

### Overview

#### 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 a CAF-like PGAS feature as "local-view model" programming
- Designed by XMP Specification Working Group
  - Members from academia, research labs, and industries

#### Implementation Status

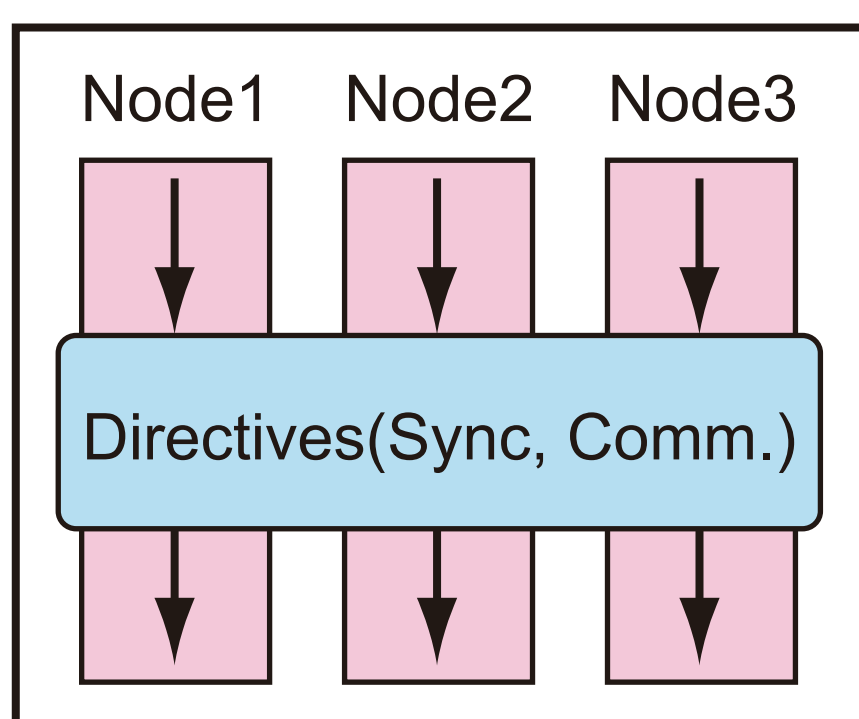
- XMP specification ver. 1.2 is available
