Title: PaaS Cloud Service for the Deployment and Execution of Mobile Social Applications

Team: Myriads, Inria Rennes – Bretagne Atlantique

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Duration: 16 months

Starting date: fall 2016

Mission

This objective is to design and implement a Platform-as-a-Service (PaaS) environment to easily deploy and efficiently execute cloud-based urban-scale applications involving urban and social data sensing and analytics.

Job description

In urban environments, a lot of data is continuously collected originating from a variety of sensors and from people's smart devices. We can foresee that mining and learning from the rich and various data generated in cities from different sources (sensor networks, smart devices, open data) will lead to a new generation of mobile social applications. Clouds provide infrastructures of choice to store and process collected data, as cloud resources can be dynamically provisioned on-demand in self-service. As the volume and velocity of data to be stored and processed may vary over time, cloud-based elastic data management services are needed to enable near real-time processing of data coming from sensor networks and smartphones possibly combined with other data such as open data. The data processing chain may involve filtering, aggregating and ultimately storing resulting data for further processing by data analytics applications.

Many stakeholders are involved in the collection and the storage of data from sensor networks, smart devices and open data and in the provision of services and applications for citizens and city government. Thus, multiple private and public cloud providers are likely to be involved providing storage and computation services to urban services and applications. This calls for elastic cloud-based services, which are portable on different clouds and can be deployed on several clouds.

This objective of the proposed work is to design and implement a Platform-as-a-Service (PaaS) environment to easily program, deploy and efficiently execute cloud-based urban-scale applications involving urban and social data sensing and analytics. A PaaS-as-a-Service runtime environment dedicated to mobile social applications in the context of smart cities should provide the following features:

- Algorithms and mechanisms to seamlessly off-load computing tasks and storage from static and mobile smart devices into the cloud,
- Protocols for efficient data transfer from the sensors and smart devices to the services running in the cloud,
- Elastic services for data streams processing in near real-time,
- Elastic services for data analytics.

The design of the envisioned PaaS raises a number of challenges in terms of *scalability* with the number of users, devices, services, data streams, *ease of deployment* of the cloud-based urban services and mobile social applications, *elasticity management* of the data stream processing [Ananthanarayanan13] and data analytics services and *flexibility and extensibility*.

Work Plan

The work will be divided in the following steps:

- Study the software architecture of urban services and mobile social applications and their underlying middleware [Hachem14].
- Propose a PaaS cloud environment providing a simple web interface and API for the development and deployment of mobile social applications [Moreno-Vozmediano 2013]. The proposed PaaS cloud environment could leverage ConPaaS PaaS [Pierre 2012, ConPaaS] and customize it to the needs of mobile social applications.
- Design and implement algorithms and mechanisms to seamlessly off-load computation tasks and storage from mobile devices into the cloud.
- Design and implement protocols for efficient data transfer from sensors and smart devices to the services running in the cloud,
- Integrate auto-scaling services in the PaaS environment (i) to process data streams in near real-time [Storm] and (ii) to perform efficient data analytics.
- Validate the proposed PaaS with some of the next generation urban services and mobile social applications developed within CityLab@Inria (see https://citylab.inria.fr). Experiments will use the Grid'500 experimentation platform [G5K] and other testbeds as needed.

References

[Ananthanarayanan13] R. Ananthanarayanan, V. Basker, S. Das, A. Gupta, H. Jiang, T. Qiu, A. Reznichenko, D. Ryabkov, M. Singh, S. Venkataraman. *Photon: Fault-tolerant and Scalable Joining of Continuous Data Streams*. SIGMOD '13: Proceedings of the 2013 international conference on Management of data. 2013.

[Hachem14] S. Hachem, A. Pathak, V. Issarny. *Service-Oriented Middleware for Large-Scale Mobile Participatory Sensing*. In Pervasive and Mobile Computing Journal. 2014.

[Moreno-Vozmediano 2013] R. Moreno-Vozmediano, R.S. Montero, I.M. Llorente. *Key Challenges in Cloud Computing: Enabling the Future Internet of Services*, IEEE Internet Computing. 17(4). 2013.

[Pierre 2012] ConPaaS: a Platform for Hosting Elastic Cloud Applications. Guillaume Pierre and Corina Stratan. *IEEE Internet Computing* 16(5), September-October 2012.

 [ConPaaS] http://www.conpaas.eu/

[G5K] http://www.grid5000.fr

[Storm] Apache Storm website: https://storm.incubator.apache.org

Skills and profile

Ph.D defended after September 1st, 2014 required. The defense date and the composition of the PhD committee must be mentioned if the PhD has not yet been defended at the application time.

The candidate should have a PhD in Computer Science with knowledge and experience in one or several of the following domains: cloud computing, mobile computing, mobile cloud computing, middleware, service-oriented programming, smartphone applications programming. Experience

in performing large-scale experiments on distributed system testbeds is desirable. Good command of English required. Note that knowledge of French is not required for this position.

Benefits

- Monthly gross salary: 2 621 €
- Financial support from Inria to catering and transportation expenses

Additional information

<u>Apply on line</u> ONLY.

Before applying, it is advised to contact by e-mail:
- the scientific advisor for more information on the research project
- the above-mentioned HR person on any administrative and practical information.

<u>Security and defense procedure</u>
In the interests of protecting its scientific and technological assets, Inria is a restricted-access establishment. Consequently, it follows special regulations for welcoming any person who wishes to work with the institute. The final acceptance of each candidate thus depends on applying this security and defense procedure.