

thin-edge.io for PLCnext Controls

PLCnext App

Revision: 0.8.1 (20221214)
Date: 11/14/2022
Publisher: IMA Engineering
PHOENIX CONTACT Deutschland GmbH
Flachsmarkstraße 8
D-32825 Blomberg

Table of Contents

1	Introduction	3
1.1	Version Information	3
1.2	Supported PLCnext Controls	3
1.3	Third Party	3
2	Installation	4
3	Sending data to the cloud	6
3.1	Send measurements	6
3.2	Send alarms	6
3.3	Send events	6
4	Deploy PLCnext Engineer Project	8
4.1	Create a Software Package	8
4.2	Add Software to Software Repository	9
5	Access PLCnext log files	11
6	Known Issues	12
6.1	Version 0.8.1 (20221214)	12
7	Support	13
8	Appendix A - Third Party Licenses	14
8.1	Mosquitto MQTT Broker	14
8.1.1	EPL-v20	14
8.1.2	EDL-v10	18
8.2	cJSON	19
8.3	libwebsockets	19
8.3.1	MIT License applied to libwebsockets	20
8.3.2	BSD2	20
8.3.3	BSD3	21
8.3.4	ZLIB	21
8.3.5	APACHE2	22
8.3.6	CC0	22

1 Introduction

This PLCnext App installs the *thin-edge.io* (<https://thin-edge.io/>) agent. This provides an easy connection to the Cumulocity IoT cloud platform. Optional Cumulocity modules as (PLCnext) Software Update, Restart Commands and Log File Retrieval are supported as well. Thin-edge.io is an open edge framework to connect your device to the cloud. Refer to the *thin-edge.io* documentation (<https://thin-edge.github.io/thin-edge.io/html/>) on how to use the client.

1.1 Version Information

The version notation includes the thin-edge.io version and the build information as build date of the PLCnext App container. The build information will be updated if the PLCnext App container is patched. Example: `0.8.1 (20221214)` where `0.8.1` is the thin-edge.io version and `20221214` is the build date of the app.

1.2 Supported PLCnext Controls

This PLCnext App supports the following PLCnext Controls from firmware `2022.0 LTS`:

Name	Item number
AXC F 2152	2404267
AXC F 3152	1069208
EPC 1502	1185416
EPC 1522	1185423
RFC 4072S	1051328

1.3 Third Party

This PLCnext App deploys the following third party software packages on the PLCnext Control. See *Appendix A - Third Party Licenses* for the respective software licenses.

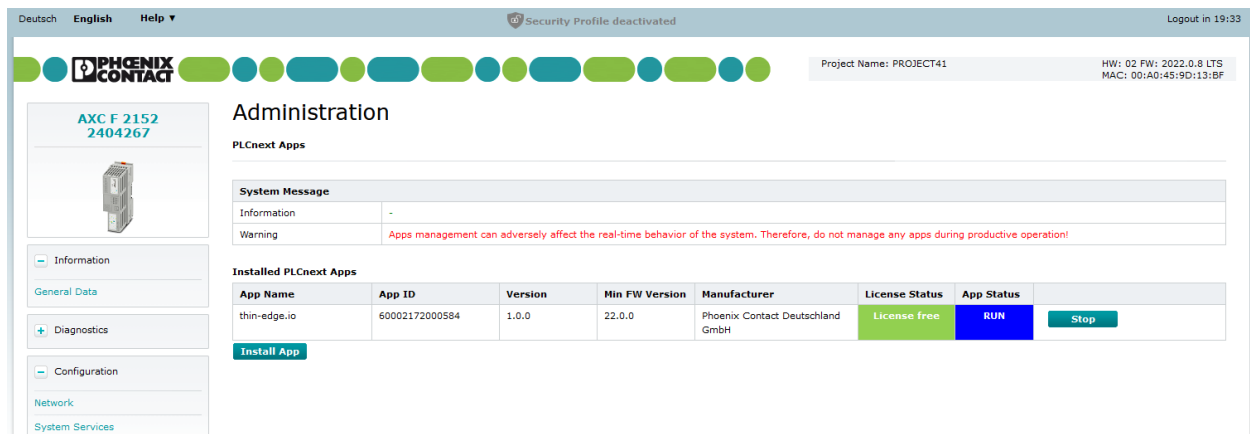
Name	Version	URL
thin-edge.io	0.8.1	https://thin-edge.io
Mosquitto	2.0.11	https://mosquitto.org/
cJSON	1.7.15	https://github.com/DaveGamble/cJSON
libwebsockets	4.3.2	https://libwebsockets.org/

2 Installation

Download the PLCnext App from the PLCnext App Store. Download link:
<https://www.plcnextstore.com/eu/app/1712>



Open the Web Based Management of the controller and install the PLCnext App.



App Name	App ID	Version	Min FW Version	Manufacturer	License Status	App Status
thin-edge.io	60002172000584	1.0.0	22.0.0	Phoenix Contact Deutschland GmbH	License free	RUN Stop

Before starting the PLCnext App, it is possible to configure basic settings for the thin-edge.io agent. These settings can be provided with the file `tedge_default` in the directory `/opt/plcnext/` on the device. With this file it is possible to set the `tedge` config parameters on installation.



Use Unix style linefeed (LF) for newlines not Windows Style (CRLF).

