What is a DBA?

Mullins chapter 1

Bjarte Wang-Kileng

HVL

January 23, 2025

Western Norway University of Applied Sciences

Outline

1. Database Administration
2. DBA Tasks
3. DBA types
4. Other DBA issues

Outline

1 Database Administration

2 DBA Tasks

3 DBA types

4 Other DBA issues

Databases, DBMS and DBA

- A database is an organised store of structured data where the data is accessible by named data elements.
- A DBMS (Database Management System) is software that enables end users and application programs to share and manage data.
- A DBA (Database Administrator) is a person responsible for the databases, DBMS and application programs using them.

Examples of DBMSs

- Oracle
- Sybase
- MySQL
- MariaDB
- IBM DB2
- Microsoft SQL Server
- Sybase
- PostgreSQL
- EnterpriseDB
- InterBase
- Berkeley DB
- CA IDMS
- IBM Information Management System (IMS)
- ADABAS D
- MaxDB
- Microsoft Access
- Paradox
- FileMaker
- ADABAS
- Apache CouchDB
- Cassandra
- MongoDB
- Infinispan
- Riak
- ObjectStore
- Versant Object Database

Administrator roles with database responsibilities

- Data Administrator (DA).
- Database Administrator (DBA).
- System Administrator (SA).

Data Administrator (DA)

- Most involved in the early stages of the application development life cycle.
- Identifying and cataloguing the data required by the users.
- Produce conceptual and logical data models.
- Describing the data (meta data, ie. what is the meaning of the data, domain of data, data types, etc.).
- Setting data policies for the organization.
  - Privacy policies – Norway, EU and others have legislation concerning data privacy
- Setting standards for control and usage of data.
- Identifying data owners and users.

Database Administrator (DBA)

- Transform logical data models into an efficient physical database designs.
- Ongoing support of the databases.
- Management of the applications that access the databases.

System Administrator (SA)

- Responsible for the upkeep, configuration, and reliable operation of the computer system.
- Installation, setup and support of the DBMS.
- Setup and configure the computer system and DBMS and to make the DBMS operate effectively.

Data-, Database- and System Administrators

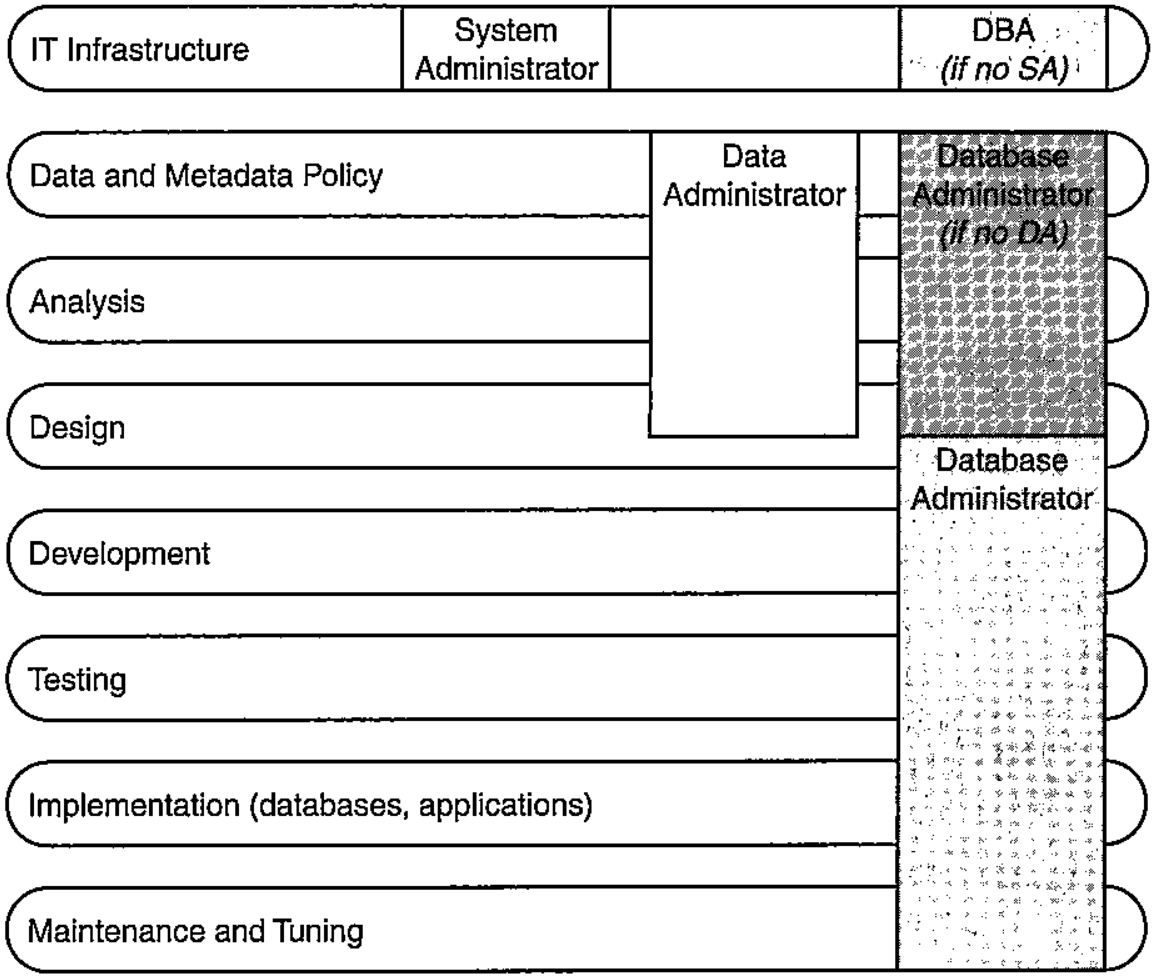

Figure 1-5 *DA, DBA, and SA responsibilities*

Outline

1 Database Administration

2 DBA Tasks

3 DBA types

4 Other DBA issues

DBA Tasks

- Performance monitoring and tuning.
- Availability.
- Database security and authorisation.
- Backup and recovery.
- Data integrity.
- Maintenance of test and production.
- DBMS release migration.

