses HSR or PRP, What is the recommended network redundancy protocol for the OPCUA?	OPC UA is relying on redundancy protocols defined in IEC/IEEE standards. Which specific redundancy protocol(s) is/are being used will be defined in the communication profiles that FLC specifies.

Answerer	Question Asked	Answer Given
Field		
Peter Lutz	In technology view slide, does that mean UDP-based mapping only applies to BEST Effort traffic, or to say there will no UDP based TSN traffic?	For FLC devices using TSN, the process data is directly mapped to Layer 2. There can be communication via UDP (or other protocols) in addition to that. But this option is then typically only used for non-real-time traffic.
Peter Lutz	It seems FLC is almost a new fieldbus, an Ethernet based fieldbus?	The intention of the FLC initiative is not to develop "yet another fieldbus". The approach is extending OPC UA to cover the various requirements for field level communication in FA & PA applications and to contribute to the convergence of today's heterogeneous landscape with the various fieldbus and Real-Time Ethernet solutions. In addition, the intention is to harmonize the information modelling for all the various automation components for interoperability and full scalability "from sensor to cloud".
Peter Lutz	Can "OPC UA over TSN" be used as a "Real Time Service Bus" in a manufacturing network?	Yes, the combination OPC UA+PubSub+TSN delivers deterministic transport and can, therefore, be used as a real-time communication system for the shop-floor.
Peter Lutz	What is the future of the current fieldbuses? Can they use the 802.3 MAC/PHY layer?	There are already many industrial protocols used in automation that rely on 802.3 MAC/PHY. Ethernet Single Pair Ethernet (SPE) and Ethernet Advanced Physical Layer (APL), as frontend to the physical layer, will further drive adoption of Ethernet-based protocols in FA and PA. Talking about the future, it is also important to mention Ethernet TSN (802.1) and the IEC/IEEE 60802 TSN Profile for Industrial Automation. The combination of TSN with the IEC/IEEE 60802 Profile support the network convergence so that IT & OT protocols can share a common network infrastructure.
Peter Lutz	Can you please explain / give an example of what motion functionality is?	The FLC Motion Working Group develops the so-called motion facet which is a common information model for motion devices, such as PLCs / motion controllers, standard drives / frequency converters, positioning drives, servo drives, motion encoders, motor starters, and power supplies. So it is about a common, manufacturing-independent semantic, supporting cross-vendor interoperability. This motion facet can be combined with other facets, e.g. safety if the device is for example a safe motion device.
Peter Lutz	What is the difference between local OT communication and C2C?	Local OT communication is already supported by OPC UA today using Client-Server over TCP. C2C (controller-to-controller) is covering additional requirements needed for the various use cases, including determinism and functional safety. C2C is making use of PubSub (with and without TSN, depending on the specific communication requirements).
Peter Lutz	What makes FLC features so different from a normal OPC UA Server for devices and controller ?	FLC provides optional solutions for all communication requirements in factory and process like deterministic data transfer, functional safety, and motion functionality
Peter Lutz	Are there already any concrete actions regarding WiFi 6 in the OPC F?	The Quality of Service (QoS) modelling approach that we use for FLC separates application-related QoS from the transport-related QoS. With this approach we can achieve an easy adaptation / mapping to Wi-Fi 6, 5G, DetNet, or whatever standard technology is coming up.
Peter Lutz	Can you tell a little bit more about how AutomationML is used in OPC FLC ?	We are currently discussing, in our FLC Offline Engineering WG, different options to combine OPC UA and AutomationML. One option is to have AML "linking back" to OPC UA. Another option is to have OPC UA types remodelled in AML. A final decision has not been taken, especially because we also want to have alignment with other groups (e.g. OPAF) that use OPC UA.
Peter Lutz	Are there any vendors involved in the development of OPC UA Safety stack code?	The OPC UA Safety stack is being developed by a service provider contracted by the FLC initiative of the OPC Foundation. Companies can contribute to the co-funding of this stack development which enables them to use code and the documentation for the development of commercial products. The code will also be provided as Open Source after approval by a notified body.
Peter Lutz	What mixture of traffic can be transmitted when combining C2D with TSN?	The FLC Initiative has given a clear commitment to the IEC/IEEE 60802 IA TSN profile. This means that OPC UA FLC applications can run over a converged network using different traffic types (cyclic with deadline, cyclic with bounded latency, traffic with bandwidth guarantee, ...). For this, FLC is defining the TSN control and data plane.
Peter Lutz	What use case is Isochronous TSN used in C2C?	There are different use cases for C2C that require deterministic communication, including tight synchronization. For example: two or more robots (each equipped with a robot controller) that interact with each other. Or a printing press that consists of machine modules each equipped with a controller and one supervisory control.
Peter Lutz	Which TSN configuration models are supported by the FLC standard?	FLC supports all TSN configuration models: distributed, centralized and a combination of both (hybrid).
Peter Lutz	Will this new specifications/feature be available as a part of Java, .net Standard & other OPC stack ?	We can expect that the features that are specified by the FLC initiative will become an integrated part of the different OPC UA communication stacks.

