ScaleMP Introduction
ScaleMP Fact-sheet

Founded in 2003

Software-based Shared-memory System

World’s largest SMP: 32,768 CPUs & 256 TB RAM

Leverages x86 and InfiniBand

Product shipping since 2006

Channel-only business model

300+ customers worldwide
Selected Customers and Applications

**Life Sciences**
- AMBER
- CFOUR
- DOCK
- GAMESS
- Gaussian
- GOLD
- NWChem
- Octopus
- OpenEye FRED
- OpenEye OMEGA
- Schrödinger Jaguar
- Schrödinger Glide
- SCM ADF
- VASP

**Comp. Chemistry**
- GAMESS
- Gaussian
- NWChem
- Octopus
- OpenEye FRED
- OpenEye OMEGA
- Schrodinger Jaguar
- Schrödinger Glide
- SCM ADF
- VASP

**Molecular Dynamics**
- GROMACS
- MOLPRO
- NAMD
- OpenEye ROCS
- Schrödinger Desmond
- Turbomole

**Fluid Dynamics**
- ANSYS CFX
- ANSYS Fluent
- ANSYS TGrid
- AVL FIRE
- EXA PowerFlow
- EZNSS
- GeoDict
- MHD3D
- NASA Cart3D
- STAR-CCM+
- STAR-CD

**Structural Mechanics**
- ABAQUS/Explicit
- ABAQUS/Standard
- ALTAIR Radios
- ANSYS Mechanical
- LSTC LS-DYNA
- NASTRAN
- TNO Diana

**Manufacturing**
- ABAQUS/Explicit
- ABAQUS/Standard
- ALTAIR Radios
- ANSYS Mechanical
- LSTC LS-DYNA
- NASTRAN
- TNO Diana

**EDA**
- Cadence
- HSPICE
- Mentor
- Quartus
- Silvaco SmartSpice
- Synopsys

**Bio-informatics**
- 454/Newbler
- Abyss
- Bowtie
- CLC Bio
- FASTA
- HMMER
- Illumina
- mpiBLAST
- SOAPDenovo
- Velvet

**RDBMS & Analytics**
- Actian VectorWise
- Oracle
- SAP HANA
- Sybase

**Finance**
- KX
- Wombat

...and many more homegrown applications
PARTITIONING
Subset of the physical resources

AGGREGATION
Concatenation of physical resources

Virtual Machines
- App
- OS
- App
- OS
- App
- OS

Hypervisor or VMM

Virtual Machine
- App
- OS

Hypervisor or VMM
- Hypervisor or VMM
- Hypervisor or VMM
- Hypervisor or VMM

ScaleMP

vmware
redhat
CITRIX
ORACLE
Microsoft
Usage Models for Server Aggregation

Application Driven

Large Memory

Compute Intensive

I/O Intensive

IT Driven

Consolidation
vSMP Foundation - Solutions

**Single Operating System**
- Cluster management and server consolidation

vSMP Foundation for Cluster

**Single (large) System**
- Compute and memory demanding applications

vSMP Foundation for SMP

**Single Infrastructure**
- Cloud enabler – on-demand infrastructure

vSMP Foundation for Cloud

**Benefits**
- OPEX savings
- CAPEX savings
- Flexibility (CAPEX and OPEX savings)
Server Consolidation Solution

- Single OS
- Server consolidation platform for both enterprise and technical computing environments
- Simplified IT: One system to manage, instead of several
Target analytics with integrated solution.

Very large memory: could support up to 7.5TB RAM without IB switch and 48TB RAM with IB switch.
The Virtualized Datacenter

- Single infrastructure, many workloads. Allows for big-data problems in cloud environment
- Integrated with leading provisioning software.
### Traditional Accelerators and Xeon Phi

<table>
<thead>
<tr>
<th><strong>Traditional Accelerator</strong></th>
<th><strong>Intel Xeon Phi</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• 3 main developer challenges</td>
<td>• Targeting challenge #2, but...</td>
</tr>
<tr>
<td>1. Out of band programming</td>
<td>– Missing instruction-set</td>
</tr>
<tr>
<td>2. Requires changes to program architecture due to <strong>instruction set</strong></td>
<td>• Does not support the MMX and the SSE instruction-set. As a result recompilation is required to run existing applications on the Intel Xeon Phi.</td>
</tr>
<tr>
<td>3. Requires changes to program architecture due to <strong>memory size</strong></td>
<td>– New instruction-set needed to squeeze all the chip horsepower</td>
</tr>
<tr>
<td></td>
<td>• Different from the Sandy-Bridge AVX instruction-set</td>
</tr>
<tr>
<td></td>
<td>• Requires either recompilation of the application, the use of specific libraries provided by Intel, or sometimes even recoding of the application</td>
</tr>
<tr>
<td></td>
<td>• Challenge #3 is significant...</td>
</tr>
<tr>
<td></td>
<td>• About 128 MB per core. Or less than 50MB per thread</td>
</tr>
<tr>
<td></td>
<td>• Compared with &gt;2GB per core in typical system</td>
</tr>
</tbody>
</table>
High-density computing

- Virtualize Xeon Phi (MIC) into the host OS context
  - Single system
  - No offloading

- Core usage without boundaries
  - Hundreds of cores for one application
  - No need to MPI/SSH into the Phi

- Transparent large memory access
  - Hundreds of GB for application data
  - No manual buffer bouncing
Accelerator Virtualization

ACCELERATOR ADD-ON

Traditional offload programming model

AGGREGATION

Unified processing and memory