How Bull contributes to Meteo Projects?

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It was better before

**How many humans did you need to optimize a code?**
None, I just have to wait for the next generation

**How many types of architectures were on the market place?**
Much less than today (x86, GPGPU, many cores, ARM, …)
What occurred?

End of dennard's law (constant power density)
End of frequency increase

but

Feature size keeps shrinking (14nm today)
Rising of Multicore

ITRS predicts 5nm in 2021

What will you do with a 8 times larger die?
What will be the impact on your software?

Worse! 2021 is the end of the CMOS road

ref: http://www.itrs2.net/
More Moore
Find other technologies to keep improving (post-CMOS, 3D...)
Quantum, cognitive, beyond von Neumann, in mem. comput....

More than Moore
Mixing with other technologies (sensors, MEMs...)

Process Improvement
More adaptive microelec process
Time Variability and Time underdeterminism

Variability exists for a long time
Turbomode revealed it

Underdeterminism (in time) is now standard
Underlying power optimisation is unknown from application

Applications must be less tightly coupled
The slowest part will pace the whole
So you are wondering....

**How many humans will I need to optimize a code?**
3 months for 3% multiplied by 20 codes multiplied by .... Arg!

**How will I select the right architectures for my workflow?**
- x86, GPGPU, many cores, ARM, FPGA
- Vector size impact
- Flops/Byte decrease impact
- Precision impact
- Variability impact
- Underlying power management impact
  ....
Our strategy

Understand the needs, constraints and wishes
Be part of projects, spend time with you

Design products
Answer the needs

Accompany users
Be beside users to overcome issues and get the performance you target
2 Understand the needs, constraints and whishes
Bull Role

Optimisations of “dwarfs”, KNL
Bull Role

Roadmap vision, optimisation, guidance
European Earth System Modelling Infrastructure Strategy

ENES is holding a community meeting in Reading (UK) on the 25th, 26th and 27th of October, supported by IS-ENES2 to discuss the future infrastructure strategy for earth system modelling. The meeting is expected to run from midday Tuesday, to mid-day Thursday.

In 2012, the European Network for Earth System Modelling (ENES) published an "Infrastructure Strategy for the European Earth System Modelling Community" (Mitchell et al., 2012) based on meetings held in 2010 and 2011. This strategy addressed the underlying needs for the delivery of the next decade of European research on seasonal to centennial climate prediction. It envisaged a drive towards coarse-scale global modelling, with improved initialization and larger ensemble sizes. At the same time, attribution was expected to be addressed with enhanced paleo-climate modelling, and more attention would be focused on climate predictability on regional scales.

The key recommendations were to:

1. Provide a blend of high-performance computing facilities ranging from national machines to a world-class computing facility suitable for climate applications, which, given the workload anticipated, may well have to be dedicated to climate simulations.
2. Accelerate the preparation for exascale computing, e.g. by establishing closer links to PRACE and by developing new algorithms for massively parallel many-core computing.
3. Ensure data from climate simulations are easily available and well documented, especially for the climate impacts community.
4. Build a physical network connecting national archives with transfer capacities exceeding 1013 byte/sec.
5. Strengthen the European expertise in climate science and computing to enable the long term vision to be realized.

Five years on, ENES is convening a meeting to address a "mid-term" update of this strategy. Since 2010-2012 there has been much progress, often with support from IS-ENES2. In particular, ideas that have been taken forward range from the establishment of a European Centre of Excellence in the Simulation of Weather and Climate2 and the European engagement and leadership in the Earth System Grid Federation providing access to climate data, to the proposal of a European Programme on Extreme Computing and Climate. However, it is timely to take stock of how much progress, and whether or not these are still the right objectives - both scientifically, and in terms of the infrastructure. An updated strategy will also be important to address the issue of how to sustain the European research infrastructure for climate modelling.

The outcome of this meeting should be both the input for an update of the infrastructure strategy, and community agreement on which new or existing initiatives should be prioritised to address the science requirements of decadal to centennial prediction (including model evaluation, process understanding, and perhaps whether the scope should be widened to include seasonal prediction).

A registration website will be made available shortly. In the mean time, interested participants should hold the dates.

