SQL Server Basics for non-DBAs

Speaker Information

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Overview and Agenda

I. SQL Server 2005 Platform Overview

II. Managing Databases

III. Database Maintenance and Data Protection

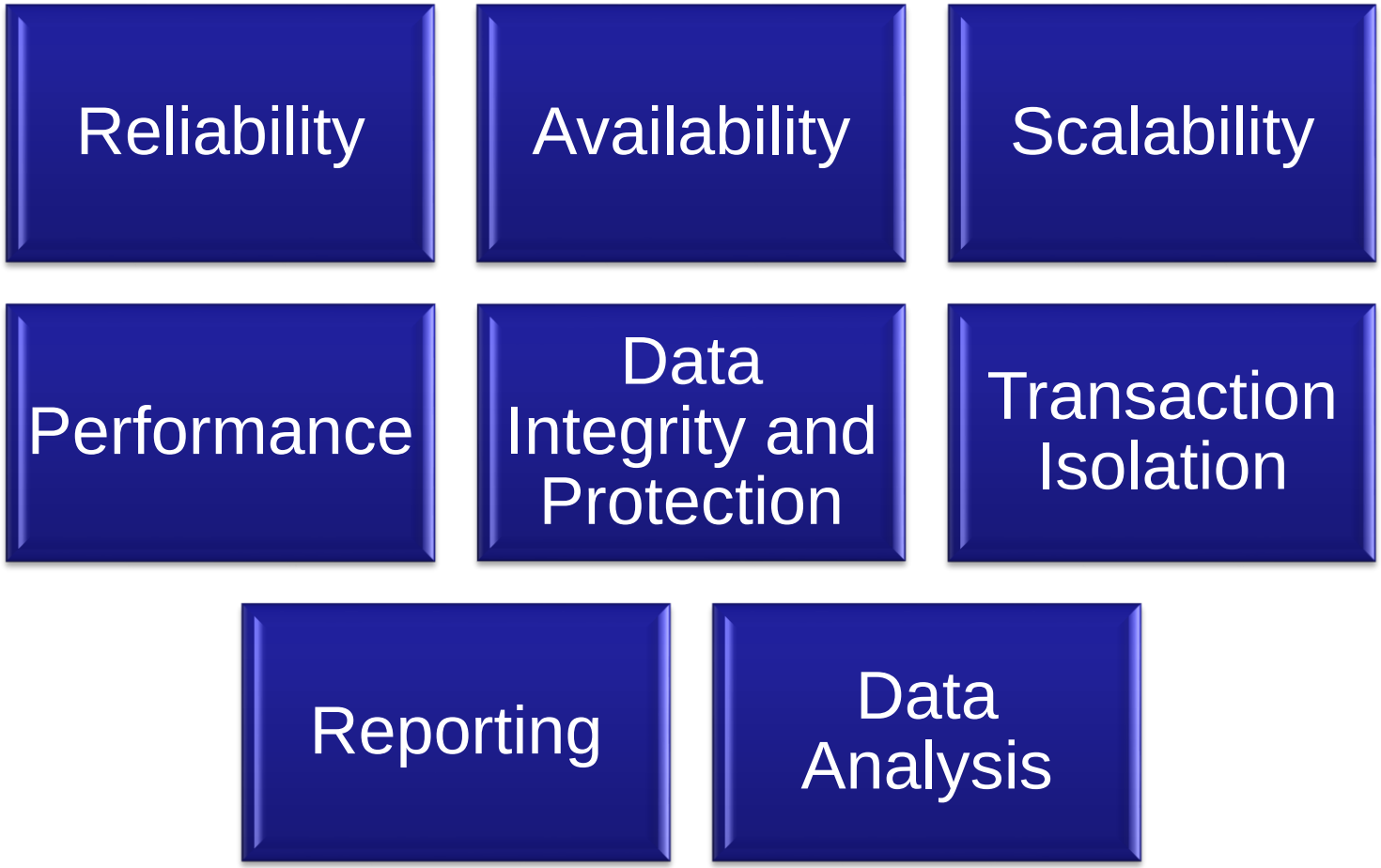
IV. Securing SQL Server

V. Managing Database Objects / Best Practices

SQL Server 2005 Platform Overview

Understanding SQL Server's features, services, and administrative tools

Relational Database Server Goals



SQL Server 2005 Architecture

- SQL Server Database Engine
  - Storage Engine
  - Query Engine
- Databases
  - Logical collections of related objects
- Instances
  - Separate running services of SQL Server
    - Default instance and named instances

