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TABLE OF CONTENTS

- Database administrator
  - What, why, how
- Building the database environment - DBMS
  - Strategy, features, architecture
  - Types of DBMS
  - Installing, upgrading,
  - Standards and procedures
  - Roles and responsibilities
- What is to come on this course

CT60A7650 – DATABASE SYSTEMS MANAGEMENT

INTRODUCTION TO DATABASE MANAGEMENT

Lecture

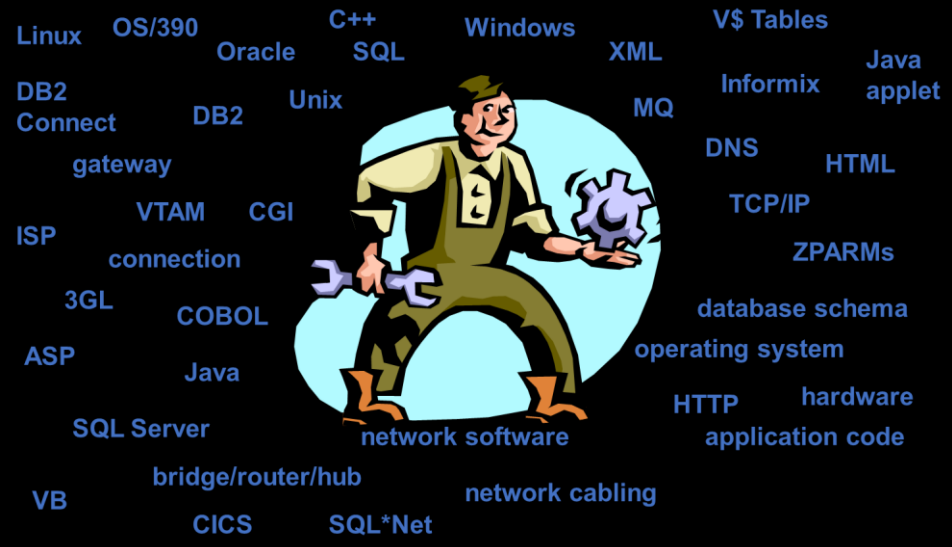
Jiri Musto, D.Sc.

WHY LEARN DATABASE ADMINISTRATION

- Database administrator (DBA) is responsible for designing and maintaining databases
  - DBA is at the center of the business
  - Communicates with data admins, software admins, business analysts, etc.
- A good DBA is
  - A problem solver
  - Enjoys challenges
  - Likes technology
  - Can work alone or part of a group
  - Has experience in programming and data handling

DBA TASKS

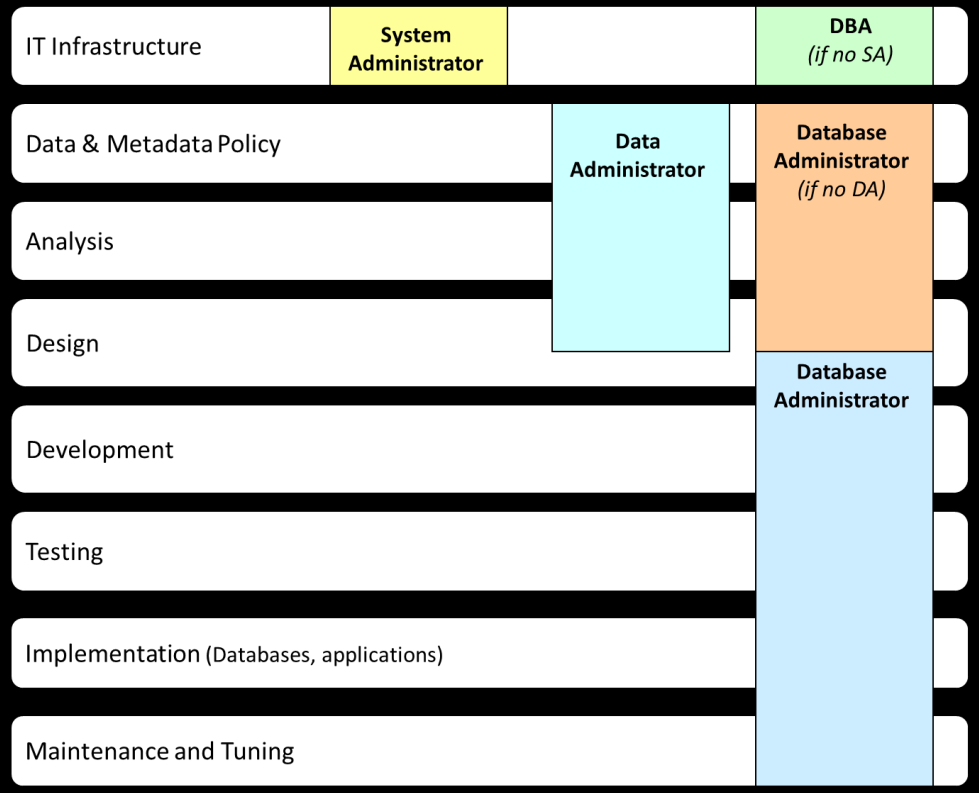
- Creating and managing the database environment
  - Database and application design and design review
  - Change management
  - Availability
  - Performance and storage management
  - Data integrity and security
  - Backup, recovery, and disaster planning
- DBA is a “Jack of all Trades”



