Configure ASR9K TACACS with Cisco Identity Services Engine 2.4

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Introduction

This document describes the configuration of ASR 9000 series Aggregation Services Router (ASR) in order to authenticate and authorize via TACACS+ with Cisco Identity Services Engine 2.4 server.

Background Information

It examples the implementation of the administrative model of task-based authorization that is used in order to control user access in the Cisco IOS® XR software system. The major tasks required to implement task-based authorization involve how to configure user groups and task groups. User groups and task groups are configured through the Cisco IOS® XR software command set used for Authentication, Authorization and Accounting (AAA) services. Authentication commands are used to verify the identity of a user or principal. Authorization commands are used to verify that an authenticated user (or principal) is granted permission in order to perform a specific task. Accounting commands are used for logging of sessions and to create an audit trail by recording certain user or system generated actions.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- ASR 9000 Deployment and Basic Configuration
- TACACS+ Protocol
- ISE 2.4 Deployment and Configuration

Components Used

The information in this document is based on these software and hardware versions:

- ASR 9000 with Cisco IOS® XR Software, Version 5.3.4
- Cisco ISE 2.4

The information in this document is created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If the network is live, make sure that the potential impact of any configuration change is completely understood.

Configure

Predefined Components on the IOS® XR

There are predefined user groups and task groups in IOS® XR. The administrator can either use these predefined groups or define custom groups as per requirement.

Predefined User Groups

These user groups are predefined on IOS® XR:

User Group	Privileges
cisco-support	Debug and troubleshoot features (usually, used by Cisco Technical Support personnel).
netadmin	Configure network protocols such as Open Shortest Path First (OSPF) (usually used by net administrators).
operator	Perform day-to-day monitoring activities, and have limited configuration rights.
root-lr	Display and execute all commands within a single RP.
root-system	Display and execute all commands for all RPs in the system.
sysadmin	Perform system administration tasks for the router, such as maintaining where the core dum are stored or setting up the Network Time Protocol (NTP) clock.
serviceadmin	Perform service administration tasks, such as Session Border Controller (SBC).

Each predefined user group has certain task groups mapped to them and cannot be modified. Use these commands in order to check the predefined user groups:

```
RP/0/RSP0/CPU0:ASR9k#sh aaa usergroup ?

 |              Output Modifiers
 root-lr        Name of the usergroup
 netadmin       Name of the usergroup
 operator       Name of the usergroup
 sysadmin       Name of the usergroup
```

```
 retrieval      Name of the usergroup
 maintenance    Name of the usergroup
 root-system    Name of the usergroup
 provisioning   Name of the usergroup
 read-only-tg   Name of the usergroup
 serviceadmin   Name of the usergroup
 cisco-support  Name of the usergroup
 WORD           Name of the usergroup
 <cr>
```

Pre-Defined Task Groups

These predefined task groups are available for administrators to use, typically for initial configuration:

- cisco-support: Cisco support personnel tasks
- netadmin: Network administrator tasks
- operator: Operator day-to-day tasks (for demonstration purposes)
- root-lr: Secure domain router administrator tasks
- root-system: System-wide administrator tasks
- sysadmin: System administrator tasks
- serviceadmin: Service administration tasks

Use these commands in order to check the predefined task groups:

```
RP/0/RSP1/CPU0:ASR9k#show aaa taskgroup ?

|              Output Modifiers
root-lr        Name of the taskgroup
netadmin       Name of the taskgroup
operator       Name of the taskgroup
sysadmin       Name of the taskgroup
root-system    Name of the taskgroup
serviceadmin   Name of the taskgroup
cisco-support  Name of the taskgroup
WORD           Name of the taskgroup
<cr>
```

Use this command in order to check the supported tasks:

```
RP/0/RSP1/CPU0:ASR9k#show aaa task supported
```

Here is the list of supported tasks:

Aaa	Acl	Admin	Ancp	Atm	basic-services	Bcdl	Bfd	b
Boot	Bundle	call-home	Cdp	Cef	Cgn	cisco-support	config-mgmt	c
Crypto	Diag	Disallowed	Drivers	Dwdm	Eem	Eigrp	ethernet-services	e
Fabric	fault-mgr	Filesystem	Firewall	Fr	Hdlc	host-services	Hsrp	i
Inventory	ip-services	Ipv4	Ipv6	Isis	L2vpn	Li	Lisp	l
Lpts	Monitor	mpls-ldp	mpls-static	mpls-te	Multicast	Netflow	Network	n
Ospf	Ouni	Pbr	pkg-mgmt	pos-dpt	Ppp	Qos	Rcmd	r
Rip	root-lr	root-system	route-map	route-policy	Sbc	Snmp	sonet-sdh	s
Sysmgr	System	Transport	tty-access	Tunnel	Universal	Vlan	Vpdn	v

Each of these mentioned tasks can be given with any of these or all the four permissions:

Read	Specifies a designation that permits only a read operation.
Write	Specifies a designation that permits a change operation and implicitly allows a read operation.

Execute Specifies a designation that permits an access operation; for example, ping and Telnet.
Debug Specifies a designation that permits a debug operation.

User-Defined Task Groups

Administrators can configure custom task groups to meet particular needs. Here is a configuration example:

```
RP/0/RSP1/CPU0:ASR9k(config)#taskgroup TAC-Defined-TASK
RP/0/RSP1/CPU0:ASR9k(config-tg)#task ?
  debug    Specify a debug-type task ID
  execute  Specify a execute-type task ID
  read     Specify a read-type task ID
  write    Specify a read-write-type task ID

RP/0/RSP1/CPU0:ASR9k(config-tg)#task read aaa
RP/0/RSP1/CPU0:ASR9k(config-tg)#task write aaa
RP/0/RSP1/CPU0:ASR9k(config-tg)#task execute aaa
RP/0/RSP1/CPU0:ASR9k(config-tg)#task debug aaa
RP/0/RSP1/CPU0:ASR9k(config-tg)#task read acl
RP/0/RSP1/CPU0:ASR9k(config-tg)#task write acl
RP/0/RSP1/CPU0:ASR9k(config-tg)#task execute acl
RP/0/RSP1/CPU0:ASR9k(config-tg)#commit

RP/0/RSP1/CPU0:ASR9k#show aaa taskgroup TAC-Defined-TASK
Task group 'TAC-Defined-TASK'

Task IDs included directly by this group:
Task:                  aaa  : READ    WRITE    EXECUTE    DEBUG
Task:                  acl  : READ    WRITE    EXECUTE

Task group 'TAC-Defined-TASK' has the following combined set
  of task IDs (including all inherited groups):
Task:                  aaa  : READ    WRITE    EXECUTE    DEBUG
Task:                  acl  : READ    WRITE    EXECUTE
```

Describe command can be used to find what task group and permission is needed for a certain command.

Example 1.

```
RP/0/RSP1/CPU0:ASR9k#describe show aaa usergroup
Package:
.....
User needs ALL of the following taskids:

aaa (READ)
RP/0/RSP1/CPU0:ASR9k#
```

In order to allow a user to run the command**show aaa usergroup**, task group: **task read aaa** should be assigned to the usergroup.