Here is an example for the config file. Notice the double underscores as separator characters:

```
TEDGE__C8Y__URL='mytenant.eu-latest.cumulocity.com'
TEDGE__DEVICE__ID='TestDevice65'
TEDGE__CERT__UPLOAD__C8Y__USER='my.username@domain.tld'
TEDGE__CERT__UPLOAD__C8Y__PASSWORD='SuperSecretPassword'
```

For security reasons, the access rights have to be set for the configuration file. Only the owner must be allowed to read or write the file.

```
-rw----- 1 admin plcnext 224 Dec 6 09:07 /opt/plcnext/tedge_default
```

Connect via ssh to the PLCnext control as `admin` user and use the command `chmod 600 /opt/plcnext/tedge_default` to set the access rights of the file. You can also use for example WinSCP on Windows hosts to set the access rights.

After the configuration file is uploaded to the device and the access rights are set, the PLCnext App can be started by clicking the start button in the Web Based Management. The initial start of the App will take some time. The App will install the thin-edge.io agent into the system. It creates a test certificate with the provided device ID and will upload the certificate to the Cumulocity tenant, if a valid username and password is provided. The provided user has to have set the proper role in Cumulocity to upload device certificates to the tenant. The installer will also connect the device to the Cumulocity cloud automatically. After the start of the PLCnext App has finished the device should be present in the Cumulocity tenant.

STATUS	NAME	MODELL	SERIENNUMMER	GRUPPE	REGISTRIERUNGSDATUM	SYSTEM-ID	IMEI	ALARME
	TestDevice65	AXC F 2152	1355498684		06.12.2022, 07:39:42	95724		

If you don't want to create a test certificate set `WITH_TEST_CERTIFICATE` to `0`. If you don't want to upload the test certificate to the Cumulocity cloud set `WITH_CERTIFICATE_UPLOAD` to `0`. If you don't want to auto connect to Cumulocity cloud after installation set `WITH_CONNECT_C8Y` to `0`.

Here is an example `tedge_default` file that does not create test certificates on installation:

```
TEDGE_C8Y_URL='mytenant.eu-latest.cumulocity.com'
TEDGE_DEVICE_ID='TestDevice65'
WITH_TEST_CERTIFICATE=0
WITH_CONNECT_C8Y=0
```

This PLCnext App bundles the Mosquitto MQTT Broker. The thin-edge.io agent relies on an available mosquitto installation for cloud connection. If there is already a running mosquitto service installed on the system, set `WITH_MOSQUITTO` to `0` in the `tedge_default` configuration file. This prevents installing the included Mosquitto MQTT Broker during App installation. Keep in mind to patch the existing Mosquitto configuration file to include the tedge mqtt configuration directory.

Here is an example `tedge_default` file that does not install Mosquitto MQTT Broker during installation:

```
TEDGE_C8Y_URL='mytenant.eu-latest.cumulocity.com'
TEDGE_DEVICE_ID='TestDevice65'
WITH_MOSQUITTO=0
WITH_CONNECT_C8Y=0
```

3 Sending data to the cloud

With the thin-edge.io client it is possible to send measurements, alarms and events to the cloud. The data has to be sent to the local MQTT broker as JSON encoded messages. Refer to the *thin-edge.io documentation* (<https://thin-edge.github.io/thin-edge.io/html/tutorials/send-thin-edge-data.html>) for more information on sending data to the cloud.

3.1 Send measurements

Publish topic: `tedge/measurements`

Payload example:

```
{
  "time": "2020-10-15T05:30:47+00:00",
  "temperature": 25,
  "current": {
    "L1": 9.5,
    "L2": 10.3,
    "L3": 8.8
  },
  "pressure": 98
}
```

3.2 Send alarms

Publish topic: `tedge/alarms/<severity>/<alarm-type>`

Severity:

- critical
- major
- minor
- warning

Alarm-type: The custom alarm type of the alarm.

The message must be sent with QoS 1 and MQTT retained flag.

Example:

Topic: `tedge/alarms/critical/temperature_high`

Payload:

```
{
  "text": "Temperature is very high",
  "time": "2021-01-01T05:30:45+00:00"
}
```

3.3 Send events

Topic: `tedge/events/<event-type>`

Event-type: The custom event type.

Example:

Topic: `tedge/events/login_event`

Payload:

