Deploying a BYOD Policy for AirWatch Managed Devices

This example shows how to use Access Control Service policies to enable security based on device identity, device posture, or user identity in a bring your own device (BYOD) environment for an enterprise that uses AirWatch® for mobile device management (MDM). It includes the following information:

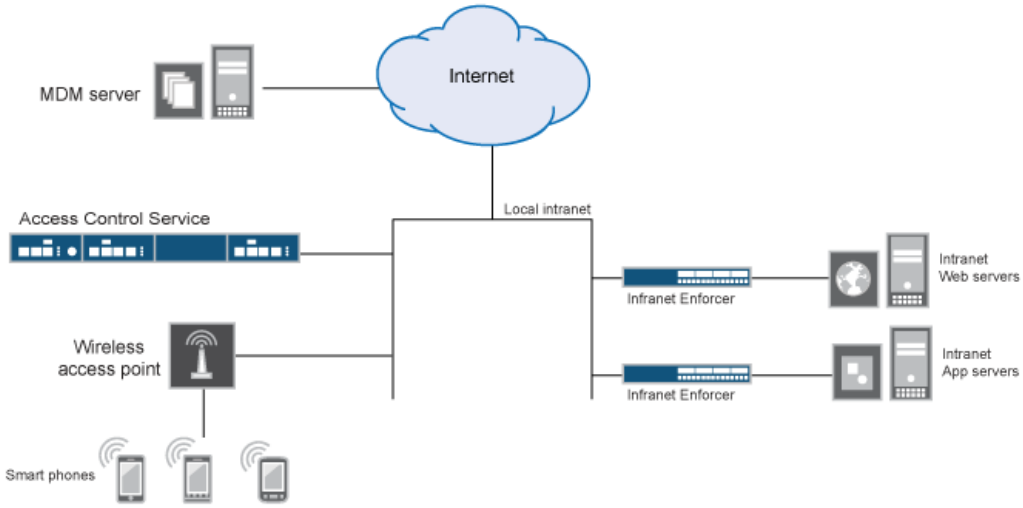
Solution Overview

In the past, to ensure security and manageability of the corporate network, enterprise information technology (IT) departments had restricted network access to company-issued equipment. For mobile phones, the classic example was the company-issued BlackBerry handset. As powerful mobile smart phones and tablets have become commonly held personal possessions, the trend in enterprise IT has been to stop issuing mobile equipment and instead allow employees to use their personal smart phones and tablets to conduct business activities. This has lowered equipment costs, but BYOD environments pose capacity planning and security challenges: how can an enterprise track network access by non-company-issued devices? Can an enterprise implement policies that can restrict the mobile devices that can access the network and protected resources in the same way network access control solutions restrict user access?

MDM vendors have emerged to address the first issue. MDMs such as AirWatch provide enrollment and posture assessment services that prompt employees to enter data about their mobile devices. The MDM data records include device attributes and posture assessment status that can be used in the Access Control Service access management framework to enforce security policies.

Figure 1 shows a deployment with Access Control Service, a wireless access point, and the AirWatch MDM cloud service.

Figure 1: Solution Topology



The solution shown in this example leverages the Junos Pulse access management framework to support attribute-based network access control for mobile devices. In the *device access management framework*, the MDM is a device authorization server and MDM record attributes are the basis for access policy determinations. For example, suppose your enterprise wants to enforce a policy that allows access only to mobile devices that have enrolled with the MDM or are compliant with the MDM posture assessment policies. You can use the attributes and status maintained by the MDM in Access Control Service role-mapping rules to implement the policy.

It is possible to use the MAC address as the device identifier, and, indeed, this is supported as a fallback plan. We recommend, however, that you implement the solution as shown here, using client certificates. This example shows how to enable security with the familiar 802.1x framework. In this framework, a native supplicant is used to authenticate the user of the device. The device itself is identified using a client certificate that contains device identity.

Client certificates provide a more secure way to identity a device than the MAC address, which is vulnerable to spoofing. The 802.1x EAP methods that provide a TLS tunnel (PEAP, TLS and TTLS) can use a client certificate.

The following behavior is illustrative:

- TTLS/MS-CHAPv2—The client certificate presented during the TLS handshake is used to identify the device against the MDM records, and MS-CHAPv2 is used to authenticate the user against an authentication server.
- PEAP/MS-CHAPv2—Although PEAP does not allow for user authentication with a client certificate, the client certificate can still be presented during the TLS handshake and can be used to identify the device against the MDM records. MS-CHAPv2 is used to authenticate the user against an authentication server.
- TLS—The client certificate can be used to identify the device against the MDM records and authenticate the user against a certificate server.

The Juniper solution supports attribute-based Layer 2 network access control through familiar RADIUS return attribute policies, and it supports Layer 3 enforcement through resource access policies. For example, you can implement policies that allow devices that have a clean MDM posture assessment and are compliant with MDM policies to access the network, but deny access to servers when you want to prevent downloads to employee-owned devices or to a particular platform that might be vulnerable.

Requirements

Table 1 lists version information for the solution components shown in this example.

Table 1: Component Version Information

Component	Version
ACS	Release 4.4R4-MDM or 5.0r1 or later is required.
AirWatch MDM	Release 6.4.1.2 is used in this example. Any version that supports the device ID and device attributes you plan to query is compatible.
Wireless access point	Juniper Networks WLC2 wireless LAN controller and WLA322 access point are used in this example. Any wireless access point that supports deployment as an 802.1x authenticator is compatible.

Configuring the AirWatch MDM Service

This solution assumes you know how to configure and use the features of your MDM, and that you can enroll employees and their devices. For more information about the AirWatch MDM, refer to its documentation and support resources. This section focuses on the following elements of the MDM configuration that are important to this solution:

- Device identifier—The primary key for device records. Your MDM configuration determines whether a universal unique identifier (UUID), unique device identifier (UDID), or serial number is used as the device identifier. For AirWatch, UDID is supported and recommended.
- Device attributes—A standard set of data maintained for each device. For AirWatch, see Table 2.

When the user installs the MDM application on the device and completes enrollment, the MDM pushes the device certificate to the device. After enrollment, the MDM maintains a database record that includes information about the enrollee—attributes related to device identity, user identity, and posture assessment against MDM policies. Table 2 describes these attributes. In this solution, these attributes are used in the Access Control Service role mapping that is the basis for network access and resource access policies. When you configure role-mapping rules, you specify the normalized ACS attribute name.

