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Hardening SQL Server

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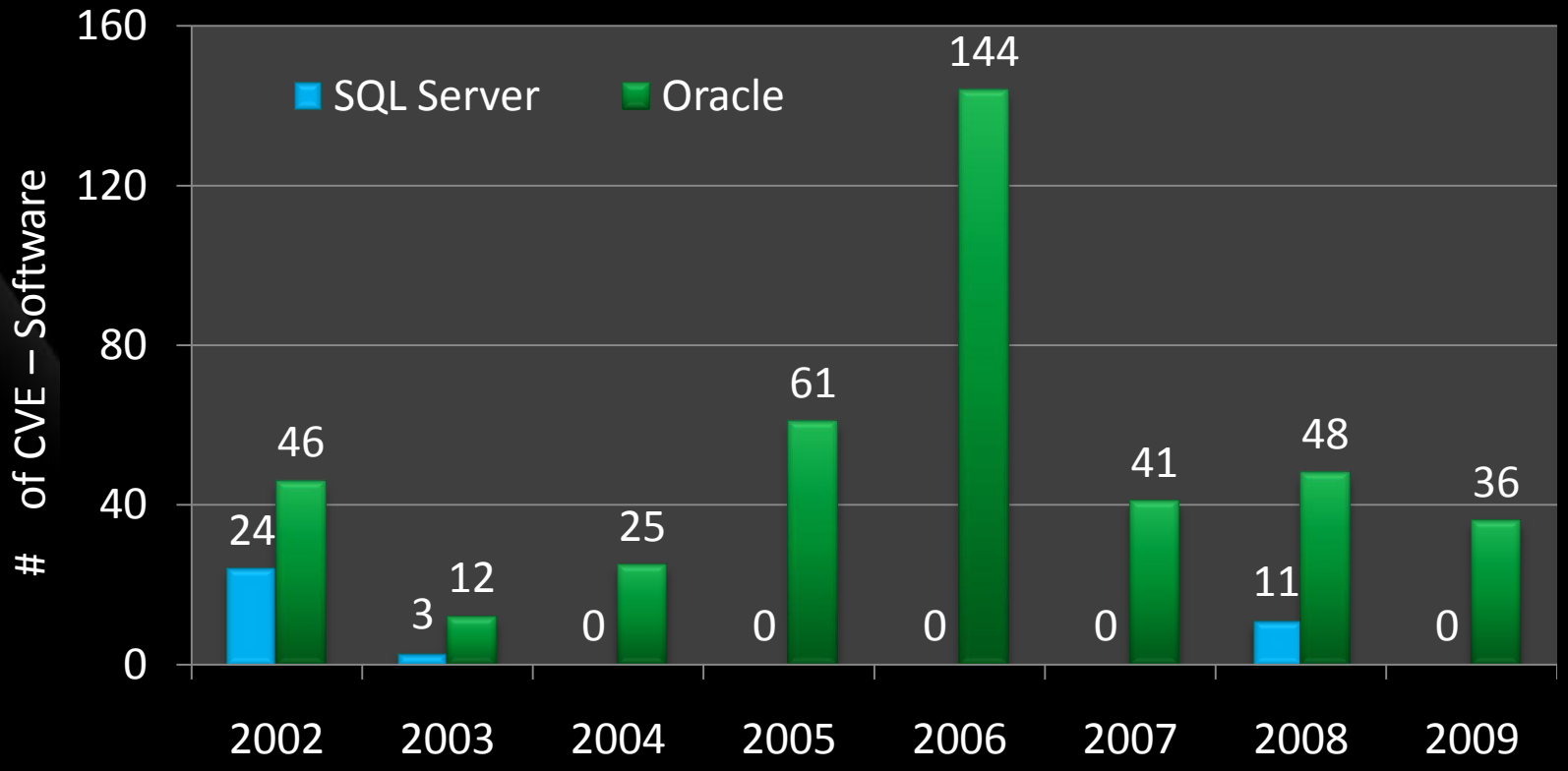
Key Session takeaways

- Understand the many views of SQL Server
- Look at hardening SQL Server
  - At the network level
  - At the access level
  - At the data level
  - At the application level
- Tools and features for hardening
- Best practices

