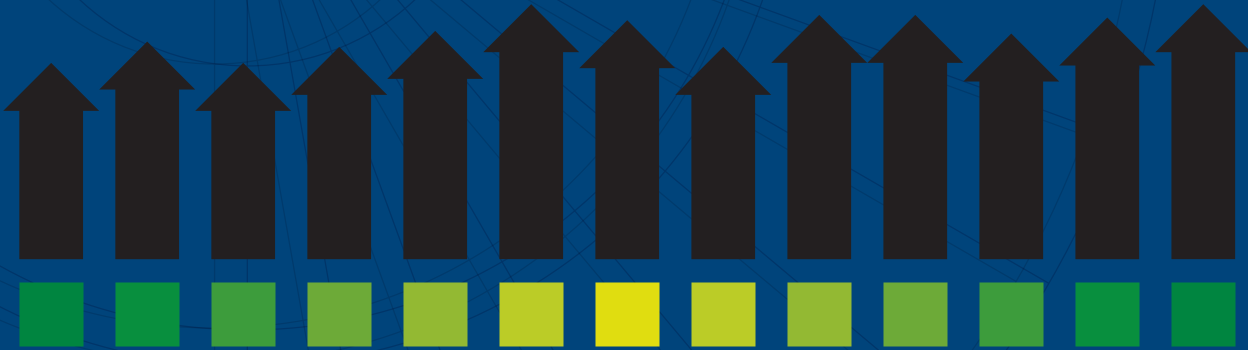
Microsoft

Windows PowerShell



BEST PRACTICES

Ed Wilson

Microsoft

Windows PowerShell Best Practices

Ed Wilson

Published with the authorization of Microsoft Corporation by:

O'Reilly Media, Inc.
1005 Gravenstein Highway North
Sebastopol, California 95472

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ISBN: 978-0-7356-6649-8

Second Printing: April 2014

Printed and bound in the United States of America.

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This book is dedicated to Teresa. You make each day feel like it is filled with infinite possibilities.

—Ed Wilson

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Foreword

In April 2003, Microsoft's Jeffrey Snover gave me an early peek at PowerShell or, as it was known in its beta days, "Monad." I must admit that, while I fell in love with PoSH at first sight, I was just too darned busy with other work to really get my hands dirty with it for another five years, and I soon realized that boy, had I missed a few memos. "Objects in a pipeline? Is that anything like snakes on a plane?" "Hash tables? Can I get mine with a fried egg?"

Yup, there was a lot to learn, and I nearly wore out Google looking up PoSH-y things. Just about every one of those searches, however, seemed to lead me to the same place: the Hey, Scripting Guy! Blog. I quickly noticed that the blog delivered new articles daily, and so I was very surprised to see that the vast majority of those articles were penned by one guy: Ed Wilson. Since then, I've gotten to know Ed personally, and trust me, he's even funnier and more entertaining in person than he is in print, which brings me to this volume.

If you're a Windows admin, learning Windows PowerShell is an essential (as in you need to do this if you want to remain a Windows admin) task. It's not always an easy one, though, and you will often find yourself wishing for the "answers in the back of the book" so to speak. Well, Ed's written that book, and you're holding the latest edition. Work your way through *Windows PowerShell Best Practices*, actually take the time to try out the examples, and soon you, too, will be automating, scripting, and workflow-ing like mad. Happy PowerShelling!

—Mark Minasi, author of the *Mastering Windows Server* books

P.S. In case you don't already know, objects in a pipeline are way cooler than snakes on a plane. Really.

Introduction

Welcome to *Windows PowerShell Best Practices*, a book that was developed together with the Microsoft Windows PowerShell product group to provide in-depth information about Windows PowerShell and best practices based on real-life experiences with the product in use in different environments. Numerous sidebars are also included that detail experiences from skilled industry professionals such as Enterprise Admins and Windows PowerShell Most Valuable Professionals (MVPs).

The book is largely based on Windows PowerShell 4.0 as it exists on Windows 8.1 and on Windows Server 2012 R2. Because Windows PowerShell introduced Desired State Configuration in Windows PowerShell 4.0, Chapter 23, "Using the Windows PowerShell DSC," must be run on a computer with Windows PowerShell 4.0 installed on it. Nearly all of the material in the other chapters will work without modification on Windows PowerShell 3.0 (on Windows 8 or on Windows Server 2012). A large part of the book also applies to Windows PowerShell 2.0 running on any version of Windows that it installs upon.

Who is this book for?

Microsoft *Windows PowerShell Best Practices* is for anyone tasked with designing, implementing or managing enterprise products. This includes Active Directory Domain Services, System Center, Exchange, and SharePoint products. In addition, it is designed for anyone who either teaches or trains others on Windows PowerShell or even for the MCSE track of courseware. Lastly, power users who want to automate their desktops will also benefit from the explanations, scenarios, and sample scripts.

How is this book organized?

This book is organized into four parts:

- Part I: Understanding the basics of Windows PowerShell
- Part II: Planning for scripting
- Part III: Designing the script
- Part IV: Deploying the script

The first part of this book consists of two chapters that focus on the basics of Windows PowerShell capabilities. This portion of the book is a level setting and would be ideal for anyone just learning Windows PowerShell.

The second part of the book discusses identifying scripting opportunities, the scripting environment, and avoiding scripting pitfalls. This part is also ideal for people learning Windows PowerShell, but it is also a great section for admins experienced with the fundamentals of Windows PowerShell but who need to write new scripts.

The third section of the book talks about how you actually design a script—how you plan for inputs and outputs to the script and how you document your scripts. This is a more advanced section, and it is appropriate for advanced students and for people who write scripts that others are expected to utilize.

The last section of the book talks about deploying scripts—how you run them; how you handle versioning; and how you use remote, workflow, and DSC capabilities in your script. This is appropriate for enterprise admins who are firmly entrenched in DevOps.

System requirements

This book is designed to be used with the following Exchange 2010 software:

- Windows Server 2008 or Windows Server 2008 R2
- 1 GB of RAM
- x64 architecture-based computer with Intel or AMD processor that supports 64 bit
- 1.2 GB of available disk space
- Display monitor capable of 800 × 600 resolution

The following list details the minimum system requirements needed to run the content in the book's companion website:

- Windows XP with the latest service pack installed and the latest updates from Microsoft Update Service
- Display monitor capable of 1024 × 768 resolution
- CD-ROM drive
- Microsoft mouse or compatible pointing device

The companion website

This book features a companion website that makes available to you additional information such as job aids, quick reference guides, and additional Windows PowerShell resources. These elements are included to help you plan and manage your Windows PowerShell organization and apply the book's recommended best practices. The companion website includes the following:

- **Job Aids** Additional documents on most of the chapters that help you to collect and structure your work through the book.
- **Quick Reference Guides** These guides provide an overview of all best practice recommendations in the book as well as a collection of all Internet links referenced in the book.

You can download these files from the companion website, which is located at *http://gallery.technet.microsoft.com/scriptcenter/PowerShell-40-Best-d9e16039*.

Acknowledgements

A book of this scope does not happen without assistance. First I must thank my wife, Teresa Wilson, aka the Scripting Wife. She not only coordinated the acquisition of sidebars, but she also read the entire book at least three times. My technical reviewer, Microsoft PFE Brian Wilhite, was great at catching things that would have made me look silly. He also made numerous suggestions for improving not only the clarity of the writing, but in some cases the accuracy of the code. Brian absolutely rocks. Luckily, the Windows PowerShell community is very enthusiastic and as a result was receptive for my call for sidebars. The high quality of the sidebars, and the diversity of content was fun to read, and in the end makes for a much better book. If you run across one of the authors of the sidebars, make sure you tell them "hi." Lastly, I want to thank Jeffrey Snover, Ken Hansen and the rest of the Windows PowerShell team. They made an awesome product that just keeps getting better and better each year. Windows PowerShell for the win!

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Errata

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CHAPTER 3

Using the Active Directory module

- Understanding the Active Directory module
- Using the Active Directory module
- Additional resources

Understanding the Active Directory module

Microsoft made Active Directory Domain Services (AD DS) Windows PowerShell cmdlets available beginning with Windows Server 2008 R2. You can also download and install the Active Directory Management Gateway Service (ADMGS) that provides a web service interface to Active Directory domains or Active Directory Lightweight Directory Services that are running on the same server as the ADMGS. The ADMGS can run on Windows Server 2003 with Service Pack 2 or on Windows Server 2008. On Windows Server 2008 R2 and above, the ADMGS installs as a role and does not require an additional download. When you have one domain controller running Windows Server 2008 R2 (or later) in your domain, you can use the new cmdlets to manage your AD DS installation. Installing the ADMGS Windows Server 2003 or Windows Server 2008 does not make it possible to load the Active Directory module on those machines, but it does permit you to use the Active Directory module from another machine to manage those servers.

INSIDE TRACK

Ashley McGlone, Senior Premier Field Engineer
Microsoft Corporation

Some of us have been using Active Directory since the release candidates in 1999. Others have gotten started with it recently. But we all have one thing in common. We need to automate tasks across hundreds or thousands of users, computers, groups, OUs, and so on.

Over the years, our tools were basically VBScript with ADSI or canned command-line utilities like CSVDE or DSQUERY. (A few of us even used WMI or ADODB to

interface with the directory.) Those legacy scripting techniques faithfully carried us through many implementations and change controls.

But in the autumn of 2009, our tools made a giant leap forward. Windows Server 2008 R2 and the RSAT for Windows 7 introduced the Active Directory PowerShell Module. Wow! What would take 20 lines of VBScript can now be done in a single line of Windows PowerShell.

