Who can beat X86?

Piero Altoè
E4® Computer Engineering S.p.A. specializes in the manufacturing of high performance IT systems of medium and high range. Our products aim to accomplish both industrial and scientific research requirements and space from universities to computing centers.

Thanks to the established experience and quality in this circle, E4® has become a valued technology’s supplier and it is acknowledged and appreciated by famous and prestigious organizations such as C.E.R.N. in Geneva.
HARDWARE AGNOSTICS

Our “hardware agnostic” approach allows us to provide highly personalized solutions of outstanding quality, which adhere to the customer’s needs without favoring one technology over another.

We offer state of the art informatics at the best possible price/performance ratio and we even give the opportunity to test the system from remote or in loco, so as to further help the customer in choosing the right product and making a thoughtful purchase free from unexpected events.
E4® PRODUCT RANGE
Our product range is as diverse as our customer base

- Workstation for scientific/engineering applications (CAD, CAE, CFD, FEM, etc.)
- Workstation for professional editing
- Computing Server
- Virtualization Server data center/ISP
- Cluster Server in high availability
- Storage server/NAS
- Storage/SAN in high availability
- HPC storage
- HPC cluster
- GPU cluster
- Advanced visualization systems (stereoscopy, 3D cave ...)
- Data centers
R&D

Our R&D department is made of engineers specialized in hardware, software and applications. Research focuses on intense studies of the most innovative technologies so as to increase the Company's technical/scientific knowledge. With the acquired know-how we develop and create prototypes, then the first pilot series up to the finished product, ready to be manufactured.

Our staff’s knowledge and efficiency, paired to their daily relationship with the main manufacturers of technology, allow E4® to offer ever innovative products with the best Time to Market available, to ensure the effectiveness of our customers’ IT investments.
CERTIFICATIONS
• ISO 9001:2008
• ISO 14001:2004
• Intel Platinum Technology Provider
• Tesla Preferred Provider
• AMD Platinum Premier
• VMware – professional solution provider
• Microsoft Gold certified
• Intel Cluster Ready

CORPORATE SOCIAL RESPONSIBILITY
Definition from EU is: «The responsibility of enterprises for their impacts on society»
For E4, which has always been committed in this area, being socially responsible means not only fulfilling legal obligations, but also going beyond compliance and investing in human capital, in relations with stakeholders and sustainable development.
case history
CERN – Geneva (Switzerland)

5.357 dual socket mainboards
68.476 cores
34.300 server grade hard disks
67PB

Ref: Olof Barring, Fatima Najeh
Tier 1 (CNAF)

- 12PB HPC storage (DDN with GPFS)
- 1,000 server dual socket (~10k computing cores)
- Several GPU systems
- 4h intervention times

Tier 2-3

- 5PB direct attached storage (Alice – CMS)
- 3,500 server dual socket (~30k computing cores)
- Several GPU systems
- NBD intervention times

Ref: Mauro Morandin, Gianpaolo Carlino, Alessandro De Salvo
ICTP - Trieste (Italy)

High Performance Computing Cluster:

212 dual socket server
> 1,500 computing cores
Infiniband Host Channel adapter QDR 40Gbps
Infiniband Switch QDR 40Gbps
Networking
E4 HPC Suite

Ref: Clement Onime, Ulrich Singe
ENEA Italian National Agency for New Technologies, Energy and Sustainable Economic Development - Roma (Italy)

High Performance Computing Cluster (Cresco 4):

- 256 dual socket server
- 4,096 computing cores
- Infiniband Host Channel adapter QDR 40Gbps
- Infiniband Switch 336 QDR 40Gbps ports
- Networking
- E4 HPC Suite

Ref: Giovanni Bracco, Silvio Migliori

delivery scheduled for Sept.'13
EPFL - Lausanne (Switzerland)

High Performance Computing Hybrid (GPU/CPU) Cluster:

- 192 CPU computing cores
- 8,320 GPU computing cores
- Infiniband Host Channel adapter QDR 40 Gbps
- Infiniband Switch 36 QDR 40Gbps ports
- Networking
- E4 HPC Suite

Ref: Simone Melchionna
ETH - Zurich (Switzerland)

HPC Hybrid (GPU/CPU) Cluster:

- 432 CPU computing cores
- 16,128 GPU computing cores
- Infiniband Host Channel adapter QDR 40 Gbps
- Infiniband Switch 432 QDR 40Gbps ports
- 1PB Lustre Storage (sustained 20Gb/s)
- 180 TB Panasas Storage

Ref: Olivier Byrde, Teodoro Brasacchio
Nato Undersea Research Center - La Spezia (Italy)

Computing Server & HPC Storage:

> 1.000 CPU computing cores
> 10.000 GPU computing cores
HPC Storage Panasas > 100TB

Ref: Francesco Baralli
European Synchrotron Radiation Facility - Grenoble (France)

Servers for X-ray beam data acquisition

Ref: Pierre Pinel
European Institute of Oncology – Milano (Italy)

> 500TB ZFS Storage

Ref: Alessandro Della Vedova
Novartis - Siena (Italy)

High Availability HPC Cluster (Genomics applications):

- 96 dual socket server
- 1,152 computing cores
- Infiniband Host Channel adapter QDR 40Gbps
- Infiniband Switch QDR 40Gbps ports
- HPC Storage Panasas > 400TB

Networking
E4 HPC Suite

Ref: Riccardo Beltrami
E4 Solutions
WE ARE NOT GREEN

A simulation of 200 ns with 90 k atoms = 1 week on 512 cores = 3200 kWh

Correspond to:

a) 1600 CO₂ kg
b) 340 € energy bill
c) 13000 km by car
WE ARE NOT GREEN

A NATIONAL SUPERCOMPUTING FACILITY HAS A YEARLY CO$_2$ FOOTPRINT COMPARABLE TO A TAKE OFF OF A SATURN V
Established in 2002, **E4 Computer Engineering** designs and manufactures **high performance systems** which aim to accomplish both industrial and scientific research requirements and to reach a variety of customers ranging from universities to computing centers. E4’s focus is on HPC although our expertise extends to all segments of IT.

**SECO** is an **European designer and manufacturer of high integrated board computers and systems for embedded applications**. Founded in 1979 in Italy, SECO attention is focused on developing innovative products with high performances, efficiency, low power consumption and increased functionality, offering in the meantime a short time-to-market.
Modular Embedded Server (MES)

A MES is a stripped down server computer based on SoM optimized to minimize the use of physical space and energy.

- Embedded CPUs, memory, controllers, ...
- Equipped with low power CPUs (ARM, ATOM, G-Series).
- Based on System on Module (SoM)
- Easy to maintain
General purpose, power-efficient

Q7 system on module
**ARKA MicroCluster Blade**

<table>
<thead>
<tr>
<th>Features</th>
<th>ARKA Blade</th>
</tr>
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<tbody>
<tr>
<td>CPU</td>
<td>NVIDIA® Tegra® 3 ARM Cortex A9 Quad-Core</td>
</tr>
<tr>
<td>GPU</td>
<td>NVIDIA Quadro® 1000M with 96 CUDA Cores</td>
</tr>
<tr>
<td>Memory</td>
<td>2GB x CPU 2GB x GPU</td>
</tr>
<tr>
<td>Peak Performance</td>
<td>270 Single Precision GFGLOPS</td>
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<tr>
<td>Network</td>
<td>1x Gigabit Ethernet</td>
</tr>
<tr>
<td>Storage</td>
<td>1x SATA 2.0 Connector</td>
</tr>
<tr>
<td>USB</td>
<td>3x USB 2.0</td>
</tr>
<tr>
<td>Display</td>
<td>3x HDMI (serial console available)</td>
</tr>
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based on CARMA Devkit developed by **SECO**
ARKA SHOC Test

The Scalable Heterogeneous Computing Benchmark Suite (SHOC) is a collection of benchmark programs testing performance and stability (using CUDA and/or openCL).

