Microsoft

PowerShell Foundation Skills

Module 4: Pipeline Basics

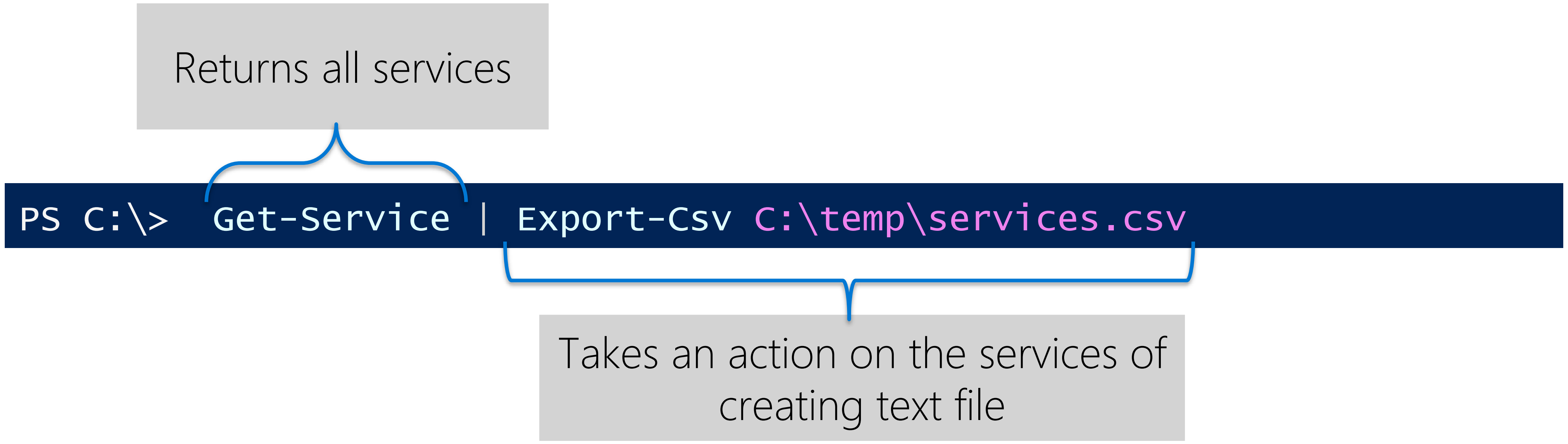
Pipeline Introduction

What is a Pipeline?

- Series of commands connected by pipeline character
- Vertical bar character |
- Sends output of command as input to another (left to right)
- Passes Objects, not text
- Filtering, Formatting, and Outputting available
- Cmdlets designed to chain together into ‘pipelines’

Get cmdlets

- Typically placed first in the pipeline
- Provides the input to be processed



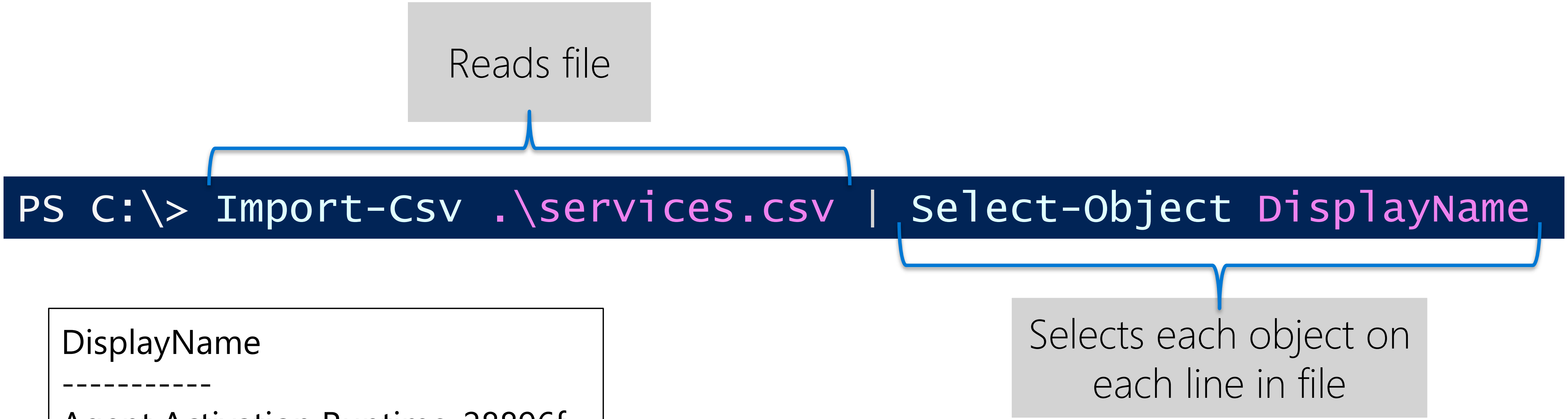
Returns all services

```
PS C:\>  Get-Service | Export-Csv C:\temp\services.csv
```

Takes an action on the services of creating text file

File input

Text files provide input to be processed by pipeline



```
PS C:\> Import-Csv .\services.csv | Select-Object DisplayName
```

```
DisplayName
-----------
Agent Activation Runtime_28896f
AllJoyn Router Service
Application Layer Gateway Service
Application Identity
...
```

Demonstration

Pipeline Basics

Pipeline Object Manipulation

Object cmdlets

Sort-Object

- Sorts objects by property values

Select-Object

- Selects object properties

Group-Object

- Groups objects that contain the same value for specified properties

Measure-Object

- Calculates numeric properties of objects
- Ex. characters, words, lines in string objects

