IPC Install Guide QNX

Introduction

Inter/Intra Processor Communication (IPC) is a product designed to enable communication between processors in a multi-processor environment. Features of IPC include message passing, multi-processor gates, shared memory primitives, and more.

IPC is designed for use with processors running SYS/BIOS applications. This is typically an ARM or DSP. IPC includes support for High Level Operating Systems (HLOS) like Linux, as well as the SYS/BIOS RTOS. The breadth of IPC features supported in an HLOS environment is reduced in an effort to simplify the product.

Install

IPC is released as a zip file. To install, simply extract the file.

```
buildhost$ unzip ipc_<version>.zip
```

This will extract the IPC product in a directory with its product name and version information (e.g. **c:\ipc_3_xx_xx_xx** or **/home/<user>/ipc_3_xx_xx_xx**)

NOTE

- This document assumes the IPC install path to be the user's home directory on a Linux host machine (**/home/<user>**) or the user's main drive on a Windows host machine (**C:**). The variable **IPC_INSTALL_DIR** will be used throughout the document. If IPC was installed at a different location, make appropriate changes to commands.
- Some customers find value in archiving the released sources in a configuration management system. This can help in identifying any changes made to the original sources - often useful when updating to newer releases.

Build

The IPC product often comes with prebuilt SYS/BIOS-side libraries, so rebuilding them isn't necessary. The QNX-side libraries/binaries may also be provided prebuilt by SDK programs, but the standalone IPC release does not currently pre-build them.

IPC provides GNU makefile(s) to rebuild all its libraries at the base of the product, details are below.

NOTE

GNU make version 3.81 or greater is required. The XDC tools (provided with most SDKs and CCS distributions) includes a pre-compiled version of GNU make 3.81 in $(XDC_INSTALL_DIR)/gmake.

products.mak

IPC contains a **products.mak** file at the root of the product that specifies the necessary paths and options to build IPC for the various OS support.

Edit **products.mak** and set the following variables:

- QNX
  - **QNX_INSTALL_DIR** - Path to your QNX installation directory.
  - **DESTDIR** - Path to which target binaries will be exported when running the 'make install' goal.
  - **DEVICE** - which device are you building for.
- SYS/BIOS

- **XDC_INSTALL_DIR** - Path to TI's XDCTools installation
- **BIOS_INSTALL_DIR** - Path to TI's SYS/BIOS installation
- **ti.targets.<device target and file format>** - Path to TI toolchain for the device.
- **gnu.targets.arm.<device target and file format>** - Path to GNU toolchain for the device.
  - Set only the variables to the targets your device supports to minimize build time.

NOTE

The dependencies applicable for each supported device can be found in the IPC Release Notes provided in the product.

ipc-qnx.mak

The QNX-side build is performed using QNX makefiles. To build using the components paths set in the **products.mak** file, issue the following command:

```
<buildhost> make -f ipc-qnx.mak all
```

ipc-bios.mak

The SYS/BIOS-side IPC is built with a GNU makefile. After editing **products.mak**, issue the following command:

```
<buildhost> make -f ipc-bios.mak all
```

Based on the number of targets you're building for, this may take some time.

Note for Windows users: If you are building with a Windows host machine and it has the QNX tools installed, you will instead need to run the following in a separate command prompt window (cmd.exe) to build the SYS/BIOS side outside of the QNX build environment:

```
<buildhost> set PATH=C:\Windows\system32;C:\Windows;C:\Windows\System32\Wbem
<buildhost> <XDC_INSTALL_DIR>\gmake -f ipc-bios.mak all
```

where <XDC_INSTALL_DIR> should be replaced with the installation directory of your XDC tools, same as the path you have used in products.mak.

Run

The IPC product provides a way to install (copy) the necessary IPC executables and libraries onto the device's target file-system to simplify the execution of the applications. The details can vary across OS's, so this description has been separated into OS-specific sections.

Configuring the BSP

Some of the provided IPC tests that use a utility called SharedMemoryAllocator require a carveout to be created in the QNX-owned memory. To reserve this memory, you must make the following change in the file <QNX BSP installation directory>\src\hardware\startup\boards\<board name>\build in the QNX BSP. E.g.

```
startup-omap5432uevm -r 0xBA300000,0x5A00000 -vvvvv -P2 -W
```

Save the file, then rebuild the QNX OS image (ifs-*.bin) and replace your existing one with the new one.

