Overview

1. Architecture of Database Systems
   - Mapping hierarchy of a DBS (5-layer model)
   - Distributed DBS: use of multi-computer DBS
   - Layer models for Client/Server DBS, etc.

2. I/O Architectures and Storage Hierarchies
   - Use of a storage hierarchy, magnetic disks
   - Disk Arrays, RAID-1 vs. RAID-5
   - Page-addressable semiconductor storage / disk caches
   - Flash disks

3. Files and Segments
   - Mapping of files and blocks: file system, methods for block allocation
   - Measures to enhance fault tolerance
   - Mapping of segments and pages

4. DB Buffer Management
   - Role of DB buffer management, various measures for locality
   - Memory allocation and search in the DB buffer
   - Page replacement algorithms: LRU, CLOCK, GCLOCK, LRD, LRU-K ...
   - Replacement algorithms – utilization of context knowledge
## Overview (2)

### 5. Storage structures
- Free placement administration
- Disk-based and memory-based record addressing
- Mapping of records, complex objects, and LOBs
- DB connection for external data

### 6. Tree-based Access Paths
- Requirements for access paths
- Multi-way trees, digital trees
- Addressing in trees

### 7. Hash-based Access Paths
- Static hash methods
- Dynamic hash methods
- External hashing using separators
- Linear hashing
- One-dimensional methods: comparison

### 8. Secondary and Hierarchical Access Paths
- Access paths for secondary keys
- Methods using bit list compression
- Access paths for Set structures
- Generalized access paths
- Join indexes and path indexes

## Overview (3)

### 9. Multi-dimensional Access Paths
- Support for space-related accesses
- Organization of data records
- Organization of embedding data space
- Grid file, R-tree, GiST, etc.
- Multi-dimensional methods: comparison

### 10. Record-oriented Interface
- Data Dictionary functions
- Scan concepts (table-, index-, link-, k-d-scans
- Sort operator, External Sorting

### 11. Table Operations - Implementation
- Operators on a single and on several tables
- Join implementation: Nested Loop, Sort/Merge, Hash
- Implementation of further binary operators

### 12. Set-oriented Interface
- Forms of host language embedding
- Translation of DB statements
- Query optimization (standardization, simplification, restructuring, and transformation, cost models)
- Code production
- Execution of DB statements
**List of References**


**Journals:**
- ACM TODS Transactions on Database Systems, ACM (4 issues/year)
- THE VLDB Journal VLDB Foundation (4 issues/year)
- Information Systems Pergamon Press (8 issues/year)
- Informatik - Forschung und Entwicklung Springer-Verlag (4 issues/year)
- ACM Computing Surveys ACM publication (4 issues/year)

**Proceedings:**
- ICDE Proceedings, "International Conference on Data Engineering", annual conference of IEEE
- SIGMOD Proceedings, annual conference of ACM Special Interest Group on Management of Data
- VLDB Proceedings, "International Conference on Very Large Data Bases", annual conference of VLDB Foundation
- BTW Proceedings of the biannual conference “Datenbanksysteme für Business, Technologie und Web” of GI, and further conferences within GI-FB “DBIS”

**Database Technology - What is it?**

Concepts, Methods, Tools and Systems for the

- persistent
- reliable
- independent management and
- comfortable
- flexible use of
- large
- integrated
- multi-user databases

- life cycle data > duration creation process
- integrity, consistency, protection against loss
- mutual change immunity application – database
- „Higher" abstract interface (objects of the user)
- ad-hoc query facility (generic DB language)
- size data >> size memory
- controlled redundancy off or several applications, parallel access
"Informationen sind in unserer vom Wettbewerb geprägten Welt ähnlich wie die Luft, die wir atmen – überall vorhanden und absolut lebenswichtig."

"Datenbanktechnik ist eine nützliche Infrastruktur wie fließendes Wasser, das wir erst bemerken, wenn es fehlt."

Not only relational tables, but also VITA data
- Storage and management, but also
- Content-oriented search, connection, and modification

Windows: Serving A Single Web Page (IIS)

Windows 3.1: 2.5 mill. LOC
Windows 95: 15 mill.
Windows XP: 40 mill.
Windows Vista: >50 mill.