Table 2: AirWatch Device Attributes

AirWatch Attribute	Normalized SAS Name	Description	Data Type
BlockLevelEncryption	BlockLevelEncryption	True if block-level encryption is enabled; false otherwise.	Boolean
ComplianceStatus	complianceReason	Values: Compliant, Non-Compliant.	String
ComplianceStatus	isCompliant	True if the status is compliant with MDM policies; false otherwise.	Boolean
CompromisedStatus	CompromisedStatus	True if the status is compromised; false otherwise.	Boolean
CompromisedStatus	isCompromised	True if the device is compromised; false otherwise.	Boolean
DataProtectionEnabled	DataProtectionEnabled	True if data protection is enabled; false otherwise.	Boolean
DeviceFriendlyName	deviceName	The concatenated name used to identify the device/user combination.	String
EnrollmentStatus	isEnrolled	True if MDM value is Enrolled; false otherwise.	Boolean
FileLevelEncryption	FileLevelEncryption	True if file-level encryption is enabled; false otherwise.	Boolean
Id.Value	deviceId	Device identifier.	String
Imei	IMEI	IMEI number of the device.	String
IsPasscodeCompliant	IsPasscodeCompliant	True if the passcode is compliant with the MDM policy; false otherwise	Boolean
IsPasscodePresent	IsPasscodePresent	True if a passcode has been configured; false otherwise.	Boolean
LastComplianceCheckOn	LastComplianceCheckOn	The refresh date and timestamp of the last status reported.	Timestamp
LastCompromisedCheckOn	LastCompromisedCheckOn	The refresh date and timestamp of the last status reported.	Timestamp
LastSeen	lastSeen	Date and time the device last made successful contact with the MDM.	Timestamp
LocationGroupName	LocationGroupName	MDM location group configuration value.	String
MacAddress	macAdress	The Wi-Fi MAC address.	String
Model	model	Model is automatically reported by the device during registration.	String
OperatingSystem	osVersion	OS version.	String
Ownership	ownership	Values: C, E, or S (Corporate, Employee, or Shared).	String
PhoneNumber	phoneNumber	Phone number entered during registration.	String
Platform	platform	Platform specified during registration.	String
SerialNumber	serialNumber	Serial number.	String
Udid	UDID	Unique device identifier.	String
UserEmailAddress	userEmail	E-mail address of device user.	String
UserName	userName	Name of device user.	String
Uuid	UUID	Universal unique identifier.	String

To configure the MDM:

1. Enroll devices in the MDM using the methods supported by the MDM.
2. Create a profile. The profile determines many MDM management options. The following configurations are key to this solution:
   a. Certificate template. Create a configuration that specifies the field and type of identifier for client device certificates. See Figure 2.

      The MDM configuration templates provide flexibility in how the device identifier can be placed in the device certificate's subject or alternative subject. We recommend you include the user ID in the certificate, so the certificate can identify both the user and the device. For example:

      ```
      CN=<DEVICE_UDID>, uid=<USER_ID>, o=Company
      ```

   b. Credential profile. Create a configuration that specifies the certificate authority and certificate template configuration. See Figure 3.
   c. Wi-Fi profile. Create a configuration that specifies the SSID, security options, and the credential configuration. See Figure 4.
3. Save and deploy the profile to devices registered with your organization. See Figure 5.
4. Enable API access and generate the AirWatch API key (tenant code). The tenant code is part of the REST API configuration. The tenant code must be included in the Access Control Service MDM server configuration. It is sent in the API call. See Figure 6.