Example 2.

```
RP/0/RSP1/CPU0:ASR9k(config)#describe aaa authentication login default group tacacs+
Package:
.....
User needs ALL of the following taskids:

aaa (READ WRITE)
RP/0/RSP1/CPU0:ASR9k(config)#
```

In order to allow a user to run the command**aaa authentication login default group tacacs+**from the configuration mode, task group: **task read write aaa** should be assigned to the usergroup.

Administrators can define the user group that can inherit several task groups. Here is the configuration example:

```
RP/0/RSP1/CPU0:ASR9k#show aaa usergroup TAC-Defined
Tue Feb 16 00:50:56.799 UTC
User group 'TAC-Defined'
  Inherits from task group 'operator'

User group 'TAC-Defined' has the following combined set
  of task IDs (including all inherited groups):
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                  cdp  : READ
Task:                 diag  : READ
Task:           ext-access  : READ             EXECUTE
Task:              logging  : READ

RP/0/RSP1/CPU0:ASR9k#conf t
RP/0/RSP1/CPU0:ASR9k(config)#usergroup TAC-Defined
RP/0/RSP1/CPU0:ASR9k(config-ug)#taskgroup TAC-Defined-TASK
RP/0/RSP1/CPU0:ASR9k(config-ug)#commit

RP/0/RSP1/CPU0:ASR9k#show aaa usergroup TAC-Defined
Tue Feb 16 00:51:31.494 UTC
User group 'TAC-Defined'
  Inherits from task group 'operator'
  Inherits from task group 'TAC-Defined-TASK'

User group 'TAC-Defined' has the following combined set
  of task IDs (including all inherited groups):
Task:                  aaa  : READ    WRITE    EXECUTE    DEBUG
Task:                  acl  : READ    WRITE    EXECUTE
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                  cdp  : READ
Task:                 diag  : READ
Task:           ext-access  : READ             EXECUTE
Task:              logging  : READ
```

AAA Configuration on the Router

Configure the TACACS server on the ASR router with the IP address and the shared secret to be used.

```
RP/0/RSP1/CPU0:ASR9k(config)#tacacs-server host 10.106.73.233 port 49
RP/0/RSP1/CPU0:ASR9k(config-tacacs-host)#key 0 cisco
RP/0/RSP1/CPU0:ASR9k(config-tacacs-host)#commit
```

```
!
tacacs-server host 10.127.196.160 port 49
key 7 14141B180F0B
!
```

Configure authentication and authorization in order to use TACACS server configured.

```
#aaa authentication login default group tacacs+ local
#aaa authorization exec default group tacacs+ local
```

Configure command authorization to use TACACS server configured (optional):

> **Note**: Ensure that the authentication and authorization work as expected, and ensure that the command sets are also configured properly before you enable command authorization. If not configured properly, users might not be able to enter any commands on the device.

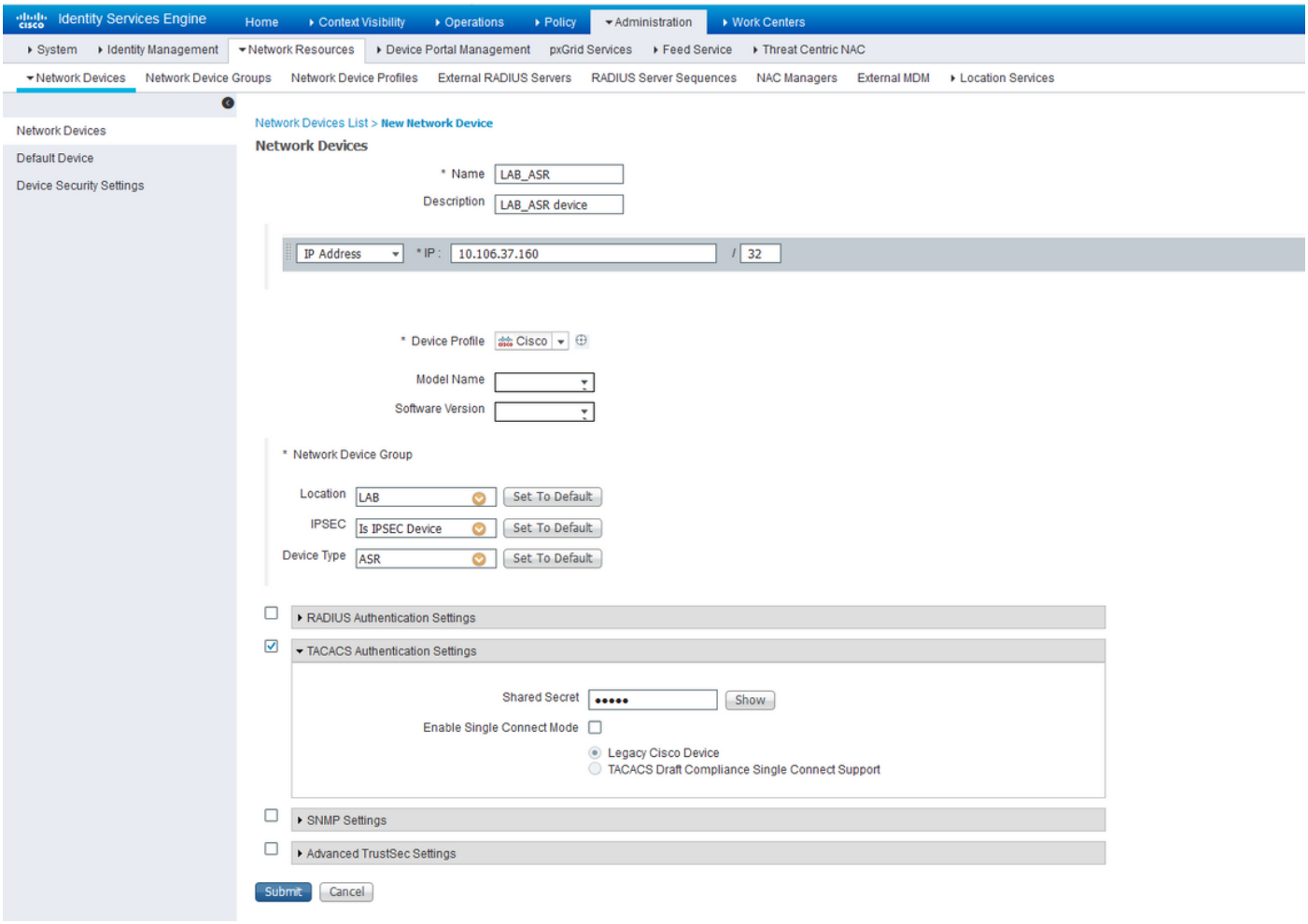
```
#aaa authorization commands default group tacacs+
```

Configure command accounting in order to use TACACS server configured (optional).