DATA ADMINISTRATOR

- Identifies and catalogs data required by users
- Produces the conceptual and logical data models
- Sets up data policies
- Sets up standards for control and usage of data

DA, DBA AND SA RESPONSIBILITIES

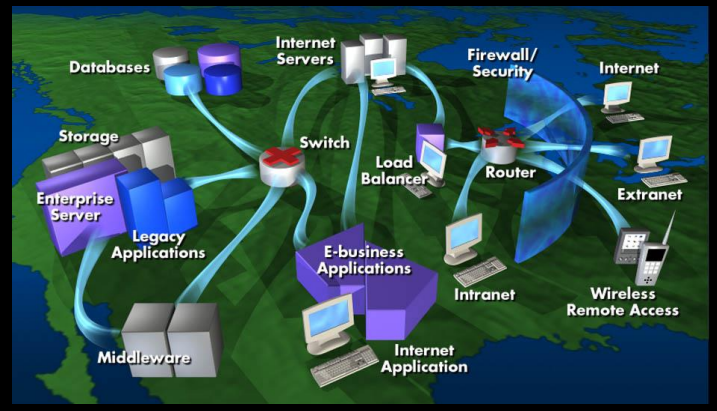


TYPES OF DATABASE ADMINISTRATORS

- DBA can be:
  - System DBA
  - Database architect
  - Database analyst
  - Data modeler
  - Application DBA
  - Task-oriented DBA
  - Performance analyst
  - Data warehouse administrator

CHALLENGES AS A DBA

- Changing technology
  - Small changes in technology can cause issues and need to be carefully considered
  - New emerging techniques, functionalities, features, and technologies can have a huge impact
- Jack of all trades – master of all
  - Have to have a good knowledge on many things, in some cases being a master of many things
  - Used technologies can vary from business to business
- Changing infrastructure
  - Ever so often a new infrastructure disrupts the existing
  - Mobile, cloud, virtual



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BUILDING THE DATABASE ENVIRONMENT

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DEFINE THE DBMS STRATEGY

- Deliberate the requirements for the DBMS usage
- Often organizations do not put much thought or planning into the DBMS procurement process
- → DBMS decisions becomes part of the project
  - New project = New DBMS
  - Not a good strategy

DBMS LANDSCAPE

- Choosing a DBMS
  - Vendor
  - Platform
  - Architecture
- Choosing the backend or mainframe
  - Server
    - Windows, Unix, Linux
  - Desktop OS
    - Windows, Linux, Mac

DBMS DECISION FACTORS

- Operating system support
- Organization type
- Benchmarks
- Scalability
- Availability of tools and technicians
- Availability of support
- Cost
- Reference customers

DBMS ARCHITECTURES

- Enterprise
- Departmental
- Personal
- Mobile
- Cloud

ENTERPRISE DBMS

- Designed for scalability and high performance
- Supports (very) large databases
- Runs on high-end machine
- High cost

DEPARTMENTAL DBMS

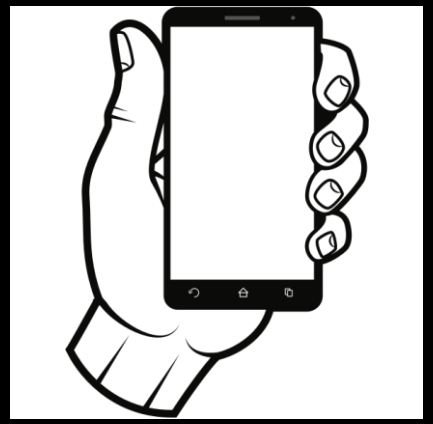
- Also known as “workgroup DBMS”
- Small- to medium-sized
- Separation between departmental and enterprise DBMS can be fuzzy
- Lower cost than enterprise DBMS

PERSONAL DBMS

- Single user
- Personal DBMS editions
  - Microsoft Access
  - DB2 Personal edition
  - Local server
- Not useful for large applications or shared work
- Low cost