Compare-Object

- Compares two sets of objects

Sort-Object and Select-Object

Get all processes, **Sort** by handle counts, then **Select** bottom 2

```
PS C:\> Get-Process | Sort-Object -Property Handles | Select-Object -last 2

Handles  NPM(K) PM(K)  WS(K)  VM(M)  CPU(s) Id  ProcessName
-------  ------ -----  -----  -----  ------ --  -----------
   1283      55 21020  30340   1237  477.78 304  svchost
   1926      44 285244 230112  1165  716.45 4124 livecomm
```

Group-Object

Get security event log, then **Group** by entry type

```
PS C:\> Get-EventLog -LogName Security | Group-Object EntryType

 Count Name             Group
------ ----             -----
18105 SuccessAudit     {System.Diagnostics.EventLogEntry,Sys...
   25 FailureAudit     {System.Diagnostics.EventLogEntry,Sys...
```

Measure-Object

Get files in **c:\scripts**, then **Measure** number (count) and **total size** (length) in **bytes**

```
PS C:\> Get-ChildItem C:\Scripts | Measure-Object -Property Length -Sum

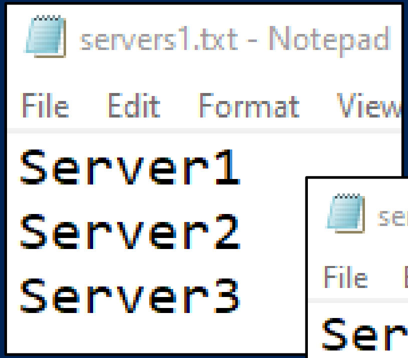
Count    : 2
Average  :
Sum      : 217837
Maximum  :
Minimum  :
Property : Length
```

Compare-Object

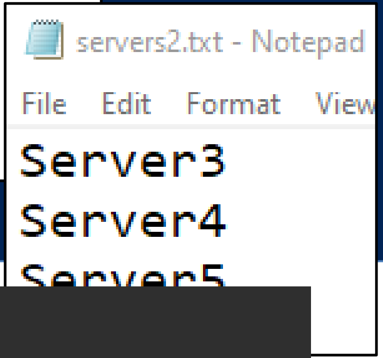
Comparing text files

```
PS C:\> Get-Content -Path .\servers1.txt -OutVariable ref
PS C:\> Get-Content -Path .\servers2.txt -OutVariable diff
PS C:\> Compare-Object -ReferenceObject $ref -DifferenceObject $diff

InputObject SideIndicator
----------- -------------
Server4     =>
Server5     =>
Server1     <=
Server2     <=
```



```
Server1
Server2
Server3
```



```
Server3
Server4
Server5
```

Server 4 and 5 only in difference file pointing to the right
Server 1 and 2 only in reference file pointing to the left
Server 3 in both files, needs **IncludeEqual** parameter for visibility

Storing pipeline output in variable

- Pipeline output can be stored in a user-defined variable using the "**=**" assignment operator

Storing cmdlet output in a variable

```
PS C:\> $Events = Get-EventLog -LogName Security | Group-Object EntryType
```

Accessing output using variable **name** and **$** prefix

```
PS C:\> $Events

 Count Name         Group
 ----- ----         -----
135950 SuccessAudit {System.Diagnostics.EventLogEntry...
    40 FailureAudit {System.Diagnostics.EventLogEntry...
```

Demonstration

Object Manipulation

Formatting Cmdlets

Format cmdlets

- Convert pipeline objects into **formatted** output, typically for **human** consumption
- Should be **last** Cmdlet on pipeline (only followed by Out-* Cmdlets)

Format-List (FL)

Format-Table (FT)

Format-Wide (FW)

Formatting Examples

```
PS> Get-Service net* | Format-Table -Property DisplayName, Status, StartType

DisplayName                     Status StartType
-----------                     ------ ---------
Netlogon                       Stopped    Manual
Network Connections            Running    Manual
Network List Service           Running    Manual
Network Setup Service          Stopped    Manual
Net.Tcp Port Sharing Service   Stopped  Disabled

PS>  Get-Service net* | Format-List -Property DisplayName, Status, StartType

DisplayName : Netlogon
Status      : Stopped
StartType   : Manual

DisplayName : Network Connections
Status      : Running
StartType   : Manual
…
```