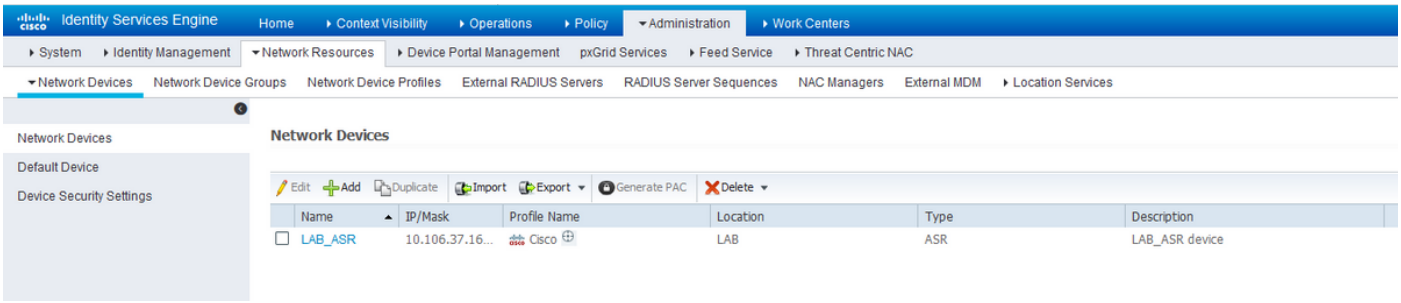
```
#aaa accounting commands default start-stop group tacacs+
#aaa accounting update newinfo
```

ISE Server Configuration

Step 1. In order to define the router IP in the AAA clients list on ISE server, navigate to **Administration > Network Resources > Network Devices** as shown in the image. Shared secret should be the same as the one configured on the ASR Router as shown in the image.



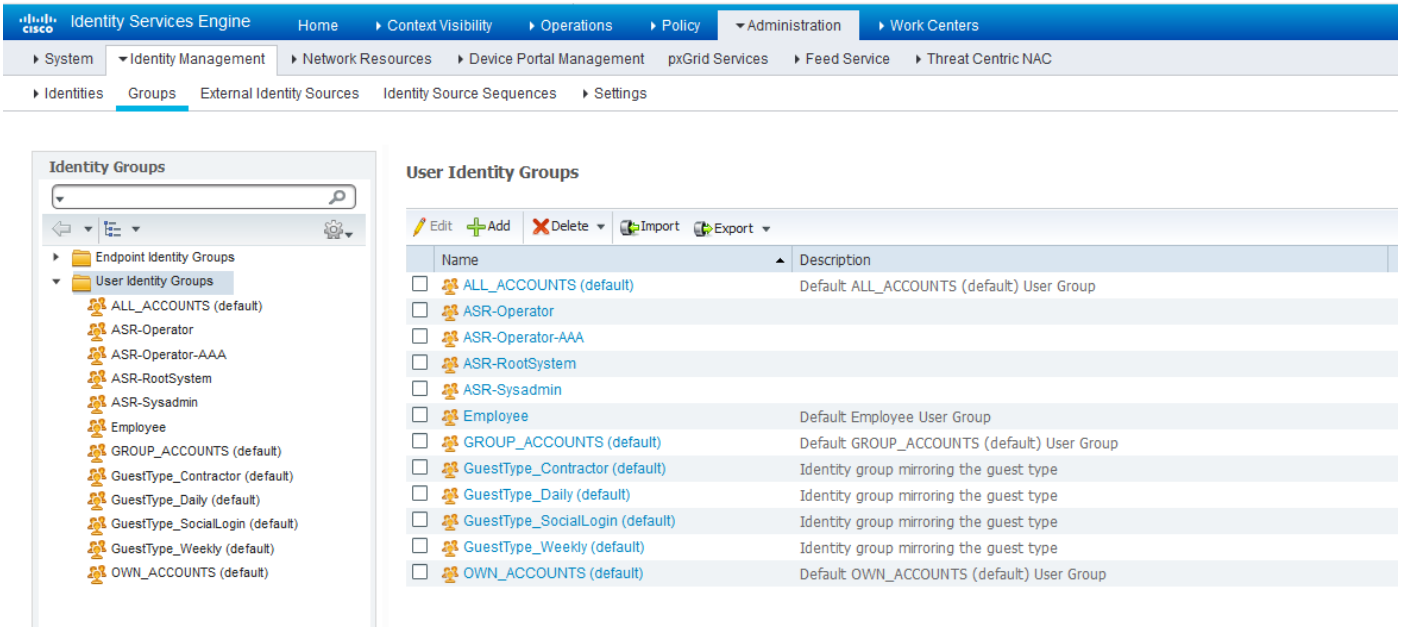
Network Device Configuration



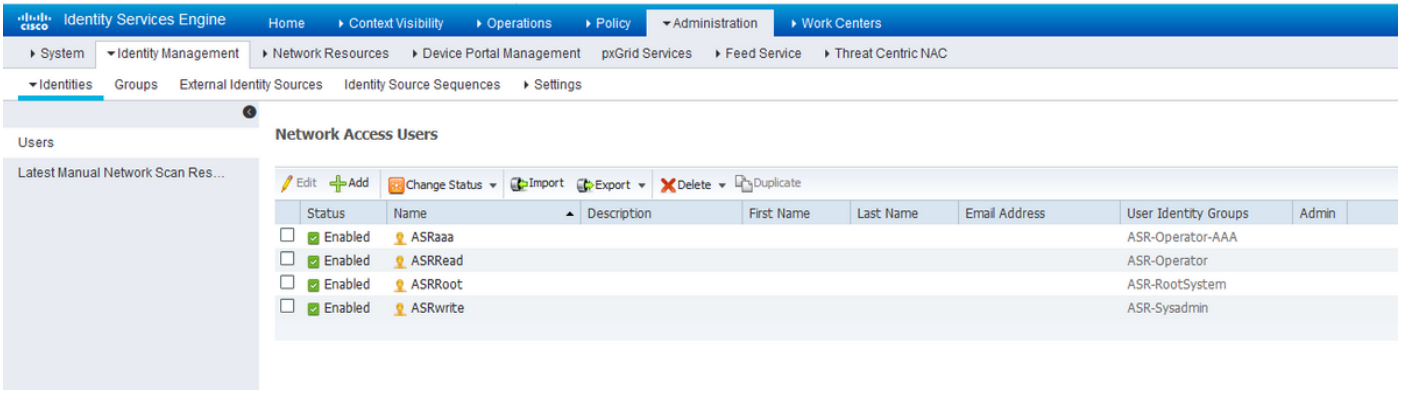
Network Device Configuration

Step 2. Define the user groups as per your requirement, in the example, as shown in this image, you use four groups. You can define the groups under **Administration > Identity Management > Groups > User Identity Groups**. The groups created in this example are:

1. ASR-Operator
2. ASR-Operator-AAA
3. ASR-RootSystem
4. ASR-Sysadmin



Identity GroupsStep 3. As shown in the image, create the users and map them to the respective user group that was created before.



Identities/Users

> **Note**: In this example, the ISE internal users are used for authentication and authorization. Authentications and authorizations with External Identity Source are out of the scope of this document.

