PicoDBMS: Scaling down database techniques for the smartcard

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Introduction

☐ Motivation
- ■ Convenient, anytime, anywhere
- ■ Various personal information
- ■ Ensure privacy

☐ Traditional DBMS
- ■ Large footprint
- ■ Significant use of materialization
- ■ Complex algorithms

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Design Considerations

☐ Small footprint to fit on a smartcard

☐ Reduce costly write operations

☐ No asynchronous processing

☐ Limited storage space for tuples

☐ Support basic query processing

☐ Support transaction management
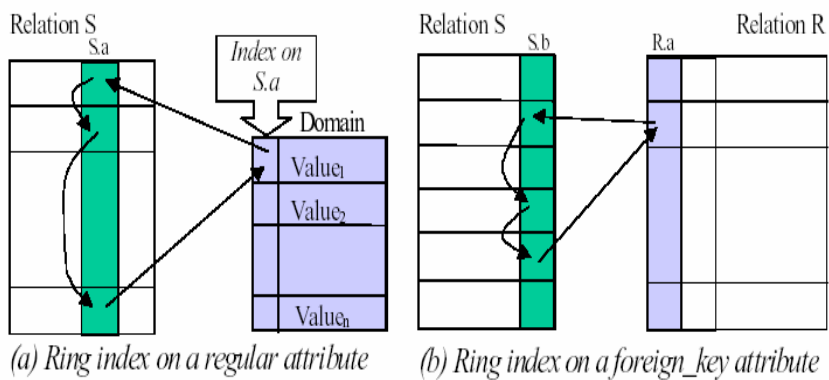
☐ Embed all processing within the chip for data security

Ring Storage Model

☐ Compact storage model supporting index

(a) Ring index on a regular attribute   (b) Ring index on a foreign_key attribute

Extreme Right-deep Tree

☐ A QEP that has zero RAM consumption!
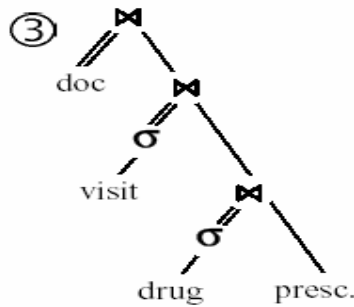
③Right deep tree   ④Extreme right deep tree
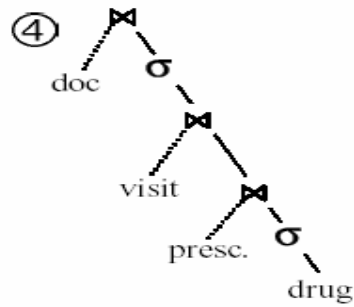
ACID Properties

☐ Atomicity
  - Update in-place
  - Pointer-based logging
  - Garbage-collecting values
  - 1PC

☐ Consistency

☐ Isolation
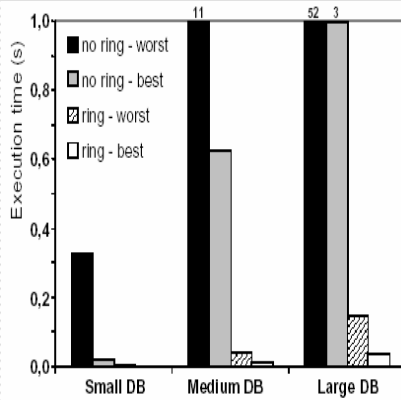
☐ Durability

Simulation Results
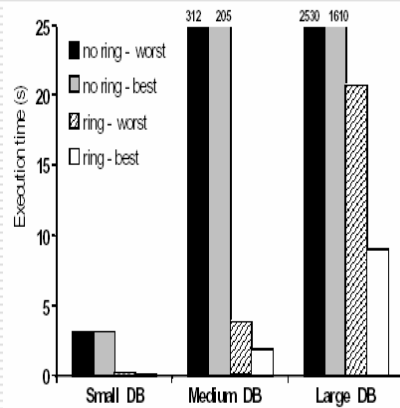

Figure 6: *Performance results for query Q1*

Figure 7: *Performance results for query Q4*

Limitations

☐ Cannot be used on block-transfer storage devices, such as compact flash memory, and hard drive

☐ Insufficient data security protection, e.g.: lack of encryption / decryption mechanism

☐ Still not fast enough to process complex queries involving aggregates

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PicoDBMS vs.. others

- ☐ IBM DB2 Everyplace 7.l
- ☐ Oracle 8i Lite
- ☐ Sybase's SQL Server Anywhere
- ☐ Cloudscape's JBMS
- ☐ Gnat DB
- ☐ Birdstep DBMS
- ☐ Mimer SQL Mobile
- ☐ ...

Conclusion

- ☐ Overall, great contribution to industry
  - ■ Ranked the best paper of VLDB 2001®
  - ■ Elegant ring-based storage model
  - ■ Powerful query processing engine
  - ■ Good techniques in transaction mgmt.
  - ■ Meets the requirements of smartcard

- ☐ Large potential for future deployment