Demonstration

Format commands

Import / Export cmdlets

Import cmdlets

Imports data from files as objects

Import-Csv

- -Path
- -Delimiter
- -Header

Import-CliXml

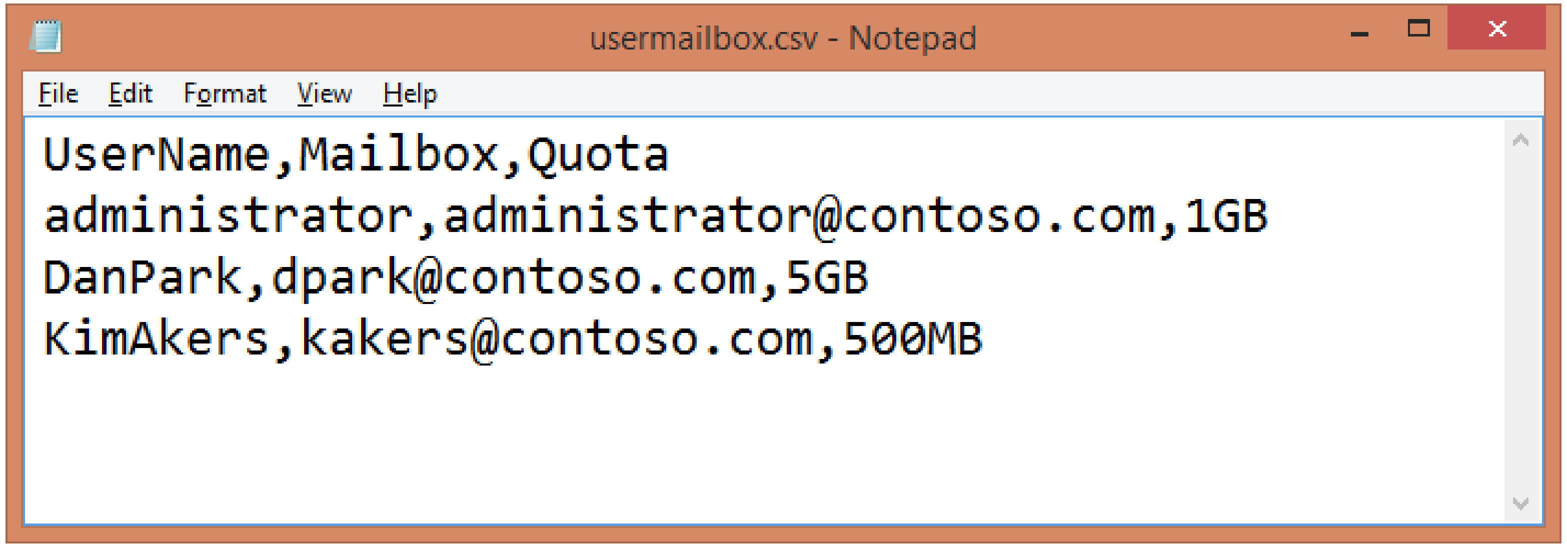
- -Path
- -First

```
PS C:\> $UPNs = Import-Csv –Path .\usernames.csv –Delimiter “;”
```

Import-Csv

```
PS> $Mailbox = Import-Csv C:\userMailboxes.csv | Select-Object mailbox
PS> $Mailbox

Mailbox
--------
administrator@contoso.com
dpark@contoso.com
kakers@contoso.com
```

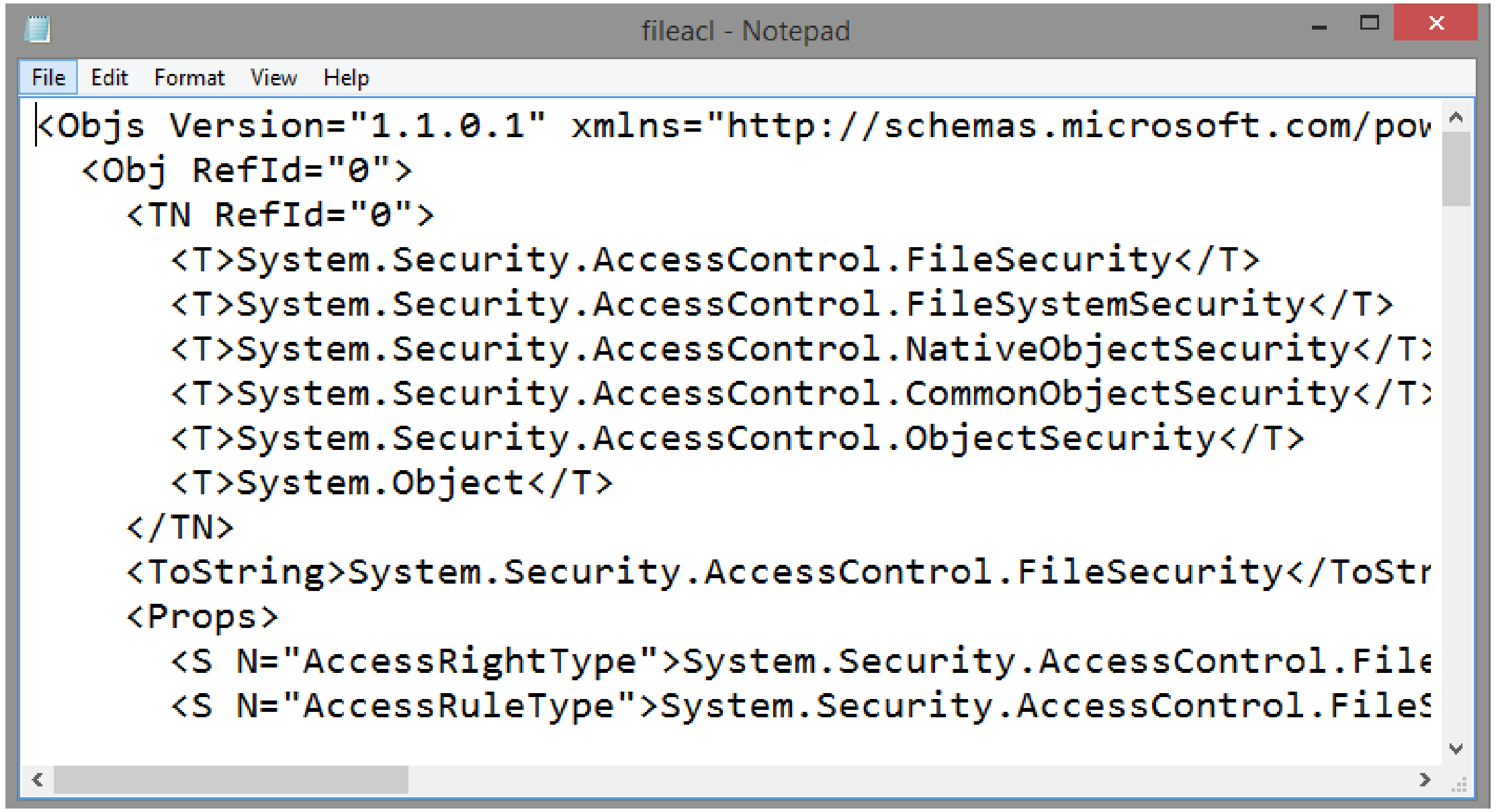


```
UserName,Mailbox,Quota
administrator,administrator@contoso.com,1GB
DanPark,dpark@contoso.com,5GB
KimAkers,kakers@contoso.com,500MB
```

