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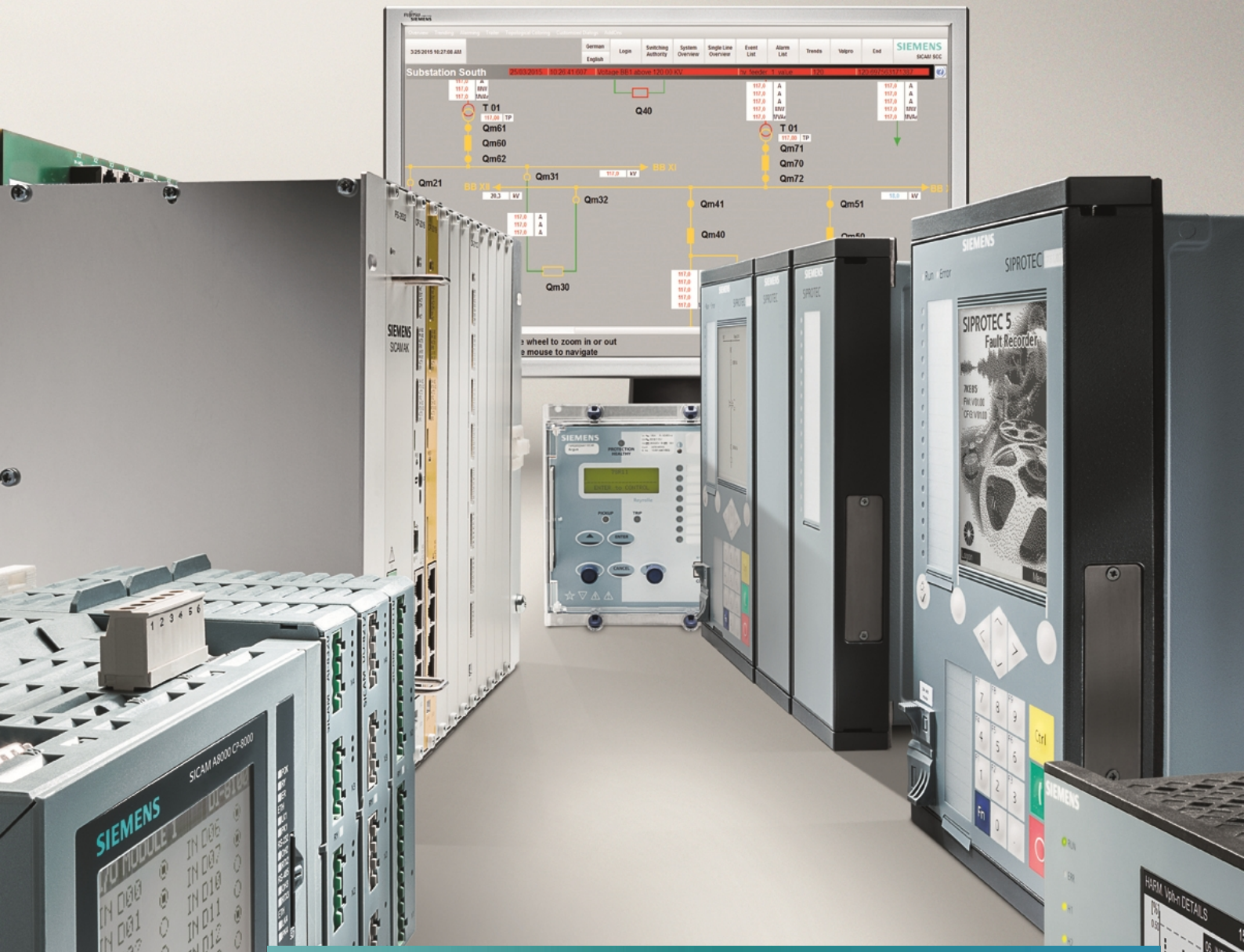

Setting Up Role-based Access Control for Siemens Digital Grid Products

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Cyber Security Application

Setting Up Role-Based Access Control for Siemens Digital Grid Products

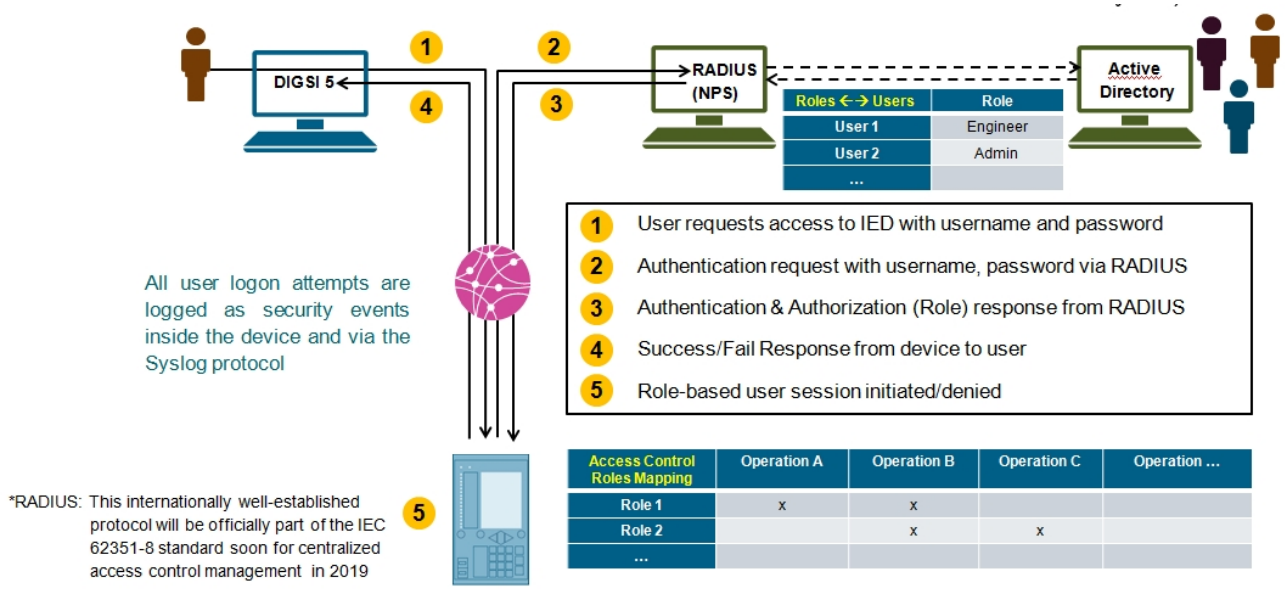
APN-051, Edition 1

Content

1 Setting Up Role-Based Access Control for Siemens Digital Grid Products

1.1 Introduction

SIPROTEC 5 and SICAM A8000 devices support role-based access control with central user management in RADIUS/Active Directory among other advanced cybersecurity features. To access information on a SIPROTEC 5 or SICAM A8000 device or to perform actions on the device, optionally the role-based access control (RBAC) can be enabled. After activation, the operator has to authenticate and authorize himself as a user before each interaction with the device. All SIPROTEC 5 and SICA A8000 devices can be connected to a central RADIUS server containing the authentication and authorization configuration. RADIUS is a standardized client/server protocol and the client implementation is integrated in the SIPROTEC 5 and SICAM A8000 device firmware.



This document describes the usage of SIPROTEC 5, SICAM A8000 devices and SICAM GridPass (certificate management product) with RADIUS server option of activated in an Active Directory Network Policy Server (NPS) installation on a Windows 2016 or Windows 2012R2 system. An Active Directory Server (ADS) needs to be installed and the NPS feature has to be activated to use the RADIUS server option within the ADS environment. Furthermore, for the local user login on a SIPROTEC 5 device over the RADIUS protocol, the ADS policy has to be adjusted. This specific configuration is also part of this documentation.

1.2 Fundamentals

Active Directory (AD)

Active Directory (AD) is a directory service that Microsoft developed for Windows domain networks. It is included in most Windows Server operating systems as a set of processes and services.[1][2] Initially, Active Directory was only in charge of centralized domain management. Starting with Windows Server 2008, however, Active Directory became an umbrella title for a broad range of directory-based identity-related services

Active Directory Server (ADS)

An Active Directory Server (ADS) is called a domain controller. It authenticates and authorizes all users and computers in a Windows domain type network—assigning and enforcing security policies for all computers and installing or updating software, e.g. when a user logs into a computer/device that is part of a Windows domain, Active Directory checks the submitted password and determines whether the user is a system administrator or normal user. Also, it allows

management and storage of information, provides authentication and authorization mechanisms, and establishes a framework to deploy other related services: Certificate Services

Network Policy Server (NPS)
Network Policy Server (NPS) is the Microsoft implementation of a Remote Authentication Dial-in User Service (RADIUS) server and proxy. It is the successor of Internet Authentication Service (IAS). As a RADIUS server, NPS performs authentication, authorization, and accounting for wireless, authenticating switch, and remote access dial-up and virtual private network (VPN) connections.

Remote Authentication Dial In User Service RADIUS
Remote Authentication Dial-In User Service (RADIUS) is a networking protocol, operating on port 1812 that provides centralized Authentication, Authorization, and Accounting (AAA or Triple A) management for users who connect and use a network service. This internationally well-established protocol will be officially part of the IEC 62351-8 standard soon (2019) for centralized access control management.

RADIUS Server

The main tasks of the RADIUS server are the authentication and control of user access rights. During authentication, the service determines who the connecting user is. Unique user names and passwords are used to check whether the user is actually who they claim. If the user is clearly identified, the authorization handles assignment of the access rights. The user receives specific access rights to data or services of the SIPROTEC 5 device.

RADIUS Client

All SIPROTEC 5 and SICAM A8000 devices (RADIUS Client) can be connected to up to two RADIUS authentication servers containing the authentication configuration. RADIUS is a client/server protocol and the client implementation is integrated in the Siemens device firmware. During a user logon, the Siemens device sends the user name and password to a RADIUS authentication server. This server checks the user data and, in case of successful authentication, sends the assigned roles of the specific user back to the Siemens device. Siemens devices have an advanced role-based access control with predefined roles.

IEC 62351-8
Power systems management and associated information exchange - Data and communications security - Part 8: Role-based access control, technical specification. Edition 1 has been released in Sept. 2011.

1.3 Implementation according IEC 62351-8 Ed.2 Standard

Siemens has implemented the RADIUS protocol according the upcoming IEC 62351-8 Ed.2 standard. During the release of the products and this document, the Edition 2 of the IEC 62351-8 has not yet released which includes the RADIUS implementation of Role-Base Access Control (RBAC). This means that all hints and implementations mentioning IEC 62351 in conjunction with RADIUS are subject to approval by the responsible IEC TC 57/WG 15 for the IEC 62351-8 standard. But all definitions of attributes used here in this application note are in conjunction with the current released IEC62351-8 Ed.1. To get more information see http://www.iec.ch/smartgrid/standards/ for Smart Grid Security.

1.4 Brief Overview

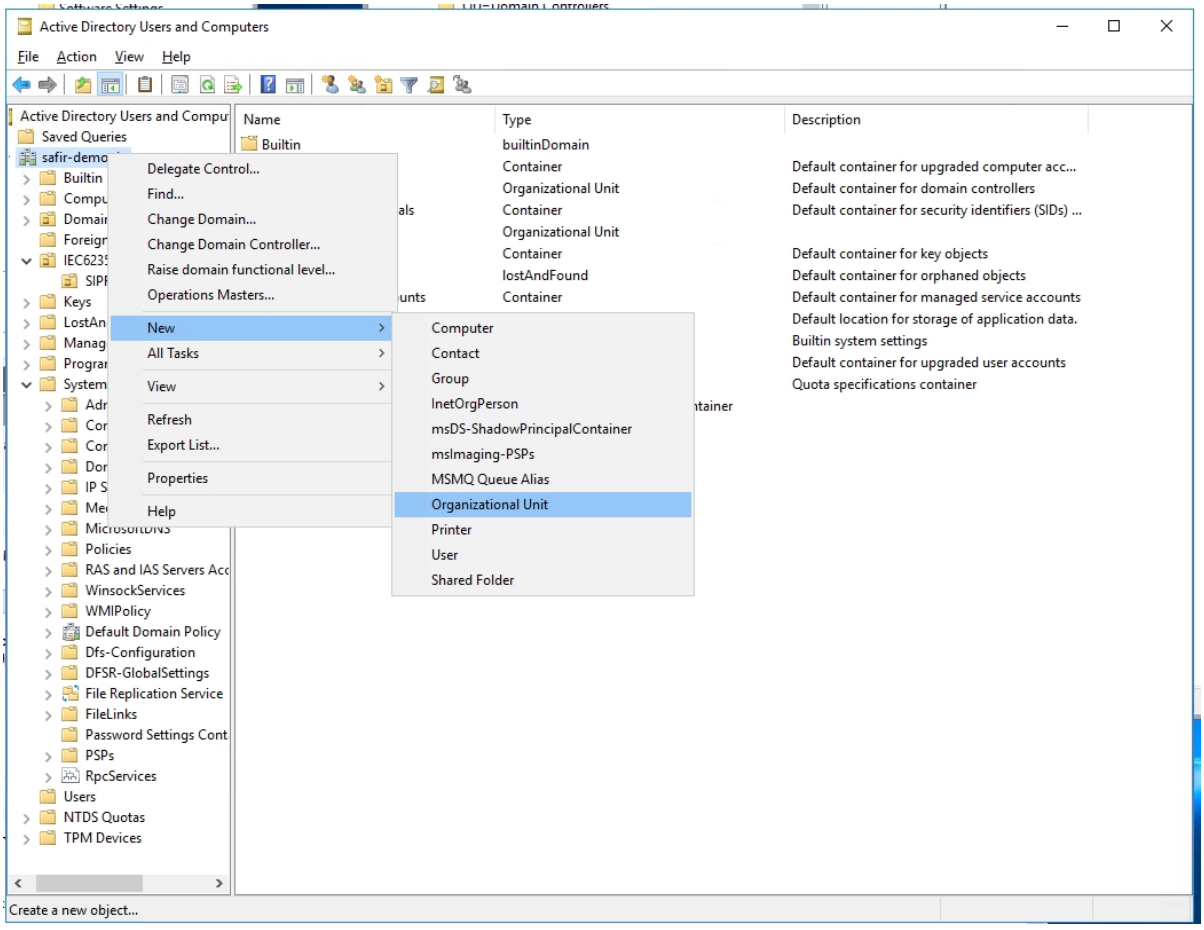
The procedure describes an example using the Network Policy Server (NPS). A RADIUS server like a FreeRADIUS for using this RADIUS protocol with the SIiemens Digital Grid devices together with the information in this document can also be used.

1. Create a new Organizational Unit (OU) called *IEC 62351*.
2. Add the IEC 62351 standardized roles and Siemens-specific roles as Windows global security groups to this Organizational Unit.
3. For the *SIPROTEC local HMI* user
    a. Add under the OU *IEC 62351* the new OU *SIPROTEC HMI User*.
    b. Because the HMI users can have only simple numeric passcodes for entering locally you need to change password policies only for these HMI-users to create users with simple passwords.
    c. Create a HMI user group and link this group to the new password policy.
    d. Create the local HMI users; add these users to the HMI user group and to the corresponding IEC 62351 or Siemens specific (roles) groups. Set numeric-only passcodes for these users.
4. Start Network Policy Server (NPS) and configure the policies and RADIUS Clients

1.5 Detailed description

1.5.1 Create a new Organizational Unit (OU) called *IEC 62351 Group*

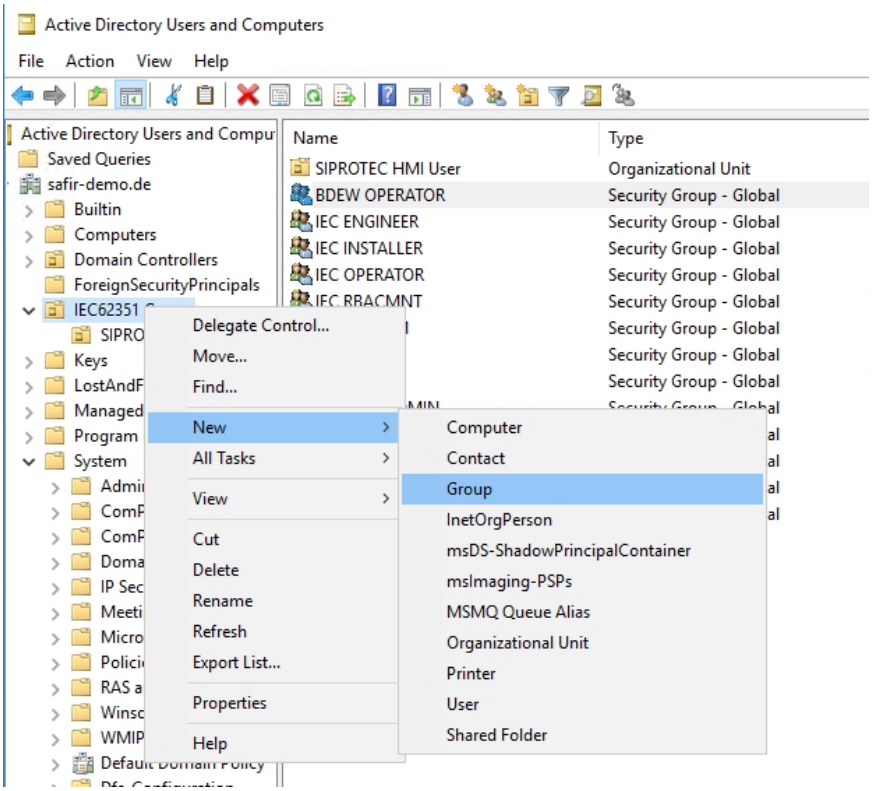
1. Open the Active Directory users Directory Users and Computers via the Server Manager and the Tools menu
2. Right click on domain level and create the new OU *IEC 62351 group* (or whatever you want to name it)



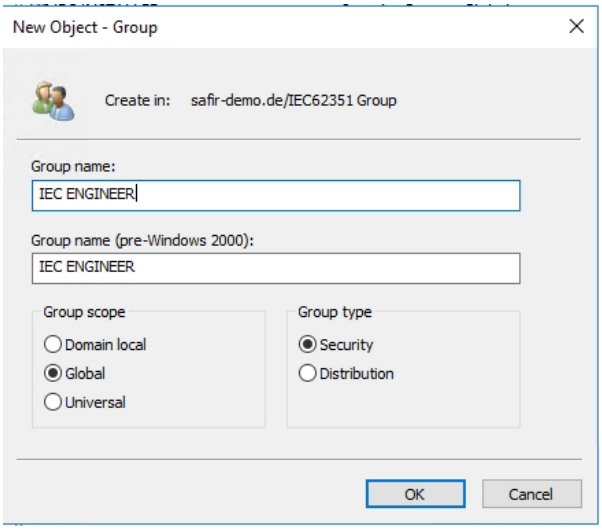
1.5.2 Add Global Security Groups

On OU level create all necessary IEC 62351 and Siemens roles as *Global Security Groups* as shown below.
Note: You can choose any other group names because the mapping to RADIUS attributes follows in a later step. The name is not essential for a proper functionality of the devices.

