Towards a P2P Cloud: Reliable Resource Reservations in Unreliable P2P Systems

Kalman Graffi, proposed solutions.

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infrastructures, each with its own network engine (the SDN component of the cloud solution). Then, interconnections between deployed systems, both inside an infrastructure and between several limitations: first, the network underlay was not considered, that is, how to manage the discovery, redundancy, self-management, unlimited scalability). But those works have two major

discovery, Gi-LAN mobile interface, level 4 to 7 to deploy applications of virtualized network functions (NFV). Indeed, operators are in the process of considering the deployment of advanced network functions (Gi-LAN mobile interface, level 4 to 7 services such as firewalls or load balancers, EPC mobile core, IMS...) as virtual machines or containers deployed on COTS x86 hardware. The distributed Cloud infrastructure could provide the IaaS layer that will support for the deployment of those NFV applications.

A major prerequisite for the suitability of this distributed Cloud is the availability of a management solution that is both simple, evolvable, and economically efficient to allow operations teams to easily manage the whole infrastructure, deploy and interconnect network functions, and modify the localization and the network connectivity between deployed resources. Solutions available today, either commercial or open source, do not meet all these requirements. They are based mainly on the use of two traditional approaches of distributed systems management: federation and centralized management, which both have major limits in terms of complexity, scalability, reliability, and cost-efficiency.

Several works have started since a few years to address those challenges by proposing solutions for the management of distributed clouds, inspiring from techniques used in P2P systems ([1,2, 3]). Indeed, P2P technologies offer interesting features to meet the above-mentioned goals (auto-discovery, redundancy, self-management, unlimited scalability). But those works have two major limitations: first, the network underlay was not considered, that is, how to manage the interconnections between deployed systems, both inside an infrastructure and between several infrastructures, each with its own network engine (the SDN component of the cloud solution). Then, most of those propositions rely on a completely new framework for infrastructure management, ignoring those that are considered for the future operational deployments. That made impossible any real deployment of the proposed solutions. Finally, aspects related to reliability, which are critical in the context of telecommunication infrastructures, have been mostly ignored in the design of the proposed solutions.

Mission confiée
The overall objective of this project is to explore and propose approaches for the design of the networking component of a self-managed and massively distributed cloud infrastructure. The proposed design should meet requirements at several levels:

- Manageability (monitoring and measurement capabilities, auto-discovery, etc.)
- Ability to provide various advanced services (flat connectivity, L2/L3 VPNs, NFVs)
- Reliability and performance (SLA, redundancy, disaster recovery, HA, ...)

Principales activités
The post-doc researcher will start by evaluating the existing solutions for distributed SDN that might be suitable for the fog/edge context, both inside the OpenStack project (Gluon, Tricircle, Tacker, DragonFlow) and outside of OpenStack (e.g., ONOS), and propose new approaches, that will be evaluated in the context of OpenStack and of the DISCOVERY Inria project.

Compétences
- Strong system programming and networking skills
- Knowledge of Cloud environments (OpenStack knowledge will be definitely an advantage)
- Autonomy / curiosity
- Mastery of scientific and technical English

Avantages sociaux
- Subsidised catering service
- Partially-reimbursed public transport

Rémunération
Salary: 2653€ gross/month