Database design[1]

- Understand relational theory and the technical details of the specific DBMSs.
- If no DA – Conceptual and logical data modelling.
- Transform the logical data model into a physical DBMS implementation.
- Database design takes a small portion of DBA time. Most time to administering and tuning.
- Poor relational design can give poor performance.

[1] Covered in depth later in course.

Performance monitoring and tuning[2]

- *Workload* – The amount of work requested of the DBMS:
  - Transactions, batch jobs, queries etc.
- *Throughput* – The capability of the computer hardware and software to process data.
- *Contention* (Konflikt/kamp/strid) – Workload components are fighting for the same and non sharable resources.
- *Optimisation* – Generate efficient access path to data:
  - Internal to the DBMS: Cache, indexes, etc.
  - SQL optimisation.

[2] Covered in depth later in course.

Availability[3]

- Keep the DBMS running.
- Monitoring and automated alerts.
- Design the database so it can be maintained with minimal disruptions.
- Clustering, replication etc.

[3] Covered in depth later in course.

Database security and authorisation[4]

- All levels of DMBS access must be authorised. e.g.:
  - Reading/modifying/creating/dropping of databases/tables/rows/columns/views/procedures.
  - Starting and stopping DBMS.
  - Setting and modifying parameters.
- Can create *Views* to block access to sensitive data.

[4] Covered in depth later in course.

Backup and recovery[5]

- Failure in hardware, software, human.
- 80% are human- or software errors.
- DBA is responsible for recovering data.
- Hardware failure:
  - Recover to current.
- Human or software error:
  - Recover to point in time (PIT).
  - Transaction recovery – Remove effects of specific transactions during a specified time frame.

[5] Covered in depth later in course.

Data integrity[6]

- Physical data integrity – Data types and data domains:
  - Choose appropriate data types for columns.
  - Using constraints.
- Semantic data integrity – E.g. correct address, phone number, e-mail of person:
  - Must be obtained through application code business logic.
  - Need procedures to make redundant data consistent.
- Internal data integrity – Index consistency, backup consistency, etc.

[6] Covered in depth later in course.

Outline

1 Database Administration

2 DBA Tasks

3 DBA types

4 Other DBA issues

DBA types

DBA types

Some (big) organizations can split the DBA responsibilities into separate jobs.

System DBA

- Used only if no SA (System Administrator).
- Overlaps with the SA-tasks.
- Installing new DBMS versions and applying maintenance fixes from DBMS vendor.
- Installing DBA tools and utilities.
- Setting and tuning system parameters.
- Tuning of OS, network etc.
- Ensuring and enabling appropriate storage for the DBMS.
- Interfacing with other technologies required by database applications.

Application DBA

- Database design and support for specific applications.
- Write and debug complex SQL.
- Performance tuning.
- Database change management.
- Pros:
  - Better service for application.
- Cons:
  - Isolated from rest of DBA team. Looses sight of the overall data needs and resources.

Other roles

- Database Architect – Not common. New design and development only.
- Database Analyst – No clear definition. Involves tasks from the other roles.
- Data Modeller – Subset of DA role.
- Task-Oriented DBA – Focus on a specific DBA task, eg. *Performance Analyst*.
- Data Warehouse Administrator.

Outline

1 Database Administration

2 DBA Tasks

3 DBA types

4 Other DBA issues

Multiplatform DBA Issues

- Multiplatform or single platform DBA?
- Many similarities between DBMSs.
- Different features and nuances between DBMS's. Difficult to be an expert on many platforms.
- Use specialist DBAs for the heavily used DBMSs.
- Share responsibility for less used DBMSs.
- Use multiplatform DBA tools.
- Make guidelines for which DMBS to use in what situations.

Test and production

- Two separate environments must be maintained, *test* and *production*.
- Development and maintenance is first performed in the test environment.
- The test environment contains a subset of the data in production.
- The test environment must contain enough data for acceptable application testing.
- The test environment should be restored before different runs of tests:
  - Need automated procedures.

Business rules in the DBMS[7]

- Stored procedures – Program stored in and executed by the DBMS.
- Triggers – Event driven procedures. Code is triggered automatically e.g. when data is inserted into a table.
- User defined functions – Like *stored procedures*, but return values.

[7] Covered in depth later in course.

Internet, e-business and DBA

- 24/7 availability.
- New technologies (XML, JSON, Java, PHP, Web services).
- Integrating legacy data with modern web-based applications.
- Web-based administration.
- Databases in the Cloud.
- NoSQL.
- Unpredictable workload.
- Syncronization of data to and from laptops and mobile phones.
- Laptops and phones with data can be lost or stolen.

NoSQL – Not only SQL

- Tied to big data.
- Low cost storage and access to large amount of data.
- Nonrelational, distributed, flexible and scalable.
- Data typically accessed one way only. No flexibility in generating ad hoc queries.
- Common attributes are simple to use, no schema, replication support, “eventually consistent”.
- Little database administration work.
- Examples: MongoDB, Apache CouchDB, Infinispan, Apache Cassandra, Scylla.