Installing Tests in QNX

To assemble the IPC resource manager, shared libraries and test executables into a directory structure suitable for running on the device's file-system, issue the following command in the IPC_INSTALL_DIR directory:

```
buildhost$ make -f ipc-qnx.mak install
```

This will install the binaries into the directory specified by DESTDIR in products.mak. It this assumed that DESTDIR is a directory visible to the target filesystem. If not, you should copy its contents to such a location (e.g. onto an SD card that can be accessed by the EVM).

When building in Windows, some users might get build messages that report a version mismatch in cygwin:

```
C:/QNX650/host/win32/x86/usr/bin/make -j 1 -Cle.v7 -fMakefile install
      1 [main] ? (5984) C:\QNX650\host\win32\x86\usr\photon\bin\find.exe: *** fa
tal error - system shared memory version mismatch detected - 0x8A88009C/0x2D1E009C.
This problem is probably due to using incompatible versions of the cygwin DLL.
Search for cygwin1.dll using the Windows Start->Find/Search facility
and delete all but the most recent version.  The most recent version *should*
reside in x:\cygwin\bin, where 'x' is the drive on which you have
installed the cygwin distribution.  Rebooting is also suggested if you
are unable to find another cygwin DLL.
```

Based on what we observed the binaries are still exported correctly despite the messages. If you do want to eliminate them, you should replace the file cygwin1.dll in <QNX_INSTALL_DIR>\host\win32\x86\usr\photon\bin with the newest cygwin1.dll you can find on your host machine (do a search on your PC's filesystem in Windows).

Some of the tests rely on corresponding remote core applications to be run on the slave processor(s). The remote processor's applications are loaded when launching the resource manager. See section #IPC_resource_manager for details on launching the resource manager.

The location of the remote core applications within the IPC product varies based on device.

Installing remote core applications

Remote core applications can be found in <IPC_INSTALL_DIR>/packages/ti/ipc/tests/bin/ti_platform_<your platform name>_* directories.

For example, you can copy the messageq_single.xem4 for OMAP54xx uEVM's IPU onto the device's target filesystem into the **bin** directory as follows:

```
buildhost$ copy <IPC_INSTALL_DIR>/packages/ti/ipc/tests/bin/ti_platform_omap54xx_ipu/messageq_single.xem4 <DESTDIR>/armle-v7/bin
```

'ti_platform_omap54xx_ipu' indicates the platform is 'omap54xx' and the remote core name is 'IPU'. You only need to copy the binaries relevant to your platform.

IPC resource manager

Much of the functionality of IPC is provided by the resource manager. It can be launched as follows:

```
target# cd <target directory corresponding to DESTDIR>/armle-v7/bin
target# export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:<target directory corresponding to DESTDIR>/armle-v7/usr/lib
target# ipc <CORE1> <remote executable 1> <CORE2> <remote executable 2> ...
```

<CORE> should correspond to the name of the remote core on which you want the remote executable to be loaded. As a rule of thumb, it is the capitalized version of the core name specified by the name of the directory from which the executable was copied in the #Installing remote core applications section. For example, if the executable is copied from "ti_platform_omap54xx_**ipu**/test_omx_ipu_omap5.xem4", then you should load it as follows:

```
target# ipc IPU test_omx_ipu_omap5.xem4
```

Later, when you are done running applications that use IPC and no longer need the resource manager, it can be terminated as follows:

```
target# cd <target directory corresponding to DESTDIR>/armle-v7/bin
target# slay ipc
```

Running Test Applications

The QNX-side of the test applications are already on the target's filesystem in <target directory corresponding to DESTDIR>/armle-v7/bin and <target directory corresponding to DESTDIR>/armle-v7/bin/tests, assuming the #Installing Tests in QNX and #IPC resource manager sections have been followed and that the resource manager has loaded the remote core(s) with the executable corresponding to the test you'd like to run.

