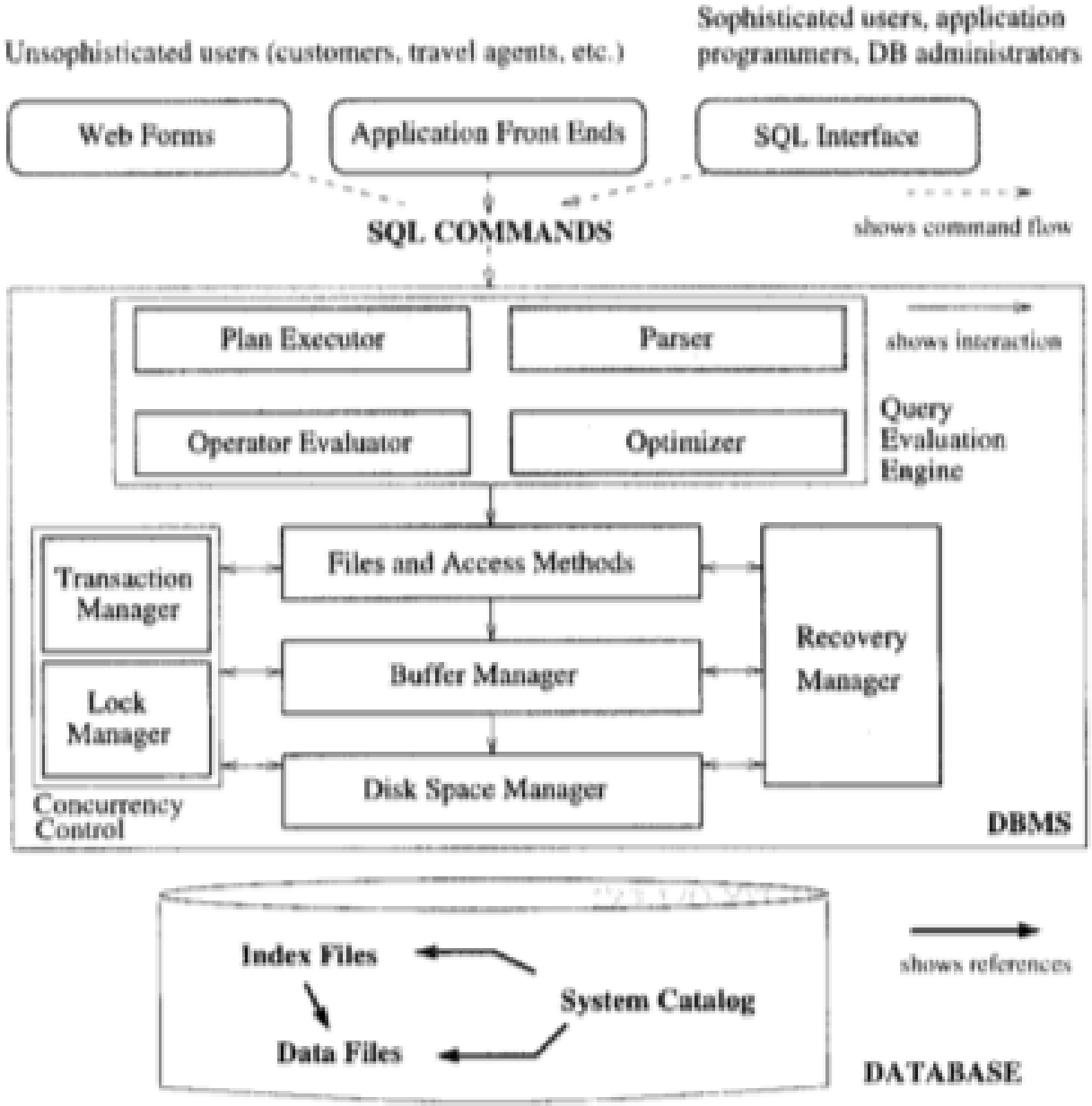
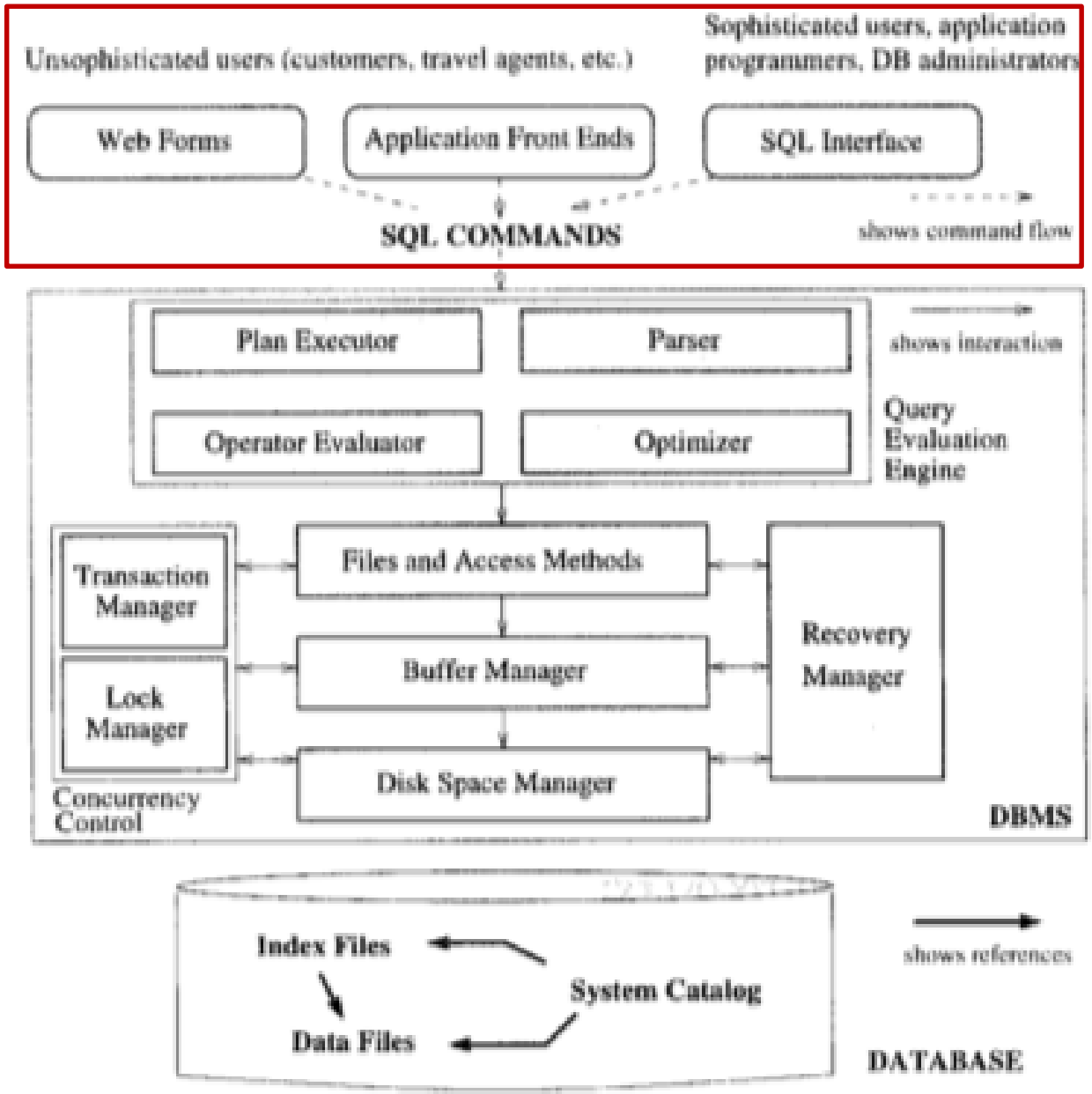
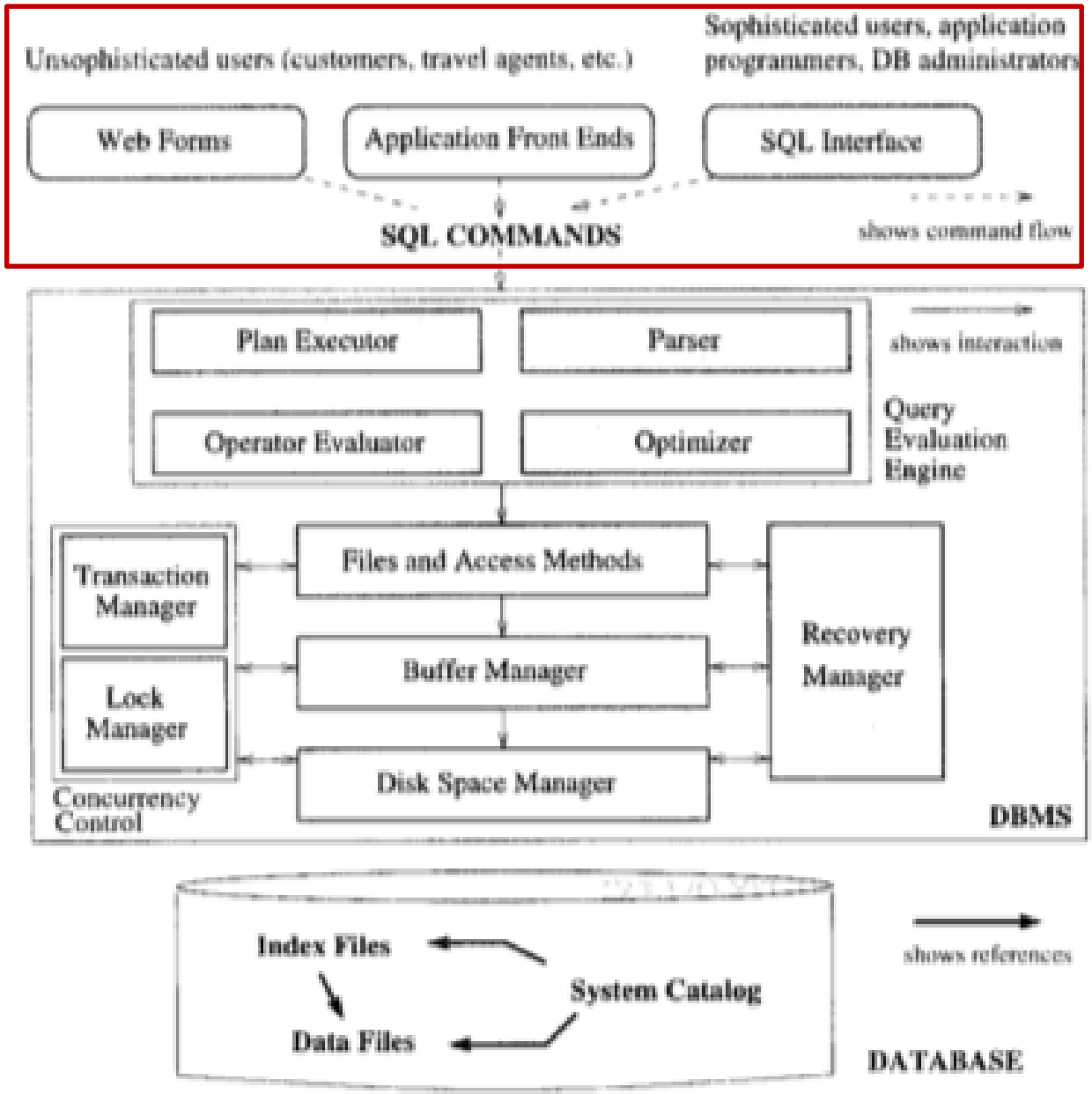
Typical Architecture of a DBMS