Figure 2: AirWatch Certificate Template Configuration

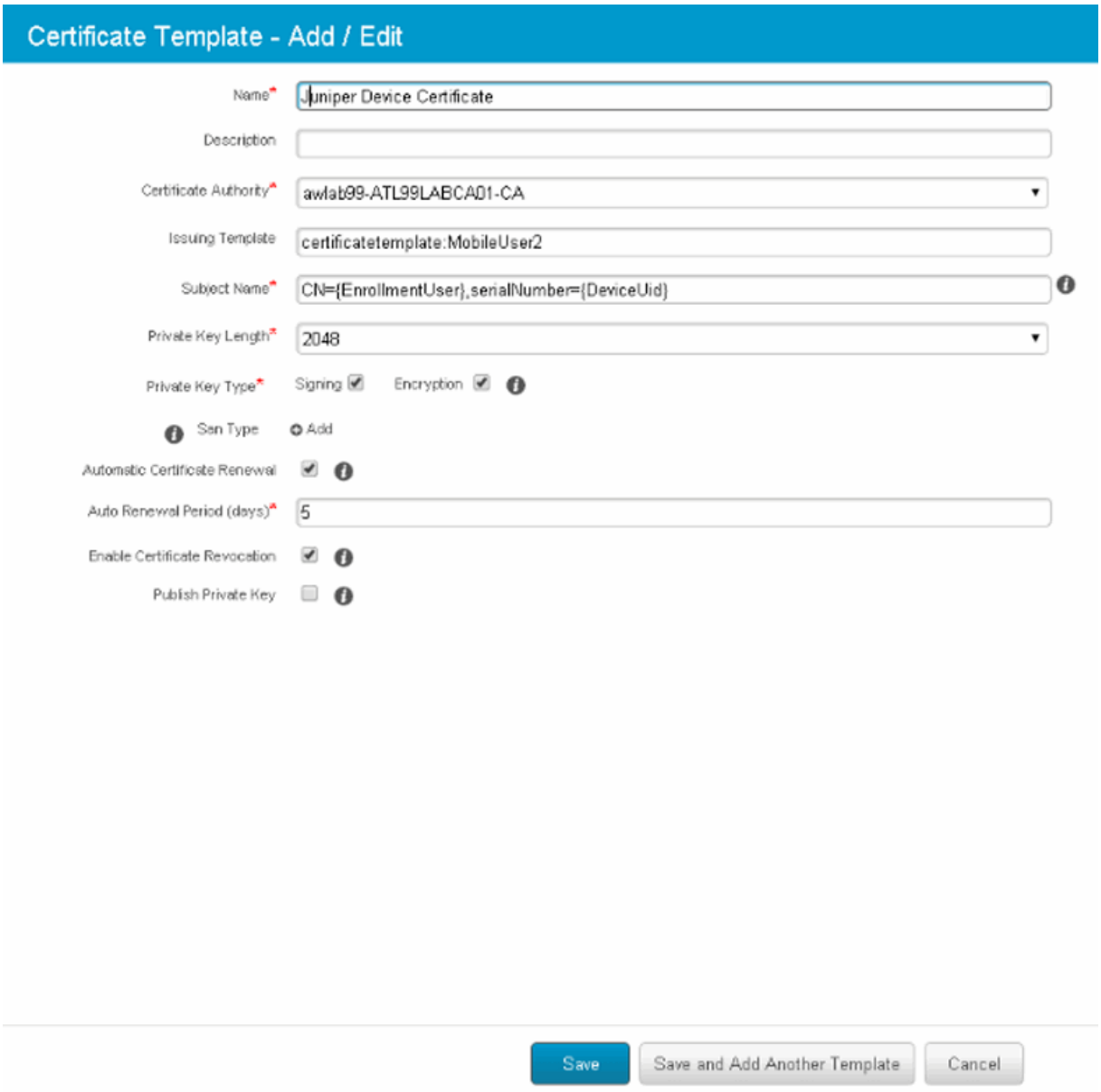


Figure 3: AirWatch Credential Configuration

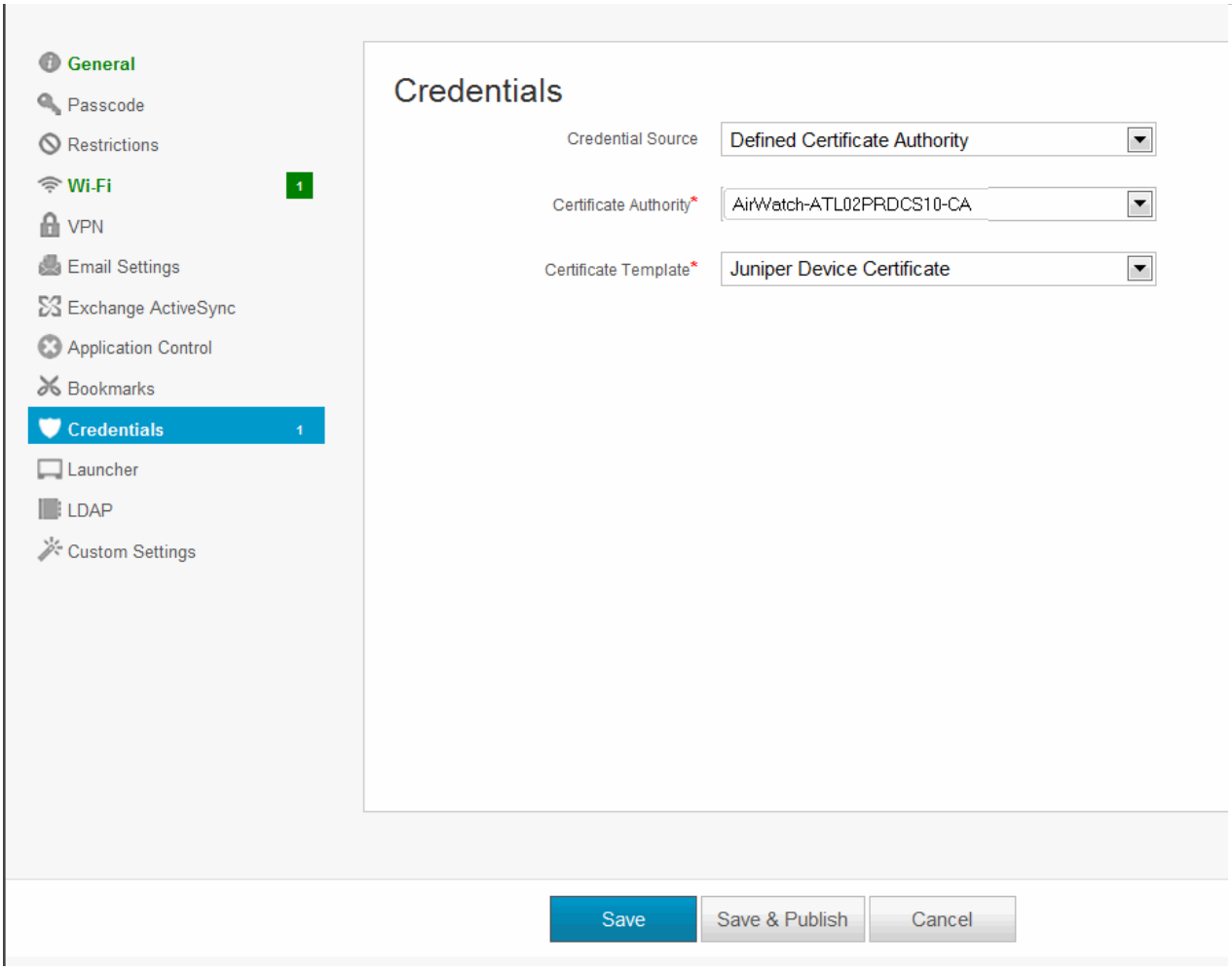


Figure 4: AirWatch Wi-FI Configuration