Import-CliXml

```
PS> notepad .\fileacl.xml

PS> $ACL = Import-Clixml -Path fileacl.xml
```



```
<Objs Version="1.1.0.1" xmlns="http://schemas.microsoft.com/pow
  <Obj RefId="0">
    <TN RefId="0">
      <T>System.Security.AccessControl.FileSecurity</T>
      <T>System.Security.AccessControl.FileSystemSecurity</T>
      <T>System.Security.AccessControl.NativeObjectSecurity</T>
      <T>System.Security.AccessControl.CommonObjectSecurity</T>
      <T>System.Security.AccessControl.ObjectSecurity</T>
      <T>System.Object</T>
    </TN>
    <ToString>System.Security.AccessControl.FileSecurity</ToStr
    <Props>
      <S N="AccessRightType">System.Security.AccessControl.File
      <S N="AccessRuleType">System.Security.AccessControl.FileS
```

Export cmdlets

Export pipeline objects to text file

Export-Csv

- -Path
- -Delimiter
- -NoTypeInformation

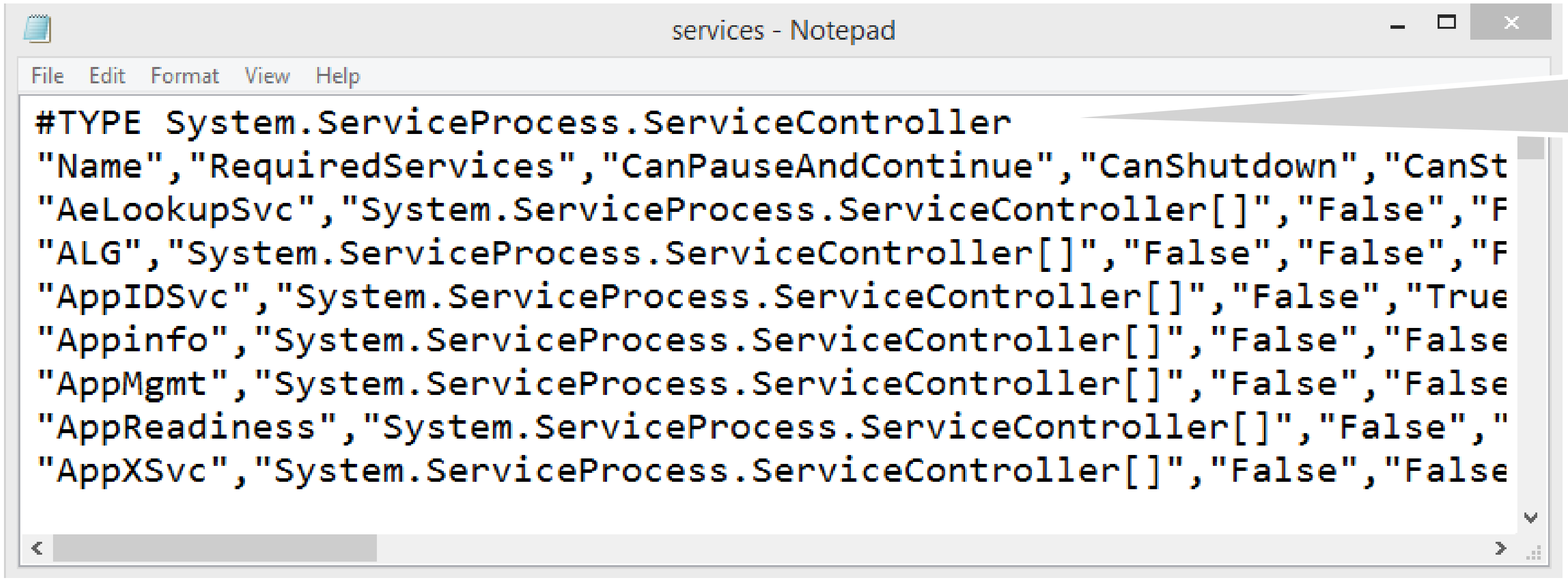
Export-CliXml

- -Path
- -First

Export-CSV

```
PS C:\> Get-Service | Export-Csv c:\temp\services.csv

PS C:\> notepad.exe C:\temp\services.csv
```