To find out the syntax to use for running the test (say MessageQApp), run

```
target# cd <target directory corresponding to DESTDIR>/armle-v7/bin/tests
target# use MessageQApp
```

To run a test application, execute it on the target's filesystem:

```
target# cd <target directory corresponding to DESTDIR>/armle-v7/bin/tests
target# ./MessageQApp 10
```

Here is a list of the main tests that are available in the IPC product:

- MessageQApp: Test that creates a single thread that sends messages from host to remote core using MessageQ
  - messageq_single.x* need to be loaded by the resource manager
- MessageQMulti: Test that creates multiple threads which send messages from host to remote core using MessageQ
  - messageq_multi.x* need to be loaded by the resource manager
- mmrpc_test: Test that exercises MMRPC
  - test_omx_ipu_<platform>.x* need to be loaded by the resource manager
  - Aside from the IPC resource manager, this test also needs the shmemallocator resource manager to be launched beforehand:

    ```
    target# cd <target directory corresponding to DESTDIR>/armle-v7/bin
    target# shmemallocator
    target# cd tests
    target# mmrpc_test 1
    ```

Expected output

To give you an idea, the expected output for MessageQApp on the QNX-side should look similar to this:

```
Using numLoops: 10; procId : 1
Entered MessageQApp_execute
Local MessageQId: 0x1
Remote queueId  [0x10000]
Exchanging 10 messages with remote processor IPU...
MessageQ_get #0 Msg = 0x11c9f0
Exchanged 1 messages with remote processor IPU
MessageQ_get #1 Msg = 0x11c9f0
Exchanged 2 messages with remote processor IPU
MessageQ_get #2 Msg = 0x11c9f0
...
...
Exchanged 9 messages with remote processor IPU
MessageQ_get #9 Msg = 0x11c9f0
Exchanged 10 messages with remote processor IPU
Sample application successfully completed!
Leaving MessageQApp_execute
```

The output on the remote processor can be obtained by running the following on the target filesystem:

```
target# cat /dev/syslink-trace1
```

The expected output on the remote processor should look similar to this:

```
[0][      0.000] 16 Resource entries at 0x3000
[0][      0.000] messageq_single.c:main: MultiProc id = 1
[0][      0.000] [t=0x006c565d] ti.ipc.transports.TransportVirtioSetup: TransportVirtio
Setup_attach: remoteProcId: 0
[0][      0.000] registering rpmsg-proto:rpmsg-proto service on 61 with HOST
[0][      0.000] [t=0x0072625b] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_create: endPt c
reated: 61
[0][      0.000] [t=0x0073e8d9] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_toHost kicked
[0][      0.000] [t=0x00753771] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][      0.000] [t=0x0076cb49] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][      0.000]          Received msg: from: 0x5a, to: 0x35, dataLen: 72
[0][      0.000] [t=0x007872e9] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: no object
for endpoint: 53
[0][      0.000] tsk1Fxn: created MessageQ: SLAVE_CORE0; QueueID: 0x10000
[0][      0.000] Awaiting sync message from host...
[0][     51.992] [t=0x0c475268] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     51.992] [t=0x0c48eb28] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     51.993]          Received msg: from: 0x400, to: 0x3d, dataLen: 176
[0][     51.993] [t=0x0c4ad220] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 176, from: 1024
```

```
[0][     51.993]
[0][     52.995] [t=0x0c873ded] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     52.996] [t=0x0c88b029] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     52.996]         Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][     52.996] [t=0x0c8a8a87] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][     52.996]
[0][     52.996] Received msg from (procId:remoteQueueId): 0x0:0x1
[0][     52.996]         payload: 8 bytes; loops: 10 with printing.
[0][     52.997] [t=0x0c8eab7e] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     52.997] [t=0x0c9031bc] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     52.997]         Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][     52.997] [t=0x0c9208fa] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][     52.997]
[0][     52.997] Got msg #0 (40 bytes) from procId 0
[0][     52.997] Sending msg Id #0 to procId 0
[0][     52.998] [t=0x0c959f33] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     52.998] [t=0x0c971df7] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     52.998]         Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][     52.998] [t=0x0c98f3e7] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][     52.998]
[0][     52.999] Got msg #1 (40 bytes) from procId 0
[0][     52.999] Sending msg Id #1 to procId 0
[0][     52.999] [t=0x0c9c7a00] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     52.999] [t=0x0c9df7fc] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     52.999]         Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][     52.999] [t=0x0c9fce5a] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][     52.999]
[0][     53.000] Got msg #2 (40 bytes) from procId 0
[0][     53.000] Sending msg Id #2 to procId 0
[0][     53.000] [t=0x0ca36e79] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][     53.000] [t=0x0ca4ea95] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][     53.000]         Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][     53.001] [t=0x0ca6c975] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][     53.001]
[0][     53.001] Got msg #3 (40 bytes) from procId 0
[0][     53.001] Sending msg Id #3 to procId 0
...
```

```
...
[0][      53.007] Got msg #8 (40 bytes) from procId 0
[0][      53.007] Sending msg Id #8 to procId 0
[0][      53.007] [t=0x0cccd3d7] ti.ipc.rpmsg.MessageQCopy: callback_availBufReady: virt
Queue_fromHost kicked
[0][      53.007] [t=0x0cce50ed] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_swiFxn:
[0][      53.007]          Received msg: from: 0x406, to: 0x3d, dataLen: 40
[0][      53.007] [t=0x0cd027bd] ti.ipc.rpmsg.MessageQCopy: MessageQCopy_send: calling c
allback with data len: 40, from: 1030
[0][      53.007]
[0][      53.008] Got msg #9 (40 bytes) from procId 0
[0][      53.008] Sending msg Id #9 to procId 0
[0][      53.008] Awaiting sync message from host...
```

