INFOTECH Seminar:
Advanced Topics in Distributed Systems

During the last years, a number of new technologies for networked and distributed systems have emerged, due to the advanced requirements of innovative applications and services. For instance, in the Internet of Things (IoT), large numbers of smart objects are equipped with sensor and actuators. These objects typically connect to the Internet through wireless communication technologies and protocols optimized for resources-poor, low-energy devices, as well as flexible communication middleware systems supporting, for instance, the publish/subscribe paradigm. A similar trend can be observed in the Industrial Internet of Things (IIoT), also known as Industry 4.0, where machines, tools, transport vehicles, etc. need to communicate and interact in real-time.

Another popular trend are virtualized and software-defined systems, which promise to enhance the flexibility and efficiency of dynamic and large-scale distributed systems.

Moreover, distributed ledger technologies enable novel electronic currencies and smart contracts. These systems invent novel approaches to solve the well-known distributed consensus problem (e.g., who owns the money?) such as proof-of-work, proof-of-stake, etc.

Another big trend is the reduction of latency in networked and distributed systems. For instance, the cloud computing paradigm, which provides huge amounts of scalable resources in datacenters, has been augmented by edge computing and fog computing infrastructures providing compute and storage resource close to the client. Latency is also of paramount interest in real-time communication systems such as the already mentioned IIoT. This requirement has spawned new real-time communication technologies such as Time-Sensitive Networking (TSN), an enhanced real-time Ethernet standard.

In this seminar, we will cover a broad range of recent concepts, technologies, protocols, and standards to tackle the challenges mentioned above and implement novel networked and distributed systems, e.g.:

- **Machine-to-Machine Communication (M2M):** MQTT (Message Queue Telemetry Transport), OPC-UA (Unified Architecture), Data Distribution Service (DDS)
- **Wireless network technologies and protocols:** Bluetooth Low Energy (BLE), ZigBee / IPv6 over Low power Wireless Personal Area Network (6LoWPAN), Long Range Wide Area Network (LoRaWAN), Visible Light Communication
- **Software-defined Networking (SDN) and Network Function Virtualization (NFV)**
- **Real-time communication:** TSN, real-time Ethernet
- **Virtualization technologies**
- **Distributed ledger, blockchain, and smart contracts:** Bitcoin, Ethereum
- **Edge and fog computing**
- **WWW technologies and Internet transport protocols:** HTTP 2.0/SPDY, QUIC, Multipath TCP

**Prerequisites:** Basic knowledge of computer networks

**Further information** such as the time and place of the first meeting will be announced through ILIAS. Be sure to check for messages (e-mails) from ILIAS!

**Language:** English

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