XcalableMP

Directive-Based Language eXtension for Scalable and Performance-Aware Parallel Programming

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Overview

MPI is widely used as a parallel programming model. However, the programming cost of MPI is high.

XcalableMP is a directive-based language extension which allows users to easily develop parallel programs for distributed memory systems and to tune the performance by having minimal and simple notations.

The specification has been being designed by XcalableMP Specification Working Group which consists of members from academia and research labs to industries in Japan.

Current Solution for parallel programming

```
int array[MAX];

main(int argc, char **argv){
  MPI_Init(&argc, &argv);
  MPI_Comm_rank(MPI_COMM_WORLD, &
  MPI_Comm_size(MPI_COMM_WORLD, &
  dx = MAX/size;
  llimit = rank * dx;
  if(rank != (size -1)) ulimit = llimit + dx;
  else ulimit = MAX;

  temp_res = 0;
  for(i=llimit; i < ulimit; i++){
    array[i] = func(i);
    temp_res += array[i];}

  MPI_Allreduce(&temp_res, &res, 1, MPI_INT, MPI_SUM, ...);
  MPI_Finalize( );
}
```

Only way to program is MPI, but MPI progrraming seems difficult,... we have to rerwite almost entire program and it is time-consuming and hard to debug... mmm

We need better solutions !!

```
int array[MAX];
#pragma xmp nodes p(*)
#pragma xmp template t(0:MAX-1)
#pragma xmp distribute t(block) onto p
#pragma xmp align array[i] with t(i)

main(){
#pragma xmp loop on t(i) reduction (+:res)
 for(i = 0; i < MAX; i++){
    array[i] = func(i);
    res += array[i];}
}
```

XcalableMP enables users to easily develop parallel programs and to tune performance with minimal and simple notation !!

Language Features

- ***XcalableMP*** supports typical parallelization based on the data parallel paradigm and work mapping under “global-view” programming model.
- The important design principle of ***XcalableMP*** is “performance-awareness”. All actions of communication and synchronization are taken by directives, different from automatic parallelizing compilers.
- ***XcalableMP*** also includes CAF-like PGAS (Partitioned Global Address Space) feature as “local-view” programming.
- ***XcalableMP*** APIs are defined on C and Fortran 95 as a base language.

You can download XcalableMP from ***http://www.xcalablemp.org***

Code Example (HPCC STREAM)

```
double a[SIZE], b[SIZE], c[SIZE];
#pragma xmp nodes p(*)
#pragma xmp template t(0:SIZE-1)
#pragma xmp distribute t(block) onto p
#pragma xmp align [i] with t(i) :: a,b,c
...
#pragma xmp loop on t(i)
for(i = 0; i < SIZE; i++) {
   a[i] = b[i] + scalar*c[i];
}
```