FIRST STEPS IN SECURING YOUR SCRIPTS

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1E

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DELL

Kollective

Microsoft

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▸Computer geek since 1982		▸10 years
▸I like cows		▸Brewing Beer and Coffee

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OVERVIEW

- PowerShell 'Security' Settings
  - Execution Policy
  - Constrained Language mode
  - Just Enough Admin (JEA)
  - Over-The-Shoulder Logging
- Access Control Security and PowerShell
  - ACLs and Permissions
  - Service Accounts and Managed Service Accounts
  - Peer Review
- SQL Injection
  - Parameterization
  - Stored Procedures
- Encryption
  - Obfuscation
  - Symmetric Encryption
  - Data Protection API
  - Asymmetric Encryption
- Conclusion
- Questions?

POWERSHELL SECURITY SETTINGS

Lets talk about Execution Policy, Constrained Language Mode and Just Enough Admin.

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EXECUTION POLICY

- What is it:
  - It was never a solution to prevent users from running scripts.
  - Prevents accidental execution of scripts.

- How does it work:
  - It is a tool to determine which scripts can run by DEFAULT
    - Bypass – Everything can run
    - Unrestricted – Everything can run but you might be prompted for downloaded
    - Remote Signed – Scripts and modules with remote bit have to be signed by a trusted publisher
    - All Signed – Everything needs to be signed by a trusted publisher
    - Restricted – nothing can run

CONSTRAINED LANGUAGE MODE

- What is it:
  - A restriction in PowerShell that limits PowerShell
    - Full language: everything is available
    - Constrained Language: Disables com objects, many .Net objects, custom types, methods, dot sourcing, and a lot more.
    - No language: No PowerShell
- How does it work:
  - It follows predefined rules.
  - The intent is to use this as part of a larger security stance including app locker.

Quick Demo

- Testing with Constrained Mode:

$ExecutionContext.SessionState.LanguageMode = <0,1,2>

```
Cannot start "powershell". Interactive console applications are not supported.
To run the application, use the Start-Process cmdlet or use "Start PowerShell.exe" from the File menu.
To view/modify the list of blocked console applications, use $psUnsupportedConsoleApplications, or consult online help.
At line:0 char:0
```

```
At line:1 char:1
+ [System.Environment]::OSVersion
+ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Property references are not allowed in restricted language mode or a Data section.
At line:1 char:1
+ [System.Environment]::OSVersion
+ ~~~~~~~~~~~~~~~~~~~~
The type System.Environment is not allowed in restricted language mode or a Data section.
    + CategoryInfo          : ParserError: (:) [], ParentContainsErrorRecordException
    + FullyQualifiedErrorId : PropertyReferenceNotSupportedInDataSection
```

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JUST ENOUGH ADMIN (JEA)

- What is it:
  - Customizable cmdlet whitelist which runs under the users account, a service account, or a virtual account.

- How does it work:
  - This is defined by a trusted admin and installed on a server.
  - The intention is to not give admins normal permissions but rather give define narrow commands that an admin needs to do their job.
    - Capabilities file – What the users can do?
    - Session Configuration file - Who can do it? And as Whom?

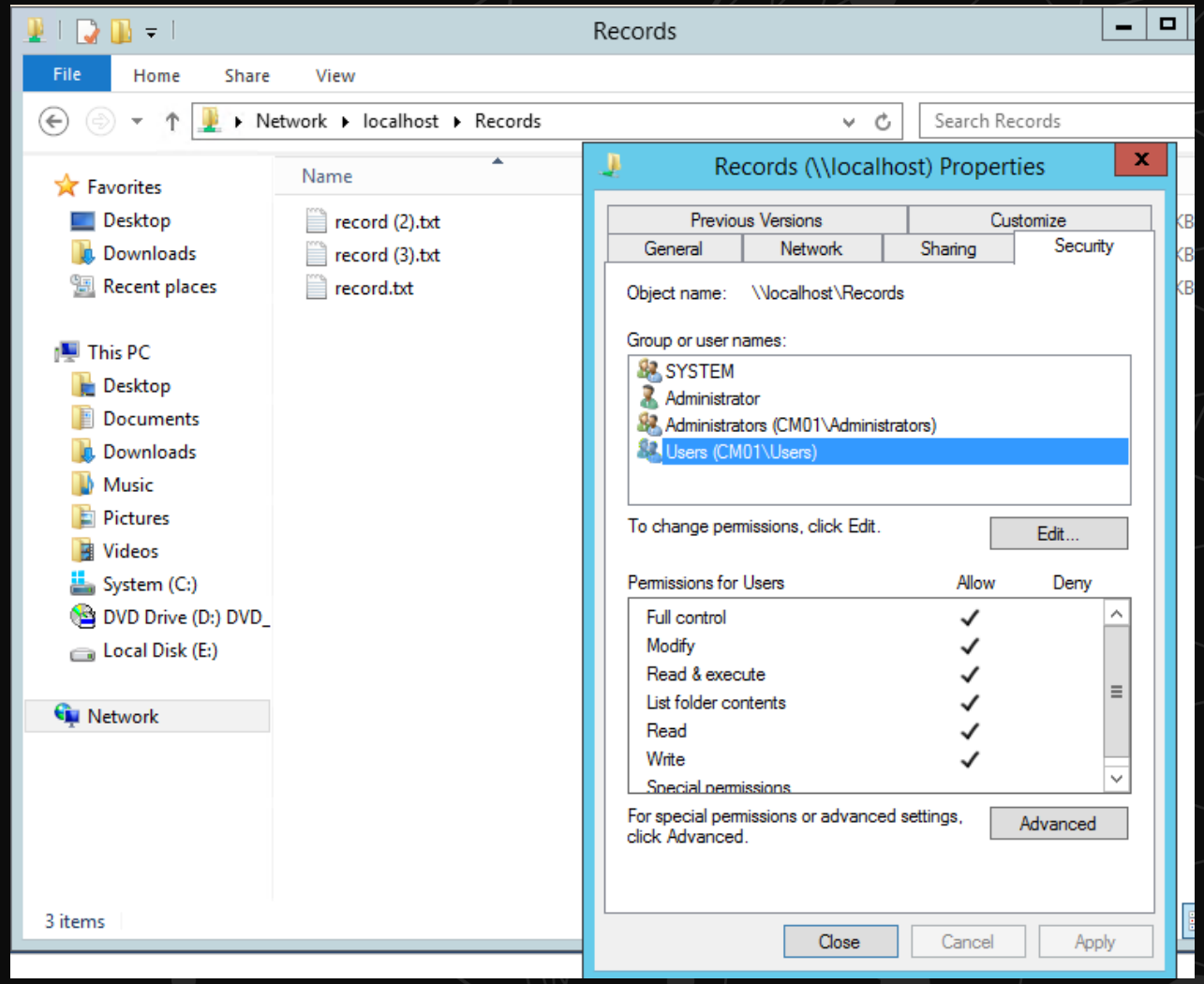
* Requires PowerShell 5

ACCESS CONTROL SECURITY

How much information is exposed to users?

ACLS AND PERMISSIONS

- When does this matter:
  - Scheduled tasks
  - File\User input
- What does this protect against:
  - Changes in your script
  - Inappropriate inputs for your script
  - Any sensitive data in your scripts:
    - Usernames and Passwords
    - Server Names



SERVICE ACCOUNTS VS. MANAGED SERVICE ACCOUNTS

- Service Accounts:
  - These are user accounts that are denied interactive logon and used to preform tasks.
  - Require password changes
  - Password is usually random

- Managed Service Accounts:
  - These are user accounts that are denied interactive logon and used to preform tasks.
  - Require password changes, but this is handled for you
  - Password are random and complex
  - Passwords are stored in AD

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MANAGED SERVICE ACCOUNTS SETUP (RSAT REQUIRED)

```
PS C:\windows\system32> New-ADServiceAccount -name MSA-Records -DNSHostName MSA-Records.jps.com -PrincipalsAllowedToRetr
ieveManagedPassword 'CN=CM01,OU=Servers,OU=JPS,DC=corp,DC=JPS,DC=com'
PS C:\windows\system32> Install-ADServiceAccount MGS-Records
```

```
PS C:\windows\system32> Install-ADServiceAccount Msa-Records
PS C:\windows\system32> $env:computername
CM01
PS C:\windows\system32> Test-ADServiceAccount msa-records
True
```

```
PS C:\windows\system32> $action =New-ScheduledTaskAction -Execute powershell -Argument '-file c:\scripts\Register.ps1'
PS C:\windows\system32> $schedule = New-ScheduledTaskTrigger -At 7:00 -Daily
PS C:\windows\system32> $prin = New-ScheduledTaskPrincipal -UserId jps\MSA-Records$ -LogonType Password
PS C:\windows\system32> register-ScheduledTask -Principal $prin -Action $action -Trigger $schedule

cmdlet Register-ScheduledTask at command pipeline position 1
Supply values for the following parameters:
TaskName: RecordsMSA

TaskPath                                 TaskName                       State
--------                                 --------                       -----
\                                        RecordsMSA                     Ready