Running standalone examples

On some platforms, there are standalone examples provided to illustrate how to use specific features in IPC. These standalone examples are designed to be easily rebuilt outside of the IPC product, and represent a good starting point for development. If available, the examples are located in <IPC_INSTALL_DIR>\xamples\archive\<platform of your choice>.

To use the examples, unzip the example you want in a working directory of your choice. Then build it. E.g.:

```
buildhost$ unzip ex02_messageq.zip
buildhost$ cd ex02_messageq
buildhost$ make clean
buildhost$ make
buildhost$ make install
```

This would produce the host and remote core binaries in an 'install' subdirectory. Copy the content of the subdirectory into a location accessible by your target board (e.g. SD card). Run the example on the target using IPC by loading the remote cores like you would with the test applications, then run the example. E.g.:

```
target# ipc IPU ex02_messageq/debug/server_ipu.xem4 DSP ex02_messageq/debug/server_dsp.xe64T
target# cd ex02_messageq/debug/
target# app_host IPU
```

Article Sources and Contributors

IPC Install Guide QNX *Source*: http://processors.wiki.ti.com/index.php?oldid=153823 *Contributors*: PagePusher

License

License

1. Definitions

a. "**Adaptation**" means a work based upon the Work, or upon the Work and other pre-existing works, such as a translation, adaptation, derivative work, arrangement of music or other alterations of a literary or artistic work, or phonogram or performance and includes cinematographic adaptations or any other form in which the Work may be recast, transformed, or adapted including in any form recognizably derived from the original, except that a work that constitutes a Collection will not be considered an Adaptation for the purpose of this License. For the avoidance of doubt, where the Work is a musical work, performance or phonogram, the synchronization of the Work in timed-relation with a moving image ("synching") will be considered an Adaptation for the purpose of this License.

b. "**Collection**" means a collection of literary or artistic works, such as encyclopedias and anthologies, or performances, phonograms or broadcasts, or other works or subject matter other than works listed in Section 1(f) below, which, by reason of the selection and arrangement of their contents, constitute intellectual creations, in which the Work is included in its entirety in unmodified form along with one or more other contributions, each constituting separate and independent works in themselves, which together are assembled into a collective whole. A work that constitutes a Collection will not be considered an Adaptation (as defined below) for the purposes of this License.

c. "**Creative Commons Compatible License**" means a license that is listed at http://creativecommons.org/compatiblelicenses that has been approved by Creative Commons as being essentially equivalent to this License, including, at a minimum, because that license: (i) contains terms that have the same purpose, meaning and effect as the License Elements of this License; and, (ii) explicitly permits the relicensing of adaptations of works made available under that license under this License or a Creative Commons jurisdiction license with the same License Elements as this License.