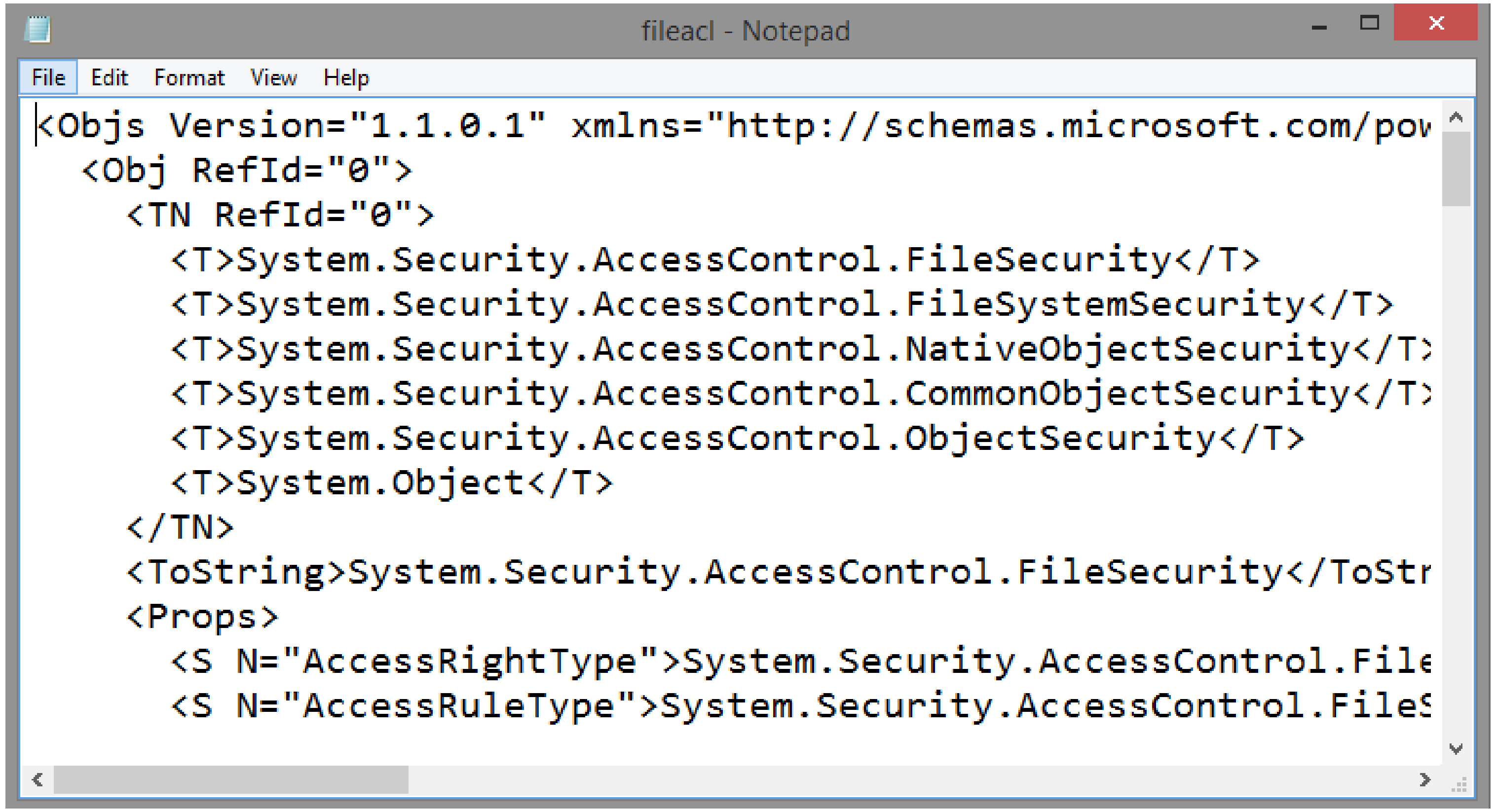
```
#TYPE System.ServiceProcess.ServiceController
"Name","RequiredServices","CanPauseAndContinue","CanShutdown","CanSt
"AeLookupSvc","System.ServiceProcess.ServiceController[]","False","F
"ALG","System.ServiceProcess.ServiceController[]","False","False","F
"AppIDSvc","System.ServiceProcess.ServiceController[]","False","True
"Appinfo","System.ServiceProcess.ServiceController[]","False","False
"AppMgmt","System.ServiceProcess.ServiceController[]","False","False
"AppReadiness","System.ServiceProcess.ServiceController[]","False","
"AppXSvc","System.ServiceProcess.ServiceController[]","False","False
```

-NoTypeInformation parameter removes 1st line type reference

Export-Clixml

```
PS C:\> Get-Acl C:\Process.txt -Audit | Export-Clixml -Path fileacl.xml

PS C:\> notepad .\fileacl.xml
```