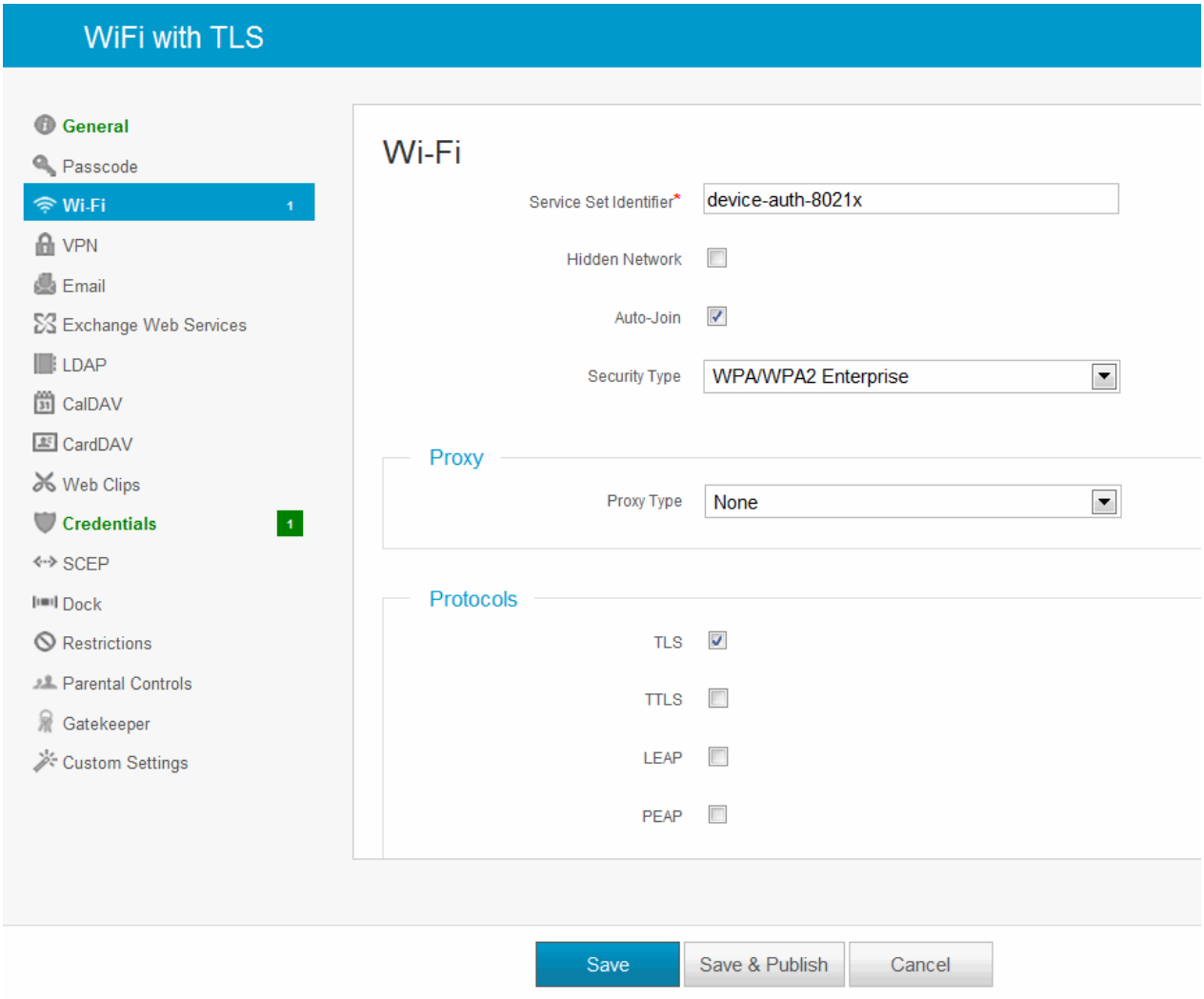


Figure 5: Deploying a Profile to Your Organization's Managed Devices

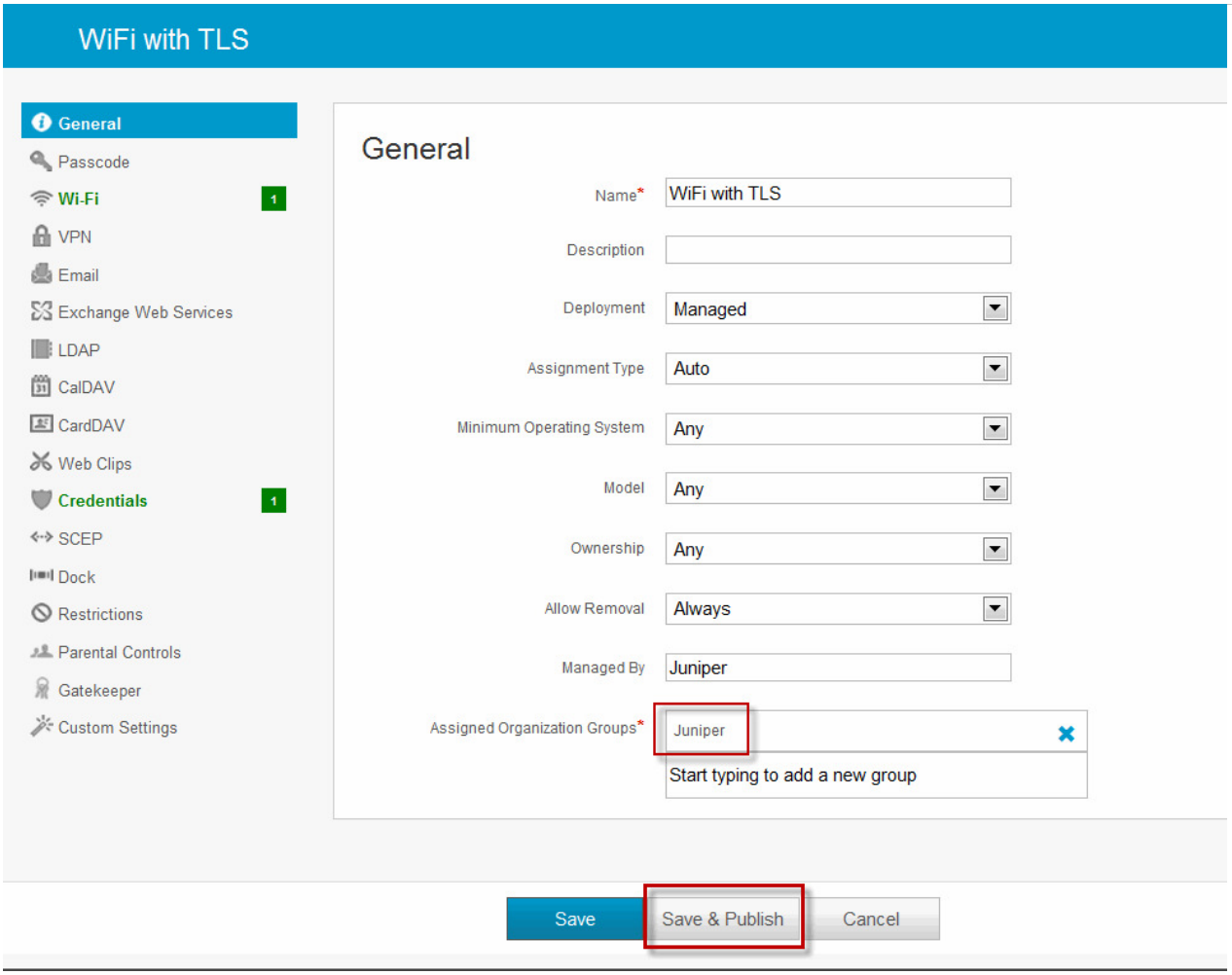
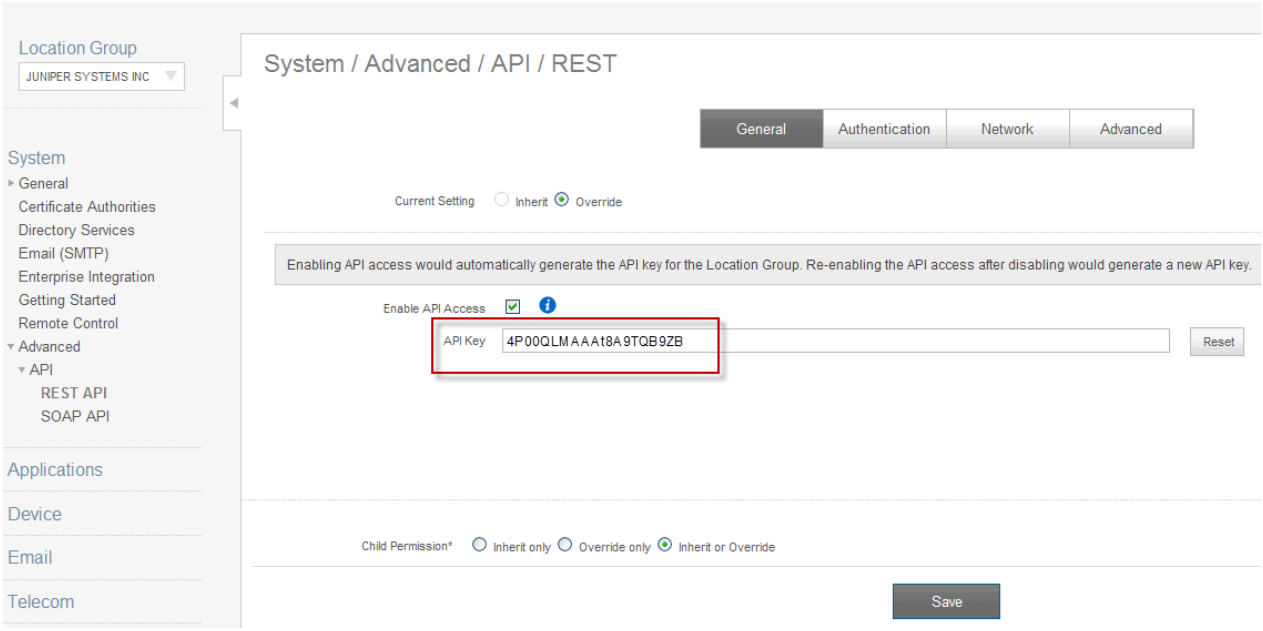