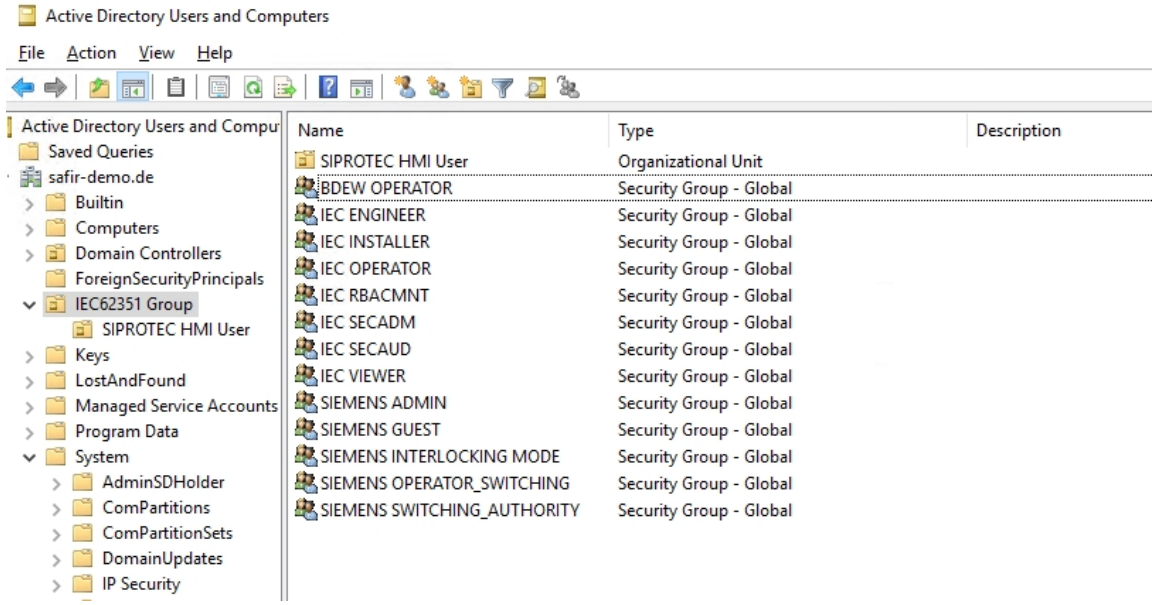
Configuration of a Windows Active Directory and NPS



Create new roles with a right click to the IEC 62351 group and select New → Group



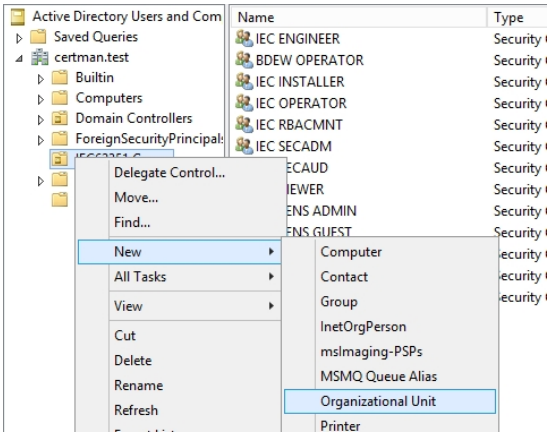
Enter the IEC 62351 or Siemens (role) group name and press OK. Repeat the procedure until all groups exists as shown in the following figure:

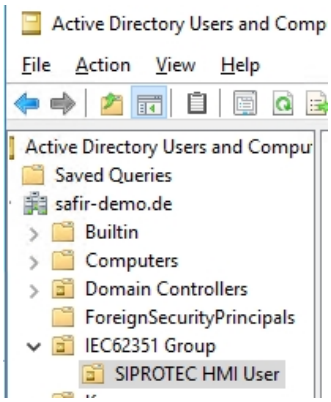


1.5.3 Local users for SIPROTEC 5 devices

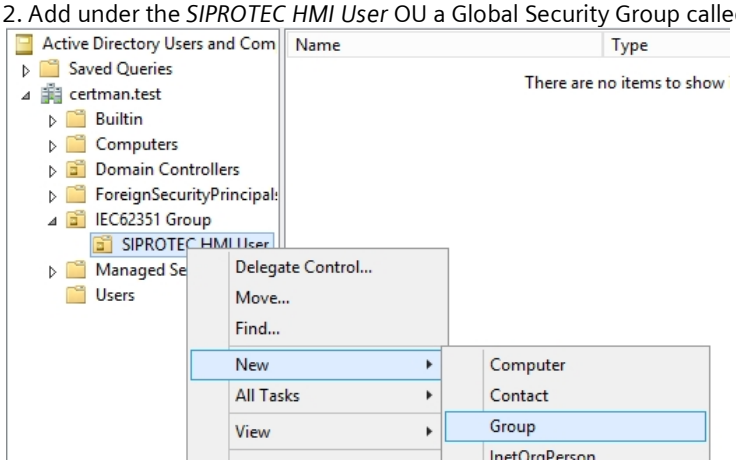
Add an additional Organizational Unit (OU) called SIPROTEC HMI User.
Note: Other group names can also be chosen. The name is not essential for the proper functionality of the devices.

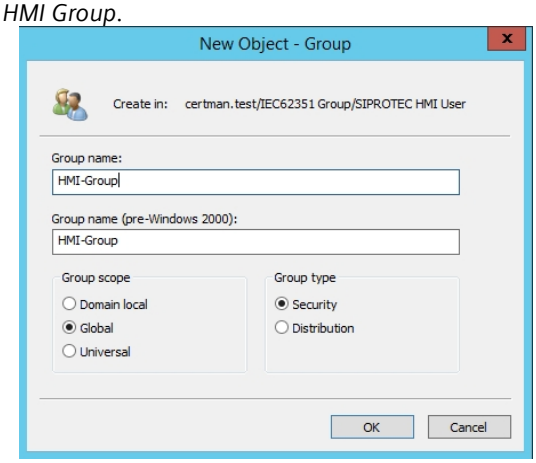
1. For the local HMI user add under the OU *IEC 62351 Group* the additional OU *SIPROTEC HMI User*.



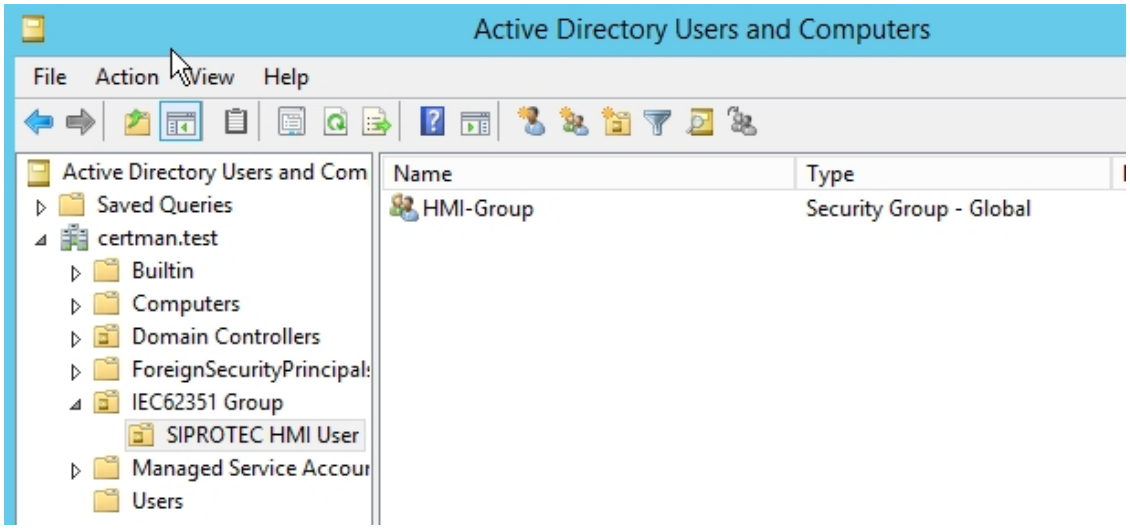


2. Add under the *SIPROTEC HMI User* OU a Global Security Group called *HMI Group*.





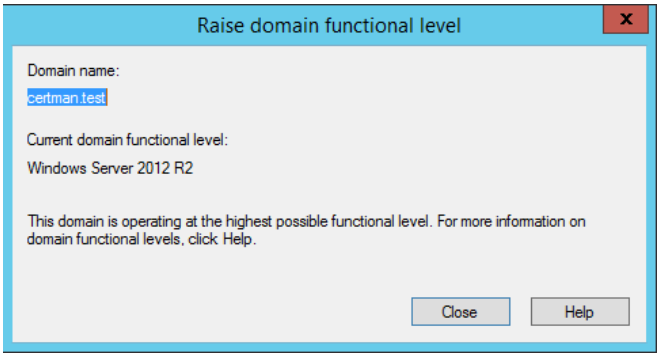
This group is needed for uses using the weak password policy with numeric passcodes



3. Due to HMI user can have only simple numeric passcodes, the password policy of the HMI users need only be changed. The following instruction has been used: http://www.grouppolicy.biz/2011/08/tutorial-how-to-setup-default-and-fine-grain-password-policy/

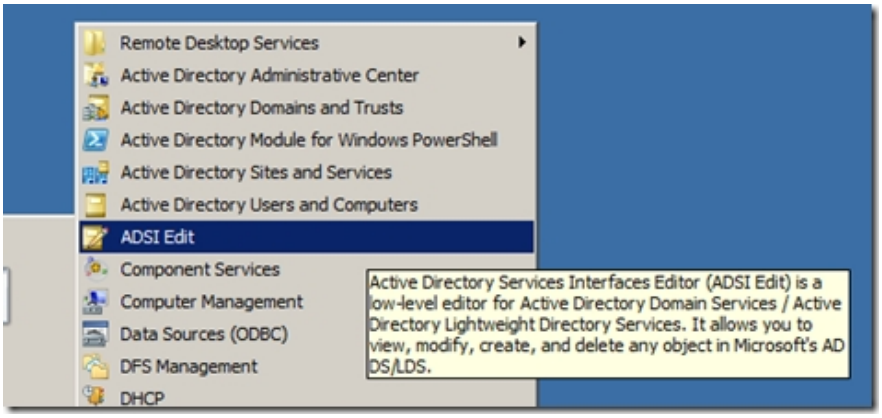
PRE-REQUISITES/RESTIRCTIONS

Your domain must be Windows Server 2008 Native Mode or later, this means ALL of your domain controllers must be running Windows Server 2008 or later. You can check this by selection the "Raise domain functional level" on the top of the domain in Active Directory Users and Computers.



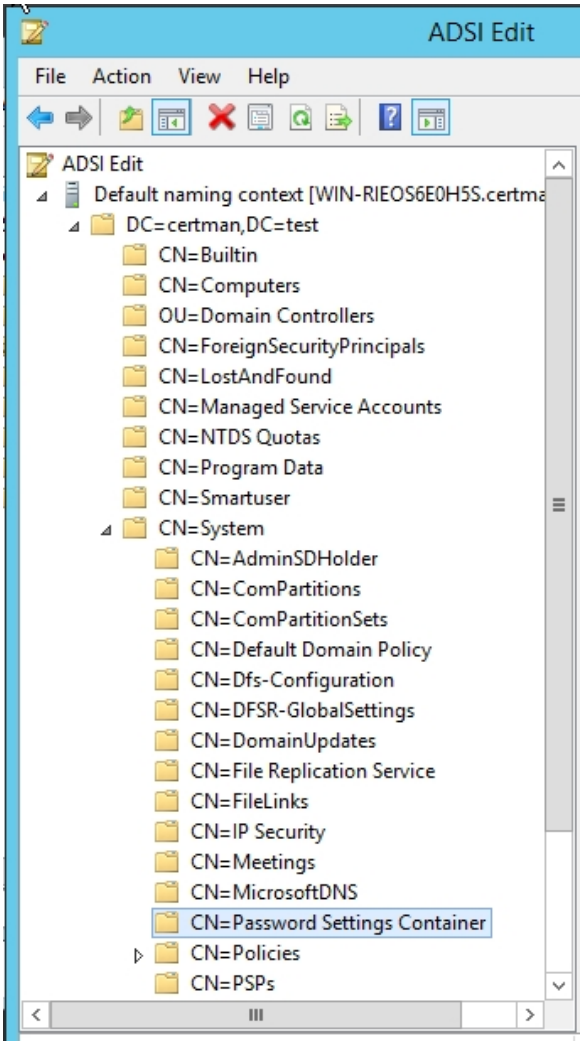
CREATING A PASSWORD SETTING OBJECT (PSO)

Step 1: Start ADSI Edit via Server Manager Tools Menu or under Administrator Tools Open ADSI Edit and connect it to a domain and domain controller you want to setup the new password policy

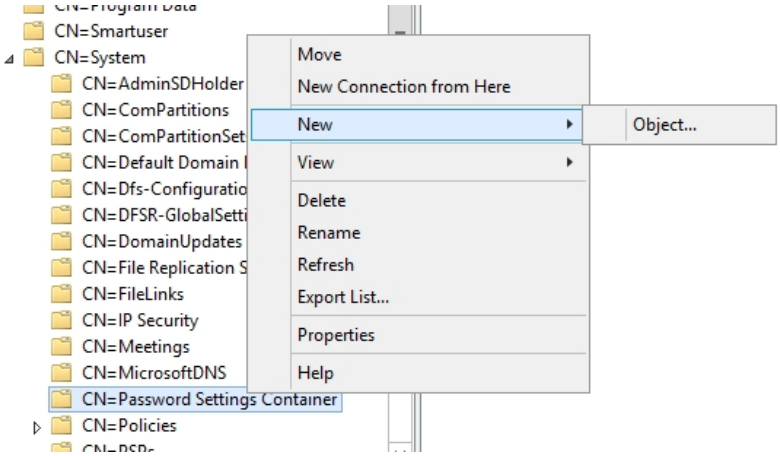


Note: If this option does not be appeared, go to "Turn Windows Features On or Off" and make sure the "AD DS and AD LDS Tools" are installed. RSAT need also to be installed in the operating system Windows 7.

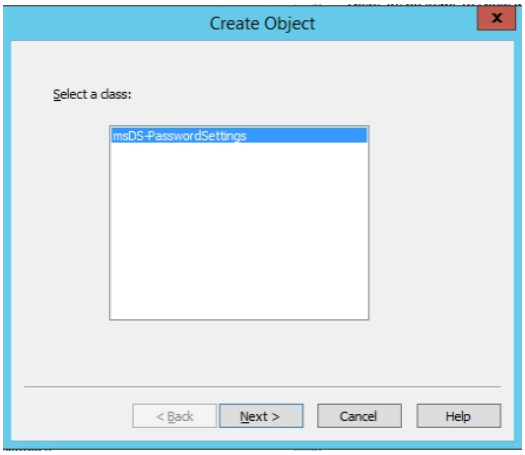
Step 2: Double click on the "CN=*DomainName*", then double click on "CN=System" and then double clikc on "CN=Passowrd Settings Container".

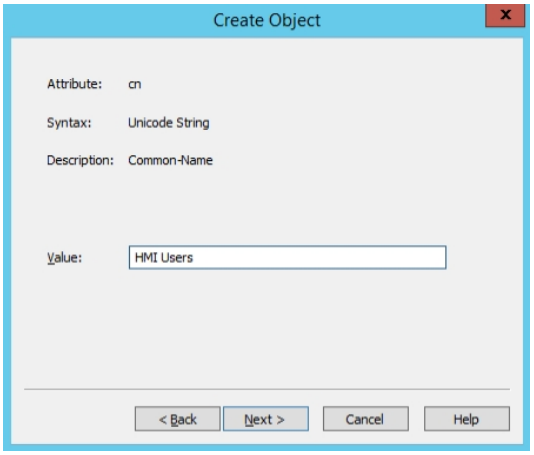


Step 3: Right click on "CN=Password Settings Container" and the nclick on "New" then "Object..."



Step 4: Click on "Next"

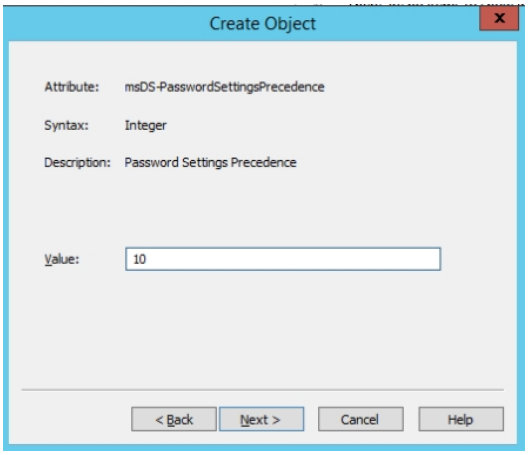


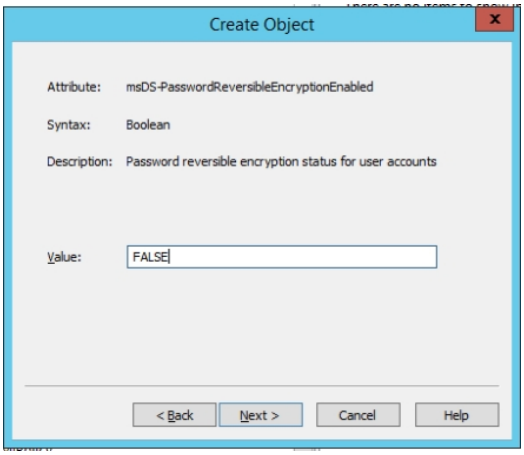


Step 5: Type the name "HMI Users" of the PSO in the "Value" field and then click "Next"

Note: With the exception of the password length the following values are all the same as the default values in "Default Domain Policy".