SQL Server Services

- **Instance-Specific**

  (one service per instance):
  - SQL Server
  - SQL Server Agent
  - Analysis Services
  - Reporting Services
  - Full-Text Search

- **Instance-unaware**
  - Notification Services
  - Integration Services
  - SQL Server Browser
  - SQL Server Active Directory Helper
  - SQL Writer

SQL Server 2005 Admin. Tools

- SQL Server Management Studio
  - Database management GUI
    - Object browser; templates, reports, etc.
  - Based on Visual Studio 2005 IDE
  - Support for writing and executing queries

- SQL Business Intelligence Dev. Studio
  - Analysis Services, Reporting Services, SSIS

SQL Server 2005 Admin. Tools

- SQL Server Profiler
- Database Engine Tuning Advisor
- SQL Server Configuration Manager
  - Manages services and protocols
- Surface Area Configuration
- SQL Server Books Online

Configuring SQL Server

- Default options are set during installation
- SQL Server Management Studio
- Server Properties:
  - Memory
  - Processors
  - Security (Windows, SQL Server); Auditing
  - Database settings (default file locations)

Managing Databases

An overview of working with physical and logical database files

SQL Server Physical Data Files

- Database storage
  - Primarily table data and index data
- Database Files:
  - Primary data file (*.mdf)
  - Secondary data files (*.ndf)
  - Transaction log file(s) (*.ldf)
- Filegroups:
  - Logical collections of files
  - Objects can be created on filegroups

Monitoring Disk Usage

- SQL Server Management Studio Reports
  - Server: Server Dashboard
  - Database: Disk Usage (several reports)
- Transact-SQL
  - Stored Procedures:
    - `sp_Help, sp_HelpDB, sp_SpaceUsed`
  - System Tables / Views
    - `Sys.Database_Files`

Designing Data Storage

- Goals:
  - Maximize performance by reducing contention
  - Simplify administration
- Best practices:
  - Monitor and analyze real-world workloads
  - Separate data files and transaction log files

Comparing RAID Levels

RAID Level	RAID Description	Disk Space Cost	Read Performance	Write Performance
RAID 1	Disk Mirroring	50% of total disk space	No change	No change
RAID 5	Stripe Set with Parity	Equivalent to the size of one disk in the array.	Increased	Decreased
RAID 0 + 1 or RAID 10	Mirrored Stripe Sets	50% of total disk space	Increased	No change

Monitoring Disk Usage

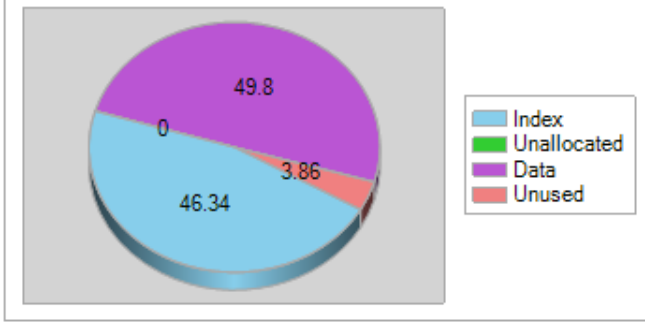
Disk Usage: [AdventureWorks]

on kerby at 1/29/2007 9:30:27 AM

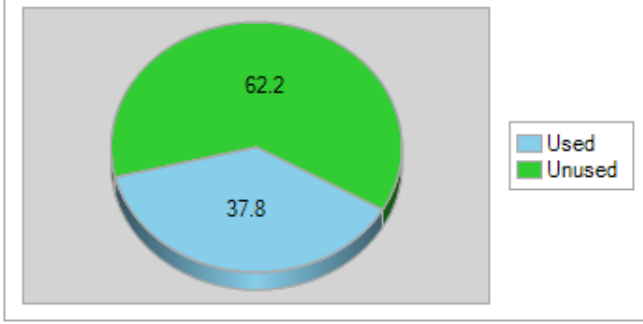
This report provides overview of the utilization of disk space within the Database.