Background



Source: NIST National Vulnerability Database

Notes: Update as of 4/21/2009.
Vulnerabilities are included for SQL Server 2000 , SQL Server 2005 , SQL Server 2008. Oracle (8i, 9i, 9iR2, 10g, 10gR2,11g)
Query for Oracle was run with vendor name: 'Oracle' , and product name: 'any' (all database product name variations were queried) .
Query for Microsoft was run with vendor name: 'Microsoft ' ; product name: 'Microsoft SQL Server'; version name: 'Any'
We are counting NIST CVE – Software Flaws (Each CVE might include more than one Oracle vulnerabilities)

Brief look at history

- SQL Slammer worm (2003)
  - Exploit on UDP port 1434
  - Buffer overflow in service resolution
- Spida worm (2002)
  - Exploit on TCP port 1433
  - Collect system info and email password hash

The many views of SQL Server

I. Network service

SQL Server offers a network service. Attacks on the network and port E.g. Port Sniffing, DoS attack

II. Access service

SQL Server requires login/password to connect and execute queries. Attacks on blank passwords, improper roles/permissions

III. Data service

SQL Server data in mdf, ldf, log files. Attempts to capture data either directly from the host or from backup disk

IV. Application service

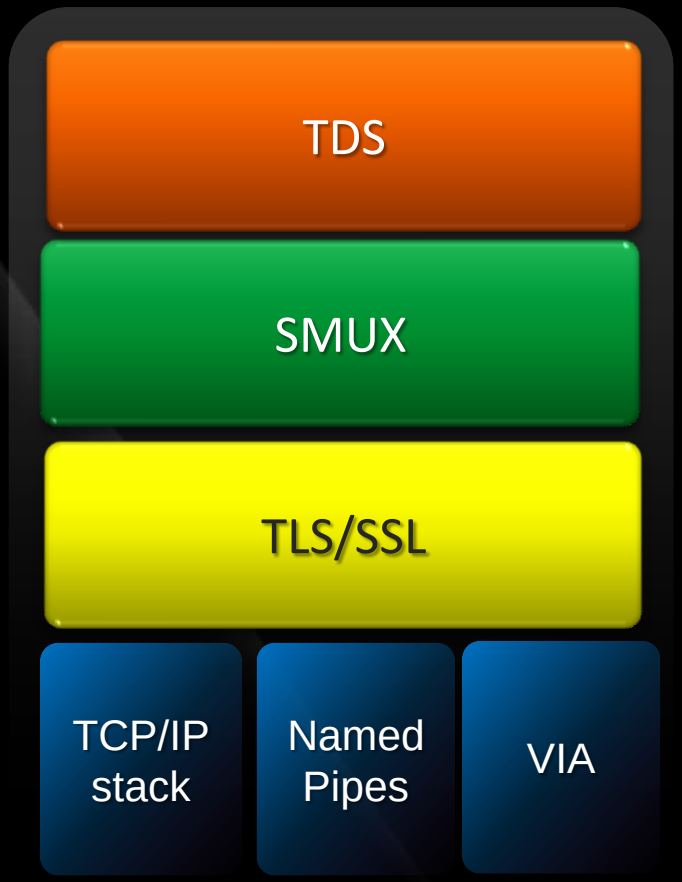
T-SQL queries interact with the instance may be poorly written. E.g. SQL Injection and elevation of privileges

Let’s look at each view….

- Highlight the *Concepts*
- Understand the *Tools* used
- *Demo* features in SQL Server 2008
- Summarize the *Best Practices*

I. Network service

Concepts



Tabular Data Stream

Session MUX protocol for MARS

Network Channel Encryption

Network Transport

Network service

SQL Server Tools

- SQL Scan: scans individual computer, a Windows domain, or a range of IP addresses for SQL Server 2000 and MSDE 2000
- SQL Check: scans the computer on which it is running for instances of SQL Server 2000 and MSDE 2000
- SQL Server Critical Update: Detect and update vulnerable files through a wizard
- Other 3rd party tools

Network service
Lock down

- Verify instance patch level
- Disable unused features DatabaseMail, XPCmdShell
- Prefer Windows mode Authentication
- Revoke permissions not needed for user
- Remove sample databases