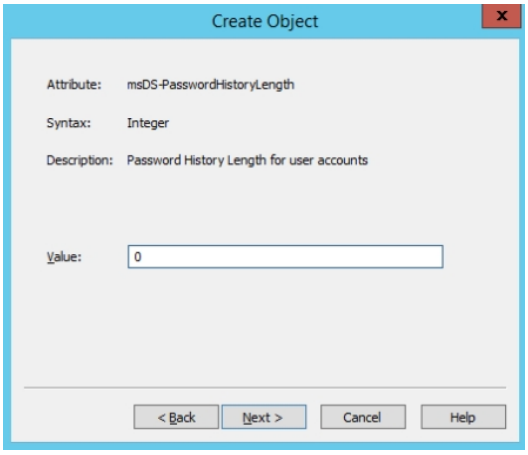
Step 6: Type in a number that will be the Precedence for this Password Policy then click "Next".
Note: This is used if a user has multiple Password Settings Object (PSO) definitions applied to them.

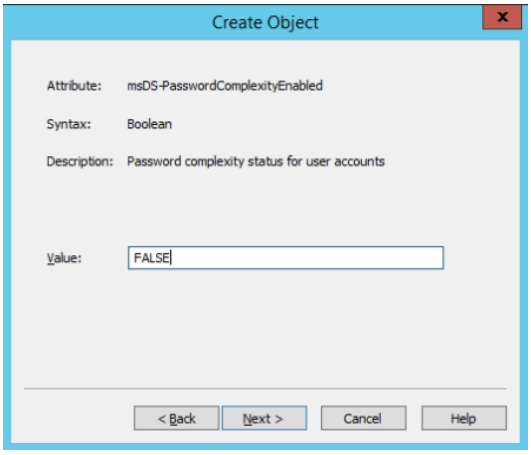




Step 7: Type "FALSE" in the value field and click "Next"
Note: You should almost never use "TRUE" for this setting.

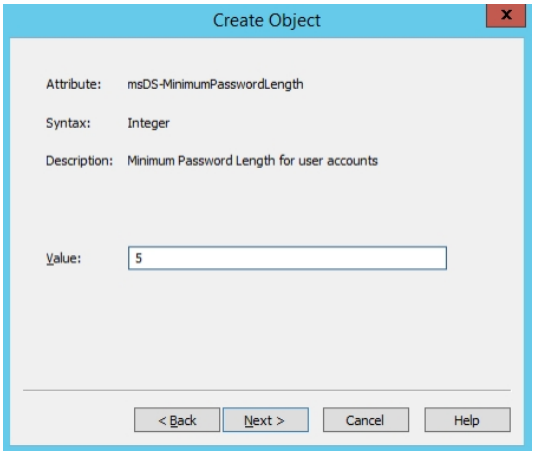
Step 8. Type "0" in the "Value" field and click "Next"

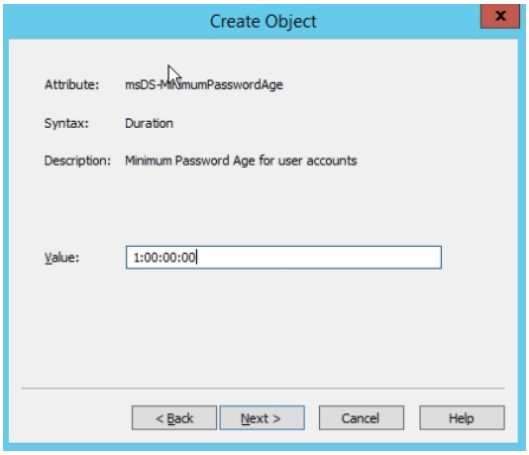




Step 9: Type "FALSE" in the "Value" field and click "Next"

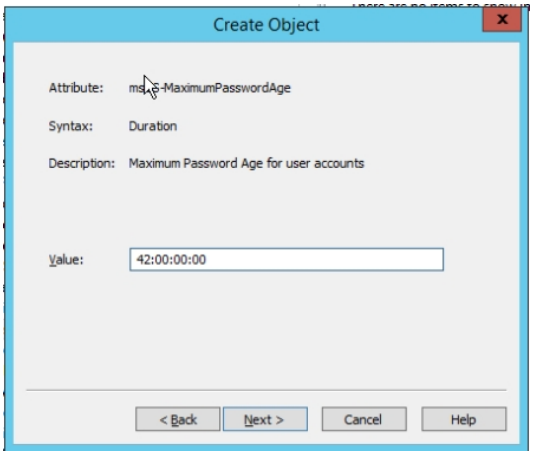
Step 10: Type "5" in the "Value" field and click "Next"

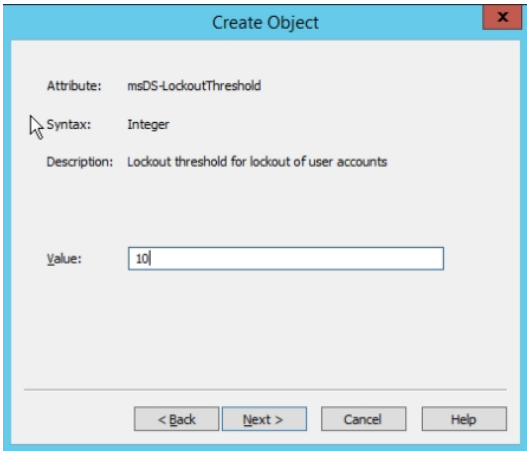




Step 11: Type "1:00:00:00" in the "Value" field and click "Next"

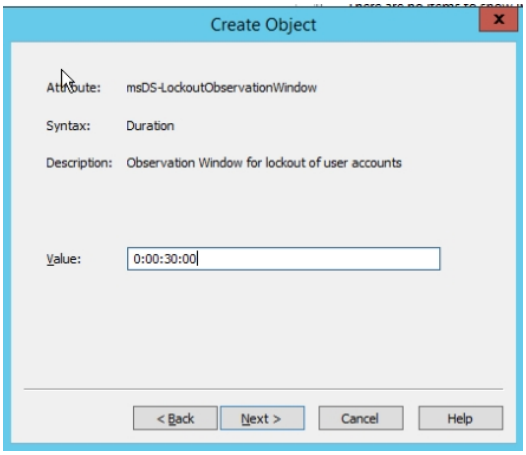
Step 12: Type "42:00:00:00" in the "Value" field and click "Next"

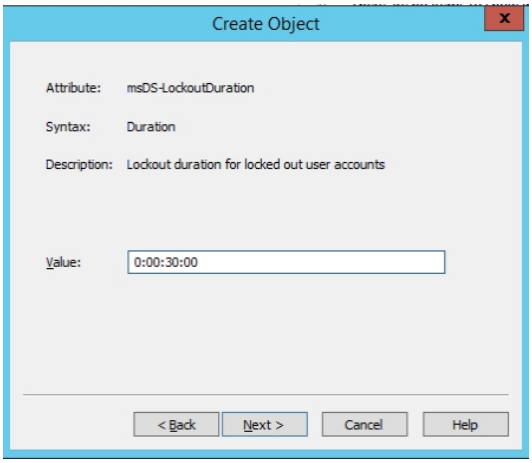




Step 13: Type "10" in the "Value" field and click "Next"

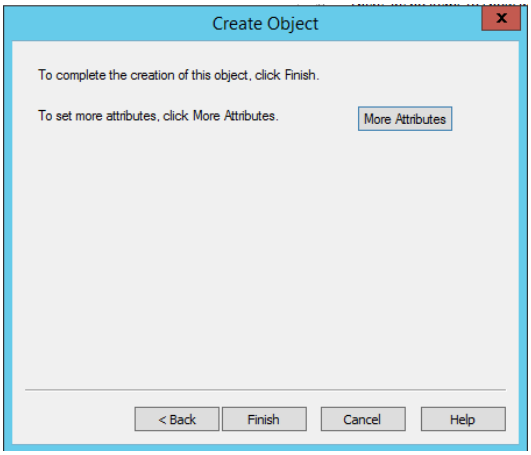
Step 14: Type "0:00:30:00" field and click "Next"



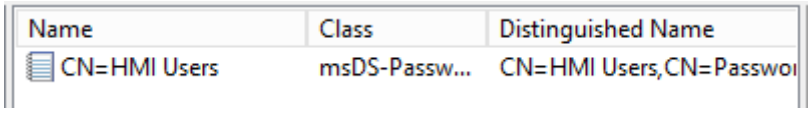


Step 15: Type "0:00:30:00" in the "Value" field and click "Next"

Step 16: Click "Finish".

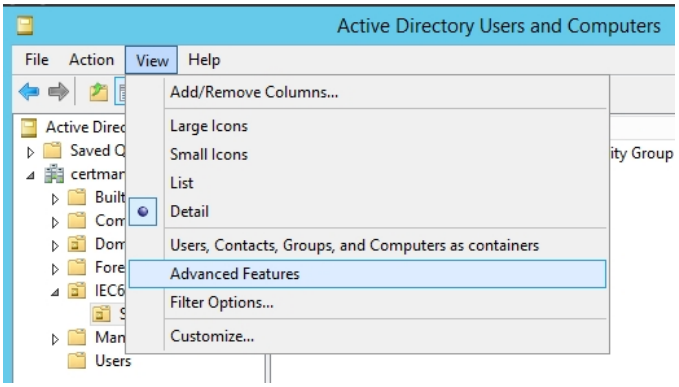


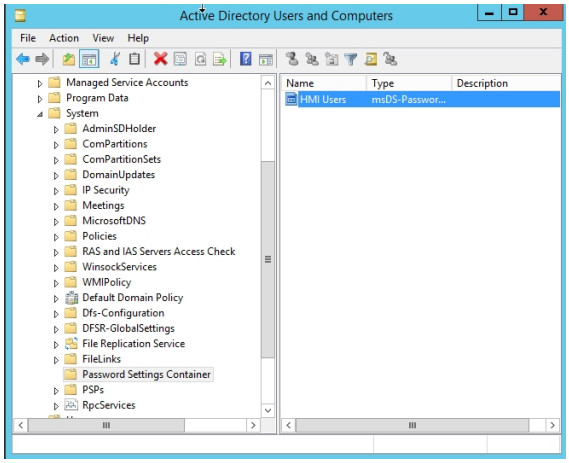
You have created the Password Settings Object (PSO) and you can cllose the ADSI Edit tool.



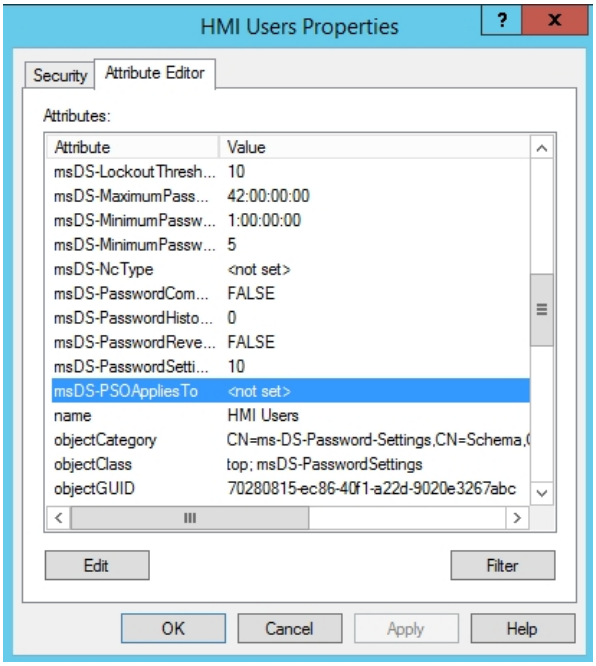
4. Now to apply the PSO to an user or group...

Step 17: Open *Active Directory Users and Computers* and navigate to "System > Password Settings Container".
Note: Advanced Mode needs to be enabled and press refresh in case of the Container is not visible.

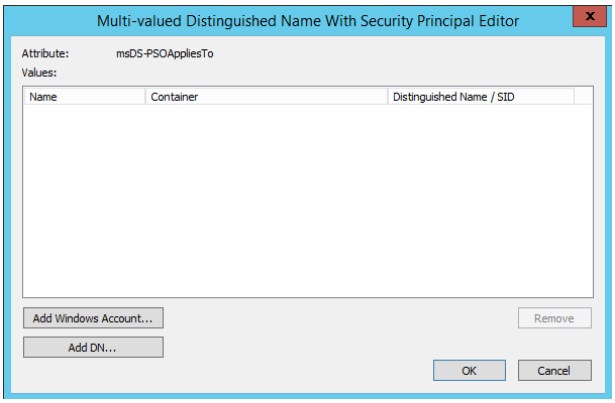


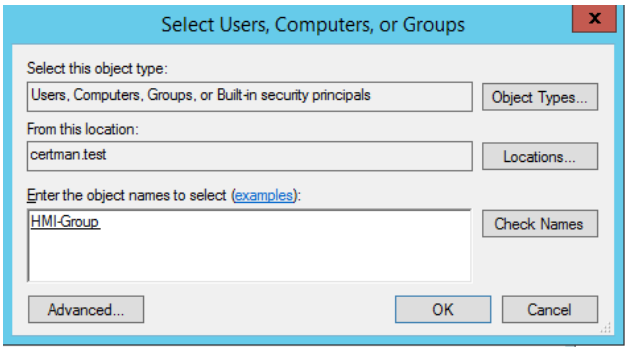


Step 18: Double click on the PSO you created then click on the "Attribute Editor" tab and then select the "*msDS-PSOAppliedTo*" attribute...
... and click "Edit"



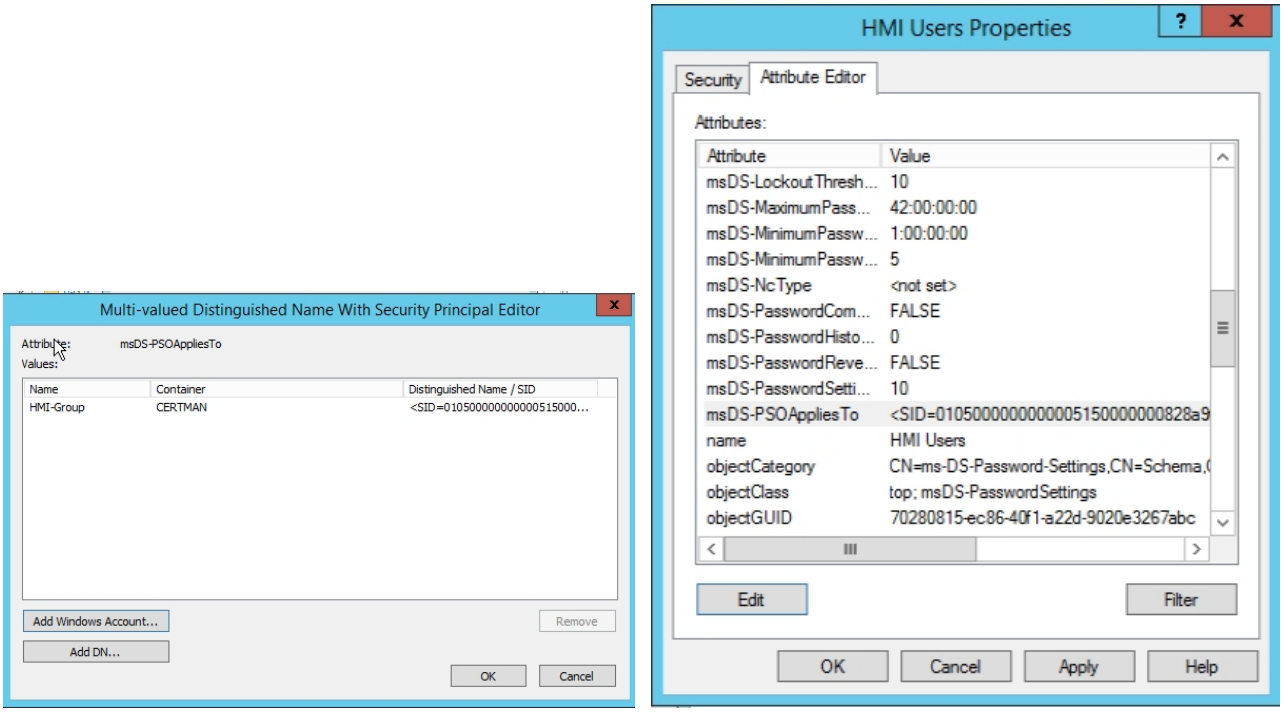
Step 19: Click "Add Windows Accounts...." button.