Here are some great examples of AD PowerShell one-liners:

```
Spreadsheet of stale accounts past 30 days:
Search-ADAccount -AccountInactive -TimeSpan 30 | Export-CSV .\Stale_
Accts.csv

Helpdesk prompt for a user password reset:
Set-ADAccountPassword (Read-Host 'Username') -Reset

Target list of global catalog domain controllers:
(Get-ADForest).GlobalCatalogs
```

In my field experience, I have written some large-scale scripts as well, such as the following:

- Active Directory SID history cleanup and file server ACL migrations
- DNS reorganization and migration to AD-integrated zones
- Security delegation reporting across OUs and GPOs

On the domain controller, this magic is made possible by the Active Directory Web Service (ADWS). The ADWS listens on port 9389 and answers to the Windows PowerShell cmdlets. Whether you're running a quick one-liner or automating across thousands of accounts, this service enables you to read and write directory data with ease.

With each release of Windows Server, the Active Directory module (and now companion modules) grows to support new features. The latest releases offer additional functionality to replace trusty utilities like DCPROMO and REPADMIN. Additionally, the Group Policy module enables further automation of workstation management through Active Directory.

The Active Directory module for Windows PowerShell is no longer new technology. This is a mature product that every administrator needs in their bag of tricks to make the work day go faster. Get started today with one simple Windows PowerShell command: `Import-Module ActiveDirectory`.

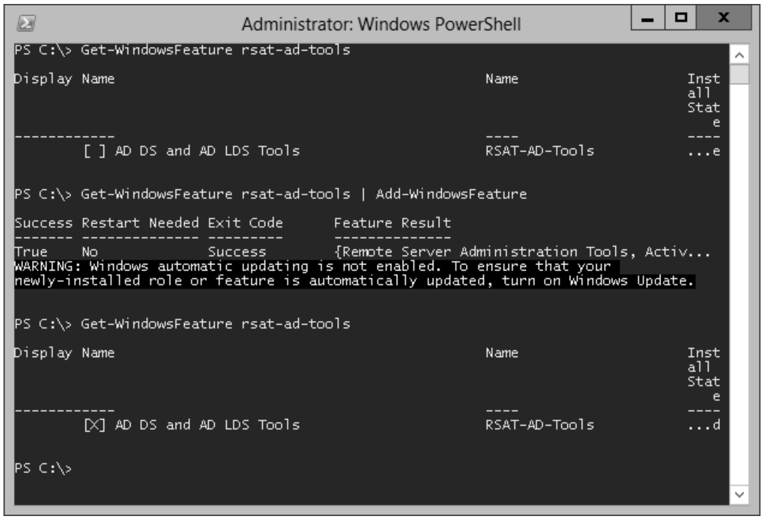
Installing the Active Directory module

The Active Directory module is available beginning with Windows 7 on the client side and with Windows 2008 R2 on servers. To make the cmdlets available on the desktop operating system requires downloading and installing the Remote Server Administration Tools (RSAT).

To install the Active Directory module on either a Windows Server 2012 or Windows Server 2012 R2 machine, you can use the `Add-WindowsFeature` cmdlet because the Active Directory module is directly available to the operating system as an optional Windows feature. Therefore, installation on a server operating system does not require downloading the RSAT tools. To install the RSAT tools for Active Directory, first use the `Get-WindowsFeature` cmdlet to get the rsat-ad-tools, and then pipeline it to the `Add-WindowsFeature` cmdlet. This technique is shown here:

```
Get-WindowsFeature rsat-ad-tools | Add-WindowsFeature
```

The output associated with getting and installing the rsat-ad-tools feature is shown in Figure 3-1.



```
Administrator: Windows PowerShell
PS C:\> Get-WindowsFeature rsat-ad-tools

Display Name                                            Name                Inst
                                                                            all
                                                                            Stat
                                                                               e
------------                                            ----                ----
        [ ] AD DS and AD LDS Tools                      RSAT-AD-Tools       ...e

PS C:\> Get-WindowsFeature rsat-ad-tools | Add-WindowsFeature

Success Restart Needed Exit Code      Feature Result
------- -------------- ---------      --------------
True    No             Success        {Remote Server Administration Tools, Activ...
WARNING: Windows automatic updating is not enabled. To ensure that your
newly-installed role or feature is automatically updated, turn on Windows Update.

PS C:\> Get-WindowsFeature rsat-ad-tools

Display Name                                            Name                Inst
                                                                            all
                                                                            Stat
                                                                               e
------------                                            ----                ----
        [X] AD DS and AD LDS Tools                      RSAT-AD-Tools       ...d

PS C:\>
```

FIGURE 3-1 Installing the RSAT tools provides access to the Active Directory module.

Getting started with the Active Directory module

After you have installed the RSAT tools, you will want to verify that the Active Directory is present and that it loads properly. To do this, use the `Get-Module` cmdlet with the *ListAvailable* switch to verify that the *ActiveDirectory* module is present. Here is the command to do this:

```
Get-Module -ListAvailable ActiveDirectory
```

After the *ActiveDirectory* module loads, you can obtain a listing of the Active Directory cmdlets by using the `Get-Command` cmdlet and specifying the *module* parameter. Because Windows PowerShell 4.0 automatically loads modules, you do not need to use the `Import-Module` cmdlet to import the *ActiveDirectory* module if you do not want to do so. This command is shown here:

```
Get-Command -Module ActiveDirectory
```

Using the Active Directory module

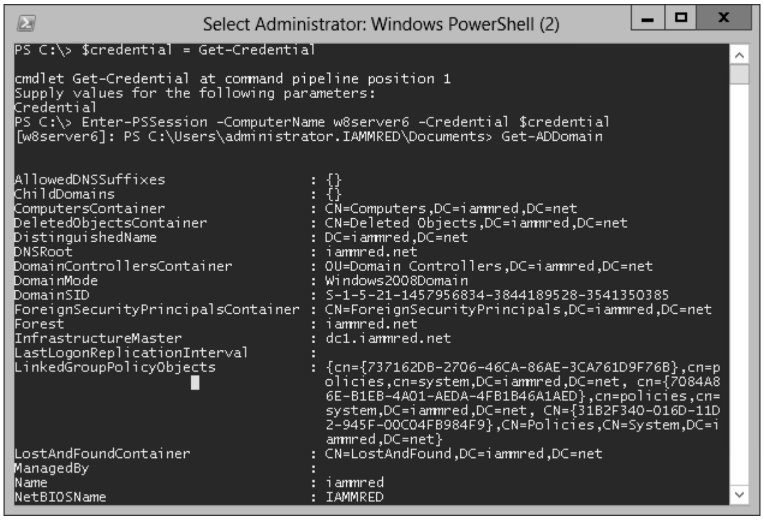
It is not necessary to always load the Active Directory module (or for that matter any module) because Windows PowerShell 3.0 and 4.0 automatically load the module containing a referenced cmdlet. The location searched by Windows PowerShell for modules comes from the environmental variable *PSModulePath*. To view the value of this environmental variable, preface the variable name with the environmental drive. The following command retrieves the default module locations and displays the associated paths:

```
PS C:\> $env:PSModulePath
C:\Users\ed.IAMMRED\Documents\WindowsPowerShell\Modules;C:\Program Files\WindowsPowe
rShell\Modules;C:\Windows\system32\WindowsPowerShell\v1.0\Modules\
```

If you do not want to install the Active Directory module on your client operating systems, all you need to do is to add the rsat-ad-tools feature to at least one server. When installed on the server, use Windows PowerShell remoting to connect to the server hosting the rsat-ad-tools feature from your client workstation. When in the remote session, if the remote server is Windows 8, all you need to do is call one of the Active Directory cmdlets. The *ActiveDirectory* module automatically loads, and the information returns. The following commands illustrate this technique:

```
$credential = get-credential
Enter-PSSession -ComputerName w8Server6 -Credential $credential
Get-ADDomain
```

The technique to use Windows PowerShell remoting to connect to a server that contains the Active Directory module and to automatically load that module while using a cmdlet from that module on Windows PowerShell 4.0 is shown in Figure 3-2.



```
PS C:\> $credential = Get-Credential

cmdlet Get-Credential at command pipeline position 1
Supply values for the following parameters:
Credential
PS C:\> Enter-PSSession -ComputerName w8server6 -Credential $credential
[w8server6]: PS C:\Users\administrator.IAMMRED\Documents> Get-ADDomain


AllowedDNSSuffixes                 : {}
ChildDomains                       : {}
ComputersContainer                 : CN=Computers,DC=iammred,DC=net
DeletedObjectsContainer            : CN=Deleted Objects,DC=iammred,DC=net
DistinguishedName                  : DC=iammred,DC=net
DNSRoot                            : iammred.net
DomainControllersContainer         : OU=Domain Controllers,DC=iammred,DC=net
DomainMode                         : Windows2008Domain
DomainSID                          : S-1-5-21-1457956834-3844189528-3541350385
ForeignSecurityPrincipalsContainer : CN=ForeignSecurityPrincipals,DC=iammred,DC=net
Forest                             : iammred.net
InfrastructureMaster               : dc1.iammred.net
LastLogonReplicationInterval       :
LinkedGroupPolicyObjects           : {cn={737162DB-2706-46CA-86AE-3CA761D9F76B},cn=p
                                     olicies,cn=system,DC=iammred,DC=net, cn={7084A8
                                     6E-B1EB-4A01-AEDA-4FB1B46A1AED},cn=policies,cn=
                                     system,DC=iammred,DC=net, CN={31B2F340-016D-11D
                                     2-945F-00C04FB984F9},CN=Policies,CN=System,DC=i
                                     ammred,DC=net}
LostAndFoundContainer              : CN=LostAndFound,DC=iammred,DC=net
ManagedBy                          :
Name                               : iammred
NetBIOSName                        : IAMMRED
```

FIGURE 3-2 Using Windows PowerShell 4.0 remoting to obtain Active Directory information without first loading the module.

NOTES FROM THE FIELD

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Like most Windows administrators, you probably work with Active Directory on a weekly, if not daily, basis. With Windows PowerShell, working with Active Directory is so much easier than it used to be. In fact, I've forgotten how complex structuring ADSI code can be. When installing a fresh copy of Windows, usually after customizing my profile, I will download and install the Remote Server Administration Tools (RSAT), to ensure that I have the *ActiveDirectory* Module for use within Windows PowerShell. From time to time, my manager has asked me to run a query against Active Directory to determine what computers have been enabled for delegation, for compliance reasons, and to possibly execute a task on those systems. So I turn to Windows PowerShell, with the *ActiveDirectory* module, for the answer.