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<Objs Version="1.1.0.1" xmlns="http://schemas.microsoft.com/pow
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      <T>System.Security.AccessControl.FileSystemSecurity</T>
      <T>System.Security.AccessControl.NativeObjectSecurity</T>
      <T>System.Security.AccessControl.CommonObjectSecurity</T>
      <T>System.Security.AccessControl.ObjectSecurity</T>
      <T>System.Object</T>
    </TN>
    <ToString>System.Security.AccessControl.FileSecurity</ToStr
    <Props>
      <S N="AccessRightType">System.Security.AccessControl.File
      <S N="AccessRuleType">System.Security.AccessControl.FileS
```

Out Cmdlets

Out cmdlets

Out-Default

- Sends output to default formatter and to default output cmdlet (Out-Host)

Out-Host

- Default, sends output to PowerShell host
- Paging switch parameter displays one page at a time

Out-File

- Sends output to a file, append switch parameter
- Encoding parameter allows control of the character encoding

Out-GridView

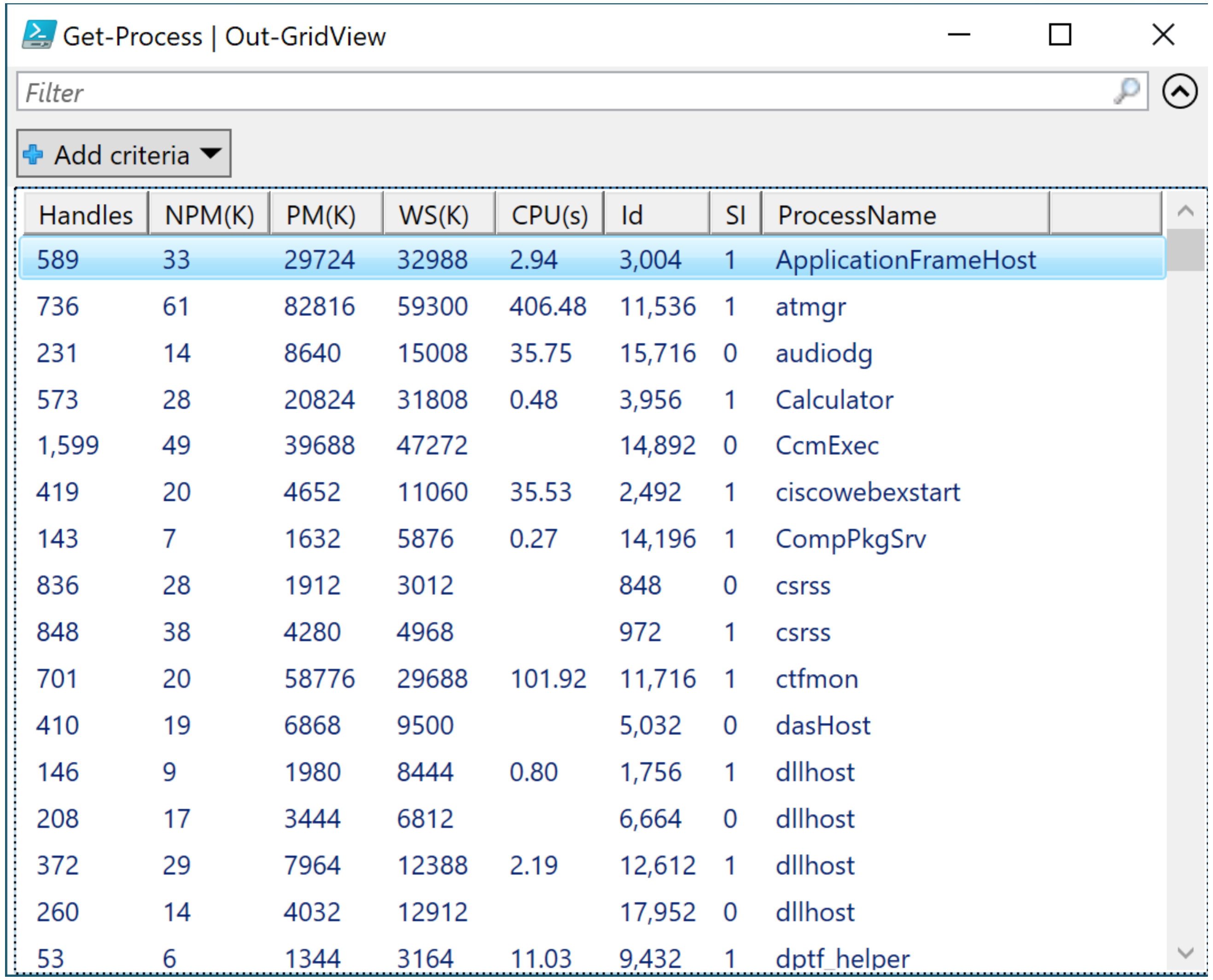