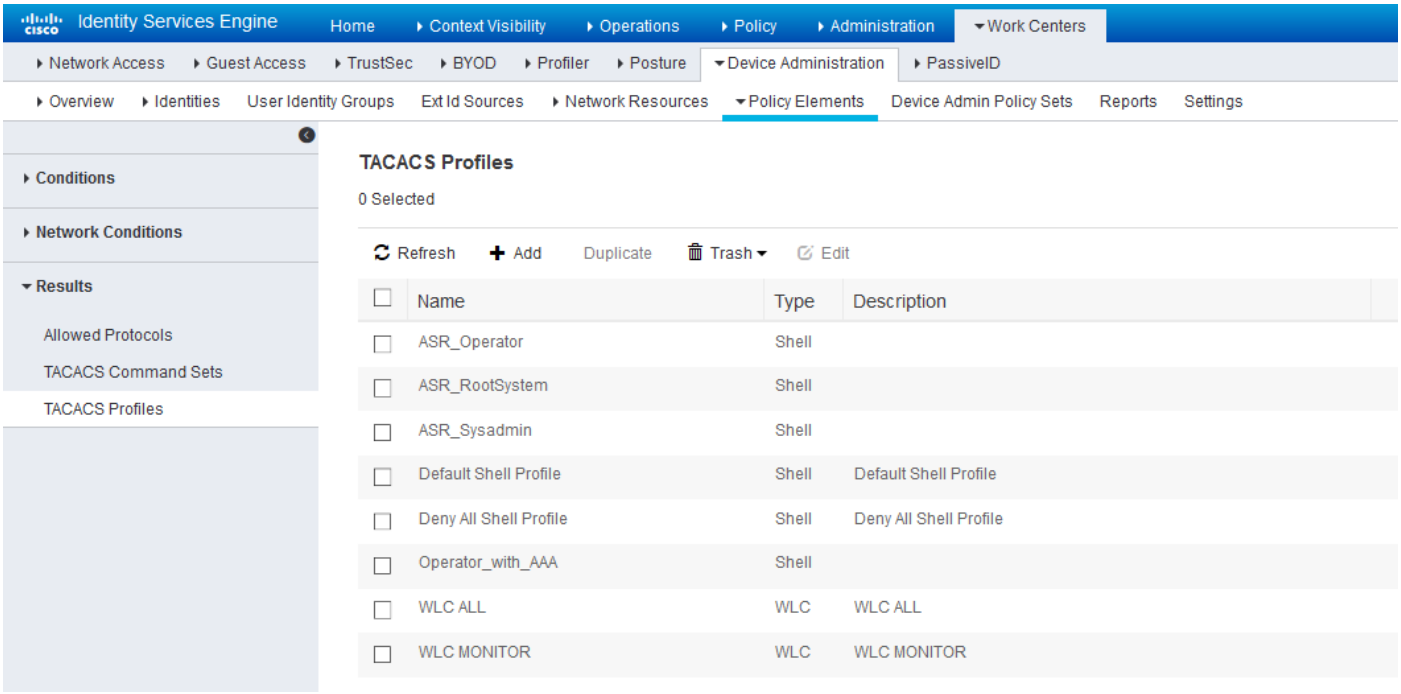
Step 4. Define the Shell Profile to be pushed for the respective users. In order to do so, navigate to **Work Centers > Device Administration > Policy Elements > Results > TACACS Profiles**. One can configure a new shell profile as shown in the images as well for previous versions of ISE. The shell profiles defined in this example are:

1. ASR_Operator

2. ASR_RootSystem

3. ASR_Sysadmin

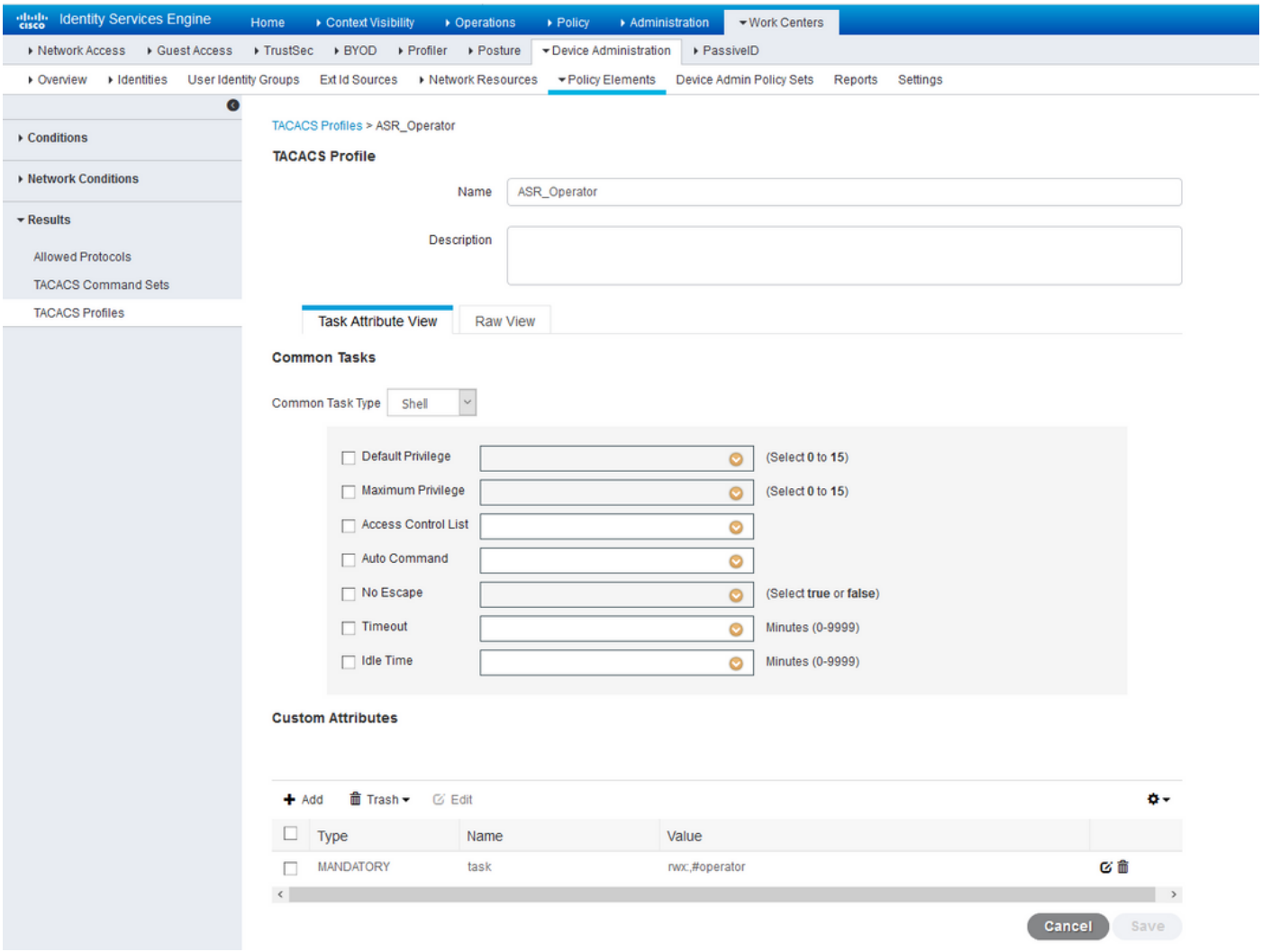
4. Operator_with_AAA



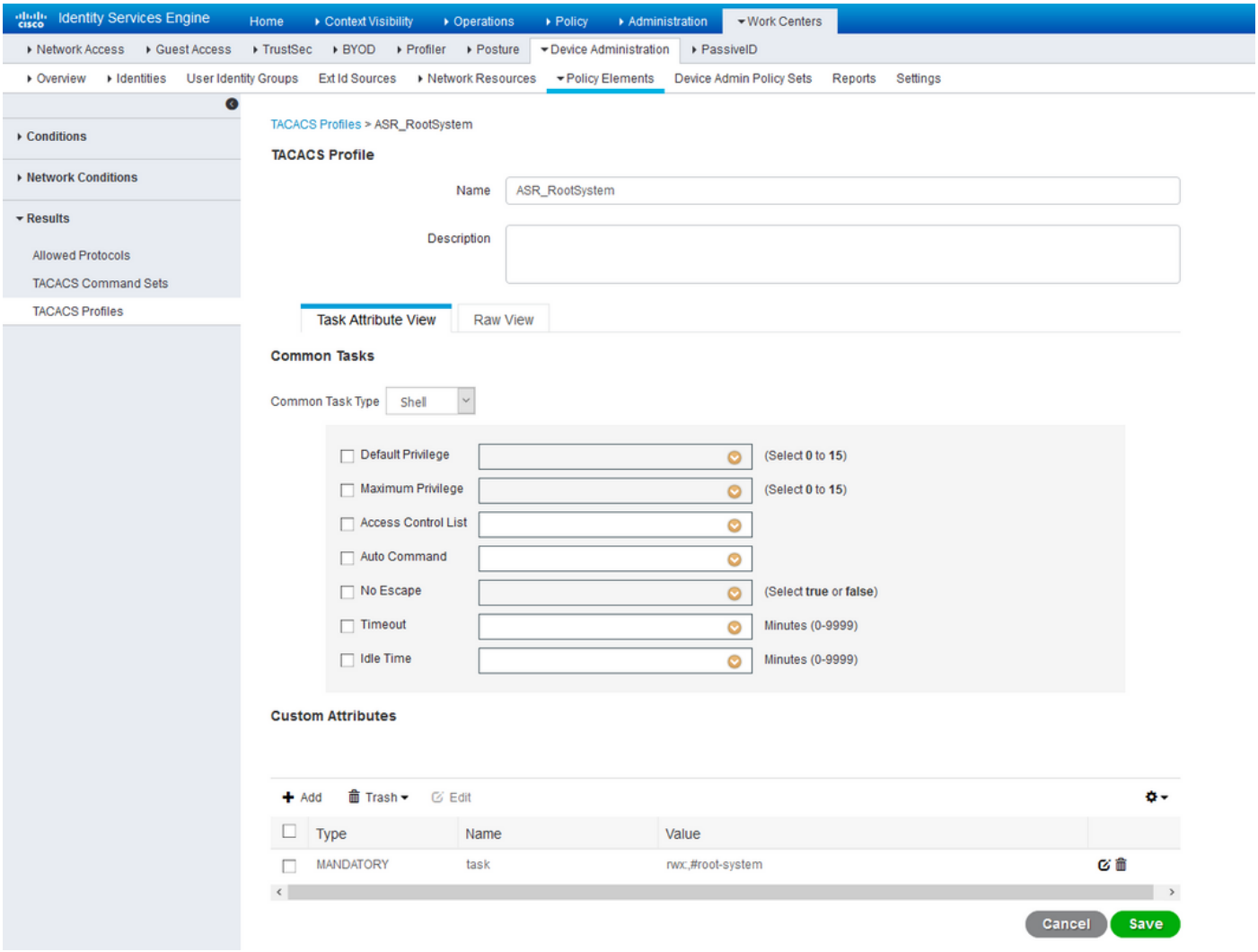
Shell Profiles for TACACS

One can click on the **Add** button to enter the fields Type, Name and Value as shown in the images under the **Custom Attributes** section.

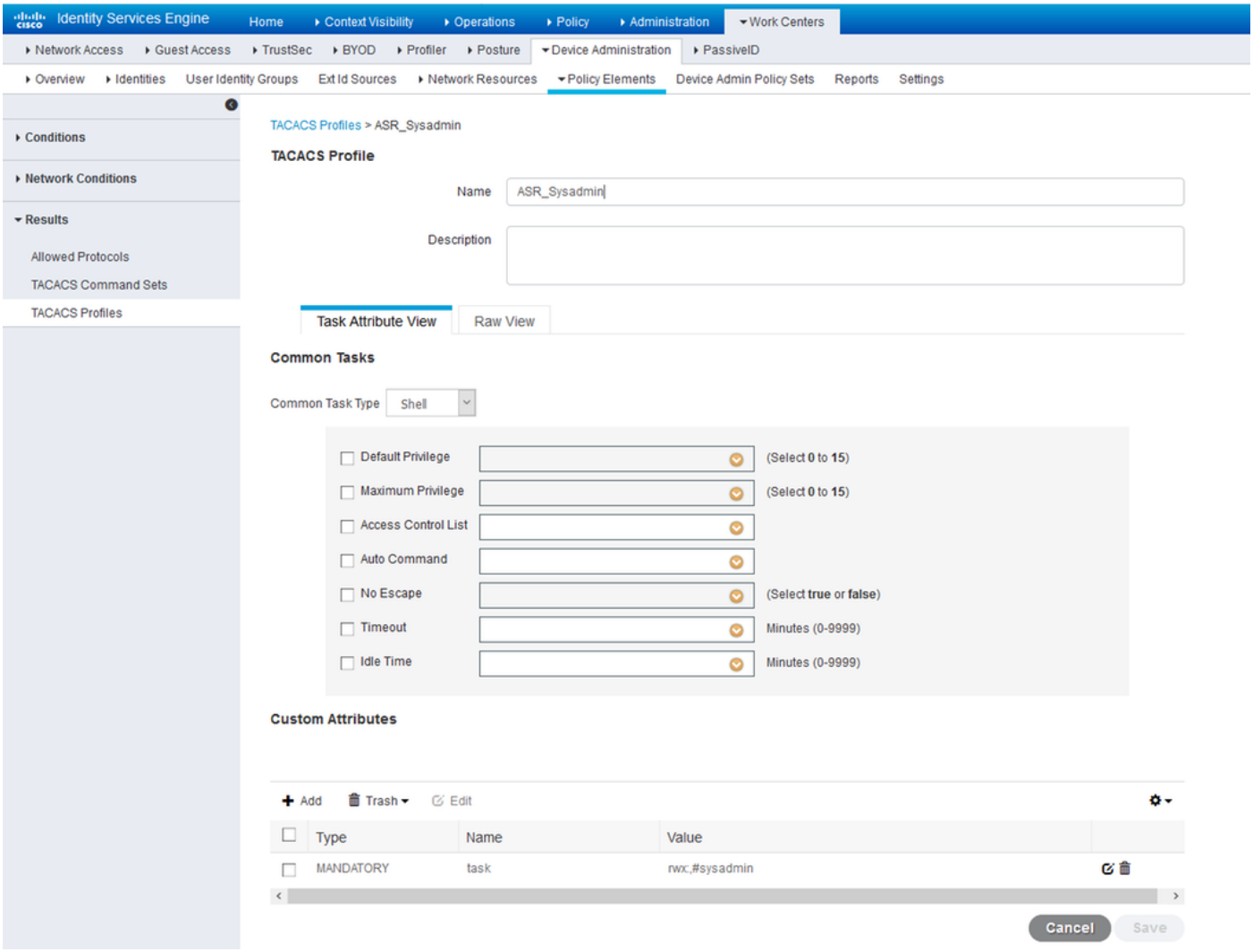
For Operator role:



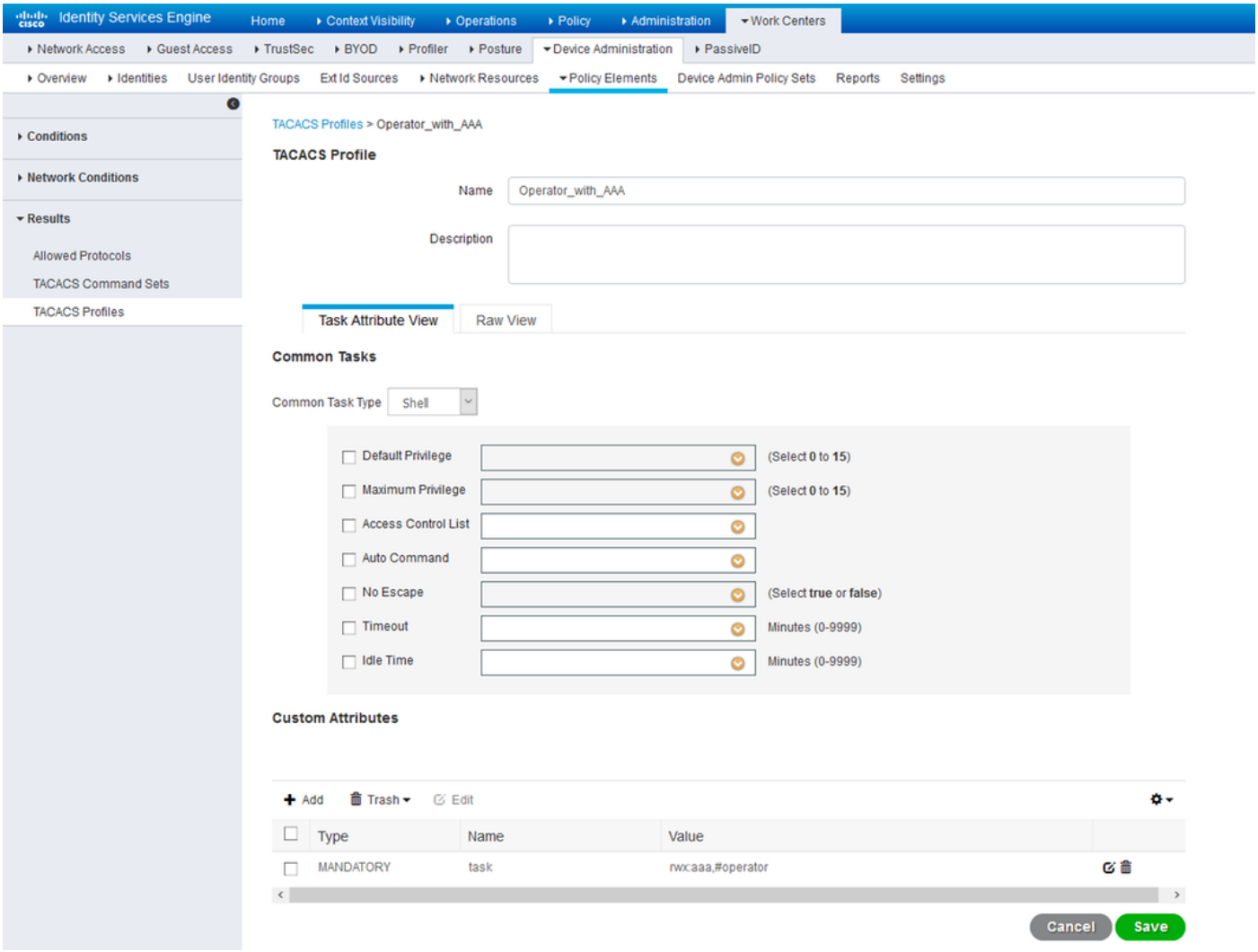
ASR Operator shell profileFor root-system role:



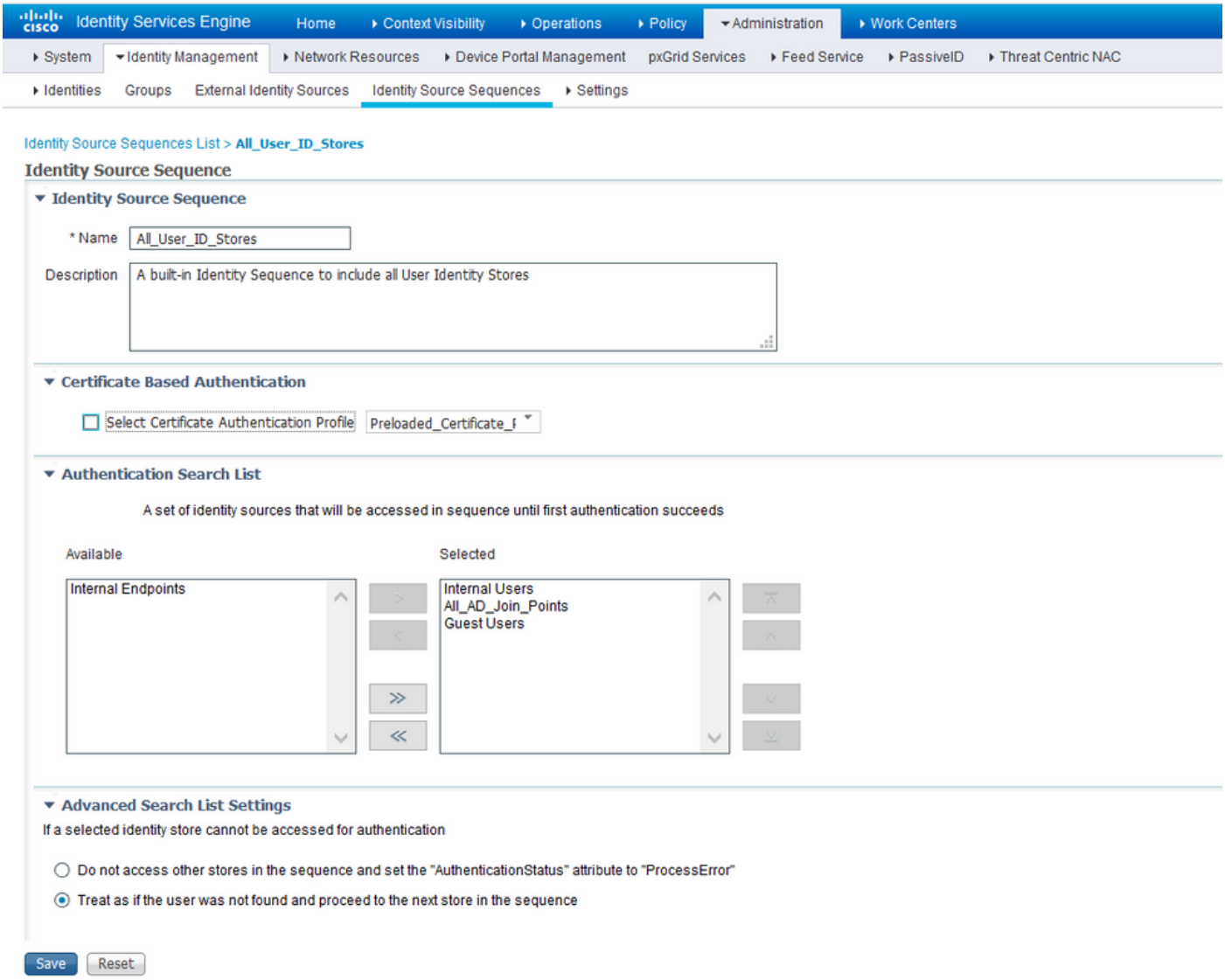
ASR Root System shell profileFor sysadmin role:



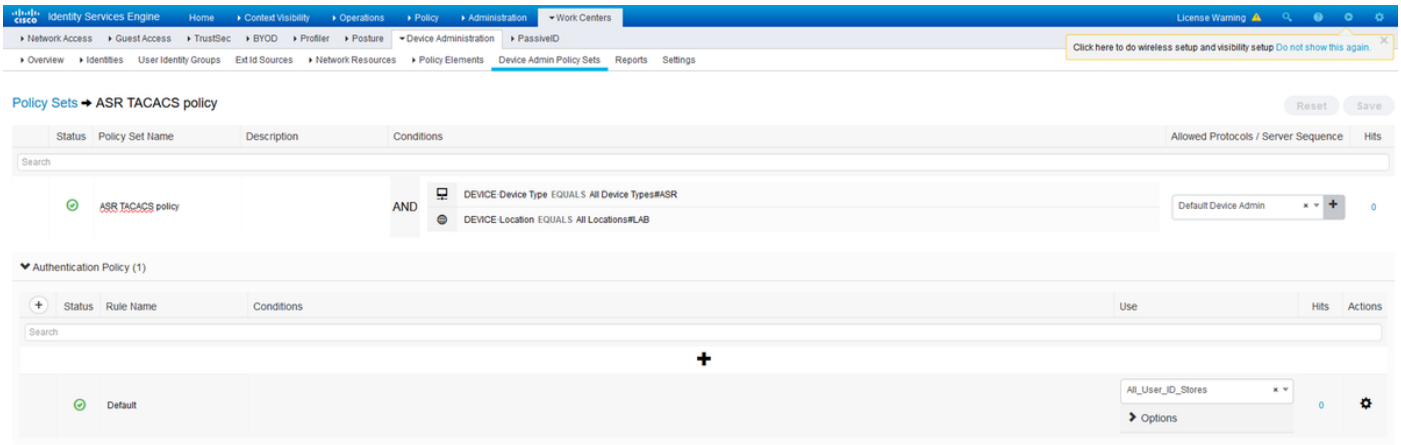
ASR Sysadmin shell profileFor operator and AAA role:



Operator with AAA shell profileStep 5. Configure the Identity Source Sequence to use the Internal Users at **Administration > Identity Management > Identity Source Sequences.** One can either add a new Identity Source Sequence or edit the available ones.



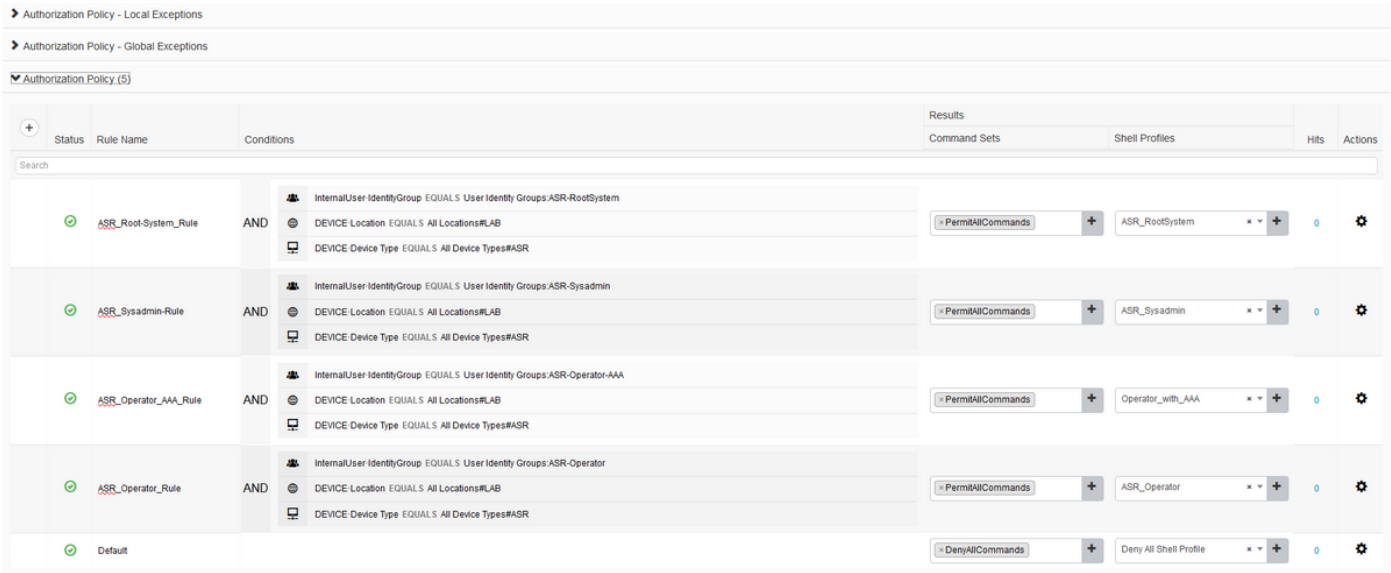
Step 6. Configure the authentication policy at **Work Centers > Device Administration > Device Admin Policy Sets > [Choose Policy Set]** in order to make use of the Identity Store Sequence that contains the internal users. Configure the authorization based on the requirement with the use of the previously created user identity groups and map the respective Shell Profiles, as shown in the image.



Authentication Policy

Authorization policies can be configured in many ways based on the requirement. The rules shown here in the image are based on the device location, type and the specific internal user identity group. The Shell Profiles selected will be pushed at the time of the authorization along with the

Command Sets.