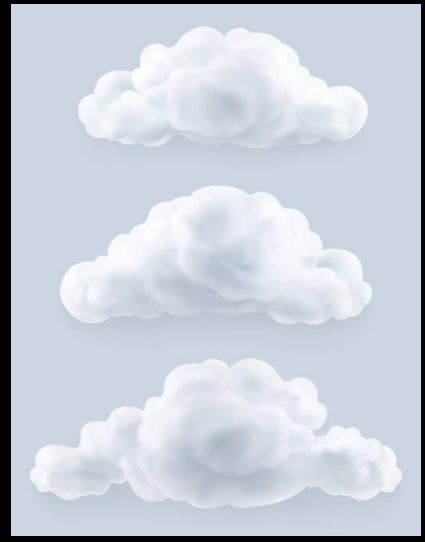
MOBILE DBMS

- Portable database
- Often used with mobile devices (such as smartphones)
- Specialized version of a departmental or enterprise DBMS
- Remote users that are not connected to the intranet
- Data can be synchronized with the central database
- Communication with the central database is short and irregular



CLOUD DBMS

- DBMS services over the internet
- Can enable organizations to focus on their business instead of computing environment
- Low hardware cost
- Accessible
- Need to trust the cloud provider



GUIDANCE - DESIGNING DATABASE ENVIRONMENT

- Understand the organization needs
  - Short-term
  - Long-term
- Avoid DBMS proliferation (multiplication)
- Every DBMS requires DBA support
- Fewer DBMS installed, less complicated the database administration is

INSTALLING THE DBMS

- Hardware requirements
  - CPU, firmware, memory, etc.
- Storage requirements
  - DBMS, system, applications
- Memory requirements
  - Buffers and cache
- Software requirements
  - Middleware, languages, compilers
- Configuration
  - DBMS, connecting software

CONNECTING THE DBMS

- DBMS does not operate in a vacuum
- Understand and test the connection of the DBMS
- Test that the installation has been done properly
  - Use sample SQL queries against sample database
- Test required connections
  - Transaction processors, drivers, etc.

UPGRADING THE DBMS

- Review the new features
  - Check requirements
- Plan the upgrade
  - Impacts to system and applications
  - When to upgrade
- Fallback strategy
- Version vs. Release
  - Version: Major
  - Release: Minor

BENEFITS AND DRAWBACKS

Benefits	Drawbacks
New features and functionalities	Some features and syntax may be deprecated
Applications may require specific version	May need to alter database structures
Enhanced performance and availability	New release may generate different access paths that perform worse
Better support and response time from vendors	Other software may not support the new DBMS release
Migrating production to the new release aligns testing and production environment, providing consistency between development and implementation	Usually causes some disruption to business operations
Cost savings (if running two versions of the DBMS, one for testing and another for production)	Upgrade can be costly

SPECIFY STANDARDS AND PROCEDURES

- Naming conventions and abbreviations – with DA
- Roles and responsibilities – with DA and SA
- Programming guideline – with application developers
- Database guidelines
  - Security – with security admin or SA
  - Migration
  - Design review – with DA, SA and application developers
  - Operational support – with operation staff
- Communication standards

ROLES AND RESPONSIBILITIES

Task	Database administrator	Data administrator	System administrator
DBMS budget	X		X
DBMS installation and upgrade	P		X
DB usage policy	P		
Data modelling and analysis	X	P	
Database design	P	X	
Database creation	P		
System performance	X		P
Database performance	P		X
Application performance	X		X
Backup, recovery, disaster, security	P		X
Procedures, user-defined functions	X		
Triggers	P		

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WHAT IS TO COME

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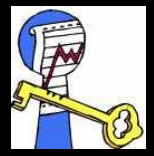
DATABASE DESIGN

- Database applications
  - Transactions and locks
  - Minimize locking problems
  - Batch processing
- Database change management
  - Difficulties
  - Types of changes
    - Hardware
    - Software
    - Structure
- Data availability



PERFORMANCE MANAGEMENT

- Performance in general
  - Factors
  - Proactive and reactive
  - Costs
- System / hardware performance
- Database performance
  - Optimization, logs, indices, partitioning
- Application performance
  - Query cost, analysis

DATA INTEGRITY

- Types of integrity
- Consistency
- Data types
- Constraints
- Triggers
- Nulls
- Referential integrity

DATABASE SECURITY

- Data breaches
- Responsibilities
- Authentication
- Privileges
- SQL injections
- Regulatory compliance
  - HIPAA, GLB, Basel, PCI-DSS, GDPR
- Masking, retention, lifecycle

BACKUP, RECOVERY, AND DISASTERS

- Backups
- Failures
- Backup plans
  - Full vs incremental
- Recovery
  - Point-in-time, transaction
- Disasters
  - Planning
  - Testing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