  - Define actions of OpenMP pragmas in XMP Programs
  - Add Intrinsic/Built-in Transformational Procedures
- Omni XMP compiler ver. 0.7 is developed by University of Tsukuba and AICS, japan
  - XMP/C and XMP/Fortran Compilers are included
  - Interface of Scalasca & tlog profiling tools
  - Supported platforms are Linux cluster, the K computer, Cray XE, XT, and so on



### Programming Model

#### Language Features

- SPMD as a basic execution model



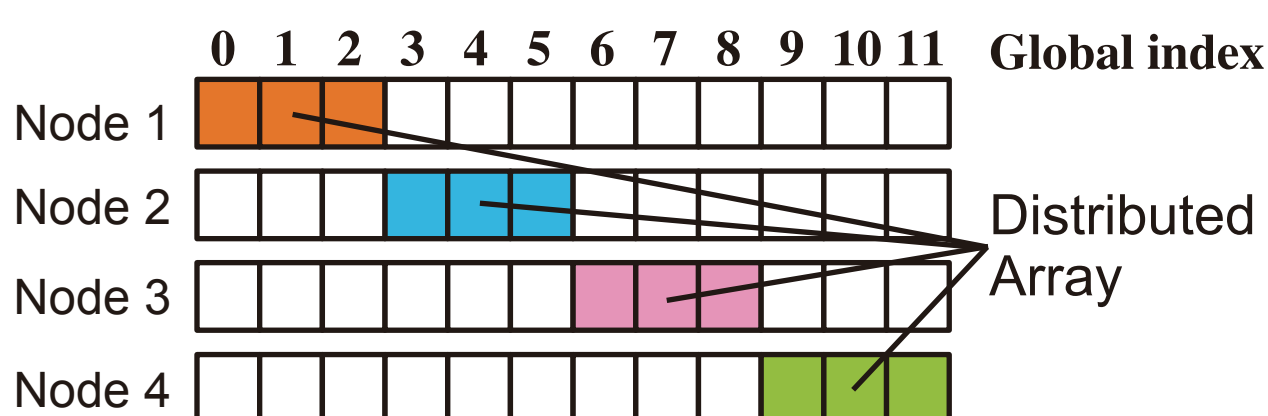
- Communication and synchronization occur when directives are encountered
- All actions are taken by directives for being "easy-to-understand" in performance tuning

#### 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)
```