d. "**Distribute**" means to make available to the public the original and copies of the Work or Adaptation, as appropriate, through sale or other transfer of ownership.

e. "**License Elements**" means the following high-level license attributes as selected by Licensor and indicated in the title of this License: Attribution, ShareAlike.

f. "**Licensor**" means the individual, individuals, entity or entities that offer(s) the Work under the terms of this License.

g. "**Original Author**" means, in the case of a literary or artistic work, the individual, individuals, entity or entities who created the Work or if no individual or entity can be identified, the publisher; and in addition (i) in the case of a performance the actors, singers, musicians, dancers, and other persons who act, sing, deliver, declaim, play in, interpret or otherwise perform literary or artistic works or expressions of folklore; (ii) in the case of a phonogram the producer being the person or legal entity who first fixes the sounds of a performance or other sounds; and, (iii) in the case of broadcasts, the organization that transmits the broadcast.

h. "**Work**" means the literary and/or artistic work offered under the terms of this License including without limitation any production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression including digital form, such as a book, pamphlet and other writing; a lecture, address, sermon or other work of the same nature; a dramatic or dramatico-musical work; a choreographic work or entertainment in dumb show; a musical composition with or without words; a cinematographic work to which are assimilated works expressed by a process analogous to cinematography; a work of drawing, painting, architecture, sculpture, engraving or lithography; a photographic work to which are assimilated works expressed by a process analogous to photography; a work of applied art; an illustration, map, plan, sketch or three-dimensional work relative to geography, topography, architecture or science; a performance; a broadcast; a phonogram; a compilation of data to the extent it is protected as a copyrightable work; or a work performed by a variety or circus performer to the extent it is not otherwise considered a literary or artistic work.

i. "**You**" means an individual or entity exercising rights under this License who has not previously violated the terms of this License with respect to the Work, or who has received express permission from the Licensor to exercise rights under this License despite a previous violation.

j. "**Publicly Perform**" means to perform public recitations of the Work and to communicate to the public those public recitations, by any means or process, including by wire or wireless means or public digital performances; to make available to the public Works in such a way that members of the public may access these Works from a place and at a place individually chosen by them; to perform the Work to the public by any means or process and the communication to the public of the performances of the Work, including by public digital performance; to broadcast and rebroadcast the Work by any means including signs, sounds or images.

k. "**Reproduce**" means to make copies of the Work by any means including without limitation by sound or visual recordings and the right of fixation and reproducing fixations of the Work, including storage of a protected performance or phonogram in digital form or other electronic medium.

2. Fair Dealing Rights

Nothing in this License is intended to reduce, limit, or restrict any uses free from copyright or rights arising from limitations or exceptions that are provided for in connection with the copyright protection under copyright law or other applicable laws.

3. License Grant

Subject to the terms and conditions of this License, Licensor hereby grants You a worldwide, royalty-free, non-exclusive, perpetual (for the duration of the applicable copyright) license to exercise the rights in the Work as stated below:

a. to Reproduce the Work, to incorporate the Work into one or more Collections, and to Reproduce the Work as incorporated in the Collections;

b. to create and Reproduce Adaptations provided that any such Adaptation, including any translation in any medium, takes reasonable steps to clearly label, demarcate or otherwise identify that changes were made to the original Work. For example, a translation could be marked "The original work was translated from English to Spanish," or a modification could indicate "The original work has been modified.";

c. to Distribute and Publicly Perform the Work including as incorporated in Collections; and,

d. to Distribute and Publicly Perform Adaptations.

e. For the avoidance of doubt:

   i. **Non-waivable Compulsory License Schemes.** In those jurisdictions in which the right to collect royalties through any statutory or compulsory licensing scheme cannot be waived, the Licensor reserves the exclusive right to collect such royalties for any exercise by You of the rights granted under this License;

   ii. **Waivable Compulsory License Schemes.** In those jurisdictions in which the right to collect royalties through any statutory or compulsory licensing scheme can be waived, the Licensor waives the exclusive right to collect such royalties for any exercise by You of the rights granted under this License; and,

   iii. **Voluntary License Schemes.** The Licensor waives the right to collect royalties, whether individually or, in the event that the Licensor is a member of a collecting society that administers voluntary licensing schemes, via that society, from any exercise by You of the rights granted under this License.