Total Space Usage:	165.94	MB
Data Files Space Usage:	164.23	MB
Transaction Log Space Usage:	2.00	MB

Data Files Space Usage (%)



Transaction Log Space Usage (%)



No entry found for autogrow/autoshrink event for AdventureWorks database in the trace log.

Disk Space Used by Data Files

Filegroup Name	Logical File Name	Physical File Name	Space Reserved	Space Used
PRIMARY	AdventureWorks_Data	C:\Program Files\Microsoft SQL Server\MSSQL.2 \MSSQL\Data\AdventureWorks_Data.mdf	163.94 MB	163.75 MB

Moving and Copying Databases

- Copy Database Wizard
- Attaching and detaching databases
  - Allows directly copying data/log files
  - Database must be taken offline
- Backup / Restore
- Other methods:
  - SQL Server Integration Services (SSIS)
  - Generating scripts for database objects
  - Bulk copy / BULK INSERT

Database Maintenance & Data Protection

Methods for maintaining, backing up, and restoring databases

Database Backup Types

- Recovery Models
  - Full
  - Bulk-logged
  - Simple
- Backup operations
  - Full Backups
  - Differential Backups
  - Transaction Log Backups
    - Allows point-in-time recovery

Recovery Processes

- Recovery process:
  - Latest full backup (Required)
  - Latest differential backup (Optional)
  - Unbroken sequence of transaction log backups (Optional)
- All transaction logs should be restored with NO RECOVERY option (except for the last one)
  - Prevents database from being accessed while restore process is taking place

Database Maintenance Plans

Maintenance Tasks

- Check database integrity
- Shrink database
- Rebuild / reorganize indexes
- Update statistics

Miscellaneous Tasks

- Execute SQL Server Agent Job
- Maintenance Cleanup Task

Backup Databases

- Full Backup
- Differential Backup
- Transaction Log Backup

Maintenance Plan Wizard

- Scheduling
  - Single schedule for all tasks
  - Multiple schedules
- Databases:
  - System, All, All User, or specific databases
- Wizard Options:
  - Order of operations
- Manages logging and history of operations

Reliability & Availability Options

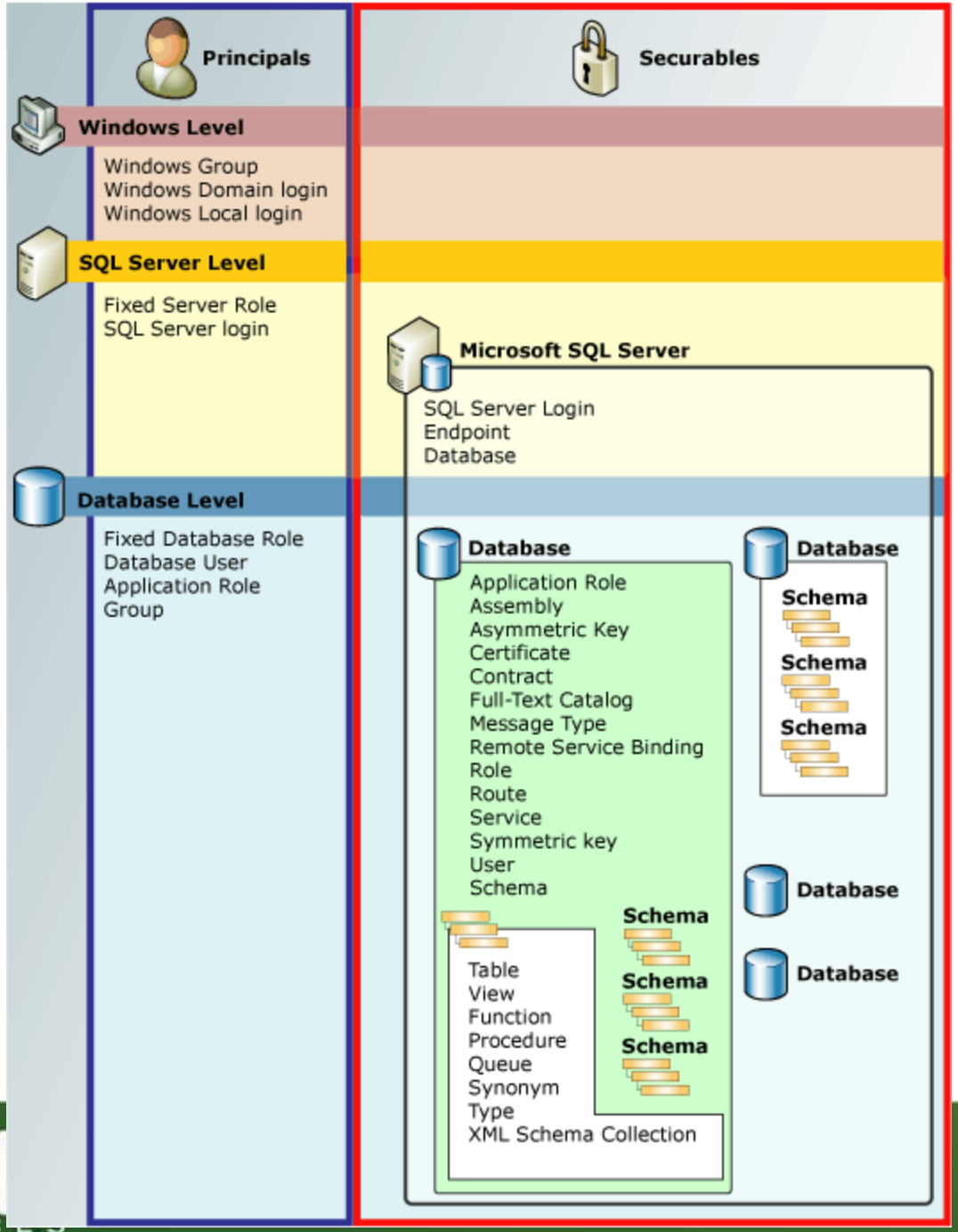
- Database Mirroring
- Log-shipping
- SQL Server Fail-Over Clusters
- Distributed Federated Servers
- Replication
- Load-Balancing (at network or OS level)