(Section 1.8; DBMS, Raghu Ramakrishna)



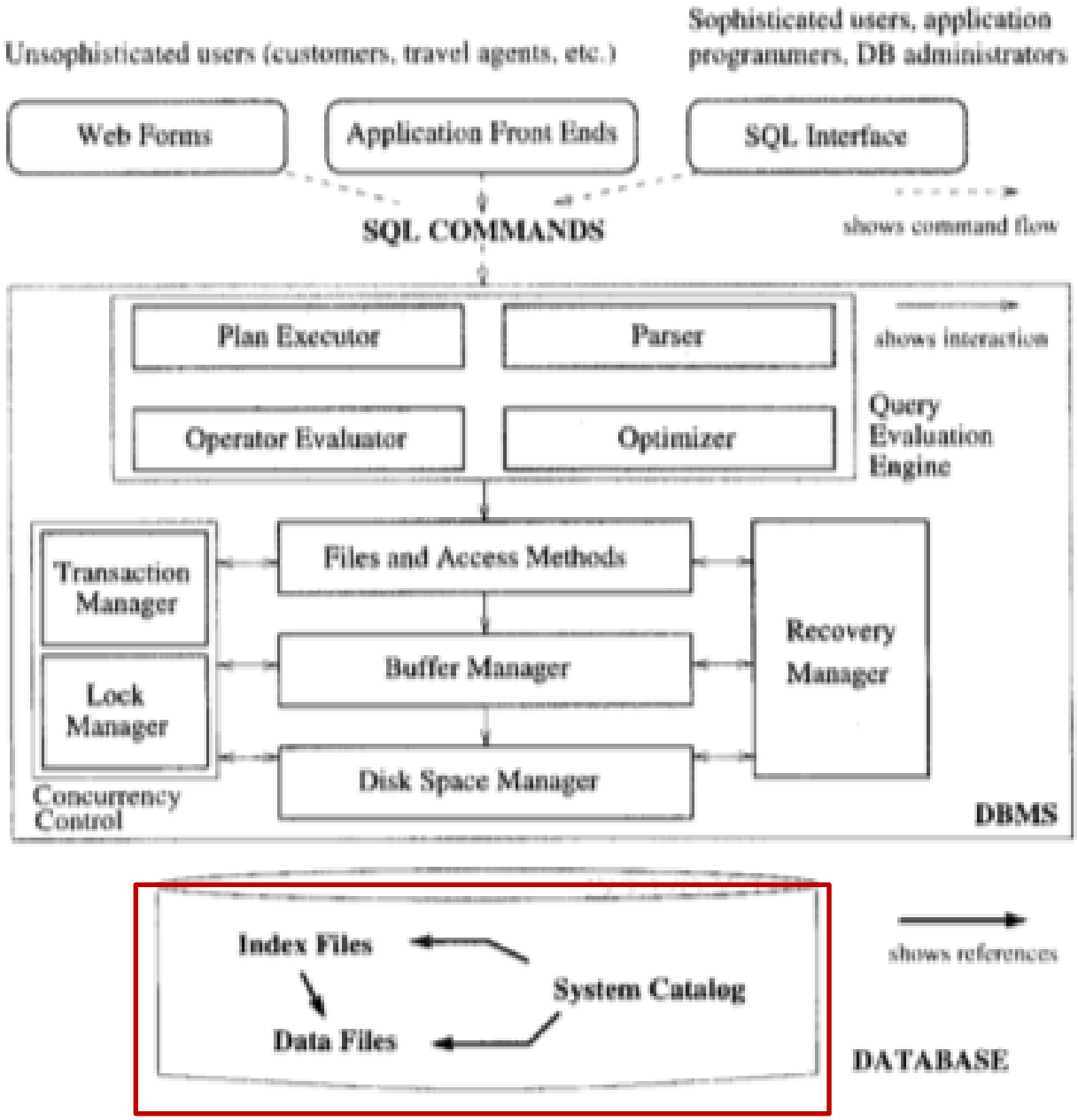


- Database Application Developers
- Database Application Users
- Database Administrators



