OSCAR Automatic Parallelizing Compiler

**To improve effective performance, cost-performance and software productivity and reduce power**

**Multigrain Parallelization**
coarse-grain parallelism among loops and subroutines, near fine grain parallelism among statements in addition to loop parallelism

**Data Localization**
Automatic data management for distributed shared memory, cache and local memory

**Data Transfer Overlapping**
Data transfer overlapping using Data Transfer Controllers (DMAs)

**Power Reduction**
Reduction of consumed power by compiler control DVFS and Power gating with hardware supports.

**Software Coherent Cache**
Parallelizing compiler directed software coherence technique for shared memory multicore systems without hardware cache coherence control

**Advantages**
- Smaller hardware and lower power consumption brought by removing expensive hardware cache coherence mechanism
- Higher performance by compiler’s careful cache operation scheduling as well as memory optimization

**Evaluation**
- # of PE: 1PE, 2PE, 4PE
- NIOS II multicore system implemented in Arria10 SoC FPGA
  - IS: 32KB / DS:32KB (Each PE)
- Application
  - NAS Parallel Benchmarks
  - Matrix Multiply (Size: 100x100)

**Parallelizing of “National Research Institute for Earth Science and Disaster Resilience” Earthquake Wave Simulation GMS by OSCAR Compiler**

**Cancer Treatment Carbon Ion Radiotherapy**

**Speedup by cache software coherent control**
3.6 times speedup for NAS parallel benchmark CG (Conjugate Gradient)

Execution environment: Hitachi SR16000 Model VM1
(IBM POWER7 Processor: 128core)
Automatic Parallelization of MATLAB/Simulink by OSCAR Compiler

Speedups of MATLAB/Simulink Image Processing on Various 4core Multicores (Intel Xeon, ARM Cortex A15 and Renesas SH4A)

- x3.6 for intel, x3.1 for ARM, x3.5 for Renesas

Vector Processing of Parallelized Program by OSCAR Compiler on NEC SX-Aurora TSUBASA

- SX-Aurora TSUBASA Architecture
  - 8 Vector Core
  - 16MB LLC
  - DMA Engine
  - 6 HBM2 Controller

Speedups on SX-Aurora TSUBASA

- 3.02 speed up against NEC vectorizing compiler