

Programming Environment Research Team

<http://www.sys.aics.riken.jp/pro-env/>



XcalableMP

What's XcalableMP ?

- XcalableMP(XMP) is a directive-based PGAS language based on C99 and Fortran95
- XMP supports typical parallelization under “global-view model” programming and enables parallelizing the original sequential code
- XMP also includes coarray features for “local-view model” programming
- Designed by XMP Specification Working Group of the PC Cluster Consortium (<http://www.pccluster.org/en/>)

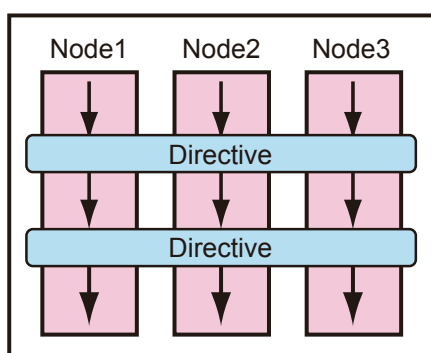
Implementation Status

- XMP specification ver. 1.2.1 (<http://xcalablemp.org>)
 - Define actions of OpenMP directives in XMP Programs
 - Start designing XMP/C++ language
- Omni compiler ver. 0.9 by RIKEN AICS and University of Tsukuba, Japan (<http://omni-compiler.org>)
 - Open source XMP compiler
 - Interface of [Scalasca](#) & [tlog](#) profiling tools
 - Supported platforms: Linux clusters, the K computer, Fujitsu FX10, Cray XE, IBM Blue Gene/Q, HITACHI SR16000, and so on

Programming Model

Execution Model

- SPMD as a basic execution model

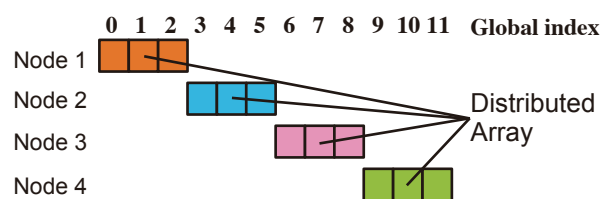


- Communication occurs when a directive is encountered (global-view model)
- One-sided communication occurs when a coarray is referred (local-view model)

Global-view Model

- a[12] is distributed onto 4 nodes

```
int a[12];  
#pragma xmp nodes p(4)  
#pragma xmp template t(0:11)  
#pragma xmp distribute t(block) onto p  
#pragma xmp align a[i] with t(i)
```



```
#pragma xmp loop on t(i) reduction(+)s  
for(int i=0; i<12; i++){  
  a[i] = func(i);  
  s += a[i];  
}
```

Work mapping

Local-view Model

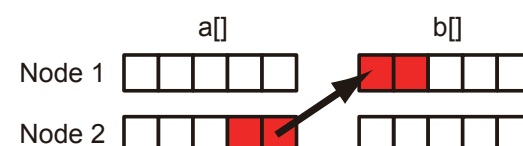
- Extends C for array section and codimension

`array_name[start:length]:[node_number]`

Above code means **length** elements from `array_name[start]` to `array_name[start+length-1]` located on a node specified by `node_number`.

- Coarray adapted for C

```
double a[5]:[*], b[5]:[*]; // Declare  
:  
if(me==2) b[0:2]:[1] = a[3:2]; // Put
```



Performance

The K computer

- SPARC64 VIIIfx 2.0GHz, 8Cores, 128GFlops
- DDR3 SDRAM 16GB, 64GB/s
- Torus fusion six-dimensional mesh/torus network, 5GB/s x10