First, you need to determine what Active Directory attributes to filter for. In my case, I'm looking for any computer object that has a value present for the *msDS-AllowedToDelegateTo* attribute or the *TrustedForDelegation* attribute value set to *true*. The Active Directory module has a cmdlet that will allow me to query Active Directory for these attributes and their settings. Consider the following example:

```
Get-ADComputer '
-Filter {msDS-AllowedToDelegateTo -like "*" -or TrustedForDelegation
-eq "True"} '
-Properties TrustedForDelegation, msDS-AllowedToDelegateTo |
Select Name, TrustedForDelegation, msDS-AllowedToDelegateTo
```

This will return any computer object that is trusted for delegation to any service or specific services. Finally, let's assume that you want to take those computers and query the Windows Updates that have been applied to them. You can run the following one-liner, assuming Windows PowerShell remoting is enabled on the targets, to pipe the results into the `Invoke-Command` cmdlet, launching *Get-HotFix* on the target machine, and storing the results in a variable:

```
$Results = Get-ADComputer '
-Filter {msDS-AllowedToDelegateTo -like "*" -or TrustedForDelegation -eq
"True"} '
-Properties TrustedForDelegation, msDS-AllowedToDelegateTo |
Select Name, TrustedForDelegation, msDS-AllowedToDelegateTo |
ForEach-Object {Invoke-Command -Command {Get-HotFix} -ComputerName
$_.Name}
```

After this runs, which might take a few minutes, given the number of computers, you will have a nice report that you can review. If you wanted to take it a step further, you could take the results variable and pipe it to a CSV file:

```
$Results | Export-Csv -Path C:\Temp\DelegationPatchReport.csv
```

Windows PowerShell with the *ActiveDirectory* module will make a Windows administrator's life easy when given a task big or small.

Finding the FSMO role holders

To find information about domain controllers and FSMO roles, you do not have to write a Windows PowerShell script; you can do it directly from the Windows PowerShell console or ISE by using the Active Directory cmdlets. The first thing that needs to done, more than likely, is to load the *ActiveDirectory* module into the current Windows PowerShell session. While it is possible to add the `import-module` command to your Windows PowerShell profile, in general it is not a good idea to load a bunch of modules that you might or might not use on a regular basis. In fact, you can load all the modules at once by piping the results of the `Get-Module` *–ListAvailable* command to the `Import-Module` cmdlet. This is shown here:

```
PS C:\> Get-Module -ListAvailable | Import-Module
PS C:\> Get-Module
```

```
ModuleType Name                      ExportedCommands
---------- ----                      ----------------
Script     BasicFunctions            {Get-ComputerInfo, Get-OptimalSize}
Script     ConversionModuleV6        {ConvertTo-Feet, ConvertTo-Miles, ConvertTo-...
Script     PowerShellPack            {New-ByteAnimationUsingKeyFrames, New-TiffBi...
Script     PSCodeGen                 {New-Enum, New-ScriptCmdlet, New-PInvoke}
Script     PSImageTools              {Add-CropFilter, Add-RotateFlipFilter, Add-O...
Script     PSRss                     {Read-Article, New-Feed, Remove-Article, Rem...
Script     PSSystemTools             {Test-32Bit, Get-USB, Get-OSVersion, Get-Mul...
Script     PSUserTools               {Start-ProcessAsAdministrator, Get-CurrentUs...
Script     TaskScheduler             {Remove-Task, Get-ScheduledTask, Stop-Task, ...
Script     WPK                       {Get-DependencyProperty, New-ModelVisual3D, ...
Manifest   ActiveDirectory           {Set-ADOrganizationalUnit, Get-ADDomainContr...
Manifest   AppLocker                 {Get-AppLockerPolicy, Get-AppLockerFileInfor...
Manifest   BitsTransfer              {Start-BitsTransfer, Remove-BitsTransfer, Re...
Manifest   FailoverClusters          {Set-ClusterParameter, Get-ClusterParameter,...
Manifest   GroupPolicy               {Get-GPStarterGPO, Get-GPOReport, Set-GPInhe...
Manifest   NetworkLoadBalancingCl... {Stop-NlbClusterNode, Remove-NlbClusterVip, ...
Script     PSDiagnostics             {Enable-PSTrace, Enable-WSManTrace, Start-Tr...
Manifest   TroubleshootingPack       {Get-TroubleshootingPack, Invoke-Troubleshoo...


PS C:\>
```

After you have loaded the Active Directory module, you will want to use the `Get-Command` cmdlet to see the cmdlets that are exported by the module. This is shown here:

```
PS C:\> Get-Module -ListAvailable

ModuleType Name                      ExportedCommands
---------- ----                      ----------------
Script     BasicFunctions            {}
Script     ConversionModuleV6        {}
Script     DotNet                    {}
Manifest   FileSystem                {}
Manifest   IsePack                   {}
Manifest   PowerShellPack            {}
Manifest   PSCodeGen                 {}
Manifest   PSImageTools              {}
Manifest   PSRSS                     {}
Manifest   PSSystemTools             {}
Manifest   PSUserTools               {}
Manifest   TaskScheduler             {}
Manifest   WPK                       {}
Manifest   ActiveDirectory           {}
Manifest   AppLocker                 {}
Manifest   BitsTransfer              {}
Manifest   FailoverClusters          {}
Manifest   GroupPolicy               {}
Manifest   NetworkLoadBalancingCl... {}
Manifest   PSDiagnostics             {}
Manifest   TroubleshootingPack       {}


PS C:\> Import-Module active*
PS C:\> Get-Command -Module active*

CommandType     Name                               Definition
-----------     ----                               ----------
Cmdlet          Add-ADComputerServiceAccount       Add-ADComputerServiceAccount [...
Cmdlet          Add-ADDomainControllerPasswordR... Add-ADDomainControllerPassword...
Cmdlet          Add-ADFineGrainedPasswordPolicy... Add-ADFineGrainedPasswordPolic...
Cmdlet          Add-ADGroupMember                  Add-ADGroupMember [-Identity] ...
Cmdlet          Add-ADPrincipalGroupMembership     Add-ADPrincipalGroupMembership...
Cmdlet          Clear-ADAccountExpiration          Clear-ADAccountExpiration [-Id...
Cmdlet          Disable-ADAccount                  Disable-ADAccount [-Identity] ...
Cmdlet          Disable-ADOptionalFeature          Disable-ADOptionalFeature [-Id...
Cmdlet          Enable-ADAccount                   Enable-ADAccount [-Identity] <...
Cmdlet          Enable-ADOptionalFeature           Enable-ADOptionalFeature [-Ide...
Cmdlet          Get-ADAccountAuthorizationGroup    Get-ADAccountAuthorizationGrou...
Cmdlet          Get-ADAccountResultantPasswordR... Get-ADAccountResultantPassword...
Cmdlet          Get-ADComputer                     Get-ADComputer -Filter <String...
<output truncated>
```

To find a single domain controller, if you are not sure of one in your site, you can use the *discover* switch on the `Get-ADDomainController` cmdlet. One thing to keep in mind is that the *discover* parameter could return information from the cache. If you want to ensure that a fresh *discover* command is sent, use the *forceDiscover* switch in addition to the *–discover* switch. These techniques are shown here:

```
PS C:\> Get-ADDomainController -Discover


Domain      : NWTraders.Com
Forest      : NWTraders.Com
HostName    : {HyperV.NWTraders.Com}
IPv4Address : 192.168.1.100
IPv6Address :
Name        : HYPERV
Site        : NewBerlinSite



PS C:\> Get-ADDomainController -Discover -ForceDiscover


Domain      : NWTraders.Com
Forest      : NWTraders.Com
HostName    : {HyperV.NWTraders.Com}
IPv4Address : 192.168.1.100
IPv6Address :
Name        : HYPERV
Site        : NewBerlinSite



PS C:\>
```

When using the `Get-ADDomainController` cmdlet, a minimal amount of information returns. If you want to see additional information from the domain controller you discovered, you would need to connect to it by using the *identity* parameter. The value of the *identity* property can be an IP address, GUID, host name, or even a NetBIOS sort of name. This technique is shown here:

```
PS C:\> Get-ADDomainController -Identity hyperv


ComputerObjectDN           : CN=HYPERV,OU=Domain Controllers,DC=NWTraders,DC=Com
DefaultPartition           : DC=NWTraders,DC=Com
Domain                     : NWTraders.Com
Enabled                    : True
Forest                     : NWTraders.Com
HostName                   : HyperV.NWTraders.Com
InvocationId               : 6835f51f-2c77-463f-8775-b3404f2748b2
IPv4Address                : 192.168.1.100
IPv6Address                :
IsGlobalCatalog            : True
IsReadOnly                 : False
LdapPort                   : 389
Name                       : HYPERV
NTDSSettingsObjectDN       : CN=NTDS Settings,CN=HYPERV,CN=Servers,CN=NewBerlinSite,
                             CN=Sites,CN=Configuration,DC=NWTraders,DC=Com
OperatingSystem            : Windows Server 2008 R2 Standard
OperatingSystemHotfix      :
OperatingSystemServicePack :
OperatingSystemVersion     : 6.1 (7600)
OperationMasterRoles       : {SchemaMaster, DomainNamingMaster}
Partitions                 : {DC=ForestDnsZones,DC=NWTraders,DC=Com, DC=DomainDnsZon
                             es,DC=NWTraders,DC=Com, CN=Schema,CN=Configuration,DC=N
                             WTraders,DC=Com, CN=Configuration,DC=NWTraders,DC=Com...}
ServerObjectDN             : CN=HYPERV,CN=Servers,CN=NewBerlinSite,CN=Sites,CN=Confi
                             guration,DC=NWTraders,DC=Com
ServerObjectGuid           : ab5e2830-a4d6-47f8-b2b4-25757153653c
Site                       : NewBerlinSite
SslPort                    : 636



PS C:\>
```

As shown in the preceding output, the server named Hyperv is a Global Catalog server. It also holds the SchemaMaster and the DomainNamingMaster FSMO roles. It is running Windows Server 2008 R2 Standard edition, which shows that the cmdlet works with down-level versions of the operating system. The `Get-ADDomainController` cmdlet accepts a *filter* parameter that can be used to perform a search and retrieve operation. It uses a special search syntax that is discussed in the online help about files. Unfortunately, it does not accept LDAP syntax.