**Data mapping**



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

**Work mapping**

#### Local-view model

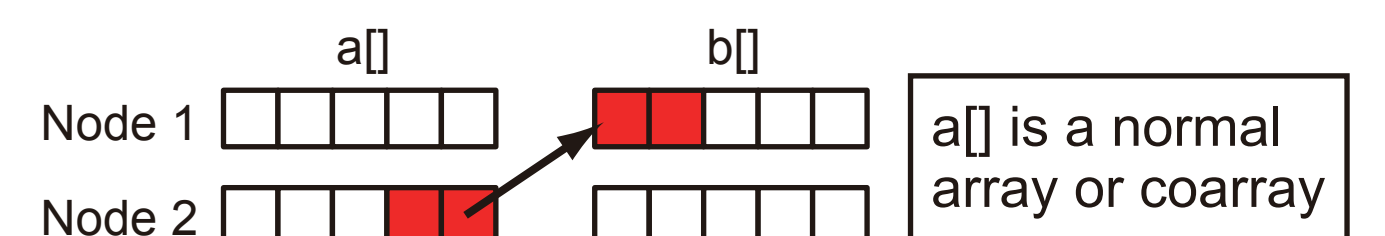
- Extends C for an array section

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

The `array_name[start:length][:node_number]` means elements from the `array_name[start]` to the `array_name[start+length-1]` located on a node whose number is `node_number`.

- Coarray Fortran like feature in C

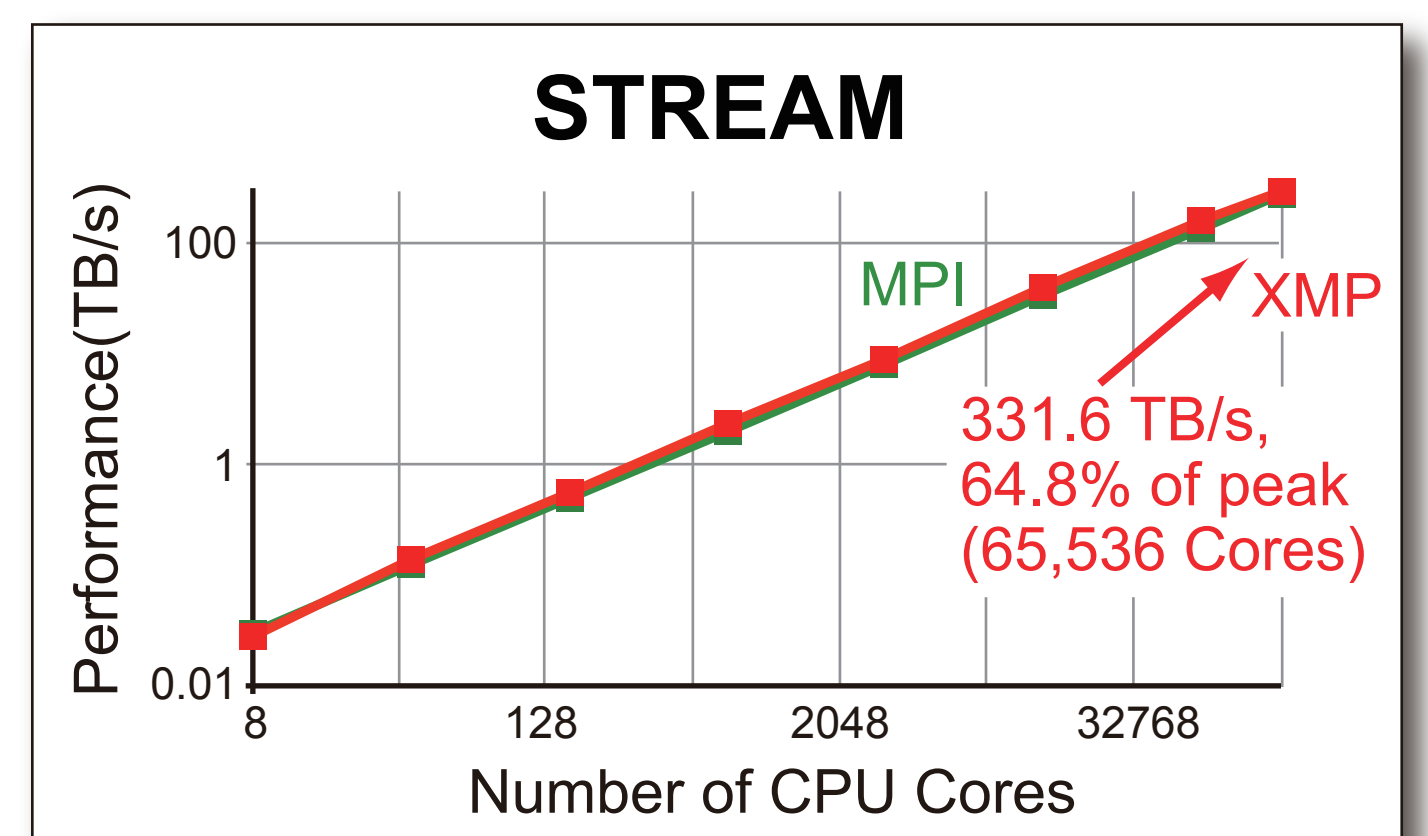
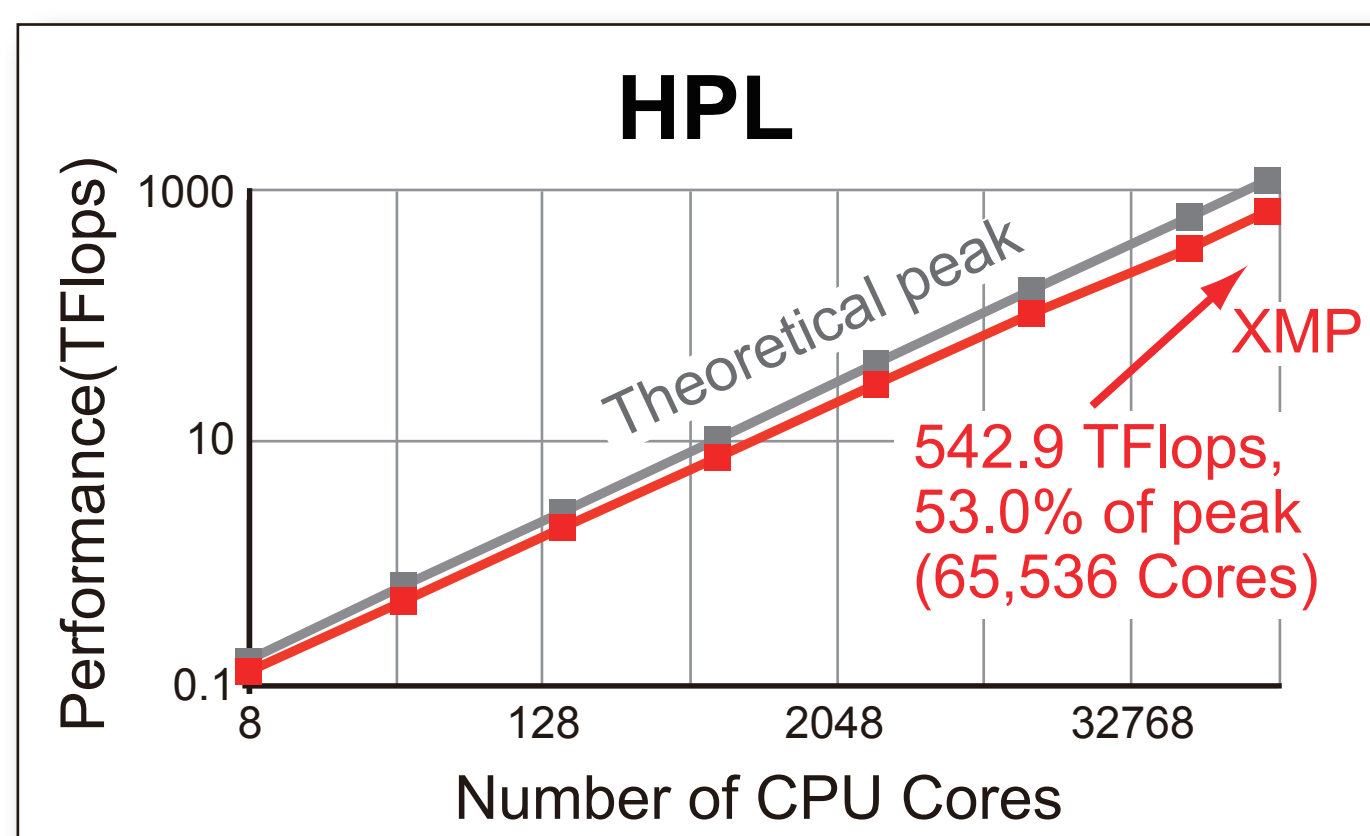
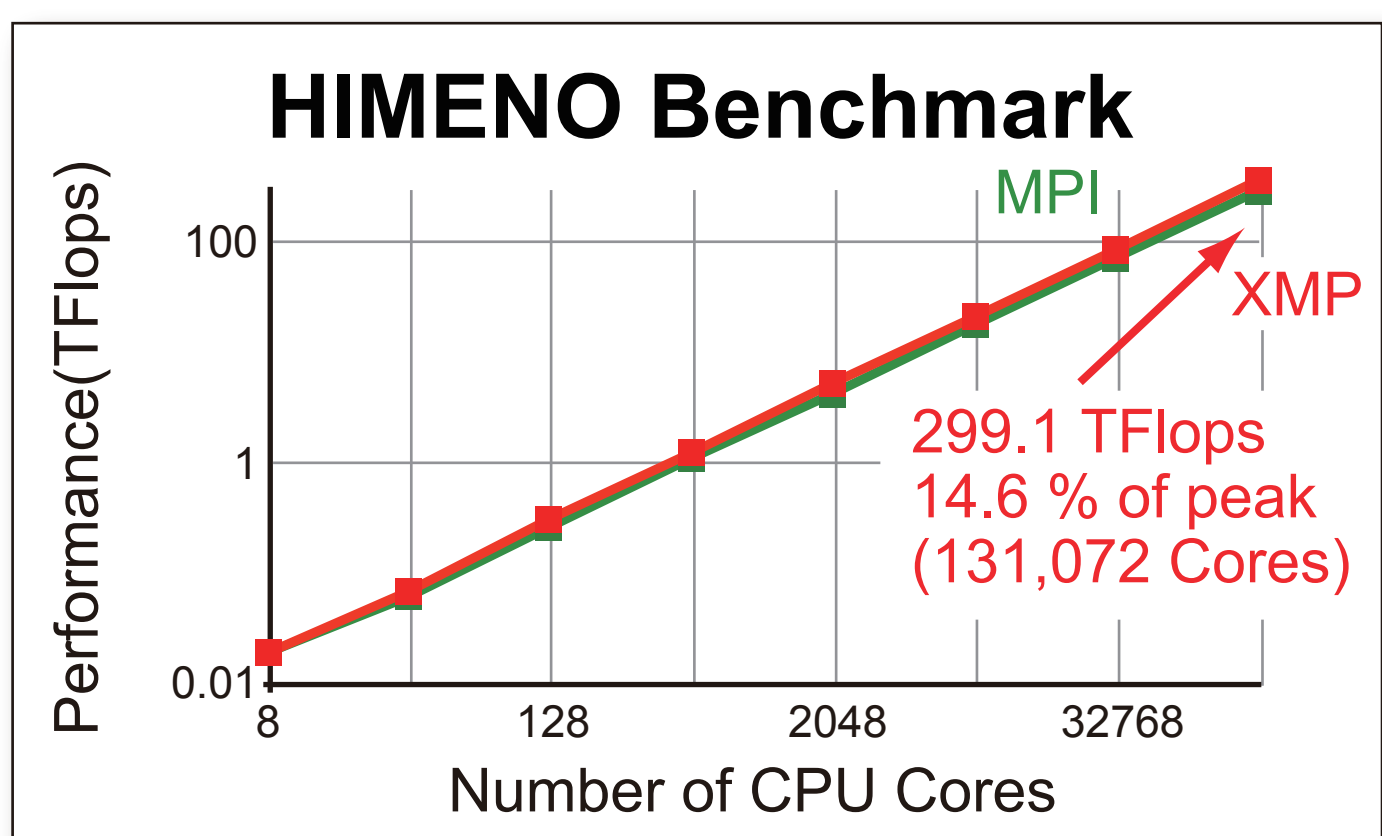
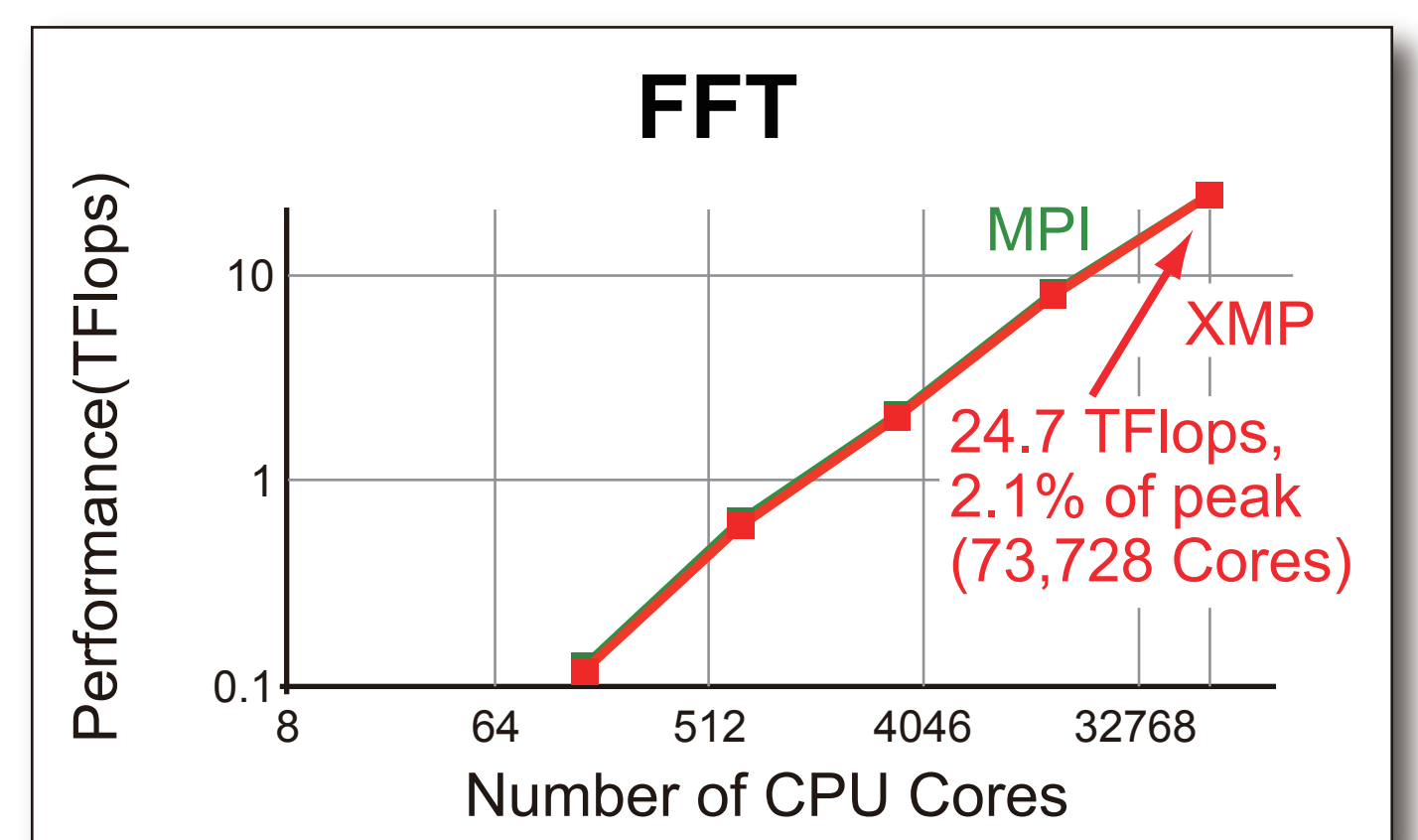
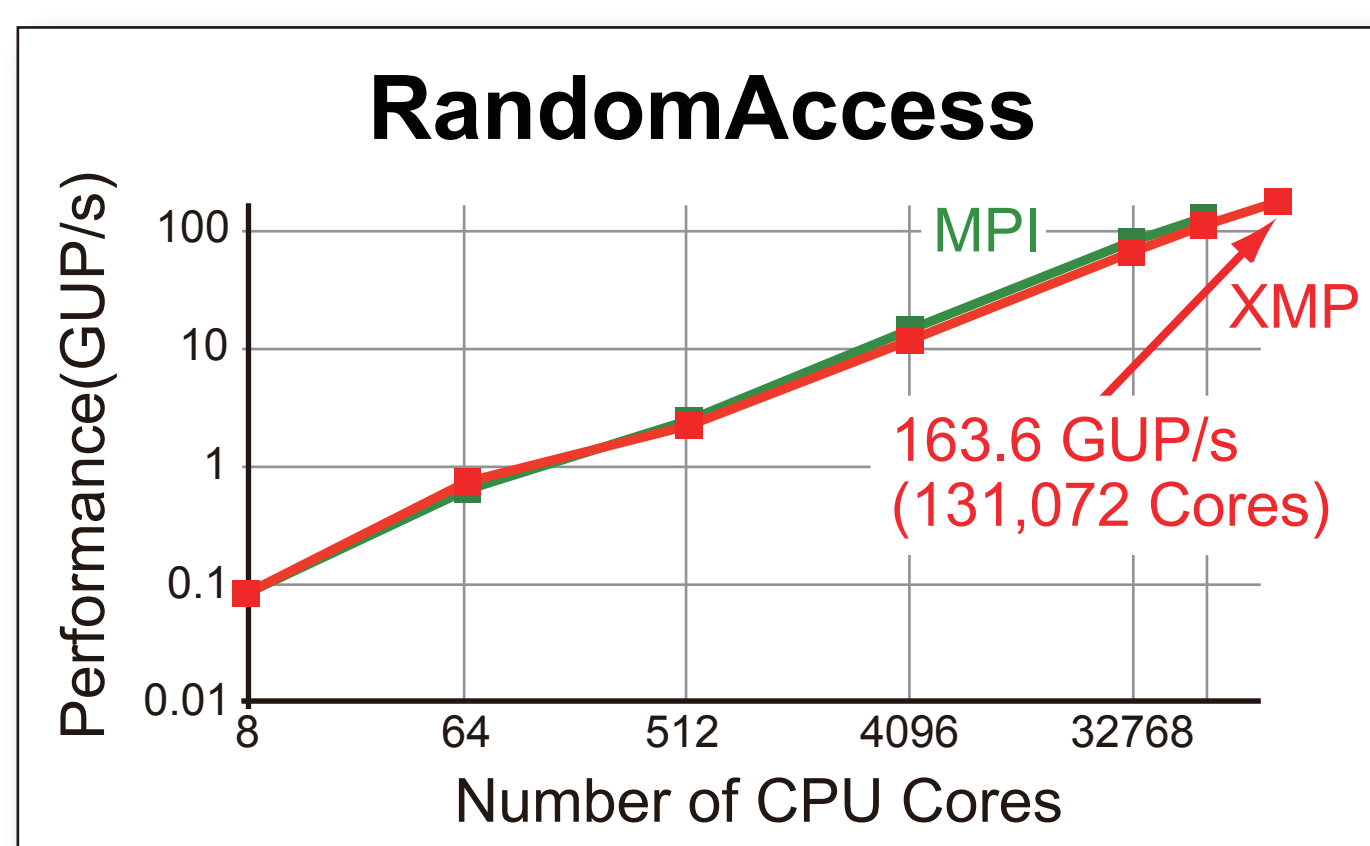
```
double b[5]:[*]; // Declaration
:
if(me==2) b[0:2]:[1] = a[3:2]; // Put
```



### Performance

#### The K computer

- CPU : SPARC64 VIIIfx 2.0GHz, 8Cores, 128GFlops
- Memory : DDR3 SDRAM 16GB, 64GB/s
- Network : Torus fusion six-dimensional mesh/torus network, 5GB/s x 10



For more information, please visit [Center for Computational Sciences, University of Tsukuba \(#2519\)](#)

