Sages

Course code:	**DB-OPT**
Course title:	**Development of effective database applications based on JEE and selected database system (PostgreSQL, MySQL, Oracle,DB/2, MSSQL)**
Days:	3

Description:

Course intended for:

The training is intended for programmers and database administrators wishing to develop their knowledge on enhancement of performance and scalability of database applications.

Course objective:

The participants will find out how to write queries and organize data to make the best use of the database system owned. The participants will also get familiar with the internal structure of the modern database systems, which will allow them to set the configuration parameters and foresee the impact of the design decisions made on performance. Weaknesses of selected database systems and remedies to these will also be discussed.

Requirements:

The participants are expected to have the basic knowledge of issues associated with relational databases, knowledge of Java language and basic knowledge of object-relational mapping (JPA or Hibernate).

Course parameters:

3*8 hours (3*7 net hours) of lectures and workshops (with a visible emphasis on workshops). During the workshops, the participants will apply the learned techniques, developing an exemplary application operating in the selected database system.

Group size: no more than 8-10 participants.

Course curriculum:

1. The database system architecture

I. Data access layer (DAO)

II. Cache of the application

III. JDBC controller

IV. SQL query compiler/parser

V. Query copying module

VI. Query optimizer

VII. Execution layer

2. The physical data layer

I. Data organization in tables

II. Table „health" diagnostics

III. Indexes: B+ trees, mixing, span, spatial

IV. Grouping indexing

V. Full text indexing

VI. Index repair

3. Query performance algorithms and their characteristics

I. Information browsing algorithms

II. Join algorithms: hash join, merge join, nested loops, index

4. nested loops

I. grouping algorithms

II. query plan clarification (EXPLAIN, AUTOTRACE)

5. writing of effective queries and designing of physical data structure

I. query optimizer limitations

II. use of advanced optimizer capabilities in Oracle / MSSQL / DB/2
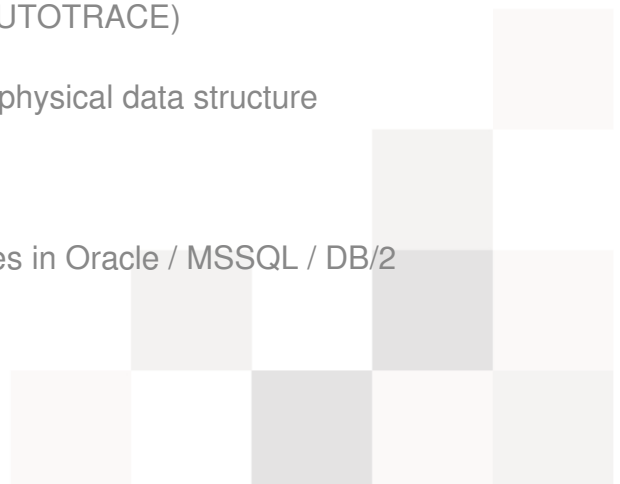
III. maintenance of optimizer statistics

IV. selection of indexes

V. selection of materialized perspectives

VI. multi-dimensional table clustering

VII. horizontal and vertical table partitioning, division into many carriers

VIII. use of tools that support performance tuning

IX. structures to be avoided

6. Buffering

I. Buffering of blocks in the files system

II. Buffering of data blocks in shared memory

III. Buffering at the record level

IV. Buffering of query results

V. Buffering of query performance plans (prepared statements)

7. Transactions

I. Concurrence management strategies - 2PL,MVCC

II. Table, record level locks

III. Writing a transaction safe code

IV. Reduction of deadlocks/ number of cancelled transactions

V. Ensuring data durability, transaction withdrawal and renewal (transaction log, withdrawal segment)

VI. Problems associated with frequent data modification and long transactions

VII. Distributed transactions

8. Replication and HA systems

I. Synchronous, asynchronous replication strategies
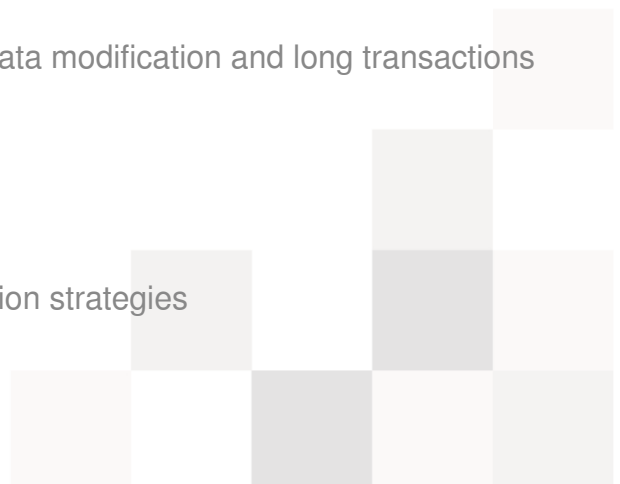
II. masterslave, mastermaster

III. replication in MySQL, PostgreSQL, Oracle, DB/2...

IV. load balancing

V. Hibernate shards

9. Development of an effective code in Java

I. lazy/eager fetching

II. bulk update/delete

III. buffering in JPA/Hibernate

IV. distributed buffering