Answerer	Question Asked	Answer Given
Field		
Peter Lutz	What Automation Components are available today?	The FLC Initiative has not yet released any specifications. So this is work in progress. This is why there are no products available today, but will be available in future by all the major automation suppliers. In a first step, controllers (PLC, DCS, Motion Controllers) supporting controller-to-controller, and, in a second step, field devices (I/Os, sensors, servo drives, safety devices, vision systems, ...) that will then connect to the controllers via OPC UA.
Peter Lutz	Is it expected that device vendor will incorporate FLC in devices directly ?	Yes, device vendors will incorporate OPC UA plus the FLC extensions directly into the various devices (controllers and field devices). This will then provide a consistent and standardized communication via OPC UA between the various automation devices (controller, field devices) plus IIoT connectivity up to edge or cloud devices.
Peter Lutz	When do you plan to release version 1 and 2 of the FLC?	FLC specification Version 1 release (including C2C) is planned for later 2020 (November 2020 is our target date). Version 2 (extending to C2D) can be expected approx. 1 year later.
Peter Lutz	When are the FLC specifications going to be released ? There have not released yet I guess. Are they a part of 1.05 Release ?	FLC will create a bundle of specifications that are complementary to the existing OPC UA specifications. The first FLC specification release is expected later in 2020. Whether the release will be combined with the 1.05 Release has not yet been decided.
Peter Lutz	Regarding to the FLC, is the controller to controller part specification ready ?	The Controller to Controller use case is covered in the Specification Release Version 1. Drafts are expected to be available in 3rd quarter of 2020. A public release can be expected later this year (plan is November 2020).
Peter Lutz	when will the FLC standard be finished? A part of the V1.05?	There will be a bundle of FLC-related specifications that become core OPC UA specifications. Whether they become part of V1.05 has not yet been decided.
Peter Lutz	If it's possible to provide the planned schedule of each working group?	An overall roadmap is available but more detailed schedules are created and maintained by the different technical working groups.
Peter Lutz	What is motivation of having FLC. Can Standard OPC not cover requirements of domain specific communication? E.g. Automotive, Functional Safety, motion etc.	FLC is adding missing features to existing OPC UA to cover the different requirements for field-level communications in Process & Factory Automation (determinism, functional safety, motion facet, instrumentation facet, offline engineering, ...). These features are being specified by FLC and become part of core OPC UA.
Peter Lutz	Do you plan to publish a TSN sample or test bed implementation that could be used as a starting development point?	The Field Level Communications (FLC) Initiative has established a Prototyping Working Group with supporting companies that also generate and exchange sample code that can be used as a starting point for a development. We expect that sample code will also be created for mapping FLC to underlying TSN network access.
Peter Lutz	Will FLC be downward-compatible to non-TSN infrastructure, e.g. 10Mb/s network speeds?	FLC is specifying the transport and network access for both, TSN and non-TSN networks. This will also allow to integrate non-TSN FLC devices in a TSN network infrastructure and combine different network link speeds.
Peter Lutz	Is there any functionality to synchronize two OPC UA Servers ? For Example, there are 2 OPC UA Servers corresponding to 2 Sensors and we want the published data from both sensors to be synchronized, is there a concept to synchronize them within a few microseconds or less than a millisecond ?	This functionality is covered in the OPC UA PubSub Specification (Part 14) which is describing how to use Sampling Offsets, Publishing Offsets, Publishing Intervals, and timestamps. To have OPC UA Servers synchronized, you need a common time base. Ideally, the network already provides a synchronized global clock, so you can take this clock (e.g. IEEE 802.1AS) as a common time base for the Publishers and Consumers. In case you also want a deterministic transmission of the data from the producer to the consumer, you would need to use OPC UA in combination with TSN.
Peter Lutz	Are FLC devices always working with TSN?	TSN is one option, if deterministic communication is needed. In this case, the UA communication protocol (UADP) is directly mapped to Ethernet Layer 2. However, FLC devices can also work with "conventional" Ethernet (Non-TSN) using a mapping of UADP to UDP/IP. In the future, other transport standards will be supported, such as 5G or Wi-Fi 6.
Peter Lutz	What FLC is abbreviated for?	FLC stands for Field Level Communications (FLC). The FLC initiative was launched in November 2018 to extend OPC UA to the field level, covering all the use cases for industrial automation including process control and discrete manufacturing.
Peter Lutz	What interest do fieldbus vendors have to establish a new technology competing with their own solution in the field of C2D communication?	Today's situation is characterized by a very heterogenous environment of different Fieldbus and Real-Time Ethernet solutions. A new communication standard, based on OPC UA, which fully scales from Sensor to Cloud, and vice versa, provides a great opportunity to bring about standardization and convergence of industrial communication, especially with regard to IIoT and Industry 4.0 use cases - for the benefit of users and suppliers.
Peter Lutz	Can OPC and industrial protocols like HART, FF, PROFIBUS, MODBUS work together ?	OPC UA Gateways exist for obtaining data from other protocols, but if you are asking whether can they co-exist in the same network infrastructure, indeed, that is the goal of the Field Level Communication (FLC) initiative.

Brownfield

Answerer	Question Asked	Answer Given
Brownfield		
Sven Goldstein	For brown field integration using edge devices, couplers, etc. is companion specification import already supported?	In principal, yes; but, it depends on the technology/software that is being used on the edge device. Several vendors already allow importing companion specifications into their server implementations and other vendors are working on implementing this functionality.
Sven Goldstein	Can Beckhoff OPC UA connect directly to Bosch OPCON MES	Yes, if the Bosch OPCON MES system implements an OPC UA client/server with TCP encoding.
Sven Goldstein	Can I use the OPC UA to get all the process parameter from the OLD machine? or need to upgrade the Machine IPC ?	One of the key pieces, while retrofitting, is to know the old machine's automation system – especially to know its existing interfaces and how to configure and analyse them. So in principal, yes; but, it depends on the vendor. In the case of Beckhoff, the TwinCAT OPC UA add-on allows you to either make selected symbols available via Beckhoff ADS or all process values.
Sven Goldstein	About brownfield, are there any common methods as OPC UA to diagnose other protocol network?	There are general "diagnose protocols" available in OPC UA but some Fieldbuses have mappings to OPC UA, which might include protocol-specific diagnose capabilities. However, until they are useable in a retrofit / brownfield scenario, I would expect that it will take 1 generation of machines – so, I hardly believe that this is able to be installed during retrofit since "old" PLCs will hide the fieldbus in most cases.
Sven Goldstein	Do the whole I/O PLC need to install OPC UA Client at local too, same as at EDGE DEVICE?	Depending on the vendor, in most use cases, a vendor-specific protocol is used to communicate from the "old" PLC to the edge device. So, on the "old" PLC, the vendor-specific communication channel needs to be available by default, or switched on, like it could be done in Beckhoff's TwinCAT. Then there needs to be a specific UA Server, talking as a client, to the "old" PLC remotely from the Edge Device in order to harvest data and provide this via OPC-UA.
Sven Goldstein	are there standard OPC wrapper available for typical PLCs`e.g. Siemens etc.?	Yes, there are plenty of wrapper software technologies available on the market from different vendors, e.g. IBH Softech, Unified Automation, Matrikon, Softing, to name a few.

