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Chapter 4

Support for the Local-view Programming

XcalableMP adopts coarray features for the local-view programming. Particularly in XcalableMP Fortran, the features are compatible with that of Fortran 2008.

4.1 Coarrays in XcalableMP

The specification of the coarray features in XcalableMP conforms to that of Fortran 2008 unless otherwise provided. Each node in the entire node set is considered to correspond to each image of a program. Therefore the number of images is always equal to the size of the entire node set. The image index of a node is its node number of the entire node set.

Declaring coarrays on an arbitrary node array, which may not correspond to the entire node set, is an open issue of XcalableMP and under discussion. Note that even if the coarray features of XcalableMP would be extended in the future version so that they could be declared on a subset of the entire node set, they are compatible with those of Fortran 2008 as long as declared on the entire node set.

Terms related to coarrays in XcalableMP (e.g. *coshape*, *coindex*, *cobound*, *cosubscript*, *image*, *image index*, etc.) are derived from that in Fortran 2008.

Described in the rest of this section is the coarray features for XcalableMP C.

4.1.1 [C] Declaration of Coarrays

Synopsis

Coarrays are declared in XcalableMP C.

Syntax

[C] *data-type variable* [, *variable*] . . . : *codimensions*

where *codimensions* is:

$[[int-expr] \dots] [*]$

Description

For XcalableMP C, coarrays are declared with a colon and square bracket where *codimensions* specify the *coshape* of a variable.

Restrictions

- A coarray *variable* must have a global scope.

Examples

```

XcalableMP C
#pragma xmp nodes p(16)
float x:[*];

```

A variable x that has a global scope is declared as a coarray.

4.1.2 [C] Reference of Coarrays

Synopsis

A coarray can be directly referenced or defined by any node. The target node is specified using an extended notation in XcalableMP C.

Syntax

[C] *variable* : [*int-expr*]...

Description

A sequence of [*int-expr*]'s preceded by a colon in XcalableMP C determines the image index for a coarray to be accessed.

An reference of coarrays can appear in the same place as an reference of normal variables in the base languages.

Examples

In the following code, each executing node gets whole of B from the image 10 (that is, the tenth node of the entire node set) and copies it into the local storage for A.

```

XcalableMP C
int A[10]:[*], B[10]:[*];
A[:] = B[:]:[10];

```

4.1.3 [C] Synchronization of Coarrays

Synopsis

XcalableMP C provides synchronization functions for coarrays.

Format

```

[C] void xmp_sync_all(int* status)
[C] void xmp_sync_memory(int* status)
[C] void xmp_sync_image(int image, int* status)
[C] void xmp_sync_images(int num, int* image_set, int* status)
[C] void xmp_sync_images_all(int* status)

```

Description

- `xmp_sync_all` is equivalent to the `sync all` statement in Fortran 2008.
- `xmp_sync_memory` is equivalent to the `sync memory` statement in Fortran 2008.
- A combination of `xmp_sync_image`, `xmp_sync_images`, and `xmp_sync_images_all` is equivalent to the `sync memory` statement in Fortran 2008.
 - `xmp_sync_image` is to synchronize one image.
 - `xmp_sync_images` is to synchronize some images.
 - `xmp_sync_images_all` is to synchronize all images.

Arguments

- The argument *status* is defined with one of the follow symbolic constants.
 - `XMP_STAT_SUCCESS`
 - `XMP_STAT_STOPPED_IMAGE`

If an execution of the function is success, the *status* is defined with `XMP_STAT_SUCCESS`. A condition where the *status* is defined with `XMP_STAT_STOPPED_IMAGE` is the same as that where the *status* is defined with `STAT_STOPPED_IMAGE` in Fortran 2008. These symbolic constants are defined in “xmp.h”. If any other error condition occurs during execution of these functions, the *status* is defined with a value which is different from the value of `XMP_STAT_SUCCESS` and `XMP_STAT_STOPPED_IMAGE`.

- In `xmp_sync_image`, the variable *image* determines a target image index.
- In `xmp_sync_images`, the variable *num* is a number of target images, and the variable *image_set* is an array where target images set is defined.