<table>
<thead>
<tr>
<th>Test</th>
<th>ARKA</th>
<th>Intel+M2075</th>
<th>Units</th>
<th>ARKA/M2075</th>
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<td>263.12</td>
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<td>GFlops</td>
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<tr>
<td>fft_sp</td>
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<td>GB/s</td>
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<tr>
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<tr>
<td>triad_bw</td>
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<td>6.0163</td>
<td>GB/s</td>
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Technology roadmap

- **Low power**
  - Highly flexible
- **HPC high-end**
- **Hadoop & Apache**
- **Mid-range & Small computing**
- **Development Server**

**ARKA MicroCluster**
- Q2 2013

**ARKA EK002 Pre-prod. K20**
- Q3 2013
- 1GbE, IB

**Refresh to ARM 64**
- Q4 2013
- Q1 2014
- Q2 2014

**ARKA EK002, K20**
- IB/10-40GbE, or up to 16x PCIe 2.0

**ARKA Blade DC, 48 ARM in a box**

**ARKA Blade HPC, 24 ARM+GPU in a box**

**PRODUCT AVAILABLE**
- 14/02/2014
ARKA EK002 diagram

Q7 Tegra 3 SOM

Mini-itx carrier board

ETH 1Gb

1x SATA

SATA 2.5” SSD

PCIe 4x

Gen 1

PCIe Gen 2

Add-on card

Add-on card

Add-on card

Add-on card

Nvidia K20/K2000

Node maximum power consumption 250W
1,310 Tflops Rpeak
5.24 Gflops/W
*run in a ARM+GPU environment
BSC PEDRAFORCA: first EK002 installation

**Computing node:**
74 or more pre-production EK002 server: ARM T30, K20, IB QDR

**OS**
Ubuntu derivative for ARM

**Development tool**

**Cluster, monitoring, management tools**

**FP7- Project**
http://www.montblanc-project.eu/

Pedraforca 2,506.4 m, Catalonia, Spain
Past Killer Microprocessor

History may be about to repeat itself …
– Mobile processor are not faster …
– … but they are significantly cheaper and greener
History may be about to repeat itself …
– Mobile processor are not faster …
– … but they are significantly cheaper and greener
Benchmarks
max GFLOPS

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<tr>
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<th>GFLOPS DP</th>
<th>GFLOPS SP</th>
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<tbody>
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<td>2xE5-2670</td>
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<td>2x6344</td>
<td>249.6</td>
<td>2672.0</td>
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<td>2x6376</td>
<td>294.4</td>
<td>2332.0</td>
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<td>2x6380</td>
<td>320.0</td>
<td>33.6</td>
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<td>2xE5-2670</td>
<td>640</td>
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<td>2xPhi</td>
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<td>1xQuadro 1000</td>
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14/02/2014
PDP-14
34
max GFLOPS DP / Watt

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<td>8</td>
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<td>4</td>
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max GFLOPS DP / k euro

<table>
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<tr>
<th>Config</th>
<th>max GFLOPS DP</th>
<th>k euro</th>
<th>including 3 yrs power bill</th>
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<tr>
<td>2xE5-2670 2x6320</td>
<td>66</td>
<td>53</td>
<td>298</td>
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<tr>
<td>2x6344 2x6376</td>
<td>51</td>
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<td>328</td>
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<td>2x6380 2xE5-2670</td>
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GFLOPS are millions per second.
<table>
<thead>
<tr>
<th>Model</th>
<th>max GFLOPS SP / k euro</th>
<th>including 3yrs power bill</th>
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<tbody>
<tr>
<td>2xE5-2670</td>
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