Programming Stateful Cloud Applications with Actors

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In this course we will explore different aspects of programming cloud applications based on the actor model. The course will begin with a quick introduction to networked programming by means of actors, it will explore the semantics of actor programs, their failure and recovery mechanisms, and how actor programming enables scalability of distributed applications.

We will then explore different providers for cloud computing, and the basic services that they provide virtual machines, storage, etc., and some middleware products that facilitate their programming.

After this introduction to cloud computing, we will study programming models and frameworks developed for actor cloud computing. We will show how the principles of actor programming help to design and implement elastic applications, and we will explore the different problems introduced by this programming model.

We will conclude by exploring other programming models such as AWS-Lambda.

Requirements

- Object Oriented Programming: Familiarity with at least one OO programming language: Python, Java, C++, Scala, etc.
- Principles of Networking
- Basic Notions of Concurrency
- Some basic notions of distributed computing would be preferable.

Syllabus

1. Actor Programming
   - Principles of Actor Programming
   - Erlang Actors
   - Objects and Actors
   - AKKA
2. Cloud Infrastructures
   - Virtualization: – VMs – Containers – Storage – Services – ...
   - Orchestration: Kubernetes
   - Elasticity
3. Basic Cloud Programming
   - A simple Web-app in AWS
   - Sateless vs Stateful applications
   - Data Replication – Consistency Models – Transactions – CRDTs
4. Stateful Actors for Cloud Programming
   - Consistency
   - Fault Tolerance
   - MS Orleans
   - Transactions and Services
5. Other Cloud Programming Models
   - AWS-Lambda
   - Map Reduce

Evaluation

The evaluation of the course work will be split in a *small project* to be carried out in not than a couple of day, and a *light* written examination of the principal concepts introduced during the course.