The above rights may be exercised in all media and formats whether now known or hereafter devised. The above rights include the right to make such modifications as are technically necessary to exercise the rights in other media and formats. Subject to Section 8(f), all rights not expressly granted by Licensor are hereby reserved.

4. Restrictions

The license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

a. You may Distribute or Publicly Perform the Work only under the terms of this License. You must include a copy of, or the Uniform Resource Identifier (URI) for, this License with every copy of the Work You Distribute or Publicly Perform. You may not offer or impose any terms on the Work that restrict the terms of this License or the ability of the recipient of the Work to exercise the rights granted to that recipient under the terms of the License. You may not sublicense the Work. You must keep intact all notices that refer to this License and to the disclaimer of warranties with every copy of the Work You Distribute or Publicly Perform. When You Distribute or Publicly Perform the Work, You may not impose any effective technological measures on the Work that restrict the ability of a recipient of the Work from You to exercise the rights granted to that recipient under the terms of the License. This Section 4(a) applies to the Work as incorporated in a Collection, but this does not require the Collection apart from the Work itself to be made subject to the terms of this License. If You create a Collection, upon notice from any Licensor You must, to the extent practicable, remove from the Collection any credit as required by Section 4(c), as requested. If You create an Adaptation, upon notice from any Licensor You must, to the extent practicable, remove from the Adaptation any credit as required by Section 4(c), as requested.

b. You may Distribute or Publicly Perform an Adaptation only under the terms of: (i) this License; (ii) a later version of this License with the same License Elements as this License; (iii) a Creative Commons jurisdiction license (either this or a later license version) that contains the same License Elements as this License (e.g., Attribution-ShareAlike 3.0 US)); (iv) a Creative Commons Compatible License. If you license the Adaptation under one of the licenses mentioned in (iv), you must comply with the terms of that license. If you license the Adaptation under the terms of any of the licenses mentioned in (i), (ii) or (iii) (the "Applicable License"), you must comply with the terms of the Applicable License generally and the following provisions: (I) You must include a copy of, or the URI for, the Applicable License with every copy of each Adaptation You Distribute or Publicly Perform; (II) You may not offer or impose any terms on the Adaptation that restrict the terms of the Applicable License or the ability of the Adaptation to exercise the rights granted to that recipient under the terms of the Applicable License; (III) You must keep intact all notices that refer to the Applicable License and to the disclaimer of warranties with every copy of the Work as included in the Adaptation You Distribute or Publicly Perform; (IV) when You Distribute or Publicly Perform the Adaptation, You may not impose any effective technological measures on the Adaptation that restrict the ability of a recipient of the Adaptation from You to exercise the rights granted to that recipient under the terms of the Applicable License. This Section 4(b) applies to the Adaptation as incorporated in a Collection, but this does not require the Collection apart from the Adaptation itself to be made subject to the terms of the Applicable License.

c. If You Distribute, or Publicly Perform the Work or any Adaptations or Collections, You must, unless a request has been made pursuant to Section 4(a), keep intact all copyright notices for the Work and provide, reasonable to the medium or means You are utilizing: (i) the name of the Original Author (or pseudonym, if applicable) if supplied, and/or if the Original Author and/or Licensor designate another party or parties (e.g., a sponsor institute, publishing entity, journal) for attribution ("Attribution Parties") in Licensor's copyright notice, terms of service or by other reasonable means, the name of such party or parties; (ii) the title of the Work if supplied; (iii) to the extent reasonably practicable, the URI, if any, that Licensor specifies to be associated with the Work, unless such URI does not refer to the copyright notice or licensing information for the Work; and (iv) , consistent with Ssection 3(b), in the case of an Adaptation, a credit identifying the use of the Work in the Adaptation (e.g., "French translation of the Work by Original Author," or "Screenplay based on original Work by Original Author"). The credit required by this Section 4(c) may be implemented in any reasonable manner; provided, however, that in the case of a Adaptation or Collection, at a minimum such credit will appear, if a credit for all contributing authors of the Adaptation or Collection appears, then as part of these credits and in a manner at least as prominent as the credits for the other contributing authors. For the avoidance of doubt, You may only use the credit required by this Section for the purpose of attribution in the manner set out above and, by exercising Your rights under this License, You may not implicitly or explicitly assert or imply any connection with, sponsorship or endorsement by the Original Author, Licensor and/or Attribution Parties, as appropriate, of You or Your use of the Work, without the separate, express prior written permission of the Original Author, Licensor and/or Attribution Parties.