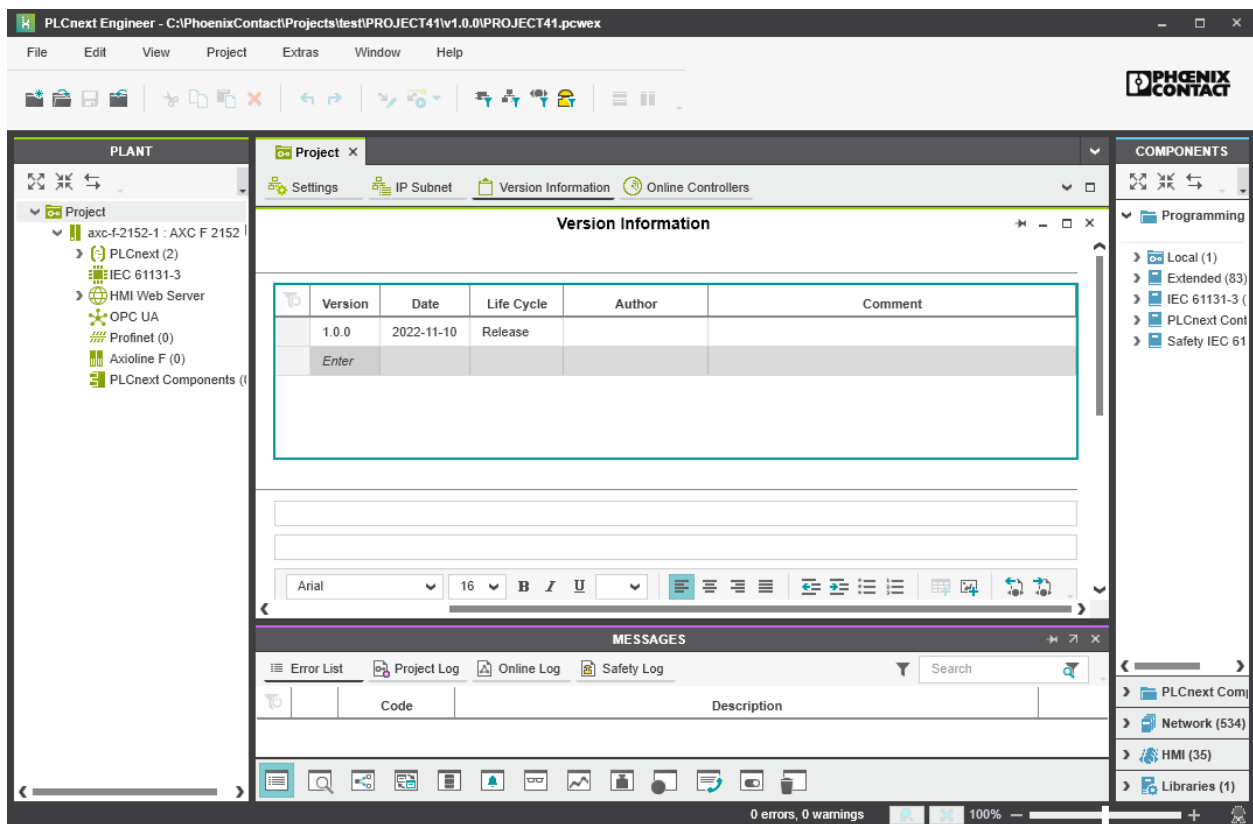
```
{  
  "text": "A user just logged in",  
  "time": "2021-01-01T05:30:45+00:00"  
}
```

4 Deploy PLCnext Engineer Project

The thin-edge.io PLCnext App comes with a custom Software Management Plugin for handling PLCnext Engineer Projects on the device. With this `plcnextengineer` Plugin it is possible to deploy and update the PLCnext Engineer Project from the cloud. For details on Software Management Plugins refer the documentation of the *thin-edge.io* (<https://thin-edge.github.io/thin-edge.io/html/tutorials/software-management.html>) client.

4.1 Create a Software Package

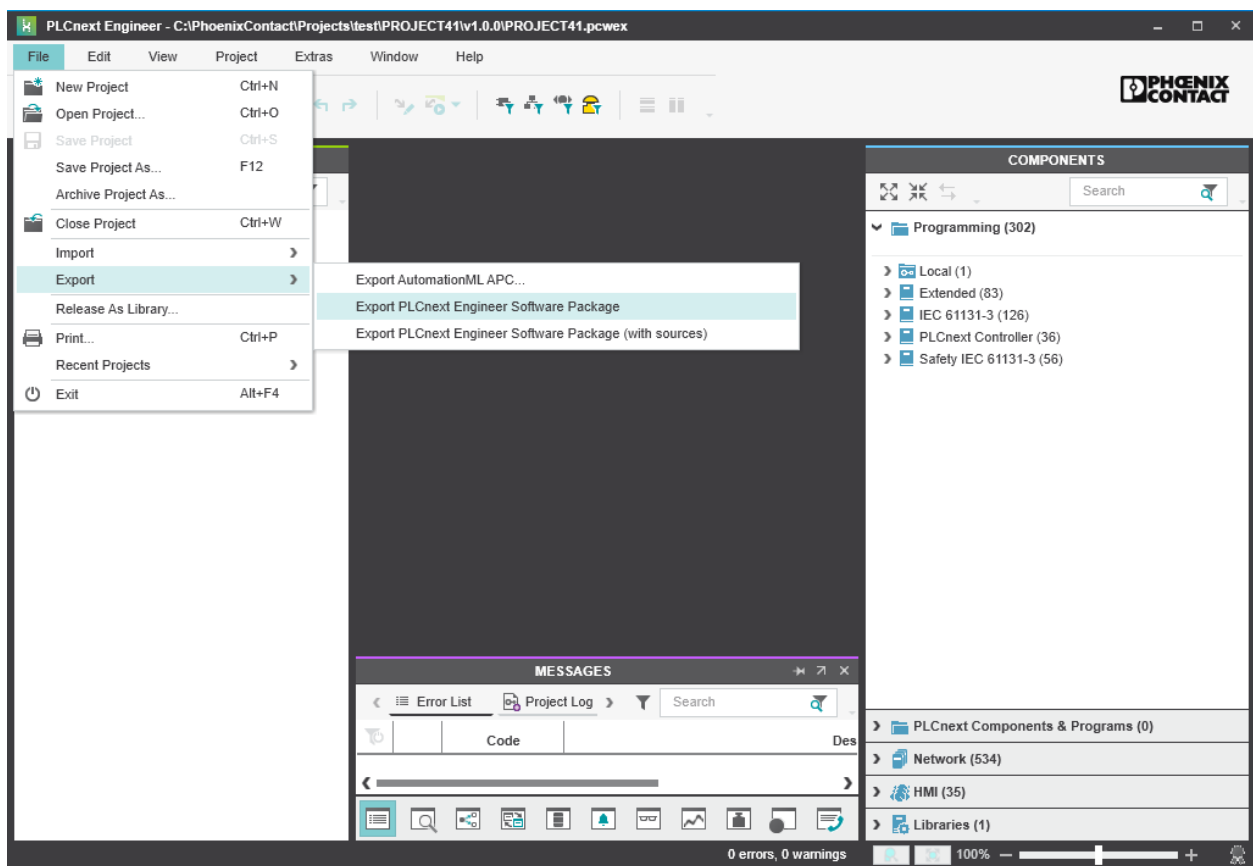
To include the PLCnext project into the Software Repository from Cumulocity the PLCnext Engineer project has to be released as Software Package. In PLCnext Engineer open the *Project* Node in the Plant Area and insert the release Information in the *Version Information* tab of the project.