Sylvie Jourdan (ENES Chair and IS-ENES2 coordinator)
Bryan Lawrence (Meeting Organiser)

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2 https://weather.eu
3 https://www.is-unes.org
4 https://is-unes.org/is-unes/2012/ims/content/flagship-european-programme-extreme-computing-and-climate

Bull contribution

Exchanging about technology trends and impacts
Design Products
Front Side
2 x 24 blades
Back Side
2 x 24 blades
**Broadwell**

3 x 2 Intel® Xeon® E5-2600 v4 processors
3 x 1 Intel® C610 chipset

3 x 1 optional SATA SSD drive

3 x 8 DDR4 memory slots (max 256 GB with 32 GB DIMMs) with heat spreaders for cooling

BXI 1 or 2 ports mezzanine board
OR InfiniBand EDR 1 port mezzanine board

Cooling by direct contact with DLC coldplate
3 x 1 Intel® Xeon Phi™ (Knightslanding) processor
3 x 1 Intel® C610 chipset

3 x 1 optional SATA drive
3 x 1 optional PCIe SSD drive via PCIe switch
3 x 6 DDR4 memory slots (max 192 GB with 32 GB DIMMs) with heat spreaders for cooling
BXI 1 or 2 ports mezzanine board
OR InfiniBand EDR 1 port mezzanine board

Cooling by direct contact with DLC coldplate
Pascal

4 Nvidia® Pascal GPUs
2 Intel® Xeon® E5-2600 v4 processors

1 optional SATA SSD drive

8 DDR4 memory slots (max 256 GB with 32 GB DIMMs) with heat spreaders for cooling

BXI 1 port mezzanine board
OR InfiniBand EDR 1 port mezzanine board

Cooling by direct contact with DLC coldplate
Accompany Users
Center for Excellence in Parallel Programming
Unlock your productivity
Center for Excellence in Parallel Programming

Unlock your productivity

- Optimization of Productivity Projects
- Projects (National or European), PhD
- Hardware Access w/ Single point of Contact
- Application performance projection
- Trainings and webinars
- Fast Start
- POC

Duration

Days
Weeks
Months
Years
Deeply involved in the WF and Climate fields

AEMET, the Spanish meteorological agency
Improving weather forecasting: a direct impact on the safety of people and property

**Business challenge**
Extend AEMET’s high performance computing resources to:
- Improve weather forecasting (faster resolution),
- Improve severe weather phenomena forecasts,
- Expand AEMET’s work in different areas such as climate change or wave prediction.

**Solution**
- Bull’s patented Direct Liquid Cooling system, to reach a PUE < 1.1,
- A bull x86 supercomputer with a peak performance of 168 Teraflops in its mainframe,
- 338 servers (13,828 Intel® Xeon® E5-2600 processors) i.e.
- 30 high-speed nets
- 360 Terabytes storage

**Benefit**
- AEMET can tackle services

DKRZ, Deutsches Klimarechenzentrum
The German Weather Prophet

**Business challenge**
- Climate simulations demand a huge compute capacity
- Climate simulations produce large quantities of data
- Well-designed techniques for data management and storage are an important prerequisite for climate research

**Solution**
- More than 60,000 computing cores in 8760 Direct Liquid Cooling blades distributed over 60 racks
- A supercomputer with a peak performance of 3 petaflops
- The corresponding L is up to 45 petabytes + in the world

**Benefit**
- Improve climate forecast
- Energy efficiency (P)
- Cooperation on applied science
- Capacity to handle large datasets

MARIN, the Maritime Research Institute Nederland
A new HPC facility to initiate a co-operation program with the maritime industry

**Business challenge**
- Extend their HPC facility
- Find solutions for the maritime industry
- Strong constrains on footprint and consumption

**Solution**
- A 4096-core HPC system with a peak performance of almost 170 TFlops:
- Fat-tree interconnect based on InfiniBand FDR
- 204 bull x86 E4 nodes (Haswell EP)
- Shared NetApp E2600 storage

**Benefit**
- The detailed benchmarking of MARIN’s code by Bull experts convinced the customer
- A new co-operation program with the maritime industry was initiated by sharing with them the new HPC facility with dedicated maritime CFD code

KNMI
A bull supercomputer for the Dutch weather forecast agency

**Business challenge**
- More computing power to
  - Be able to issue early warnings in case of extreme weather
  - Enhance capabilities for climate research

**Solution**
- A system 40x more powerful than the previous one:
  - 396 bull x86 5000 compute nodes, equipped with Intel® Xeon® processors, for a total of 4,724 cores
  - 9.5 TB memory
  - Peak performance 58.2 TFlops

**Benefit**
- “The hardware, combined with Bull’s expert support, gives us confidence in our cooperation”
Many others

- Arome on ARM
- BRAMS performance for LNCC
- Full compilation of Harmonie on PGI, test on GPU
- Port of MESONH and DYNAMICO on KNL
- Several kernel of NEMO on KNC
- ...

Contact us: cepp@atos.net
Thanks

Be efficient at scale

If you were plowing a field, which would you rather use? Two strong Bulls or 1024 chickens?