Securing SQL Server

Understanding SQL Server 2005's security architecture and objects

SQL Server Security Overview

- Layered Security Model:
  - Windows Level
  - SQL Server Level
  - Database
    - Schemas (for database objects)
- Terminology:
  - Principals
  - Securables
  - Permissions
    - Scopes and Inheritance



- (from Microsoft SQL Server 2005 Books Online)

Security Best Practices

- Make security a part of your standard process
- Use the principle of least privilege
- Implement defense-in-depth (layered security)
- Enable only required services and features
- Regularly review security settings
- Educate users about the importance of security
- Define security roles based on business rules

SQL Server Service Accounts

- Local Service Account
  - Permissions of “Users” group (limited)
  - No network authentication
- Network Service Account
  - Permissions of Users group
  - Network authentication with Computer account
- Domain User Accounts
  - Adds network access for cross-server functionality

SQL Server Surface Area Configuration

- Default installation: Minimal services
- SAC for Services and Connections
  - Allow Remote Connections
  - Access to Reporting Services, SSIS, etc.
- SAC for Features
  - Remote queries
  - .NET CLR Integration
  - Database Mail
  - xp_cmdshell

Managing Logins

- Windows Logins
  - Authentication/Policy managed by Windows
- SQL Server Logins
  - Managed by SQL Server
    - Based on Windows policies
  - Password Policy Options:
    - HASHED (pw is already hashed)
    - MUST_CHANGE
    - CHECK_EXPIRATION
    - CHECK_POLICY

Creating Logins

- Transact-SQL
  - CREATE LOGIN statement
    - Replaces sp_AddLogin and sp_GrantLogin
  - SQL Server Logins
  - Windows Logins
- SQL Server Management Studio
  - Setting server authentication options
  - Login Auditing
  - Managing Logins

Database Users and Roles

- Database Users
  - Logins map to database users
- Database Roles
  - Users can belong to multiple roles
  - *Guest* (does not require a user account)
  - *dbo* (Server *sysadmin* users)
- Application Roles
  - Used to support application code

Creating Database Users and Roles

- CREATE USER
  - Replaces sp_AddUser and sp_GrantDBAccess
  - Can specify a default schema
  - Managed with ALTER USER and DROP USER
- CREATE ROLE
  - Default owner is creator of the role
- SQL Server Management Studio
  - Working with Users and Roles