Collaboration / Modeling

Answerer	Question Asked	Answer Given
Collaboration / Modeling		
Alexander Allmendinger	Will OPC UA be widely adopted by SCADA manufacturers or IEC 101 and 104?	Are there any SCADA companies not supporting OPC UA today? The extended question would be, "do SCADA systems support the concept of OPC UA information models" - please check with your SCADA product vendor
Alexander Allmendinger	The OPC Scheduler with BACnet capability sounds interesting. any way to keep us updated on the progress?	Please keep in contact with the group and their chairperson - find information here: https://opcfoundation.org/markets-collaboration/bacnet/
Andreas Faath	Is the number of attendees at the VDMA webinars limited? Shouldn't be, but in a recent webinar it was. Unfortunately.	As the event is an online event, and we are using GoToWebinar, there is no limit. The Web Series will be held, in English, in late Fall. Please register starting September on our registration page at: opcua.vdma.org
Andreas Faath	Is there a way to know which VDMA specs are the most used by OPCUA users ? what are the metric to determine the popularity of VDMA specs ?	Since most OPC Companion Specifications are under development, and the released OPC UA Companion Specifications are still new to the market, there is no metric or knowledge as to which are most used. The VDMA is currently planning an internal study that will answer this question, among others. The results are expected at the end of the year on opcua.vdma.org.
Andreas Faath	VDMA - any plans to develop specifications for ionising devices/ sensors	For this specific field, there is no VDMA Group yet. If there is interest to start a group in any field, please get in contact with Andreas Faath directly. There are several ways in which VDMA might support that Group and share its Know-How in developing OPC UA Companion Specifications
Andreas Faath	Where can I find infoModel for time-series data, especially robots' performance data?	Time series can be enabled with Historical Access; this is described in OPC UA 10000-11. The evaluation and display must be performed by a suitable client. The Robotics working group is currently working on Part 2 of its specification. This will deal with machine states, which can also provide information about performance data. You can follow the developments in this topic on opcua.vdma.org.
Andreas Faath	How is OPC UA for machinery related to the 'Asset Administration Shell' (Verwaltungsschale) ?	As the VDMA is one of the initiating Organisations of the German Platform Industrie 4.0, the VDMA is well connected to any approaches in this field. For that, the results and approaches of the AAS is taken into account in the development of the OPC UA for Machinery. In addition, there is a group by VDMA, ZVEI, and OPC F discussing technical bidirectional mapping of AAS and OPC UA Companion Specifications: https://opcfoundation.org/markets-collaboration/i4aas/
Andreas Faath	Is there an companion specification to connect OPC UA to CNC machines?	Yes, there is a companion specification for CNC machines (OPC 40501-1 UA for Machine Tools), which is currently available as a release candidate: https://opcua.vdma.org/catalog-detail/-/catalog/3914 You can also download all VDMA related companion specs at OPCF: https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models
Andreas Faath	Where could be found further and deeper information about use cases of OPC-UA for Machine Vision?	https://opcua.vdma.org/en/viewer/-/v2article/render/27003893
Andreas Faath	What is Umati in few words? And which relationship has it with OPC UA? Why is umati necessary? Why is offering OPC UA compliance not enough to prove connectivity etc.	universal machine technology interface - is the marketing brand and machine builder and software vendor community to enable plug and play by agreeing on common implementation and configuration of the underlying servers and clients. umati is the end-user-facing brand to promote the use of OPC UA standards and to address the end user needs across the entire machine building community. The umati partners (machines and software vendors) want to ensure, that they, together, solve the connectivity challenges for the end user. The umati community will show functionality in show cases and promote OPC UA Companion Specifications by strong marketing.
Andreas Faath	What is the difference between OPC UA for machine Tool and umati ?	umati was never intended to be a specification. It started as universal machine tool interface community, which tended to market the underlying OPC 40501-1 Machine Tools specification. Now, umati is the universal machine technology interface and addresses the whole mechanical engineering industry.

Answerer	Question Asked	Answer Given
Collaboration / Modeling		
Andreas Faath	Where can I find the VDMA Companion Specifications?	https://opcua.vdma.org/en/companion-specifications#catalogs https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models
Jim Luth	Any SEMI std for OPC security?	There are currently no OPC UA companion standards for SEMI .
Jim Luth	How to meet CE and SEMICON std with OPC	There are currently no OPC UA companion standards for SEMI .
Matthias Damm	What is the difference between device and machinery ?	The OPC UA for Devices model is a generic base model and does not mention any specific model or device type. This is done by the device, branch, or use-case-specific working group. The joint PA-DIM working group, between OPCF and FieldComm Group, defines device class specific models. https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models/opc-ua-for-process-automation-devices/ Devices are typically sensors, actuators, or equipment from one manufacturer that is connected to a communication network which fulfill a specific task, e.g. a motor, a flow meter, or a bar-code reader. Machines are typically a composition of several devices with a controller and human machine interface used to produce something.
Matthias Damm	What is the use case of OPC UA for devices ?	Device identification, device configuration, and device management.
Matthias Damm	How EDD FDI package will play its role with OPC UA?	The transformation of EDDL to OPC UA / OPC UA for Devices is defined by Field Device Integration (FDI). EDDL experts were involved in the initial definition of OPC UA for Devices but there is no reference to EDDL in the OPC UA for Device specification. Also, in FDI, the device package is used to create the OPC UA information model. Generic OPC UA clients do not have any knowledge about EDD. Specific FDI clients will have knowledge about EDD.
Matthias Damm	Could you please clarify the difference between FDI and FDT?	FDI and FDT are two standards used for centralized device management using a configuration host for off-line configuration. Their main standardization effort is to standardize the package provided by the device vendor for making the device known to the configuration host. FDI has a more textual approach, where the device vendor provides the device description in EDDL format that describes device parameters, business logic, and user interface aspects in a text file (EDDL). The FDT approach is that the device vendor is providing a software component for the device that is loaded and executed in the configuration host system.
Matthias Damm	In the specification OPC DI, what represent BlockTypes ? Do they represent functionalities of a device ?	Objects, based on BlockType, are used if a system wants to expose function blocks executed in a device or controller. This is also the base type used for function blocks exposed from a PLCOpen (IEC 61131-3) PLC program.
Matthias Damm	What kind of devices? Flow meter, temperature? pressure? Motors?	The OPC UA for Devices model is a generic base model and does not mention any specific model or device type. This is done by the device, branch, or use-case-specific working group. The joint PA-DIM working group, between OPCF and FieldComm Group, defines device class specific models.
Matthias Damm	Have you heard of any attempts for a working group on using OPC-UA / spec for medical devices as they face the same problems as the industrial world?	We are aware of medical device vendors that use OPC UA but we do not know any standardization activities for medical devices. To start activities please contact Karl.deiretsbacher@opcfoundation.org