Next export the project as *Software Package*. Click in the top menu under “*File / Export / Export PLCnext Engineer Software Package*”.

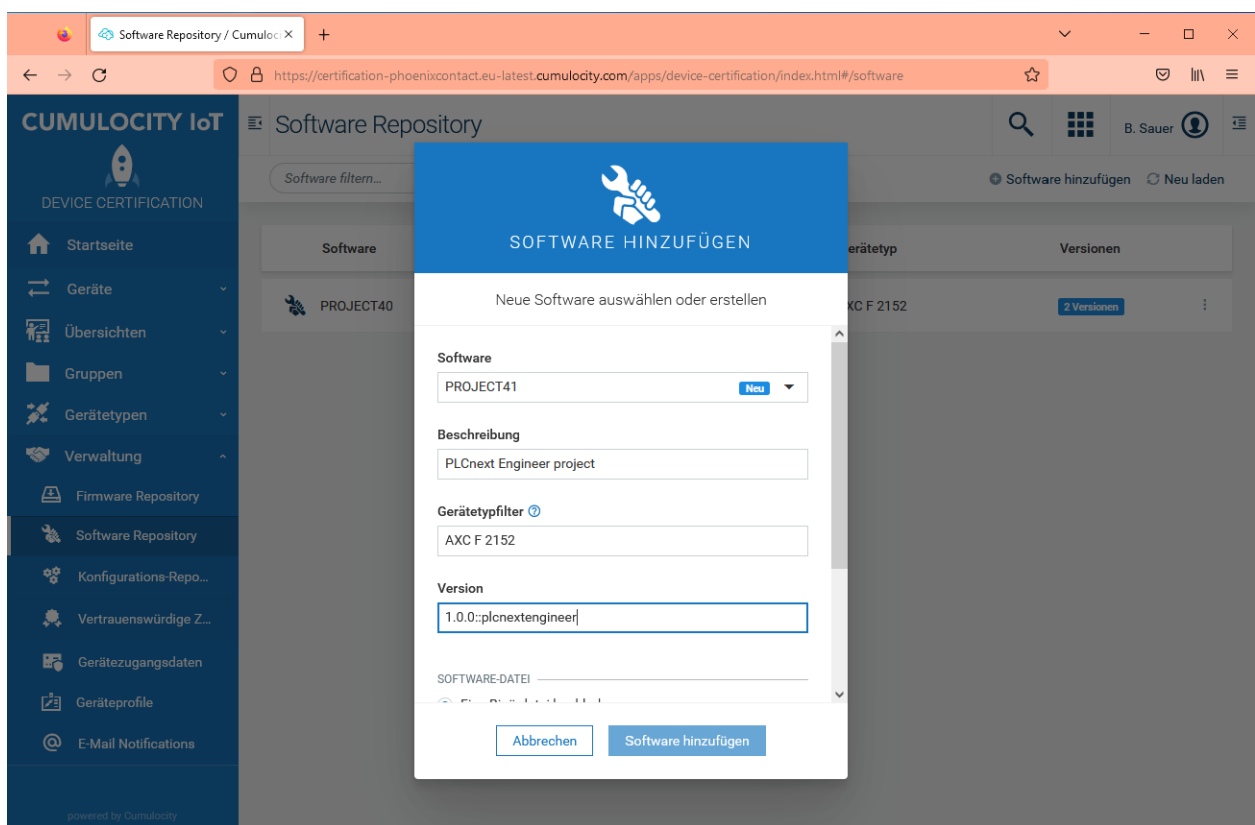


The feature *Export PLCnext Engineer Software Package* ist available from PLCnext Engineer Version 2022.9.



4.2 Add Software to Software Repository

The PLCnext Engineer Software Package can now be imported as a Software to the Cumulocity Software Repository. When you add the software to the Software Repository the plugin type name `plcnnextengineer` must be provided to the Software. Keep in mind in the current Cumulocity version (1015.0.218) the plugin type name is provided as suffix to the software version in the form of `::plugin_type_name` e.g. `1.0.0::plcnnextengineer`



5 Access PLCnext log files

The thin-edge.io client allows to access the PLCnext logs of the device. Per default there are two PLCnext specific logs types configured for access:

- `plcnext-output` This is the main PLCnext logfile. On the device it can be found at `/opt/plcnext/logs/Output.log`.
- `plcnext-plcnextapp` This is the PLCnext App logfile. On the device it can be found at `/opt/plcnext/logs/plcnextapp.log`.

For more information of the available logfiles of the PLCnext device refer to the *PLCnext Info Center* (<https://www.plcnext.help>) .

