High-Performance Computing from Commodity Embedded Technology

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Enabling Exascale in Europe for Industry

Dublin, 26/05/2015
Mont-Blanc in a glance

Mont-Blanc 2011-2015

• HPC prototype based on current mobile embedded technology
• Learn from the experience, plan for future architecture
• Port real scientific applications

Mont-Blanc 2013-2016

• Extend
  • Set of scientific applications
  • OmpSs programming model
  • Productivity tools
  • Next generation Mont-Blanc architecture

• Explore
  • ARM 64-bit
  • Fault tolerance and resiliency
  • Market of ARM-based platforms for mini-clusters

• Disseminate
  • End-User Group
The idea is to exploit commodity technology

HPC
Servers
Desktop
Mobile

TOP 500
~23M cores (Nov 2014)

<table>
<thead>
<tr>
<th></th>
<th>Servers</th>
<th>PC</th>
<th>Smartphones</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>9.0M</td>
<td>316M</td>
<td>1000M</td>
</tr>
<tr>
<td>2014</td>
<td>9.3M</td>
<td>+3%</td>
<td>314M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>-1%</td>
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<td></td>
<td></td>
<td></td>
<td>1300M</td>
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<td>+30%</td>
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...and we are still ignoring tablets: >200M

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Prototypes are critical to accelerate software development
System software stack + applications
The Mont-Blanc prototype

**Exynos 5 compute card**
- 2 x Cortex-A15 @ 1.7GHz
- 1 x Mali T604 GPU
- 6.8 + 25.5 GFLOPS
- 15 Watts
- 2.1 GFLOPS/W

**Carrier blade**
- 15 x Compute cards
- 485 GFLOPS
- 1 GbE to 10 GbE
- 300 Watts
- 1.6 GFLOPS/W

**Blade chassis 7U**
- 9 x Carrier blade
- 135 x Compute cards
- 4.3 TFLOPS
- 2.7 kWatts
- 1.6 GFLOPS/W

**Rack**
- 8 BullX chassis
- 72 Compute blades
- 1080 Compute cards
- 2160 CPUs
- 1080 GPUs
- 4.3 TB of DRAM
- 17.2 TB of Flash
- 35 TFLOPS
- 24 kWatt

<table>
<thead>
<tr>
<th></th>
<th>Mont-Blanc [GFLOPS/W]</th>
<th>Green500 [GFLOPS/W]</th>
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<tbody>
<tr>
<td>Nov 2011</td>
<td>0.15</td>
<td>2.0</td>
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<tr>
<td>Nov 2014</td>
<td>1.5</td>
<td>5.2</td>
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Mont-Blanc project status

DONE!

- Prototype: design, development, deployment, monitor
- Deployment of HPC software stack on ARM
- Porting of HPC kernel and applications
- Test of non-HPC workload (Hadoop, OpenStack)

ON GOING…

- Next-generation architecture modelling
- ARM 64-bit exploration (mobile and server market)
- Porting of new applications
- Programming model enhancement
- Monitoring prototype for fault tolerance techniques

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Enabling Exascale in Europe for Industry

MontBlancEU

montblanc-project.eu

@MontBlanc_EU
End-User Group

• Develops a synergy among industry, research centers and partners of the project
• Validates the novel HPC technologies produced by the project
• Provides feedback to the project

Mont-Blanc provides EUG members with:

- Remote access to Mont-Blanc prototype platforms
- Support in platform evaluation and performance analysis
- Invitation to the Mont-Blanc training program