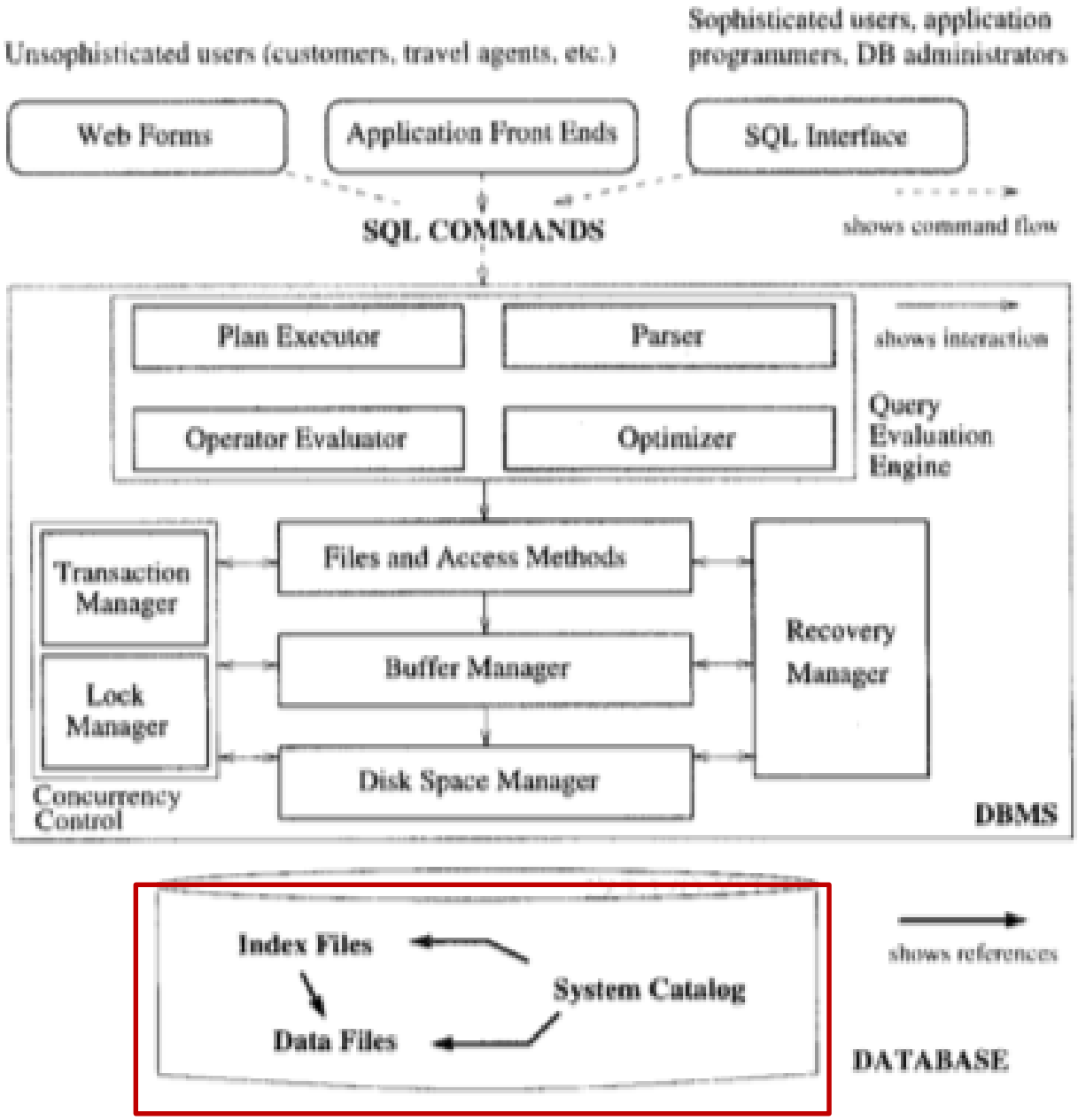
- Database Application Developers
- Database Application Users
- Database Administrators

- Use SQL DDL to create databases and tables
- Use SQL DML to populate, access or modify database



- **Storage**

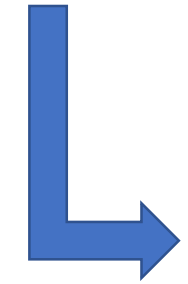
Data permanently stored at secondary storage



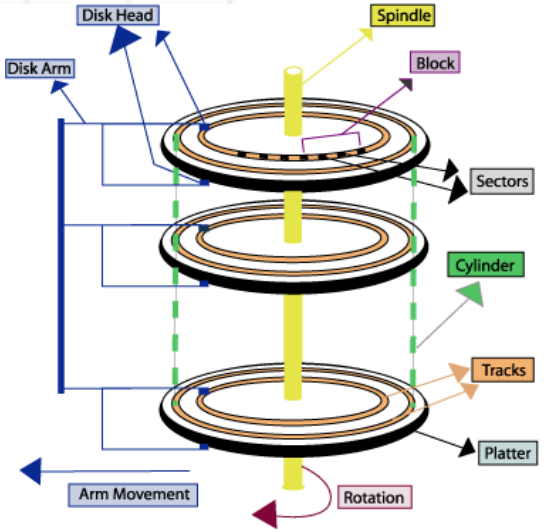
- **Storage**

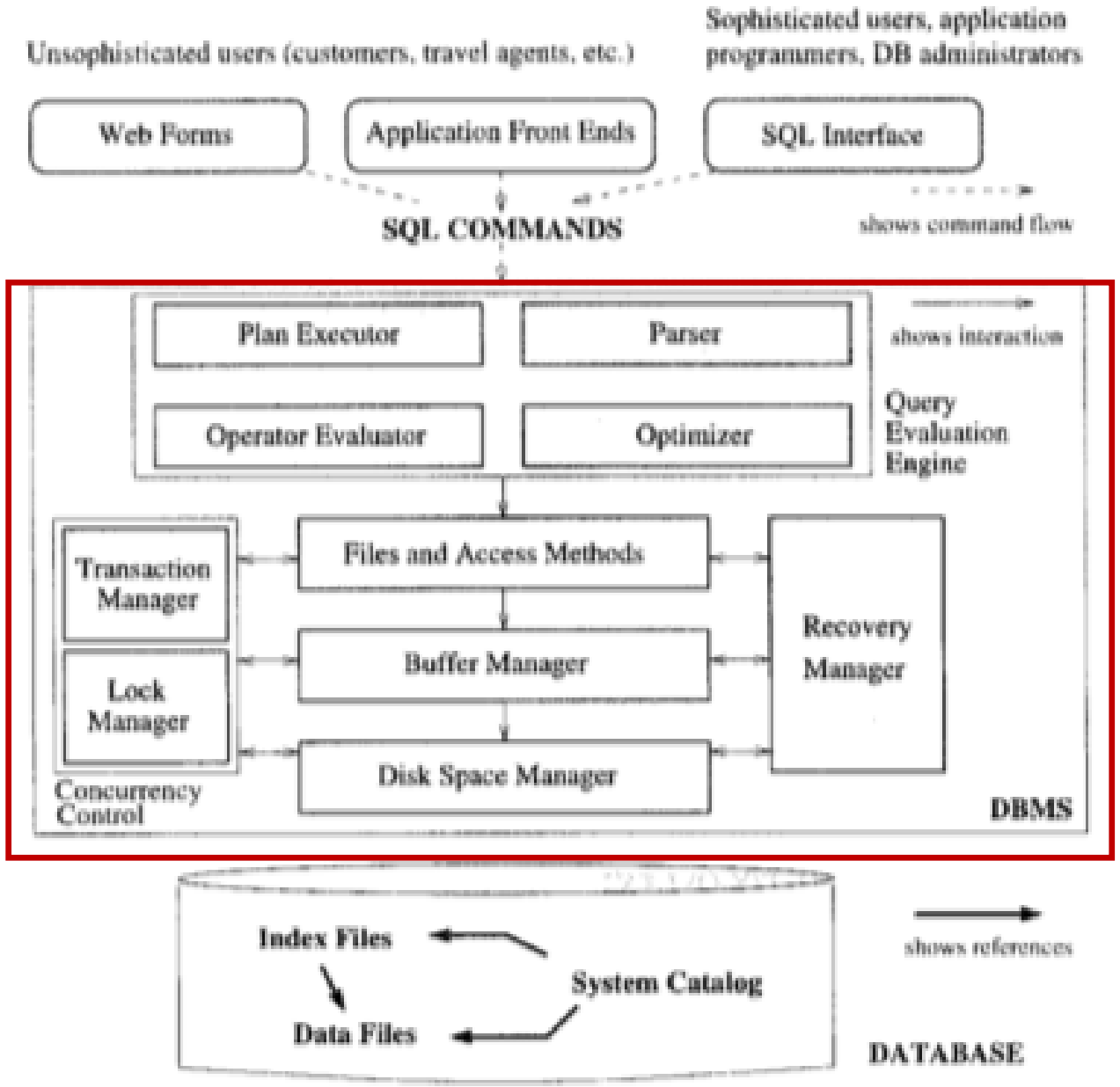
Data permanently stored at secondary storage