PS C:\windows\system32> _
```

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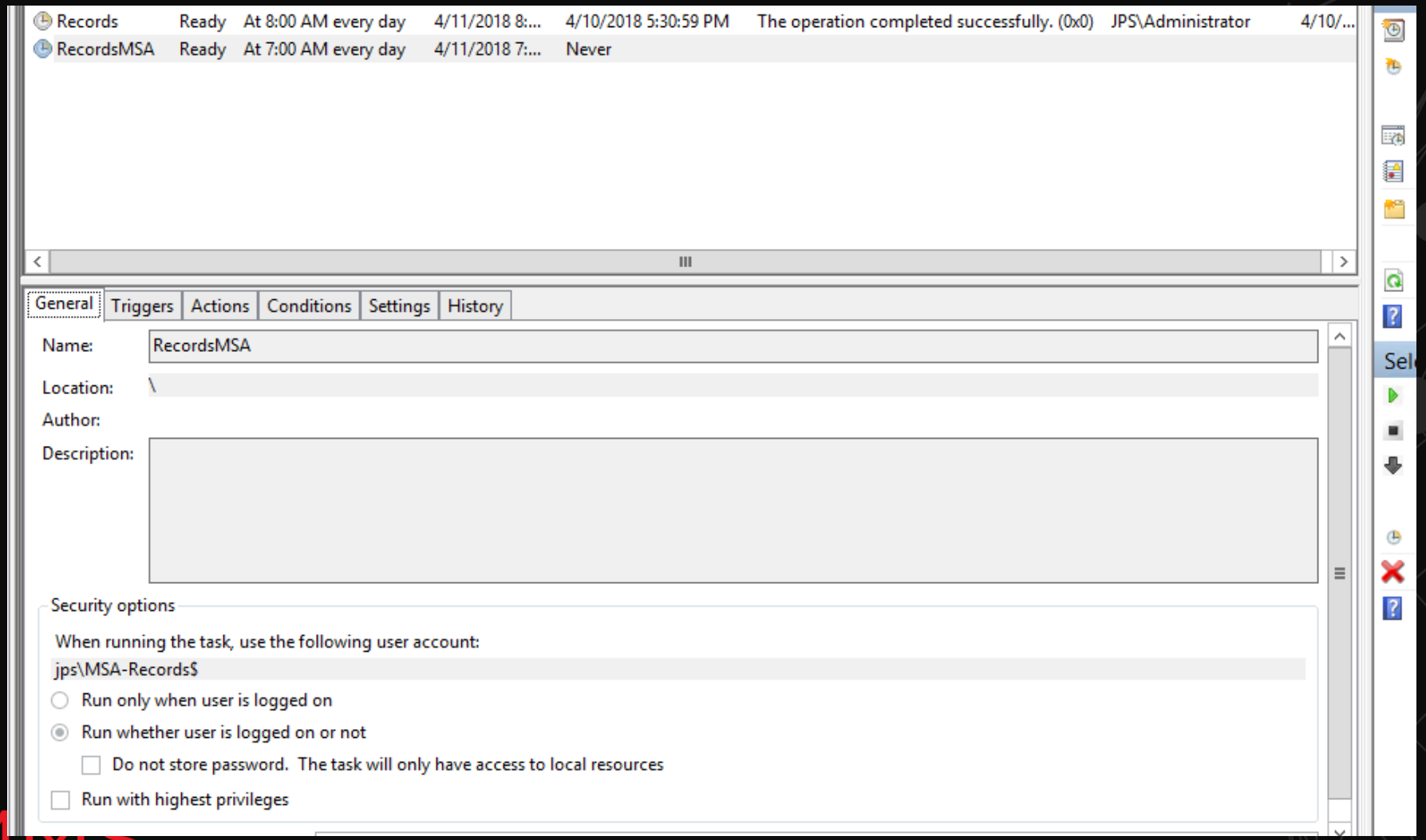
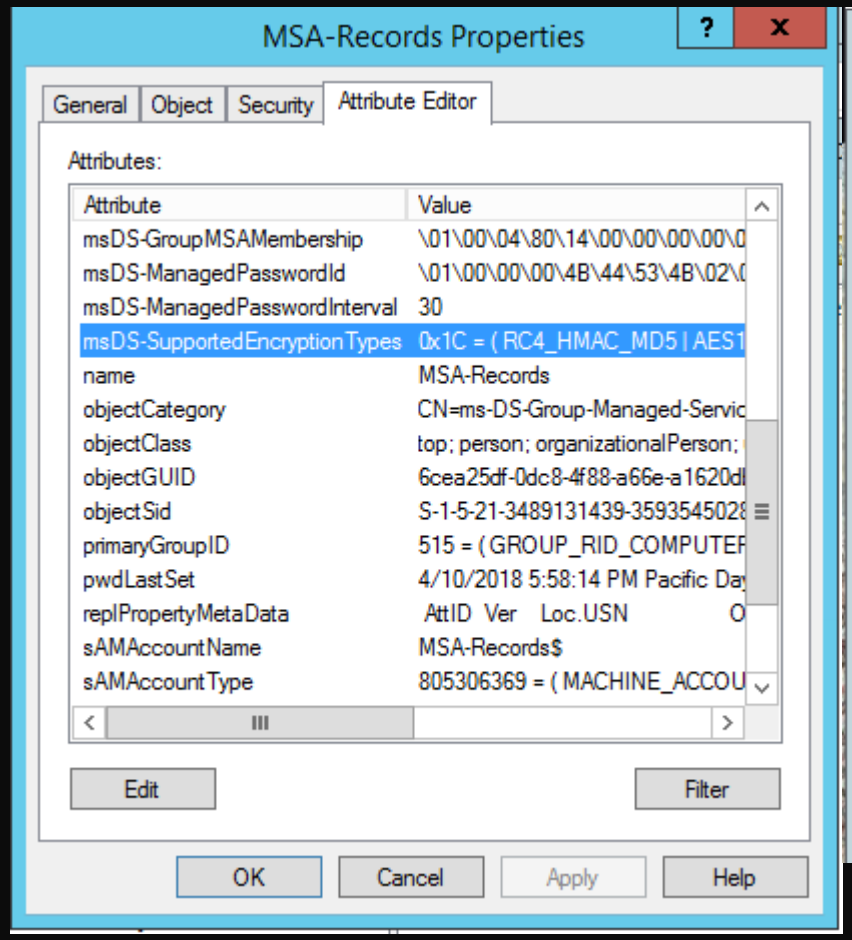
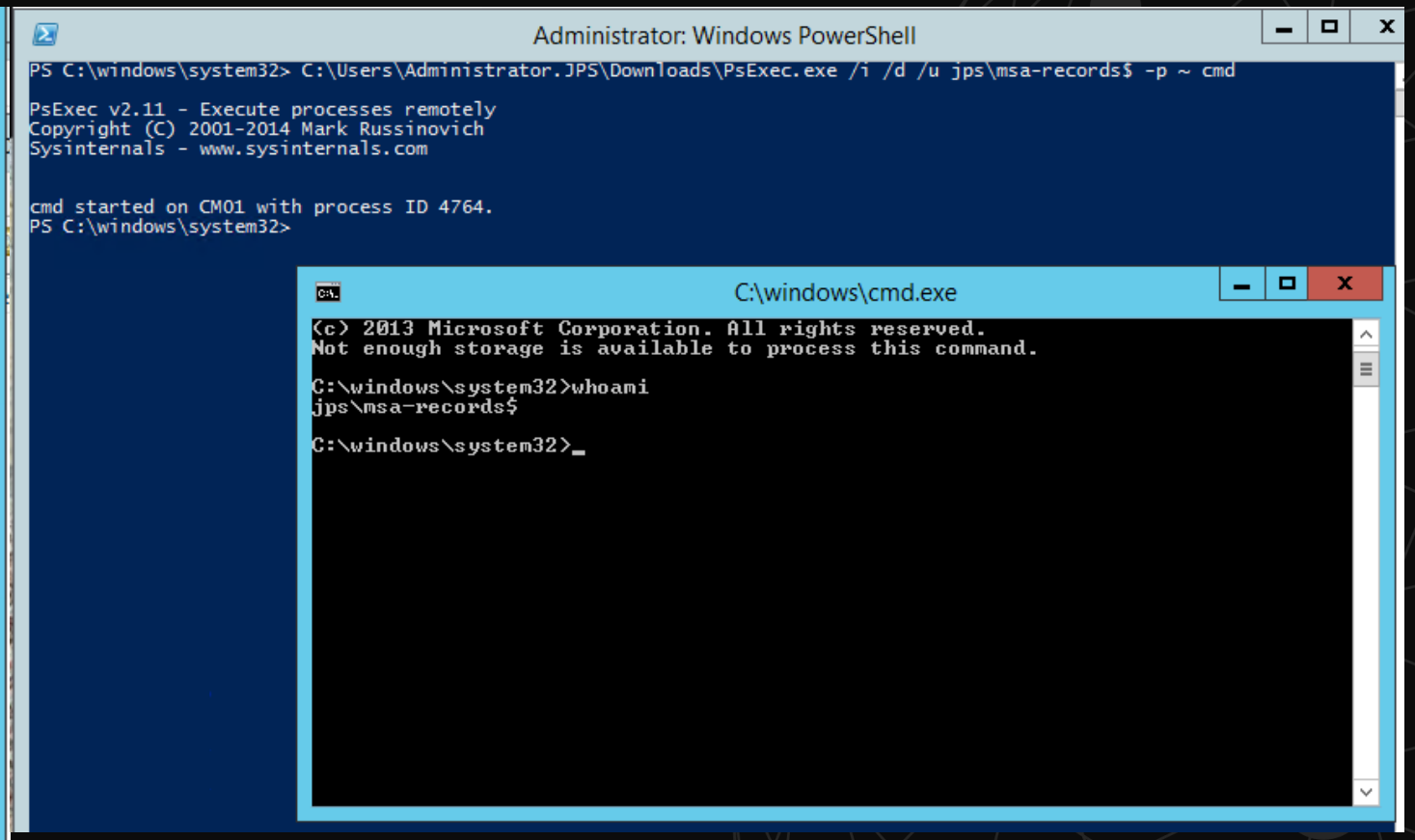
MANAGED SERVICE ACCOUNTS SETUP



MANAGED SERVICE ACCOUNTS SECURITY





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MANAGED SERVICE ACCOUNTS SECURITY

Retrieving MSA Passwords

- Only with the system account that has permissions
- 256 bit random password
- Not stored locally*

```
PS C:\windows\system32> Get-ADServiceAccount msa-records -Properties 'msDS-ManagedPassword'


DistinguishedName : CN=MSA-Records,CN=Managed Service Accounts,DC=corp,DC=JPS,DC=com
Enabled           : True
Name              : MSA-Records
ObjectClass       : msDS-GroupManagedServiceAccount
ObjectGUID        : 6cea25df-0dc8-4f88-a66e-a1620dbb8385
SamAccountName    : MSA-Records$
SID               : S-1-5-21-3489131439-3593545028-3395961476-1127
UserPrincipalName :



PS C:\windows\system32>
```

Run with highest privileges

```
Windows PowerShell
Copyright (C) 2013 Microsoft Corporation. All rights reserved.