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Lock down SQL Server

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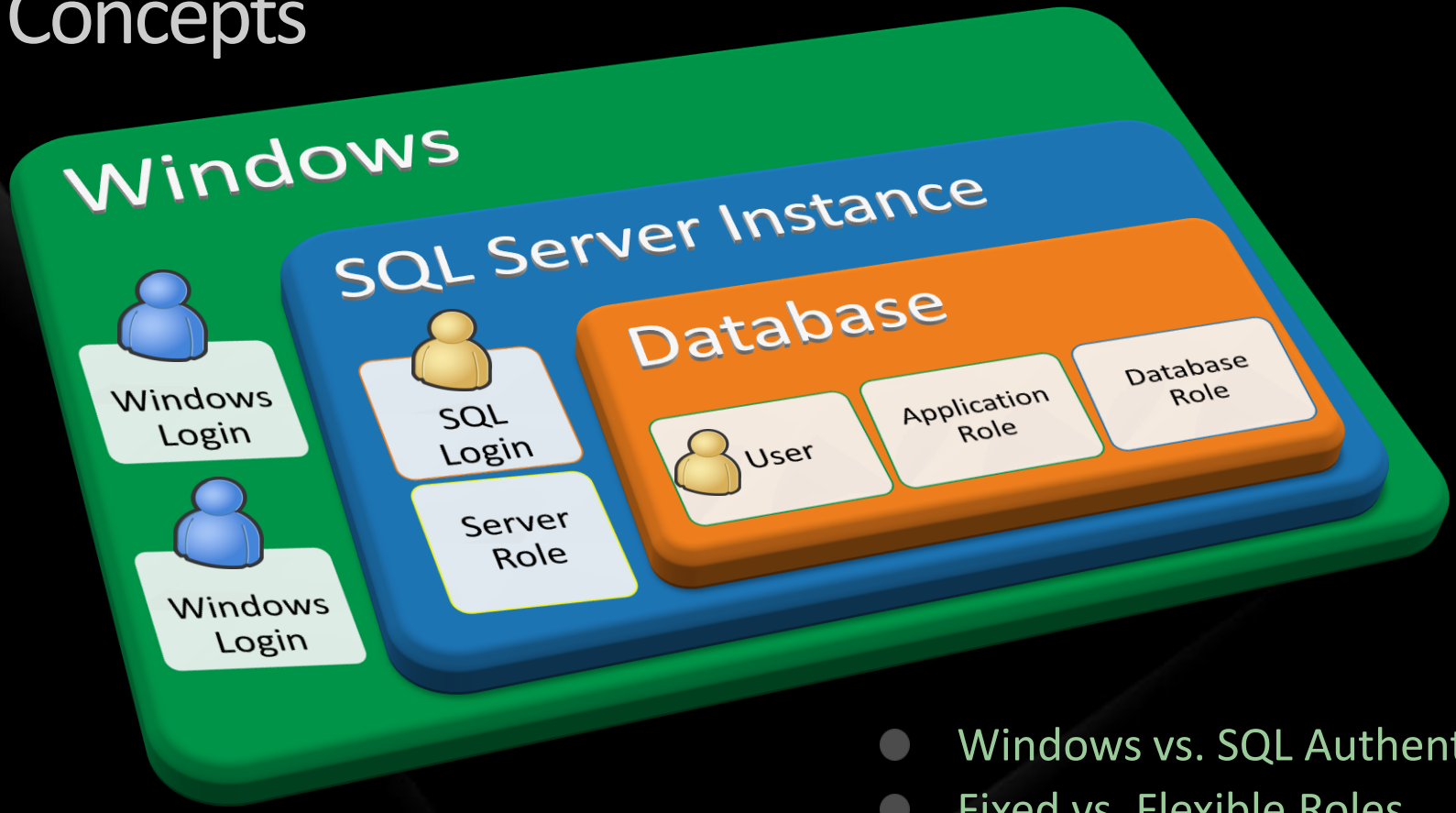
Network service

Best Practices

- Ensure patch level is up-to-date
- Use TCP/IP as the preferred network protocol
- Not exposing TCP/IP ports over the Internet
- Using SSL encrypted communication
- Disabling protocols that are not required
- Lock down SQL Server