Luckily, you do not have to learn the special filter syntax, because the `Get-ADObject` cmdlet will accept a LDAP dialect filter. You can simply pipeline the results of the `Get-ADObject` cmdlet to the `Get-ADDomainController` cmdlet. This technique is shown here:

```
PS C:\> Get-ADObject -LDAPFilter "(objectclass=computer)" -searchbase "ou=domain
controllers,dc=nwtraders,dc=com" | Get-ADDomainController


ComputerObjectDN           : CN=HYPERV,OU=Domain Controllers,DC=NWTraders,DC=Com
DefaultPartition           : DC=NWTraders,DC=Com
Domain                     : NWTraders.Com
Enabled                    : True
Forest                     : NWTraders.Com
HostName                   : HyperV.NWTraders.Com
InvocationId               : 6835f51f-2c77-463f-8775-b3404f2748b2
IPv4Address                : 192.168.1.100
IPv6Address                :
IsGlobalCatalog            : True
IsReadOnly                 : False
LdapPort                   : 389
Name                       : HYPERV
NTDSSettingsObjectDN       : CN=NTDS Settings,CN=HYPERV,CN=Servers,CN=NewBerlinSite,
                             CN=Sites,CN=Configuration,DC=NWTraders,DC=Com
OperatingSystem            : Windows Server 2008 R2 Standard
OperatingSystemHotfix      :
OperatingSystemServicePack :
OperatingSystemVersion     : 6.1 (7600)
OperationMasterRoles       : {SchemaMaster, DomainNamingMaster}
Partitions                 : {DC=ForestDnsZones,DC=NWTraders,DC=Com, DC=DomainDnsZones,
                             DC=NWTraders,DC=Com, CN=Schema,CN=Configuration,DC
                             =NWTraders,DC=Com, CN=Configuration,DC=NWTraders,DC=Com...}
ServerObjectDN             : CN=HYPERV,CN=Servers,CN=NewBerlinSite,CN=Sites,CN=Confi
                             guration,DC=NWTraders,DC=Com
ServerObjectGuid           : ab5e2830-a4d6-47f8-b2b4-25757153653c
Site                       : NewBerlinSite
SslPort                    : 636

ComputerObjectDN           : CN=DC1,OU=Domain Controllers,DC=NWTraders,DC=Com
DefaultPartition           : DC=NWTraders,DC=Com
Domain                     : NWTraders.Com
Enabled                    : True
Forest                     : NWTraders.Com
HostName                   : DC1.NWTraders.Com
InvocationId               : fb324ced-bd3f-4977-ae69-d6763e7e029a
IPv4Address                : 192.168.1.101
IPv6Address                :
IsGlobalCatalog            : True
IsReadOnly                 : False
LdapPort                   : 389
Name                       : DC1
NTDSSettingsObjectDN       : CN=NTDS Settings,CN=DC1,CN=Servers,CN=NewBerlinSite,CN=
                             Sites,CN=Configuration,DC=NWTraders,DC=Com
OperatingSystem            : Windows Serverr 2008 Standard without Hyper-V
```

```
OperatingSystemHotfix      :
OperatingSystemServicePack : Service Pack 2
OperatingSystemVersion     : 6.0 (6002)
OperationMasterRoles       : {PDCEmulator, RIDMaster, InfrastructureMaster}
Partitions                 : {DC=ForestDnsZones,DC=NWTraders,DC=Com, DC=DomainDnsZones,
                             DC=NWTraders,DC=Com, CN=Schema,CN=Configuration,DC
                             =NWTraders,DC=Com, CN=Configuration,DC=NWTraders,DC=Com...}
ServerObjectDN             : CN=DC1,CN=Servers,CN=NewBerlinSite,CN=Sites,CN=Configur
                             ation,DC=NWTraders,DC=Com
ServerObjectGuid           : 80885b47-5a51-4679-9922-d6f41228f211
Site                       : NewBerlinSite
SslPort                    : 636


PS C:\>
```

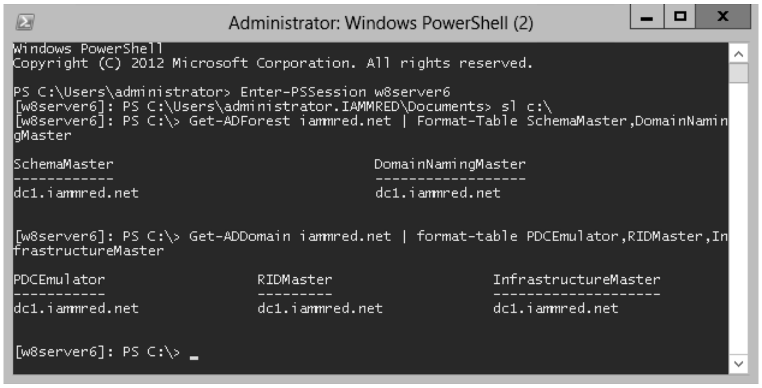
If it returns too much information, the Active Directory cmdlets work just like any other Windows PowerShell cmdlet and therefore permit using the pipeline to choose the information you want to display. To obtain only the FSMO information, it comes down to two commands—three commands if you want to include importing the Active Directory module in your count, or four commands if you need to make a remote connection to a domain controller to run the commands. One cool thing about using Windows PowerShell remoting is that you specify the credentials that you need to run the command. If your normal account is a standard user, you use an elevated account only when you require performing actions with elevated rights. If you have already started the Windows PowerShell console with elevated credentials, you can skip typing in credentials when you enter the remote Windows PowerShell session (assuming that the elevated account also has rights on the remote server). The first two commands seen here create a remote session on a remote domain controller and load the *ActiveDirectory* module:

```
Enter-PSSession w8Server6
```

When the Active Directory module loads, you type a one-line command to get the Forest FSMO roles, and you type another one-line command to get the domain FSMO roles. These two commands are shown here:

```
Get-ADForest iammred.net | Format-Table SchemaMaster,DomainNamingMaster
Get-ADDomain iammred.net | format-table PDCEmulator,RIDMaster,InfrastructureMaster
```

That is it—two or three one-line commands, depending on how you want to count. Even at worst case, three one-line commands are much easier to type than 33 lines of code that would be required if you did not have access to the Active Directory module. In addition, the Windows PowerShell code is much easier to read and to understand. The commands and the associated output from the Windows PowerShell commands appear in Figure 3-3.



```
Windows PowerShell
Copyright (C) 2012 Microsoft Corporation. All rights reserved.

PS C:\Users\administrator> Enter-PSSession w8server6
[w8server6]: PS C:\Users\administrator.IAMMRED\Documents> sl c:\
[w8server6]: PS C:\> Get-ADForest iammred.net | Format-Table SchemaMaster,DomainNamin
gMaster

SchemaMaster                                  DomainNamingMaster
------------                                  ------------------
dc1.iammred.net                               dc1.iammred.net


[w8server6]: PS C:\> Get-ADDomain iammred.net | format-table PDCEmulator,RIDMaster,In
frastructureMaster

PDCEmulator                  RIDMaster                   InfrastructureMaster
-----------                  ---------                   --------------------
dc1.iammred.net              dc1.iammred.net             dc1.iammred.net


[w8server6]: PS C:\> _
```

FIGURE 3-3 Using Windows PowerShell remoting to obtain FSMO information.

Documenting Active Directory

Using the Microsoft Active Directory Windows PowerShell cmdlets and remoting, you can easily discover information about the forest and the domain. The first thing you need to do is to enter a *PSSession* on the remote computer. To do this you use the `Enter-PSSession` cmdlet. Next, you import the Active Directory module and set the working location to the root of the C drive. The reason for setting the working location to the root of the C drive is to regain valuable command-line space. These commands are shown here:

```
PS C:\Users\Administrator.NWTRADERS> Enter-PSSession dc1
[dc1]: PS C:\Users\Administrator\Documents> Import-Module activedirectory
[dc1]: PS C:\Users\Administrator\Documents> Set-Location c:\
```

After you have connected to the remote domain controller, you can use the `Get-WmiObject` cmdlet to verify the operating system on that computer. This command and associated output are shown here:

```
[dc1]: PS C:\> Get-WmiObject win32_operatingsystem
SystemDirectory : C:\Windows\system32
Organization    :
BuildNumber     : 7601
RegisteredUser  : Windows User
SerialNumber    : 55041-507-0212466-84005
Version         : 6.1.7601
```

Now you want to get information about the forest. To do this, you use the `Get-ADForest` cmdlet. The output from the `Get-ADForest` cmdlet includes lots of great information, such as the Domain Naming Master, Forest Mode, Schema Master, and Domain Controllers. This command and associated output appears here:

```
[dc1]: PS C:\> Get-ADForest
ApplicationPartitions : {DC=DomainDnsZones,DC=nwtraders,DC=com, DC=ForestDnsZones,DC
=nwtraders,DC=com}
CrossForestReferences : {}
```

```
DomainNamingMaster    : DC1.nwtraders.com
Domains               : {nwtraders.com}
ForestMode            : Windows2008Forest
GlobalCatalogs        : {DC1.nwtraders.com}
Name                  : nwtraders.com
PartitionsContainer   : CN=Partitions,CN=Configuration,DC=nwtraders,DC=com
RootDomain            : nwtraders.com
SchemaMaster          : DC1.nwtraders.com
Sites                 : {Default-First-Site-Name}
SPNSuffixes           : {}
UPNSuffixes           : {}
```