PS C:\windows\system32> Get-ADServiceAccount msa-records -Properties 'msDS-Manag
edPassword'


DistinguishedName     : CN=MSA-Records,CN=Managed Service
                        Accounts,DC=corp,DC=JPS,DC=com
Enabled               : True
msDS-ManagedPassword  : {1, 0, 0, 0...}
Name                  : MSA-Records
ObjectClass           : msDS-GroupManagedServiceAccount
ObjectGUID            : 6cea25df-0dc8-4f88-a66e-a1620dbb8385
SamAccountName        : MSA-Records$
SID                   : S-1-5-21-3489131439-3593545028-3395961476-1127
UserPrincipalName     :
```

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OVER-THE-SHOULDER LOGGING

- Event Logging:
  - Some executions of PowerShell are logged in the event viewer.
- Task manager:
  - The command line can be exposed in the task manager.

PEER REVIEW

- There is a lot to consider!
- Learn from your teammates!

SQL INJECTION

What is it and how do you prevent it?

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SQL INJECTION

- When are you at risk:
  - When Users input data that is intended for a SQL query.

- How do you prevent this:
  - Parameterization – This reformats the sql query to automatically sanitize inputs
  - Stored Procedures – Using stored procedures doesn't prevent sql injection but it allows you to restrict permissions

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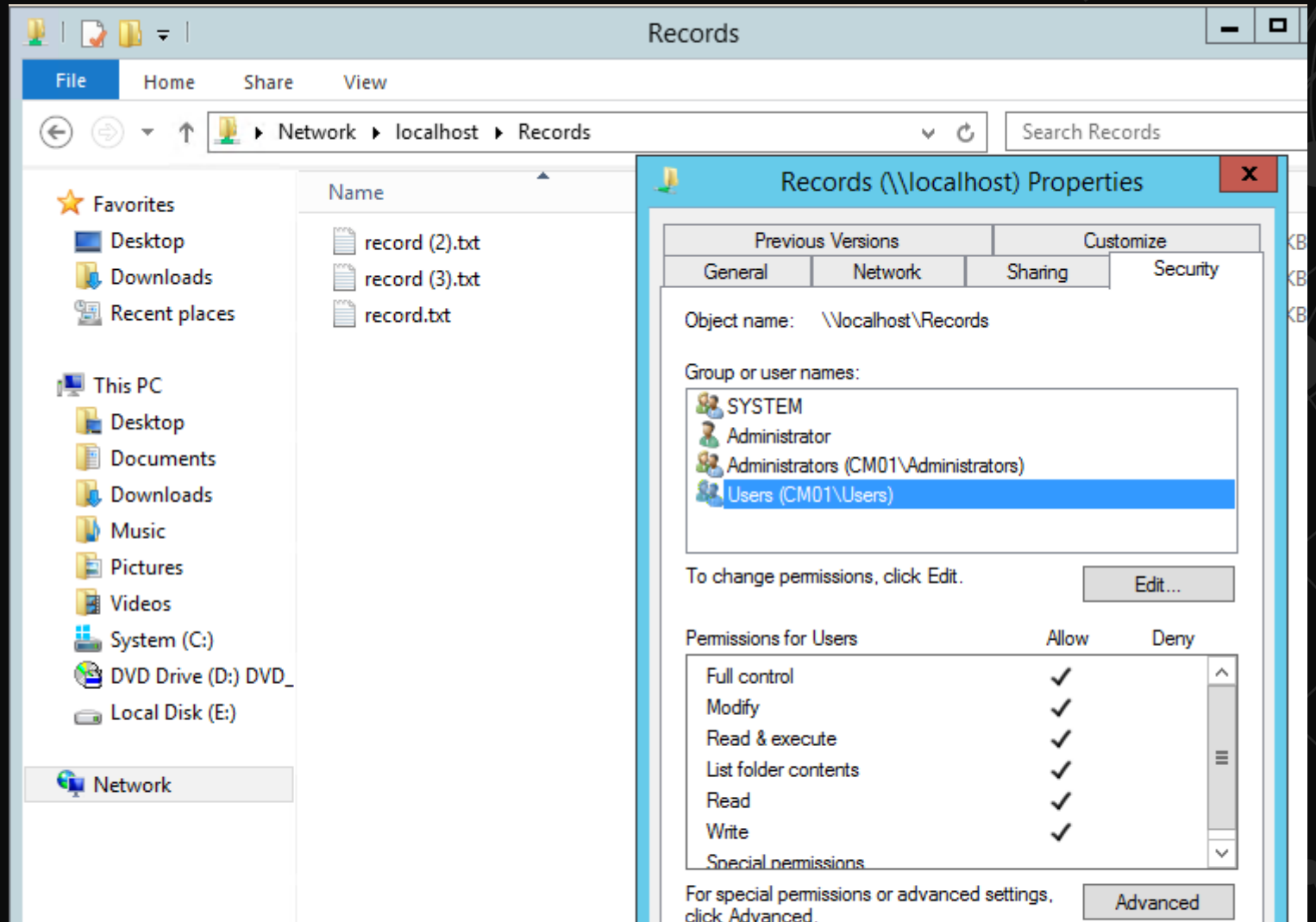
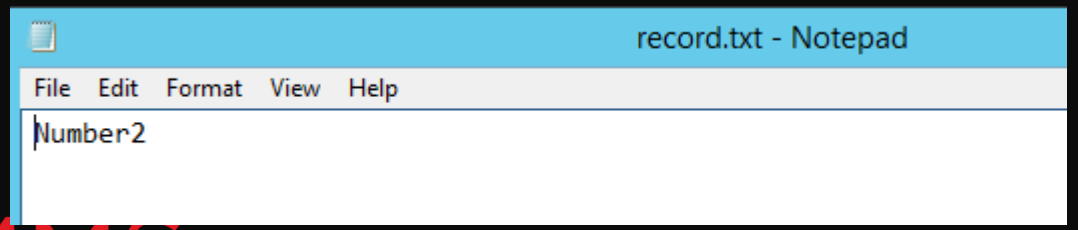
EXAMPLE


Records
File
Home
Share
View
Network ▸ localhost ▸ Records
Search Records
Favorites
Desktop
Downloads
Recent places
This PC
Desktop
Documents
Downloads
Music
Pictures
Videos
System (C:)
DVD Drive (D:) DVD_
Local Disk (E:)
Network
Name
record (2).txt
record (3).txt
record.txt
Records (\\localhost) Properties
Previous Versions
Customize
General
Network
Sharing
Security
Object name: \\localhost\Records
Group or user names:
SYSTEM
Administrator
Administrators (CM01\Administrators)
Users (CM01\Users)
To change permissions, click Edit.
Edit...
Permissions for Users
Allow
Deny
Full control
Modify
Read & execute
List folder contents
Read
Write
Special permissions
For special permissions or advanced settings, click Advanced.
Advanced

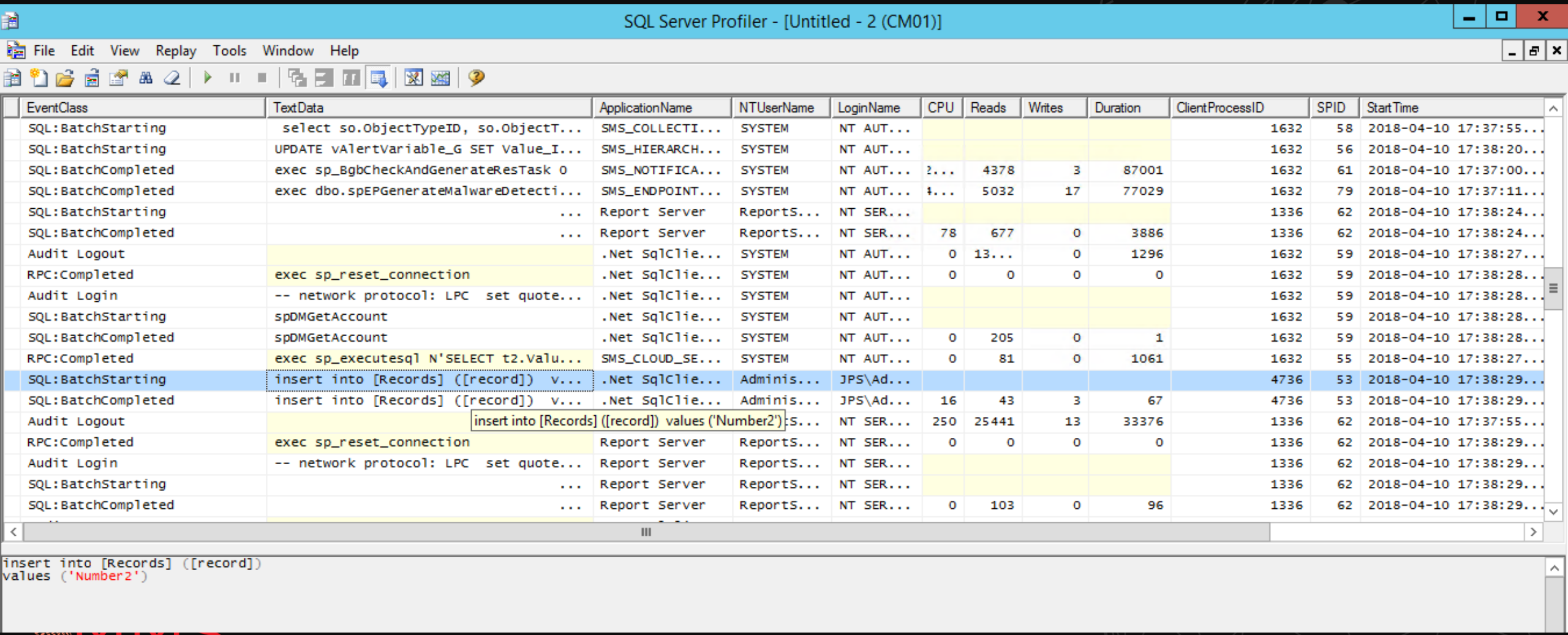
EXAMPLE

Register-Params.ps1 | Register.ps1

```powershell
$PWD = ConvertTo-SecureString -String 'P@sswOrd' -AsPlainText -Force
$cred = new-object pscredential ('jps\administrator',$pwd)
New-PSDrive -Name R -PSProvider FileSystem -Root \\dc01\c$ -Credential $cred