II. Access service

Concepts

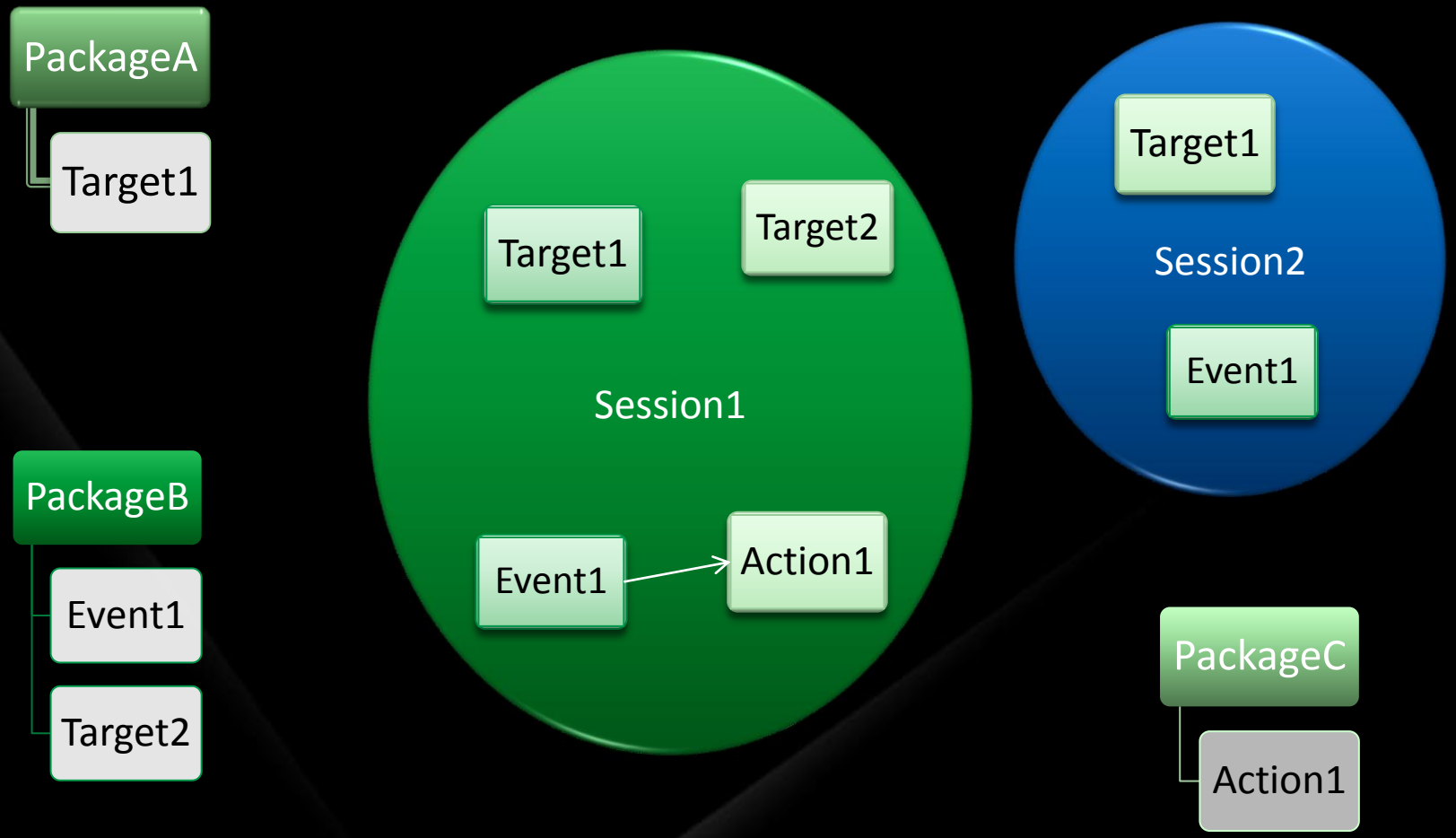


- Windows vs. SQL Authentication
- Fixed vs. Flexible Roles
- Users and Application Role
- Statement vs. Object permissions

Access service
SQL Server 2008 Tools

- XEvent: scalable and configurable asynchronous eventing infrastructure
- SQL Server 2008 Auditing: unified box wide solution to audit DDL for configuration and management purpose

XEvent Session



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Capturing events using XEvent

