Introduction of Fujitsu’s HPC Processor for the Post-K Computer

August 22nd, 2016
Toshio Yoshida
Advanced System Research & Development Unit
FUJITSU LIMITED
Fujitsu, as a “lead partner,” has been collaborating closely with ARM and contributed to the development of the HPC extensions (called SVE) for ARMv8-A, a cutting-edge ISA optimized for a wide range of HPC applications.

Fujitsu is developing a new HPC processor conforming to ARMv8-A with SVE for the Post-K computer, based on our own microarchitecture, as used in our ongoing SPARC64 and mainframe processor development.
Post-K Processor Overview

- Enhances and inherits the superior features of the K computer, PRIMEHPC FX10 and FX100

- High performance for a wide range of real applications
  - Many-core processor with 512-bit wide SIMD
  - Fujitsu HPC compiler for the ARM ISA, optimized for our microarchitecture

- High scalability
  - Scalable, integrated Tofu interconnect
  - Assistant cores for daemons, IOs & MPI asynchronous communications

- Optimized performance-per-watt

<table>
<thead>
<tr>
<th></th>
<th>Post-K</th>
<th>PRIMEHPC FX100</th>
<th>K computer/ PRIMEHPC FX10</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISA</td>
<td>ARMv8-A+SVE</td>
<td>SPARC-V9+HPC-ACE2</td>
<td>SPARC-V9+HPC-ACE</td>
</tr>
<tr>
<td>SIMD</td>
<td>512-bit</td>
<td>256-bit</td>
<td>128-bit</td>
</tr>
<tr>
<td>Four-operand FMA</td>
<td>✓ Enhanced</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Gather/Scatter</td>
<td>✓ Enhanced</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Predicated Operation</td>
<td>✓ Enhanced</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Math. Acceleration</td>
<td>✓ Enhanced</td>
<td>✓ Enhanced</td>
<td>✓</td>
</tr>
<tr>
<td>HW Barrier*/ Sector Cache*</td>
<td>✓ Enhanced</td>
<td>✓ Enhanced</td>
<td>✓</td>
</tr>
</tbody>
</table>

* Fujitsu extensions, utilizing the ARM ISA’s “implementation-defined” space
Post-K Development at Fujitsu

- Fujitsu has 40 years’ experience in supercomputers, where we have consistently adopted the most appropriate ISA for each project, such as the HPC extensions for SPARC-V9 called HPC-ACE.

- Fujitsu chose to adopt ARMv8-A with SVE in order to best position the Post-K computer to contribute to a wider user base and utilize the assets. This decision was also a natural result of collaboration with ARM on the development of the HPC extensions.

- The Post-K computer will be a massively parallel supercomputer system based on Fujitsu’s ARM ISA-equipped HPC processor, leveraging Fujitsu’s trusted HPC technologies to protect and enhance users’ application assets.
shaping tomorrow with you