Figure 6: AirWatch API Tenant Code Configuration



Configuring the Wireless Access Point

The following wireless access point settings are important in this solution:

- 802.1x authentication
- RADIUS authenticator communication with the Access Control Service RADIUS server
- VLANs, if you want to assign user roles to VLANs

Refer to your vendor's documentation for information about the wireless access point 802.1x configuration. For information about Juniper Networks wireless access controllers, refer to the Juniper Networks wireless LAN services documentation.

Figure 7 shows the 802.1x configuration for a Juniper Networks WLC deployment similar to the one used in this example.

Figure 7: WLC 802.1x Authentication Configuration

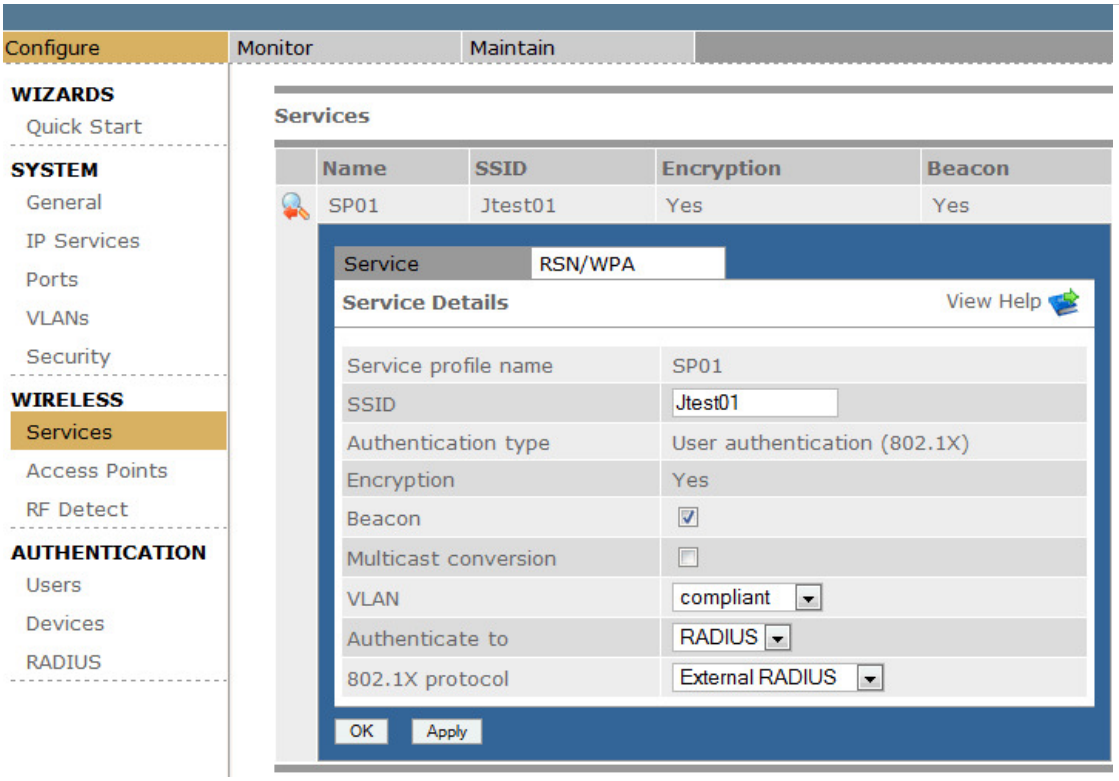


Figure 8 shows the RADIUS configuration for a Juniper Networks WLC deployment similar to the one used in this example.