6 Known Issues

6.1 Version 0.8.1 (20221214)

- Log file retrieval with `c8y_log_plugin` fails to work after some time *GitHub #1688* (<https://github.com/thin-edge/thin-edge.io/issues/1688>)
- Client error 401 Unauthorized while requesting configuration file via `c8y_configuration_plugin` *GitHub #1562* (<https://github.com/thin-edge/thin-edge.io/issues/1562>)

7 Support

For technical support please contact your local PHOENIX CONTACT agency at <https://www.phoenixcontact.com>

Owner:

PHOENIX CONTACT Deutschland GmbH
Business Unit Industry Management & Automation (IMA)
IMA Engineering
Flachmarktstraße 8
D-32825 Blomberg

8 Appendix A - Third Party Licenses

This software makes use of third party packages with different licenses. The software packages and the licenses are listed in this chapter.

8.1 Mosquitto MQTT Broker

This project is dual licensed under the Eclipse Public License 2.0 and the Eclipse Distribution License 1.0 as described in the epl-v20 and edl-v10 files.

8.1.1 EPL-v20

Eclipse Public License - v 2.0

THE ACCOMPANYING PROGRAM IS PROVIDED UNDER THE TERMS OF THIS ECLIPSE PUBLIC LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION OR DISTRIBUTION OF THE PROGRAM CONSTITUTES RECIPIENT'S ACCEPTANCE OF THIS AGREEMENT.

1. DEFINITIONS

"Contribution" means:

a) in the case of the initial Contributor, the initial content Distributed under this Agreement, and

b) in the case of each subsequent Contributor:
 i) changes to the Program, and
 ii) additions to the Program;

where such changes and/or additions to the Program originate from and are Distributed by that particular Contributor. A Contribution "originates" from a Contributor if it was added to the Program by such Contributor itself or anyone acting on such Contributor's behalf. Contributions do not include changes or additions to the Program that are not Modified Works.

"Contributor" means any person or entity that Distributes the Program.

"Licensed Patents" mean patent claims licensable by a Contributor which are necessarily infringed by the use or sale of its Contribution alone or when combined with the Program.

"Program" means the Contributions Distributed in accordance with this Agreement.

"Recipient" means anyone who receives the Program under this Agreement or any Secondary License (as applicable), including Contributors.

"Derivative Works" shall mean any work, whether in Source Code or other form, that is based on (or derived from) the Program and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship.

"Modified Works" shall mean any work in Source Code or other form that results from an addition to, deletion from, or modification of the contents of the Program, including, for purposes of clarity any new file in Source Code form that contains any contents of the Program. Modified Works shall not include works that contain only declarations, interfaces, types, classes, structures, or files of the Program solely

in each case in order to link to, bind by name, or subclass the Program or Modified Works thereof.

"Distribute" means the acts of a) distributing or b) making available in any manner that enables the transfer of a copy.

"Source Code" means the form of a Program preferred for making modifications, including but not limited to software source code, documentation source, and configuration files.

"Secondary License" means either the GNU General Public License, Version 2.0, or any later versions of that license, including any exceptions or additional permissions as identified by the initial Contributor.

2. GRANT OF RIGHTS

a) Subject to the terms of this Agreement, each Contributor hereby grants Recipient a non-exclusive, worldwide, royalty-free copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, Distribute and sublicense the Contribution of such Contributor, if any, and such Derivative Works.

b) Subject to the terms of this Agreement, each Contributor hereby grants Recipient a non-exclusive, worldwide, royalty-free patent license under Licensed Patents to make, use, sell, offer to sell, import and otherwise transfer the Contribution of such Contributor, if any, in Source Code or other form. This patent license shall apply to the combination of the Contribution and the Program if, at the time the Contribution is added by the Contributor, such addition of the Contribution causes such combination to be covered by the Licensed Patents. The patent license shall not apply to any other combinations which include the Contribution. No hardware per se is licensed hereunder.

c) Recipient understands that although each Contributor grants the licenses to its Contributions set forth herein, no assurances are provided by any Contributor that the Program does not infringe the patent or other intellectual property rights of any other entity. Each Contributor disclaims any liability to Recipient for claims brought by any other entity based on infringement of intellectual property rights or otherwise. As a condition to exercising the rights and licenses granted hereunder, each Recipient hereby assumes sole responsibility to secure any other intellectual property rights needed, if any. For example, if a third party patent license is required to allow Recipient to Distribute the Program, it is Recipient's responsibility to acquire that license before distributing the Program.

d) Each Contributor represents that to its knowledge it has sufficient copyright rights in its Contribution, if any, to grant the copyright license set forth in this Agreement.

e) Notwithstanding the terms of any Secondary License, no Contributor makes additional grants to any Recipient (other than those set forth in this Agreement) as a result of such Recipient's receipt of the Program under the terms of a Secondary License (if permitted under the terms of Section 3).

3. REQUIREMENTS

3.1 If a Contributor Distributes the Program in any form, then:

a) the Program must also be made available as Source Code, in accordance with section 3.2, and the Contributor must accompany the Program with a statement that the Source Code for the Program is available under this Agreement, and informs Recipients how to obtain it in a reasonable manner on or through a medium customarily used for software exchange; and

b) the Contributor may Distribute the Program under a license different than this Agreement, provided that such license:

i) effectively disclaims on behalf of all other Contributors all warranties and conditions, express and implied, including warranties or conditions of title and non-infringement, and implied warranties or conditions of merchantability and fitness for a particular purpose;

ii) effectively excludes on behalf of all other Contributors all liability for damages, including direct, indirect, special, incidental and consequential damages, such as lost profits;

iii) does not attempt to limit or alter the recipients' rights in the Source Code under section 3.2; and

iv) requires any subsequent distribution of the Program by any party to be under a license that satisfies the requirements of this section 3.

