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Course

Realization of Database Systems

SS 2009

Theo Härder

Times:
Tuesday, 13.45 - 15.15 h, 48-462
Thursday, 13.45 - 15.15 h, 48-462
Start: Thursday, 23. 04. 2009
Exercise: to be announced

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Overview

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Overview (2)

- **5. Web Caching and Database Caching**
  - Client-to-Server Path and User-to-Data Path
  - Types of Web caches, differences DB buffer – DB cache
  - Materialized views, adaptive constraint-based DB caching
  - Implementation issues for a middleware-based cache system
- **6. Storage structures**
  - Free placement administration
  - Disk-based and memory-based record addressing
  - Mapping of records, complex objects, and LOBs
  - DB connection for external data
- **7. Tree-based Access Paths**
  - Requirements for access paths
  - Multi-way trees, digital trees
  - Addressing in trees
- **8. Hash-based Access Paths**
  - Static hash methods
  - Dynamic hash methods
  - External hashing using separators
  - Linear hashing
  - One-dimensional methods: comparison

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Overview (3)

- **9. 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
- **10. 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
- **11. Record-oriented Interface**
  - Data Dictionary functions
  - Scan concepts (table-, index-, link-, k-d-scans
  - Sort operator, External Sorting
- **12. Table Operations – Implementation**
  - Operators on a single and on several tables
  - Join implementation: Nested Loop, Sort/Merge, Hash
  - Implementation of further binary operators

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Overview (4)

- **14. 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
- **15. OS Embedding and DB Tuning**
  - Requirements and problems
  - Single-process / multi-process
  - Single-tasking / multi-tasking
  - Index-, storage-, query-tuning
  - Monitoring and Troubleshooting
  - ...

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List of References

- **Härder, T., Rahm, E.:** Datenbanksysteme — Konzepte und Techniken der Implementierung, 2. Ed., Springer, 2001.
- **Gray, J., Reuter, A.:** Transaction Processing—Concepts and Techniques, Morgan Kaufmann Publishers, Inc., San Mateo, CA., 1998 (5th printing).
- **O'Neil, P.:** Database—Principles, Programming, Performance, Morgan Kaufmann Publishers, Inc., San Mateo, CA., 1994.
- **Mitschang, B.:** Anfrageverarbeitung in Datenbanksystemen — Entwurfs- und Implementierungskonzepte, Reihe Datenbanksysteme, Vieweg, 1995.
  Saake, G., Heuer, A., Sattler, K.-U.: Datenbanken: Implementierungstechniken, MITP, 2005.
- **Stallings, W.:** Betriebssysteme – Prinzipien und Umsetzung, 4. Ed., Pearson Studium, 2003

- **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"

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Database Technology - What is it?

Concepts, Methods, Tools and Systems for the

- persis tent — life cycle data > duration creation process
- reliable — integrity, consistency, protection against loss
- independent — mutual change immunity applicaton – database

management and

- comfortable — „higher“ abstract interface (objects of the user)
- flexible — ad-hoc query facility (generic DB language)

use of

- large — size data >> size memory
- integrated — controlled redundancy of/for several applications, parallel access
- multi-user

databases

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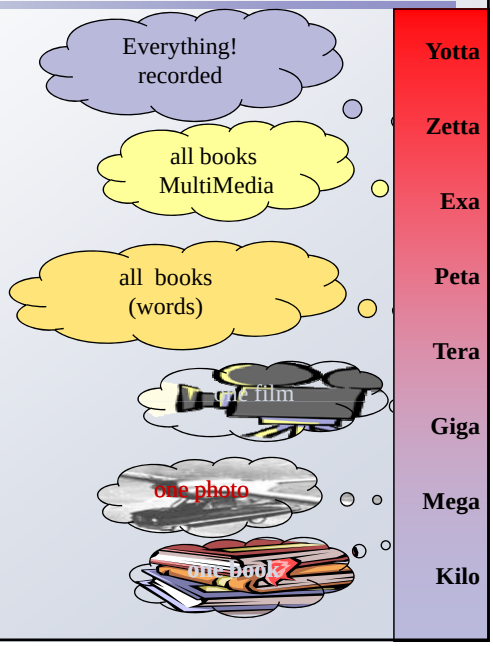
Necessity of Efficient DBMSs

- “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



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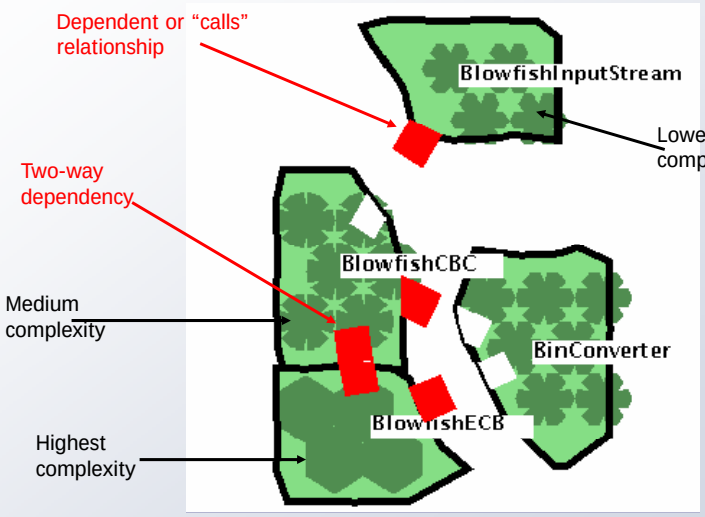
Software Complexity Visualization



The meaning of symbols
used in the implementation of the Pattern Puzzle metaphor

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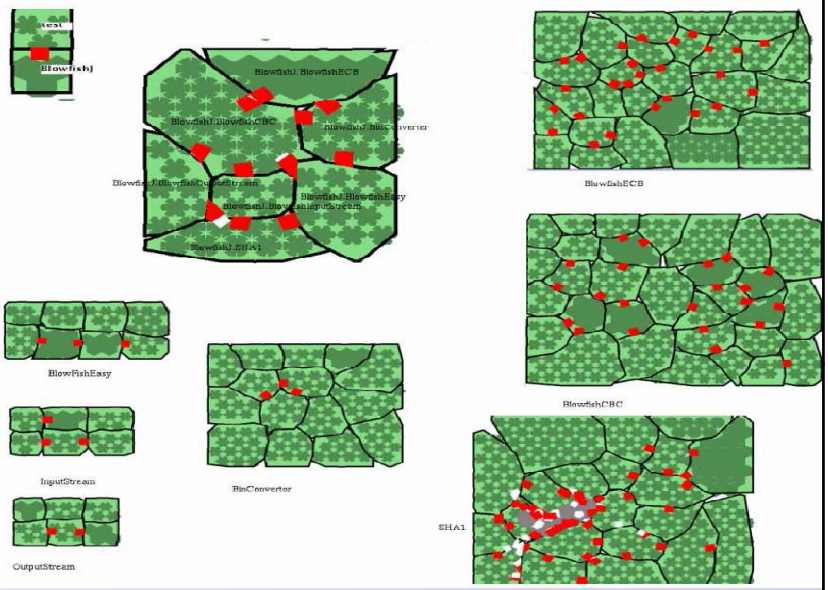
Software Complexity Visualization



Visualization of the Blowfish library

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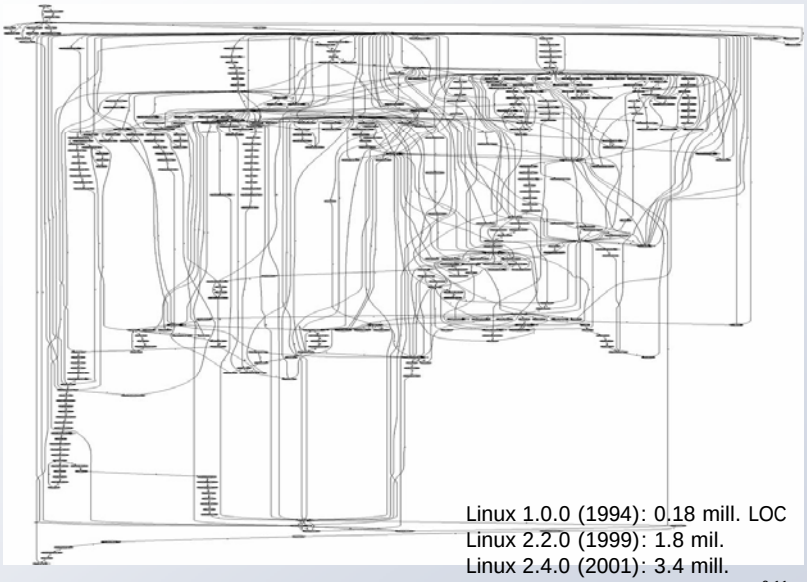
Linux: Serving A Single Web Page (Apache)



Linux 1.0.0 (1994): 0.18 mill. LOC
Linux 2.2.0 (1999): 1.8 mil.
Linux 2.4.0 (2001): 3.4 mill.
Linux 2.6.0 (2003): 5 mill.

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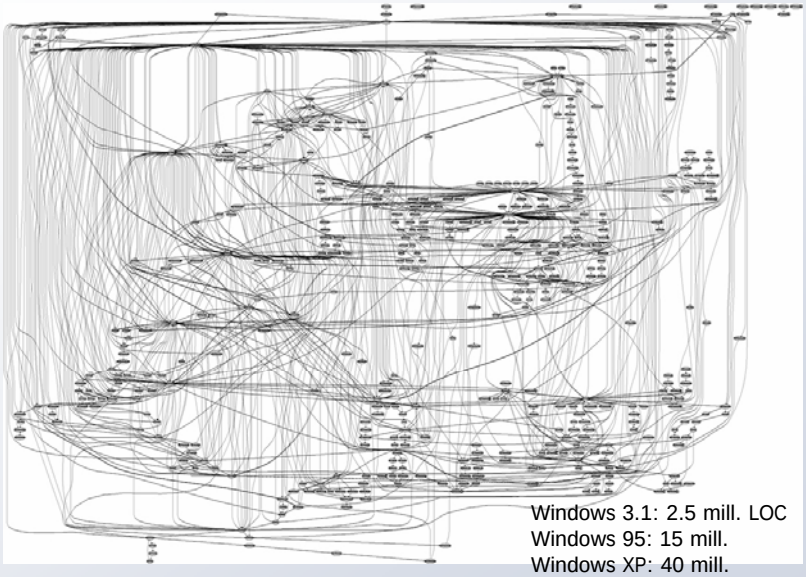
Windows: Serving A Single Web Page (IIS)



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

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