Figure 8: WLC RADIUS Configuration

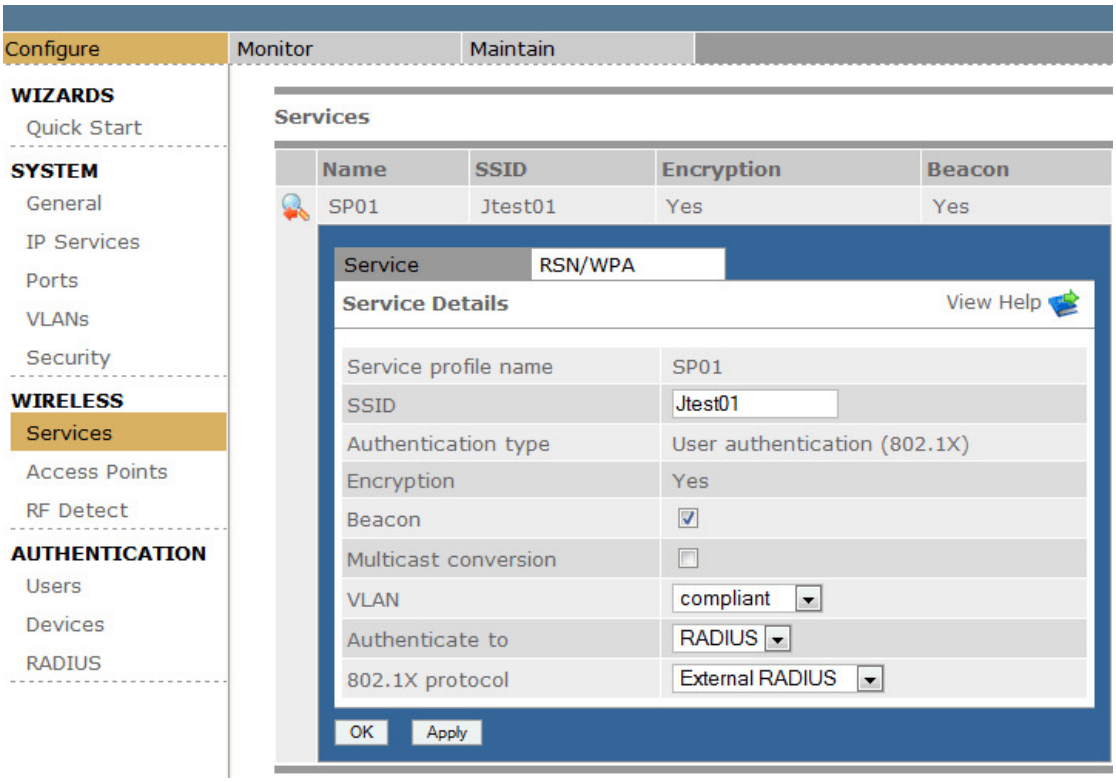
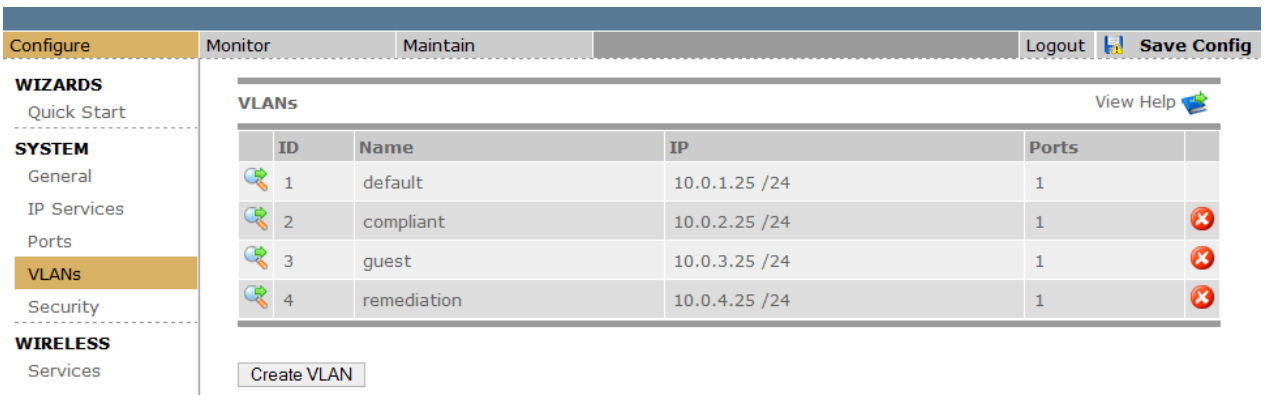


Figure 9 shows the VLAN configuration for a Juniper Networks WLC deployment similar to the one used in this example.

Figure 9: WLC VLAN Configuration



Configuring the Device Access Management Framework

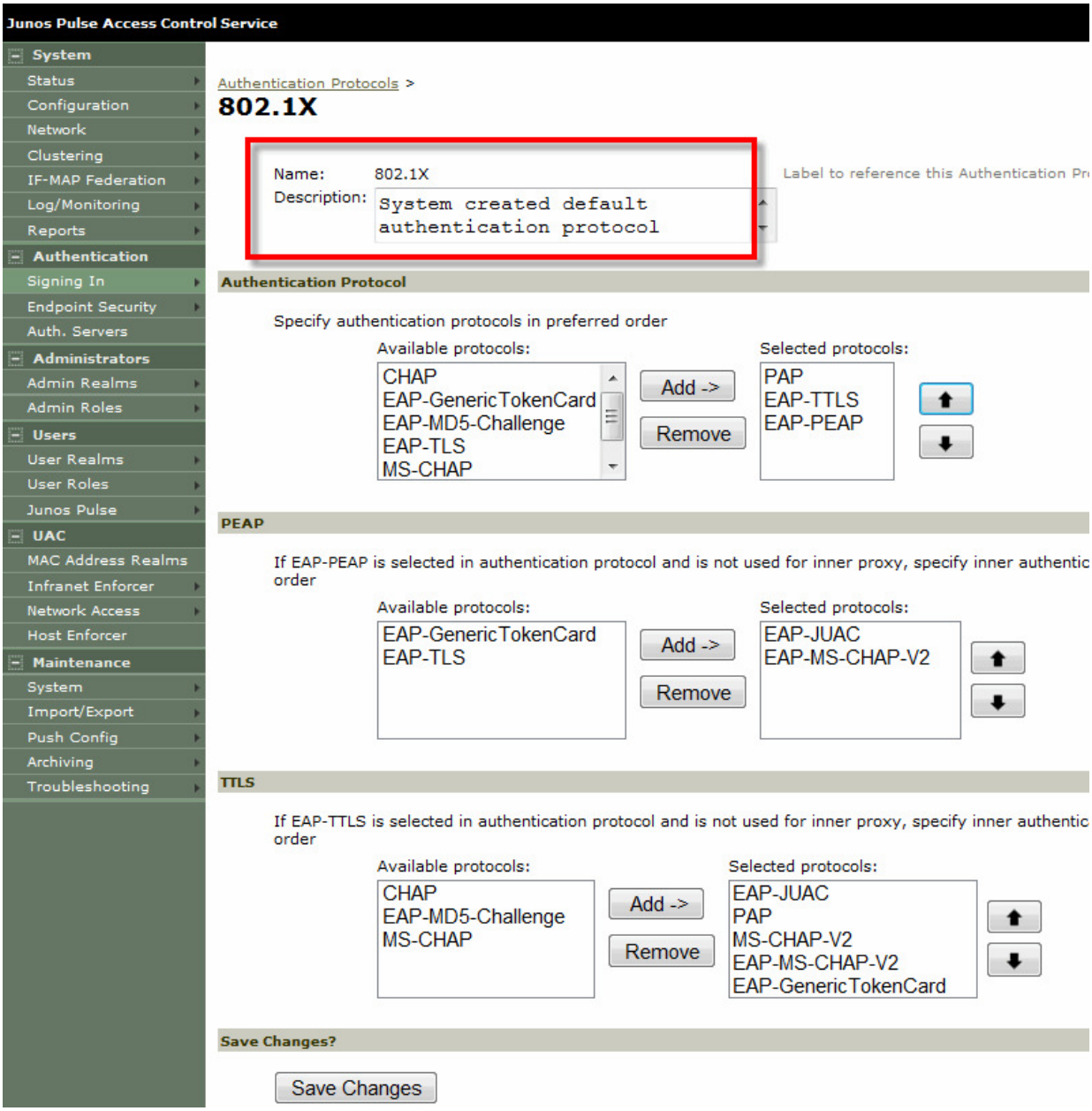
This section describes the basic steps for configuring the device access management framework:

1. Configuring an Authentication Protocol Set
2. Configuring the MDM Authentication Server
3. Configuring the Certificate Server
4. Adding the MDM Certificate to the Trusted Client CA Configuration
5. Configuring User Roles
6. Configuring a Realm and Role Mapping Rules
7. Configuring a Sign-In Policy

Configuring an Authentication Protocol Set

The authentication protocol set associated with the sign-in page must include the EAP method selected in the MDM Wi-Fi profile. The predefined authentication protocol set named **802.1x** shown in Figure 10 can be used as-is because it includes all the EAP methods currently configurable on MDMs.

Figure 10: Authentication Protocol Set Configuration Page



If you want to define a custom set for this solution, configure the authentication protocol set.

To configure the authentication protocol set:

1. Select **Signing In > Authentication Protocols** to display the configuration page.
2. Click **New Authentication Protocol** or select the predefined 802.1x set and click **Duplicate**.
3. Complete the configuration as described in Table 3.
4. Save the configuration.

Table 3: Authentication Protocol Set Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the protocol set.

Settings	Guidelines
Description	Describe the purpose of the set so that other administrators are aware of it.
Authentication Protocol	Use the Add/Remove buttons to select protocols to be used. Use the up/down buttons to list the selected protocols in the preferred order.
PEAP	Use the Add/Remove buttons to select protocols to be used. Use the up/down buttons to list the selected protocols in the preferred order.
TLS	Use the Add/Remove buttons to select protocols to be used. Use the up/down buttons to list the selected protocols in the preferred order.

Configuring the MDM Authentication Server

The MDM authentication server configuration is used by the system to communicate with the MDM. In the device access management framework, the MDM server is used as the device authorization server.

To configure the authentication server:

1. Select **Authentication > Auth Servers** to navigate to the authentication server configuration pages.
2. Select **MDM Server** and click **New Server** to display the configuration page shown in Figure 11.
3. Complete the configuration as described in Table 4.
4. Save the configuration.

