

UPC Interoperability with Fortran

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Where are We?

- Fortran 2003 defines interoperability with C.
- Co-arrays will be part of Fortran 2006.
- There is an overlap of co-array objects and UPC objects.
- Do we want to define an interface between the intersection of objects?
- Can we do it without changing anything on either side?



Fortran Interoperability with C

- Fortran

```
use iso_c_binding
```

```
real(c_double) :: x(18,3:7,*)
```

```
Integer(c_int) :: index
```

- C

```
double x[][5][18];
```

```
int index;
```



Co-array Interoperability with UPC

- Fortran

```
use iso_c_binding
```

```
real(c_double) :: x(18,3:7,*)[*]
```

```
Integer(c_int) :: index[*]
```

- C

```
shared double x[][5][18][THREADS];
```

```
shared int index[THREADS];
```



Derived Types and Structures

- Fortran

```
type, bind(c) :: myType
  integer(c_int) :: i,j
  real(c_float) :: s
end type myType
type(myType) :: x[*]
z = x[p]%s
```

- C

```
typedef struct{
  int m,n;
  float r;
} myctype
myctype y[THREADS];
w = y[p].r
```



Procedure Interfaces

- C Interface

```
int C_Function(shared void* x, int y)
```

- Fortran Interface

```
interface
```

```
  integer(c_int) function cFtn(z,j), bind(c, name='C_Function')
```

```
  type(c_ptr),value :: z[*]
```

```
  integer(c_int) :: j
```

```
end interface
```

```
real(c_float), target :: z[*]
```

```
integer(c_int) :: k
```

```
call cFtn(c_loc(z),k)
```



Allocatable Variables

- Fortran

```
real,allocatable,target :: x[:]
```

```
allocate(x[*])
```

```
type(c_ptr),value :: p2x
```

```
p2x = c_loc(x)
```

- C

```
upc_malloc(x,...);
```



The Co-Array Fortran Standard

- Co-arrays will be added to Fortran 2006
 - R.W. Numrich and J.K. Reid, “Co-Array Fortran for Parallel Programming”, ACM Fortran Forum, 17(2):1-31, 1998
 - R.W. Numrich and J.K. Reid, “Co-arrays in the next Fortran Standard”, ACM Fortran Forum, to appear, 2005
 - <ftp://ftp.nag.co.uk/sc22wg5/N1642.pdf>
 - R.W. Numrich, “Parallel numerical algorithms based on tensor notation and Co-Array Fortran syntax”, Parallel Computing, 31 (2005) 588-607.
 - C.E. Rasmussen and J.M. Squyres, “A Case for New MPI Fortran Bindings”, MPI/PVM Meeting, Sorrento, Italy, Sept 2005.
- Additional information on the web:
 - www.co-array.org
 - www.pmodels.org