3.2 When the Program is Distributed as Source Code:

a) it must be made available under this Agreement, or if the Program (i) is combined with other material in a separate file or files made available under a Secondary License, and (ii) the initial Contributor attached to the Source Code the notice described in Exhibit A of this Agreement, then the Program may be made available under the terms of such Secondary Licenses, and

b) a copy of this Agreement must be included with each copy of the Program.

3.3 Contributors may not remove or alter any copyright, patent, trademark, attribution notices, disclaimers of warranty, or limitations of liability ("notices") contained within the Program from any copy of the Program which they Distribute, provided that Contributors may add their own appropriate notices.

4. COMMERCIAL DISTRIBUTION

Commercial distributors of software may accept certain responsibilities with respect to end users, business partners and the like. While this license is intended to facilitate the commercial use of the Program, the Contributor who includes the Program in a commercial product offering should do so in a manner which does not create potential liability for other Contributors. Therefore, if a Contributor includes the Program in a commercial product offering, such Contributor ("Commercial Contributor") hereby agrees to defend and indemnify every other Contributor ("Indemnified Contributor") against any losses, damages and costs (collectively "Losses") arising from claims, lawsuits and other legal actions brought by a third party against the Indemnified Contributor to the extent caused by the acts or omissions of such Commercial Contributor in connection with its distribution of the Program in a commercial product offering. The obligations in this section do not apply to any claims or Losses relating to any actual or alleged intellectual property infringement. In order to qualify, an Indemnified Contributor must: a) promptly notify the Commercial Contributor in

writing of such claim, and b) allow the Commercial Contributor to control, and cooperate with the Commercial Contributor in, the defense and any related settlement negotiations. The Indemnified Contributor may participate in any such claim at its own expense.

For example, a Contributor might include the Program in a commercial product offering, Product X. That Contributor is then a Commercial Contributor. If that Commercial Contributor then makes performance claims, or offers warranties related to Product X, those performance claims and warranties are such Commercial Contributor's responsibility alone. Under this section, the Commercial Contributor would have to defend claims against the other Contributors related to those performance claims and warranties, and if a court requires any other Contributor to pay any damages as a result, the Commercial Contributor must pay those damages.

5. NO WARRANTY

EXCEPT AS EXPRESSLY SET FORTH IN THIS AGREEMENT, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, THE PROGRAM IS PROVIDED ON AN "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, EITHER EXPRESS OR IMPLIED INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OR CONDITIONS OF TITLE, NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Each Recipient is solely responsible for determining the appropriateness of using and distributing the Program and assumes all risks associated with its exercise of rights under this Agreement, including but not limited to the risks and costs of program errors, compliance with applicable laws, damage to or loss of data, programs or equipment, and unavailability or interruption of operations.

6. DISCLAIMER OF LIABILITY

EXCEPT AS EXPRESSLY SET FORTH IN THIS AGREEMENT, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, NEITHER RECIPIENT NOR ANY CONTRIBUTORS SHALL HAVE ANY LIABILITY FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOST PROFITS), HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OR DISTRIBUTION OF THE PROGRAM OR THE EXERCISE OF ANY RIGHTS GRANTED HEREUNDER, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

7. GENERAL

If any provision of this Agreement is invalid or unenforceable under applicable law, it shall not affect the validity or enforceability of the remainder of the terms of this Agreement, and without further action by the parties hereto, such provision shall be reformed to the minimum extent necessary to make such provision valid and enforceable.

If Recipient institutes patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Program itself (excluding combinations of the Program with other software or hardware) infringes such Recipient's patent(s), then such Recipient's rights granted under Section 2(b) shall terminate as of the date such litigation is filed.

All Recipient's rights under this Agreement shall terminate if it fails to comply with any of the material terms or conditions of this Agreement and does not cure such failure in a reasonable period of time after becoming aware of such noncompliance. If all Recipient's rights under this Agreement terminate, Recipient agrees to cease use and distribution of the Program as soon as reasonably practicable.

However, Recipient's obligations under this Agreement and any licenses granted by Recipient relating to the Program shall continue and survive.

Everyone is permitted to copy and distribute copies of this Agreement, but in order to avoid inconsistency the Agreement is copyrighted and may only be modified in the following manner. The Agreement Steward reserves the right to publish new versions (including revisions) of this Agreement from time to time. No one other than the Agreement Steward has the right to modify this Agreement. The Eclipse Foundation is the initial Agreement Steward. The Eclipse Foundation may assign the responsibility to serve as the Agreement Steward to a suitable separate entity. Each new version of the Agreement will be given a distinguishing version number. The Program (including Contributions) may always be Distributed subject to the version of the Agreement under which it was received. In addition, after a new version of the Agreement is published, Contributor may elect to Distribute the Program (including its Contributions) under the new version.

Except as expressly stated in Sections 2(a) and 2(b) above, Recipient receives no rights or licenses to the intellectual property of any Contributor under this Agreement, whether expressly, by implication, estoppel or otherwise. All rights in the Program not expressly granted under this Agreement are reserved. Nothing in this Agreement is intended to be enforceable by any entity that is not a Contributor or Recipient. No third-party beneficiary rights are created under this Agreement.