Name	FName	City	Age	Salary
Smith	John	3	35	$280
Doe	Jane	1	28	$325
Brown	Scott	3	41	$265
Howard	Shemp	4	48	$359
Taylor	Tom	2	22	$250



File system

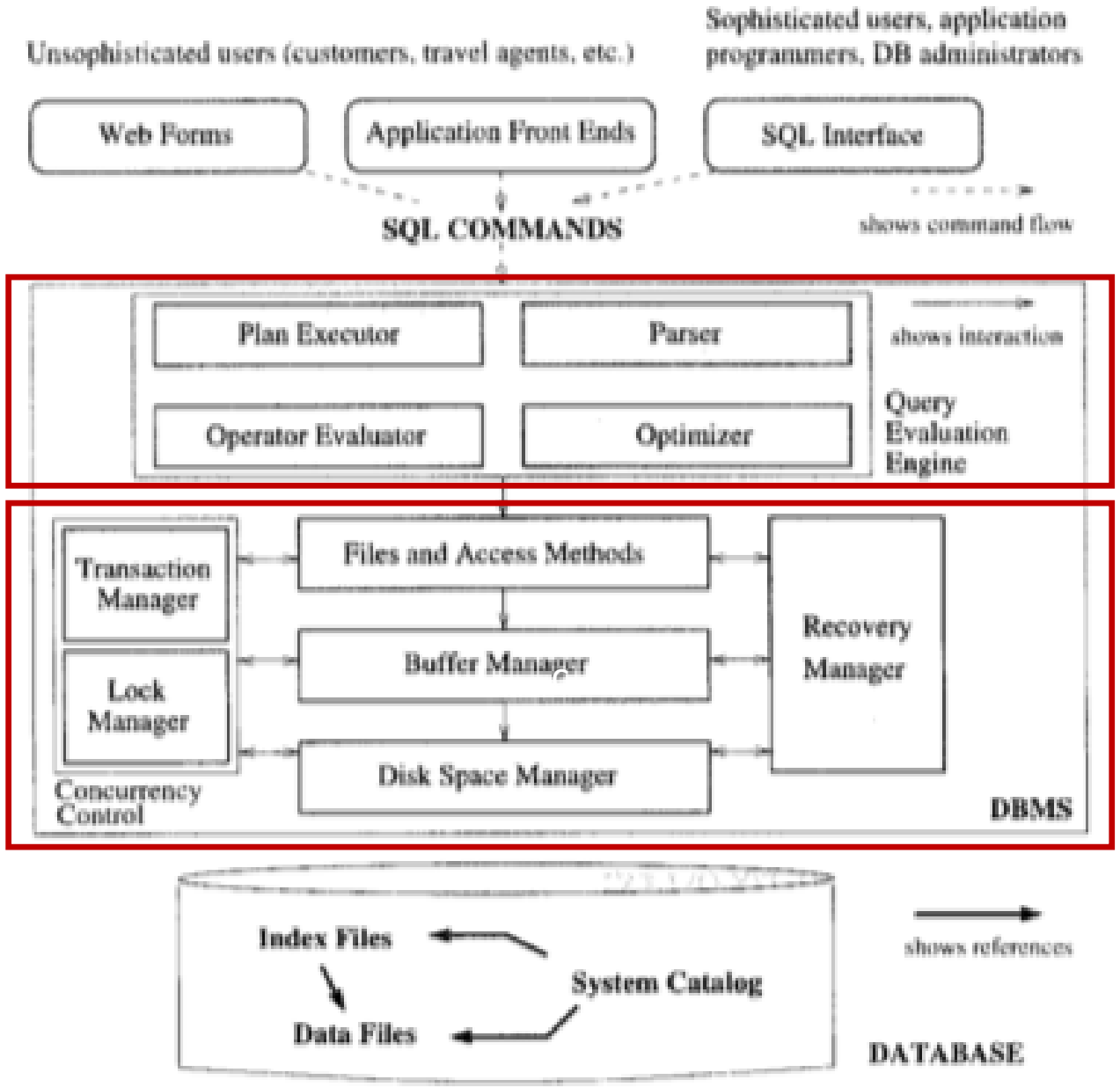




- **Database Management System Internal**

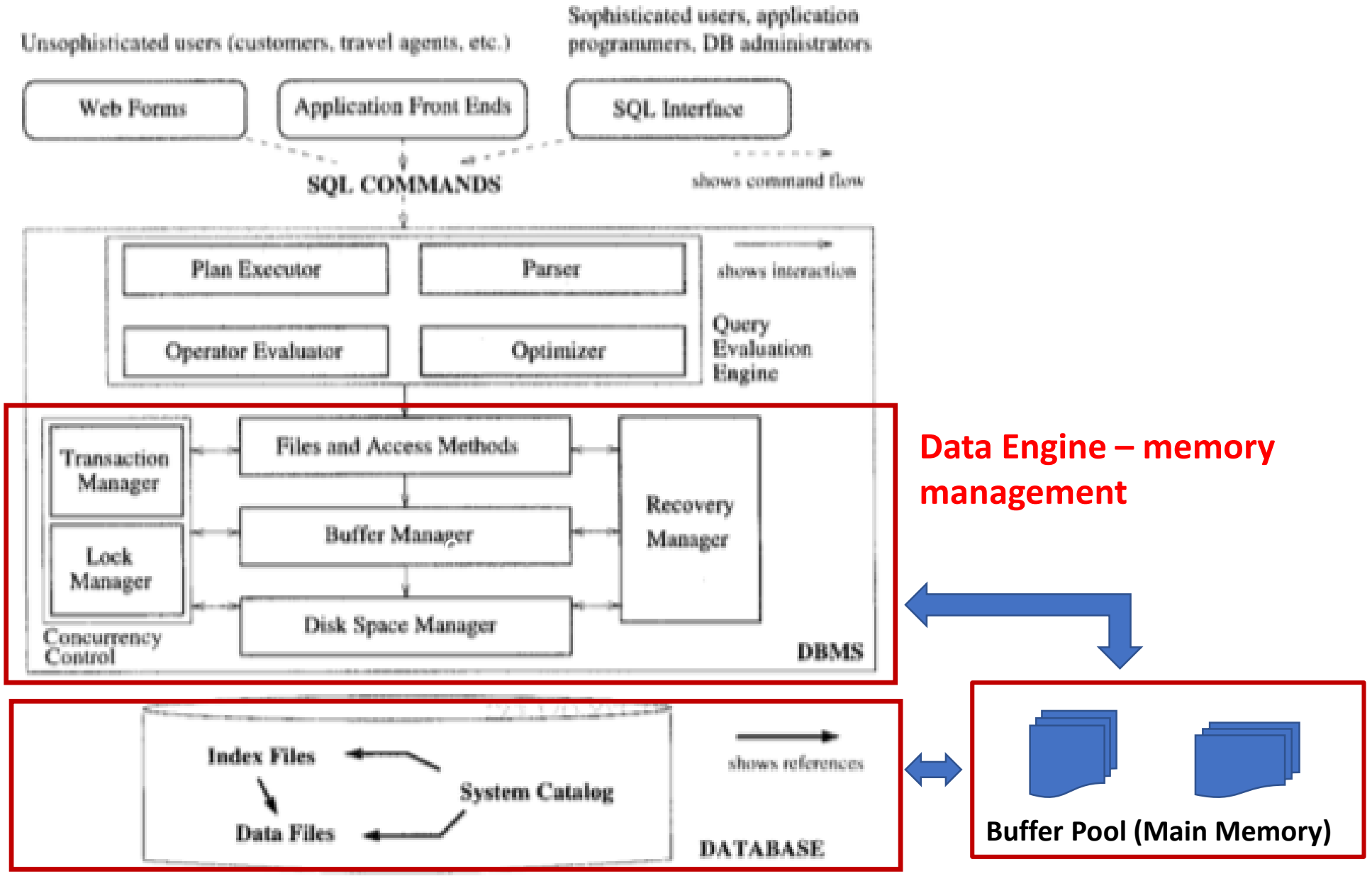
- **How high level SQL commands are actually transformed into execution plans?**
- **How high level data model is actually stored in the secondary storage?**
- **How does data flow from secondary storage to database application and vice versa?**
- **How to support simultaneous access from multiple users to database?**