Now, to obtain information about the domain, use the `Get-ADDomain` cmdlet. The command returns important information such as the location of the default domain controller OU, the PDC emulator, and the RID master. The command and associated output are shown here:

```
[dc1]: PS C:\> Get-ADDomain
AllowedDNSSuffixes                 : {}
ChildDomains                       : {}
ComputersContainer                 : CN=Computers,DC=nwtraders,DC=com
DeletedObjectsContainer            : CN=Deleted Objects,DC=nwtraders,DC=com
DistinguishedName                  : DC=nwtraders,DC=com
DNSRoot                            : nwtraders.com
DomainControllersContainer         : OU=Domain Controllers,DC=nwtraders,DC=com
DomainMode                         : Windows2008Domain
DomainSID                          : S-1-5-21-909705514-2746778377-2082649206
ForeignSecurityPrincipalsContainer : CN=ForeignSecurityPrincipals,DC=nwtraders,DC=com
Forest                             : nwtraders.com
InfrastructureMaster               : DC1.nwtraders.com
LastLogonReplicationInterval       :
LinkedGroupPolicyObjects           : {CN={31B2F340-016D-11D2-945F-00C04FB984F9},CN
                                     =Policies,CN=System,DC=nwtraders,DC=com}
LostAndFoundContainer              : CN=LostAndFound,DC=nwtraders,DC=com
ManagedBy                          :
Name                               : nwtraders
NetBIOSName                        : NWTRADERS
ObjectClass                        : domainDNS
ObjectGUID                         : 0026d1fc-2e4d-4c35-96ce-b900e9d67e7c
ParentDomain                       :
PDCEmulator                        : DC1.nwtraders.com
QuotasContainer                    : CN=NTDS Quotas,DC=nwtraders,DC=com
ReadOnlyReplicaDirectoryServers    : {}
ReplicaDirectoryServers            : {DC1.nwtraders.com}
RIDMaster                          : DC1.nwtraders.com
SubordinateReferences              : {DC=ForestDnsZones,DC=nwtraders,DC=com,
                                     DC=DomainDnsZones,DC=nwtraders,DC=com,
                                     CN=Configuration,DC=nwtraders,DC=com}
SystemsContainer                   : CN=System,DC=nwtraders,DC=com
UsersContainer                     : CN=Users,DC=nwtraders,DC=com
```

From a security perspective, you should always check the domain password policy. To do this, use the `Get-ADDefaultDomainPasswordPolicy` cmdlet. Things you want to pay attention to are the use of complex passwords, minimum password length, password age, and password retention. You also need to check the account lockout policy. This policy is especially important to review closely when inheriting a new network. Here is the command and associated output that does that very thing:

```
[dc1]: PS C:\> Get-ADDefaultDomainPasswordPolicy
ComplexityEnabled           : True
DistinguishedName           : DC=nwtraders,DC=com
LockoutDuration             : 00:30:00
LockoutObservationWindow    : 00:30:00
LockoutThreshold            : 0
MaxPasswordAge              : 42.00:00:00
MinPasswordAge              : 1.00:00:00
MinPasswordLength           : 7
objectClass                 : {domainDNS}
objectGuid                  : 0026d1fc-2e4d-4c35-96ce-b900e9d67e7c
PasswordHistoryCount        : 24
ReversibleEncryptionEnabled : False
```

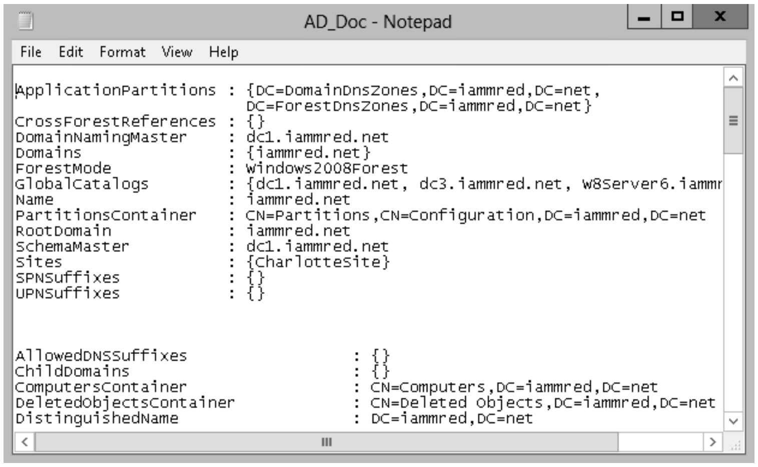
The last things to check are the domain controllers themselves. To do this, use the `Get-ADDomainController` cmdlet. This command returns important information, such as whether the domain controller is read-only, a global catalog server, operations master roles held, and operating system information. Here is the command and associated output:

```
 [dc1]: PS C:\> Get-ADDomainController -Identity dc1
ComputerObjectDN           : CN=DC1,OU=Domain Controllers,DC=nwtraders,DC=com
DefaultPartition           : DC=nwtraders,DC=com
Domain                     : nwtraders.com
Enabled                    : True
Forest                     : nwtraders.com
HostName                   : DC1.nwtraders.com
InvocationId               : b51f625f-3f60-44e7-8577-8918f7396c2a
IPv4Address                : 10.0.0.1
IPv6Address                :
IsGlobalCatalog            : True
IsReadOnly                 : False
LdapPort                   : 389
Name                       : DC1
NTDSSettingsObjectDN       : CN=NTDS Settings,CN=DC1,CN=Servers,CN=Default-First-Site-Na
me,CN=Sites,CN=Configuration,DC=nwtraders,DC=com
OperatingSystem            : Windows Server 2008 R2 Enterprise
OperatingSystemHotfix      :
OperatingSystemServicePack : Service Pack 1
OperatingSystemVersion     : 6.1 (7601)
OperationMasterRoles       : {SchemaMaster, DomainNamingMaster, PDCEmulator,
                             RIDMaster...}
Partitions                 : {DC=ForestDnsZones,DC=nwtraders,DC=com, DC=DomainDnsZones,
                             DC=nwtraders,DC=com, CN=Schema,CN=Configuration,
                             DC=nwtraders,DC=com, CN=Configuration,DC=nwtraders,
                             DC=com...}
ServerObjectDN             : CN=DC1,CN=Servers,CN=Default-First-Site-Name,CN=Sites,
                             CN=Configuration,DC=nwtraders,DC=com
ServerObjectGuid           : 5ae1fd0e-bc2f-42a7-af62-24377114e03d
Site                       : Default-First-Site-Name
SslPort                    : 636
```

To produce a report is as easy as redirecting the output to a text file. These commands gather the information discussed earlier in this section and store the retrieved information in a file named AD_Doc.txt. The commands also illustrate that it is possible to redirect the information to a file stored in a network share.

```
Get-ADForest >> \\dc1\shared\AD_Doc.txt
Get-ADDomain >> \\dc1\shared\AD_Doc.txt
Get-ADDefaultDomainPasswordPolicy >> \\dc1\shared\AD_Doc.txt
Get-ADDomainController -Identity dc1 >>\\dc1\shared\AD_Doc.txt
```

The file as viewed in Notepad appears in Figure 3-4.



```
ApplicationPartitions : {DC=DomainDnsZones,DC=iammred,DC=net,
                        DC=ForestDnsZones,DC=iammred,DC=net}
CrossForestReferences : {}
DomainNamingMaster    : dc1.iammred.net
Domains               : {iammred.net}
ForestMode            : Windows2008Forest
GlobalCatalogs        : {dc1.iammred.net, dc3.iammred.net, W8Server6.iammr
Name                  : iammred.net
PartitionsContainer   : CN=Partitions,CN=Configuration,DC=iammred,DC=net
RootDomain            : iammred.net
SchemaMaster          : dc1.iammred.net
Sites                 : {CharlotteSite}
SPNSuffixes           : {}
UPNSuffixes           : {}



AllowedDNSSuffixes                 : {}
ChildDomains                       : {}
ComputersContainer                 : CN=Computers,DC=iammred,DC=net
DeletedObjectsContainer            : CN=Deleted Objects,DC=iammred,DC=net
DistinguishedName                  : DC=iammred,DC=net
```

FIGURE 3-4 Active Directory documentation displayed in Notepad.

Renaming Active Directory sites

It is easy to rename a site. All you need to do is to right-click the site and select Rename from the action menu. By default, the first site is called Default-First-Site-Name, which is not too illuminating. To work with Active Directory sites, it is necessary to understand that they are a bit strange. First, they reside in the configuration naming context. Connecting to this context by using the Active Directory module is rather simple. Just use the `Get-ADRootDSE` cmdlet, and then select the *ConfigurationNamingContext* property. First, you have to make a connection to the domain controller and import the Active Directory Module (assuming that you do not have the RSAT tools installed on your client computer). This is shown here:

```
Enter-PSSession -ComputerName dc3 -Credential iammred\administrator
Import-Module activedirectory
```

Here is the code that will retrieve all of the sites. It uses the `Get-ADObject` cmdlet to search the configuration naming context for objects that have the object class of *site*.

```
Get-ADObject -SearchBase (Get-ADRootDSE).ConfigurationNamingContext -filter "objectclass
-eq 'site'"
```

When you have the site you want to work with, you first change the *DisplayName* attribute. To do this, you pipeline the site object to the `Set-ADOObject` cmdlet. The `Set-ADOObject` cmdlet allows me to set a variety of attributes on an object. This command is shown here. (This is a single command that is broken into two pieces at the pipeline character.)

```
Get-ADObject -SearchBase (Get-ADRootDSE).ConfigurationNamingContext -filter "objectclass
-eq 'site'" | Set-ADObject -DisplayName CharlotteSite
```

When you have set the *DisplayName* attribute, you decide to rename the object itself. To do this, you use another cmdlet called `Rename-ADObject`. Again, to simplify things, you pipeline the site object to the cmdlet and you assign a new name for the site. This command is shown here. (This is also a one-line command broken at the pipe.)

```
Get-ADObject -SearchBase (Get-ADRootDSE).ConfigurationNamingContext -filter "objectclass
-eq 'site'" | Rename-ADObject -NewName CharlotteSite
```