Step 20: Select the group "HMI-Group" to apply this PSO and click "OK"

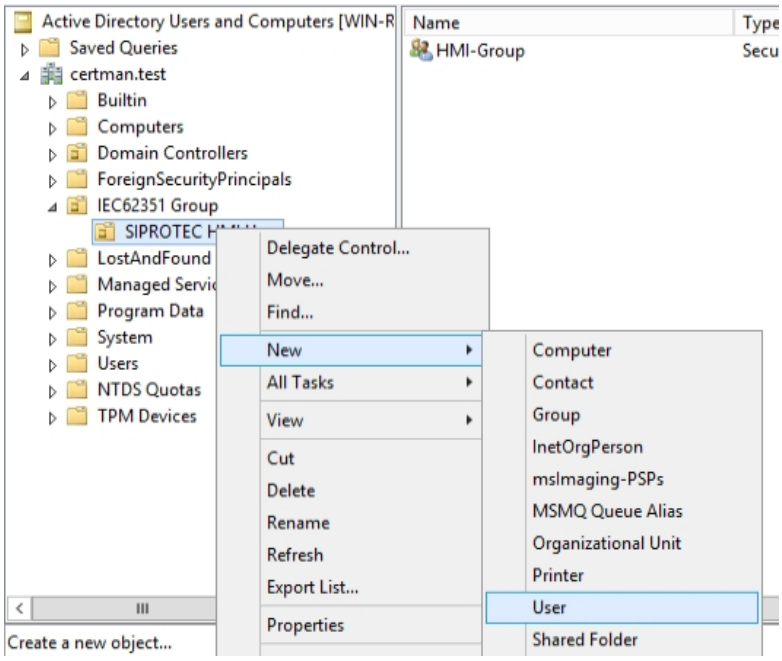
Step 21: Click "OK"

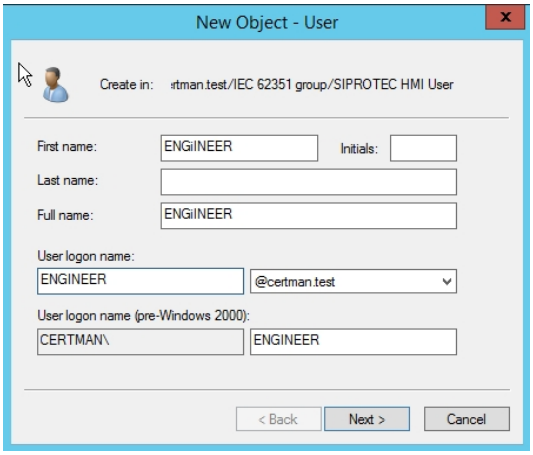


Step 22: Click "OK"

And now it is done in ADSI.

5. Now, add all HMI users under "SIPROTEC HMI User" in a first step with a strong password.

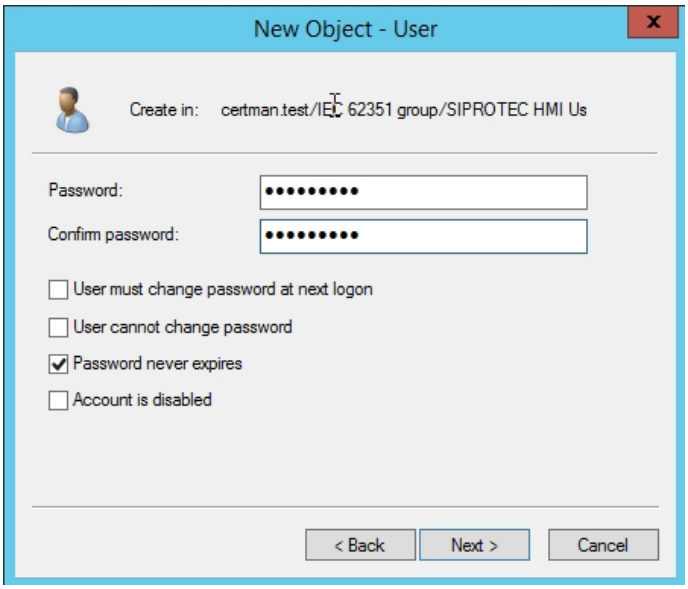




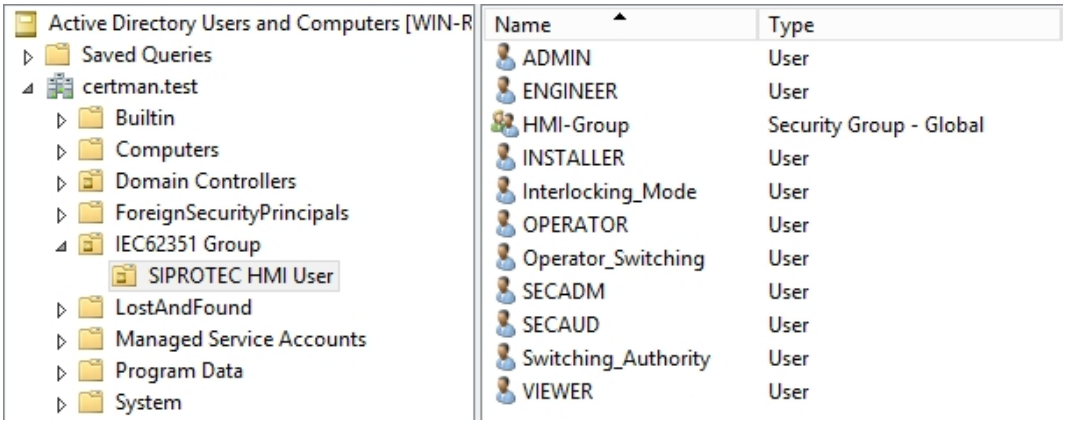
Be sure that the *User logon name* is identical to the name. Create in the same way following users:

ADMIN, ENGINEER, VIEWER, INSTALLER, OPERATOR, SECADM, SECAUD,
Operator_Switching, Switching_Authority, Interlocking_Mode

Note: These are HMI users which are hard-wired inside the SIPROTEC 5 devices for HMI local login. The names cannot be adjusted or changed; these are not groups or roles but has to be mapped to the corresponding group in a later step.

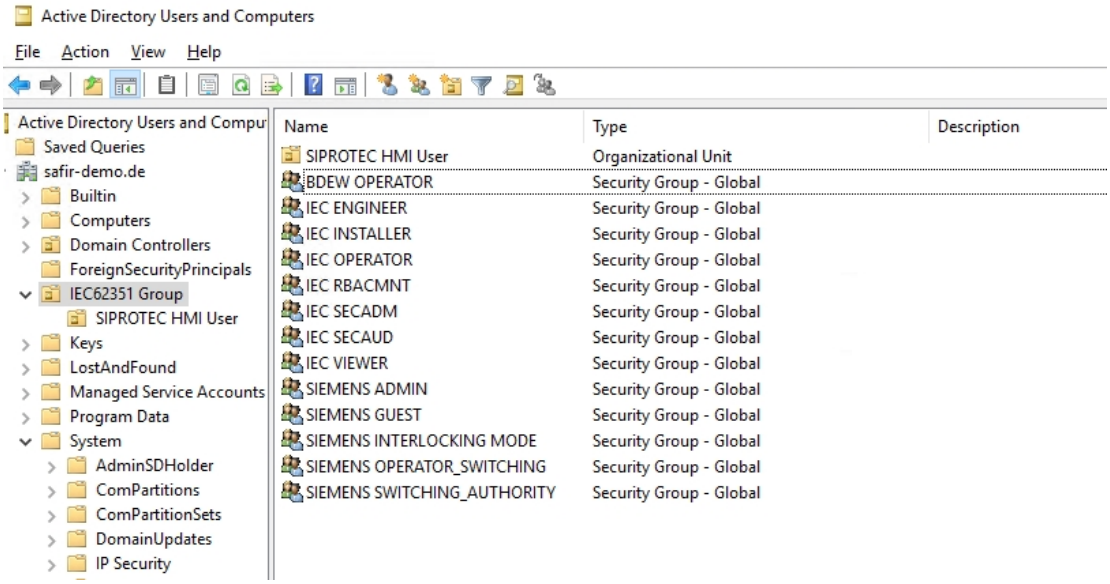


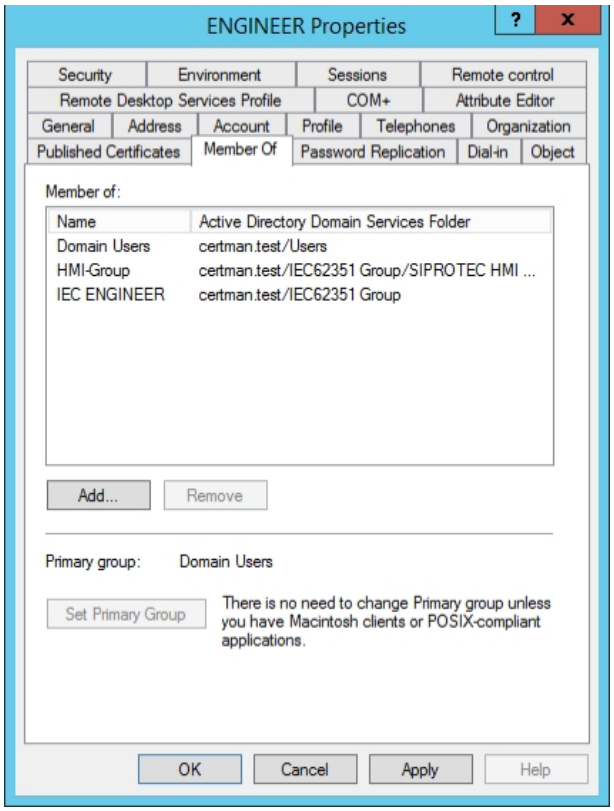
Note: You have to use a strong password during user creation phase also in case you have mapped the weak security policy in an earlier step.

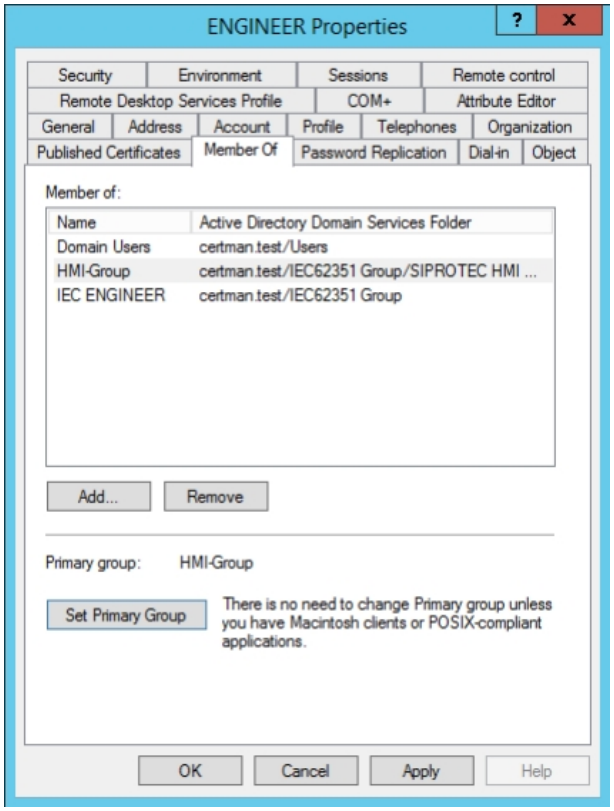


6. Add the users to a member of HMI-Group (for weak password policy) and to their specific IEC 62351 or Siemens Group:

Users of HMI-Group	**IEC or Siemens Group**
ADMIN	SIEMENS ADMIN
VIEWER	IEC VIEWER
OPERATOR	IEC OPERATOR
ENGINEER	IEC ENGINEER
INSTALLER	IEC INSTALLER
SECADM	IEC SECADM
SECAUD	IEC SECAUD
RBACMNT	IEC RBACMNT
Operator_Switching	SIEMENS OPERATOR_SWITCHING
Switching_Authority	SIEMENS SWITCHING_AUTHORITY
Interlocking_Mode	SIEMENS INTERLOCKING MODE

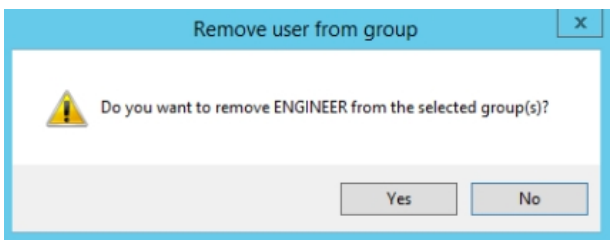


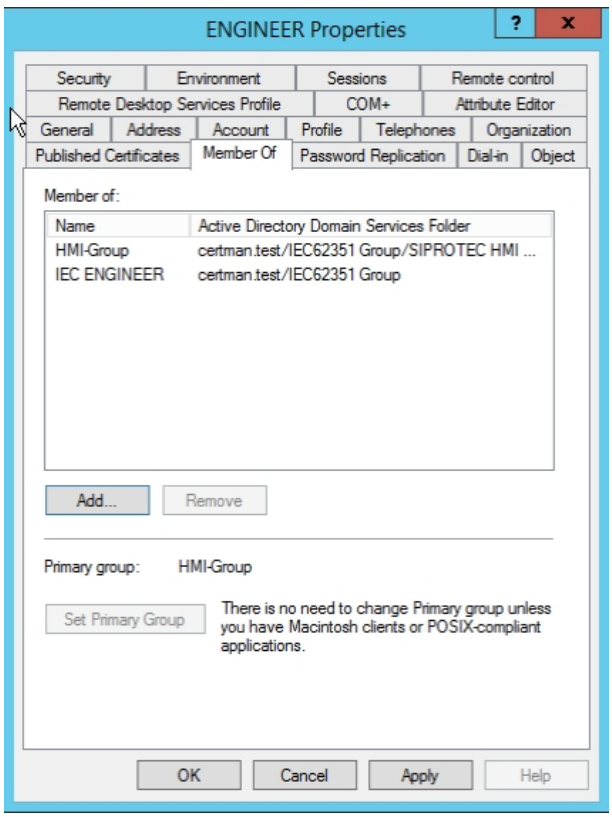




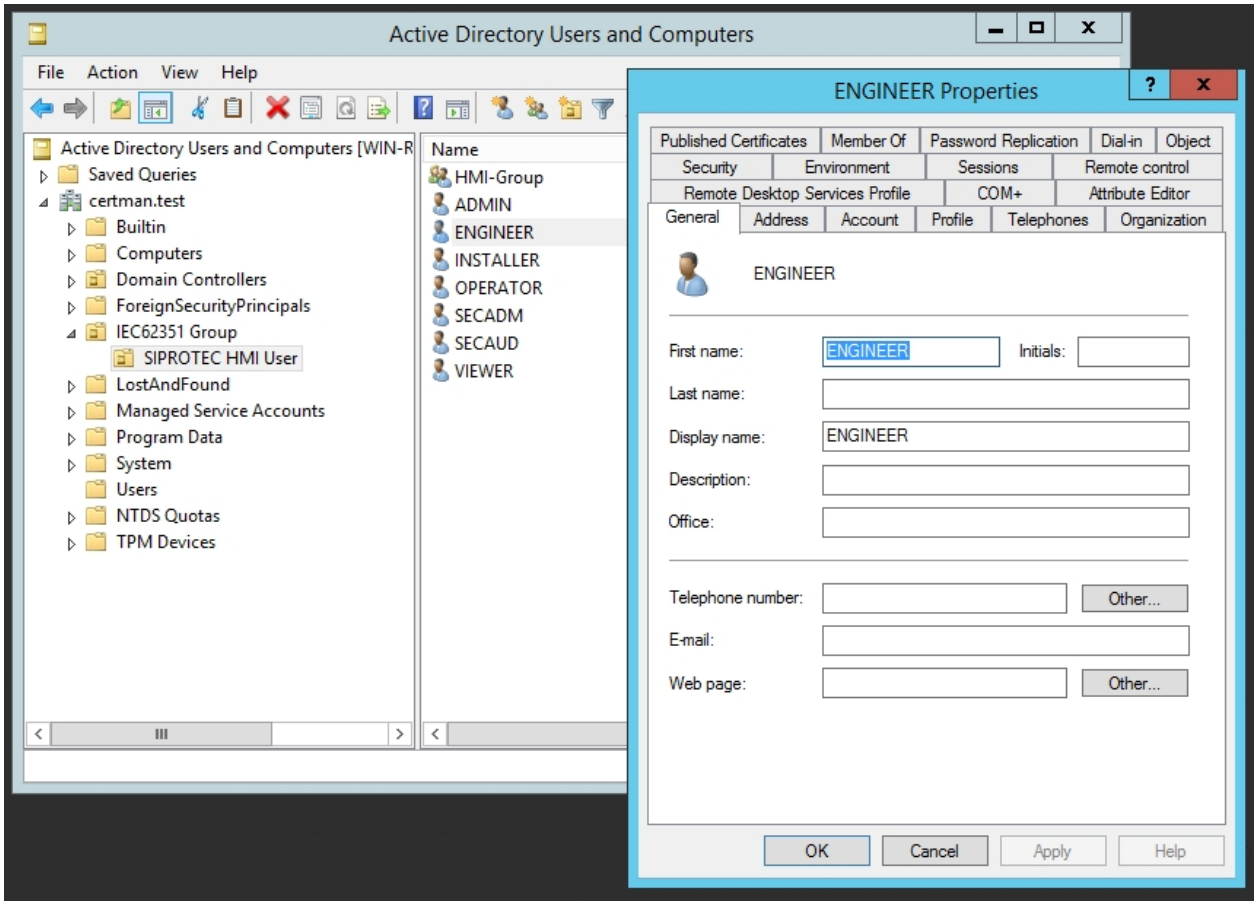
7. Set HMI-Group as Primary Group.