- **Database Management System Internal**



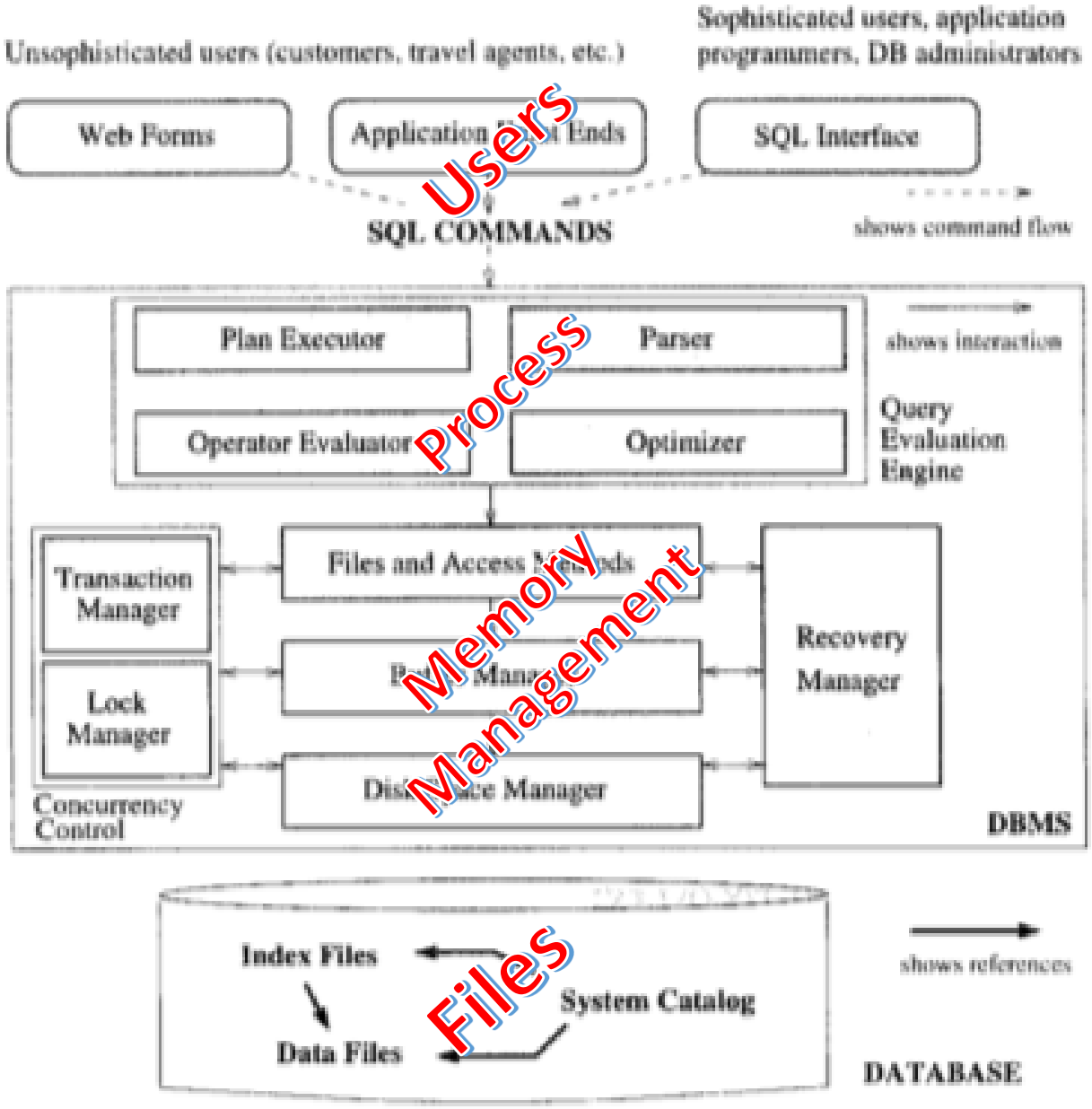
Query Engine - compiler

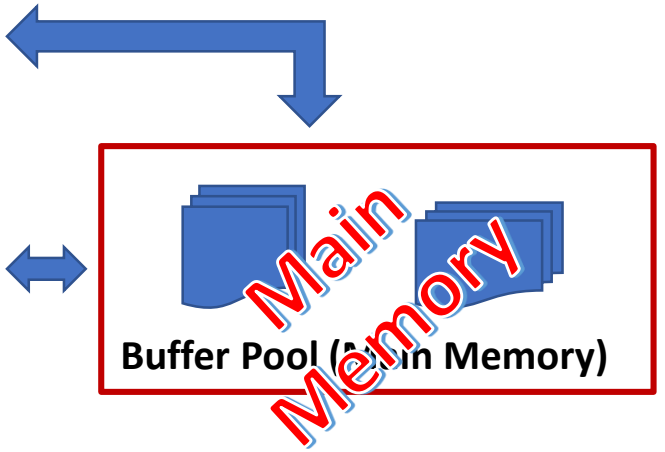
Data Engine – memory management

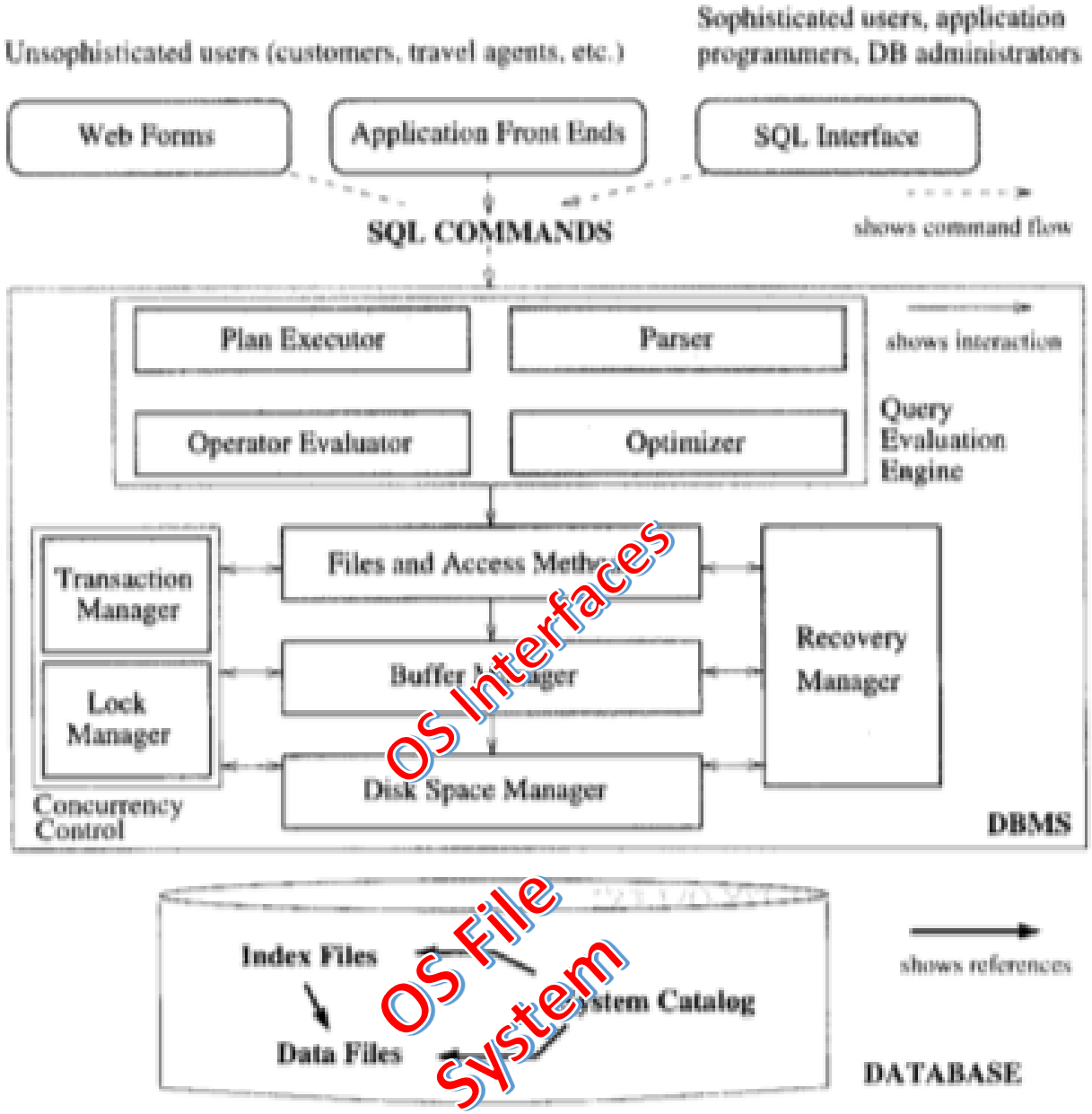


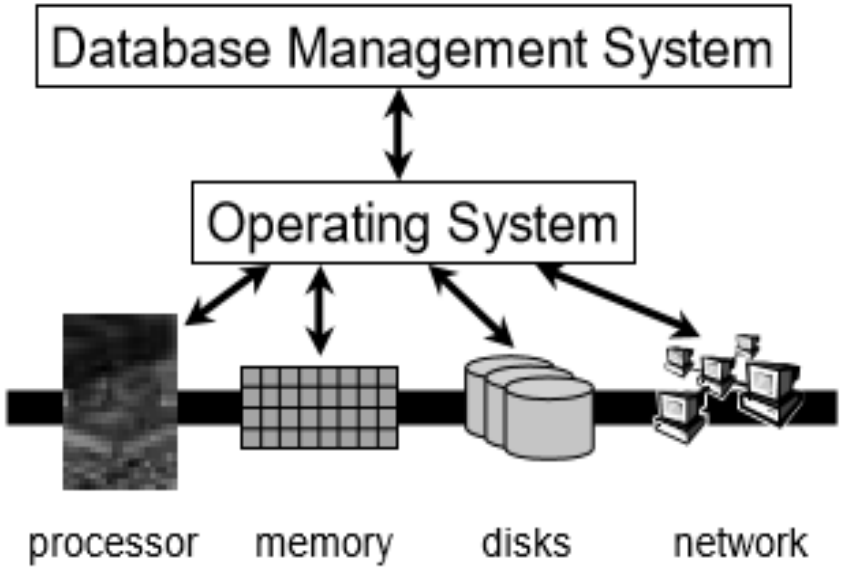
Data Engine – memory management

Similarities with OS









OS Interfaces

OS File System

OS Buffer Pool