Exhibit A - Form of Secondary Licenses Notice

"This Source Code may also be made available under the following Secondary Licenses when the conditions for such availability set forth in the Eclipse Public License, v. 2.0 are satisfied: {name license(s), version(s), and exceptions or additional permissions here}."

Simply including a copy of this Agreement, including this Exhibit A is not sufficient to license the Source Code under Secondary Licenses.

If it is not possible or desirable to put the notice in a particular file, then You may include the notice in a location (such as a LICENSE file in a relevant directory) where a recipient would be likely to look for such a notice.

You may add additional accurate notices of copyright ownership.

8.1.2 EDL-v10

Eclipse Distribution License - v 1.0

Copyright (c) 2007, Eclipse Foundation, Inc. and its licensors.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

Neither the name of the Eclipse Foundation, Inc. nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

8.2 cJSON

Copyright (c) 2009–2017 Dave Gamble and cJSON contributors

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

8.3 libwebsockets

Libwebsockets and included programs are provided under the terms of the MIT license shown below, with the exception that some sources are under a similar permissive license like BSD, or are explicitly CC0 / public domain to remove any obstacles from basing differently-licensed code on them.

Original liberal license retained:

- lib/misc/sha-1.c - 3-clause BSD license retained, link to original *BSD3*
- win32port/zlib - *ZLIB* license (see `zlib.h`) *ZLIB*
- lib/tls/mbedtls/wrapper - Apache 2.0 (only built if linked against mbedtls) *APACHE2*
lib/tls/mbedtls/mbedtls-extensions.c
- lib/misc/base64-decode.c - already MIT
- lib/misc/ieeehalfprecision.c - 2-clause BSD license retained *BSD2*

Relicensed to MIT:

- lib/misc/daemonize.c - relicensed from Public Domain to MIT, link to original Public Domain version
- lib/plat/windows/windows-resolv.c - relicensed from “Beerware v42” to MIT

Public Domain (CC-zero) to simplify reuse:

- test-apps/*.c
- test-apps/*.h
- minimal-examples/*
- lwsws/*

Although libwebsockets is available under a permissive license, it does not change the reality of dealing with large lumps of external code... if your copy diverges it is guaranteed to contain security problems after a while and can be very painful to pick backports (especially since historically, we are very hot on cleaning and refactoring the codebase). The least painful and lowest risk way remains sending your changes and fixes upstream to us so you can easily use later releases and fixes.

8.3.1 MIT License applied to libwebsockets

<https://opensource.org/licenses/MIT>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

8.3.2 BSD2

```

* Redistribution and use in source and binary forms, with or without
* modification, are permitted provided that the following conditions are
* met:
*
*   * Redistributions of source code must retain the above copyright
*     notice, this list of conditions and the following disclaimer.
*   * Redistributions in binary form must reproduce the above copyright
*     notice, this list of conditions and the following disclaimer in
*     the documentation and/or other materials provided with the distribution
*
* THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS"
* AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
* ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE
* LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
* CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
* SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.

```

8.3.3 BSD3

For convenience, a copy of the license on `./lib/misc/sha-1.c`. In binary distribution, this applies to builds with ws support enabled, and without `LWS_WITHOUT_BUILTIN_SHA1` at cmake.

```

/*
* Copyright (C) 1995, 1996, 1997, and 1998 WIDE Project.
* All rights reserved.
*
* Redistribution and use in source and binary forms, with or without
* modification, are permitted provided that the following conditions
* are met:
* 1. Redistributions of source code must retain the above copyright
*    notice, this list of conditions and the following disclaimer.
* 2. Redistributions in binary form must reproduce the above copyright
*    notice, this list of conditions and the following disclaimer in the
*    documentation and/or other materials provided with the distribution.
* 3. Neither the name of the project nor the names of its contributors
*    may be used to endorse or promote products derived from this software
*    without specific prior written permission.
*
* THIS SOFTWARE IS PROVIDED BY THE PROJECT AND CONTRIBUTORS ``AS IS'' AND
* ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
* ARE DISCLAIMED. IN NO EVENT SHALL THE PROJECT OR CONTRIBUTORS BE LIABLE
* FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL
* DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS
* OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
* HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
* LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
* SUCH

```

8.3.4 ZLIB

For convenience, a copy of the license on zlib. In binary distribution, this applies for win32 builds with internal zlib only. You can avoid building any zlib usage or copy at all with `-DLWS_WITH_ZLIB=0` (the default), and so avoid needing to observe the license for binary distribution that doesn't include the related code.

```
This software is provided 'as-is', without any express or implied
warranty. In no event will the authors be held liable for any damages
arising from the use of this software.
```

```
Permission is granted to anyone to use this software for any purpose,
including commercial applications, and to alter it and redistribute it
freely, subject to the following restrictions:
```

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution.

```
Jean-loup Gailly
jloup@gzip.org
```

```
Mark Adler
madler@alummi.caltech.edu
```

8.3.5 APACHE2

For convenience, a copy of the license on the mbedtls wrapper part. In binary distribution, this applies only when building lws against mbedtls.

