DDT, a Global Debugger Solution at KIT

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University

- 11 faculties
- 120 institutes
- 4,000 employees
- 18,500 students
- 250 mio € budget

Forschungszentrum

- 10 programs (research areas)
- 21 large institutes
- 4,000 employees
- 310 mio € budget

University and Forschungszentrum Karlsruhe (KIT)

- 10 km, 15 min distance

Science, education, structures for the administration, institutes, services, infrastructure
Karlsruhe Institute of Technology - two strong partners united

- Universität Karlsruhe (TH)
  - One of the most research oriented universities in Germany
  - Nominated to one of three top universities in October 2006
  - Capitalized with over 100 million € over 5 years

- Forschungszentrum Karlsruhe
  - Member of the Helmholtz Association
  - Internationally acknowledged non-university institution

Under the roof of KIT – Steinbuch Centre for Computing

- Computing Center of the Universität Karlsruhe (TH)
- Institute of Scientific Computing at the Forschungszentrum Karlsruhe
Virtual Computing Centre Karlsruhe since 1996

- IT-Services for UKA
- High Performance Computing
- Numerical Methods on HPC
- Integrated Information Mgmt.

IWR / FZK

IT-Services for FZK
Scientific Computing
GridKa, CampusGrid, D-Grid
Nat. & Intl. Grid Projects

Cooperation in High Performance Computing
HP XC4000 – Baden-Württemberg-State-Supercomputer, a part of SCC

- Total of 3000 processor cores
- Total of 15.6 TFlop/s peak performance
- Total of 12 TB of main memory
- Total 110 TB of local disk space (scratch)

Phase 2 (Q3 2006)
- 750 4-way nodes (two sockets)
  - dual core AMD Opteron 2.6 Ghz
  - 16 GB main memory
- 10 server nodes
- 10 file server nodes
  - Approx. 56 TB storage system
- Infiniband DDR interconnect
- 20 water cooled racks (HP MCS)
Parts of SCC

a SX-9 node will be added in autumn 2008
DDT versions at KIT

- 1.9.1c in the Linux based OPUS\textsuperscript{IB} environment
- SX8beta6.RELEASE on SX8R and front-ends (Version 2.3)
- 1.10 in the AIX environment
- 2.2 on the HP XC4000 system

Concept: Like the solution with TotalView 5-10 years ago, SCC will give the users the possibility to use only one interface for solving problems in a parallel and heterogeneous environment. In the future only one version should be in production.

But: user’s don’t want to use a debugger. Help from the computer centre is needed!
DDT at HP XC4000

- Interactive mode is limited to 8 tasks
- No limitation for batch, but wait time is required if the machine is fully loaded

DDT at OPUS\textsuperscript{IB}

- Interactive mode with only limitations in memory and CPU-time
- No limitation for batch, but wait time is required if the machine is fully loaded
DDT under AIX

- Interactive mode is limited to 8 tasks
- No limitation for batch, but wait time is required if the machine is fully loaded

DDT at SX-8R

- Interactive mode with no limitations in memory and CPU-time (interactive mode preferred), limitation is one node
- No limitation for batch, but wait time is required because the machine is normally fully loaded
DDT at SX-8R, some features

- Breakpoints
- attaching running processes
- OpenMP
- visualize data
- Watchpoints
DDT problems at SX-8R

- timeout because debugging is not a high priority process, you have to set DDT_NO_TIMEOUT=1, it’s not the solution but it helps!
- selection of message queues doesn’t work
- the scalar unit of the SX-8R is very slow compared with x86 hardware
- add a close icon to close windows (some have it!)
- evaluating for visualization in 3D takes a lot of time
- adding static fields to a list of watchpoints is not possible
- 3-D view isn’t very helpful, but the table helps a lot
3-D view of data, helpfull?
### Data Table

**Array Expression:** \( c[i,j] \)

<table>
<thead>
<tr>
<th>Range of ( i )</th>
<th>Range of ( j )</th>
</tr>
</thead>
<tbody>
<tr>
<td>From: 1</td>
<td>From: 1</td>
</tr>
<tr>
<td>To: 100</td>
<td>To: 100</td>
</tr>
</tbody>
</table>

**Aggregate Function:** Sum

<table>
<thead>
<tr>
<th>Data Table</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>10925.54870298208</td>
</tr>
<tr>
<td>2</td>
<td>1166.444316954099</td>
</tr>
<tr>
<td>3</td>
<td>571.168755806970</td>
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<td>512.7761596216023</td>
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<td>5</td>
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<td>6</td>
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<td>653.7166822328418</td>
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<td>10</td>
<td>124890.5563461092</td>
</tr>
<tr>
<td>11</td>
<td>658.184097517930</td>
</tr>
</tbody>
</table>

Expression "c[i,j]" evaluated for process 0 at 09:32.
DDT at HP XC4000
Factor 20-25 between Cluster and vector computer
The influence of a Storage Lake in the Arid Elqui Valley in Chile on the Local Climate

out: $\Delta x = 800 \text{ m}, \quad \Delta y = 800 \text{ m}$

in(1): $\Delta x = 400 \text{ m}, \quad \Delta y = 400 \text{ m}$

in(2): $\Delta x = 200 \text{ m}, \quad \Delta y = 200 \text{ m}$

in(3): $\Delta x = 100 \text{ m}, \quad \Delta y = 100 \text{ m}$

225 x 135 horizontal gridpoints
100 vertical levels
Thank you!

Questions?