$record = Get-Content -path c:\records\Record.txt

$query = "insert into [Records] ([record])
values ('$record')"

$SQLConnection = New-object System.Data.SqlClient.SqlConnection('Data Source=cm01;Integrated security = true; Initial catalog = re
$SQLConnection.open()

$SQLInsert = new-object System.Data.SqlClient.SqlCommand($query,$SQLConnection)
$Null = $SQLInsert.ExecuteNonQuery()

copy-item C:\Records\record.txt -Destination \\dc01\c$\

Remove-PSDrive -Name R
```



EXAMPLE


SQL Server Profiler - [Untitled - 2 (CM01)]
File Edit View Replay Tools Window Help
EventClass | TextData | ApplicationName | NTUserName | LoginName | CPU | Reads | Writes | Duration | ClientProcessID | SPID | StartTime
SQL:BatchStarting | select so.ObjectTypeID, so.ObjectT... | SMS_COLLECTI... | SYSTEM | NT AUT... | | | | | 1632 | 58 | 2018-04-10 17:37:55...
SQL:BatchStarting | UPDATE vAlertVariable_G SET Value_I... | SMS_HIERARCH... | SYSTEM | NT AUT... | | | | | 1632 | 56 | 2018-04-10 17:38:20...
SQL:BatchCompleted | exec sp_BgbCheckAndGenerateResTask 0 | SMS_NOTIFICA... | SYSTEM | NT AUT... | ?... | 4378 | 3 | 87001 | 1632 | 61 | 2018-04-10 17:37:00...
SQL:BatchCompleted | exec dbo.spEPGenerateMalwareDetecti... | SMS_ENDPOINT... | SYSTEM | NT AUT... | 4... | 5032 | 17 | 77029 | 1632 | 79 | 2018-04-10 17:37:11...
SQL:BatchStarting | ... | Report Server | ReportS... | NT SER... | | | | | 1336 | 62 | 2018-04-10 17:38:24...
SQL:BatchCompleted | ... | Report Server | ReportS... | NT SER... | 78 | 677 | 0 | 3886 | 1336 | 62 | 2018-04-10 17:38:24...
Audit Logout | | .Net SqlClie... | SYSTEM | NT AUT... | 0 | 13... | 0 | 1296 | 1632 | 59 | 2018-04-10 17:38:27...
RPC:Completed | exec sp_reset_connection | .Net SqlClie... | SYSTEM | NT AUT... | 0 | 0 | 0 | 0 | 1632 | 59 | 2018-04-10 17:38:28...
Audit Login | -- network protocol: LPC set quote... | .Net SqlClie... | SYSTEM | NT AUT... | | | | | 1632 | 59 | 2018-04-10 17:38:28...
SQL:BatchStarting | spDMGetAccount | .Net SqlClie... | SYSTEM | NT AUT... | | | | | 1632 | 59 | 2018-04-10 17:38:28...
SQL:BatchCompleted | spDMGetAccount | .Net SqlClie... | SYSTEM | NT AUT... | 0 | 205 | 0 | 1 | 1632 | 59 | 2018-04-10 17:38:28...
RPC:Completed | exec sp_executesql N'SELECT t2.Valu... | SMS_CLOUD_SE... | SYSTEM | NT AUT... | 0 | 81 | 0 | 1061 | 1632 | 55 | 2018-04-10 17:38:27...
SQL:BatchStarting | insert into [Records] ([record]) v... | .Net SqlClie... | Adminis... | JPS\Ad... | | | | | 4736 | 53 | 2018-04-10 17:38:29...
SQL:BatchCompleted | insert into [Records] ([record]) v... | .Net SqlClie... | Adminis... | JPS\Ad... | 16 | 43 | 3 | 67 | 4736 | 53 | 2018-04-10 17:38:29...
Audit Logout | | insert into [Records] ([record]) values ('Number2') | NT SER... | 250 | 25441 | 13 | 33376 | 1336 | 62 | 2018-04-10 17:37:55...
RPC:Completed | exec sp_reset_connection | Report Server | ReportS... | NT SER... | 0 | 0 | 0 | 0 | 1336 | 62 | 2018-04-10 17:38:29...
Audit Login | -- network protocol: LPC set quote... | Report Server | ReportS... | NT SER... | | | | | 1336 | 62 | 2018-04-10 17:38:29...
SQL:BatchStarting | ... | Report Server | ReportS... | NT SER... | | | | | 1336 | 62 | 2018-04-10 17:38:29...
SQL:BatchCompleted | ... | Report Server | ReportS... | NT SER... | 0 | 103 | 0 | 96 | 1336 | 62 | 2018-04-10 17:38:29...
insert into [Records] ([record])
values ('Number2')

EXAMPLE

record (2).txt - Notepad

File Edit Format View Help

```
Number3'); Delete from records --
```

SQL Server Profiler - [Untitled - 2 (CM01)]

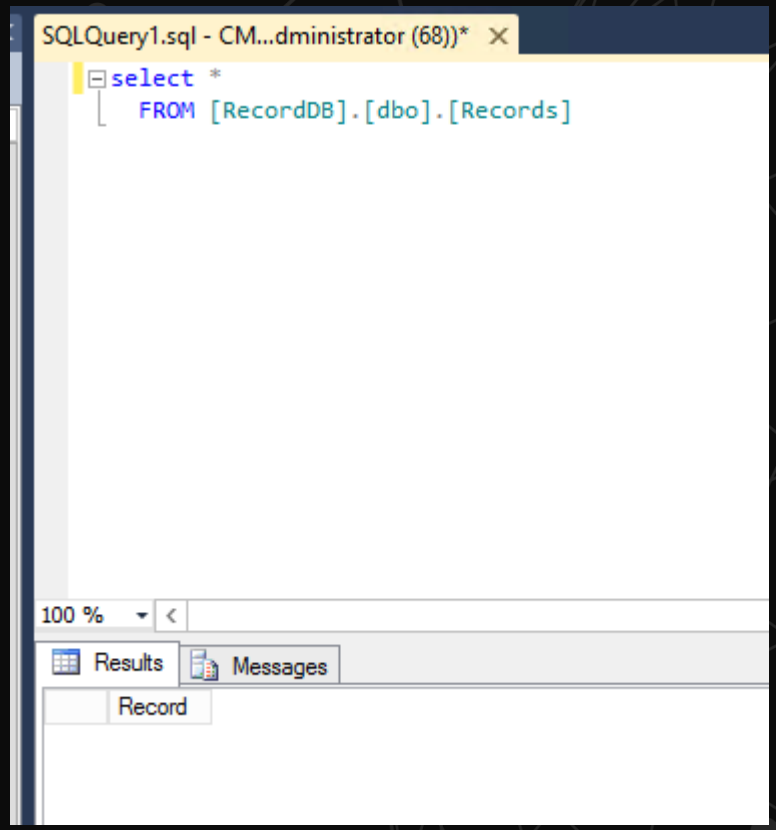
File Edit View Replay Tools Window Help

EventClass	TextData	ApplicationName	NTUserName	LoginName	CPU	Reads	Writes	Duration	ClientProcessID	SPID	StartTime
SQL:BatchStarting	select DateLastModified from SiteCo...	SMS_OBJECT_R...	SYSTEM	NT AUT...					1632	78	2018-04-10 17:
SQL:BatchCompleted	select DateLastModified from SiteCo...	SMS_OBJECT_R...	SYSTEM	NT AUT...	0	117	0	15	1632	78	2018-04-10 17:
SQL:BatchCompleted	exec sp_BgbCheckAndGenerateResTask 0	SMS_NOTIFICA...	SYSTEM	NT AUT...	63	2808	0	386	1632	67	2018-04-10 17:
Audit Logout		.Net SqlClie...	SYSTEM	NT AUT...	0	15069	0	1293	1632	60	2018-04-10 17:
RPC:Completed	exec sp_reset_connection	.Net SqlClie...	SYSTEM	NT AUT...	0	0	0	0	1632	60	2018-04-10 17:
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	SYSTEM	NT AUT...					1632	60	2018-04-10 17:
SQL:BatchStarting	spDMGetAccount	.Net SqlClie...	SYSTEM	NT AUT...					1632	60	2018-04-10 17:
SQL:BatchCompleted	spDMGetAccount	.Net SqlClie...	SYSTEM	NT AUT...	0	205	0	1	1632	60	2018-04-10 17:
Audit Logout		.Net SqlClie...	SYSTEM	NT AUT...	0	15274	0	1030	1632	60	2018-04-10 17:
RPC:Completed	exec sp_reset_connection	.Net SqlClie...	SYSTEM	NT AUT...	0	0	0	0	1632	60	2018-04-10 17:
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	SYSTEM	NT AUT...					1632	60	2018-04-10 17:
SQL:BatchStarting	spDMGetAccount	.Net SqlClie...	SYSTEM	NT AUT...					1632	60	2018-04-10 17:
SQL:BatchCompleted	spDMGetAccount	.Net SqlClie...	SYSTEM	NT AUT...	0	205	0	1	1632	60	2018-04-10 17:
Audit Logout		.Net SqlClie...	Adminis...	JPS\Ad...	16	143	3	229296	4736	53	2018-04-10 17:
RPC:Completed	exec sp_reset_connection	.Net SqlClie...	Adminis...	JPS\Ad...	0	0	0	0	4736	53	2018-04-10 17:
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	Adminis...	JPS\Ad...					4736	53	2018-04-10 17:
SQL:BatchStarting	insert into [Records] ([record]) v...	.Net SqlClie...	Adminis...	JPS\Ad...					4736	53	2018-04-10 17:
SQL:BatchCompleted	insert into [Records] ([record]) v...	.Net SqlClie...	Adminis...	JPS\Ad...	0	46	2	14	4736	53	2018-04-10 17:
Audit Login	-- network protocol: LPC set quote...	SMS_STATE_SY...	SYSTEM	NT AUT...					1632	74	2018-04-10 17:

```
insert into [Records] ([record])
values ('Number3'); Delete from records --')
```

EXAMPLE

Other Attacks:
- Drop database
- Add permissions for user
- Change records
- Create Backups



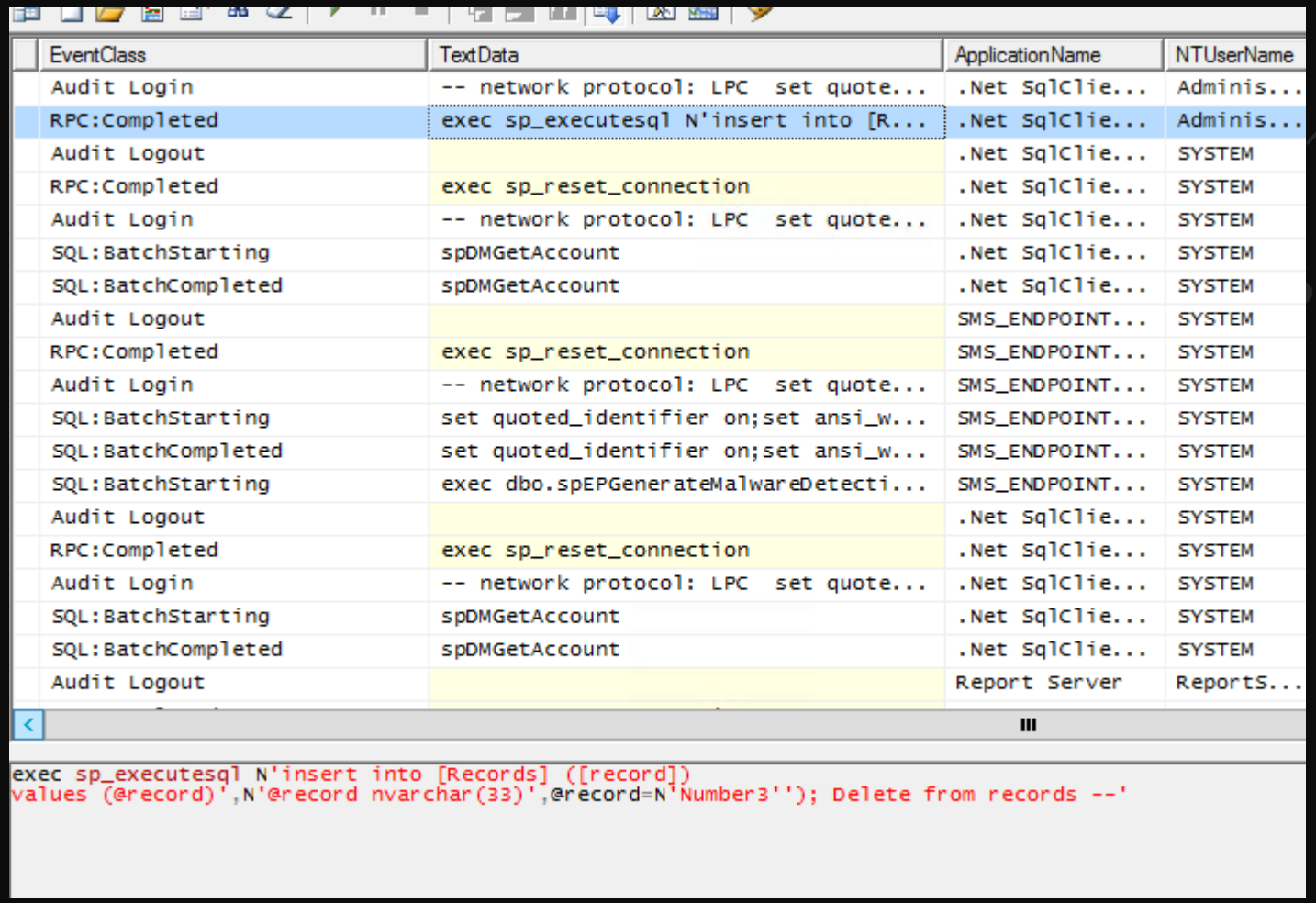
PARAMETERIZATION

Register-Params.ps1 | Register.ps1

```powershell
$PWD = ConvertTo-SecureString -String 'P@sswOrd' -AsPlainText -Force
$cred = new-object pscredential ('jps\administrator',$pwd)
New-PSDrive -Name R -PSProvider FileSystem -Root \\dc01\c$ -Credential $cred

$record = Get-Content -path c:\records\Record.txt

$query = "insert into [Records] ([record])
values ('$record')"

$SQLConnection = New-object System.Data.SqlClient.SqlConnection('Data Source=cm01;Integrated security = true; Initial catalog = re
$SQLConnection.open()

$SQLInsert = new-object System.Data.SqlClient.SqlCommand($query,$SQLConnection)
$Null = $SQLInsert.ExecuteNonQuery()

copy-item C:\Records\record.txt -Destination \\dc01\c$\

Remove-PSDrive -Name R
```

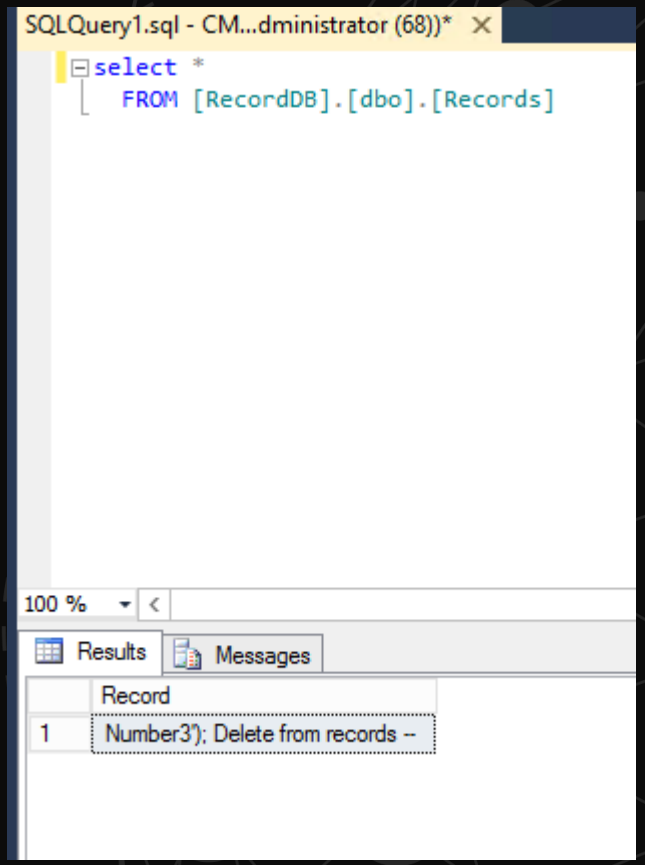
```powershell
$PWD = ConvertTo-SecureString -String 'P@sswOrd' -AsPlainText -Force
$cred = new-object pscredential ('jps\administrator',$pwd)
New-PSDrive -Name R -PSProvider FileSystem -Root \\dc01\c$ -Credential $cred

$record = Get-Content -path c:\records\Record.txt

$query = "insert into [Records] ([record])
values (@record)"

$SQLConnection = New-object System.Data.SqlClient.SqlConnection('Data Source=cm01;Integrated security = true; Initial catalog = re
$SQLConnection.open()

$SQLInsert = new-object System.Data.SqlClient.SqlCommand($query,$SQLConnection)
$SQLInsert.Parameters.Add('@record',$record)
$SQLInsert.ExecuteNonQuery()

copy-item C:\Records\record.txt -Destination \\dc01\c$\

Remove-PSDrive -Name R
```

PARAMETERIZATION



EventClass	TextData	ApplicationName	NTUserName
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	Adminis...
RPC:Completed	exec sp_executesql N'insert into [R...	.Net SqlClie...	Adminis...
Audit Logout		.Net SqlClie...	SYSTEM
RPC:Completed	exec sp_reset_connection	.Net SqlClie...	SYSTEM
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	SYSTEM
SQL:BatchStarting	spDMGetAccount	.Net SqlClie...	SYSTEM
SQL:BatchCompleted	spDMGetAccount	.Net SqlClie...	SYSTEM
Audit Logout		SMS_ENDPOINT...	SYSTEM
RPC:Completed	exec sp_reset_connection	SMS_ENDPOINT...	SYSTEM
Audit Login	-- network protocol: LPC set quote...	SMS_ENDPOINT...	SYSTEM
SQL:BatchStarting	set quoted_identifier on;set ansi_w...	SMS_ENDPOINT...	SYSTEM
SQL:BatchCompleted	set quoted_identifier on;set ansi_w...	SMS_ENDPOINT...	SYSTEM
SQL:BatchStarting	exec dbo.spEPGenerateMalwareDetecti...	SMS_ENDPOINT...	SYSTEM
Audit Logout		.Net SqlClie...	SYSTEM
RPC:Completed	exec sp_reset_connection	.Net SqlClie...	SYSTEM
Audit Login	-- network protocol: LPC set quote...	.Net SqlClie...	SYSTEM
SQL:BatchStarting	spDMGetAccount	.Net SqlClie...	SYSTEM
SQL:BatchCompleted	spDMGetAccount	.Net SqlClie...	SYSTEM
Audit Logout		Report Server	ReportS...