Answerer	Question Asked	Answer Given
Collaboration / Modeling		
Matthias Damm	Where would I go to learn more about robot program upload/download? Is the program in the spec, or just the interface (start, stop, enable, etc.)?	You can download the currently released robotics specification. But the first release does not cover all aspects that are planned. https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models/opc-unified-architecture-for-robotics/ The first release was mainly related to asset management. I think there was nothing about programs yet. I think the current spec development step includes the robot state machine and ways to influence the state.
Matthias Damm	The idea of abstract functionality is very nice. At the end, the functionality must be implemented. How can we map the functionality to the real controller.	When you'd like to get further information regarding the integration of OPC UA, please check out our OPC Foundation Website especially the Resource section where you'll find YouTube recordings (search for "TheOPCFoundation") with technical introductions to the technology. Then, when you want to dive even deeper in the technology, you can attend development training sessions, which are offered by our members, especially the well known SDK vendors.
Paul Hunkar	Where can I find the information about the testing process for MDIS?	Send a request for MDIS information to Compliance@opcfoundation.org and we will help you
Stefan Hoppe	How will this work with Open Field Message Bus (OpenFMB) - interoperability framework?	I am not aware of a working group regarding this topic, but you are welcome to initiate such a working group. Is there an organization that can work with the OPC Foundation on this topic? Please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Stefan Hoppe	Has OPC considered a working group to support medical imaging devices that incorporate DICOM?	I am not aware of a working group regarding this topic, but you are welcome to initiate such a working group. Is there an organization that can work with the OPC Foundation on this topic? Please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Stefan Hoppe	Are there any efforts to use OPC-UA as a technology within the automotive domain for ECU to ECU communication to replace protocols like SOME-IP or AVB with OPC-UA TSN?	There is no active working group working on this topic. But once the Field Level Initiative of the OPC Foundation has completed the deterministic mapping, ECU to ECU communication could be covered with the same technology. If you are from this industry and you are interested in using this technology, please send an email to peter.lutz@opcfoundation.org
Stefan Hoppe	Is there a collaboration between OPC and FDT/DTM Groups as majorly both Groups are based on Microsoft technologies (COM, .NET)?	Yes - there is a collaboration. Please navigate to https://opcfoundation.org/markets-collaboration/fdt/ and see the details and also find the contact partner.
Stefan Hoppe	How about monitoring devices relating to ambient and water based ionising radiation ?	I am not aware of a working group regarding this topic, but you are welcome to initiate such a working group. Is there an organization that can work with the OPC Foundation on this topic? Please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Stefan Hoppe	I see the word Companion Specifications on VDMA Website do these differ from the OPC UA Companion Specs ?	The content of companion specifications published on the VDMA website are the same as the ones being published by the OPC Foundation. Joint companion specs (OPCF and VDMA) are published with different number but reference to each other - most importantly, the content is 100% identical.
Stefan Hoppe	Does OPCUA have a group working on connection among semicon industry equipment?	There is a group from Singapore that signaled interest to start UA for SECS/GEM companion spec together with OPC Foundation. Also, VDMA is interested in working on this topic.
Stefan Hoppe	Similar to Umati and packml into OPC UA, is there any initiative on machine to machine communications for the semiconductor industry? thanks	A new initiative for "OPC UA for SECS/GEM" is in its preparation phase.

Answerer	Question Asked	Answer Given
Collaboration / Modeling		
Stefan Hoppe	Is there a working group about information modeling for Multi Agent systems (or AI in general)? A working group about information modeling for Multi Agent systems : There is an organization that can work with the OPC Foundation on this topic.	I am not aware of a working group regarding this topic, but you are welcome to initiate such a working group. Is there an organization that can work with the OPC Foundation on this topic? Please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Stefan Hoppe	I know VDMA or Euromap create some specification like Euromap 79. As OPC UA corporate member, how can I access this specification which is not formally released ?	In order to get access to a working group as corporate member, please contact the chairman of the desired working group. See the list of chairpersons here: https://opcfoundation.org/about/working-groups/joint-working-groups/
Stefan Hoppe	Is there any working group for Intelligent Buildings?	On behalf of building automation, there is a working group, together with BACnet International, which describes a gateway interface. Please check the OPC Foundation Website for more information regarding this activity.
Stefan Hoppe	Why OPC-UA is not present in the field of EV electrification? Why charger communication is not using OPC UA?	I am not aware of a working group regarding this topic, but you are welcome to initiate such a working group. Is there an organization that can work with the OPC Foundation on this topic? Please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Stefan Hoppe	Please, could explore a bit more the interfaces with The Open Group initiatives?	The OPC Foundation is heavily involved with OPAF and the O-PAS standard, this includes information models, communication, and certification. During tomorrow's session on certification, we will explain more about the certification aspects.
Stefan Hoppe	Is there a Companion Spec or data model for machine performance data (e.g., robot start/stop, operations)?	A complete list is available on the OPC Foundation website: https://opcfoundation.org/markets-collaboration/
Stefan Hoppe	Some CSs stand for similar markets: UMATI - MachineTool - Machinery - MTConnect... Will they be harmonize into one single CS ?	Because of the rapidly growing number of companion specifications, we've noticed the same difficulty and have initiated the Harmonization Working Group. This helps bring these groups into contact with each other (on the neutral ground of OPC Foundation). For example, umati will be re-using parts of MTConnect. But, sometimes, there will be an overlap, which cannot be harmonized due to different use-cases. In such cases the market will decide by adoption.
Stefan Hoppe	Is there any OPCUA companion Specification for IEC60870 ?	There is no active working group working on this topic. But once the Field Level Initiative of the OPC Foundation has completed the deterministic mapping, ECU to ECU communication could be covered with the same technology. If you are from this industry and you are interested in using this technology, please send an email to peter.lutz@opcfoundation.org
Stefan Hoppe	Is there a description available how AutomationML and OPC UA would work?	All information (e.g. descriptions, contacts, etc.) about collaborations are available on the landing page https://opcfoundation.org/markets-collaboration/
Stefan Hoppe	Are there any Companion specifications for devices used in chemical and pharmaceutical industry? Say for reactor control: circulators, stirrers, pumps, various probes?	Yes - there are multiple initiatives based on OPC UA for process and Pharma: PA-DIM, NOA, MTP, OPAF, - Pharma is also engaged in OPEN-SCS for track and trace. Please join the session on Thursday where we will share overviews about many of these initiatives. You'll also find all information in OPC Web under About->Working Groups. Joint Working groups: https://docs.google.com/spreadsheets/d/10SOpad6uu7JA5ZSpccVyqaqkyhYBiIXqNus28-1cJtU/edit#gid=1248333029
Stefan Hoppe	Where OPC-UA will fit or stand with CIP (Common Industrial Protocol)?	There is a joint working group with ODVA to map CIP to OPC UA, providing the openness and technology advantages of OPC UA to such solutions.
Stefan Hoppe	How does OPC UA Supplement / Interact with PA-DIM Standard from FieldComm Group... that is predominantly for Process Automation Domain ?	The PA-DIM Companion standard is a joint working group between FieldComm Group and OPC Foundation (equal partners on the same level). OPC Foundation is supporting PA-DIM and I am sure it will become more and more popular in Process Automation in the near future. OPCF has integrated PA-DIM validation into its CTT tools already.
Stefan Hoppe	Is there a companion spec for the Water Industry ?	Not one specifically for the water industry - but, pumps (and other components used in the water industry) are already modelled by the "pumps group" in cooperation with VDMA

