Database Tuning

Tuning rests on a foundation of informed common sense. This makes it both easy and hard.

Dennis Shasha and Philippe Bonnet
Database Tuning: Principles, Experiments and Troubleshooting Techniques
... Disk Characteristics

- Disk accesses are slow
- Random accesses are even slower

Solutions:
- Buffering
- Access by disk page
  - 1k, 4k, or 8k block
  - Clustering
- Multiple disks
  - put tables, indexes, and logs on different disks

RAID

- Redundant Array of Independent Disks
- RAID levels
  - 0 – striping
  - 1 – mirroring
  - 5 – rotated parity mirroring
  - 0+1 – mirrored striping

RAID 0

- Benefits large sequential read
- Problem??

RAID 1

- Redundancy
- Performance improvement??

RAID 5

- Benefits of both RAID0 and RAID1 with some redundancy and better storage utilization

RAID 0+1
RAID in DBMS

- Log files – RAID 1
- Temporary files – RAID 0
- Data and index files – RAID 5 if read traffic dominates

Tables – Heap File

- by tuple
- unordered – low update cost

Indexes – B+-tree (dense)

Indexes – Hash Index

Clustered vs. Non-clustered

- Clustered (primary) index
  - Tuples are clustered by the indexed attribute(s)
- Non-clustered (secondary) index

Composite Index

- Composite index – an index which involves multiple attributes
Index Choices

- Index or not?
  - update, small table, search attributes
- Hashing or B-tree?
  - query types
- Clustered or non-clustered?
- Composite index?

Vertical Partitioning and Denormalization

- Vertical partitioning
  - (AccountID, Address, Balance)
  - (AccountID, Address) and (AccountID, Balance)
- Denormalization
  - (SupplierID, SupplierRegion) and (SupplierID, ProductID, Quantity)
  - (SupplierID, ProductID, Quantity, SupplierRegion)

Query Tuning

- DISTINCT, ORDER BY, HAVING
- Subqueries
- Use of temporary tables
- Joins

Query Tuning Experiments

Database Tuning: Principles, Experiements and Troubleshooting Techniques, Shasha and Bonnet, 2003

Performance Tuning Tools

- Query plan tools
  - Are the query optimizer doing its job?
- Trace and profiling tools
  - More detailed information about query costs.
- Analysis tools
  - Keep the table stats up-to-date
- Tuning helpers
- Maintenance tools

Some Performance Tuning Tools in PostgreSQL

- explain
- cluster
- vacuum
- analyze
Summary

- Knowledge of DBMS and computer systems in general
- Performance tuning heuristics
- Performance tuning tools