H2020 VINEYARD Project: Versatile Integrated Accelerator-based Heterogeneous Data Centres

Project name: VINEYARD: Versatile Integrated Accelerator-based Heterogeneous Data Centres
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Neurasmus BV, NL
Neurocom Luxembourg, LU
Athens Exchange (ATHEX), GR
Leanxcale SL, SP
Globaz SA, PT
Start date: February, 2016
Duration: 36 months
Key themes: Accelerator-based heterogenous data centers
Budget: 6,283,895 Euros
Website: www.vineyard-h2020.eu

VINEYARD's goal is to develop the technology and the ecosystem that will enable the efficient integration of the hardware acceleration in the data centre applications, seamlessly. The deployment of energy-efficient hardware accelerators will be used to improve significantly the performance of cloud computing applications and reduce the energy consumption in data centres.

VINEYARD is developing an integrated framework for energy-efficient data centres based on programmable hardware accelerators. It is working towards a high-level programming framework that allows end-users to seamlessly utilize these accelerators in heterogeneous computing systems by using typical data-centre cluster frameworks (i.e. Spark). The VINEYARD framework and the required system software hides the programming complexity of the heterogeneous computing system based on hardware accelerators. This programming framework also allows, the hardware accelerators to be swapped in and out of the heterogeneous infrastructure so as to offer both efficient energy use and flexibility. To allow the efficient utilization of the accelerators from several applications, a novel VM appliance model for provisioning of data to shared accelerators has been developed. The enhanced VINEYARD middleware augments the functionality of the resource manager, by enabling more informed allocation of tasks to accelerators.
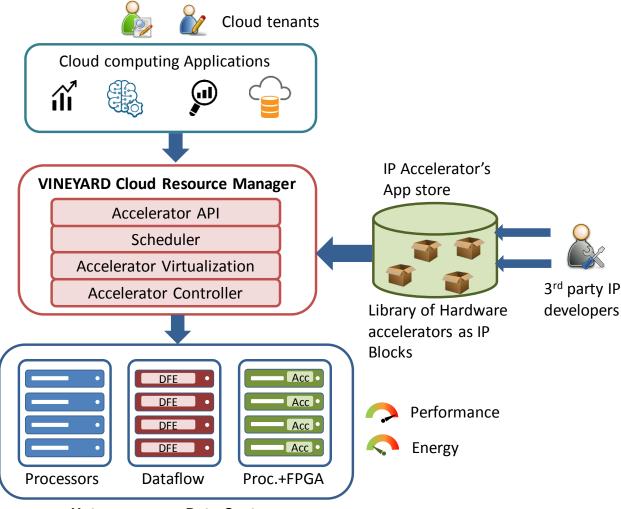
VINEYARD is also developing two types of novel energy-efficient servers integrating two kinds of hardware accelerator: programmable dataflow-based accelerators and FPGA-based accelerators. The servers coupled with dataflow-based accelerators are suitable for cloud computing applications that can be represented in dataflow graphs while the latter will be used for accelerating applications that need tight communication between the processor and the hardware accelerators.

VINEYARD also foster the establishment of an ecosystem that will empower open innovation based on hardware accelerators as data-centre plugins, thereby facilitating innovative enterprises (large industries, SMEs, and creative start-ups) to develop novel solutions using VINEYARDS's leading edge developments. The ecosystem will bring together existing communities from all relevant stakeholders including providers of hardware intellectual-property (IP) technologies, data centre developers, data centre operators and more. This ecosystem will allow the promotion of open pluggable custom hardware accelerators (i.e. a hardware accelerator Application Store) that can be used in data centres in the same way that software libraries are currently being utilized.

VINEYARD plans to demonstrate the advantages of its approach on three real use-cases

a) a bioinformatics application for high-performance brain simulations,

b) two critical financial applications, and

c) a big-data analysis application.

VINEYARD framework will be also integrated with widely used cluster computing frameworks, like Spark, that will allow the utilization of the accelerators for typical cloud computing applications like machine learning and graph computations.