The canonical license application to source files uses the URL reference, so the whole is not reproduced here.

```
// Copyright 2015-2016 Espressif Systems (Shanghai) PTE LTD
//
// Licensed under the Apache License, Version 2.0 (the "License");
// you may not use this file except in compliance with the License.
// You may obtain a copy of the License at
//
//     http://www.apache.org/licenses/LICENSE-2.0
//
// Unless required by applicable law or agreed to in writing, software
// distributed under the License is distributed on an "AS IS" BASIS,
// WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
// See the License for the specific language governing permissions and
// limitations under the License.
```

8.3.6 CC0

For convenience, the full text of CC0 dedication found on the lws examples. The intention of this is to dedicate the examples to the public domain, so users can build off and modify them without any constraint.

Statement of Purpose

```
The laws of most jurisdictions throughout the world automatically confer exclusive
Copyright and Related Rights (defined below) upon the creator and subsequent owner(s)
(each and all, an "owner") of an original work of authorship and/or a database (each,
a "Work").
```

Certain owners wish to permanently relinquish those rights to a Work for the purpose of contributing to a commons of creative, cultural and scientific works ("Commons") that the public can reliably and without fear of later claims of infringement build upon, modify, incorporate in other works, reuse and redistribute as freely as possible in any form whatsoever and for any purposes, including without limitation commercial purposes. These owners may contribute to the Commons to promote the ideal of a free culture and the further production of creative, cultural and scientific works, or to gain reputation or greater distribution for their Work in part through the use and efforts of others.

For these and/or other purposes and motivations, and without any expectation of additional consideration or compensation, the person associating CC0 with a Work (the "Affirmer"), to the extent that he or she is an owner of Copyright and Related Rights in the Work, voluntarily elects to apply CC0 to the Work and publicly distribute the Work under its terms, with knowledge of his or her Copyright and Related Rights in the Work and the meaning and intended legal effect of CC0 on those rights.

1. Copyright and Related Rights. A Work made available under CC0 may be protected by copyright and related or neighboring rights ("Copyright and Related Rights"). Copyright and Related Rights include, but are not limited to, the following:

- the right to reproduce, adapt, distribute, perform, display, communicate, and translate a Work;
- moral rights retained by the original author(s) and/or performer(s);
- publicity and privacy rights pertaining to a person's image or likeness depicted in a Work;
- rights protecting against unfair competition in regards to a Work, subject to the limitations in paragraph 4(a), below;
- rights protecting the extraction, dissemination, use and reuse of data in a Work;
- database rights (such as those arising under Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases, and under any national implementation thereof, including any amended or successor version of such directive); and
- other similar, equivalent or corresponding rights throughout the world based on applicable law or treaty, and any national implementations thereof.

2. Waiver. To the greatest extent permitted by, but not in contravention of, applicable law, Affirmer hereby overtly, fully, permanently, irrevocably and unconditionally waives, abandons, and surrenders all of Affirmer's Copyright and Related Rights and associated claims and causes of action, whether now known or unknown (including existing as well as future claims and causes of action), in the Work (i) in all territories worldwide, (ii) for the maximum duration provided by applicable law or treaty (including future time extensions), (iii) in any current or future medium and for any number of copies, and (iv) for any purpose whatsoever, including without limitation commercial, advertising or promotional purposes (the "Waiver"). Affirmer makes the Waiver for the benefit of each member of the public at large and to the detriment of Affirmer's heirs and successors, fully intending that such Waiver shall not be subject to revocation, rescission, cancellation, termination, or any other legal or equitable action to disrupt the quiet enjoyment of the Work by the public as contemplated by Affirmer's express Statement of Purpose.

3. Public License Fallback. Should any part of the Waiver for any reason be judged legally invalid or ineffective under applicable law, then the Waiver shall be preserved to the maximum extent permitted taking into account Affirmer's express Statement of Purpose. In addition, to the extent the Waiver is so judged Affirmer hereby grants to each affected person a royalty-free, non transferable, non sublicensable, non exclusive, irrevocable and unconditional license to exercise Affirmer's Copyright and Related Rights in the Work (i) in all territories worldwide, (ii) for the maximum duration provided by applicable law or treaty (including future time extensions), (iii) in any current or future medium and for any number of copies, and (iv) for any purpose whatsoever, including without limitation commercial, advertising or promotional purposes (the "License"). The License shall be deemed effective as of the date CC0 was applied by Affirmer to the Work. Should any part of

the License for any reason be judged legally invalid or ineffective under applicable law, such partial invalidity or ineffectiveness shall not invalidate the remainder of the License, and in such case Affirmer hereby affirms that he or she will not (i) exercise any of his or her remaining Copyright and Related Rights in the Work or (ii) assert any associated claims and causes of action with respect to the Work, in either case contrary to Affirmer's express Statement of Purpose.

4. Limitations and Disclaimers.

No trademark or patent rights held by Affirmer are waived, abandoned, surrendered, licensed or otherwise affected by this document.

Affirmer offers the Work as-is and makes no representations or warranties of any kind concerning the Work, express, implied, statutory or otherwise, including without limitation warranties of title, merchantability, fitness for a particular purpose, non infringement, or the absence of latent or other defects, accuracy, or the present or absence of errors, whether or not discoverable, all to the greatest extent permissible under applicable law.

Affirmer disclaims responsibility for clearing rights of other persons that may apply to the Work or any use thereof, including without limitation any person's Copyright and Related Rights in the Work. Further, Affirmer disclaims responsibility for obtaining any necessary consents, permissions or other rights required for any use of the Work.

Affirmer understands and acknowledges that Creative Commons is not a party to this document and has no duty or obligation with respect to this CC0 or use of the Work.