Managing users

To create a new Organizational Unit, you use the `New-ADOrganizationalUnit` cmdlet as shown here:

```
New-ADOrganizationalUnit -Name TestOU -Path "dc=nwtraders,dc=com"
```

If you want to create a child Organizational Unit (OU), you use the `New-ADOrganizationalUnit` cmdlet, but in the path, you list the location that will serve as the parent, as shown here:

```
New-ADOrganizationalUnit -Name TestOU1 -Path "ou=TestOU,dc=nwtraders,dc=com"
```

If you want to make several child OUs in the same location, use the up arrow to retrieve the previous command and edit the name of the child. You can use the home key to move to the beginning of the line, the end key to move to the end of the line, and the left and right arrow keys to find your place on the line so that you can edit it. A second child OU is created here:

```
New-ADOrganizationalUnit -Name TestOU2 -Path "ou=TestOU,dc=nwtraders,dc=com"
```

To create a computer account in one of the newly created child Organizational Units, you must type the complete path to the OU that will house the new computer account. The `New-ADComputer` cmdlet is used to create new computer accounts in AD DS. In this example, the TestOU1 OU is a child of the TestOU OU, and therefore, both OUs must appear in the path parameter. Keep in mind that the path that is supplied to the *path* parameter must be contained inside quotation marks, as shown here:

```
New-ADComputer -Name Test -Path "ou=TestOU1,ou=TestOU,dc=nwtraders,dc=com"
```

To create a user account, you use the `New-ADUser` cmdlet as shown here:

```
New-ADUser -Name TestChild -Path "ou=TestOU1,ou=TestOU,dc=nwtraders,dc=com"
```

Because there could be a bit of typing involved that tends to become redundant, you might want to write a script to create the OUs at the same time that the computer and user accounts are created. A sample script that creates OUs, users, and computers is the UseADCmdletsToCreateOuComputerAndUser.ps1 script shown here.

UseADCmdletsToCreateOuComputerAndUser.ps1

```
Import-Module -Name ActiveDirectory
$Name = "ScriptTest"
$DomainName = "dc=nwtraders,dc=com"
$OUPath = "ou={0},{1}" -f $Name, $DomainName

New-ADOrganizationalUnit -Name $Name -Path $DomainName
-ProtectedFromAccidentalDeletion $false

For($you = 0; $you -le 5; $you++)
{
 New-ADOrganizationalUnit -Name $Name$you -Path $OUPath
-ProtectedFromAccidentalDeletion $false
}

For($you = 0 ; $you -le 5; $you++)
{
 New-ADComputer -Name  "TestComputer$you" -Path $OUPath
 New-ADUser -Name "TestUser$you" -Path $OUPath
}
```

The UseADCmdletsToCreateOuComputerAndUser.ps1 script begins by importing the Active Directory module. It then creates the first OU. When testing a script, it is important to disable the deletion protection by using the *ProtectedFromAccidentalDeletion* parameter. This will allow you to easily delete the OU and avoid having to go into the advanced view in Active Directory Users And Computers and changing the protected status on each OU.

After the ScriptTest OU is created, the other OUs, users, and computer accounts can be created inside the new location. It seems obvious that you cannot create a child OU inside the parent OU if the parent has not yet been created, but it is easy to make a logic error like this.

To create a new global security group, use the `New-ADGroup` Windows PowerShell AD DS cmdlet. The `New-ADGroup` Windows PowerShell cmdlet requires three parameters: the *name* of the group, a *path* to the location where the group will be stored, and the *groupscope*, which can be global, universal, or domain local. Before running the command shown here, remember that you must import the Active Directory module into your current Windows PowerShell session.

```
New-ADGroup -Name TestGroup -Path "ou=TestOU,dc=nwtraders,dc=com" -groupScope global
```

To create a new universal group, you need to change only the *groupscope* parameter value as shown here:

```
New-ADGroup -Name TestGroup1 -Path "ou=TestOU,dc=nwtraders,dc=com" -groupScope universal
```

To add a user to a group, you must supply values for the *identity* parameter and for the *members* parameter. The value that you use for the identity parameter is the name of the group. You do not need to use the LDAP syntax of *cn=groupname*; you need to supply only the name. Use ADSI Edit to examine the requisite LDAP attributes needed for a group in ADSI Edit.

It is a bit unusual that the *members* parameter is named members and not member because most Windows PowerShell cmdlet parameter names are singular and not plural. The parameters are singular even when they accept an array of values (such as the *computername* parameter). The command to add a new group named TestGroup1 to the UserGroupTest group is shown here:

```
Add-ADGroupMember -Identity TestGroup1 -Members UserGroupTest
```

To remove a user from a group, use the `Remove-ADGroupMember` cmdlet with the name of the user and group. The *identity* and the *members* parameters are required, but the command will not execute without confirmation, as shown here:

```
PS C:\> Remove-ADGroupMember -Identity TestGroup1 -Members UserGroupTest

Confirm
Are you sure you want to perform this action?
Performing operation "Set" on Target "CN=TestGroup1,OU=TestOU,DC=NWTraders,DC=Com".
[Y] Yes  [A] Yes to All  [N] No  [L] No to All  [S] Suspend  [?] Help (default is "Y"):
y
PS C:\>
```

If you are sure that you want to remove the user from the group and that you want to suppress the query, you use the *confirm* parameter and assign the value *$false* to it. The problem is that you will need to supply a colon between the parameter and *$false* value.

NOTE **The use of the colon after the *confirm* parameter is not documented, but the technique works on several different cmdlets.**

The command is shown here:

```
Remove-ADGroupMember -Identity TestGroup1 -Members UserGroupTest -Confirm:$false
```

You need the ability to suppress the confirmation prompt to be able to use the `Remove-ADGroupMember` cmdlet in a script. The first thing the RemoveUserFromGroup.ps1 script does is load the Active Directory module. When the module is loaded, the `Remove-ADGroupMember` cmdlet is used to remove the user from the group. To suppress the confirmation prompt, the *–confirm:$false* command is used. The RemoveUserFromGroup.ps1 script is shown here.

RemoveUserFromGroup.ps1

```
import-module activedirectory
Remove-ADGroupMember -Identity TestGroup1 -Members UserGroupTest -Confirm:$false
```

Creating a user

Now create a new user in Active Directory. You will name the user "ed." The command to create a new user is simple; it is `New-Aduser` and the user name. The command to create a disabled user account in the *users* container in the default domain is shown here:

```
new-aduser -name ed
```

When the preceding command that creates a new user completes, nothing is returned to the Windows PowerShell console. To check to ensure that the user is created, use the `Get-Aduser` cmdlet to retrieve the user object. This command is shown here:

```
Get-aduser ed
```

When you are certain that your new user is created, you decide to create an organizational unit to store the user account. The command to create a new organizational unit off the root of the domain is shown here:

```
new-ADOrganizationalUnit scripting
```

Just like the previously used `New-Aduser` cmdlet, nothing returns to the Windows PowerShell console. If you use the `Get-ADOrganizationalUnit` cmdlet, you must use a different methodology. A simple `Get-AdOrganizationalUnit` command returns an error; therefore, you use an *LDAPFilter* parameter to find the OU. The command using the *LDAPFilter* parameter to find my newly created OU is shown here:

```
Get-ADOrganizationalUnit –LDAPFilter "(name=scripting)"
```

Now that you have a new user and a new OU, you need to move the user from the *users* container to the newly created *scripting* OU. To do that, you use the `Move-ADObject` cmdlet. You first get the *distinguishedname* attribute for the scripting OU and store it in a variable called *$oupath*. Next, you use the `Move-ADObject` cmdlet to move the *ed* user to the new OU. The trick here is that where the `Get-AdUser` cmdlet can find a user with the name of *ed*, the `Move-ADObject` cmdlet must have the *distinguishedname* of the *ed* user object to move it. The error that occurs when not supplying the *distinguishedname* appears in the figure that follows. You could use the `Get-AdUser` cmdlet to retrieve the *distinguishedname* in a similar method as you did with the scripting OU.

The next thing you need to do is to enable the user account. To do this, you need to assign a password to the user account. The password must be a secure string. To do this, you can use the `ConvertTo-SecureString` cmdlet. By default, warnings display about converting text to a secure string, but these prompts are suppressible by using the *force* parameter. Here is the command you use to create a secure string for a password:

```
$pwd = ConvertTo-SecureString -String "P@ssword1" -AsPlainText –Force
```

Now that you have created a secure string to use for a password for my user account, you call the `Set-ADAccountPassword` cmdlet to set the password. Because this is a new password, you need to use the *newpassword* parameter. In addition, because you do not have a previous password, you use the *reset* parameter. This command is shown here:

```
Set-ADAccountPassword -Identity ed -NewPassword $pwd –Reset
```

After the account has a password, you can enable the account. To do this, you use the `Enable-ADAccount` cmdlet and specify the user name to enable. This command is shown here:

```
Enable-ADAccount -Identity ed
```

As with the previous commands, none of the cmdlets return any information. To ensure that you have actually enabled the *ed* user account, you use the `Get-ADUser` cmdlet. In the output, you are looking for the value of the *enabled* property. The *enabled* property is a Boolean, so expect the value to be true.