8. Then remove “Domain Users” default group.

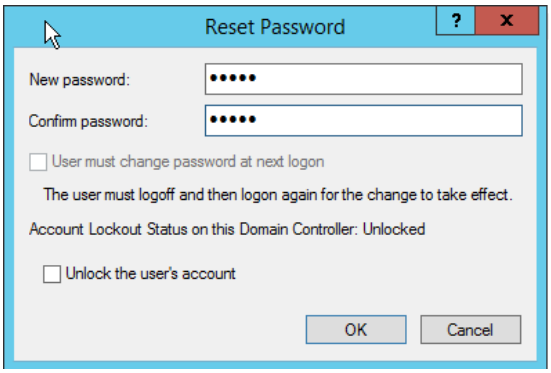


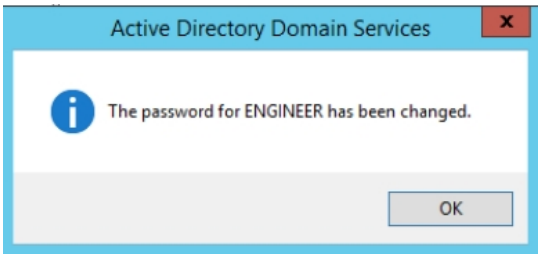


Now it should look like as follows for all users:

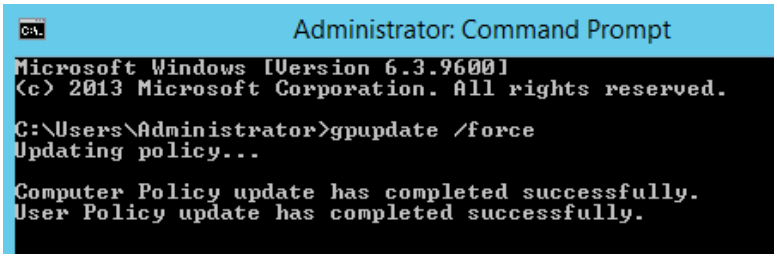


9. Now the HMI Passwords can be set to a simple numeric passcode, e.g 12345 (recommended to be with at least 5 digits)





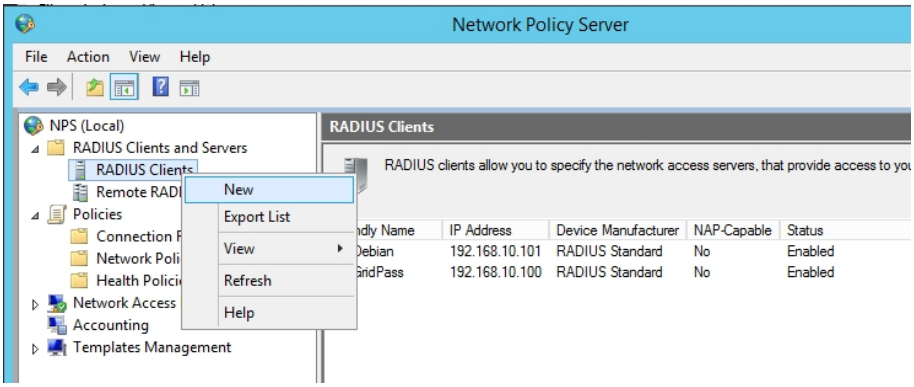
Before starting NPS update Computer and User Policy via the command shell and following command: *gpupdate /force*

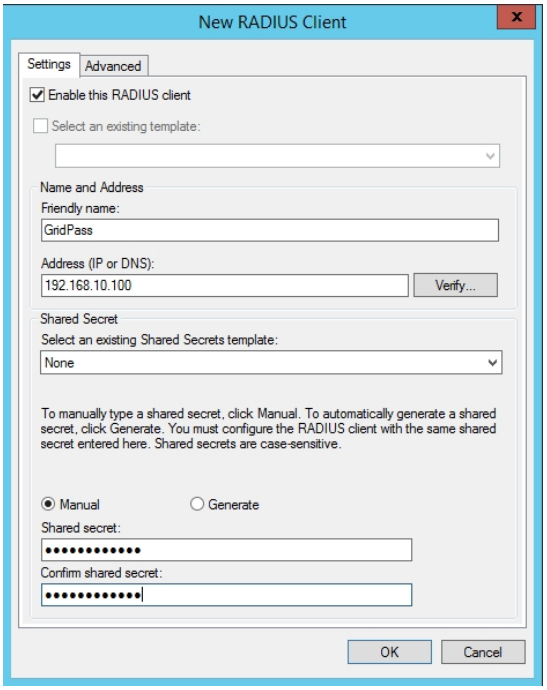


1.5.4 Configuration of the Network Policy Server

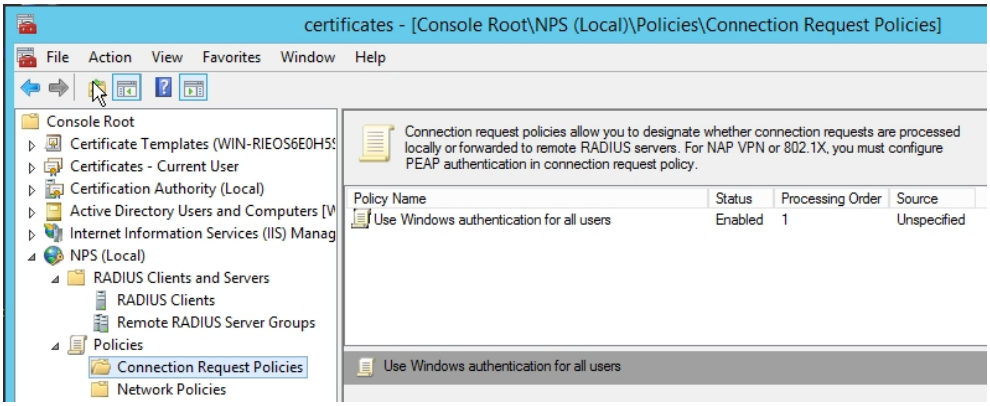
Start the Network Policy Server via the Server Manager Tools.

1. Add all RADIUS Clients with friendly name and the IP which comes with the requested UDP packet to the NPS and choose a shared secret which you have also to enter in the client system.

