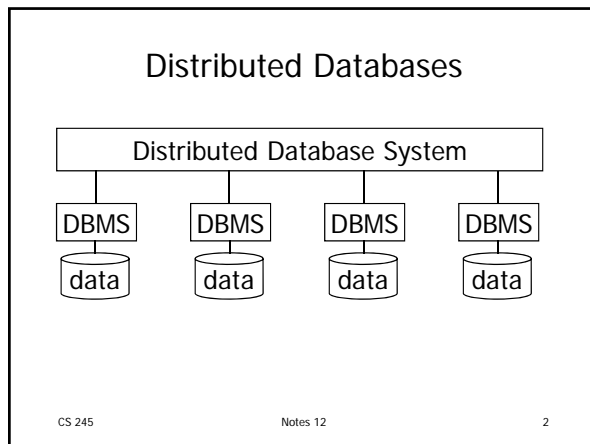


CS 245: Database System Principles

Notes 12: Distributed Databases

Hector Garcia-Molina

CS 245 Notes 12 1



Advantages of a DDBS

- Modularity
- Fault Tolerance
- High Performance
- Data Sharing
- Low Cost Components

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Issues

- Data Distribution
- Exploiting Parallelism
- Concurrency and Recovery
- Heterogeneity

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Parallelism: Pipelining

- Example:
 - $T_1 \leftarrow \text{SELECT } * \text{ FROM } A \text{ WHERE cond}$
 - $T_2 \leftarrow \text{JOIN } T_1 \text{ and } B$

```

    graph TD
      A[(A)] --> S(select)
      S --> J(join)
      B[(B with index)] --> J
      J --> Out[ ]
    
```

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Parallelism: Concurrent Operations

- Example: $\text{SELECT } * \text{ FROM } A \text{ WHERE cond}$

```

    graph BT
      S1[(A where A.x < 10)] --> S1_sel(select)
      S2[(A where 10 ≤ A.x < 20)] --> S2_sel(select)
      S3[(A where 20 ≤ A.x)] --> S3_sel(select)
      S1_sel --> M(merge)
      S2_sel --> M
      S3_sel --> M
      M --> Out[ ]
      Note[data location is important...]
    
```

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Join Processing

- Example: JOIN A, B over attribute X

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Join Processing

- Example: JOIN A, B over attribute X

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Concurrency & Recovery

- Two Phase Commit

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2PC: ATM Withdrawl

- Mainframe is coordinator
- Phase 1: ATM checks if money available; mainframe checks if account has funds (money and funds are "reserved")
- Phase 2: ATM releases funds; mainframe debits account

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Replicated Data Mangement

- Key to fault-tolerance, durability
- Illustrates transaction processing issues
- Various concurrency control/recovery algorithms available

CS 245 Notes 12 11

Primary Copy Algorithm

- Updates run at primary site
- Backups repeat writes; backups allow "out-of-date" reads

Primary Site		Backup Site 1		Backup Site 2	
A	5	A	5	A	5
B	9	B	9	B	8
C	7	C	7	C	6
D	25	D	25	D	25

T1: A:5; C:6
T2: B:9; C:7

propagate in order

CS 245 Notes 12 12

To be covered in CS347

- More replicated data algorithms
- More commit protocols
- Distributed query processing
- And many, many more fun topics!!