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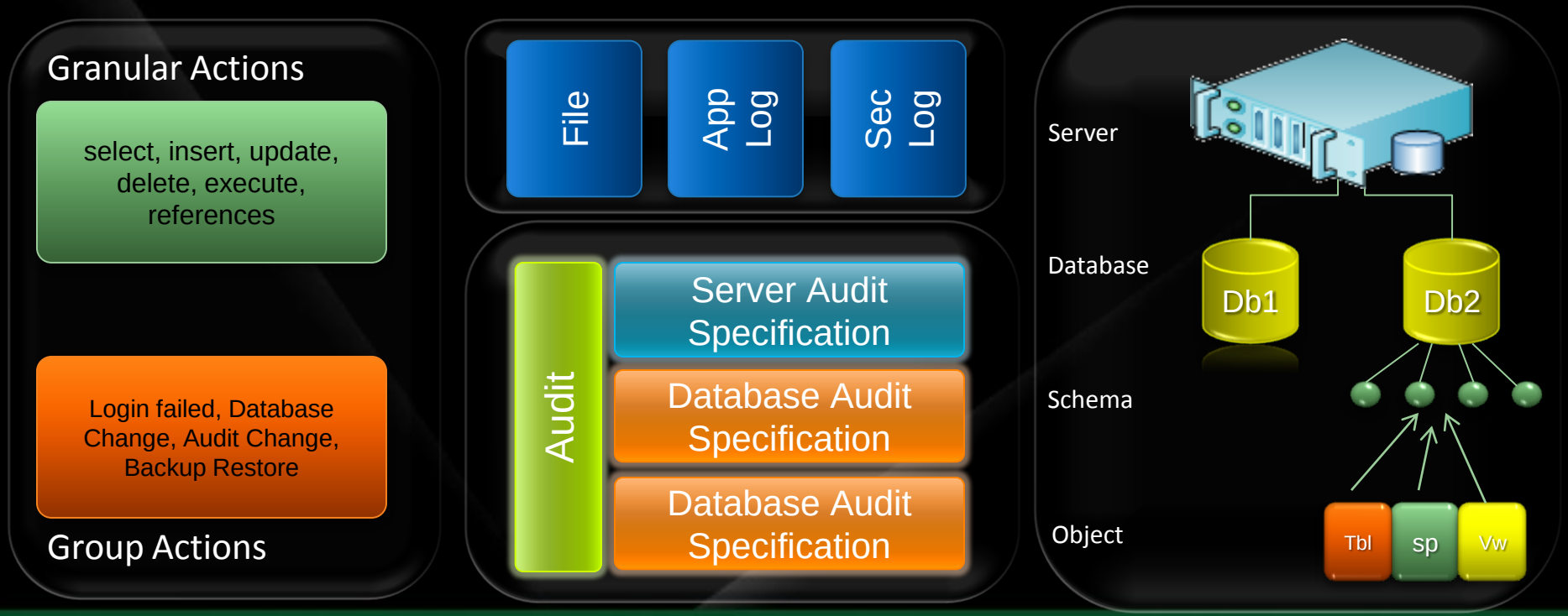
SQL Server Auditing

- Specifications
- Scope
- Actions
- Target



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Access checks using SQL Server Auditing

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Access service
Best Practices

- Enable Audits on SQL Server access, failed logins
- Strong sa passwords
- Prefer Windows Authentication over SQL Authentication
- Restrict PUBLIC role
- Consider no guest access on production boxes

III. Data service

Concepts

- SQL Server data store mdf, ndf, ldf files
- SQL Server logs from audit, database mail, maintenance plans
- SQL Policy files

Data service
SQL Server 2008 Tools

- Transparent Data Encryption:
  - Encryption and Decryption at the database level using Database Encryption Key (DEK)
  - Transparent to the user application
- Extensible Key Management
  - Encryption key is stored and managed on an external device (Hardware Storage Module)
  - Encryption Decryption by HSM

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Data encryption using TDE

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Data service

Best Practices

- Drop sample databases
- Built-in encryption functions
- T-SQL Procedure encryption
- Database encryption
- Extensible Key Management

IV. Application service
Concepts

- SQL Injection: Injecting vulnerable SQL code into an application query

- Types
  - Incorrectly escaped quotes
  - Time delays during execution
  - Conditional errors

SQL Injection sample code

```
' or 1=1 --

' union select @@VERSION

declare @query varchar (8000)
set @query =
0x73656C656374202A2066726F6D207379732E7365727665725F7072696E636970616C
732077686572652074797065206696E20282753272C27552729
exec(@query)

--select * from sys.server_principals where type in ('S','U')

select 1/0 from sys.server_principals where type in ('S','U')
and name='admin'
```

Application service
Best Practices

- Validate data passed as query input
  - Escape single quotes
- Use parameterization
- Check query strings composed on a ad-hoc basis
  - Use stored procedures
- Use tools like Microsoft Source Code Analyzer for SQL Injection
- Configure error reporting

Summary

- Take advantage of SQL Server 2008 security features
- Understand the different levels of threat in your environment
- Not every tool and configuration may be necessary
- Finally, note the chain is as strong as the weakest link

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Thank You!

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