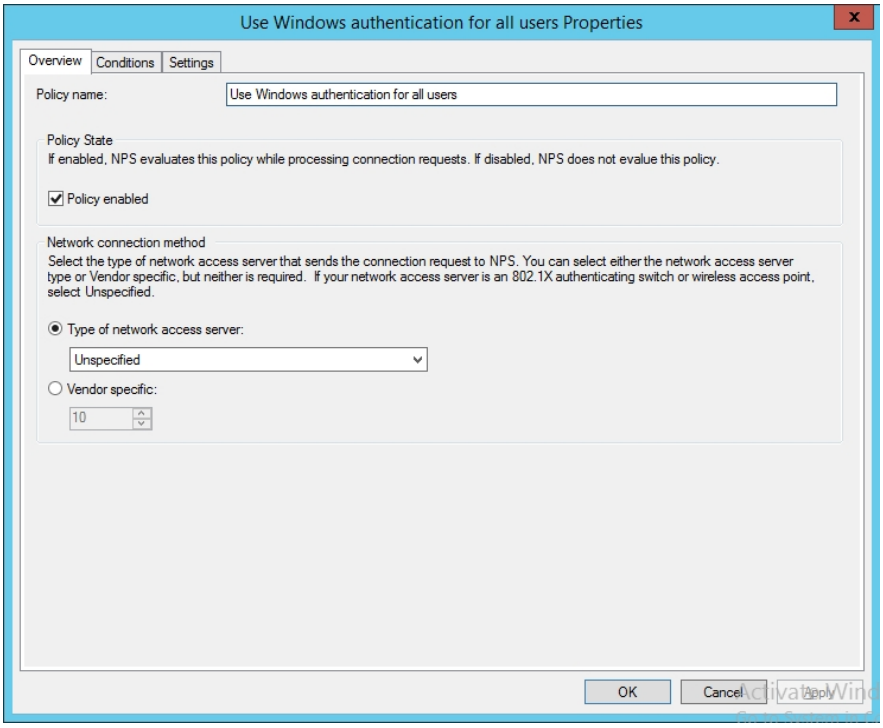


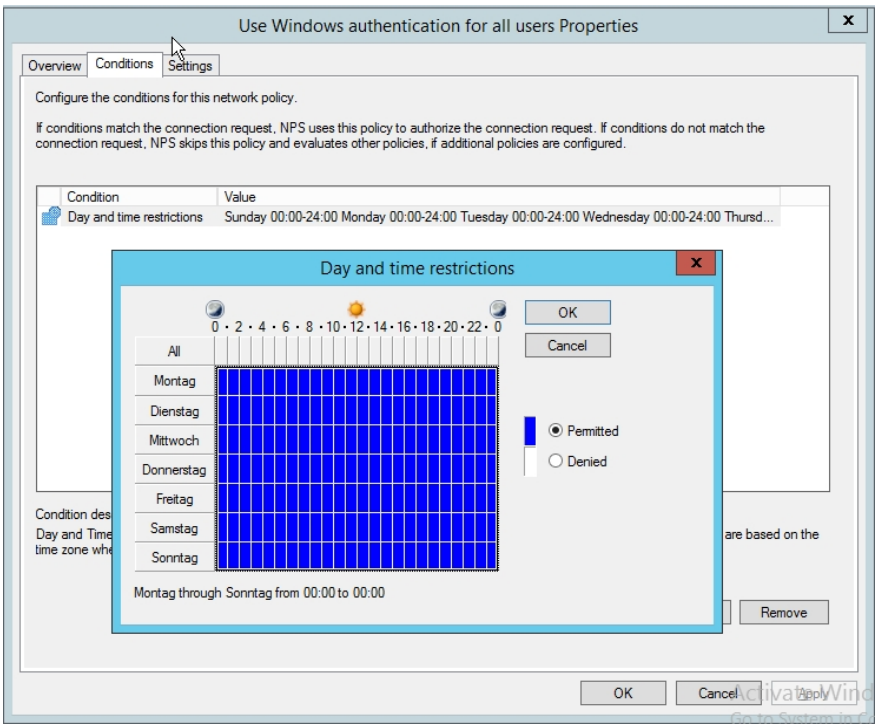


2. Add least one allowing connection policy.

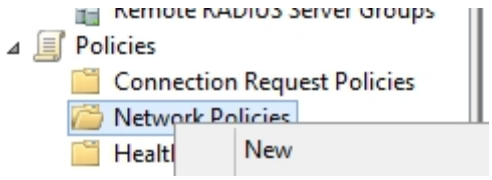


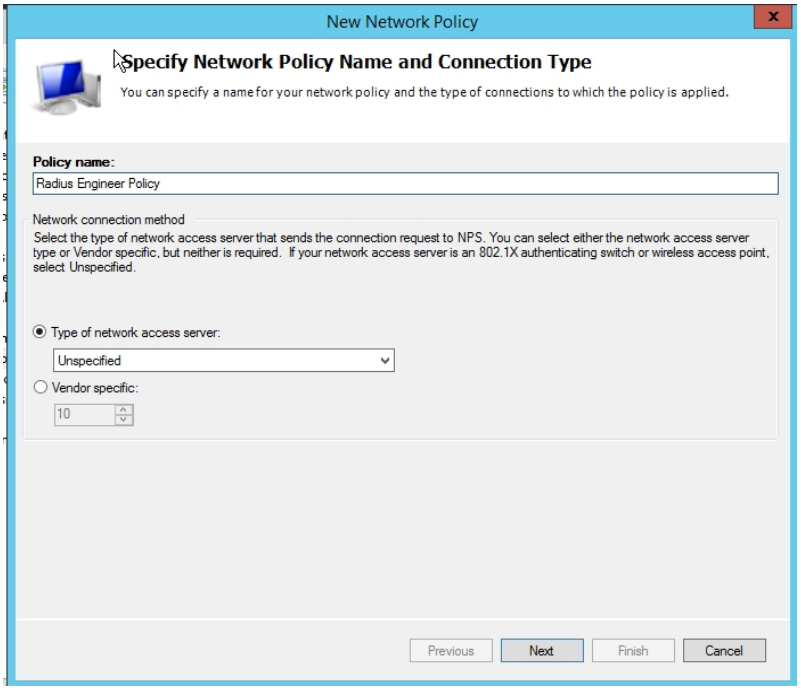
e.g. for day and time restriction



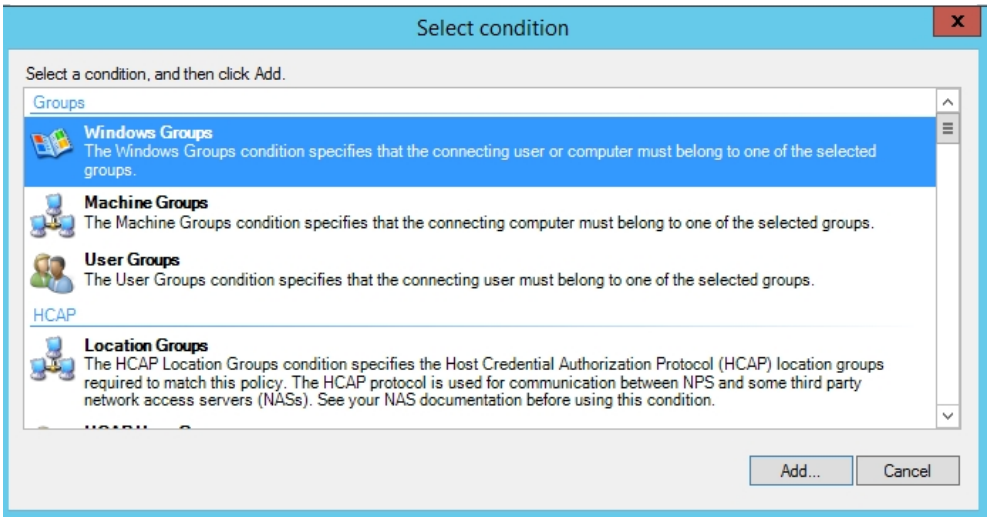


3. Create the network policies with the context menu and choose New,

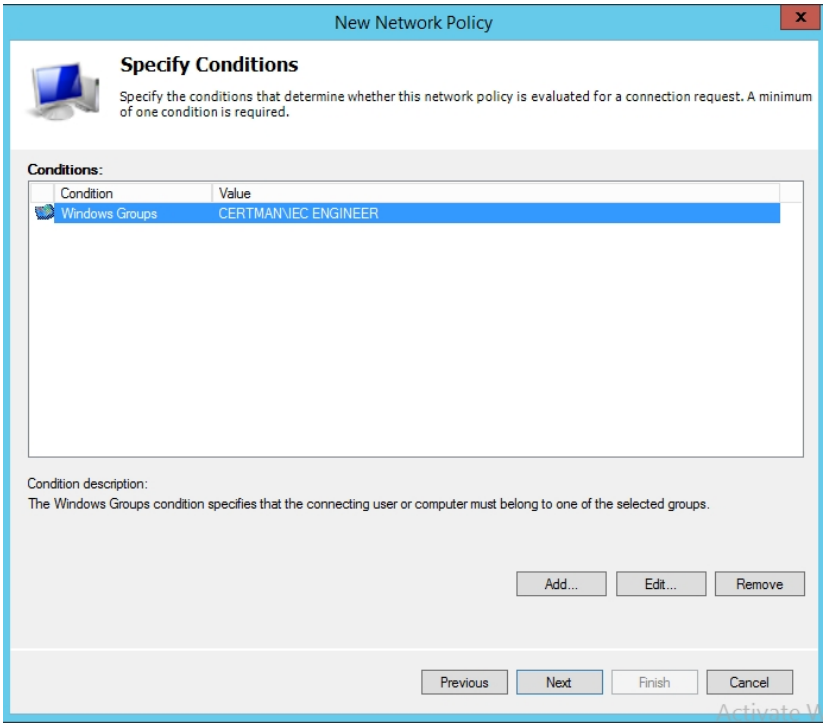


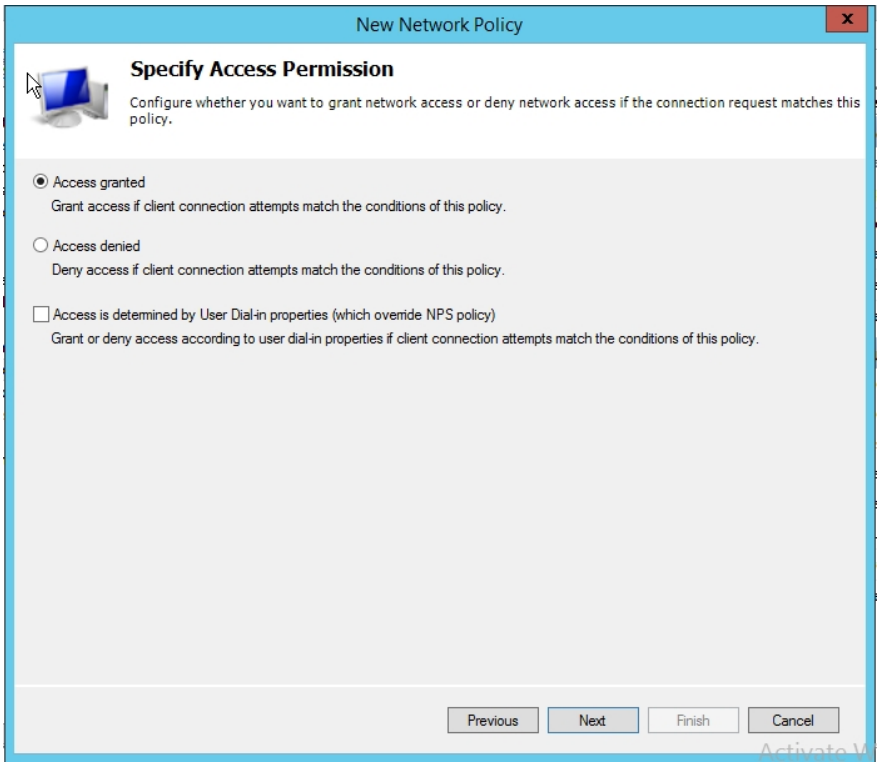


Click Next and add a Windows Group as Condition

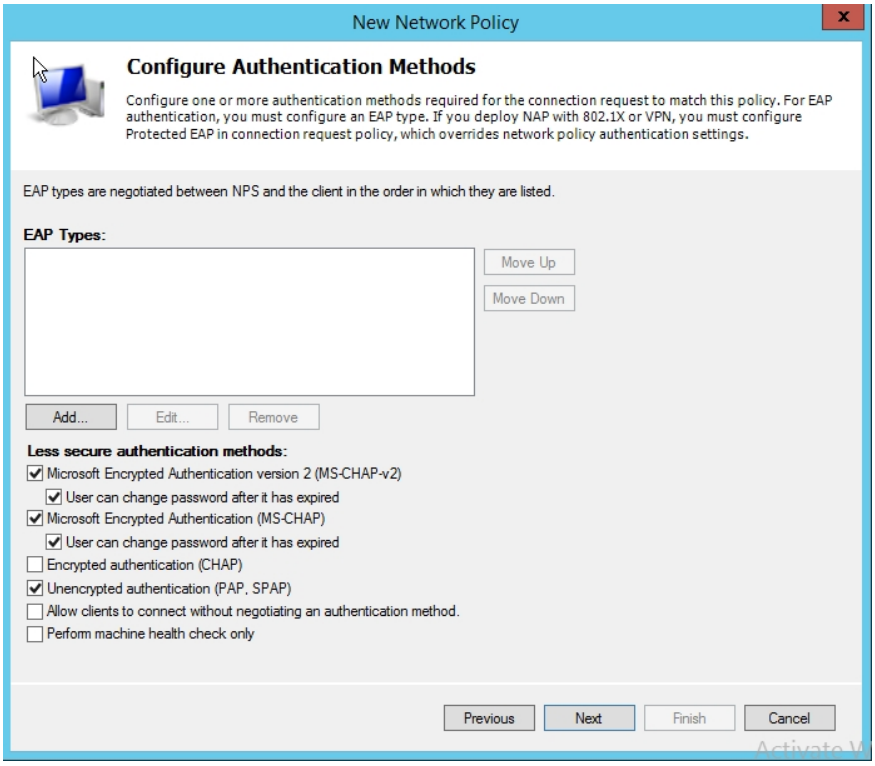


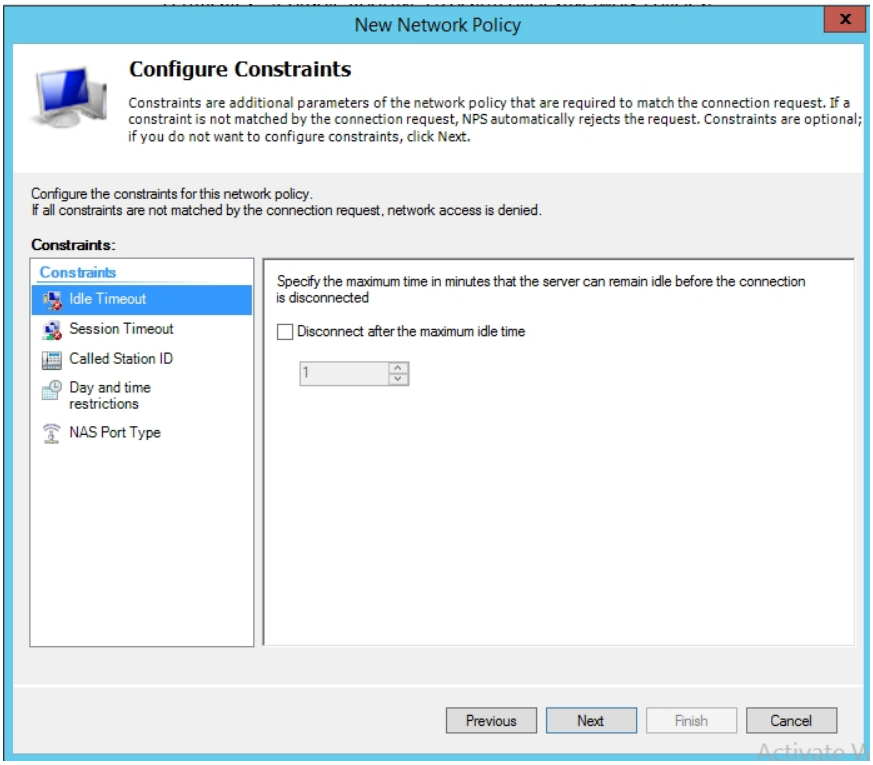
Choose the corresponding IEC or Siemens group for the created policy

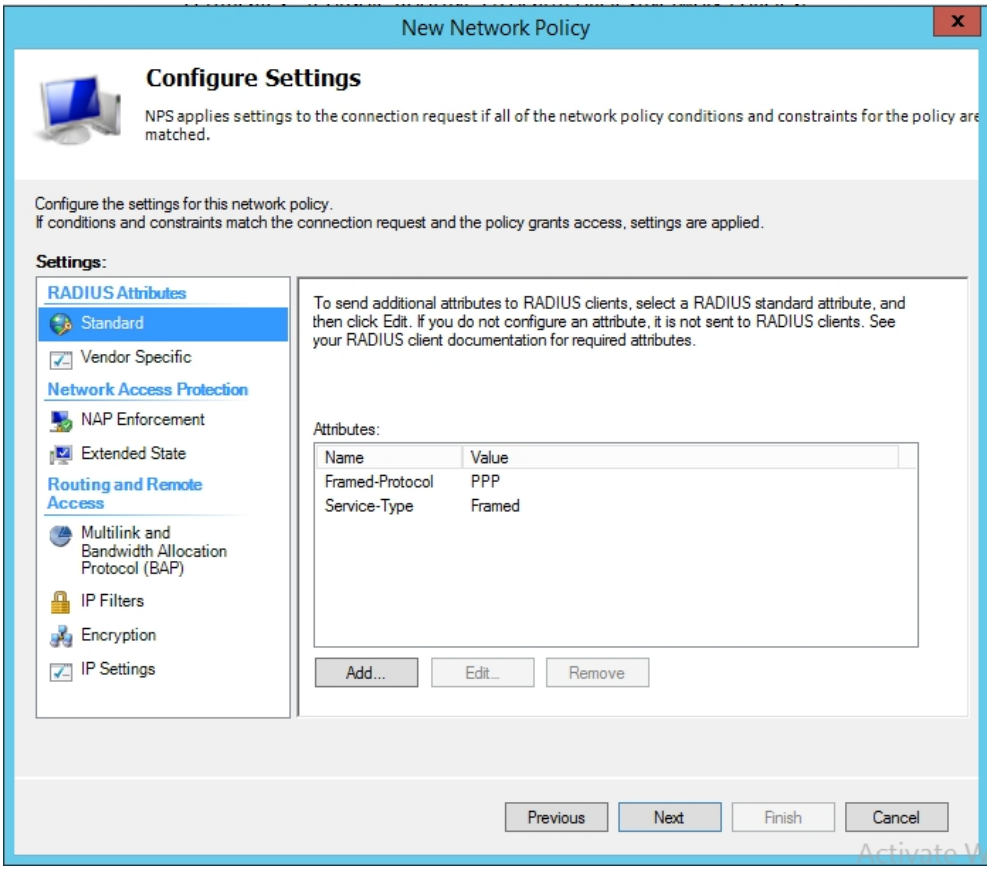




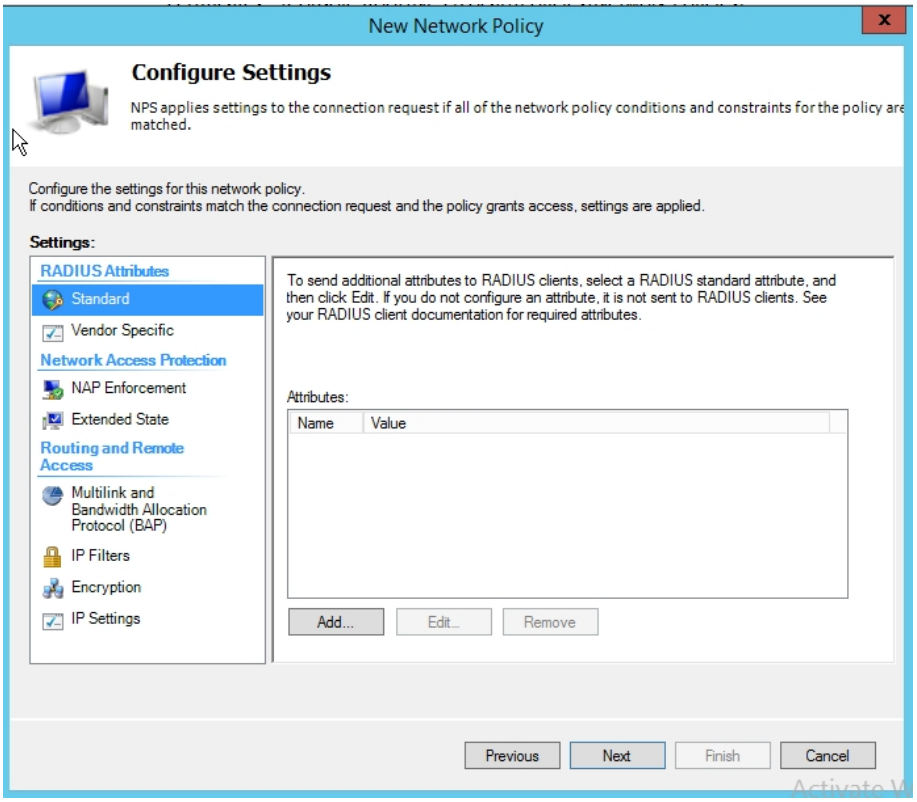
Choose the additional authentication method PAP


New Network Policy
Configure Authentication Methods
Configure one or more authentication methods required for the connection request to match this policy. For EAP authentication, you must configure an EAP type. If you deploy NAP with 802.1X or VPN, you must configure Protected EAP in connection request policy, which overrides network policy authentication settings.
EAP types are negotiated between NPS and the client in the order in which they are listed.
EAP Types:
Move Up
Move Down
Add...
Edit...
Remove
Less secure authentication methods:
Microsoft Encrypted Authentication version 2 (MS-CHAP-v2)
User can change password after it has expired
Microsoft Encrypted Authentication (MS-CHAP)
User can change password after it has expired
Encrypted authentication (CHAP)
Unencrypted authentication (PAP, SPAP)
Allow clients to connect without negotiating an authentication method.
Perform machine health check only
Previous
Next
Finish
Cancel

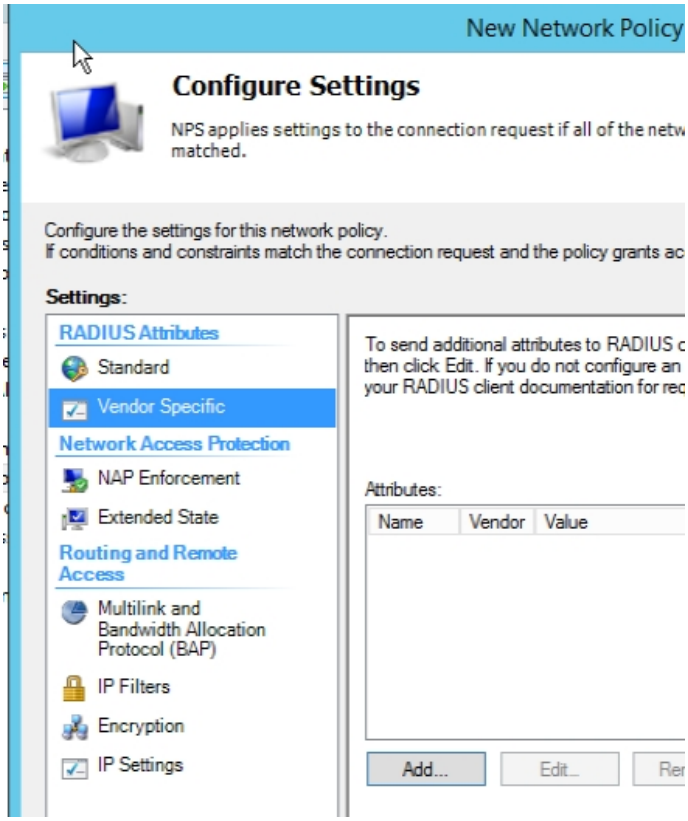

New Network Policy
Configure Constraints
Constraints are additional parameters of the network policy that are required to match the connection request. If a constraint is not matched by the connection request, NPS automatically rejects the request. Constraints are optional; if you do not want to configure constraints, click Next.
Configure the constraints for this network policy.
If all constraints are not matched by the connection request, network access is denied.
Constraints:
Constraints
Idle Timeout
Session Timeout
Called Station ID
Day and time restrictions
NAS Port Type
Specify the maximum time in minutes that the server can remain idle before the connection is disconnected
Disconnect after the maximum idle time
1
Previous
Next
Finish
Cancel



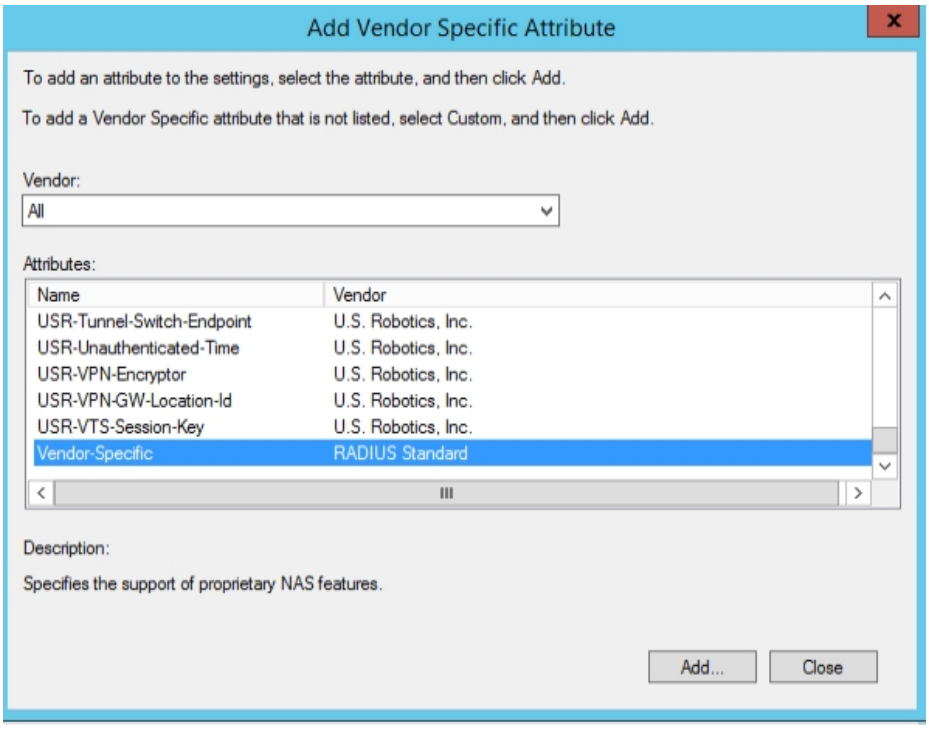
Remove the standard Attributes

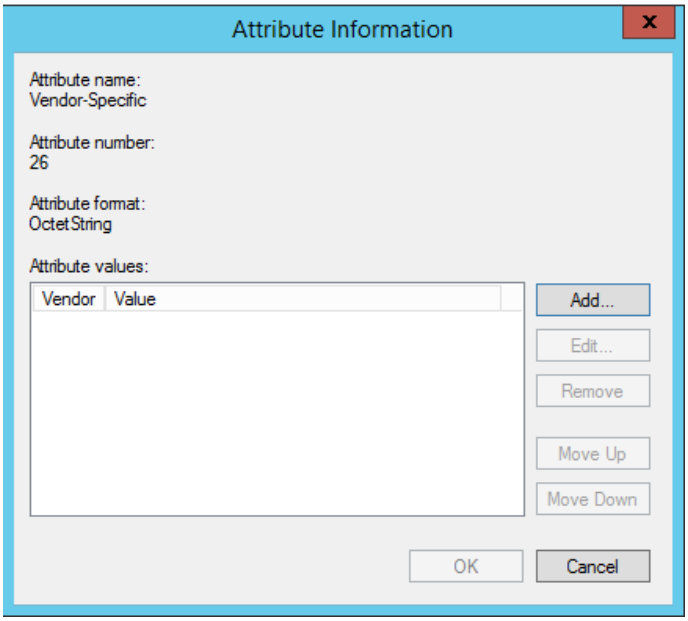


And add Vendor Specific Attributes



Add Vendor Specific



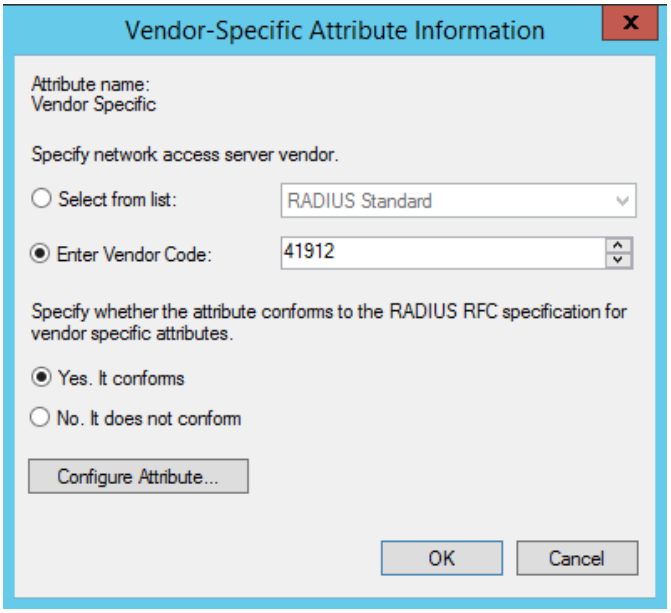


And add the necessary IEC 62351 attributes to the Policy

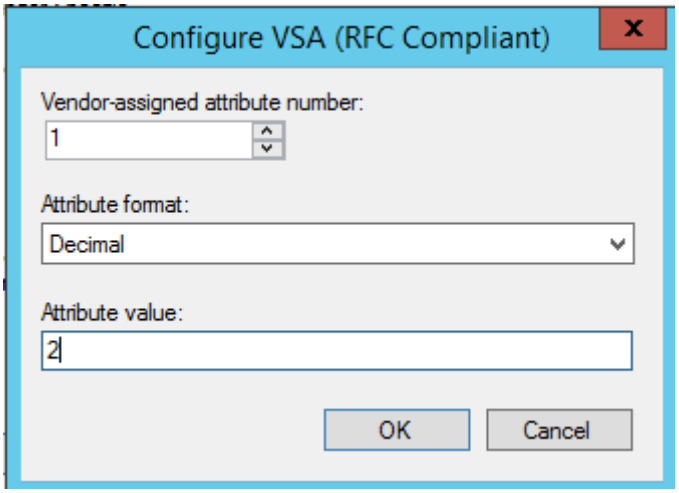
Note, enclosed the current IEC62351 Dictionary for Radius for a better understanding see **Error! Reference source not found.**

```
   Attribute Name                Attribute Value    Required
   IEC62351-8-RoleID-i           (i*10)+1           mandatory
   IEC62351-8-roleDefinition-i   (i*10)+2           optional
   IEC62351-8-aor-i              (i*10)+3           mandatory
   IEC62351-8-revision-i         (i*10)+4           mandatory
   IEC62351-8-ValidFrom-i        (i*10)+5           optional
   IEC62351-8-ValidTo-i          (i*10)+6           mandatory
Note: integer i=0..N

VENDOR International Electrotechnical Commission          41912
BEGIN-VENDOR International Electrotechnical Commission

   ATTRIBUTE IEC62351-8-RoleID-0          1         integer
   ATTRIBUTE IEC62351-8-roleDefinition-0  2         string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-0             3         string
   ATTRIBUTE IEC62351-8-revision-0        4         integer
   ATTRIBUTE IEC62351-8-ValidFrom-0       5         string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-0         6         string

   ATTRIBUTE IEC62351-8-RoleID-1          11        integer
   ATTRIBUTE IEC62351-8-roleDefinition-1  12        string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-1             13        string
   ATTRIBUTE IEC62351-8-revision-1        14        integer
   ATTRIBUTE IEC62351-8-ValidFrom-1       15        string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-1         16        string

   ATTRIBUTE IEC62351-8-RoleID-2          21        integer
   ATTRIBUTE IEC62351-8-roleDefinition-2  22        string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-2             23        string
   ATTRIBUTE IEC62351-8-revision-2        24        integer
   ATTRIBUTE IEC62351-8-ValidFrom-2       25        string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-2         26        string

END-VENDOR    International Electrotechnical Commission
```

Note: For limitations see chapter Siemens Appendix



Configure Attribute...



