Open
Source
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Lab eG

Building an Open Source OPC UA/TSN Ecosystem

Project phase #2: “Security & Certification”

Letter of Intent, 2nd edition

(V6, January 31, 2019)

This Letter of Intent is signed between

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hereafter Open Source OPC UA/TSN Ecosystem participant or simply as participant

and the

Open Source Automation Development Lab (OSADL) eG, 69120 Heidelberg, Germany

hereafter OSADL.

Introduction

A rapidly growing number of companies and organizations is fostering the development of a standardized method for real-time network communication based on OPC UA as platform protocol and TSN as link layer. This broad interest has led to the open62541 project (https://open62541.org/). It was founded to provide an OPC UA implementation that can be freely copied and distributed under the Mozilla 2.0 Open Source license.

The next important evolution of OPC UA after having implemented the base technology were the Publish/Subscribe (PubSub) components to allow for a connection-less and, thus, resource saving communication suitable for the low-power devices that are expected to be used throughout the future Internet of Things. For this purpose, Fraunhofer IOSB in Karlsruhe, Germany, the India based system integrator Kalycito In-

fotech and the Open Source Automation Development Lab (OSADL) founded a joint interest working group. This group launched a community project and distributed a call for contributions in form of a Letter of Intent of project phase #1. This Letter of Intent was signed by the working group participants

a) Heidelberger Druckmaschinen AG
b) Kontron AG
c) Linutronix GmbH
d) Pilz GmbH & Co. KG
e) SICK AG
f) TQ-Systems GmbH

which resulted in sufficient funding to execute the project in addition to the contributions made by Fraunhofer IOSB, Kalycito Infotech and OSADL. The support of all participants is gratefully acknowledged.

The software that was created during the project phase #1 from January to March 2018 was merged gradually into the existing open62541 repository in April 2018. The implemented features are

a) brokerless OPC UA PubSub via IP multicast and the binary message encoding format according to the draft of part 14 of the OPC UA specification,
b) integration of the publisher in a regular OPC UA server with additional real-time interrupting,
c) implementation of the subscribers as standalone software, and
d) a first step towards secure client/server communication.

The above software can be accessed via Github at the URL https://github.com/open62541/open62541/.

Letter of Intent of project phase #2 of the community project

After the successful completion of the above described project phase #1, there is now an OPC UA implementation available that can be used by industry with rich generic features ready to be combined with a proprietary technology and application to deliver tangible outcomes to customers. While a very affordable total cost of ownership is a key differentiator of this joint initiative, the market demands feature completeness, stability and certified adherence to the standards. It, thus, is the aim of this Letter of Intent of project phase #2 to launch a subsequent community project that fills the gap to use the existing OPC UA PubSub over TSN software components in real products and release them to the industry and automation market.

Operative partner companies of the project

1. Fraunhofer IOSB

Fraunhofer IOSB (Institute of Optronics, System Technologies and Image Exploitation) is based in Karlsruhe, Germany, and its department of Information Management and Production Control has a long history of successfully developing and researching solutions for the design, operation and maintenance of information, control and test systems. As one of these activities they provide the maintainership of the open62541

project and have largely been contributing to the project. Fraunhofer IOSB is member of the OPC Foundation.

2. Kalycito Infotech
Kalycito Infotech helps leading machine builders and automation OEMs globally with consulting and integration services. The company very early identified the potential behind the open62541 stack, PubSub and TSN as candidates to become a universal communication standard from field level to the cloud. Kalycito triggered the initial move and funded Fraunhofer IOSB to develop the PubSub parts under an Open Source license suitable for industry and to build an ecosystem around it. Kalycito is member of the OPC Foundation and of the newly constituted Field Level Communication (FLC) Steering Committee of the OPC Foundation.

3. Open Source Automation Development Lab (OSADL)
The Open Source Automation Development Lab (OSADL) is a registered cooperative and based in Heidelberg, Germany. It was founded in 2005 to provide support for industry when using Open Source software in products. OSADL provides services that are requested by its members, but makes many of them available not only to its members, but also to the entire community. These services comprise software development, hardware and software quality assessment as well as legal support, project management and consulting.