Answerer	Question Asked	Answer Given
Collaboration / Modeling		
Stefan Hoppe	What Edition level of 61850 does OPC UA currently support?	Please navigate to the joint IEC61850 & OPCF landing page and find the contact of the chairperson to answer your question: https://opcfoundation.org/markets-collaboration/iec61850/
Stefan Hoppe	Is there any partnership with the SILA standard?	Currently there is no collaboration going on with the SILA standard. If you see this as an advantage for OPC UA please contact stefan.hoppe@opcfoundation.org or karl.deiretsbacher@opcfoundation.org
Wolfgang Mahnke	What's the advantage of OPC-UA for Machinery over the ISA-95 Companion Specification?	Both specifications address different levels of an automation system. ISA95 is on a rather high-level MES view, addressing equipment, personnel, etc. The Machinery specification is a base specification for machinery, which provides base functionality like identification of machines that can be used by machine vendors and other companion specifications (like Machine Tools). Here, the focus is on information provided by the machine. So both specs are doing different things.
Wolfgang Mahnke	What is the difference between OPC information model and other industry specific information models such as the Common Information Model (CIM) of electric utilities? i.e. in the electric utility domain, should the manufacturer use the OPC information model or the CIM or both?	OPC UA does not define one information model but provides information modelling capabilities, which are used by companion specifications to define domain-specific information models. This can be from scratch (e.g. robotics, machine visions) or mapping existing information models (e.g. IEC61131-3 for PLC programs, IEC61850). There has been work done to map CIM to OPC UA (see www.offis.de), you might want to check there for details (this might be the right publication for it: https://www.offis.de/offis/publikation/cimbat-automated-generation-of-cim-based-opc-ua-address-spaces.html). The advantage of OPC UA to a pure domain-specific information model is that OPC UA does provide a standardized, vendor-independent, secure communication infrastructure to exchange the information.
Wolfgang Mahnke	Which Development Tool are you using for the Electronic Description Model?	There are different tools available. I (Wolfgang) am using the UaModeler from Unified Automation.
Wolfgang Mahnke	I am interested in Information Modelling best practices. There was mention of a work group for that. Is there any documentation / guidelines for this?	The first version of the whitepaper is released and will soon be published on the website of the OPC Foundation (under resources->whitepaper). This is a living document, so we will continue working on it. If you want to join the subgroup of the harmonization working group, please send an email to: wolfgang.mahnke@unified-automation.com
Wolfgang Mahnke	How the electronic description of a model will be handled in case of a dynamic server	This is, in general, an implementation detail of the server. Models defined by companion specifications typically only define static nodes (types and entry points). Instances of the model might very well be dynamic and are often created dynamically in code.
Wolfgang Mahnke	What are possibilities included in companion specification for CNC? Can that be extended to brownfield CNC machines ?	The companion specs (same as OPC UA specs) are publicly available for download. For brownfield scenarios please join tomorrow's session "Brownfield"
Wolfgang Mahnke	The explanation about the stacklight: But then also the client software needs to be adapted individually for each customer.	Context: Stacklights is an easy way to provide a machine status as you would also see in the factory. Different customers demand different handling of the stacklight (when is what light doing what). When a client is just displaying the information, nothing needs to be done, just the user needs to interpret (as if he/she would see the stacklight on the machine). When a client wants to derive/calculate the overall machine status from a stacklight, it would need to be adapted to the handling of the customer. Note that the machinery working group is currently working on an overall machine status.
Wolfgang Mahnke	When we have a stacklight on the top of the machine, what we would like to know is in which status the machine is, not that a lamp is on or off. Is the interpretation of data addressing in the information model or does it it to solve apart ?	The idea of the stacklight was born because it was hard to agree on a general status of a machine. Often, customers define how a stacklight should behave, and depending on the configuration the machines stacklight will behave differently. Therefore, providing the exact stacklight behaviour is a helpful tool for customers, seeing electronically the same they see in front of the machine. However, how you visualize the information of the stacklight is up to the client implementation.

Answerer	Question Asked	Answer Given
General		
Stefan Hoppe	Is there a relationship / ongoing collaboration between OPC UA and OMG (providing the DDS pubsub with QoS features) ?	In April 2016, the OMG, together with OPCF, published a whitepaper document about a converter/mapping from the DDS world into/from the OPC UA world. See details here: https://opcfoundation.org/news/press-releases/opc-foundation-and-object-management-group-omg-announce-collaborative-strategy-for-the-opc-ua-and-dds-connectivity-standards/ The OPC Field level communications initiative is using underlaying TSN for QoS features for OPC UA.
Stefan Hoppe	Regarding pub-sub. Is there any plans to include DDS (data distribution service)?	In April 2016, the OMG, together with OPCF, published a whitepaper document about a converter/mapping from the DDS world into/from the OPC UA world. See details here: https://opcfoundation.org/news/press-releases/opc-foundation-and-object-management-group-omg-announce-collaborative-strategy-for-the-opc-ua-and-dds-connectivity-standards/ The OPC Field level communications initiative is using underlaying TSN for QoS features for OPC UA.
Stefan Hoppe	What benefits OPC UA offers in case of a homogenic Setup (HART based setup)? Or in other words, if I have a homogenic Setup why should I then implement OPC UA?	One important point is that, in your example, HART is not scaling to the cloud or MES/ERP - but OPC UA does. Sure, you will keep your HART devices at the field level, but you may use gateways (e.g. from Emerson) to bridge HART to OPC UA.
Stefan Hoppe	What is the difference between Open Platform Communications and OLE for process Control ?	The name of the technology has been changed to better reflect the definitions in the standard, so there is no difference. But, of course, there is a big difference between the Classic OPC and the state of the art technology OPC UA. If you are interested in those differences, please take a look at the available whitepapers and recordings.
Stefan Hoppe	In what way is OPC UA superior to other protocols such as MQTT etc.?	OPC UA is not a protocol but a whole framework including a protocol aspect (including rich information modelling, security concepts, and a lot more). Please watch the Getting Started session to get information on everything included in OPC UA. The bottom line is that interoperability is not being provided by MQTT, because the payload is not standardized and it needs to be agreed upon by both sides. Instead, OPC UA to MQTT mapping provides this interoperability because it standardizes this part.
Stefan Hoppe	Are there any plans to standardize companion specifications on ISO or IEC level ? If yes, in which technical committee ?	The companion specifications are already international standards and published through the OPC Foundation. Currently there is no work in progress to also release them as ISO or IEC standard.
Stefan Hoppe	How OPC-UA or any other future version of OPC will impact the existing industrial networks like ProfNet, Modbus, Ethernet IP, J1939 etc.? What is the vision OPC foundation has?	The vision of the OPC Foundation is to provide a uniformed solution, which scales from the sensor to the cloud, to provide interoperability between all vendors, all industries and markets, in all levels. This will not outdate existing solutions, but provide a path forward to break free from existing silos.
Stefan Hoppe	Is providing OPC UA SDKs from open-source including OPC PubSub mechanism?	The OPC Foundation can't deliver a list of open source projects because this continuously changes. In general, we noticed that some open source projects are supporting parts of PubSub.

