

# **OpenMP Implementations For FUJITSU Supercomputer PRIMEHPC FX100**

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# OpenMP® and VISIMPACT™

implemented in PRIMEHPC FX100

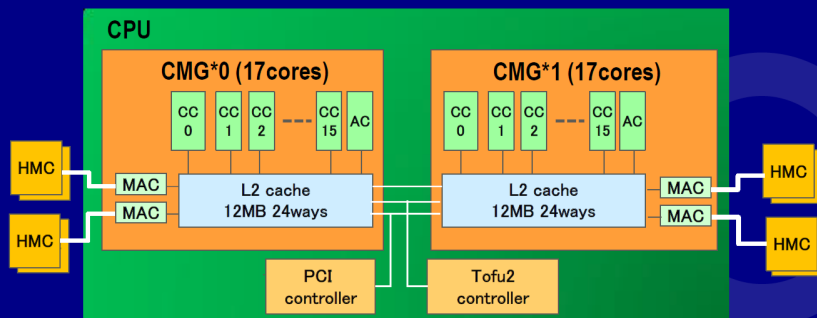
- Key technologies for the Exascale era
- Enabling Efficient Hybrid Parallelization
- Creating synergy with Explicit Vector Programming



# Thread Affinity Control of OpenMP 4.0

## Many-Core Architecture

- SPARC64™ Xifx has 2 CMGs (Core Memory Group)
  - CMG consists of 17 cores, L2 cache and 2 memory controllers (MAC)
  - Two CMGs keep cache coherency by ccNUMA with on-chip directory
    - 32GB memory capacity
    - To bind a process in a CMG is recommended



"SPARC64(TM) Xifx", HOT CHIPS 26,  
<http://jp.fujitsu.com/solutions/hpc/brochures/>

To fit the ccNUMA architecture, first, spread two threads among CMGs. Second, place 15 threads close to the parent thread.

```
export OMP_PLACES="{0:16},{16:16}"
```

```
!$omp parallel proc_bind(spread)
```

```
!$omp parallel proc_bind(close)
```

```
!$omp end parallel
```

```
!$omp end parallel
```

# Explicit Vector Programming Using SIMD Constructs of OpenMP 4.0

## HPC-ACE2: ISA enhancements

- Wider SIMD enhancements from K computer / FX10
  - 256-bit wide SIMD (64-bit x 4 / 32-bit x 8)
  - More integer operations
  - Stride load/store
  - Indirect load/store
  - Compress
  - Round
  - Permutation

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SIMD constructs of OpenMP 4.0 are useful to make use of the 256-bit wide SIMD instructions.

```
#pragma omp declare simd
float fmax(float a, float b) {
    return (a < b ? b : a);
}

void vfmax(float *r, float *p, float *q) {
    #pragma omp parallel for simd
    for (t = 0; t < SIZE; t++) {
        r[t] = fmax(p[t], q[t]);
    }
}
```

# OpenMP Japanese Translation

- Version 3.0 in Japanese now available on the web.

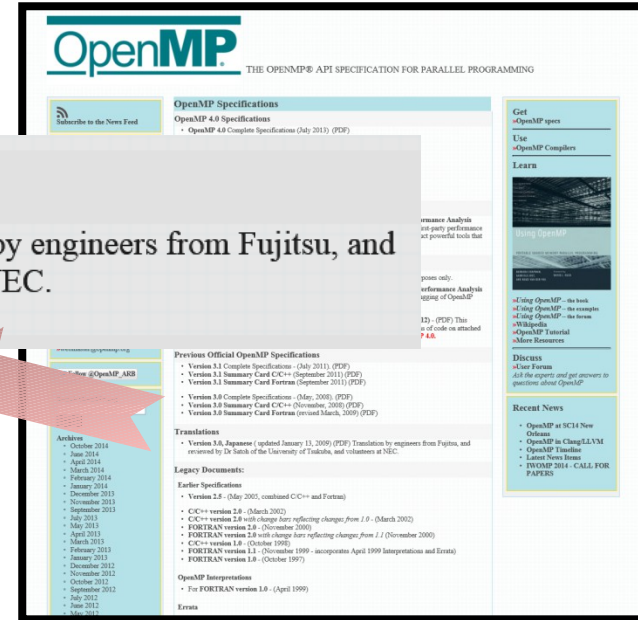
## Translations

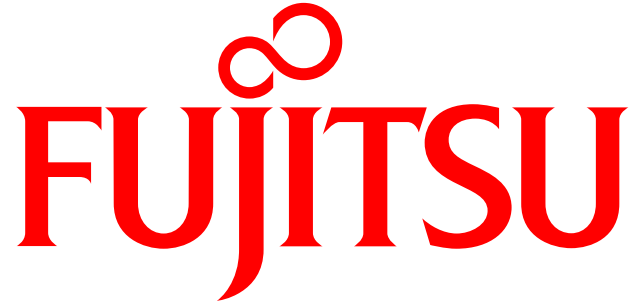
- **Version 3.0, Japanese** ( updated January 13, 2009 ) (PDF) Translation by engineers from Fujitsu, and reviewed by Dr Satoh of the University of Tsukuba, and volunteers at NEC.

- Version 4.0 in Japanese is expected by many Japanese users.

➤ Targeting to publish by SC15

➤ Calling for Volunteers!





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