Finding and unlocking AD user accounts

When using the Microsoft Active Directory cmdlets, locating locked out users is a snap. In fact, the `Search-ADAccount` cmdlet even has a *LockedOut* switch. Use the `Search-ADAccount` cmdlet with the *LockedOut* parameter. This command is shown here:

```
Search-ADAccount –LockedOut
```

NOTE **Many network administrators who spend the majority of their time working with Active Directory import the Active Directory module via their Windows PowerShell profile. This way, they never need to worry about the initial performance hit that occurs due to autoloading the Active Directory module.**

The `Search-ADAccount` command and the associated output are shown here:

```
[w8server6]: PS C:\> Search-ADAccount -LockedOut

AccountExpirationDate :
DistinguishedName     : CN=kimakers,OU=test,DC=iammred,DC=net
Enabled               : True
LastLogonDate         : 1/24/2012 8:40:29 AM
LockedOut             : True
Name                  : kimakers
ObjectClass           : user
ObjectGUID            : d907fa99-cd08-435f-97de-1e99d0eb485d
PasswordExpired       : False
PasswordNeverExpires  : False
```

```
SamAccountName          : kimakers
SID                     : S-1-5-21-1457956834-3844189528-3541350385-1608
UserPrincipalName       : kimakers@iammred.net

[w8server6]: PS C:\>
```

You can unlock the locked out user account as well—assuming that you have permission. In Figure 3-5, you attempt to unlock the user account with an account that is a normal user, and an error arises.

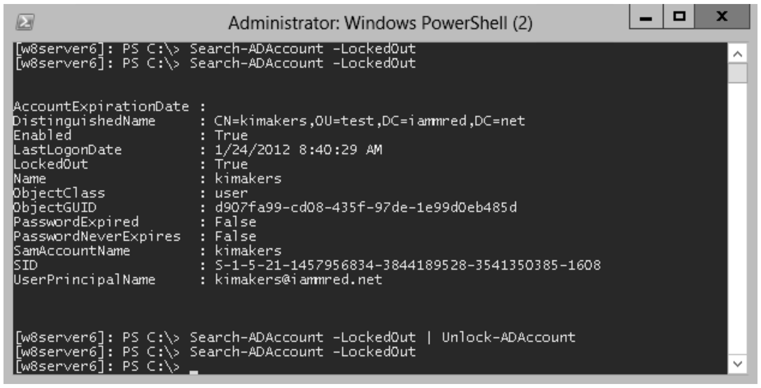
NOTE **People are often worried about Windows PowerShell from a security perspective. Windows PowerShell is only an application, and therefore a user cannot do anything that they do not have the rights or permission to accomplish. This is a case in point.**

If your user account does not have admin rights, you need to start Windows PowerShell with an account that has the ability to unlock a user account. To do this, you right-click the Windows PowerShell icon while holding down the Shift key; this allows you to select Run As Different User from the quick action menu.

When you start Windows PowerShell back up with an account that has rights to unlock users, the Active Directory module needs to load once again. You then check to ensure that you can still locate the locked out user accounts. After you have proven you can do that, you pipeline the results of the `Search-ADAccount` cmdlet to the `Unlock-ADAccount` cmdlet. A quick check ensures that you have unlocked all the locked out accounts. The series of commands is shown here:

```
Search-ADAccount –LockedOut
Search-ADAccount -LockedOut | Unlock-ADAccount
Search-ADAccount –LockedOut
```

The commands and associated output are shown in Figure 3-5.



```
[w8server6]: PS C:\> Search-ADAccount -LockedOut
[w8server6]: PS C:\> Search-ADAccount -LockedOut


AccountExpirationDate :
DistinguishedName     : CN=kimakers,OU=test,DC=iammred,DC=net
Enabled               : True
LastLogonDate         : 1/24/2012 8:40:29 AM
LockedOut             : True
Name                  : kimakers
ObjectClass           : user
ObjectGUID            : d907fa99-cd08-435f-97de-1e99d0eb485d
PasswordExpired       : False
PasswordNeverExpires  : False
SamAccountName        : kimakers
SID                   : S-1-5-21-1457956834-3844189528-3541350385-1608
UserPrincipalName     : kimakers@iammred.net


[w8server6]: PS C:\> Search-ADAccount -LockedOut | Unlock-ADAccount
[w8server6]: PS C:\> Search-ADAccount -LockedOut
[w8server6]: PS C:\> _
```

FIGURE 3-5 Using the Active Directory module to find and to unlock user accounts.

NOTE **Keep in mind that the command** `Search-ADAccount -LockedOut | Unlock-ADAccount` **will unlock every account that you have permission to unlock. In most cases, you will want to investigate prior to unlocking all locked out accounts. If you do not want to unlock all locked out accounts, use the *confirm* switch to be prompted prior to unlocking an account.**

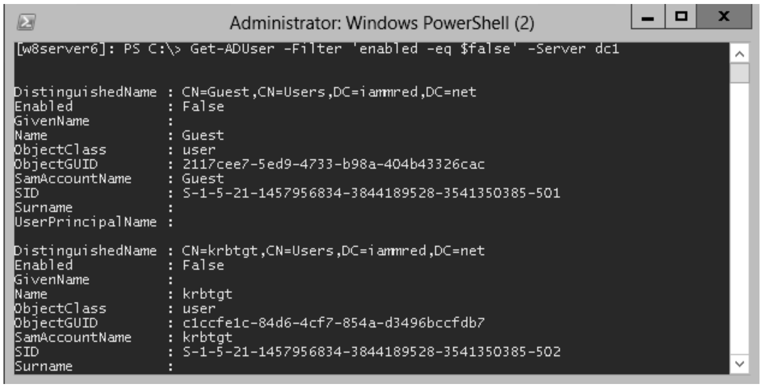
If you do not want to unlock all users, you use the *confirm* parameter from the `Unlock-ADAccount` cmdlet. For example, you first check to see what users are locked out by using the `Search-ADAccount` cmdlet—but you do not want to see everything, only their name. Next, you pipeline the locked out users to the `Unlock-ADAccount` cmdlet with the *confirm* parameter. You are then prompted for each of the three locked out users; choose to unlock the first and third users, but not the second user. You then use the `Search-ADAccount` cmdlet one last time to ensure that the second user is still locked out.

Finding disabled users

Luckily, by using Windows PowerShell and the Microsoft Active Directory cmdlets, it takes a single line of code to retrieve the disabled users from your domain. The command is shown here. (Keep in mind that running this command automatically imports the Active Directory module into the current Windows PowerShell host.)

```
Get-ADUser -Filter 'enabled -eq $false' -Server dc3
```

Not only is the command a single line of code, but it is also a single line of readable code. You get users from AD DS; you use a filter that looks for the enabled property set to false. You also specify that you want to query a server named dc3 (the name of one of the domain controllers on my network). The command and the associated output appear in Figure 3-6.



```
[w8server6]: PS C:\> Get-ADUser -Filter 'enabled -eq $false' -Server dc1


DistinguishedName : CN=Guest,CN=Users,DC=iammred,DC=net
Enabled           : False
GivenName         :
Name              : Guest
ObjectClass       : user
ObjectGUID        : 2117cee7-5ed9-4733-b98a-404b43326cac
SamAccountName    : Guest
SID               : S-1-5-21-1457956834-3844189528-3541350385-501
Surname           :
UserPrincipalName :

DistinguishedName : CN=krbtgt,CN=Users,DC=iammred,DC=net
Enabled           : False
GivenName         :
Name              : krbtgt
ObjectClass       : user
ObjectGUID        : c1ccfe1c-84d6-4cf7-854a-d3496bccfdb7
SamAccountName    : krbtgt
SID               : S-1-5-21-1457956834-3844189528-3541350385-502
Surname           :
```

FIGURE 3-6 Finding disabled user accounts.

If you want to work with a specific user, you can use the *identity* parameter. The *identity* parameter accepts several things: distinguishedname, sid, guid, or SamAccountName. Probably the easiest one to use is the SamAccountName. This command and associated output are shown here:

```
PS C:\Users\ed.IAMMRED>    Get-ADUser -Server dc3 -Identity teresa
DistinguishedName : CN=Teresa Wilson,OU=Charlotte,DC=iammred,DC=net
Enabled           : True
GivenName         : Teresa
Name              : Teresa Wilson
ObjectClass       : user
ObjectGUID        : 75f12010-b952-4d3-9b22-3ada7d26eed8
SamAccountName    : Teresa
SID               : S-1-5-21-1457956834-3844189528-3541350385-1104
Surname           : Wilson
UserPrincipalName : Teresa@iammred.net
```

To use the DistinguishedName value for the *identity* parameter, you need to supply it inside a pair of quotation marks—either single or double. This command and associated output are shown here:

```
PS C:\Users\ed.IAMMRED>    Get-ADUser -Server dc3 -Identity 'CN=Teresa Wilson,OU
=Charlotte,DC=iammred,DC=net'
DistinguishedName : CN=Teresa Wilson,OU=Charlotte,DC=iammred,DC=net
Enabled           : True
GivenName         : Teresa
Name              : Teresa Wilson
ObjectClass       : user
ObjectGUID        : 75f12010-b952-4d3-9b22-3ada7d26eed8
SamAccountName    : Teresa
SID               : S-1-5-21-1457956834-3844189528-3541350385-1104
Surname           : Wilson
UserPrincipalName : Teresa@iammred.net
```

It is not necessary to use quotation marks when using the SID for the value of the *identity* parameter. This command and associated output are shown here:

```
PS C:\Users\ed.IAMMRED>    Get-ADUser -Server dc3 -Identity S-1-5-21-1457956834-
3844189528-3541350385-1104


DistinguishedName : CN=Teresa Wilson,OU=Charlotte,DC=iammred,DC=net
Enabled           : True
GivenName         : Teresa
Name              : Teresa Wilson
ObjectClass       : user
ObjectGUID        : 75f12010-b952-4d3-9b22-3ada7d26eed8
SamAccountName    : Teresa
SID               : S-1-5-21-1457956834-3844189528-3541350385-1104
Surname           : Wilson
UserPrincipalName : Teresa@iammred.net
```

Again, you can also use *ObjectGUID* for the *identity* parameter value. It does not require quotation marks either. This command and associated output are shown here:

```
PS C:\Users\ed.IAMMRED>    Get-ADUser -Server dc3 -Identity 75f12010-b952-4d3-9
b22-3ada7d26eed8
DistinguishedName : CN=Teresa Wilson,OU=Charlotte,DC=iammred,DC=net
Enabled           : True
GivenName         : Teresa
Name              : Teresa Wilson
ObjectClass       : user
ObjectGUID        : 75f12010-b952-4d3-9b22-3ada7d26eed8
SamAccountName    : Teresa
SID               : S-1-5-21-1457956834-3844189528-3541350385-1104
Surname           : Wilson
UserPrincipalName : Teresa@iammred.net
```