Security

Answerer	Question Asked	Answer Given
Security		
Darek Kominek	Q1: when you talked about security threats, you said they are addressed by OPC-F. Does this mean an OPC Client or OPC server needs to be tested for them by vendor ? The test cases available on Reporting Portal, don't have direct test cases for this ? Q2:When we test an OPC client or OPC server for compliance & Interoperability, is it required that it is to be tested with Licensed products or testing with Simulation Server/clients is fine ?	Yes, all OPC applications should be tested following the security test cases defined by the OPC Foundation. All threats are published on the Profile Reporting Tool of the OPC Foundation. The granularity of testing your own product on behalf of its OPC UA integration is up to the vendor itself. The Compliance Working Group did decide that interoperability needs to be verified with a great variety of products including different programming languages and SDKs. As a result, during certification testing, a mixture of free demo and normal product versions are used to verify interoperability. But, if you want to have good test coverage, we highly recommend joining one of the IOP Workshops, which are regularly held by the OPC Foundation. In these events, vendors, who have OPC enabled products, are getting together and verifying the interoperability between applications. The attendees of these events usually include major automation and SDK vendors.
Darek Kominek	Regarding security, do you think only TPM? Not secure element?	TPM is only one example of a security element (for secure storage), additional security elements are also supported. The specification describes the use of a TMP or other secure storage. The vendor application/products can then choose the Secure element that they implement.
Darek Kominek	Is security mandatory for any OPC UA server or optional?	In OPC UA, we do differentiate servers and their capabilities by profiles. There are 4 full features profiles defined, which start from a Nano Device Server Profile (e.g. Sensors) up to Standard UA Servers (HMI/SCADA). While signing and encryption is not required for Nano Devices, it is required for bigger servers. But, for all servers, it is required to support Username/Password.
Darek Kominek	Does open source OPC Foundation code support CA signed certificate? In Client-Server and PubSub ?	Yes support for CAs is a basic part of the security infrastructure - the sample applications provided in the OPC Foundation GitHub do include it.
Randy Armstrong	Is the defense in depth (as a topology-based approach) still a valid approach in our current digital world where no specific fixed boarders exist between the enterprise, its customers, its ecosystem and the IoT devices? Especially in this circumstance, the IoT devices may be owned by the enterprise, its customers, or its partners. Is it better to use policy based approach instead?	IoT devices represent a significant security threat that is often forgotten in the hype. In many installations, directly connecting IoT devices would be a mistake and operators should be using layers of gateways and firewalls to protect them. So, defense in depth can never go away as a strategy.
Randy Armstrong	Are there intentions in the OPC Foundation to extend the security specification in a way to support other cryptographic public key algorithms beyond RSA, such as ECC?	The algorithms supported by OPC UA will expand over time. The ECC amendment is in RC and should be released by the fall of 2020.
Randy Armstrong	Is there already an outlook for the security policies for the post quantum age. Also for the pub/sub specification?	There are no specific initiatives for quantum computing at this time, however, the OPC UA Working Groups follow the recommendations on this issue provided by the major national agencies such as BSI (Germany) and NIST (US).
Randy Armstrong	What does built in security mean?	OPC UA was designed with security in mind; it was not an afterthought. Security is embedded in all aspects of OPC UA, from communication, application access, user access, roles, and authentication. Other protocols do not take this approach. They just assume the problem can be solved by the transport layer.
Randy Armstrong	Do you think about using blockchain could improve security?	Blockchain has a role in factories of the future; however, that role will likely be part of the supply chain as a means to track the authenticity of devices. It is not clear what benefits blockchain could offer that would improve communication between industrial devices.
Randy Armstrong	Could you please explain about security certificate management in the Device Provisioning model, is it the device manufacturer that should provide them or is it the owner?	There are multiple certificates with multiple authorities. The Device Manufacturer will have to provide an initial Device identity Certificate. The Owner can add additional identity Certificates.

Answerer	Question Asked	Answer Given
Security		
Randy Armstrong	Regarding security for TSN, if UADP is directly put on layer 2, how to do security?	In UA PubSub, security is applied to messages before they are passed to the network layer so there is no difference between security for UDP communication and Layer 2 communication.
Randy Armstrong	If implemented by manufacturer, could OPC UA cover the whole machine lifecycle: configuration, operation and maintenance, or would there be a need for other means of access, like shell/SSH, web console?	The Device Provision specification is designed to cover the complete lifecycle. It will be supplemented by information models that provide UA APIs for s/w and firmware updates.
Randy Armstrong	How can the UADP work when a Uni-directional Gateway (aka: Data Diode) is used between the Publisher PC and the Subscriber PC ? Seems like the Security Key Server needs bi-directional communications ...	The Key Server does not need to be a single endpoint. Two key servers -- which is a common way to generate keys -- could allow a publisher inside a data diode to send messages to a subscriber outside.
Randy Armstrong	Where can I find in V1.04 the concept "OPC UA via a cloud relay"?	These are only prototypes at this time. There is nothing publicly available.
Randy Armstrong	if 5 users want to connect and download data to same controller in parallel. is this possible? Since I saw serializing in a layer	You can create an information model that would provide some sort of locking mechanism to prevent users from downloading conflicting updates. The DI specification has examples: https://reference.opcfoundation.org/v104/DI/v102/docs/8.3.1/
Randy Armstrong	Would a suitable platform for the info model database be best?. For example, Github.com in order to also have a place with history/comments etc.?	The information model maintained by the OPC Foundation are in GitHub. See: https://github.com/OPCFoundation/UA-Nodeset/tree/v1.04 The online reference is generated from the specifications: https://reference.opcfoundation.org/v104/index.html A new initiative will develop a cloud-based repository for information models.
Randy Armstrong	We have an enterprise network into which we need to input data created by machines with PLCs attached and connected to a segregated network fabric and communicating through a DMZ. Is this the recommended architectural model or are people adding and additional layer of abstraction? If vendors are asking for remote connectivity to the machines, how can their access be limited to PLC and not allowed to penetrate the core network?	Any Device, accessible via the cloud, needs to be robust enough to deal with DoS attacks. PLCs will generally not meet this requirement and you would be better off with an aggregating server. That said, the issue is complex and depends on your detailed requirements.
Randy Armstrong	Calls like Read, Write and Browse could work without an explicit Session. Is this possible with the current OPC UA specification, or would this require an update?	This is a feature in 1.04 but a server has to support it. See: https://reference.opcfoundation.org/v104/Core/docs/Part4/6.3.1/
Randy Armstrong	Do you have studies to adopt blockchain as a future security tool?	Block chain is a topic that keeps coming up. The biggest potential will likely come from using it as a mechanism for distributing tickets used in Device Provisioning and the specification is designed to allow for that possibility, even if the details are out of scope.
Randy Armstrong	Is it possible to connect two devices by plug and play without any additional configuration when they are connected. How would the subscription process be established?	The UA specifications will have mechanisms to allow devices to be automatically installed and configured; however, establishing a subscription requires knowledge of the information exposed by a device. If the device is known to support a standard information model, such as PLCopen, then this could also be automated.
Uwe Steinkrauss	Can we integrate OPC UA with an external AAA authentication service like Activity Directory?	OPC UA supports different kinds of User Tokens to solve a lot of use cases like OAuth2. Such an OAuth2 token can be used when connecting two applications. But, the support for this is application specific, so please check the product descriptions of your desired products for the support of this use case.