Built-In Server / Database Roles

Server Roles	Database Roles
• SysAdmin • ServerAdmin • SetupAdmin • SecurityAdmin • ProcessAdmin • DiskAdmin • DBCreator • BulkAdmin	• db_accessadmin • db_BackupOperation • db_DataReader • db_DataWriter • db_DDLAdmin • db_DenyDataReader • db_DenyDataWriter • db_Owner • db_SecurityAdmin • public

Understanding Database Schemas

- Schemas
  - Logical collection of related database objects
  - Part of full object name:
    - `Server.Database.Schema.Object`
  - Default schema is “dbo”

- Managing Schemas
  - `CREATE, ALTER, DROP SCHEMA`
  - SQL Server Management Studio
  - Can assign default schemes to database users:
    - `WITH DEFAULT_SCHEMA ‘SchemaName’`

Configuring Permissions

- Scopes of Securables
  - Server
  - Database
  - Schema
  - Objects
- Permission Settings:
  - GRANT
  - REVOKE
  - DENY
- Options
  - WITH GRANT OPTION
  - AS (Sets permissions using another user or role)

Managing Execution Permissions

- Transact-SQL Code can run under a specific execution context
  - By default, will execute as the caller
- EXECUTE AS clause:
  - Defined when creating an object or procedure
  - Options:
    - CALLER (Default)
    - SELF: Object creator
    - Specified database username

Other Security Options

- Database Encryption
  - Encrypting Object Definitions
  - Data encryption
- SQL Server Agent
  - Proxies based on subsystems allow lock-down by job step types
- Preventing SQL Injection attacks
  - Use application design best practices

Managing Database Objects

Understanding database design, tables, and indexes

Overview of Database Objects

Tables	Indexes	Views	Programmability
• Data storage & Retrieval • Referential integrity	• Improves query performance • Clustered • Non-clustered	• Logical result sets • Based on SELECT queries	• Stored Procedures • Functions • Triggers • Constraints

Designing a database

- Normalization
  - Reduces redundancy and improves data modification performance
  - Denormalization is often done to enhance reporting performance (at the expense of disk space and redundancy)
- Referential Integrity
  - Maintains the logical relationships between database objects

The 1-Minute* SQL Overview

- The Structured Query Language (SQL) defines a standard for interacting with relational databases
  - Most platforms support ANSI-SQL 92
  - Most platforms provide many non-ANSI-SQL additions

- Most important data modification SQL statements:
  - SELECT: Returning rows
  - UPDATE: Modifying existing rows
  - INSERT: Creating new rows
  - DELETE: Removing existing rows

* Presenter makes no guarantee about the time spent on this slide

Indexing Overview

- Index Considerations
  - Can dramatically increase query performance
  - Adds overhead for index maintenance
- Best Practices
  - Base design on real-world workloads
    - SQL Profiler; Execution Plans
  - Scenarios:
    - Retrieving ranges of data
    - Retrieving specific values

Index Types

- Clustered index
  - Controls the physical order of rows
  - Does not require disk space
  - One per table (may inc. multiple columns)
  - Created by default on tables' Primary Key column

- Non-Clustered Index
  - Physical data structures that facilitate data retrieval
  - Can have many indexes
  - Indexes may include many columns

Database Management Best Practices

Maintenance and optimization of SQL Server 2005

SQL Server Maintenance

- Monitor real-world (production) database usage
- Communicate and coordinate with application developers and users
- Develop policies and roles for database administration
- Optimize database administration
  - Automate common operations
  - Generate scripts for routine maintenance

SQL Server Maintenance

- Regular tasks
  - Monitor disk space usage
  - Monitor application performance
  - Monitor physical and logical disk space
  - Maintain indexes and data files
  - Review backup and recovery operations
  - Review security
  - Review SQL Server Logs and/or Windows logs
  - Verify the status of all jobs

SQL Server Management Features

- SQL Server Agent
  - Jobs
  - Alerts
  - Operators
- SQL Server Logs
- Database Mail
- Linked Servers

For More Information

- www.microsoft.com/sql
- Resources from Anil Desai
  - Web Site (http://AnilDesai.net)
  - E-Mail: Anil@AnilDesai.net
    - Keystone Learning Course: "*Microsoft SQL Server 2005: Implementation and Maintenance (Exam 70-431)*"
    - *The Rational Guide to Managing Microsoft Virtual Server 2005*
    - *The Rational Guide to Scripting Microsoft Virtual Server 2005*

AnilDesai.net

KeyStone Learning Systems

Questions & Discussion