```
exec sp_executesql N'insert into [Records] ([record])
values (@record)',N'@record nvarchar(33)',@record=N'Number3''); Delete from records --'
```



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STORED PROCEDURES

What does it not do:

- Prevent Injection attacks

What does it do:

- Give you granular permissions for specific SQL tasks

```
USE [RecordDB]
GO
/****** Object:  StoredProcedure [dbo].[InsertRecor
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
-- =============================================
-- Author:      <Author,,Name>
-- Create date: <Create Date,,>
-- Description: <Description,,>
-- =============================================
ALTER PROCEDURE [dbo].[InsertRecord] (
@Record varchar(50)
)
AS
BEGIN
insert into [Records] ([record])
values (@record)
END
```

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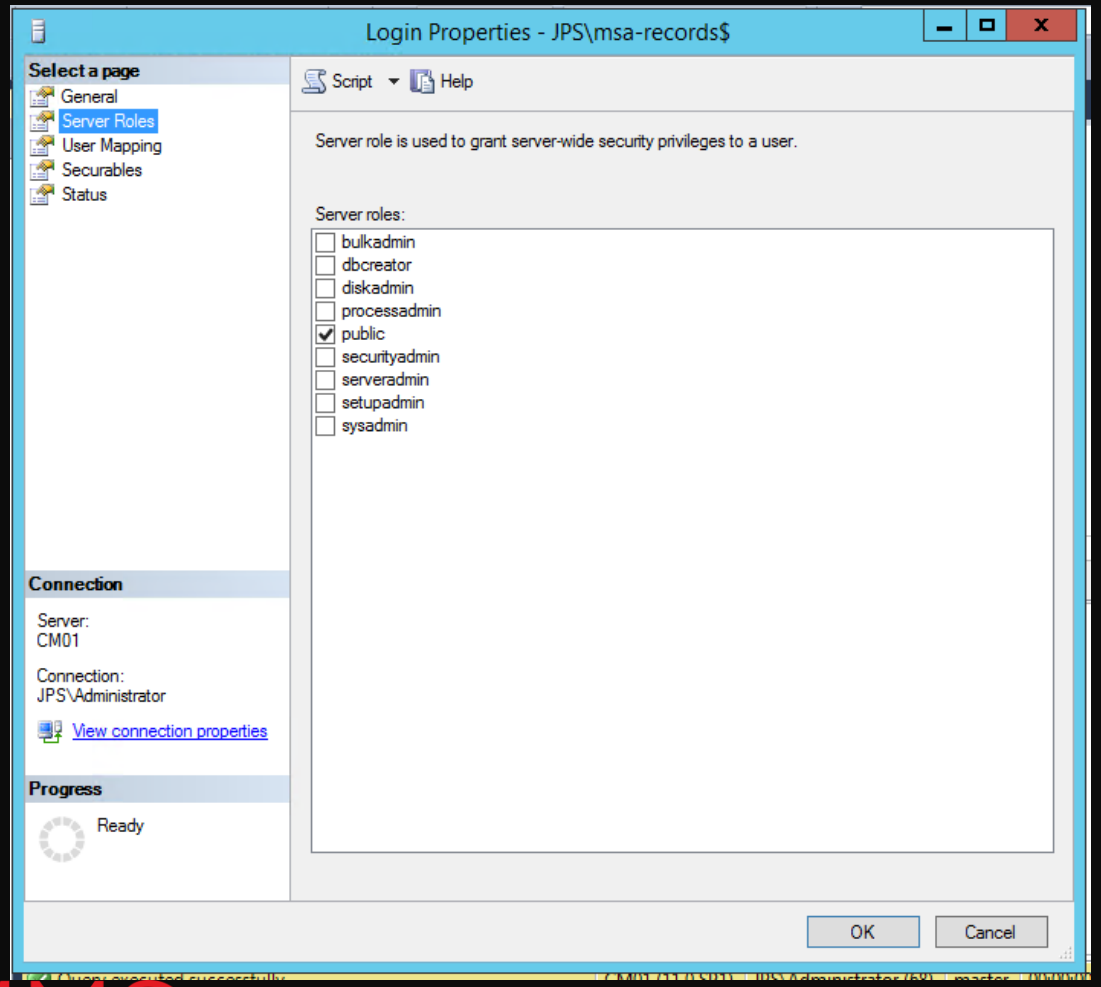
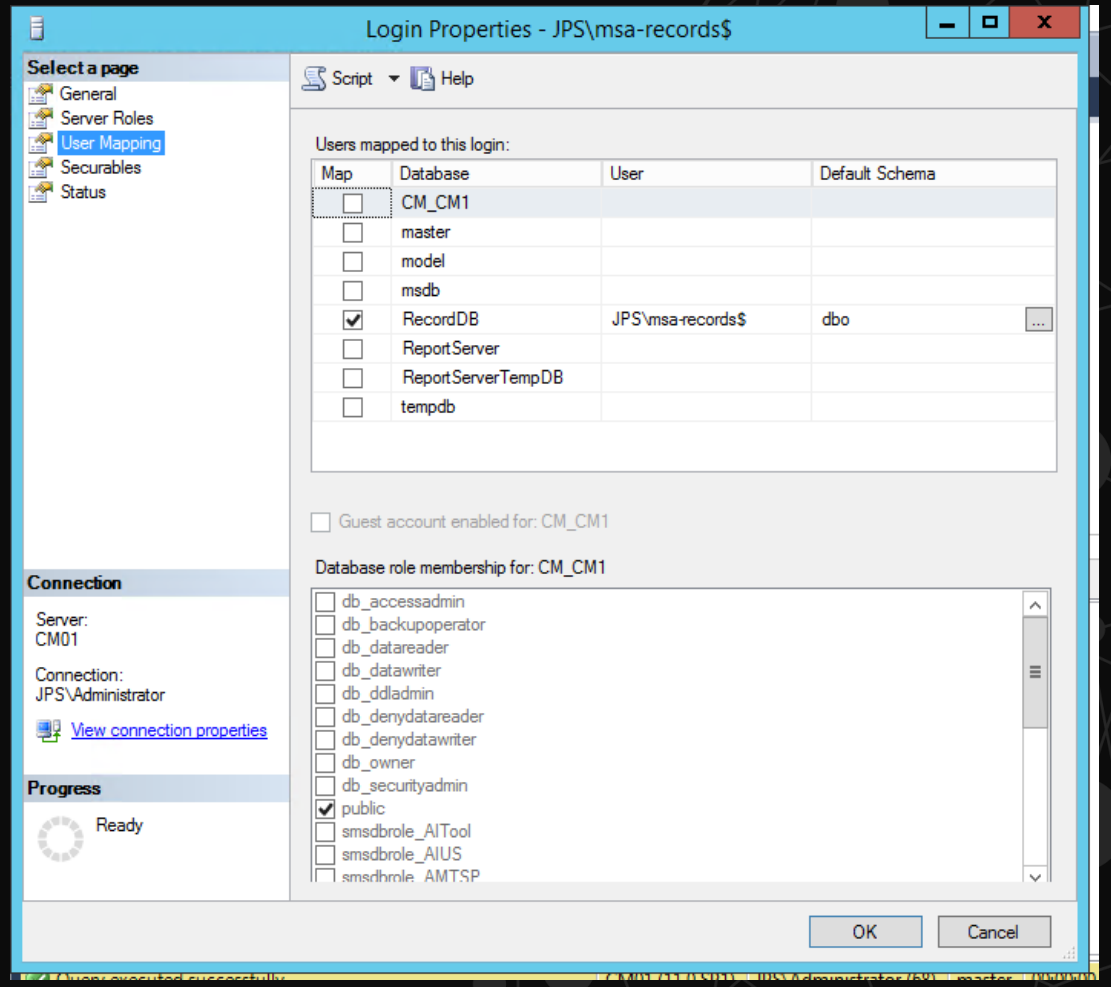
STORED PROCEDURES





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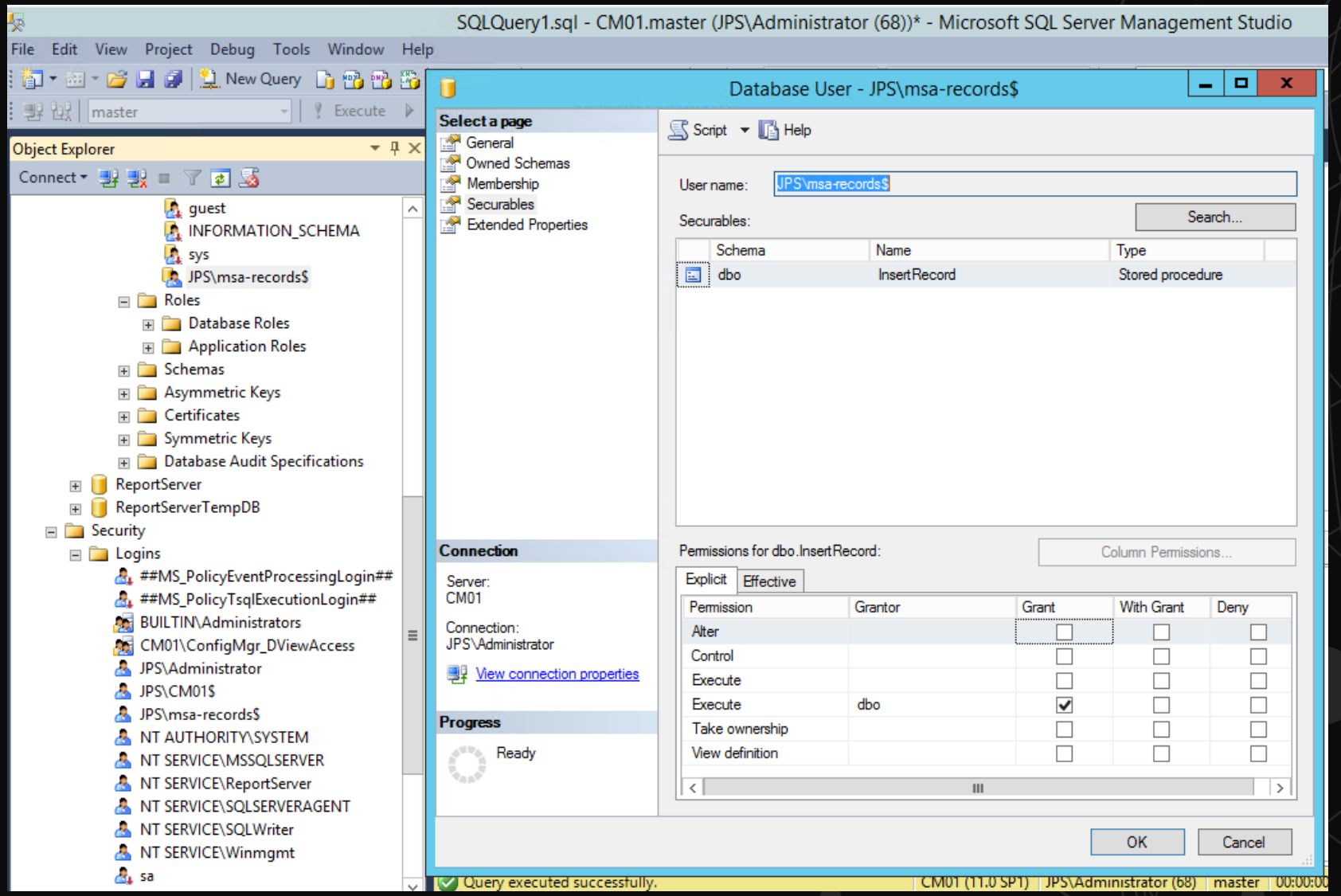
STORED PROCEDURES



STORED PROCEDURES