Organization

Product & Implementation

Answerer	Question Asked	Answer Given
Organization		
Stefan Hoppe	Who is leading or representing OPC foundation in Africa (South Africa)?	I attended an Automation conference in Johannesburg, South Africa in 2019 - due to the COVID-19 situation, we have not finalized our discussions yet - please contact me directly.
Stefan Hoppe	Is there any semiconductor maker as OPC UA member?	There are multiple semiconductor vendors who are members of the OPC Foundation. Samsung, Intel, IBM, QUALCOMM, and NXP are some examples. Find an overview of members here: https://opcfoundation.org/members
Stefan Hoppe	Where/how to get more details about OPC F regional hub and its activities?	More information about regional hubs will be published on the OPC Foundation website shortly.
Stefan Hoppe	We can cooperate, I manage an Indonesia media	We are in contact with many different media partners around the world. But we are happy to hear that you are also interested in providing information about OPC UA to your readers. All of our press releases are released on our website https://opcfoundation.org/news/press-releases/ and you are very welcome to provide them to your readers. Also, subscribing to our Newsletter and following us on Twitter to retweet important content is very much appreciated.
Stefan Hoppe	What is the process to be a contributing member for OPC UA effort?	The steps for becoming a member are explained on the OPC Foundation website: https://opcfoundation.org/membership/become-a-member/step1 In case you have further questions, please send an email to: office@opcfoundation.org
Stefan Hoppe	Do I have to be a paying member of OPC Foundation to get my UA certified? ⬜	In order to certify your product as being compliant with OPC UA, you only need to be a Logo Member of the OPC Foundation, which is free of charge.
Stefan Hoppe	Can sample code be used in commercial product? Is there license restriction for IP protection?	Sample code can be used in commercial products but, it depends on 1) quality and 2) IP . The sample code from OPC Foundation is available as full IPR, for OPC members, and GPLv2, for non-OPC members
Stefan Hoppe	From a legal point of view: a OPC Stack/tool found on github can be used in a industrial Environment ?	The technology OPC UA is open for everybody to use. The rules for the usage of solutions, provided on GitHub, are defined by those projects. For the project hosted by the OPC Foundation, the code is available as dual license: OPC members have full rights - non-members have GPLv2 rights. But in general, using code in an industrial environment is not only about legal issues, but also about quality and support, which should be determined before using a solution.

Answerer	Question Asked	Answer Given
Product & implementations & offerings		
Stefan Hoppe	When it comes to cloud based communication with OPC UA products, Why only considered Microsoft Azure ? Why not AWS(Amazon Web Service) ?	OPC UA scales from sensor to cloud, bi-directionally and with end-to-end security. The OPC UA technology is not only implemented in the cloud by Microsoft, but, also, by other cloud providers. For example, Google Cloud was recently announced as new member of the OPC Foundation. We name Microsoft-Azure because they were first on market and they have lot of applications within the market. More information about OPC UA in the cloud was provided on Wednesday at this virtual conference, please check the recordings available on YouTube.
Stefan Hoppe	What are your thoughts on the open62541? Why is it not mentioned?	There are lot of OPC UA open source projects available - you'll find them by doing web-searches. Since the OPC Foundation can't show bias to any particular one of them, we don't make any statements regarding these projects or start comparing open source solutions.
Stefan Hoppe	Hello all, are there any PHP OPC LIBRARY? TO USE this PUB / SUB?	When looking for an OPC UA product (a specific solution), it always makes sense to search the OPC Foundation product catalog for such keywords (e.g. PHP). Doing so, will show the product of one of the SDK vendors being actively involved in the UA Working Group for a long time: https://opcfoundation.org/products/view/net-and-com-client-toolkit-quickopc
Stefan Hoppe	Some manufacturers claim to support OPC UA in their products, but provide no details and no information models. Are information models supposed to be open, or is it at the discretion of the manufacturer?	The specifications (human readable) and also the nodesetfile (machine readable) are both openly available without any fee - no paid OPC membership is required. So the information about information models are openly available and no secret. But it is up to the vendor to which extent the supported OPC UA features are being listed.
Stefan Hoppe	Do you have a university program to get skd tools ?	If "you" means the OPC Foundation, I have to say "no", since the OPC Foundation does not provide SDK's. However, the toolkit vendors (like Unified Automation, MatrikonOPC or ProSys OPC) might have programs - so please contact them directly. But the OPC Foundation has a "OPC UAcademic" where we provide slide decks and practical courses for universities to use.
Stefan Hoppe	Some manufacturers claim to support OPC UA in their products, but provide no details and no information models. Are information models supposed to be open, or is it at the discretion of the manufacturer?	The specifications (human readable) and also the nodesetfile (machine readable) are both openly available without any fee - no paid OPC membership is required. So the information about information models are openly available and no secret. But it is up to the vendor to which extent the supported OPC UA features are being listed.
Stefan Hoppe	is there a data base or webpage where I could confirm if a vendor is comply with the Companion Spec? ⯑	The OPC Foundation maintains a list of products that have passed certification: https://opcfoundation.org/certified-products
Stefan Hoppe	Does OPC Foundation offer a list of gateway manufacturers?	Member companies can provide information regarding their products in the OPC Foundation product catalog. This also provides the opportunity to search for specific products, e.g. like gateways. The product catalog is available here: https://opcfoundation.org/products
Stefan Hoppe	Is there are cloudservice available, that is hosting an opc ua server with information models, for example euromap models?	Many SDK vendors have demo applications and tools which allow a user to load information models from an existing NodeSet file into their demo applications. With this you could create your own server, having such an information model exposed. If you are looking for a server which is not only exposing the information model but also integrating behavior defined in the specification, please get in contact with the chairperson of the desired companion specification group. A full list of the companion specifications and the contact persons is available here: https://opcfoundation.org/about/working-groups/joint-working-groups/
Stefan Hoppe	Does SAP support OPC-UA? Meaning can I transfer data to/from SAP using OPC-UA companion spec?	SAP has provided an OPC UA client since 2008 for their MES solution. Since 2015 they also provide an OPC UA Server. Both their client and their server are able to process complex data and also method calls. Please do get in contact with SAP to get more details on their OPC UA products.
Stefan Hoppe	Are there free of charge OPC UA clients for test available	Nearly every toolkit vendor provides a free-of-charge client ... see companies Unified Automation, Softing, ProsysOPC, MatrikonOPC, Inductive Automation, and more
Stefan Hoppe	Can OPC UA servers be implemented on a Cloud level ? Are there any implemented examples ?	Yes - you can implement UA Server and UA client everywhere - in sensors.. through all layers up to cloud. There are products like a OPC UA Server in the cloud pushing the received data from UA client into a database. So, the UA server is not polling the data, instead, OPC UA clients are pushing energy measurement data into the ua-server. On Wednesday we announced a new OPC Foundation initiative for OPC UA in the cloud
Stefan Hoppe	Does SAP support OPC-UA? Meaning can I transfer data to/from SAP using OPC-UA companion spec?	SAP has provided an OPC UA client since 2008 for their MES solution. Since 2015 they also provide an OPC UA Server. Both their client and their server are able to process complex data and also method calls. Please do get in contact with SAP to get more details on their OPC UA products.

