Generic Arrays

An Alternative to the Name Brands

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A Generic What-sis?

- A generic array is an array super type.
  - Any array may be passed as a generic array
  - A generic array has no static dimension or type
  - A generic array's data cannot be accessed
  - A generic array's meta-data may be accessed, dimension, upper, lower, type, order, etc.
  - A generic array may be 'cast' to a type and dimension.

Who needs it?

- Anyone who needs a method to be able to take multiple different kinds of arrays.
  - Generic arrays were originally requested by the Scientific Data Components and Interfaces Working Group.

Using a Generic Array

- A Generic array may be
  - AddRef'd DeleteRef'd
  - smartcopy'd
- Data may be accessed after the generic array is cast to a basic type.
  - bool, int, dcomplex, etc. OK
  - object array. NO
- The type() function returns type as an enumeration.

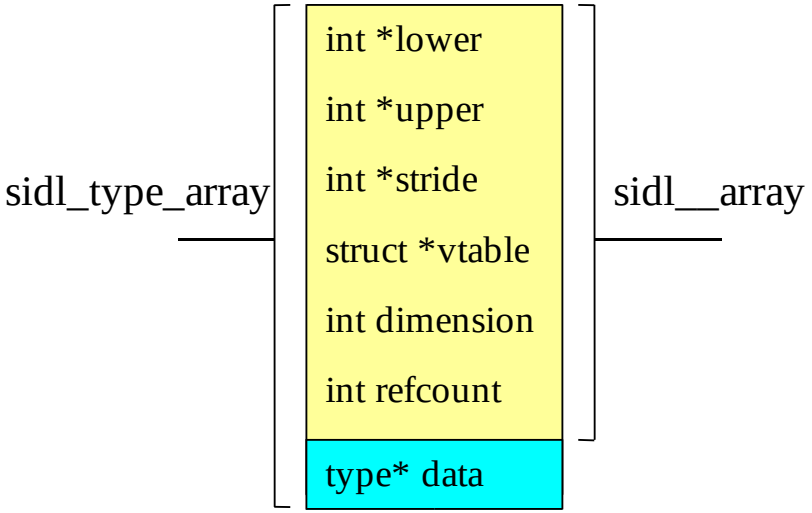
SIDL Syntax

- Generic arrays are a type, like int, or bool.
  - Example:
    - array<> passGeneric(in array<> inArg,
      inout array<> inOutArg,
      out array<> outArg);

Generic Arrays in C (IOR)

- The generic array type name is “struct sidl__array”
- Functions are called in the usual manner:
  - int32_t sidl__array_type(struct sidl__array* array

- Casting is done with a standard C cast.
- The generic array type holds all the meta-data for any array.



C example code

```
struct sidl__array* impl_ArrayTest_ArrayOps_passGeneric(
  /*in*/ struct sidl__array* inArg) {
/* DO-NOT-DELETE splicer.begin(ArrayTest.ArrayOps.passGeneric) */
  int32_t lower[7], upper[7], i;
  struct sidl__array *result = NULL;
  if (sidl__array_type(inArg) == sidl_bool_array) {
   struct sidl_bool__array * a = (struct sidl_bool__array *)inArg;
      /* DO SOMETHING…….*/
   }
return result;
 /* DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric) */
```

Generic Arrays in Cxx and UCxx

- In C++ the generic array is literally a super class of other arrays called sidl::basearray
- The type function in C++ is arrayType().
- A standard static_cast can be used to cast the generic array.

Cxx/UCxx Example

```
::sidl::basearray ArrayTest::ArrayOps_impl::passGeneric (
/*in*/ ::sidl::basearray inArg ) throw () {
// DO-NOT-DELETE splicer.begin(ArrayTest.ArrayOps.passGeneric)
  int32_t lower[7], upper[7], i;
  ::sidl::basearray result = NULL;
  if (inArg.arrayType() == sidl_bool_array) {
     ::sidl::array<bool > & temp =
        static_cast< ::sidl::array< char > &>(inArg);
     // DO SOME STUFF…..
}
return result;
 // DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric)
```

Generic Arrays in Fortran 77

- As usual, Generic Arrays are passed in as a 64-bit integer.
- Methods are called by the usual method (these may be called on any array)
  - call sidl__array_type(a)
- There is no need to cast.

