Module Description, available in: EN

Advanced Data Management – Foundations of data-intensive systems

General Information

Number of ECTS Credits

3

Module code

TSM_AdvDataMgmt

Valid for academic year

2026-27

Last modification

2023-10-24

Coordinator of the module

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Explanations regarding the language definitions for each location:

- Instruction is given in the language specified for each location and module execution.
- Documentation is available in the language(s) listed for each location and module execution. If the documentation is in multiple languages, the percentage distributed is indicated (100% = all documentation provided).
- The examination, including both questions and answers, is provided entirely (100%) in the language(s) specified for each location and module execution. The exams are on-site.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- Database design
- Relational Model
- Normalization
- SQL
- Object relational database systems
- Object-oriented programming languages

Brief course description of module objectives and content

The course covers the following core topics:

- Distributed and parallel database systems architectures, internals and services such as transaction processing, concurrency control and query processing
- No-SQL Systems
- Data processing architectures

Aims, content, methods

Learning objectives and competencies to be acquired

Students understand how to use database technologies to process and manage large data collections.

- They know databases alternatives beyond Relational and Object Relational systems and are able to decide which database system is appropriate depending on the context, and depending on the kind of data available
- They can design and implement Systems based on different architectures
- They understand the functioning of internal components of a database system
- They can reuse the material acquired in this course in their own working environment and apply them to solve their specific problems
- They know the current research directions of these domains.

Module content with weighting of different components

The Internet, new types of data and applications and new business requirements have driven the development of data management systems having data models and architectures beyond the traditional relational and object-relational systems and centralised architectures.

The module is organised around the following core subject areas:

- Parallel query processing (20%)
- Replication and partitioning (40%)
- Consistency (25%)
- DLT and Blockchain (15%)

Contents:

- Introduction, data intensive architectures, relational vs document-based systems
- Data processing architectures, parallel queries on a single node
- Serializability
- Storage and retrieval, row-oriented vs column-oriented storage
- Partitioning
- Consistent hashing
- Replication
- Distributed consensus (2PC, 3PC, Paxos, Raft)
- Zookeeper (CAP, ZAB, Leader election)
- Batch processing: Distributed storage: block vs object storage
- Stream processing
- Blockchain

Teaching and learning methods

- Lectures with integrated exercises
- Self study of literature
- case studies

Literature

Lecture slides, references to internet resources and books

Assessment

Additional performance assessment during the semester

The module does not contain an additional performance assessment during the semester

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

No aids permitted

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted