



Database Technology

In Software Engineering Environment

WEITING LI

01

What is Database?

Definition:

A collection of interelated data stored electronically in a computer system.



Property of Databases

- Mini-world
- Logically coherent and integrated.
- Access is user-Friendly and efficient.
 - Nonredundant data.
 - Data independence.



02

What is Database Technology?

comprises: 1. concepts; 2. systems;
3. methods; 4. tools
to support the construction
and operation of databases.



Properties of Database Technology

Data modeling

- Relational
- Object-oriented
- Object-relational

Persistence

Stored persistently

Data Integrity

Semantic integrity control mechanism are provided

Quering

Data can be retrieved as needed; And has flexible, powerful interfaces

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Concurrency control

Functionality to allow concurrent access

Security

To prevent malicious access

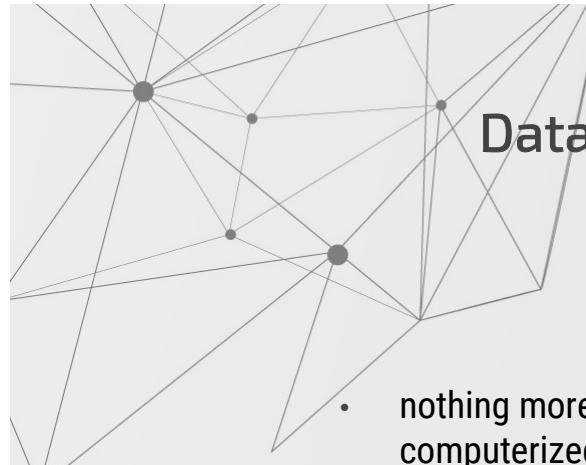
Secondary storage

Indexing, clustering, and resource allocation

Distribution

Prevent damage from accidents or increase efficiency





Database Management Systems (DBMS)

- nothing more than a computerized data-keeping system
- **Manipulation of the data or management for the database** itself
- 4 types of databases: inverted list, hierachic, network or relational





Pause And Think



MySQL 8.0.11 : TLS : MySQL Loc : classicmodels : customers

The screenshot shows a MySQL database interface with the following details:

- Database:** classicmodels
- Table:** customers
- Columns:** customerNumber, customerName, contactLastName, contactFirstName, phone, add
- Data Preview:** A list of 122 rows of customer data.
- Toolbar:** Includes icons for search, refresh, and various database operations.
- Left Sidebar:** Shows other databases (world) and tables (employees, offices, orderdetails, orders, payments, productlines, products) under the classicmodels database.
- Bottom Buttons:** Data, Structure, + Row, Columns, Filters, and navigation arrows.

customerNumber	customerName	contactLastName	contactFirstName	phone	add
103	Atelier graphique	Schmitt	Carine	40.32.2555	54, rue Roy
112	Signal Gift Stores	King	Jean	7025551838	8489 Stro
114	Australian Collectors, Co.	Ferguson	Peter	03 9520 4555	636 St Kild
119	La Rochelle Gifts	Labrune	Janine	40.67.8555	67, rue des
121	Baane Mini Imports	Bergulsen	Jonas	07-98 9555	Erling Skakl
124	Mini Gifts Distributors Ltd.	Nelson	Susan	4155551450	5677 Stro
125	Havel & Zbyszek Co	Piestrzewicz	Zbyszek	(26) 642-7555	ul. Filtrowa
128	Blauer See Auto, Co.	Keitel	Roland	+49 69 66 90 2555	Lyonerstr. 3
129	Mini Wheels Co.	Murphy	Julie	6505555787	5557 North
131	Land of Toys Inc.	Lee	Kwai	2125557818	897 Long A
141	Euro+ Shopping Channel	Freyre	Diego	(91) 555 94 44	C/ Moralzar
144	Volvo Model Replicas, Co	Berglund	Christina	0921-12 3555	Berguvsväg
145	Danish Wholesale Imports	Petersen	Jytte	31 12 3555	Vinbæltet 3
146	Saveley & Henriot, Co.	Saveley	Mary	78.32.5555	2, rue du C
148	Dragon Souvenirs, Ltd.	Natividad	Eric	+65 221 7555	Bronz Sok.
151	Muscle Machine Inc	Young	Jeff	2125557413	4092 Furth
157	Diecast Classics Inc.	Leona	Kelvin	2155551555	7586 Pomp

Reference: [7]

Reference: https://www3.ntu.edu.sg/home/ehchua/programming/sql/MySQL_Beginner.html

Basic MySQL operations

Select which database to use:

```
$> mysql your-database-name
```

Insert a row into the database:

```
-- Insert a row with all the column values
mysql> INSERT INTO products VALUES (1001, 'PEN', 'Pen Red', 5000, 1.23);
Query OK, 1 row affected (0.04 sec)
```

Query the dataset:

```
-- List all the rows of the specified columns
SELECT columnName, column2Name, ... FROM tableName

-- List all the rows of ALL columns, * is a wildcard denoting all columns
SELECT * FROM tableName

-- List rows that meet the specified criteria in WHERE clause
SELECT columnName, column2Name,... FROM tableName WHERE criteria
SELECT * FROM tableName WHERE criteria
```





03

Database Technology in SEE

How Software engineering environment(SEE) can use
database technology to its advantage

Software Engineering Environment

Definition:

A software system that provides support for the development, repair, and enhancement of software, and for the management and control of these activities.

Characteristics:

- Integrated environment facilities: platform, data, presentation, control, and process integration;
- Designated to support team based activities;
- Should support a wide range of software development activities;

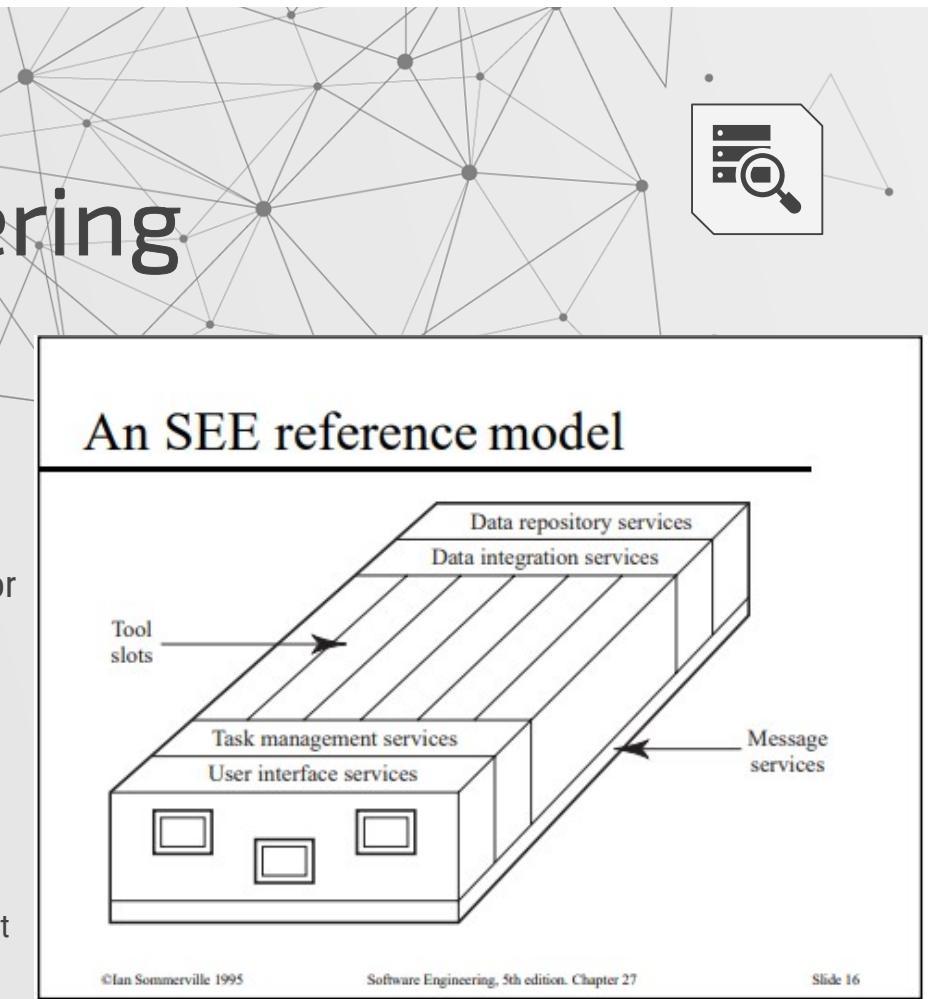
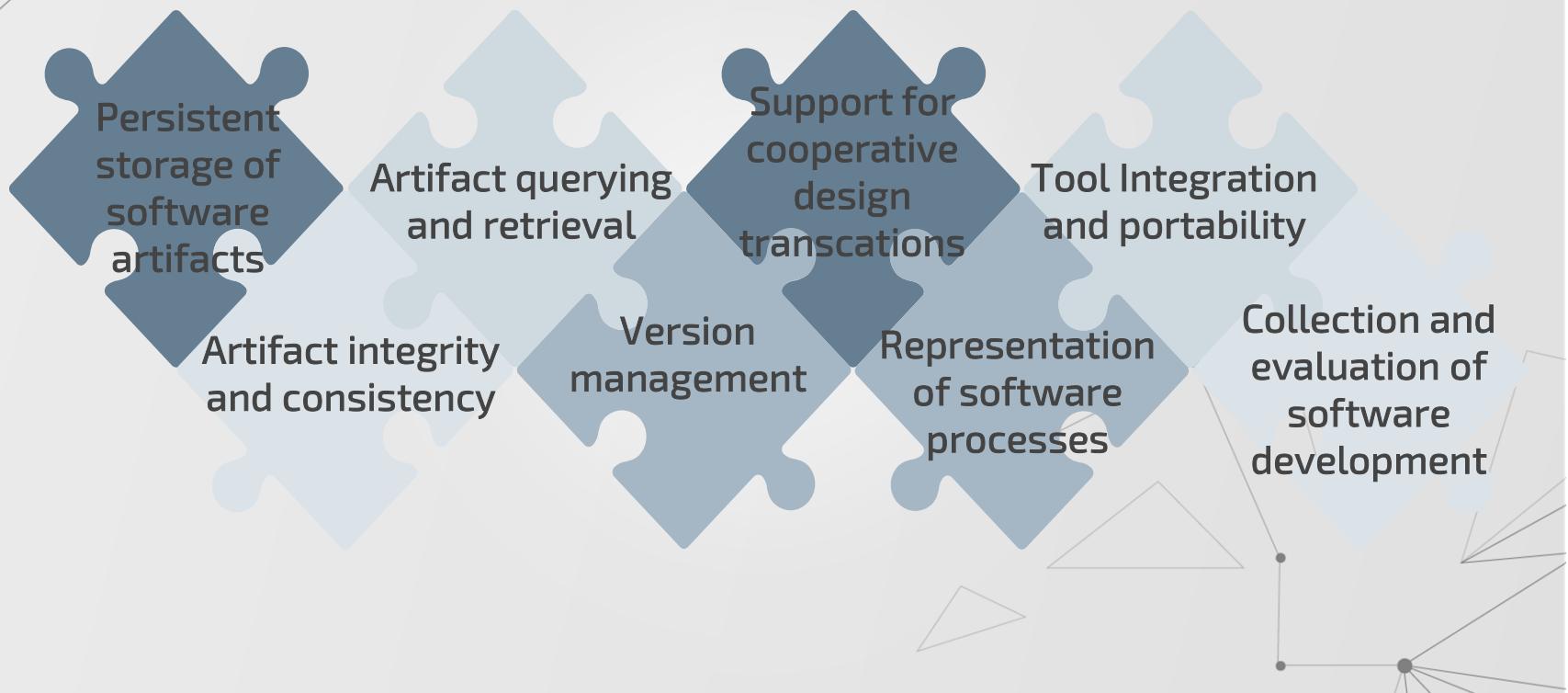


Figure 1. An example of SEE model [1]



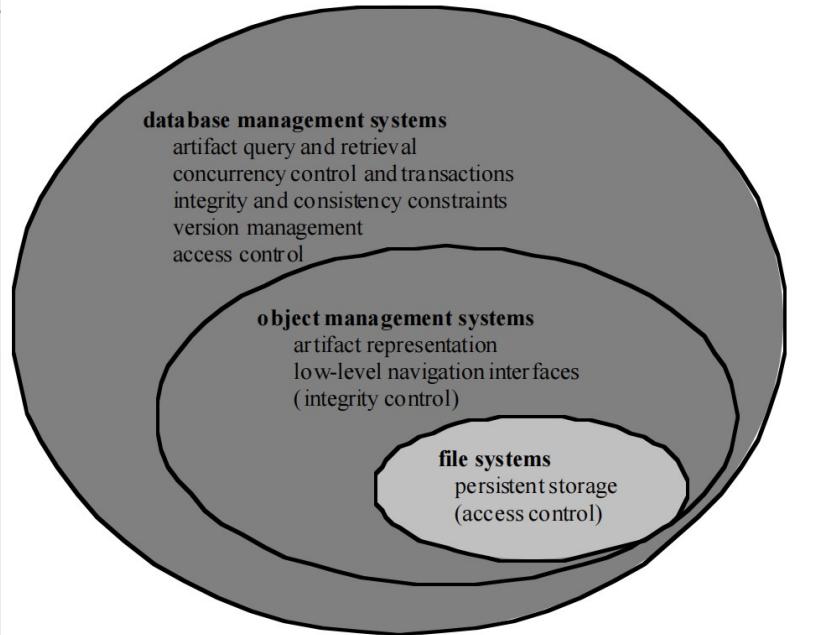
Functional Requirements For Database Support In SEE



History

Database Management System

& Object management systems (OMS)



database management systems
artifact query and retrieval
concurrency control and transactions
integrity and consistency constraints
version management
access control

object management systems
artifact representation
low-level navigation interfaces
(integrity control)

file systems
persistent storage
(access control)

- Developed Early in mid 80's to early 90's
- Artifact representation and persistence
 - Rudimentary navigation interfaces
 - Low-level integrity control

Figure 2. The difference between DBMS and OMS [4]

Example of OMS

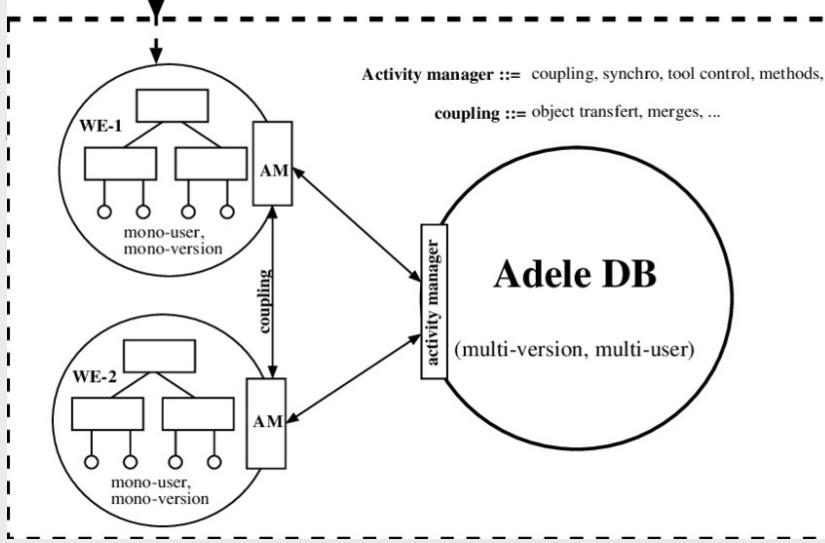


Figure 3. Adele DB OMS Diagram [2]

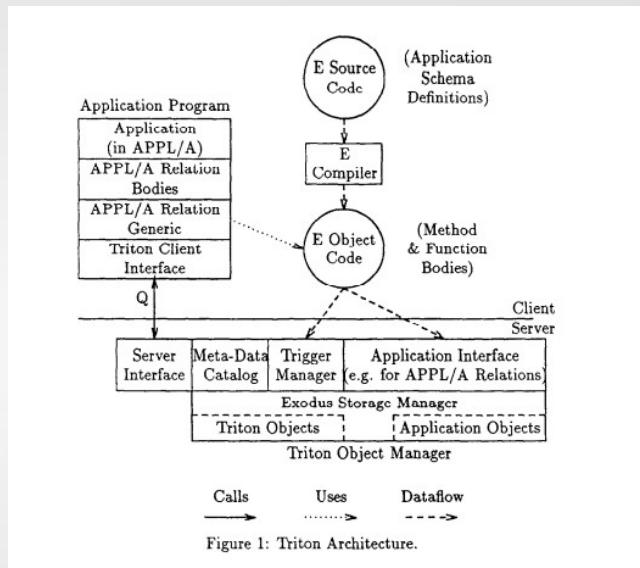


Figure 1: Triton Architecture.

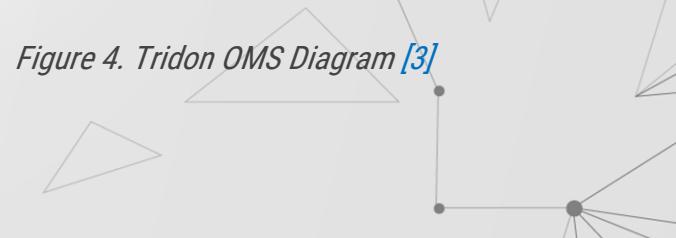


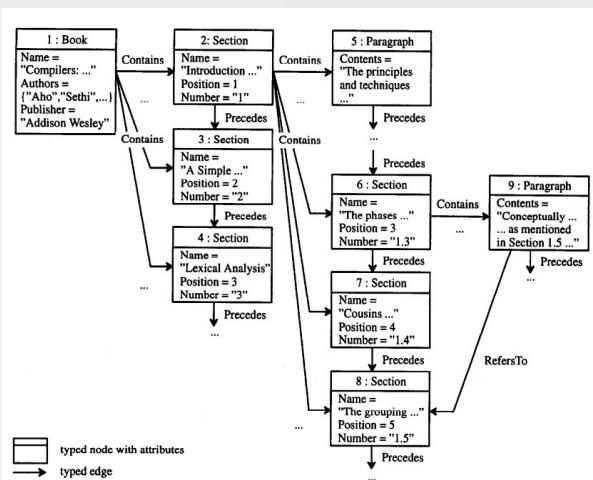
Figure 4. Tridon OMS Diagram [3]

Proprietary DBMS for SEE

Figure 6. Visualization of EPOSDB life-cycle [5]

1. EPOSDB Software Engineering Database :

- General Entity Relationship (ER)-based DBMS
 - Manage complex & evolving data structures
 - Novel change oriented versioning (COV)
 - Used in EPOS SEE



2. GRAS Software Engineering Database System :

- Graph- Oriented SE database system
 - Handle different coarse and fine-grained objects
 - Support incremental computation of derived data
 - undo/redo of data modification

Figure 5. Graph representation of the structured text [6]

Commercial DBMS for SEE

Name	Type of system	Used in SEE	Reference
Adele-DB	Structurally object-oriented OMS	Adele 2	[7]
ALF OMS	PCTE-based repository	ALF	[12]
Cactis	Semantic DBMS	-	[32]
DAMOKLES	Structurally object-oriented DBMS	UNIBASE	[21]
EPOSDB	Structurally object-oriented DBMS	EPOS	[17]
GRAS	Graph-based active DBMS	IPSEN, Melmac	[39]
H-PCTE	PCTE-based repository	-	[37]
Marvel OMS	Structurally object-oriented OMS	Marvel	[8]
NAOS	Active layer on top of O ₂ object-oriented DBMS	GOODSTEP	[16]
Pleiades	Database programming language	Arcadia	[51]
P-RooT	PCTE-based repository	Coo	[13]
SIB	Proprietary repository	ITHACA	[19]
Triton	Extension of the Exodus OMS	Arcadia	[31]

Table 1. special purpose DBMS for SEE in industrial field [4]

References

- [1] T. Anderson and D. Sharon, "A Complete Software Engineering Environment" in IEEE Software, vol. 14, no. 02, pp. 123-127, 1997.
doi: 10.1109/52.582983 keywords: {} url: <https://doi.ieeecomputersociety.org/10.1109/52.582983>
- [2] Belkhatir, Noureddine & Melo, Walcelio. (1994). Supporting Software Development Processes in Adele 2. Comput. J.. 37. 621-628. 10.1093/comjnl/37.7.621.
- [3] Dennis Heimbigner. 1992. Experiences With an Object Manager for a Process-Centered Environment. In Proceedings of the 18th International Conference on Very Large Data Bases (VLDB '92). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 585–595.[4] Dittrich, Klaus R., Dimitrios Tombros, and Andreas Geppert. "Databases in software engineering: a roadmap." Proceedings of the Conference on the Future of Software Engineering. 2000.
- [5] Jaccheri, Maria Letizia et al. "Software process modeling and evolution in EPOS." Proceedings Fourth International Conference on Software Engineering and Knowledge Engineering (1992): 574-581.
- [6] Norbert Kiesel, Andy Schuerr, Bernhard Westfechtel, Gras, a graph-oriented (software) engineering database system, Information Systems, Volume 20, Issue 1, 1995, Pages 21-51, ISSN 0306-4379, [https://doi.org/10.1016/0306-4379\(95\)00002-L](https://doi.org/10.1016/0306-4379(95)00002-L).
- [7] **Reference for picture on Slide 8:** <https://tableplus.com/blog/2018/07/mysql-how-to-install-sample-database.html>
- [8] picture of sybase database source: <https://dbdb.io/db/adaptive-server-enterprise>