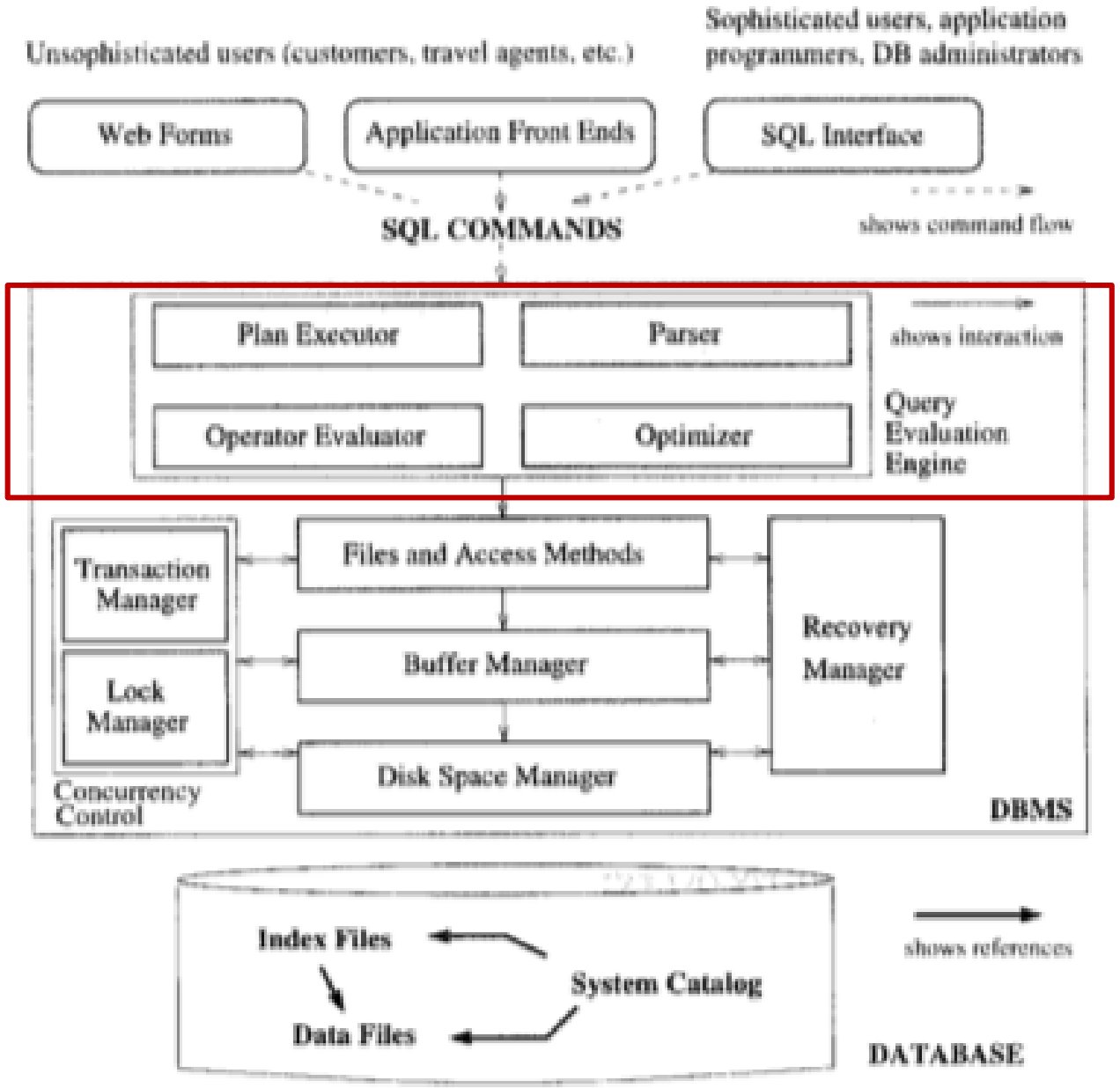
Buffer Pool (main Memory)

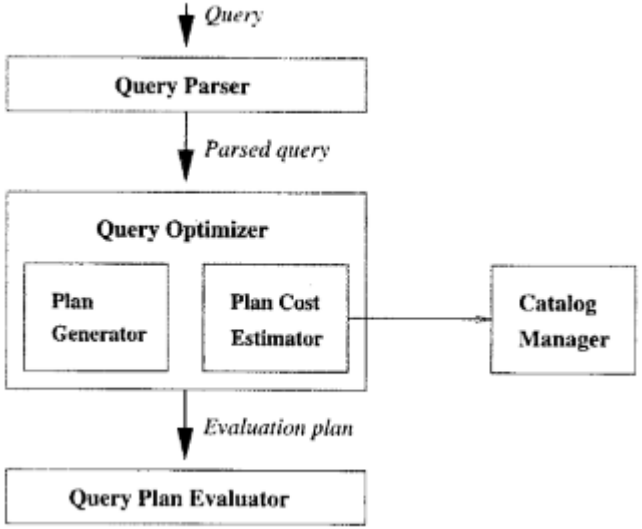
OS Issues with Database System

Michael Stonebraker, Operating System Support for Database Management, Communications of the ACM, Vol. 24(7), 1981

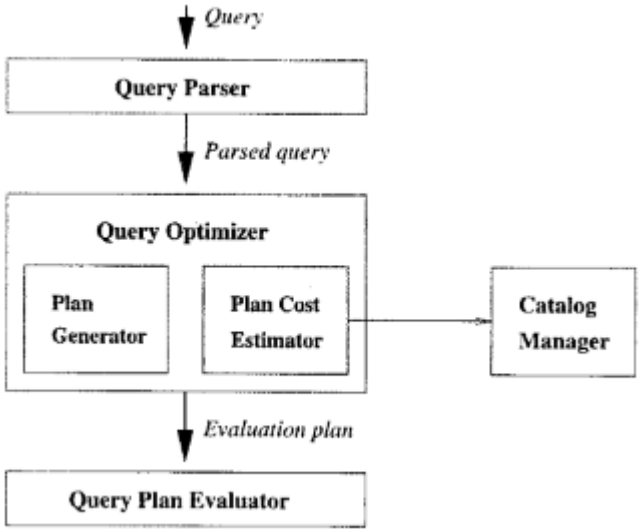
- Buffer Pool Management
- File System
- Scheduling, Processes, IPC
- Concurrency/Recovery
- Virtual Memory