Fortan 77 Example

```
 subroutine ArrayTest_ArrayOps_passGeneric_fi(inArg, retval)
       implicit none
C       in array<> inArg
       integer*8 inArg
C       out array<> retval
       integer*8 retval
C     DO-NOT-DELETE splicer.begin(ArrayTest.ArrayOps.passGeneric)
C     Insert the implementation here...
      integer*4 lower(7), upper(7), i, type, dimen, outdimen
      call sidl__array_type_f(inArg, type)
      if (type .eq. 1) then
C      DO SOME STUFF
       end if
C     DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric)
       end
```

Generic Arrays in FORTRAN 90

- Generic arrays in Fortran 90 have the type sidl__array.
- The generic array module is called sidl_array_array
- The module includes the standard generic array functions is short form:
  - tp = type(a); call smartcopy(src,dest)
- Casting is done by this cast function:
  - cast(<source>, <target>)

Fortran 90 Example

```
recursive subroutine ArrayO_passGenericwdjmxoh8x1_mi(inArg,  retval)
  use ArrayTest_ArrayOps
  use sidl_array_array
  use ArrayTest_ArrayOps_impl
  ! DO-NOT-DELETE splicer.begin(ArrayTest.ArrayOps.passGeneric.use)
  use sidl_int_array
  ! DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric.use)
  implicit none
  type(sidl__array) :: inArg ! in
  type(sidl__array) :: retval ! out
  ! DO-NOT-DELETE splicer.begin(ArrayTest.ArrayOps.passGeneric)
   type(sidl_bool_1d) :: b1
  integer (selected_int_kind(9)) :: lw(7), up(7), i, tp, dmn, outdimen
  if (type(inArg) .eq. 1) then
     call set_null(b1)
     call cast(inArg, b1)
  end if
! DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric)
end subroutine ArrayO_passGenericwdjmxoh8x1_mi
```

Generic Arrays in Java

- In Java, the Generic Array type is a super type of all arrays: gov.llnl.sidl.BaseArray
- Casting is done with a simple Java cast.
- A _dcast() call is required to resolve the dimension.
- The type function may be used.
- class BaseArray includes all the standard functions

Java Example

```
public static gov.llnl.sidl.BaseArray passGeneric_Impl (
    /*in*/ gov.llnl.sidl.BaseArray inArg)  {
    // DO-NOT-DELETE splicer.begin
     (ArrayTest.ArrayOps.passGeneric)
    int lower[] = new int[7];
    int upper[] = new int[7];
    int i;
    gov.llnl.sidl.BaseArray result = null;
    if (inArg._type() == sidl_bool_array) {
     sidl.Boolean.Array ba = (sidl.Boolean.Array) inArg;
     sidl.Boolean.Array1 ba1 = (sidl.Boolean.Array1) ba._dcast();
      //DO SOMETHING
    }
    return result;
    // DO-NOT-DELETE splicer.end(ArrayTest.ArrayOps.passGeneric)
}
```

Generic Arrays in Python

- Python is very simple, since it is dynamically typed.
- Python is unlike any due to Numeric. There is no 'type' function, only typecode()

Python Example

```
def passGeneric(inArg):
# DO-NOT-DELETE splicer.begin(passGeneric)
  ret = None
  if (inArg.typecode() == 'c'): #char array
    #DO SOME STUFF
  return (ret)
# DO-NOT-DELETE splicer.end(passGeneric)
```

Conclusion

- Generic Arrays are a simple way to generalize your SIDL interface.
- Generic Arrays are fairly natural in every language, although the interface varies.
- We hope you will find Generic Arrays a useful addition to the Babel toolkit.