```
$record = Get-Content -path c:\records\Record.txt

$query = "[dbo].[InsertRecord] '$record'"

$SQLConnection = New-object System.Data.SqlClient.SqlConnection('Data Source=cm01;Integrated security = true; Ini
$SQLConnection.open()

$SQLInsert = new-object System.Data.SqlClient.SqlCommand($query,$SQLConnection)
$SQLInsert.ExecuteNonQuery()

copy-item C:\Records\record.txt -Destination \\dc01\c$\
```

```
\windows\system32> $SQLConnection = New-object System.Data.SqlClient.SqlConnection('Data Source=cm01;Integrated se

\windows\system32> $SQLConnection.open()

\windows\system32> $SQLInsert = new-object System.Data.SqlClient.SqlCommand($query,$SQLConnection)

\windows\system32> $SQLInsert.ExecuteNonQuery()
tion calling "ExecuteNonQuery" with "0" argument(s): "The DELETE permission was denied on the object 'Records',
ase 'RecordDB', schema 'dbo'."
ne:1 char:1
LInsert.ExecuteNonQuery()
~~~~~~~~~~~~~~~~~~~~~~~~~
 CategoryInfo          : NotSpecified: (:) [], MethodInvocationException
 FullyQualifiedErrorId : SqlException


\windows\system32>
```

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ENCRYPTION

How to protect shared secrets and sensitive data.

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ENCRYPTION

- It is always best to not store data that you do not need anymore.
  - Use the running context as much as possible for permissions.
- Eventually storing sensitive data is unavoidable.
  - Encryption is no good if your keys and certificates are not secure.
- There are already great tools built into PowerShell and .NET but there are more advanced options if you need.

OBFUSCATION

- THIS IS NOT ENCRYPTION!
- Base64 encoding is the most common in PowerShell.
  - This is very useful for encoding data for storage
- This is fast!
  - Encoding 10,000 times ~0.2 seconds
  - Decoding 10,000 times ~0.18 seconds

OBFUSCATION

- **Encoding**:

```
$pwd = 'Password123'
$bytes =  [System.Text.Encoding]::UTF8.GetBytes($pwd)
$Base64String = [Convert]::ToBase64String($bytes)
$Base64String|clip
$Base64String
```

- **Decoding**:

```
$ConvertedBytes = [Convert]::FromBase64String('UGFzc3dvcmQxMjM=')
[System.Text.Encoding]::UTF8.Getstring($ConvertedBytes)
```

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SYMMETRIC ENCRYPTION

- This is a common and well respected encryption solution.
  - Disk encryption
  - File encryption
  - SQL encryption
  - Data Protection API

- Speeds

(Convertfrom-securestring)Encoding 10,000 times ~4.5 seconds

(Convertfrom-securestring)Encoding Decoding 10,000 times ~3.7 seconds

(.Net)Encoding 10,000 times ~1 seconds

(.Net)Encoding Decoding 10,000 times ~1.06 seconds

SYMMETRIC ENCRYPTION

- **Encoding**:

```
$Userinput = 'someParam2Secure'
$keybytes = [System.Text.Encoding]::UTF8.GetBytes($Userinput)
[Byte[]] $Key = [System.Security.Cryptography.HashAlgorithm]::Create('SHA256').ComputeHash($keybytes)
$secure = ConvertTo-SecureString -String 'Password123' -AsPlainText -Force
ConvertFrom-SecureString -SecureString $secure -Key $key
```

- **Decoding**:

```
$securestring2 = ConvertTo-SecureString -Key $key -String
'76492d1116743f0423413b16050a5345MgB8AGMASwBCAE0ASABWAEEASABCAGkAZgBLAGgAUABrAFcA
MwBGAEEAcgB5AEEAPQA9AHwAMAAwADcAMQBlADkAMwBhAGUAZABlAGEAMgBjADAANwBiADkAYQA
zADkANQBkADIANgBiADIANgAzAGQAZgBlAA=='
[System.Runtime.InteropServices.marshal]::PtrToStringAuto([System.Runtime.InteropServices.marshal]::Secu
reStringToBSTR($securestring))
```

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DPAPI ENCRYPTION

- This is the mechanism that is used by secure data in the windows OS.

Local Machine - Local WIFI Passwords, windows services passwords, Certificate Private keys

Current User - IE saved passwords, Credential Manager, Certificate Private keys, App Passwords (Chrome, Skype Dropbox, Icloud)

- This uses user password hash and system information to generate 256 bit keys.

- Speeds

(Convertfrom-securestring)Encoding 10,000 times ~10 seconds

(Convertfrom-securestring)Encoding Decoding 10,000 times ~8.3 seconds

(.Net)Encoding 10,000 times ~8.6 seconds

(.Net)Encoding Decoding 10,000 times ~8.6 seconds

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DPAPI ENCRYPTION

- **Encoding**:

```
$securestring = ConvertTo-SecureString -String 'Password123' -AsPlainText -Force
ConvertFrom-SecureString -SecureString $securestring
```

- **Decoding**:

```
ConvertTo-SecureString
'01000000d08c9ddf0115d1118c7a00c04fc297eb01000000010a0f4cb8ab5a42a48998a4aa3754
d900000000020000000000106600000001000020000000ff6cfd739a8c52f3f06ff44c2089b356af9
52fc12ab9daec787377a90dfc9f51000000000e8000000020000200000034a67856119722d27a
3d0663d439373358e13cd2b2200802c16c8ad7084caa8f200000005e1053fa55aa396212a0dbbb
5e29cc947cf293a18a9310a0bcf6369ccd81d286400000003c1c7887c32c25c6e240761bedad3be
a05d68b4edb2b4157f3a3cda2e3062cdcb1fdd9b41b17db1f917706c27abe9cde1e4ece48800eb
85a867b3e263b916422'

[System.Runtime.InteropServices.marshal]::PtrToStringAuto([System.Runtime.InteropServices.ma
rshal]::SecureStringToBSTR($securestring))
```

ASYMMETRIC ENCRYPTION

- This is mainly useful when encryption and decryption need to be controlled separately.
  - SSL
  - Signing
- Try to use a trusted CA
- This is less common in PowerShell
- Speeds

(.Net)Encoding 10,000 times ~1.2 seconds

(.Net)Encoding Decoding 10,000 times ~17.9 seconds

ASYMMETRIC ENCRYPTION

- **Encoding**:

```
$cert = New-SelfSignedCertificate -Subject "Encrypt" -KeyUsage KeyEncipherment, DataEncipherment -Provider "Microsoft Enhanced RSA and AES Cryptographic Provider" -CertStoreLocation Cert:\CurrentUser\my

$pwd = 'Password123'
#$cert = get-item Cert:\CurrentUser\my\ABE7B616CF9858235072CE715A0DCC5F5436107A
$bytes =  [System.Text.Encoding]::UTF8.GetBytes($pwd)
$encryptedblob = $cert.PublicKey.Key.Encrypt($bytes,$true)
$EncryptedBase64String = [Convert]::ToBase64String($encryptedblob)
```

- **Decoding**:

```
$encryptedBytes = [System.Convert]::FromBase64String($EncryptedBase64String)
$pwdbytes = $cert.PrivateKey.Decrypt($encryptedBytes, $true)
[System.Text.Encoding]::UTF8.GetString($pwdbytes )
```

ENCRYPTION

- Which Encryption method is the best:
  - It depends

- I still have code that can expose passwords
  - Encryption separates the pieces needed to retrieve sensitive data.
  - Find an operation method for passing the key and certificates into the script. (Parameters, Retrieve from a management tool, etc)

- Can Multiple encryption solutions be used:
  - Yes, but try not to add complexity unnecessarily

Review

- Operation Security
  - Peer Reviews are important
- SQL Injection
  - This is a common attack vector.
  - There are easy steps to prevent it.
- Encryption
  - Encryption will not make lazy coding secure.
  - This is an important piece of a secure process.