- Sends output to an interactive table in a separate GUI

Out-Null

- Deletes output instead of sending it down the pipeline

Out-GridView

```
PS C:\> Get-Process | Out-GridView
```

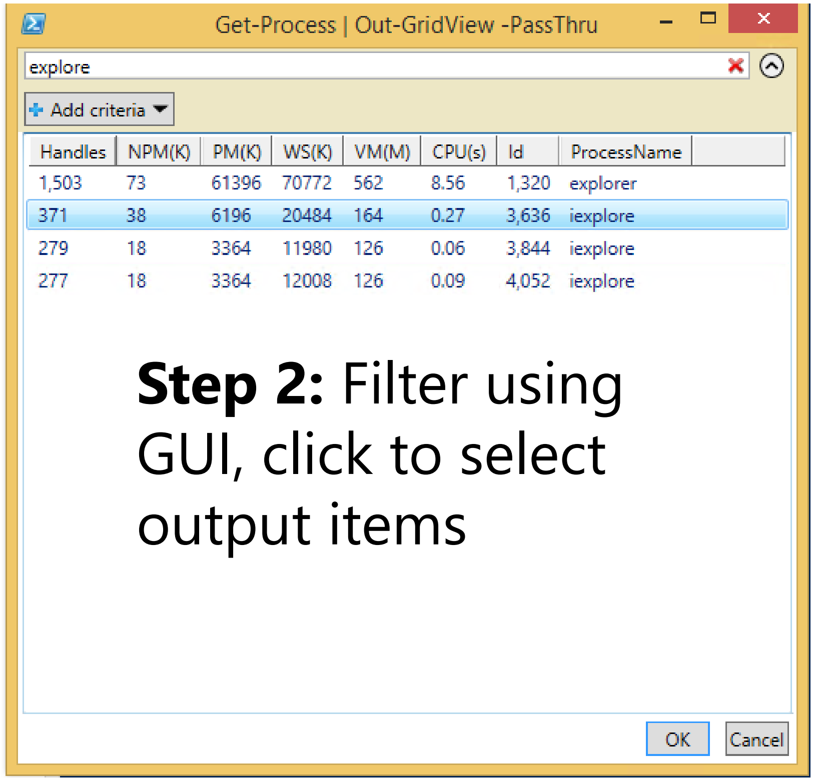


Handles	NPM(K)	PM(K)	WS(K)	CPU(s)	Id	SI	ProcessName
589	33	29724	32988	2.94	3,004	1	ApplicationFrameHost
736	61	82816	59300	406.48	11,536	1	atmgr
231	14	8640	15008	35.75	15,716	0	audiodg
573	28	20824	31808	0.48	3,956	1	Calculator
1,599	49	39688	47272		14,892	0	CcmExec
419	20	4652	11060	35.53	2,492	1	ciscowebexstart
143	7	1632	5876	0.27	14,196	1	CompPkgSrv
836	28	1912	3012		848	0	csrss
848	38	4280	4968		972	1	csrss
701	20	58776	29688	101.92	11,716	1	ctfmon
410	19	6868	9500		5,032	0	dasHost
146	9	1980	8444	0.80	1,756	1	dllhost
208	17	3444	6812		6,664	0	dllhost
372	29	7964	12388	2.19	12,612	1	dllhost
260	14	4032	12912		17,952	0	dllhost
53	6	1344	3164	11.03	9,432	1	dptf_helper

Out-GridView with PassThru

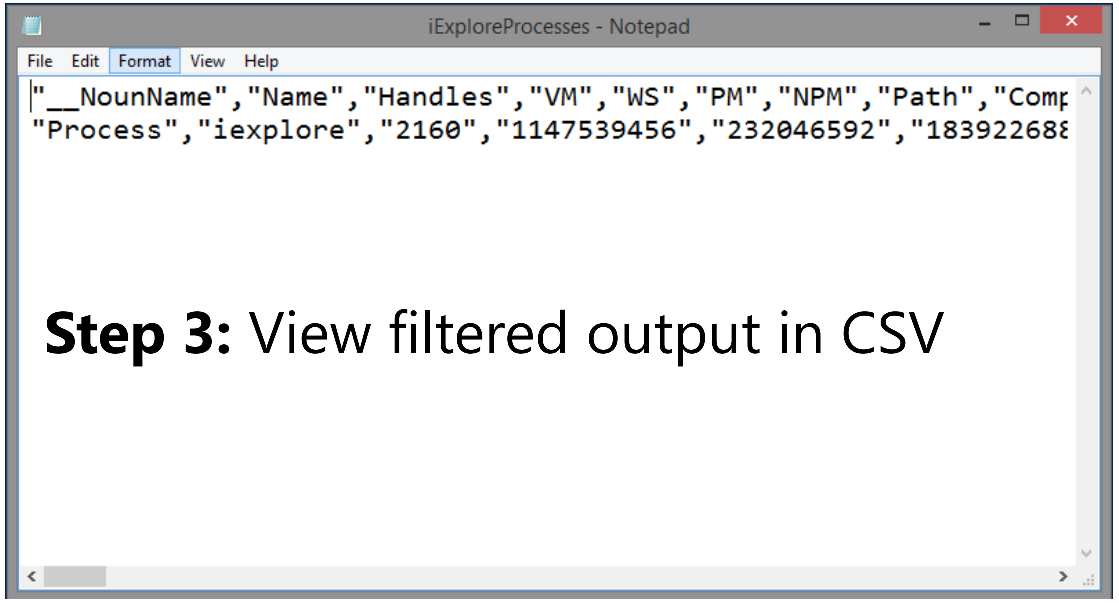
Step 1: Create variable with content and pipe to desired result

