

# OpenCoarrays

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## Overview

OpenCoarrays supports [Fortran 2018](#) compilers by providing a parallel application binary interface (ABI) that abstracts away the underlying parallel programming model, which can be the Message Passing Interface (MPI) or [OpenSHMEM](#). Parallel Fortran 2018 programs may be written and compiled into object files once and then linked or re-linked to either MPI or [OpenSHMEM](#) without modifying or recompiling the Fortran source. Not a single line of source code need change to switch parallel programming models. The default programming model is MPI because it provides the broadest capability for supporting Fortran 2018 features. However, having the option to change parallel programming models at link-time may enhance portability and performance (see [Rouson et al. \(2017\)](#)).

OpenCoarrays provides a compiler wrapper ( `caf` ), parallel runtime libraries ( `libcaf_mpi` and `libcaf_openshmem` ), and a parallel executable file launcher ( `cafrun` ). The wrapper and launcher provide a uniform abstraction for compiling and executing parallel Fortran 2018 programs without direct reference to the underlying parallel programming model.

## Downloads

Please see our [Releases](#) page.

## Compatibility

The GNU Compiler Collection ([GCC](#)) Fortran front end ([gfortran](#)) has used OpenCoarrays since the GCC 5.1.0 release . Discussions are under way around incorporating OpenCoarrays into other compilers.

## Prerequisites

Building OpenCoarrays requires

- An MPI implementation (default: [MPICH](#)).
- CMake.
- A Fortran compiler (default: [GCC](#)).
- *Optional*: An [OpenSHMEM](#) implementation.

If you use a package manager or the OpenCoarrays installer, any missing prerequisites will be built for

you.

## Installation

Please see the [INSTALL.md](#) file.

Or [try OpenCoarrays online](#) as a [Jupyter notebook kernel](#) using [Binder](#) with no downloads, configuration or installation required. The default [index.ipynb](#) notebook is read only, but you can execute it, copy it to make changes, or create an entirely new [CAF kernel](#) notebook.

## Packaged Version

If you would like to be able to install OpenCoarrays through your favorite package manager, please ask them to add it, or contribute it yourself. If you see your favorite package manager has an outdated version, please ask them to update it, or contribute an update yourself.

## Packaging status

AUR	2.9.2
Debian 9	1.7.4
Debian 10	2.4.0
Debian 11	2.9.2
Debian 12	2.9.2
Debian Unstable	2.9.2
Deepin	2.4.0
Devuan 2.0	1.7.4
Devuan 3.0	2.4.0
Devuan 4.0	2.9.2
Devuan Unstable	2.9.2
DPorts	2.9.0
Fedora 28	2.3.1
Fedora 29	2.3.1
Fedora 30	2.3.1
Fedora 31	2.3.1
Fedora 32	2.3.1
FreeBSD Ports	2.9.0
Gentoo overlay GURU	2.9.2
Homebrew	2.9.2
Kali Linux Rolling	2.9.2
MacPorts	1.8.6
Pardus 17	1.7.4
Pardus 19	2.4.0
Pardus 21	2.9.2
Parrot	2.9.2
PureOS Amber	2.4.0
PureOS landing	2.9.2
Raspbian Oldstable	2.4.0
Raspbian Stable	2.9.2
Raspbian Testing	2.9.2
Spack	2.7.1
Trisquel 9.0	2.0.0~rc1
Trisquel 10.0	2.8.0
Ubuntu 18.04	2.0.0~rc1
Ubuntu 20.04	2.8.0
Ubuntu 20.10	2.9.0
Ubuntu 21.04	2.9.2
Ubuntu 21.10	2.9.2
Ubuntu 22.04	2.9.2
YACP	2.2.0

# Getting Started

To start using OpenCoarrays, please see the [GETTING\\_STARTED.md](#) file.

# Contributing

Please see the [CONTRIBUTING.md](#) file.

# Status

A list of open issues can be viewed on the [issues page](#).

# Support

Please submit bug reports and feature requests via our [Issues](#) page.

# Acknowledgments

We gratefully acknowledge support from the following institutions:

- [Arm](#) for approving compiler engineer contributions of code.
- [National Center for Atmospheric Research](#) for access to the Yellowstone/Caldera supercomputers and for logistics support during the initial development of OpenCoarrays.
- [CINECA](#) for access to Eurora/PLX for the project HyPS- BLAS under the ISCRA grant program for 2014.
- [Google](#) for support of a related [Google Summer of Code](#) 2014 project.
- The National Energy Research Scientific Computing Center ([NERSC](#)), which is supported by the Office of Science of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231, for access to the Hopper and Edison supercomputers under the OpenCoarrays project start allocation.
- [Sourcery, Inc.](#), for financial support for the domain registration, web hosting, advanced development, and conference travel.

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