Authorization Policy

Verify

Use this section in order to confirm that your configuration works properly.

Operator

Verify the user group and the task groups assigned when**asrread** user logs into the router.

```
username: ASRread
password:

RP/0/RSP1/CPU0:ASR9k#show user
ASRread

RP/0/RSP1/CPU0:ASR9k#show user group
operator

RP/0/RSP1/CPU0:ASR9k#show user tasks
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                  cdp  : READ
Task:                 diag  : READ
Task:           ext-access  : READ             EXECUTE
Task:              logging  : READ
```

Operator with AAA

Verify the user group and the task groups assigned when**asraaa** user logs into the router.

> **Note**:**asraaa**is the operator task pushed from TACACS server along with the AAA task read, write and execute permissions.

```
username: asraaa
```

```
password:

RP/0/RSP1/CPU0:ASR9k#sh user
asraaa

RP/0/RSP1/CPU0:ASR9k#sh user group
operator

RP/0/RSP1/CPU0:ASR9k#sh user tasks
Task:                  aaa  : READ    WRITE    EXECUTE
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                  cdp  : READ
Task:                 diag  : READ
Task:           ext-access  : READ             EXECUTE
Task:              logging  : READ
```

Sysadmin

Verify the user group and the task groups assigned when**asrwrite** user logs into the router.

```
username: asrwrite
password:

RP/0/RSP1/CPU0:ASR9k#sh user
asrwrite

RP/0/RSP1/CPU0:ASR9k#sh user group
sysadmin

RP/0/RSP1/CPU0:ASR9k#sh user tasks
Task:                  aaa  : READ
Task:                  acl  : READ    WRITE    EXECUTE    DEBUG
Task:                admin  : READ
Task:                 ancp  : READ
Task:                  atm  : READ
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                 bcdl  : READ
Task:                  bfd  : READ
Task:                  bgp  : READ
Task:                 boot  : READ    WRITE    EXECUTE    DEBUG
Task:               bundle  : READ
Task:            call-home  : READ
Task:                  cdp  : READ    WRITE    EXECUTE    DEBUG
Task:                  cef  : READ
Task:                  cgn  : READ
Task:          config-mgmt  : READ    WRITE    EXECUTE    DEBUG
Task:      config-services  : READ    WRITE    EXECUTE    DEBUG
Task:               crypto  : READ    WRITE    EXECUTE    DEBUG
Task:                 diag  : READ    WRITE    EXECUTE    DEBUG
Task:              drivers  : READ
Task:                 dwdm  : READ
Task:                  eem  : READ    WRITE    EXECUTE    DEBUG
Task:                eigrp  : READ
Task:    ethernet-services  : READ
--More--
(output omitted )
```

Root-System

Verify the user group and the task groups assigned when**asrroot** user logs into the router.

```
username: asrroot
password:

RP/0/RSP1/CPU0:ASR9k#show user
asrroot

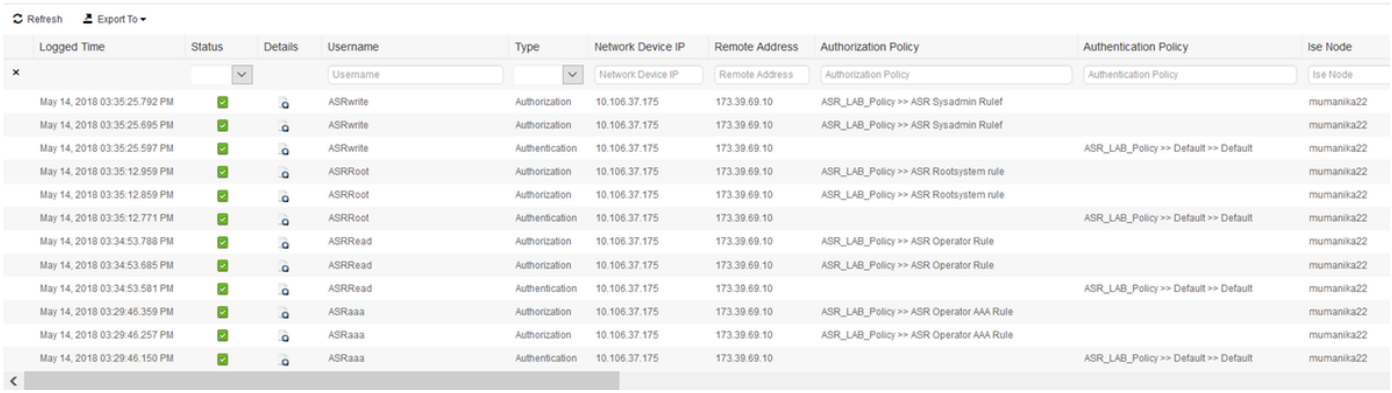
RP/0/RSP1/CPU0:ASR9k#show user group
root-system

RP/0/RSP1/CPU0:ios#show user tasks
Task:                  aaa  : READ    WRITE    EXECUTE    DEBUG
Task:                  acl  : READ    WRITE    EXECUTE    DEBUG
Task:                admin  : READ    WRITE    EXECUTE    DEBUG
Task:                 ancp  : READ    WRITE    EXECUTE    DEBUG
Task:                  atm  : READ    WRITE    EXECUTE    DEBUG
Task:       basic-services  : READ    WRITE    EXECUTE    DEBUG
Task:                 bcdl  : READ    WRITE    EXECUTE    DEBUG
Task:                  bfd  : READ    WRITE    EXECUTE    DEBUG
Task:                  bgp  : READ    WRITE    EXECUTE    DEBUG
Task:                 boot  : READ    WRITE    EXECUTE    DEBUG
Task:               bundle  : READ    WRITE    EXECUTE    DEBUG
Task:            call-home  : READ    WRITE    EXECUTE    DEBUG
Task:                  cdp  : READ    WRITE    EXECUTE    DEBUG
Task:                  cef  : READ    WRITE    EXECUTE    DEBUG
Task:                  cgn  : READ    WRITE    EXECUTE    DEBUG
Task:          config-mgmt  : READ    WRITE    EXECUTE    DEBUG
Task:      config-services  : READ    WRITE    EXECUTE    DEBUG
Task:                crypto  : READ    WRITE    EXECUTE    DEBUG
Task:                  diag  : READ    WRITE    EXECUTE    DEBUG
Task:               drivers  : READ    WRITE    EXECUTE    DEBUG
Task:                  dwdm  : READ    WRITE    EXECUTE    DEBUG
Task:                  eem  : READ    WRITE    EXECUTE    DEBUG
Task:                eigrp  : READ    WRITE    EXECUTE    DEBUG
--More--
(output omitted )
```

Troubleshoot

This section provides information you can use in order to troubleshoot your configuration.

Verify the ISE report from the **Operations > TACACS > Live Logs**. Click on the magnifying glass symbol in order to see the detailed report.



These are a few helpful commands in order to troubleshoot on ASR:

- **show user**
- **show user group**
- **show user tasks**
- **show user all**