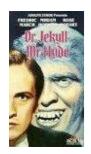


# Fortran: A Dr. Jekyll and Mr. Hyde Story

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# Fortran is the Language of Science

- Fortran is still popular in the scientific community
  - 19 out of 20 SciDAC I applications were in Fortran
  - 85% of ORNL Cray cycles are in Fortran
  - All of the major codes at LANL are in Fortran
  - 58% of DOD applications are in Fortran

## MPI Fortran Bindings are Problematic

- Fortran 77 (implicit interfaces)
  - rather frightening warnings in the standard about portability
  - no defined interface so not type safety
    - what happens when error return value is forgotten?
  - requires wrappers to get to C
- Fortran 90 (explicit interfaces)
  - type safety
    - but how safe is void\* anyway
    - requires countless TKR (type-kind-rank) interfaces
  - anyone using these?

# Proposal: A New Fortran MPI Binding Based on the Fortran 2003 C Interoperability Standard

- Fortran now has a well-defined mechanism for interoperating with C
- Programmer defines a BIND(C) interface in Fortran
  - implementation can be in either Fortran or C
  - can be called from either Fortran or C
- Fortran now has types equivalent to many C primitives
  - integer (kind=C\_INT, C\_INT\_32T...)
  - type(C\_PTR)
  - CLOC function
  - value (pass by) attribute

#### There Are Unresolved Issues

- What type should an MPI handle be?
  - an integer (MPI\_HANDLE\_KIND)
    - could be of size to hold a C pointer
  - an opaque type (MPI\_HANDLE\_TYPE)

## Example Usage

```
! import C interop and MPI interfaces
   use, intrinsic :: ISO C BINDING
   use :: MPI3
   integer(MPI INT KIND) :: rank, size, err
! MPI_Init example
   character(len=:, kind=C CHAR), allocatable :: args(:)
   integer :: n args
   err = MPI Init(n args, args)
   err = MPI Comm rank(MPI COMM WORLD, rank)
   err = MPI Comm size(MPI COMM WORLD, size)
! MPI Send and MPI Recv examples
   integer(MPI_INT_KIND) :: next, tag
   err = MPI_Send(C_LOC(message), 1, MPI_INTEGER, next, tag, MPI_COMM_WORLD)
   err = MPI_Recv(C_LOC(message), 1, MPI_INTEGER, prev, tag, MPI_COMM_WORLD, MPI_STATUS_IGNORE)
   err = MPI Finalize()
```