Finding unused user accounts

To obtain a listing of all the users in Active Directory, supply a wildcard to the *filter* parameter of the `Get-ADUser` cmdlet. This technique is shown here:

```
Get-ADUser -Filter *
```

If you want to change the base of the search operations, use the *searchbase* parameter. The *searchbase* parameter accepts an LDAP style of naming. The following command changes the search base to the TestOU:

```
Get-ADUser -Filter * -SearchBase "ou=TestOU,dc=nwtraders,dc=com"
```

When using the `Get-ADUser` cmdlet, only a certain subset of user properties are displayed (10 properties to be exact). These properties will be displayed when you pipeline the results to `Format-List` and use a wildcard and the *force* parameter, as shown here:

```
PS C:\> Get-ADUser -Identity bob | format-list -Property * -Force


DistinguishedName : CN=bob,OU=TestOU,DC=NWTraders,DC=Com
Enabled           : True
GivenName         : bob
Name              : bob
ObjectClass       : user
ObjectGUID        : 5cae3acf-f194-4e07-a466-789f9ad5c84a
SamAccountName    : bob
SID               : S-1-5-21-3746122405-834892460-3960030898-3601
Surname           :
UserPrincipalName : bob@NWTraders.Com
PropertyNames     : {DistinguishedName, Enabled, GivenName, Name...}
PropertyCount     : 10



PS C:\>
```

Anyone who knows very much about Active Directory Domain Services (AD DS) knows that there are certainly more than 10 properties associated with a user object. If you try to display a property that is not returned by the `Get-ADUser` cmdlet, such as the *whenCreated* property, an error is not returned—the value of the property is not returned. This is shown here:

```
PS C:\> Get-ADUser -Identity bob | Format-List -Property name, whenCreated


name        : bob
whencreated :
```

The *whenCreated* property for the user object has a value—it just is not displayed. However, suppose you were looking for users who had never logged on to the system? Suppose you used a query such as the one seen here, and you were going to base a delete operation on the results? The results could be disastrous.

```
PS C:\> Get-ADUser -Filter * | Format-Table -Property name, LastLogonDate

name                                       LastLogonDate
----                                       -------------
Administrator
Guest
krbtgt
testuser2
ed
SystemMailbox{1f05a927-a261-4eb4-8360-8...
SystemMailbox{e0dc1c29-89c3-4034-b678-e...
FederatedEmail.4c1f4d8b-8179-4148-93bf-...
Test
TestChild
<results truncated>
```

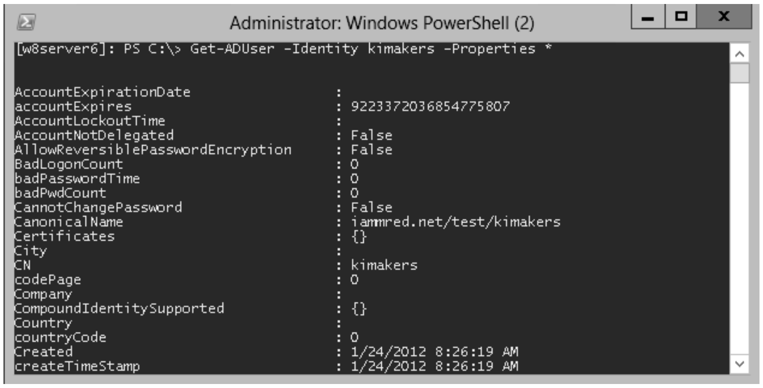
To retrieve a property that is not a member of the default 10 properties, you must select it by using the *property* parameter. The reason that `Get-ADUser` does not automatically return all properties and their associated values is because of performance reasons on large networks—there is no reason to return a large dataset when a small dataset will perfectly suffice. To display the *name* and the *whenCreated* date for the user named *bob*, the following command can be used:

```
PS C:\> Get-ADUser -Identity bob -Properties whencreated | Format-List -Property name,
whencreated


name        : bob
whencreated : 6/11/2010 8:19:52 AM



PS C:\>
```

To retrieve all of the properties associated with a user object, use the wildcard "*" for the properties parameter value. You would use a command similar to the one shown here:

```
Get-ADUser -Identity kimakers -Properties *
```

Both the command and the results associated with the command to return all user properties are shown in Figure 3-7.



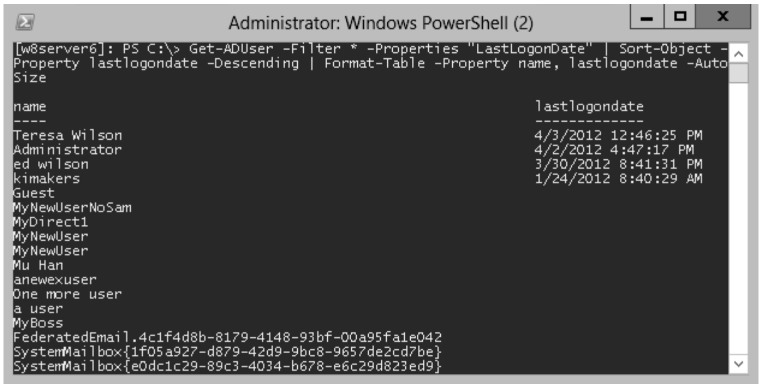
```
[w8server6]: PS C:\> Get-ADUser -Identity kimakers -Properties *


AccountExpirationDate                :
accountExpires                       : 9223372036854775807
AccountLockoutTime                   :
AccountNotDelegated                  : False
AllowReversiblePasswordEncryption    : False
BadLogonCount                        : 0
badPasswordTime                      : 0
badPwdCount                          : 0
CannotChangePassword                 : False
CanonicalName                        : iammred.net/test/kimakers
Certificates                         : {}
City                                 :
CN                                   : kimakers
codePage                             : 0
Company                              :
CompoundIdentitySupported            : {}
Country                              :
countryCode                          : 0
Created                              : 1/24/2012 8:26:19 AM
createTimeStamp                      : 1/24/2012 8:26:19 AM
```

FIGURE 3-7 Using the Get-ADUser cmdlet to display all user properties.

To produce a listing of all the users and their last logon date, you can use a command similar to the one shown here. This is a single command that might wrap the line, depending on your screen resolution.

```
Get-ADUser -Filter * -Properties "LastLogonDate" |
sort-object -property lastlogondate -descending |
Format-Table -property name, lastlogondate -AutoSize
```

The output produces a nice table. Both the command and the output associated with the command to obtain the time a user last logged on are shown in Figure 3-8.



```
[w8server6]: PS C:\> Get-ADUser -Filter * -Properties "LastLogonDate" | Sort-Object -
Property lastlogondate -Descending | Format-Table -Property name, lastlogondate -Auto
Size

name                                                           lastlogondate
----                                                           -------------
Teresa Wilson                                                  4/3/2012 12:46:25 PM
Administrator                                                  4/2/2012 4:47:17 PM
ed wilson                                                      3/30/2012 8:41:31 PM
kimakers                                                       1/24/2012 8:40:29 AM
Guest
MyNewUserNoSam
MyDirect1
MyNewUser
MyNewUser
Mu Han
anewexuser
One more user
a user
MyBoss
FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042
SystemMailbox{1f05a927-d879-42d9-9bc8-9657de2cd7be}
SystemMailbox{e0dc1c29-89c3-4034-b678-e6c29d823ed9}
```

FIGURE 3-8 Using the Get-ADUser cmdlet to identify the last logon times for users.

NOTES FROM THE FIELD

Jeff Wouters
Microsoft PowerShell MVP

"Write tools, not scripts" is one of my favorite phrases from the Windows PowerShell community. When I had just started to write some Windows PowerShell code, I was (and still am!) crazy about one-liners.

The ease with which the pipeline allows you to connect commands to each other and make them work together were unheard of in the VBS world.

But then I got a customer who wanted me to leave some code with them when I left. So I did, and only one week later, I got a call from that customer, in panic, saying that my script had deleted half their Active Directory!

I asked them to send me the code of the script. After only a few seconds, I noticed that this wasn't my code. There was a whole lot more in there that didn't come from me. So I connected to my home environment and looked in the backup I had made of all the scripts and documentation I had left with the customer, and yes, the script I had left them had a lot less code in there. So someone had changed my script!

Luckily, this customer had the Active Directory Recycle Bin enabled, so restoring the objects in Active Directory wasn't that hard. But for me, this was a wake-up call. Sign your scripts! Or at least make sure that you can verify the integrity of your scripts.

I also found that the person who changed my script, and basically was the cause of the problem, was a member of the service desk at that company. This is where "write tools, not scripts" comes into play.

So I rewrote my script, added a GUI, and signed it. This way, the help desk would have a nice clickable interface, and the script itself would be safe from malicious editors causing all kinds of issues. Because there were a whole bunch of scripts, I've created a module for them called "<CompanyName>Administration." To finish things off, I've introduced them to the concept of a centralized store for their modules.

For me, this was a learning curve, and these days I prefer a six steps approach:

1. Log everything; what it does and who executes it.
2. Support the common parameters, such as –*Whatif* and -*Confirm*.
3. Create an interface for the appropriate user—a command line for people who understand PowerShell and a GUI for those who don't.
4. Sign your script!

5. **Group scripts into modules.**
6. **Use a centralized module repository, preferably with read-only rights for everyone who is not responsible for the modules.**

These steps will make your life a whole lot easier when people start messing with your scripts.

Additional resources

- The TechNet Script Center at *http://www.microsoft.com/technet/scriptcenter* contains numerous script examples.
- All scripts from this chapter are available via the TechNet Script Center Script Repository at *http://gallery.technet.microsoft.com/scriptcenter/PowerShell-40-Best-d9e16039*.

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