```
PS> $Procs = Get-Process
PS> $Procs | Out-GridView -PassThru | Export-Csv c:\temp\File.csv -NoTypeInformation
```



Handles	NPM(K)	PM(K)	WS(K)	VM(M)	CPU(s)	Id	ProcessName
1,503	73	61396	70772	562	8.56	1,320	explorer
371	38	6196	20484	164	0.27	3,636	iexplore
279	18	3364	11980	126	0.06	3,844	iexplore
277	18	3364	12008	126	0.09	4,052	iexplore

Step 2: Filter using GUI, click to select output items



```
"__NounName","Name","Handles","VM","WS","PM","NPM","Path","Comp
"Process","iexplore","2160","1147539456","232046592","18392268
```

Step 3: View filtered output in CSV

ConvertTo/From cmdlets

ConvertTo/From cmdlets

Helpful when converting native data formats into PowerShell objects

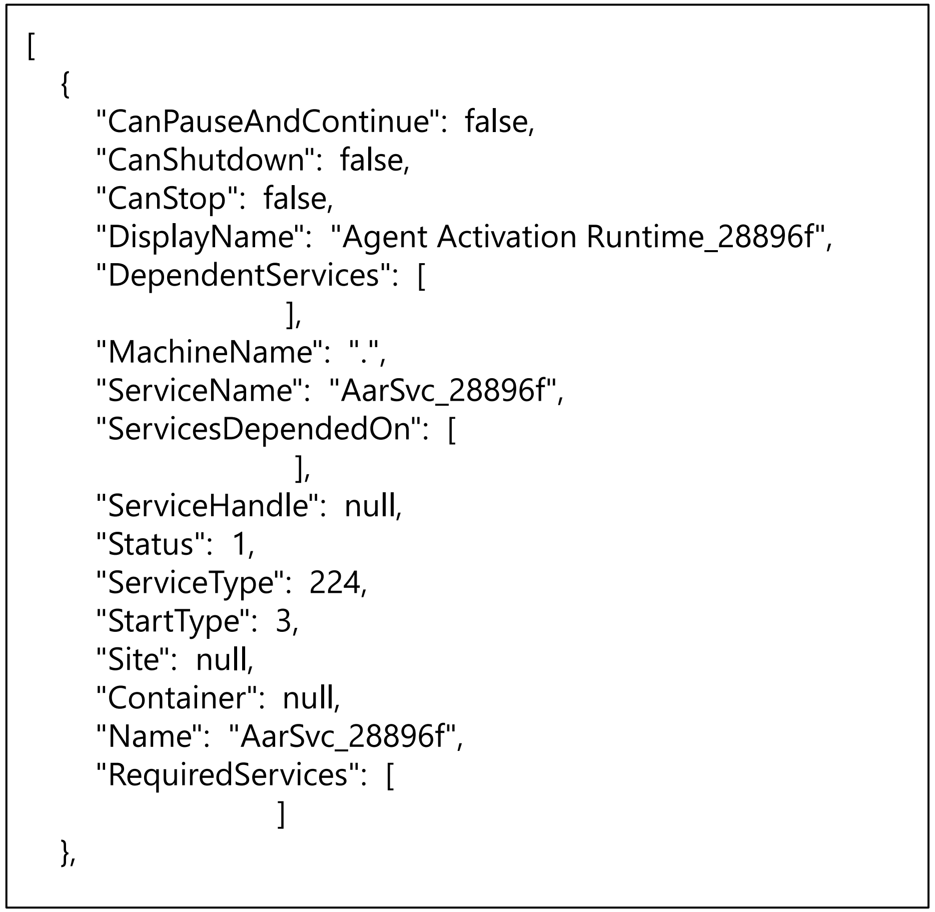
ConvertTo-CSV
ConvertFrom-CSV

ConvertTo-Json
ConvertFrom-Json

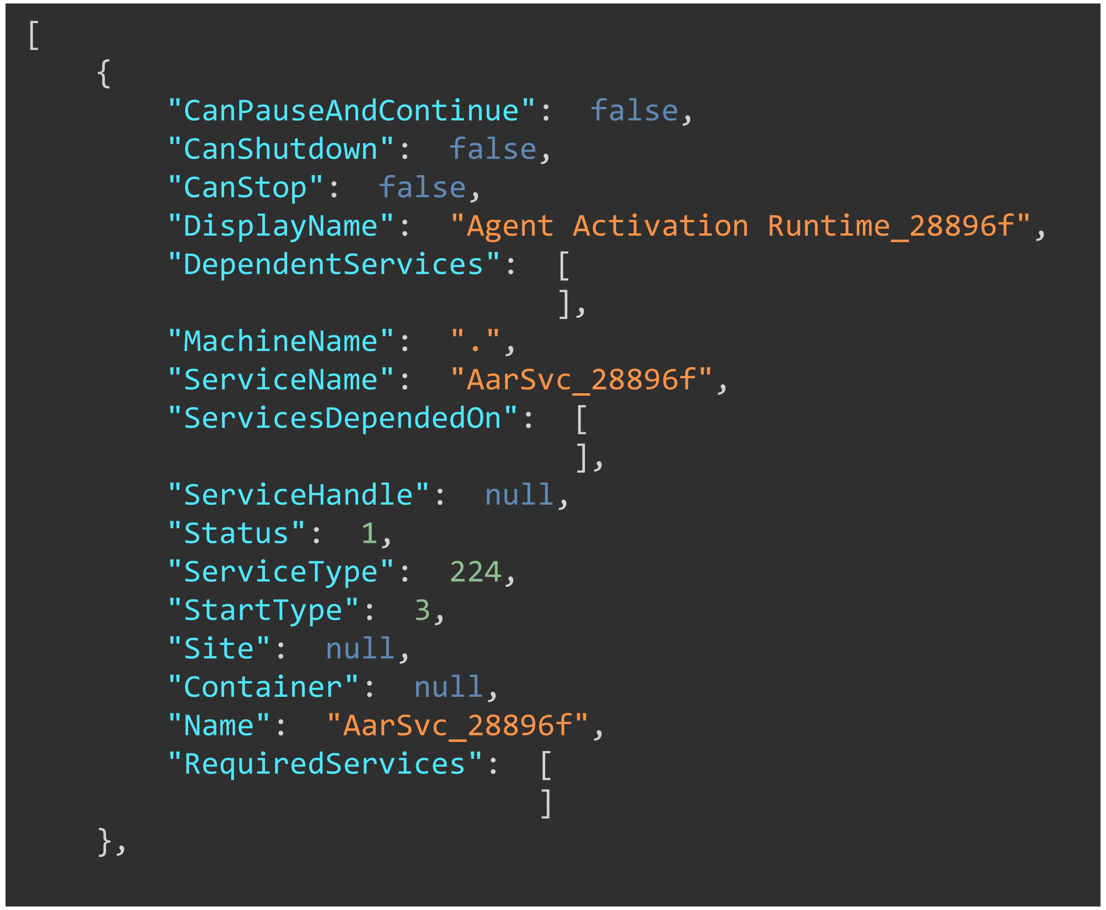
ConvertTo-Html

ConvertTo-Json

```
PS C:\> Get-Service | ConvertTo-Json | Out-File c:\temp\services.json
PS C:\> notepad.exe C:\temp\services.json
PS C:\> code . C:\temp\services.json
```



```
[
    {
        "CanPauseAndContinue":  false,
        "CanShutdown":  false,
        "CanStop":  false,
        "DisplayName":  "Agent Activation Runtime_28896f",
        "DependentServices":  [
                              ],
        "MachineName":  ".",
        "ServiceName":  "AarSvc_28896f",
        "ServicesDependedOn":  [
                               ],
        "ServiceHandle":  null,
        "Status":  1,
        "ServiceType":  224,
        "StartType":  3,
        "Site":  null,
        "Container":  null,
        "Name":  "AarSvc_28896f",
        "RequiredServices":  [
                             ]
    },
```



```
[
    {
        "CanPauseAndContinue":  false,
        "CanShutdown":  false,
        "CanStop":  false,
        "DisplayName":  "Agent Activation Runtime_28896f",
        "DependentServices":  [
                              ],
        "MachineName":  ".",
        "ServiceName":  "AarSvc_28896f",
        "ServicesDependedOn":  [
                               ],
        "ServiceHandle":  null,
        "Status":  1,
        "ServiceType":  224,
        "StartType":  3,
        "Site":  null,
        "Container":  null,
        "Name":  "AarSvc_28896f",
        "RequiredServices":  [
                             ]
    },
```

Demonstration

Import / export commands

Lab 3:
Pipeline Basics

60 Minutes

LAB

Microsoft