d. Except as otherwise agreed in writing by the Licensor or as may be otherwise permitted by applicable law, if You Reproduce, Distribute or Publicly Perform the Work either by itself or as part of any Adaptations or Collections, You must not distort, mutilate, modify or take other derogatory action in relation to the Work which would be prejudicial to the Original Author's honor or reputation. Licensor agrees that in those jurisdictions (e.g. Japan), in which any exercise of the right granted in Section 3(b) of this License (the right to make Adaptations) would be deemed to be a distortion, mutilation, modification or other derogatory action prejudicial to the Original Author's honor and reputation, the Licensor will waive or not assert, as appropriate, this Section, to the fullest extent permitted by the applicable national law, to enable You to reasonably exercise Your right under Section 3(b) of this License (right to make Adaptations) but not otherwise.

5. Representations, Warranties and Disclaimer

UNLESS OTHERWISE MUTUALLY AGREED TO BY THE PARTIES IN WRITING, LICENSOR 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, NONINFRINGEMENT, OR THE ABSENCE OF LATENT OR OTHER DEFECTS, ACCURACY, OR THE PRESENCE OF ABSENCE OF ERRORS, WHETHER OR NOT DISCOVERABLE. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO SUCH EXCLUSION MAY NOT APPLY TO YOU.

6. Limitation on Liability

EXCEPT TO THE EXTENT REQUIRED BY APPLICABLE LAW, IN NO EVENT WILL LICENSOR BE LIABLE TO YOU ON ANY LEGAL THEORY FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES ARISING OUT OF THIS LICENSE OR THE USE OF THE WORK, EVEN IF LICENSOR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

7. Termination

a. This License and the rights granted hereunder will terminate automatically upon any breach by You of the terms of this License. Individuals or entities who have received Adaptations or Collections from You under this License, however, will not have their licenses terminated provided such individuals or entities remain in full compliance with those licenses. Sections 1, 2, 5, 6, 7, and 8 will survive any termination of this License.

b. Subject to the above terms and conditions, the license granted here is perpetual (for the duration of the applicable copyright in the Work). Notwithstanding the above, Licensor reserves the right to release the Work under different license terms or to stop distributing the Work at any time; provided, however that any such election will not serve to withdraw this License (or any other license that has been, or is required to be, granted under the terms of this License), and this License will continue in full force and effect unless terminated as stated above.

8. Miscellaneous

a. Each time You Distribute or Publicly Perform the Work or a Collection, the Licensor offers to the recipient a license to the Work on the same terms and conditions as the license granted to You under this License.

b. Each time You Distribute or Publicly Perform an Adaptation, Licensor offers to the recipient a license to the original Work on the same terms and conditions as the license granted to You under this License.

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

d. No term or provision of this License shall be deemed waived and no breach consented to unless such waiver or consent shall be in writing and signed by the party to be charged with such waiver or consent.

e. This License constitutes the entire agreement between the parties with respect to the Work licensed here. There are no understandings, agreements or representations with respect to the Work not specified here. Licensor shall not be bound by any additional provisions that may appear in any communication from You. This License may not be modified without the mutual written agreement of the Licensor and You.

f. The rights granted under, and the subject matter referenced, in this License were drafted utilizing the terminology of the Berne Convention for the Protection of Literary and Artistic Works (as amended on September 28, 1979), the Rome Convention of 1961, the WIPO Copyright Treaty of 1996, the WIPO Performances and Phonograms Treaty of 1996 and the Universal Copyright Convention (as revised on July 24, 1971). These rights and subject

matter take effect in the relevant jurisdiction in which the License terms are sought to be enforced according to the corresponding provisions of the implementation of those treaty provisions in the applicable national law. If the standard suite of rights granted under applicable copyright law includes additional rights not granted under this License, such additional rights are deemed to be included in the License; this License is not intended to restrict the license of any rights under applicable law.