Open Source policy

Fraunhofer IOSB, Kalycito Infotech and OSADL wholeheartedly agree and adhere to the principles of a community funded Open Source software development:

- Release early, release often
- Manage everything as transparently as possible
- Do not retain any community funded material for proprietary purposes

Licensing

Every software component that is intended to be copied and distributed to customers is and will be licensed under the Mozilla 2.0 (MPL-2.0) license. This license is an internationally accepted Open Source license with a so-called weak copyleft. In consequence, the mandatory unrestricted rights of an Open Source license to use, analyze, modify and convey the software are granted. In turn, the license obligation must be fulfilled to inform the recipients of a binary delivery “how they can obtain a copy of” the source code “by reasonable means in a timely manner, at a charge no more than the cost of distribution to the recipient”. Software that merely links to such MPL-2.0 licensed software can be licensed under the license of choice of the owner.

Example code and similar material that is not intended to be copied and distributed to end customers is and will be licensed under the Creative Commons Zero v1.0 Universal (CC0-1.0) that does not impose any license obligations.

Confidentiality and IP Issues

Any contribution or communication will be kept confidential on request of the Open Source OPC UA/TSN Ecosystem participants with the only exception that the developed software will be made publicly available under Open Source licenses as outlined above.

Project funding and management

The project will be managed in form of a so-called OSADL mixed-funded project, i.e. a subgroup of OSADL members and non-members is formed who contribute to the project. Project management, software development and testing provided by OSADL is partly funded by the project and partly provided from the regular annual OSADL budget while employing existing office and laboratory infrastructure. Deciding which components to develop with which priority is done according to a poll among the participants while taking into consideration the number of votes of their contribution level (see below).

Contribution levels

There are the following four contribution levels that participants may select from:

Contribution level	Contribution amount (euros)	
	OSADL Member	Not OSADL member
Silver	5,000.00	7,500.00
Gold	10,000.00	15,000.00
Platinum	20,000.00	30,000.00
Diamond*	60,000.00	90,000.00

*The Diamond contribution level can be taken only once.

Benefits of the various contribution levels

Participants enjoy a number of benefits that are graded according to the contribution level as given in the following table:

Contribution level	Logo display and listed as contributor	Certification assistance	Number of votes when deciding on the development priority of components
Silver	yes	no	1
Gold	yes	yes	2
Platinum	yes	yes	4
Diamond	yes	yes	8

Overall budget, schedule and deliverables

The overall budget to provide all below given software components is estimated to amount to 180,000 euros. However, the project will already be launched when and if a minimum threshold of 60,000 euros will have been reached. If this also is the final budget, some of the below given software components will only have a partial or even

rudimentary implementation. The more budget will be available, the more software components will be developed and reach production quality. It, therefore, is expected that project participants will join in after the start of the project which will be possible during its entire duration. The project is intended to start latest on February 26, 2019 and will last as long as project funds are available.

Budget distribution

The obtained budget will be distributed among the three project partners in the following way:

Fraunhofer IOSB: OPC UA software development	45 %
Kalycito Infotech: Software development, assistance for certification	45 %
OSADL: Project management, software development and testing	10 %

Delivery

In contrast to conventional software development projects where the software normally is directly delivered to the project managers and/or collaborating parties, the entire software that will be developed throughout this project will be uploaded to the repository of the open62541 project. Whenever a significant portion of the developed software is upgraded or added or a relevant milestone is reached the project participants will be notified immediately.

Software components planned to be developed and delivered

1. Configuration of TSN endpoints

Part 14 of the OPC UA Specification defines how the configuration of OPC UA PubSub should be represented in the information model of the related OPC UA server. The PubSub configuration may be modified interactively using this information model. The TSN working group of the OPC Foundation currently is designing a similar mechanism to represent the TSN configuration in the OPC UA information model. In parallel to this standardization process, the proposed project will continuously implement the standardization drafts using representative network hardware and submit the practical experience when doing so as feedback to the standardization working group.

