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

```c
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.
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 \texttt{sidl\_\_array}.
- The generic array module is called \texttt{sidl\_array\_array}.
- The module includes the standard generic array functions is short form:
  - \texttt{tp = type(a); call smartcopy(src,dest)}
- Casting is done by this cast function:
  - \texttt{cast(<source>, <target>)}
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
public static gov.llnl.sidl.BaseArray passGeneric_Impl (gov.llnl.sidl.BaseArray inArg) {  
    gov.llnl.sidl.BaseArray result = null;
    if (inArg._type() == sidl_bool_array) {  
        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
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.