Master Seminar (Winter Term 2022/2023)

Trends in Distributed and Context-Aware Systems

Distributed systems are a corner stone of many services today. Distribution ensures scalability of cloud services, implemented atop a massive number of servers. For instance, Google’s data centers host an estimated number of 2.5 million servers! At the same time, distribution ensures reliability through replicating functions and data. This does not only apply to cloud services, but also to peer-to-peer networks as used for instance by the Bitcoin network for implementing a highly replicated distributed ledger storing financial transactions. Another example of distributed systems are mobile systems including billions of mobile user devices such as smartphones as well as vehicular networks, networks of unmanned aerial vehicles, etc. Such mobile systems are inherently distributed geographically and are supported by edge cloud services located close to the mobile devices to reduce network latency. Last but not least, the Internet is evolving into an Internet of Things (IoT), where virtually everything can communicate through the Internet, implementing a distributed systems of heterogeneous devices, ranging from resource-constrained battery-operated sensors to backend cloud servers.

Such distributed systems come with many challenges, as the following quote shows: „At scale, everything breaks … Keeping things simple and yet scalable is actually the biggest challenge. It's really, really hard.“ – Urs Hölzl (Senior Vice President for technical infrastructure at Google). Other exemplary challenges include ensuring consistency for replicated services, where (some) copies can be outdated, privacy if private mobile devices are involved, or protection against attacks if untrusted devices are involved, for instance in the Bitcoin system.

In this Master’s seminar, we take a deep dive into specific distributed systems concepts and technologies that enable the broad spectrum of distributed systems mentioned above and tackle their challenges. The following (incomplete) list mentions a few exemplary areas covered by this seminar:

- Distributed ledger systems.
- Consensus concepts, including distributed locking and coordination services such as Google Chubby or ZooKeeper, etc.
- Mobile sensing services employing crowds of mobile devices for huge sensor networks.
- Privacy concepts to protect mobile users.
- Edge cloud services supporting, for instance, resource-constrained mobile systems.
- Acquiring and using context information for adapting systems, including the appearance and functionality to users.

The standard language of this seminar will be English. Talks and reports can also be given and submitted in German.

More information about the organization will be provided via ILIAS to registered participants. For further questions, please contact: lukas.epple@ipvs.uni-stuttgart.de