Extended Q&A


1E


adaptiva


DELL


Kollective


Microsoft


vmware


CTGlobal


nowmicro


cireson
your system center experts


2Pint
Software


FLEXERA


Apajove


Lenovo


PolicyPak
SECURING YOUR STANDARDS


Parallels


Patch My PC
PATCH MANAGEMENT MADE EASY

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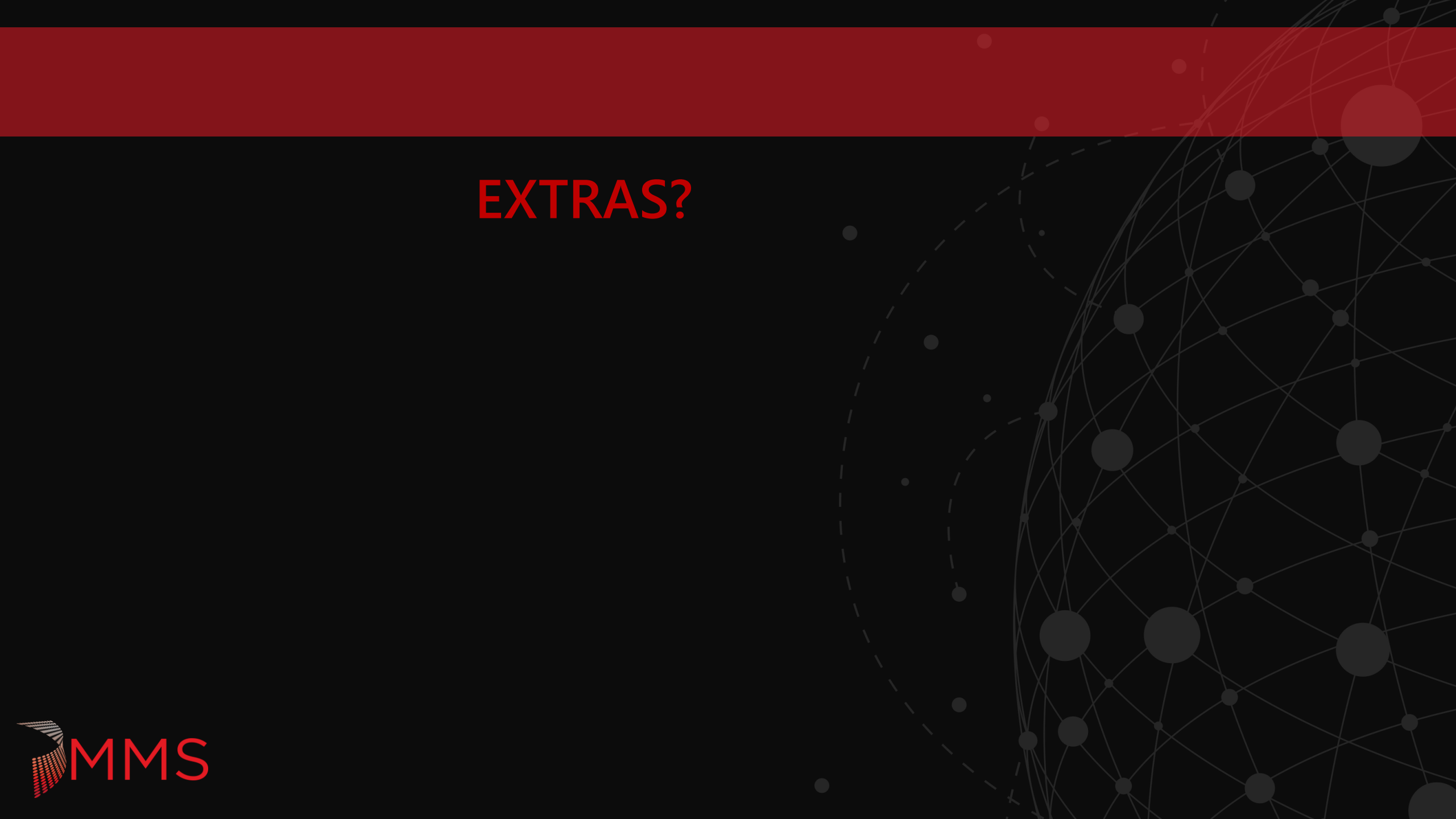
EXTRAS?



DPAPI ENCRYPTION – CREDENTIAL MANAGER

- **Is the Credential Manager a good place for Passwords:**
  - **It depends**
  - **The API for Credential manager is standard and easy to use and an obvious spot for hackers**
  - **There is no way to add entropy**

https://github.com/davotronic5000/PowerShell_Credential_Manager

MEMORY PROTECTION

- This is used by application with extremely sensitive data
- Requires Specific 16 byte chunks
- This is less common in PowerShell
- Encrypt the data in memory. The result is stored in the same array as the original data.

MEMORY PROTECTION ENCRYPTION

- **Encoding**:

```
$pwd = 'Password'
[byte[]]$Bytes = [System.Text.Encoding]::Unicode.GetBytes($pwd)
$Bytes
[System.Security.Cryptography.ProtectedMemory]::Protect($Bytes,
[System.Security.Cryptography.MemoryProtectionScope]::SameProcess)
$Bytes
```

- **Decoding**:

```
[System.Security.Cryptography.ProtectedMemory]::unProtect($Bytes,
[System.Security.Cryptography.MemoryProtectionScope]::SameProcess)
$Bytes
```

DPAPI ENCRYPTION -.NET

- **Encoding**:

```
$pwd = 'Password123'

$Bytes = [System.Text.Encoding]::Unicode.GetBytes($pwd)

$LMProtectedBytes = [System.Security.Cryptography.ProtectedData]::Protect($Bytes, $null, [System.Security.Cryptography.DataProtectionScope]::LocalMachine)

$CUProtectedBytes = [System.Security.Cryptography.ProtectedData]::Protect($Bytes, $null, [System.Security.Cryptography.DataProtectionScope]::CurrentUser)

$LMEncryptedString = [Convert]::ToBase64String($lmProtectedBytes)

$LMEncryptedString |clip

$LMEncryptedString

$CUEncrypted4String = [Convert]::ToBase64String($CUProtectedBytes)

$CUEncrypted4String|clip

$CUEncrypted4String
```

- **Decoding**:

```
'01000000d08c9ddf0115d1118c7a00c04fc297eb01000000010a0f4cb8ab5a42a48998a4aa3754d900000000020000000000106600000001000020000000ff6cfd739a8c52f3f06ff44c2089b356af952fc12ab9daec787377
a90dfc9f51000000$LMEncryptedBytes=
[Convert]::FromBase64String('AQAAANCMnd8BFdERjHoAwE/Cl+sBAAAACRDlWpWBPkWMPcyvU/E8FAQAAAACAAAAAAAQZgAAAAEAACAAAAD5y0XdgLmhV7PlNeq/qx8DMbfpTzIqIdMZaU5Enu65LAAAAAAOgAAAAAIAACAAAABZczDuLNNvGX
gzkU3zvDqM+M762/wwa6XSCbeU3sYxEiAAAAAnWf+zlZVdJVb46QmbCo9/VIbnS7OQjIMySx1OWJbxOkAAAABIsXtH7nlfGqGJY4Dj1RNmdcVd1blQKq15t9UwWYcPXAcB+tB3hpKvcl/MsTWJjr5ha8QRFdWCcAxH4aDc7r/S')

$LMDecryptedBytes = [System.Security.Cryptography.ProtectedData]::Unprotect($LMEncryptedBytes, $null, [System.Security.Cryptography.DataProtectionScope]::LocalMachine)

[System.Text.Encoding]::Unicode.GetString($LMDecryptedBytes)


$CUEncryptedBytes=
[Convert]::FromBase64String('AQAAANCMnd8BFdERjHoAwE/Cl+sBAAAAAQoPTLirWkKkiZikqjdU2QAAAAACAAAAAAAQZgAAAAEAACAAAAC3YgkN7d85y3q3O3Mn6YXyOh1T5EfU4GMg8ohN6RZECAAAAAAOgAAAAAIAACAAAAA1MaVMjrlfYG8J5
lDCtTY39Hmp7hc8QflbSUiRhKbsFCAAAADallqxWy9HeUw2FoIF5A3LoZ9mMrl8nqikyIm8em9+GkAAAAC8/cq8QTFod93Mbbl0ksNI40Uw5EcH0aegk8AxNgWT7penxgYfSZPIfZ2xbUTDr//i1adtyLDTt/P4LOx+R76+')

$CUDecryptedBytes = [System.Security.Cryptography.ProtectedData]::Unprotect($CUEncryptedBytes, $null, [System.Security.Cryptography.DataProtectionScope]::CurrentUser)

[System.Text.Encoding]::Unicode.GetString($CUDecryptedBytes)
```

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DPAPI ENCRYPTION - SUBSYSTEM

- Local system

%WINDIR%/System32/Microsoft/Protect

- Current User – Semi Portable

%appdata%\Microsoft\Protect

SYMMETRIC ENCRYPTION - .NET

- **Encoding**:

```
$pwd = 'Password123'
$bytes =  [System.Text.Encoding]::UTF8.GetBytes($pwd)

$Userinput = 'this is not the password but something else!'
$keybytes = [System.Text.Encoding]::UTF8.GetBytes($Userinput)
[Byte[]] $Key = [System.Security.Cryptography.HashAlgorithm]::Create('SHA256').ComputeHash($keybytes)
[Byte[]] $iv = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

#or
#$Key = (new-Object Security.Cryptography.PasswordDeriveBytes $Userinput, $Null, "SHA1", 5).GetBytes(32)
#$iv = (new-Object Security.Cryptography.SHA1Managed).ComputeHash( [Text.Encoding]::UTF8.GetBytes('0') )[0..15]

# default is 256 bit
$aes = [System.Security.Cryptography.Aes]::Create()
$encryptor = $aes.CreateEncryptor($Key,$iv)
$Decryptor = $aes.CreateDecryptor($Key,$iv)

$stream = [System.IO.MemoryStream]::new()
$encryptostream = [System.Security.Cryptography.CryptoStream]::new($stream,$encryptor, 'write')
$EncryptedstreamWriter = [System.IO.StreamWriter]::new($encryptostream)
$EncryptedstreamWriter.Write($pwd)
$EncryptedstreamWriter.close()
$encryptostream.close()
[byte[]]$encryptedBytes = $stream.ToArray()
$encrypted = [Convert]::ToBase64String($encryptedBytes)
```

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SYMMETRIC ENCRYPTION - .NET

- **Encoding**:

```
$pwd = 'Password123'
$bytes =  [System.Text.Encoding]::UTF8.GetBytes($pwd)

$Userinput = 'this is not the password but something else!'
$keybytes = [System.Text.Encoding]::UTF8.GetBytes($Userinput)
[Byte[]] $Key = [System.Security.Cryptography.HashAlgorithm]::Create('SHA256').ComputeHash($keybytes)
[Byte[]] $iv = $Key[0..15]
$aes = [System.Security.Cryptography.Aes]::Create()
$encryptor = $aes.CreateEncryptor($Key,$iv)
$Decryptor = $aes.CreateDecryptor($Key,$iv)

$stream = [System.IO.MemoryStream]::new()
$encryptostream = [System.Security.Cryptography.CryptoStream]::new($stream,$encryptor, 'write')
$EncryptedstreamWriter = [System.IO.StreamWriter]::new($encryptostream)
$EncryptedstreamWriter.Write($pwd)
$EncryptedstreamWriter.close()
$encryptostream.close()
[byte[]]$encryptedBytes = $stream.ToArray()
$encrypted = [Convert]::ToBase64String($encryptedBytes)
```

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SYMMETRIC ENCRYPTION - .NET

- **Encoding**:

```
$encryptedBytes = [convert]::FromBase64String('UvYe1wRg0QVoxY8ItywJbw==')
$decryptstream = [System.IO.MemoryStream]::new($encryptedBytes)
$decryptostream = [System.Security.Cryptography.CryptoStream]::new($decryptstream,
$Decryptor, 'read')
$DeStreamReader = [io.streamreader]::new($decryptostream)
$DeStreamReader.ReadToEnd()
$DeStreamReader.close()
$cryptostream.close()
$decryptstream.close()
```

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