Query Evaluation Engine





Query Evaluation Engine



Sailors(*sid:* integer, *sname:* string, *rating:* integer, *age:* real)
Reserves(*sid:* integer, *bid:* integer, *day:* dates, *rname:* string)

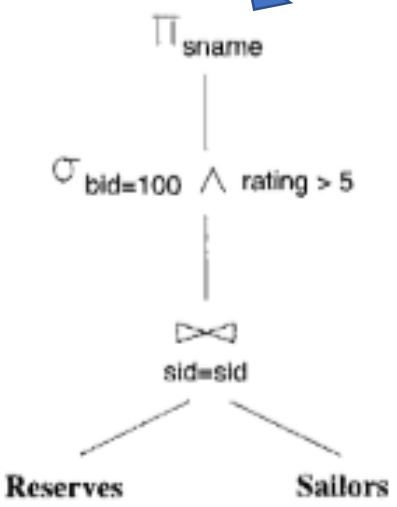
Database

Query

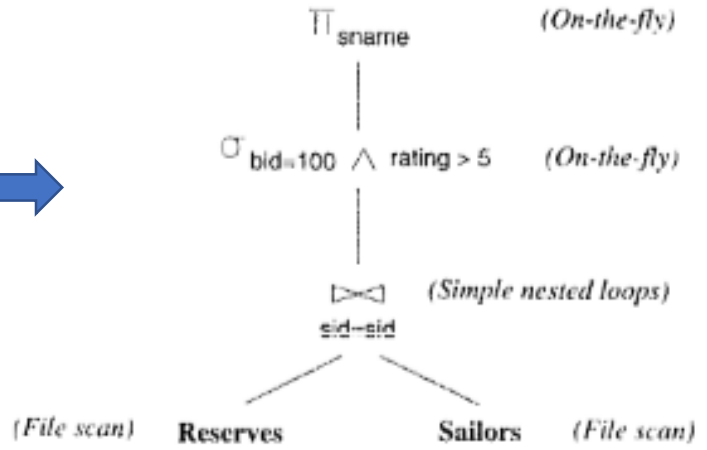
```
SELECT S.sname
FROM   Reserves R, Sailors S
WHERE  R.sid = S.sid
       AND R.bid = 100 AND S.rating > 5
```

$$\pi_{sname}(\sigma_{bid=100 \wedge rating>5}(Reserves \bowtie_{sid=sid} Sailors))$$

