



**Charles
University**

Principles of Distributed Systems

Winter 2025/26

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Harmonogram

- **October 15:** home study – no lecture
- **October 22:** home study – no lecture
- **October 29: lecture**
 - Discussion

Introduction

- Centralized, decentralized, distributed, integrative/expansive view, federated learning, CDNs, NAS
- Distribution transparency: access, location, relocation, migration, replication, concurrency, failure;
- Openness: interoperability, composability, extensibility
- Dependability: fault tolerance, availability, reliability, safety, maintainability, MTTF, MTTR, MTBF, fail, error, transient/intermittent/permanent fault, confidentiality, integrity
- Security: authorization, authentication, encrypting/decrypting, security keys,
- Scalability: size, geographical, administrative, scaling up/out, hiding communication latencies, asynchronous communication, partitioning and distribution, DNS, replication, caching, consistency problem
- Cluster computing, grid computing, (nested) transactions, ACID

- Figures: 1.1, 1.2, 1.3, 1.7, 1.8

Architectural styles (2.1)

- Layered architectures, application layering
- Service-oriented arch., services, objects, microservices, object-based arch., microservice arch., SOA, Resource-based arch., REST, RESTful arch.
- Publish-subscribe arch., publish, subscribe, coordination: direct, mailbox, event-based; shared data space, event bus
- Figures: 2.1, 2.4, 2.6, 2.7, 2.9, 2.10, 2.12

Middleware and distributed systems (2.2)

- What is middleware?
 - Wrapper, adapter, broker, interceptor (request/message-level)
 - Modifiable middleware
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- Figures: 2.13, 2.14, 2.15

Layered-system architecture (2.3)

- Client-server architecture, Idempotent operation
- Upload/download model
- Simple Web-based systems, client-side script, server-side script
- Figures: 2.17, 2.18, 2.19, 2.21

Home study by next lecture (October 29)

Communication

RPC [4.2], message communication [4.3], multicast communication [4.4],
client-server communication [8.3], group communication [8.4]

Synchronization algorithms

Physical and logical clocks [5.1, 5.2], mutual exclusion [5.3], election [5.4], Gossip-based coordination [5.5], Distributed event matching [5.6]

Consistency models

Data-centric consistency models [7.2], consistency protocols [7.5]

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 - Discuss read things
 - Discuss the structure of lectures