Answerer	Question Asked	Answer Given
Academic		
Alexander Allmendinger	I am a University Lecturer. If I want to teach this, where do I start for practical hands-on learning? Thank you.	The OPC Foundation does have its OPC UAcademics program which helps lecturers with slides for the technology as well as some ideas for practical lessons. If you are interested in this kind of content, please get directly in contact with us via mail.

Answerer	Question Asked	Answer Given
General		
Stefan Hoppe	So the difference between today and the future field devices are that: Today field devices send binary data to the controller (not easy to understand by humans and other devices) and in the future these devices will have embedded OPC UA servers on them and send standardized and more understandable data between controllers and other devices?	Correct - except this is already available for years and nothing "new". The first product on market was at the begining of 2007 -- an OPC UA server integrated into a Beckhoff embedded PLC (so 13 years ago..). Meanwhile, all serious PLC vendors have OPC UA integrated into their devices. Binary data is the only way to guarantee high speed data transfer over wire (old historical ways have been XML over HTTP.. perhaps "easier" to read, but inefficient. The key for the future is standardizing the information and interfaces inside a domain (all robots to provide the same data, interfaces with the same meanings) - Today, OPCF has 52+ initiatives standardizing this information. Looking into future, it's all about harmonization of data and interfaces, so all robots and all injection moulding machines and all pumps in process automation will have the same generic interfaces like power management, asset management, firmware updates, etc.
Stefan Hoppe	What are the key differences between IPC-CFX and OPC -UA?	There are many differences between those technologies but, to highlight some important ones, let's use Security and Transport. While OPC UA has been architectured to be independent from the transport layer and, therefore, allows the technology to be adopted in almost any use-case, IPC-CFX decided to use AMQP only. Speaking of security, security has been a key requirement for OPC UA, which resulted in an extensive security concept, including Transport, Application, and User level security; this is why OPC UA can be considered secure for any chosen transport. IPC-CFX does not include its own security concepts, but uses the ones defined for the transport itself.
Stefan Hoppe	Is there information available about usage of OPC? (e.g. number of installed servers and/or clients? number of tags?) Is this available for standards (OPC Classic Data Access, OPC Classic HDA, OPC UA, etc.) Is this available for the information models/companion specifications (how many installations/active users are utilizing which companion specifications?) and is this available for industries (which industries are actively using OPC UA and the companion specifications)?	Unfortunately, we do not have reliable information on such numbers. Please remember, nobody need to be a member of OPC Foundation or pay a runtime fee to OPCF to run OPC UA (and that's great!) Mesurement for adaption of companion spec is sometimes easier as theses groups have deep insights into their market: e.g. the umati group started to standardize machines tools 2 years ago. Within one year, they presented a huge demonstration at the EMO2019 trade show: This demo included 120 machine tools, from 70 vendors, from 10 countries around the world -- all viewable on the same dashboard -- all providing data via OPC UA enabled information models.
Stefan Hoppe	Currently, what's the OPC-UA market penetration compared to OPC-DA?	Since both OPC technologies are open, to be integrated and used without sending notes to the OPC Foundation, we don't have these statistics. But, since the adoption of OPC UA has a very high pace in many markets, we can safely assume that OPC UA hase already outpaced OPC Classic.
Stefan Hoppe	Are there any other modelling tools than the UaModeller from Unified Automation?	Many SDK vendors have Modelling Tools available for use with their SDKs. But, device vendors have also developed Modelling Tools to allow an easy mapping of device variables with OPC UA information models. One example of this would be SiOME of Siemens: https://support.industry.siemens.com/cs/document/109755133/siemens-opc-ua-modeling-editor-(siome)-for-implementing-opc-ua-companion-specifications?dti=0&lc=en-WW.
Stefan Hoppe	Where can I find the CS Template Generator Tool? In OPCF Resources?	The CS template (and other resources) can be found at: https://opcfoundation.org/about/working-groups/joint-working-groups/

Answerer	Question Asked	Answer Given
Information		
Alexander Allmendinger	Do you have a multimedia library database that can shows really, step by step, in simple way, a OPC-UA implementation/use for new interested parties ? (especially in the OT field mainly)	Please navigate to OPCF media library: https://opcfoundation.org/resources/multimedia/ There, you will find explanations based on different levels of learning and on different topics (OPC UA technology, security, companion specs, etc.)