EUROSERVER paves the way for low-power data centres

EUROSERVER, a three-year FP7 project that ended successfully early this year, was tasked by the European Commission to develop an energy-efficient server design that can meet the anticipated demands of data centres beyond 2020.

Barcelona Supercomputing Center (BSC) has contributed to the project with research in energy-efficient and cost-effective interconnects, systems software and runtime systems. Its research has been published in LCN 2015, ISUM 2017, LCN 2016, UCC 2016, Springer Computing Journal, and Elsevier Future Generation Computing Systems.

As BSC PI Paul Carpenter explains, “EUROSERVER brought together hardware and software experts to build a new kind of data centre architecture. BSC contributed to the successful completion of the project by ensuring that its runtime and system software efficiently support the EUROSERVER architecture, freeing the programmer from time consuming manual optimization. BSC is a long-term partner in the EuroEXA family of projects, and is a key partner is the follow-on ExaNoDe project.”

BSC has extended its COMP Superscalar (COMPSs) framework, which aims to ease application development for distributed infrastructures such as clusters, grids and clouds. BSC developed an energy-aware task scheduler for COMPSs that optimizes the execution across elastic computing resources, in order to get the best schedule for energy and/or performance. The (compute) task’s energy consumption is estimated using an energy model for task-based applications in distributed platforms.

Host power model using supervised machine learning
BSC also developed a host power model using supervised machine learning, trained using a collection of micro-benchmarks that selectively stress the different components of the target platform, including CPU, cache, main memory, network and disk, at different intensity levels, and energy-aware virtual machine placement policies.

These energy-aware virtual machine placement policies decide the host where to execute the VMs that minimizes the power consumption while fulfilling their performance requirements.

New hypervisor-based system
Researchers at BSC also developed a hypervisor-based system for page-based memory capacity sharing across nodes, to leverage the project's UNIMEM memory. This work was implemented using Xen Transcendent Memory (Tmem).

The first in the "EuroEXA" family
EUROSERVER is the first project in the "EuroEXA" family, in which BSC has a central role. In ExaNoDe , which brings the EUROSERVER approach to high-performance computing, BSC brings its OmpSs programming model and HPC systems expertise. There are two other follow-on projects, ExaNeSt and ECOSCALE.

The EUROSERVER impact
The project has made a number of breakthroughs in data centre design, including the prototyping of two platform testbeds: the Juno R2 development board-based system and the UltraScale+, Trenz-powered development platform. Both have energy-efficient quad-core ARM 64-bit Cortex A53 processors, with the Juno also featuring a big.LITTLE design and a Cortex A72 processor. The NEAT designed, EUROSERVER UltraScale+ boards have a Trenz 0808 module and a place-holder for a 32-core ARM System in Package.

OnApp's MicroVisor, also developed in the project, is being released commercially as an integrated system on top of KMAX, an ultra-dense low power ARM-based true-converged server appliance created by KALEAO Ltd. (UK). KALEAO is one of two startups that are bringing to the market technologies investigated in EUROSERVER. ZeroPoint Technologies AB (Gothenburg) offers memory compression technologies that have the potential to significantly compress the content of the cache and memory system, with the effect of creating three times more memory.

About EUROSERVER
EUROSERVER brought together a European consortium, joining industrial technology providers, universities and research centres: NEAT (Italy) as the system integrator, ARM (UK) as the world leader in embedded high-performance processor IP, and STMicroelectronics (France), Europe's leading semiconductor company, as well as OnApp (Gibraltar), which provides a complete IaaS platform for hosts, telcos and MSPs. In addition to the technology providers and users, EUROSERVER brought application, computer, memory architecture expertise from Barcelona Supercomputing Center (Spain), TU Dresden (Germany), FORTH (Greece), and Chalmers (Sweden).

The project had a managed budget of 12.9 million euros, including 8.6 million euros funded by the European Commission's FP7 Programme plus significant indirect support from the industrial partners.

The project explained in a new video
Recently, the project presented the video "Scale-out architecture for energy efficient servers & micro-servers".

(Caption: *The EUROSERVER team at the final review held on March 2017*)

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