



ACTiCLOUD: ACTivating resource efficiency and large databases in the  
CLOUD

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D5.8: Final Project Press Release

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**Executive summary:**

D5.8 provides the final project press release that highlights the ACTiCLOUD achievements.

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**ACTiCLOUD Consortium:**

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# 1 Introduction

ACTiCLOUD’s vision is to develop novel cloud architecture components that will break existing scale-up and share-nothing barriers for cloud infrastructure, and enable holistic management of physical resources at the local cloud site and at multi-site levels. ACTiCLOUD targets significantly improved utilization and scalability of resources. This ultimately translates to:

1. significant cost and performance improvements for Cloud Service Providers (CSPs),
2. higher performance, stability and lower pricing for cloud applications,
3. enhanced flexibility and scalability of cloud resources for intensive database applications that have until now faced tough challenges in covering their resource demands from existing cloud offerings.

ACTiCLOUD aims to enhance the viability of cloud deployment scenarios through enhancement of the various technology ingredients, i.e., the hypervisor, the cloud manager, system libraries, language runtimes, and database systems, with a novel and holistic set of mechanisms and policies built on top of these new-generation computing system architectures. Therefore, ACTiCLOUD enables the creation of distributed, hyper-converged, “share-anything”, resource scale-out cloud platforms to broaden the applicability of cloud technologies across more markets through richer and more cost effective application deployments.

## 1.1 Purpose of this document

The purpose of this deliverable is to describe the final project press release of ACTiCLOUD achievements.

## 2 Final Project Press Release

***"EU funded research project delivers a novel cloud computing architecture for drastically improved management of cloud resources."***

The European funded research project ACTiCLOUD has just been finalized at the end of 2019, under the coordination and with the participation of the Institute of Communication and Computer Systems (ICCS). With the ACTiCLOUD architecture, the project has provided a novel cloud computing architecture that drastically improves the management and utilization of cloud resources while making important steps towards bringing resource-demanding, in-memory databases to the cloud. More specifically, ACTiCLOUD successfully developed and integrated components that: (i) improve the effective utilization of cloud resources, targeting resource efficiency and performance stability, and (ii) enable the deployment of resource demanding applications in the cloud, targeting scalability and elasticity in resource provisioning. To achieve those goals, ACTiCLOUD took a holistic approach working across all layers of the computing stack.

**Hardware Platform - Scale-up:** Numascale provided the hardware platform and system library support for scaling up resources beyond the size of a single physical server. In addition, Numascale developed tools for better analyzing and understanding the performance of applications on large NUMA systems. This work has allowed Numascale to identify challenges in executing database workloads. Based on the gained experience, Numascale enters the market with the new generation improved hardware that was released in Q4 of 2019, providing 16 socket servers for running SAP HANA database.

**Hardware Platform - Scale-out:** KALEAO provided the hardware platform and support for scaling data center deployments through their innovative cost and energy-efficient architecture that shares the overhead costs across a cluster of servers. In addition, the KALEAO architecture increases further the overall capability of the solution by converging the storage and network components into a single physical server chassis. KALEAO developed various tools for the management and monitoring of this converged cluster of servers while collaborating with the partners to optimize and reduce the cost by 5-10x of running both scale-out and replicated applications. Many of these results are becoming available to KALEAO customers now, with the next generation of products to be released in the first half of 2020, increasing further the broader project results.

**Hypervisor:** OnApp has implemented ACTiCLOUD's rack-scale Hypervisor layer, a significant component of the platform, providing all necessary mechanisms for virtualizing, managing and monitoring compute, network, and storage resources across the rack, as well as the mechanisms to reconfigure resources on demand. The hypervisor layer has been optimized to provide the highest performance IO for both networking and storage traffic to and from tenant Virtual Machines (VMs), by removing any dependency from the local control domain for virtual machine setup, booting and resource allocation, and instead move this generic functionality into the hypervisor layer itself.

**System libraries:** Numascale developed improved system libraries for running resource demanding applications such as Big Data, Analytics and HPC applications that need a lot of memory and require low latency. These system libraries include improved memory allocators and other NUMA aware libraries that allow applications to enjoy significantly improved performance.

**Java Virtual Machine:** The University of Manchester focused on compilation, scheduling, and garbage collection optimizations within managed runtime systems, putting significant effort on bringing up a state-of-the-art research VM (MaxineVM) transitioning it to ACTiCLOUD's

envisioned Hyperscale JVM (HJVM). The resulting HJVM enabled not only detailed and accurate research on the underlying novel architectures, but also increased the impact on the research community as it is the first JVM capable of such functionalities.

***Distributed Cloud Resource Manager:*** ICCS and Umea University developed ACTiManager, that consists of functional components, placement algorithms, and models for workload classification, interference detection and mitigation, and performance prediction. ACTiManager manages resources at the node level, site level, and across distributed sites, playing a central role in achieving the goals of ACTiCLOUD for resource efficiency and performance stability.

***MonetDB:*** MonetDB Solutions (MDBS) extended the open-source columnar database system MonetDB to exploit the ACTiCLOUD architecture by being more resource aware and reacting to changing workloads quickly. Therefore, a MonetDB-based cloud architecture has been designed to provision resources with elasticity.

***Neo4j:*** Neo4j evolved within ACTiCLOUD to support online graph analytics alongside online transaction processing, on systems that provide an abundance of RAM and cores. Taking advantage of such resources required the redesign and implementation of a new set of runtime components within Neo4j that optimize memory use, enable efficient query scheduling, and allow the execution of queries in multiple cores. Together these advances make queries over graphs available for demanding analytic tasks, whereas Neo4j historically has targeted online transaction processing workloads for queries over bounded subgraphs.

ACTiCLOUD delivered substantial research contributions in the fields of cloud computing, databases, managed runtime systems, and systems, which has resulted in numerous papers published in renowned journals and presented at scientific conferences and workshops. A complete list of publications and links to code repos can be found on the project's website.

The ACTiCLOUD consortium united a total of eight partner organizations from industry and academia. The EU funded project was officially launched on January 1st 2017 and ended on December 31st 2019.