2. Generic interface to TSN

The tests that were conducted so far as part of the phase #1 of the OSADL OPC UA/TSN project as well as evaluations at the OSADL QA Farm were primarily based on the Intel I210 network adapter and on the Linux network driver that was provided by the manufacturer. In order to facilitate the use of future TSN network adapters and on-chip network hardware by other manufacturers, a suitable framework is needed. This framework also should provide a uniform configuration interface. To provide such a framework is the goal of the “AccessTSN” project the results of which are planned to be continuously integrated into the proposed project.

3. Improvement of the real-time capabilities

In comparison to conventional field bus protocols, OPC UA PubSub does not provide any general definitions of the size of the payload. The user may define it in so-called data sets. The implementation of OPC UA PubSub for open62541 makes it possible –

as requested by the standard – to dynamically adapt the data sets at runtime. In addition, the source of the values of the PubSub messages is an OPC UA information model. Therefore, the OPC UA read service must be used to obtain these values which usually requires more overhead that merely resolving a previously known storage address and may lead to a longer latency in a real-time setup.

In phase #1 of the project, a number of technical workarounds were used to obtain the required real-time capabilities without jeopardizing the flexibility of the setup as requested by the standard. A number of accesses to the OPC UA information model and plausibility checks of initially unknown message lengths remained inevitable. The code, therefore, still needs to be slimmed down in order to be usable in endpoint devices with very limited resources. In addition, a separate PubSub “fast path” will be provided where the configuration of the data sets will be done at compile time and the related source code that already contains the network payload will be generated to be able to execute with a minimum of processor cycles.

4. Certification assistance
Many customers and projects require that the software products are certified to ensure interoperability. Participants of this phase #2 of the OSADL OPC UA/TSN project will receive support to certify their products. This certification will be conducted at the test laboratories of the OPC Foundation and follow the recommendations of the newly founded Field Level Communications (FLC) Steering Committee of the OPC Foundation.

5. Adding a security layer
Deploying OPC UA/TSN for sensitive communication may require end-to-end encryption of the communication. Different from the OPC UA client/server protocol encryption, OPC UA PubSub for many-to-many communication relies on symmetric encryption and a so-called Security Key Service to distribute encryption keys for PubSub via the client/server protocol. This mechanism will be provided for this purpose that enables all involved peers to verify the integrity and to trust the source of the data.

Agreed intent

By signing this Letter of Intent, the Open Source OPC UA/TSN Ecosystem participant agrees to accept the above mentioned conditions. When the funding threshold is reached, this Letter of Intent will be converted automatically into a final consortium agreement that will be concluded without requiring further contractual agreement. Withdrawal from the final consortium agreement without any penalty shall be limited to the following condition

a) at least 60,000 euros estimated minimum budget is not committed by February 26, 2019.

In any other case, a penalty for breach of contract in the amount of 20 % of the accepted contribution to the budget shall be applicable.

Place of jurisdiction

This Letter of Intent will be governed by the laws of Germany, except for its conflicts of laws principles. The place of jurisdiction for all disputes arising from or in connection with this Letter of Intent shall be Mannheim, Germany.

References

The performance of the existing Open Source OPC UA PubSub over TSN software developed so far is demonstrated in two whitepapers entitled “Open Source OPC UA PubSub over TSN for Realtime Industrial Communication” and “Real-time Open Source Solution for Industrial Communication Using OPC UA PubSub over TSN”. They are available on request.

Signatures

Open Source OPC UA/TSN Ecosystem participant:

Contribution level: ☐ **Diamond** *(90.000 euros, OSADL members 60.000 euros)*

☐ **Platinum** *(30.000 euros, OSADL members 20.000 euros)*

☐ **Gold** *(15.000 euros, OSADL members 10.000 euros)*

☐ **Silver** *(7.500 euros, OSADL members 5.000 euros)*

Name of the company:

Location:

Date:

Name of the signatory or signatories:

Signature(s):

Open Source Automation Development Lab (OSADL) eG:

Location:

Date:

General Manager or OSADL Director:

Signature: