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Deployment of an *edge-cloud* benchmarking infrastructure

1 Description

The factory, city or building of the future generates large volumes of data from devices with limited energy and computing power. Depending on capacity and need, the collected information can be processed locally or transmitted to more powerful computing nodes hosted in the cloud. In these circumstances and due to the best-effort nature of the network links employed, latency and throughput are neither guaranteed nor controllable. Applications are emerging that require response times of less than 100 ms. These include incident detection in health care facilities [1], or the coordination of fleets of robots [2]. To meet these requirements, edge computing consists of exploiting computing resources located at the edge of the network near the data sources. These are formed by mini-clouds, micro-computing centres, processing equipments coupled to base stations or even smartphones. Unlike the *cloud* offering, edge computing units are typically accessible via 1 or 2 network hops and interconnected with speeds of over 100 Mbits [3–5]. On the other hand, they are constrained by their quantity, their dynamic availability and their heterogeneous architectures. The combined use of terminals, the edge and the cloud paves the way for new opportunities, both to meet quality of service constraints and to overcome bottlenecks. The question arises as to which software (and hardware) stack to implement to achieve this. OpenStack is the reference open source project for building cloud infrastructures. Tools have been added to take advantage of the new edge computing opportunities. We propose to take advantage of this to deploy an edge-cloud infrastructure in order to carry out performance tests, which is the purpose of this internship offer.

2 Missions

The first task will consist in deploying the software bricks provided by the OpenStack platform. It will be necessary to be able, via control panels and scripts, to automatically mount the computing, storage and intercommunication resources. In particular, the tools Cinder, Keystone, Glance, Kuryr, Neutron, Nova and Ironic will be used. A functional platform will be deployed and ideally a set of scripts will allow for easy deployment. Real-life applications will be executed to assess the performance of the tools. This will be followed by an evaluation of the performance by playing with the software bricks used. For example, we will be able to compare the performance of virtualised, containerised or bare-metal instances [6]. The platform will also be equipped with mechanisms capable of simulating network and machine disturbances. Depending on the state of progress, the work carried out may lead to the publication of a scientific article. Here is a summary of the steps involved in carrying out the missions :

- Understand the challenges of edge computing.
- Identify the tools to be implemented. Segment the role of the tools, highlight redundant functionalities. Propose a suitable infrastructure geared towards performance.
- Automate the setup of an edge-cloud architecture (e.g. *MicroStack*).
- Interface the platform with resource disruption tools (e.g. simulating network degradation).
- Simulate the execution of real workloads and analyse performance.
- Contribute to *OpenStack* tools (automation, debugging, feedback).

3 Keywords

IoT, high performance computing, distributed computing, edge computing, *OpenStack*, building and factory of the future.

4 Requirements

This internship is open to computer science final year masters students. The successful completion of the assignments requires a solid technical background in CS. The selection committee will be particularly sensitive to the following profiles :

— Good skills in programming and networks.

— Interests for high performance computing.

— Prior knowledge of the OpenStack environment would be appreciated.

5 Duration & Contacts

The 6-month internship will take place at CESI École d'Ingénieurs in Strasbourg, France. Your application must contain a complete CV, transcripts from the 1st year at university and one or more reference letters. Applications should be sent to Jean-François DOLLINGER (jfdollinger@cesi.fr), associate-professor in the CS Department of CESI EI.

Références

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