Relational Algebra

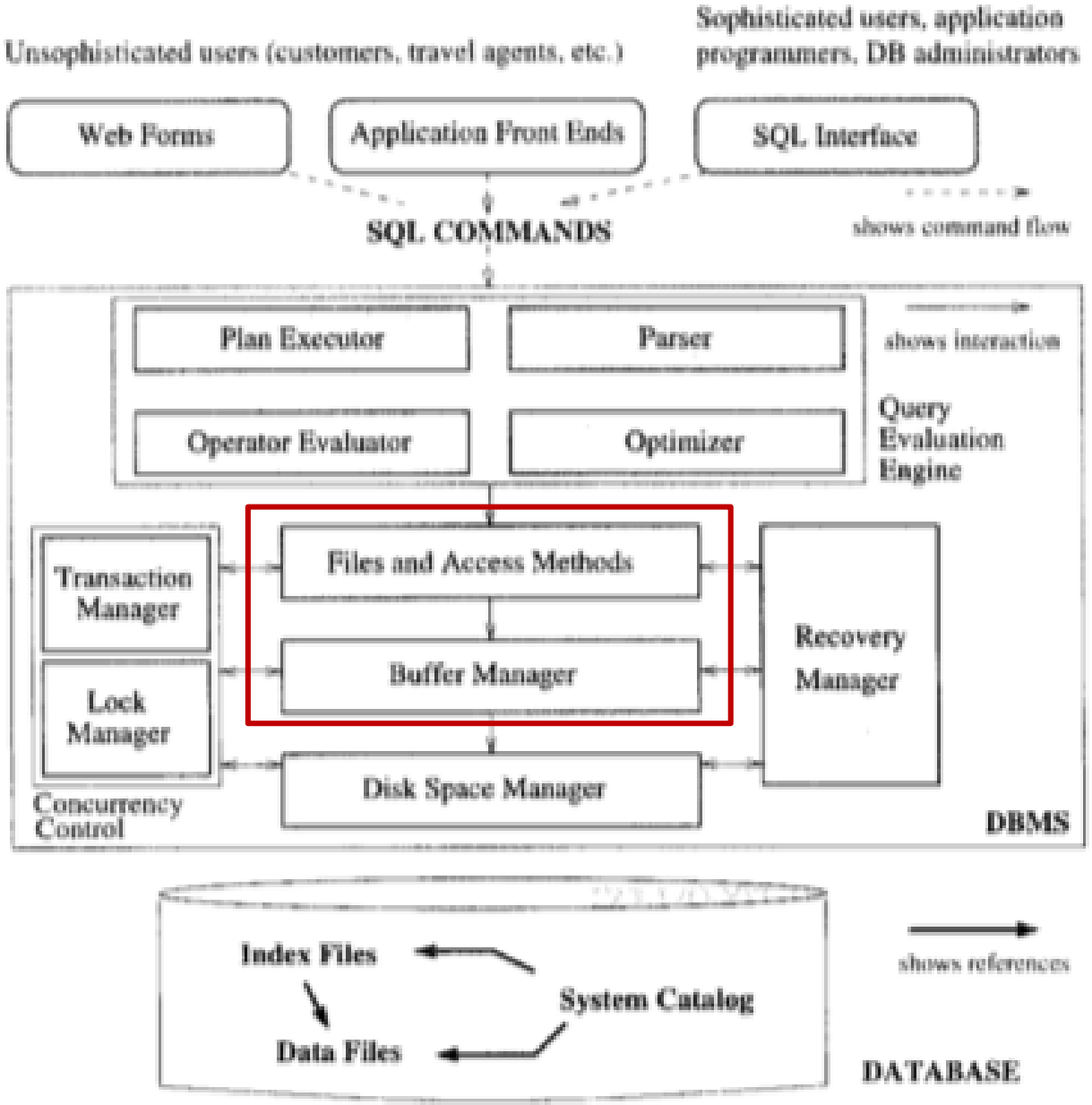


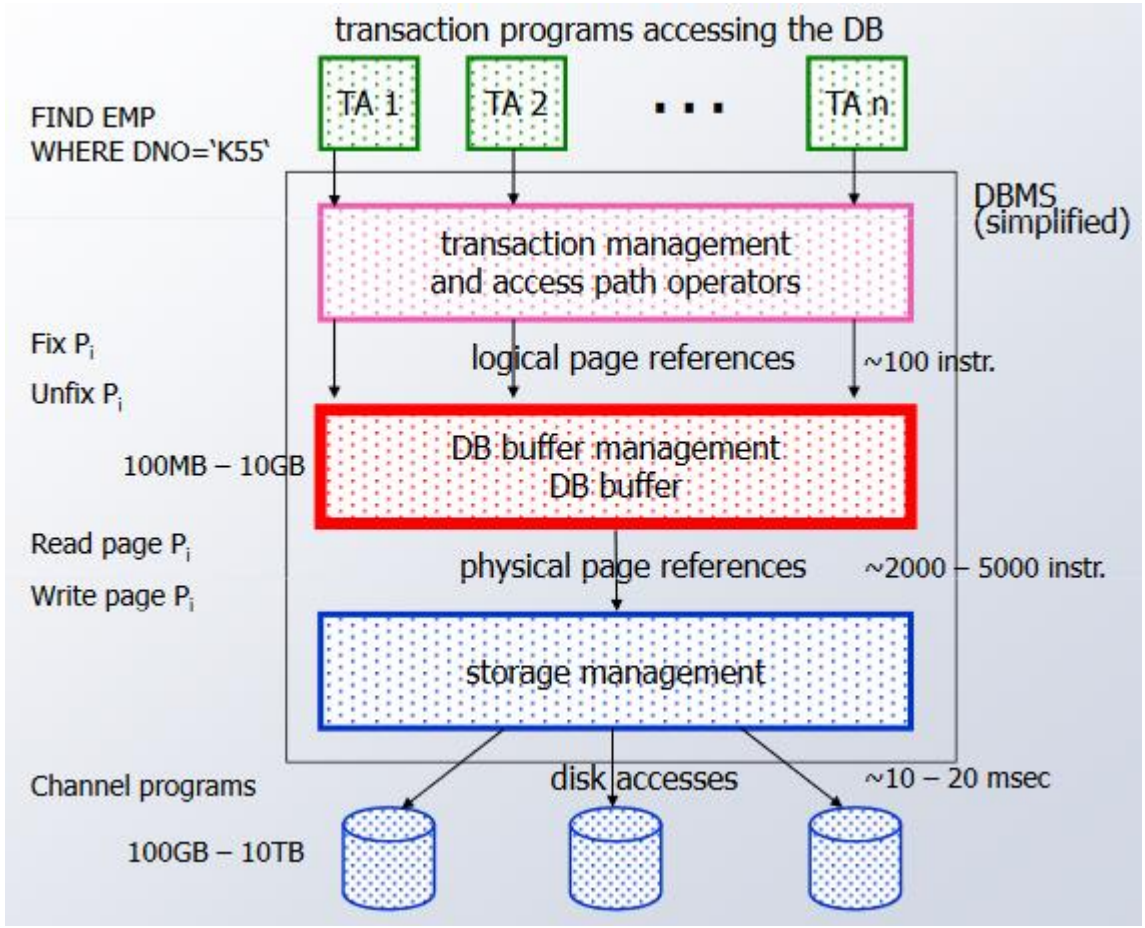
Relational Algebra tree



Query Evaluation Plan

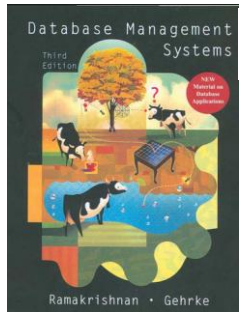
Data Access





Wolfgang E. and Theo H. 1984. Principles of database buffer management. *ACM Trans. Database Syst.* Vol. 9(4)

Books



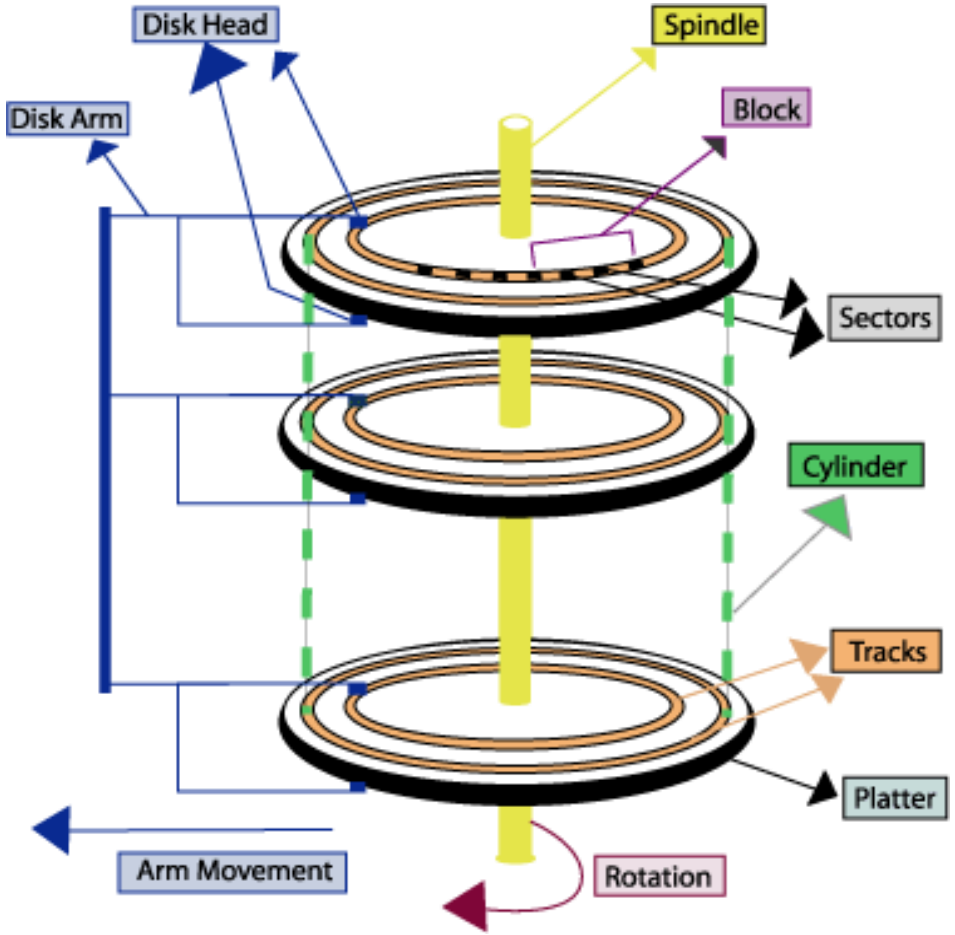
Database Management Systems, 3rd Edition

by Raghu Ramakrishnan (Author), Johannes Gehrke (Author)

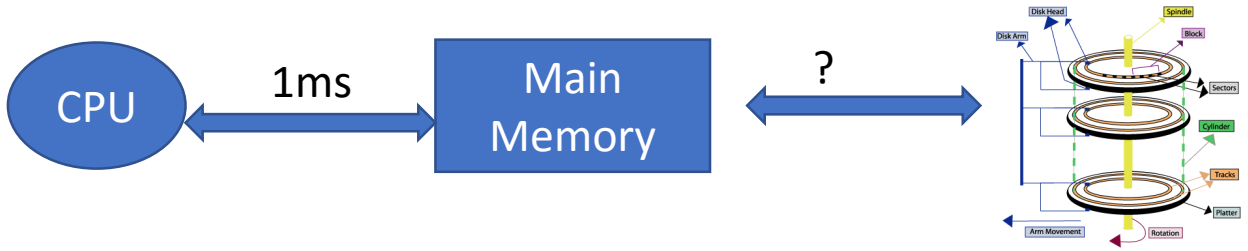
Database System Concepts

Fifth Edition

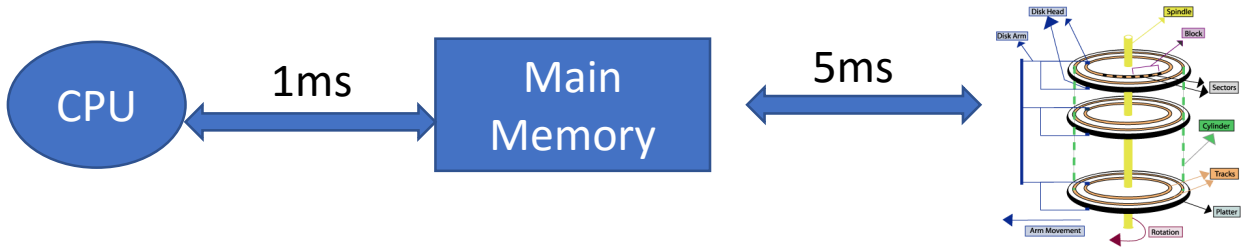
Avi Silberschatz
Henry F. Korth
S. Sudarshan

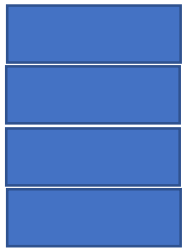


Spindle rotation speed: 250rps
Sector Size: 512bytes
Track Size: 500 sectors
Average Seek time: 5milliseconds
Average Latency time: half of the full rotation time
Access Time: ?
Transfer Rate: 50Mb/sec
Block Size: 4 sectors
File Size: 25Mb



Spindle rotation speed: 250rps
Sector Size: 512bytes
Track Size: 500 sectors
Average Seek time: 5milliseconds
Average Latency time: half of the full rotation time
Access Time: ?
Transfer Rate: 50Mb/sec
Block Size: 4 sectors
File Size: 25Mb
Number of Buffer: 4
Replacement policy: FIFO





Buffer

1, 2, 3, 1, 4, 5, 2, 3, 6, 7, 2, 3, 7, 6, 8, 3