Advanced Seminar: Distributed Systems
Trends in Distributed and Context-Aware Systems

The **Internet of Everything (IoE),** where virtually everything can now communicate through the Internet, and the increasingly demanding performance requirements of new technologies (e.g., **cryptocurrencies**) have driven the emergence of new computing paradigms for distributed systems. Scalability is now offered not only by centralized cloud providers, but also by **edge computing** systems, where geographically distributed servers provide computational resources at the edge of the network and, therefore, close to the end devices. This can significantly reduce latency for time-critical applications like vehicular networks. The advances in edge computing have led to the emergence of **edge AI**, where powerful AI algorithms are deployed at the edge, without relying on a remote cloud.

But distributed systems come with many challenges which requires a profound understanding of **core principles in distributed computing**. As pointed out by former Google Senior Vice President Urs Hölzl: "At scale, everything breaks … Keeping things simple and yet scalable is actually the biggest challenge. It's really, really hard." This is especially true for dynamic and uncertain environments that we are facing, for instance, in **smart buildings** or **smart energy systems**. **Self-adaptation** is one of the key mechanisms for coping with increasingly large and dynamic systems, often by using machine learning techniques (GNN, reinforcement learning). Challenges that come with **distributed storage systems** include consistency and scalability.

Another hot topic, especially in the context of **5G** and the development of future **6G** networks, is **Time Sensitive Networking (TSN)**, which defines a set of standards to enable reliable, deterministic real-time communication in Ethernet networks. These standards target, among others, **time synchronization** and **traffic shaping/scheduling** approaches for both event-based and time-triggered traffic.

In this seminar, we take a deep dive into specific concepts of distributed and context-aware systems that tackle the above challenges. The topics will be published on the department's website and are assigned according to a standardized procedure as explained during the kick-off.

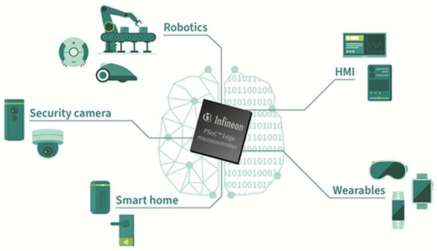

Figure 1: Edge AI empowers IoT devices to apply complex AI algorithms at the edge.

© IoT World Today., 2023: https://www.iotworldtoday.com/connectivity/the-next-chapter-in-the-world-of-iot-addressing-the-new-wave-of-the-iot-with-edge-ai

Figure 2: We explore Time-Sensitive Networking in 5G contexts… paving the way towards a reliable 6G?

Language
English

Formal prerequisites
Successful completion of at least 1 Master-level course at the department of Distributed Systems

Organization
Participants of the seminar receive an introduction to scientific writing in a mandatory kick-off session. They will then write a paper on an assigned topic. The seminar topics will be published beforehand on the website of the department of Distributed Systems. At the end of the semester, the papers will be presented in a block session and discussed with the other seminar participants.

Contact
Melanie Heck: melanie.heck@ipvs.uni-stuttgart.de