

## MPICH ABI Compatibility Status

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### Introduction

The goal of the MPICH ABI Compatibility Initiative is to provide and maintain ABI (Application Binary Interface) compatibility between the MPI implementations provided by the initiative members. Cray is a member of the MPICH ABI Compatibility Initiative along with Intel, IBM, and Argonne National Laboratory's MPICH development group (ANL MPICH). Cray, Intel, and IBM's MPI implementations are all derived from the ANL MPICH implementation.

ABI compatibility allows dynamically linked applications built with one ABI-compatible MPI to use a different ABI-compatible MPI at run time. The MPICH ABI Compatibility Initiative defines additional requirements (initiative compliance) beyond ABI compatibility. These additional requirements allow ABI compatibility to be easily used, in particular by having common shared library names. Further details on initiative compliance can be found on ANL's ABI Compatibility Initiative WIKI page<sup>1</sup>.

ANL MPICH 3.1.1 (6/6/14) is the first release to achieve full compliance with the MPICH ABI Compatibility Initiative. This MPICH release has the additional ABI initiative compliance requirements in it. As the other initiative members transition their MPI implementations to this version of MPICH, their MPI implementations will become compliant with the initiative.

While not fully compliant with the initiative, Cray's MPI became ABI-compatible with MPT 7.0.0 released in June 2014. Intel MPI will be ABI Initiative compliant beginning with Intel MPI 5.0 which is projected to be released in 2014. IBM will be ABI Initiative compliant beginning with IBM MPI v2.1 which is projected to be released in December of 2014.

It should be noted that the IBM MPI participating in the ABI Compatibility Initiative is not Platform MPI. At this time there is no indication that Platform MPI will become part of the ABI Compatibility Initiative. The IBM MPI participating in the initiative currently supports POWER and x86 architectures.

ABI Compatibility is intended for use on Cray XE/XC systems in Extreme Scaling Mode (ESM). This feature is not intended for Cray Compatibility Mode (CCM) and should not be used there.

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<sup>1</sup> [http://wiki.mpich.org/mpich/index.php/ABI\\_Compatibility\\_Initiative](http://wiki.mpich.org/mpich/index.php/ABI_Compatibility_Initiative)

## Current Usability of ABI Compatibility with MPT 7.0

It should be noted that at this time MPT 7.0 is ABI-compatible only with MPICH 3.1. Intel and IBM do not support ABI compatibility at this time.

However, we believe Intel intends Intel MPI 5.0 to be ABI upwardly compatible with Intel MPI 4.0/4.1. Intel MPI 5.0 will be a superset of Intel MPI 4.0/4.1 due to having additional MPI-3 standard functionality.

Theoretically, this means that Intel MPI 4.0/4.1 should be ABI upwardly compatible with MPT 7.0.0. Limited testing, including trying some ISV applications, indicates that this is true.

## ABI Compatibility and MPT 7.0

For MPT 7.0, Cray's primary focus is to support ISV applications built with the Intel compiler and Intel MPI 4.0/4.1 using Cray's native MPI. Unfortunately, ABI compatibility is difficult to use at this time due to differing shared library names and version numbers between Intel MPI and Cray MPI. Manual instructions are provided below showing how to use ABI compatibility between Intel MPI and Cray MPI. We hope to provide a more automated solution in the future.

## Running Applications Built with the Intel compiler and Intel MPI Using Cray MPI on Cray XC/XE Systems Including Intel Xeon Phi™ Autonomous Mode

To run an application built with Intel MPI on a Cray XE or XC systems:

1. The application must be built with the Intel compiler (12.0 or newer<sup>2</sup>)
2. The application must be built with Intel MPI 4.0 or 4.1. For Intel Xeon Phi only Intel MPI 4.1 is supported. Intel MPI 4.0 does not support Intel Xeon Phi.

To run the application using Cray MPI on a Cray XE or XC system using MPT 7.0.3 or later:

1. Make sure that the Intel Programming Environment (PrgEnv-intel) is loaded
2. `module swap cray-mpich cray-mpich-abi`
3. Prepend the environment variable `CRAY_LD_LIBRARY_PATH` to the environment variable `LD_LIBRARY_PATH`.  
`tcsh/csh: setenv LD_LIBRARY_PATH  
          ${CRAY_LD_LIBRARY_PATH}:${LD_LIBRARY_PATH}`  
`bash/sh/ksh: export LD_LIBRARY_PATH=  
                  ${CRAY_LD_LIBRARY_PATH}:${LD_LIBRARY_PATH}`

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<sup>2</sup> Cray has selected the Intel 12 compiler as the oldest Intel compiler to support. Applications built using older Intel compilers might work but are untested.

4. Launch the application using aprun.

To run the application using Cray MPI on a Cray XE or XC system using MPT 7.0.1 or MPT 7.0.2:

1. Make sure that the Intel Programming Environment (PrgEnv-intel) is loaded.
2. Create a directory in a file system accessible from the compute nodes and change directory into it.
3. Create the following symbolic links in the directory:
  - `ln -s /opt/cray/mpt/7.0.x/gni/mpich2-intel/140/lib/libmpich_intel.so.3 libmpi.so.4`
  - `ln -s libmpi.so.4 libmpi_mt.so.4`
  - `ln -s /opt/cray/mpt/7.0.x/gni/mpich2-intel/140/lib/libmpichcxx_intel.so.3 libgc4.so.4`
  - `ln -s /opt/cray/mpt/7.0.0/gni/mpich2-intel/140/lib/libmpichf90_intel.so.3 libigf.so.4`
4. Add the directory containing the symbolic links to `LD_LIBRARY_PATH`
5. Launch the application using aprun.

Instructions for Intel Xeon Phi autonomous are the same as above. Be sure to use the appropriate options for running an Intel Xeon Phi application in autonomous mode on the aprun command.

## Future Plans

To reach full compliance, Cray MPI will need to be updated to ANL MPICH 3.1.1 or later. This ANL MPICH version has the rest of the ABI Initiative compliance features including common shared library name support. Cray will be investigating how to integrate this support in its existing PE environment. Incorporation of MPICH 3.1.1 or later changes into Cray MPI is planned for late this year (4Q2014).