Note and Example: Vendor-assigned attribute, number "1" means IEC6235-8-RoleID-0

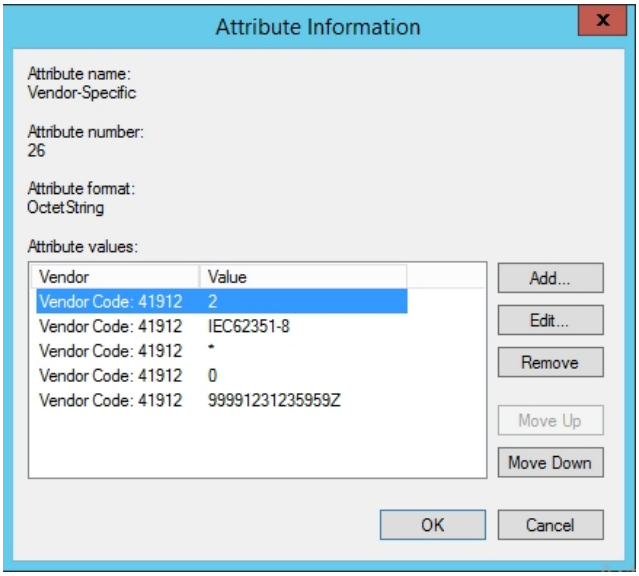
```
ATTRIBUTE              IEC62351-8-RoleID-0              1     integer
```

Attribute format: Decimal means integer, "2"means IEC roleID "ENGINEER"

Note: for negative values use the Hexadecimal format because of RADIUS RFC2865 defines the integer as unsigned int32. Using signed integer with NPS use the hexadecimal format

Range for signed int32: from –2.147.483.648 to 2.147.483.647
Range for unsigned in32: from 0 to 4.294.967.295
→ For example - 101 decimal results to FFFFFF9B hex

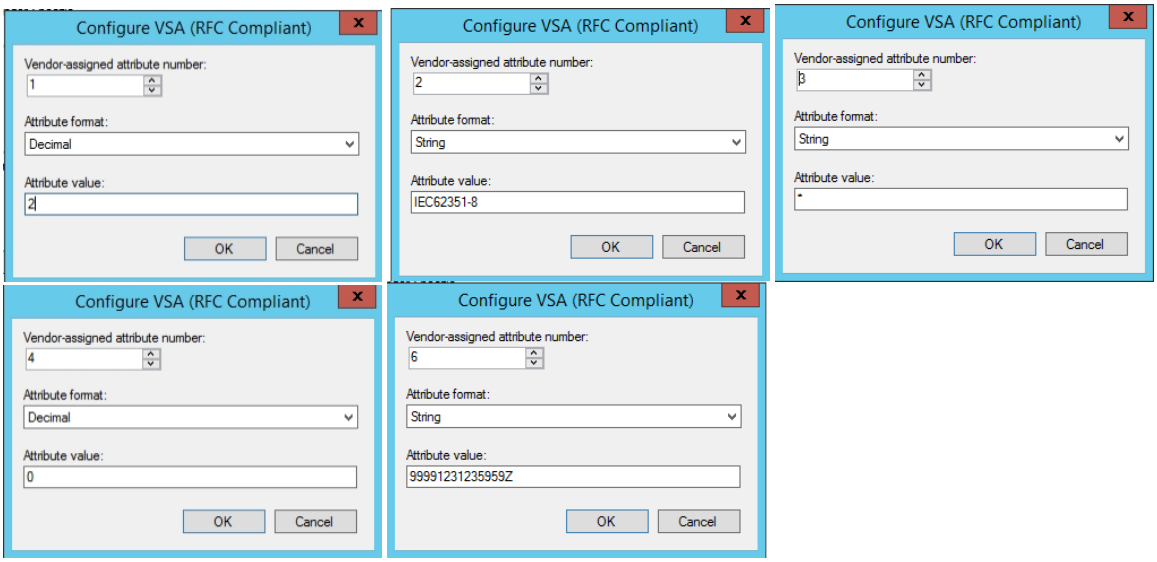
Add all attributes and values to the Policy. For example, for the role IEC ENGINEER



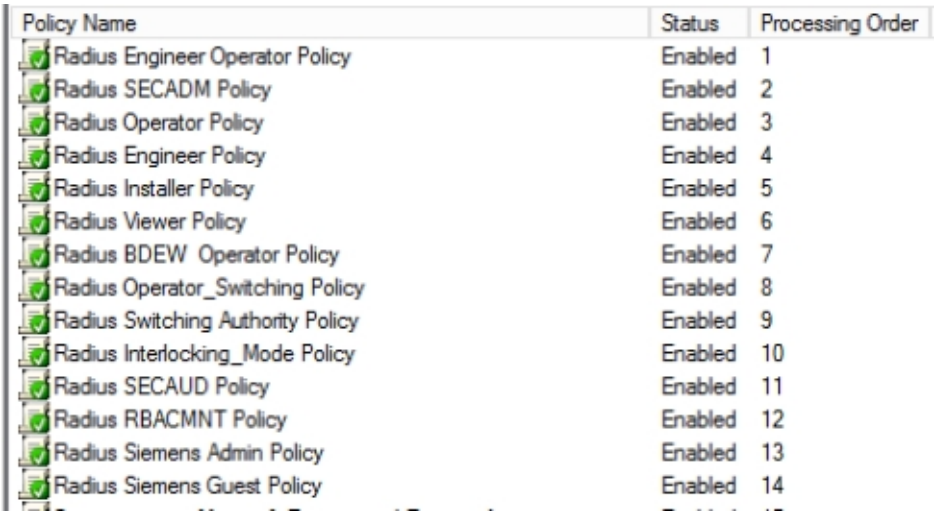
Note:

- for IEC roles use "IEC62351-8" (optional) string value for ID 2 (roleDefinition) and for Siemens roles "SiemensGridSecurity" string value for ID 2 (roleDefinition)
- for revision use always "0" as decimal value for ID 4
- for *ValidTo* and *ValidFrom* strings use the format YYYYMMDDHHMMSSZ (Year, Month,Day,Hour,Minutes,Seconds, Zulu time zone)

Example for the Engineer policy/role:

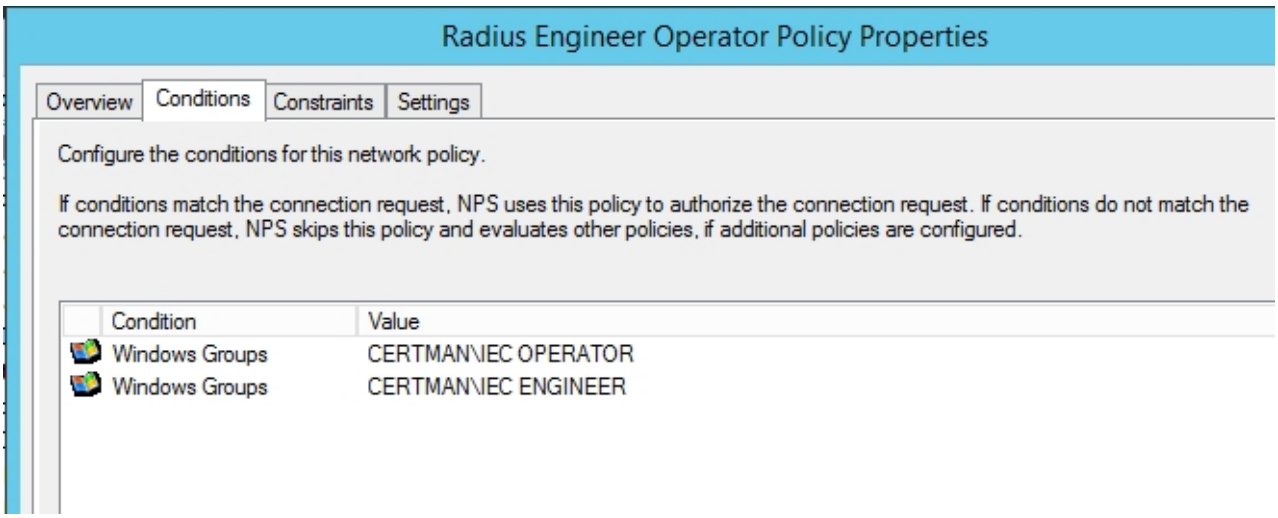


Combined roles include more than one Windows groups.



Policy Name	Status	Processing Order
Radius Engineer Operator Policy	Enabled	1
Radius SECADM Policy	Enabled	2
Radius Operator Policy	Enabled	3
Radius Engineer Policy	Enabled	4
Radius Installer Policy	Enabled	5
Radius Viewer Policy	Enabled	6
Radius BDEW Operator Policy	Enabled	7
Radius Operator_Switching Policy	Enabled	8
Radius Switching Authority Policy	Enabled	9
Radius Interlocking_Mode Policy	Enabled	10
Radius SECAUD Policy	Enabled	11
Radius RBACMNT Policy	Enabled	12
Radius Siemens Admin Policy	Enabled	13
Radius Siemens Guest Policy	Enabled	14

Note: Combined roles have to be placed at the beginning. Windows handles the policy rules like a firewall.



Note: You can add more roles to one policy but all other values have to be unique. Use another ID instead within the Policy for combined roles. The following example shows a combined role for SIEMENS ADMIN, SECAUD, RBACMNT. You have to use the shown "Vendor assigned attribute number" (x) to create a policy called "Radius Siemens Admin IEC SECAUD RBACMNT"

(1) IEC62351-8-roleID-0=-31648,

(2) IEC62351-8-roleDefinition-0="SiemensGridSecurity"

(3) IEC62351-8-aor-0="*",

(4) IEC62351-8-revision-0=0,

(6) IEC62351-8-ValidTo-0="99991231235959Z"

(11) IEC62351-8-roleID-1+=5,

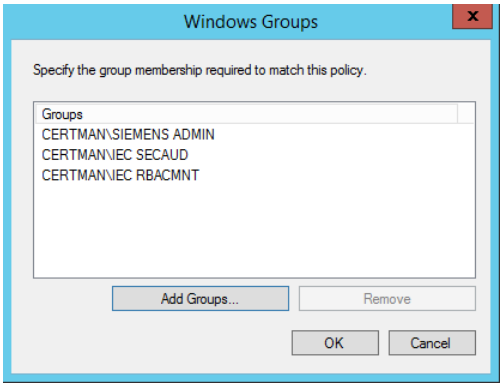
(11) IEC62351-8-roleID-1+=6,

(12) IEC62351-8-roleDefinition-1="IEC62351-8

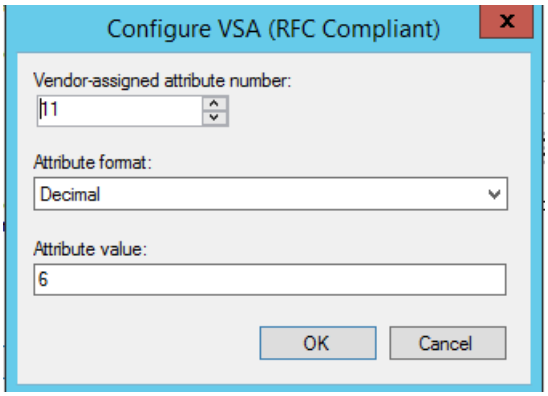
(13) IEC62351-8-aor-1="*",

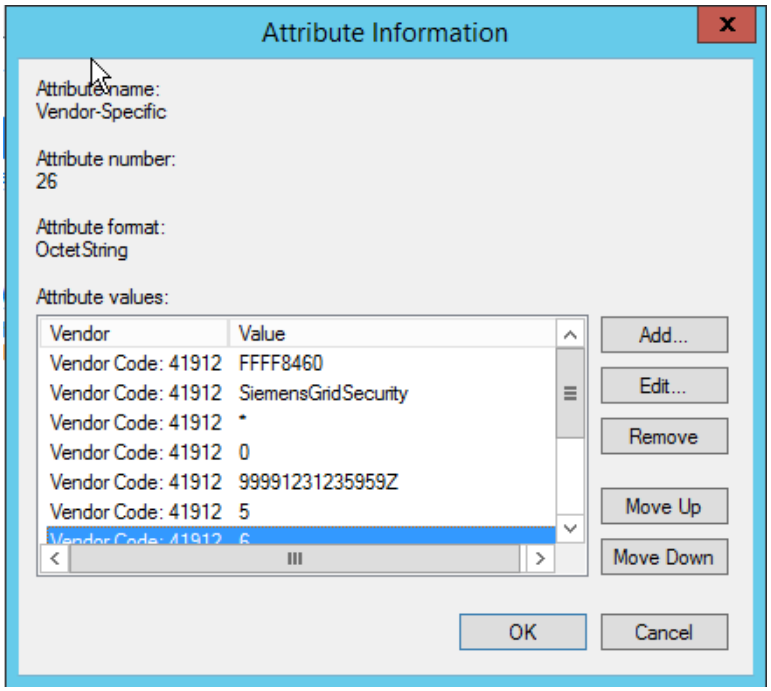
(14) IEC62351-8-revision-1=0,

(16) IEC62351-8-ValidTo-1="99991231235959Z"

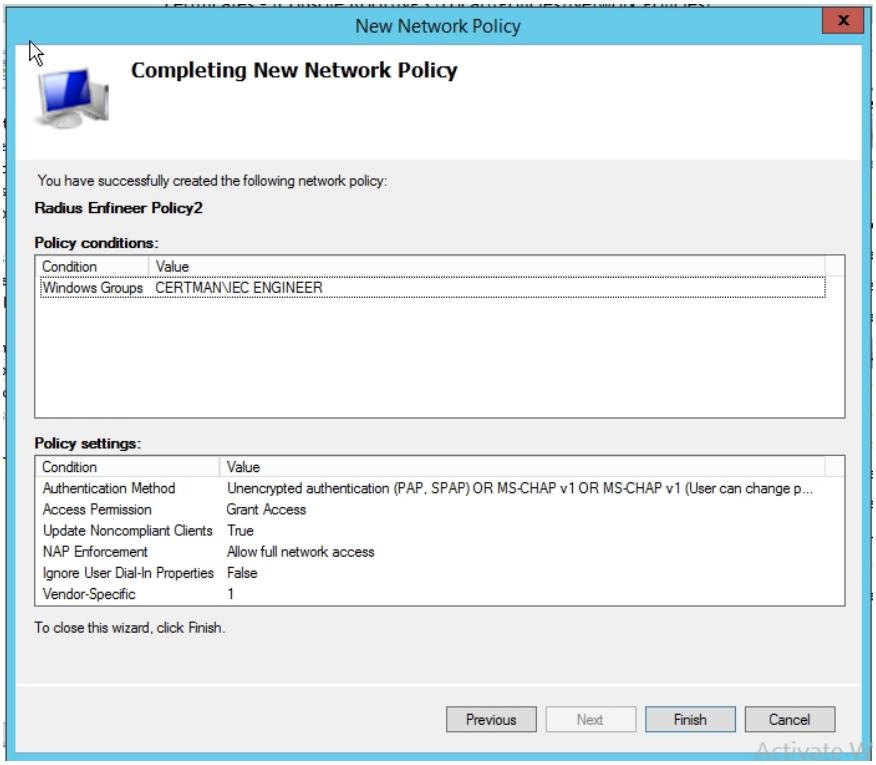


For example Vendor assigned attribute number = (11) for roleID=6 (RBACMNT)

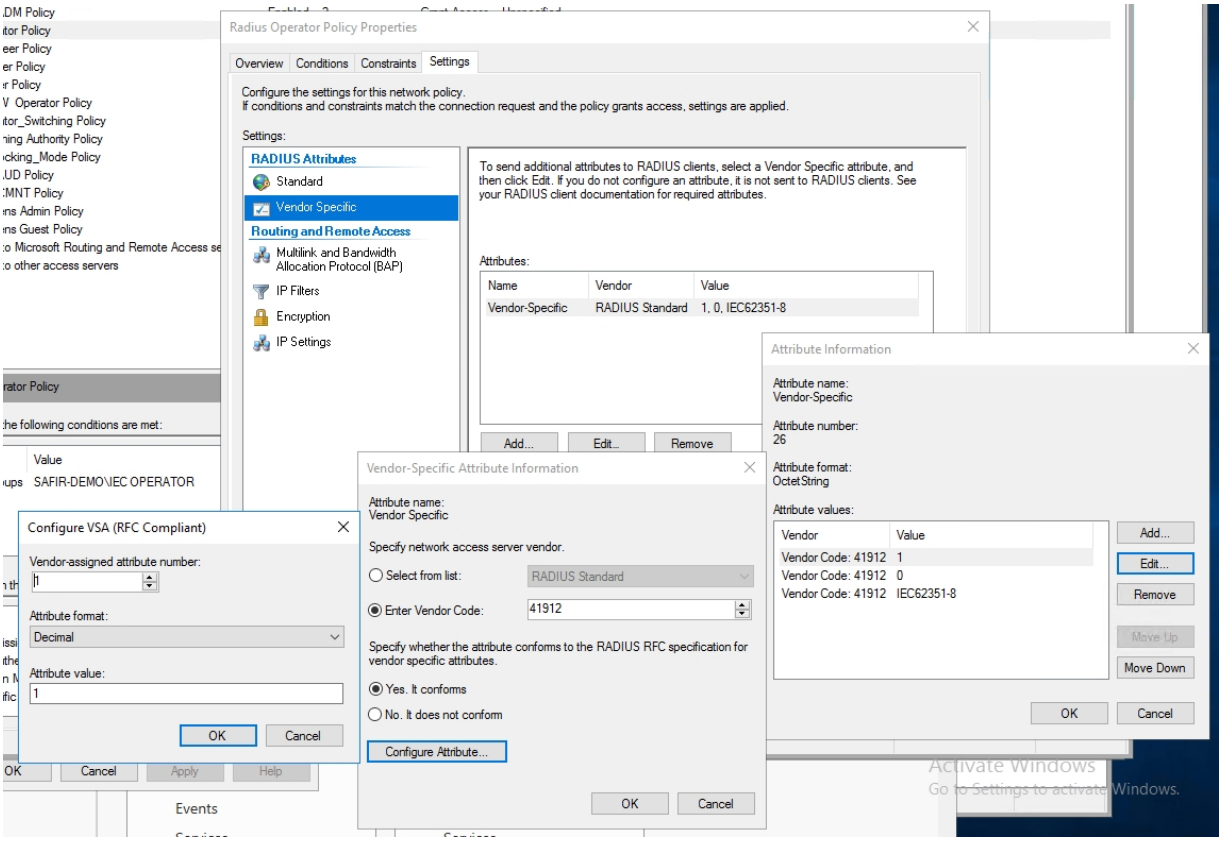




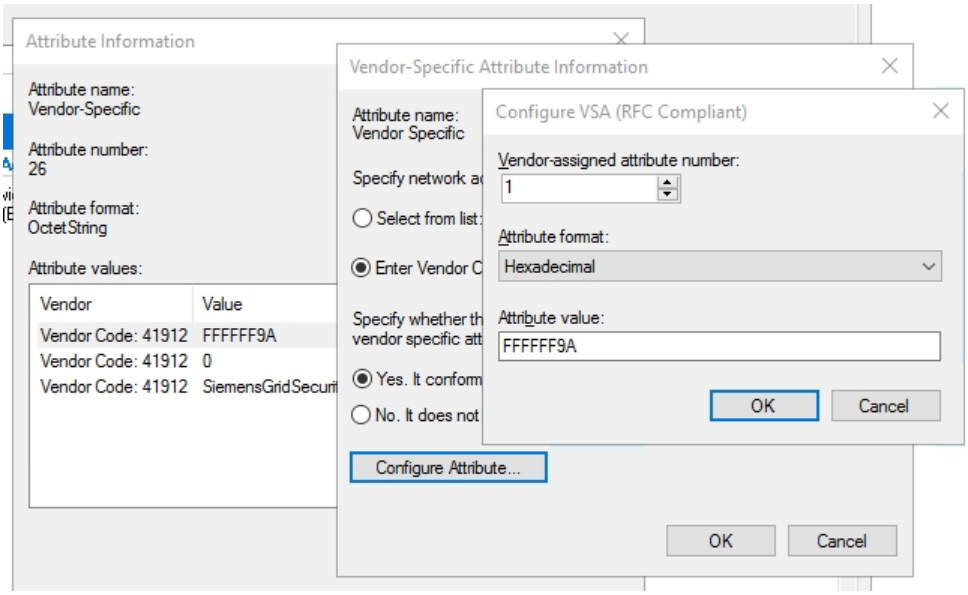
Finish the wizard



4. Add or adjust vendor specific attributes if necessary:



Note: For negative values add in hexadecimal values!



1.6 IEC 62351 Appendix

1.6.1 IEC 62351-8 Dictionary

Below is the IEC 62351 vendor specific dictionary subject to approval by the responsible IEC TC 57/WG 15! Adjusted and enclosed in the RADIUS server configuration, a RBAC token that is transmitted as part of the vendor specific attribute (VSA – see https://tools.ietf.org/html/rfc2865#page-47) contains the following set of information:

Attribute Name	**Attribute Value**	**Required**
IEC62351-8-RoleID-i	(i*10)+1	mandatory
IEC62351-8-roleDefinition-i	(i*10)+2	optional
IEC62351-8-aor-i	(i*10)+3	mandatory
IEC62351-8-revision-i	(i*10)+4	mandatory
IEC62351-8-ValidFrom-i	(i*10)+5	optional
IEC62351-8-ValidTo-i	(i*10)+6	mandatory

Note: integer i=0..N

This approach resembles the sequences described for the X.509 digital certificate extension in profile A and B of the IEC62351-8 standard.

Note that the roleID is always related to the same IEC62351-8-aor, IEC62351-8-roleDefinition (if the field is provided), IEC62351-8-revision, and IEC62351-8-ValidTo field. To support also different roles with either the same or different Area of Responsibility (AoR) associations, multiple instances may be supported according to RFC 2865.

To enable the RADIUS server to process the VSA with the RBAC information, a dictionary file is necessary. The following example shows a dictionary file for the case i=2, providing a distinction between three sets of RBAC information:

```
VENDOR International Electrotechnical Commission          41912
BEGIN-VENDOR International Electrotechnical Commission

   ATTRIBUTE IEC62351-8-RoleID-0           1         integer
   ATTRIBUTE IEC62351-8-roleDefinition-0   2         string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-0              3         string
   ATTRIBUTE IEC62351-8-revision-0         4         integer
   ATTRIBUTE IEC62351-8-ValidFrom-0        5         string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-0          6         string

   ATTRIBUTE IEC62351-8-RoleID-1           11        integer
```

```
   ATTRIBUTE IEC62351-8-roleDefinition-1   12        string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-1              13        string
   ATTRIBUTE IEC62351-8-revision-1         14        integer
   ATTRIBUTE IEC62351-8-ValidFrom-1        15        string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-1          16        string

   ATTRIBUTE IEC62351-8-RoleID-2           21        integer
   ATTRIBUTE IEC62351-8-roleDefinition-2   22        string OPTIONAL
   ATTRIBUTE IEC62351-8-aor-2              23        string
   ATTRIBUTE IEC62351-8-revision-2         24        integer
   ATTRIBUTE IEC62351-8-ValidFrom-2        25        string OPTIONAL
   ATTRIBUTE IEC62351-8-ValidTo-2          26        string

END-VENDOR    International Electrotechnical Commission
```

1.6.2 IEC 2351-8 defined roles

A role is explicit defined by the set of a *roleID*, a *revision* and a *roleDefinition* and is defined in the IEC62351-8 standard. In general a role is a set of permissions. In case of the permission assignment is changed for an existing role (roleID) than the revision has to be increased. All IEC62351 roles are based on the IEC62351-8 standard. Therefore the *roleDefinition* is IEC62351-8. Any other defined roles, for example customer-defined roles or manufacturer defined roles in the future, have own defined role Definitions because the role name (roleID) could be the same. More information can be found in the standard.

Role	roleID	revision	roleDefinition	used for
VIEWER	0	0	IEC62351-8	SICAM A8000/SIPROTEC 5
OPERATOR	1	0	IEC62351-8	SICAM A8000/SIPROTEC 5
ENGINEER	2	0	IEC62351-8	SICAM A8000/SIPROTEC 5
INSTALLER	3	0	IEC62351-8	SICAM A8000/SIPROTEC 5
SECADM	4	0	IEC62351-8	SICAM A8000/SIPROTEC5/ GridPass
SECAUD	5	0	IEC62351-8	SICAM A8000/SIPROTEC 5
RBACMNT	6	0	IEC62351-8	SICAM A8000/SIPROTEC5/ GridPass

Besides these IEC62351-8 defined roles, other roles can be defined within the numbers range <-32768 .. -1>. They are reserved for private usage. In case of using the IEC62351 roles the declaration of the roleDefinition is optional, for private usage the roleDefinition is mandatory

1.6.3 IEC 62351-8 Definition (Extract from the IEC 62351-8 Edition 1)

1.6.3.1 Role ID (9.4.4.1)

The role is defined using a mapping to an integer space, whereby the numbers:

- <0 .. 32767> are reserved for application within IEC 62351;
- <-32768 .. 1> are reserved for private usage, e.g. by other protocols like IEEE 1815

All roles to be used in the context of IEC protocols shall be defined as part of IEC/TS 62351-8. The current definition of roles comprises IEC 61850 specific roles.

Format: `INTEGER (-32767 .. 32767)`

1.6.3.2 Role definition (9.4.4.2)

To allow for uniqueness of roles in terms of an unique role-to-right mapping, a further parameter is used to provide information about the used data model. This parameter (`roleDefinition`) is optional and to be treated as "IEC 62351-8" per default for positive role IDs. In case of the private usage numbers (negative numbers), it reflects the associated role definition standard. An own role definition may be provided by other standards (other than IEC/TS 62351-

8, by an utility operator. The `roleDefinition` is valid in the context of the defined `UserRoleInfo` (access token). If multiple role definitions are used, multiple access tokens shall be used to ensure a unique role-top-right mapping.

If the `roleDefiniton` field is present the relying party shall use the mapping defined by that field.

The replying party shall reject any role ID that has a `roleDefinition` associated value that it does not recognize.

Format: `UTF8String (0 .. 23))`

1.6.3.3 Revision number (9.4.4.8)

The revision number is a monotonically increasing integer number and represents the version of the subject-to-role mapping.

1.7 Siemens Appendix

1.7.1 Defined roles by Siemens

Siemens has defined own roles with own assigned permissions. Not all roles are necessary and available in all Siemens Energy Management Digital Grid products. Which explicit permissions are assigned inside the device depends on the functionality of the device and will be found in the product manual.

Role	roleID hexadecimal	roleID decimal	revision	roleDefinition	used for
ADMIN	FFFF8460	-31648	0	SiemensGridSecurity	SICAM A8000/ SIPROTEC 5
GUEST	FFFFAFC7	-20537	0	SiemensGridSecurity	SIPROTEC 5
Operator_Switching	FFFFFF9A	-102	0	SiemensGridSecurity	SIPROTEC 5
Switching_Authority	FFFFFF99	-103	0	SiemensGridSecurity	SIPROTEC 5
Interlocking_Mode	FFFFFF98	-104	0	SiemensGridSecurity	SIPROTEC 5

1.7.2 Limitations of roles to user assignment and other limitations

1.7.2.1 SIPROTEC 5

SIPROTEC 5 is supporting all IEC62351-8 roles and the SIEMENS role ADMIN; GUEST, Operator_Switching, Switching Authority; Interlocking_Mode. All IEC62351-8 attributes are supported:

```
Attribute Name                Attribute Value    Required
IEC62351-8-RoleID-i           (i*10)+1           mandatory
IEC62351-8-roleDefinition-i   (i*10)+2           optional
IEC62351-8-aor-i              (i*10)+3           mandatory
IEC62351-8-revision-i         (i*10)+4           mandatory
IEC62351-8-ValidFrom-i        (i*10)+5           optional
IEC62351-8-ValidTo-i          (i*10)+6           mandatory
```

According the RADIUS RFC you can assign more than one *roleID* to one user if needed.

- Max. i=24 is per user supported
- Max. 32 roles per user
- According the IEC62351-8 definition only the roleID can be used multiple times for one "i"
- AoR is mandatory but will be not analyzed at the moment
- Revision has to be always "0"
- The roleDefinition is optional in case of "IEC62351-8" and mandatory in case of all other roleDefinitions according the IEC62351-8 standard
- In case of different validTo values for one user for different token the earliest day will be used

- In case of one invalid or doubled token entry the complete token will be discarded
- The minimum length of the shared secret has to be 16 characters, the maximum length is 100
- NAS identifier is SIPROTEC5\0

1.7.2.2 SICAM GridPass

SICAM GridPass supports the IEC 62351-8 roles SECADM and RBACMNT. So far, only the following attributes are supported:

```
ATTRIBUTE IEC62351-8-RoleID-0           1          integer
ATTRIBUTE IEC62351-8-roleDefinition-0   2          string OPTIONAL
ATTRIBUTE IEC62351-8-revision-0         4          integer
```

In this case only the OID 1,2 and 4 will be analyzed in the RADIUS server accept response. All other values will be discarded. According the RADIUS RFC you can assign more than one roleID to one user if needed.

- According the IEC62351-8 definition only the roleID can be used multiple times for one "i"
- The roleDefinition is optional in case of "IEC62351-8" and mandatory in case of all other roleDefinitions according the IEC62351-8 standard
- AoR is mandatory but will be not analyzed at the moment

1.7.2.3 SICAM A8000 CP-8000, CP-802x and 8050

SICAM A8000 CP8050 V2.0, SICAM A8000 CP802x V14 and SICAM A8000 CP8000 V14 are supporting all IEC62351-8 roles and the SIEMENS role ADMIN. All IEC62351-8 attributes are supported:

Attribute Name	**Attribute Value**	**Required**
IEC62351-8-RoleID-i	(i*10)+1	mandatory
IEC62351-8-roleDefinition-i	(i*10)+2	optional
IEC62351-8-aor-i	(i*10)+3	mandatory
IEC62351-8-revision-i	(i*10)+4	mandatory
IEC62351-8-ValidFrom-i	(i*10)+5	optional
IEC62351-8-ValidTo-i	(i*10)+6	optional

Due to compatibility reasons the *ValidTo* Attribute is optional.

According the RADIUS RFC you can assign more than one roleID to one user if needed.

- According the IEC62351-8 definition only the roleID can be used multiple times for one "i"
- The roleDefinition is optional in case of "IEC62351-8" and mandatory in case of all other roleDefinitions according the IEC62351-8 standard
- NAS identifier is the MAC address

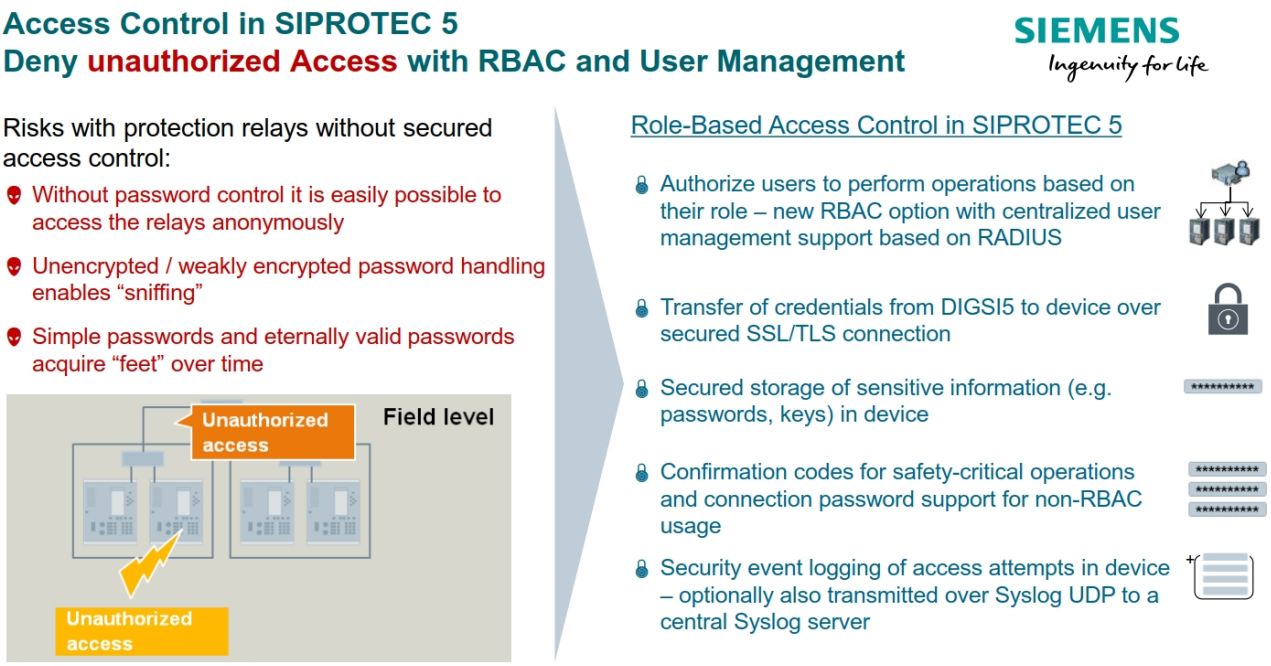
1.7.3 Microsoft Links

Import NPS:

https://docs.microsoft.com/en-us/windows-server/networking/technologies/nps/nps-manage-export
or
https://technet.microsoft.com/de-de/library/cc753571(v=ws.10).aspx

1.8 Summary

Secure products in energy automation are the basis for a secure system for energy automation. Role-based access control with central management is one of the benefits of SIPROTEC and SICAM beside other features for security like security logging, digital signed FW/SW, asset monitoring and secured communication.



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