Figure 11: Authentication Server Configuration Page

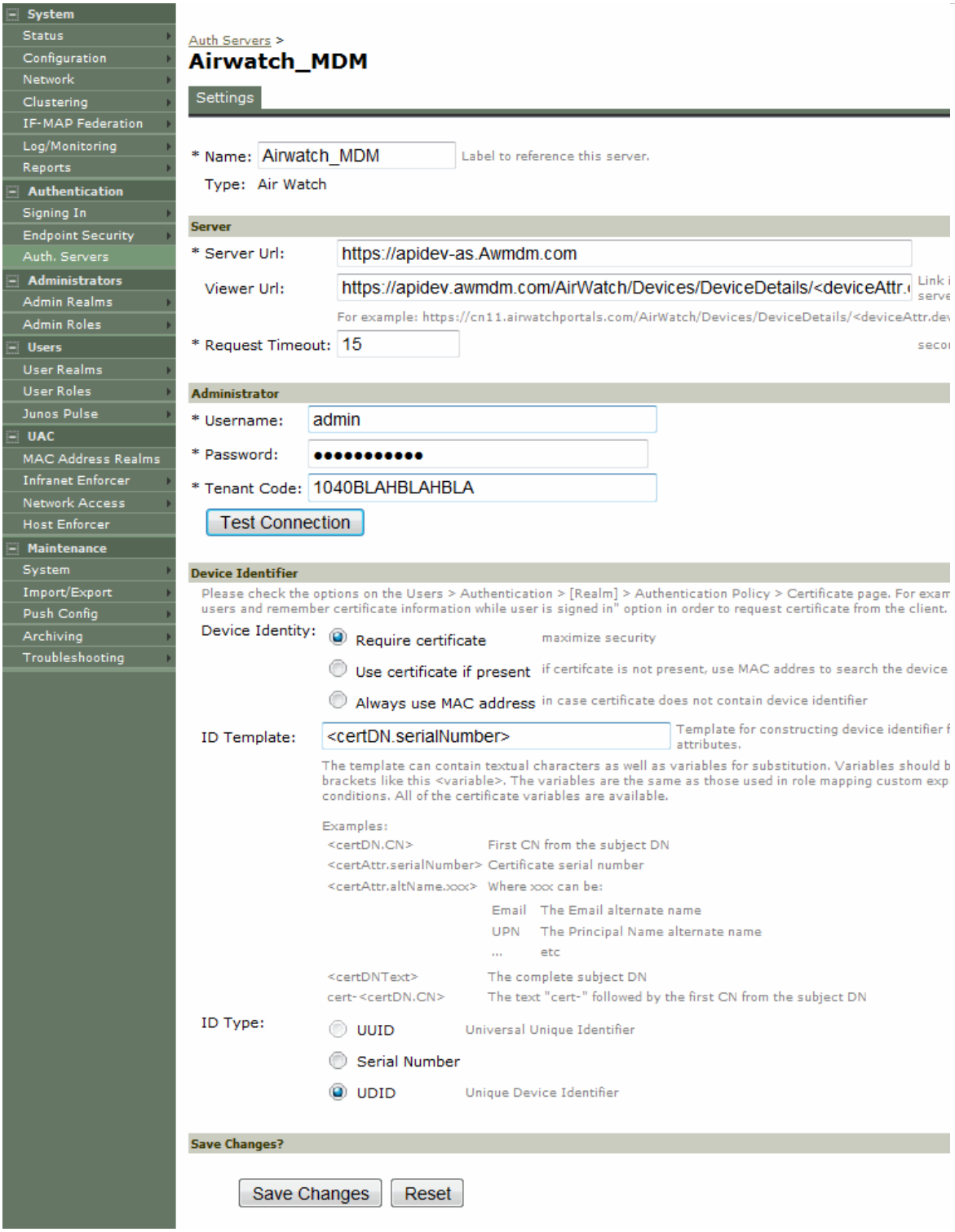


Table 4: Authentication Server Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the configuration.
Type	Select **AirWatch**.
Server	
Server Url	Specify the URL for your AirWatch server. This is the URL AirWatch has instructed you to use to access its RESTful Web API (also called a RESTful Web service). The URL for the AirWatch MDM server used in this example has the following form: **https://apidev-as.Awmdm.com** **Note:** You must configure your firewalls to allow communication between these two nodes over port 443.
Viewer Url	Specify the URL for the AirWatch report viewer. This URL is used for links from the Active Users page to the AirWatch report viewer. The URL for the AirWatch MDM viewer for this example has the following form: **https://apidev.awmdm.com/AirWatch/Devices/DeviceDetails/<deviceAttr.deviceId>**
Request Timeout	Specify a timeout period (0-60 seconds) for queries to the MDM server. The default is 15 seconds.
Administrator	

Settings	Guidelines
Username	Specify the username for an account that has privileges to access the AirWatch RESTful Web API.
Password	Specify the corresponding password.
Tenant Code	Copy and paste the AirWatch API tenant code. See Figure 6.
Device Identifier	
Device identity	*Access Control Service only*. Select an option on whether to require that the MDM certificate is presented by the endpoint when signing in: ▪ **Require**—Require that the device certificate pushed to client devices during enrollment be used at sign-in. If this option is selected, and the client device does not have a certificate, authorization fails. Use this option when you require endpoints to adhere to your certificate security requirements. ▪ **Use Certificate if present**—Use the certificate to derive the device ID if the certificate is presented at sign-in, but do not reject authentication if the certificate is not present. You can use this option in conjunction with a role mapping rule and a remediation VLAN to identify devices that have not perfected MDM enrollment. ▪ **Always Use MAC address**—In some cases, the MDM certificate might be configured without a device identifier. When the endpoint uses an 802.1x framework to authenticate, the Access Control Service can obtain the MAC address from the RADIUS return attribute callingStationID. The system can then use the MAC address as the device identifier. **Note:** This option is not present in Secure Access Service. A device certificate is required to determine device identity.
ID Template	Construct a template to derive the device identifier from the certificate attributes. The template can contain textual characters as well as variables for substitution. The variables are the same as those used in role mapping custom expressions and policy conditions. Enclose variables in angle brackets like this <variable>. For example, suppose the certificate DN is: CN=<DEVICE_UDID>, uid=<USER_ID>, o=Company. With this configuration, the certificate could identify both the user and the device. In this example, the device ID template is <certDN.CN>.
ID Type	Select the device identifier type that matches the selection in the MDM certificate configuration: ▪ **UUID**—Not applicable for the AirWatch MDM. ▪ **Serial Number**—The device serial number. ▪ **UDID**—The device unique device identifier. This is supported by the AirWatch MDM.

Configuring the Certificate Server

The certificate server configuration enables device users to authenticate using the certificate pushed to the device by the MDM. The certificates are used for user authentication, and the users do not have to enter user credentials.

To configure authentication with the certificate server:

1. Select **Authentication** > **Auth. Servers**.
2. Select **Certificate Server** and click **New Server** to display the configuration page shown in Figure 12.
3. Complete the configuration as described in Table 5.
4. Save the configuration.

Figure 12: Certificate Server Configuration Page

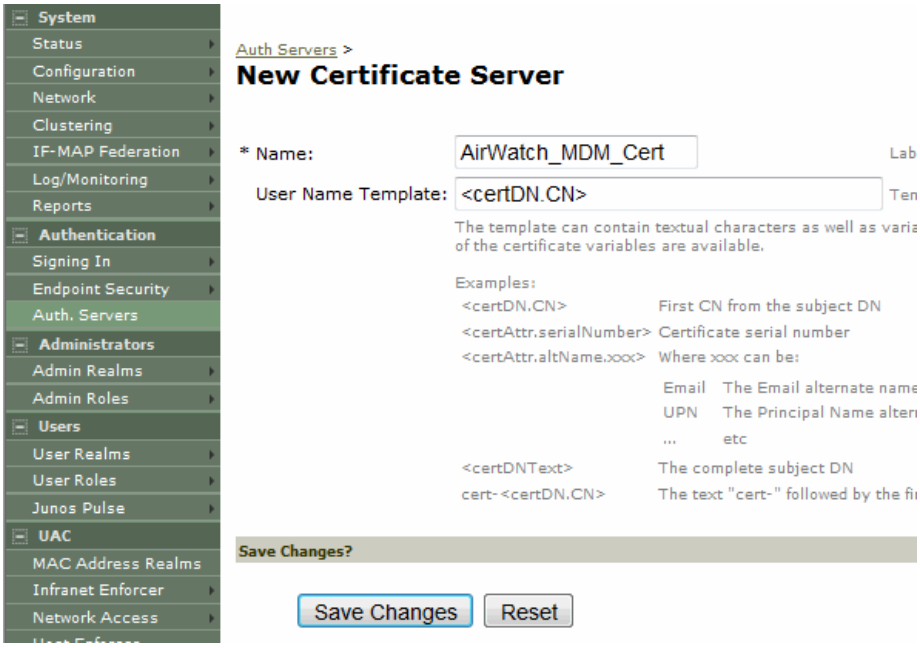


Table 5: Certificate Server Settings

Settings	Guidelines
Name	Specify a name to identify the server within the system.

Settings	Guidelines
User Name Template	Specify a username template. Specify how the system should construct a username. You may use any combination of certificate variables contained in angle brackets and plain text. The username template you configure must be consistent with the MDM certificate template configuration. Your goal is to identify the values specified in the MDM certificate that are to be used as the username in the Access Control Service system. This value populates the <USER> and <USERNAME> session variables for use throughout the rest of the system configuration. For example, suppose the certificate DN is: CN=<DEVICE_UDID>, uid=<USER_ID>, o=Company. With this configuration, the certificate could identify both the user and the device. In this example, the username template is <certDN.UID>.

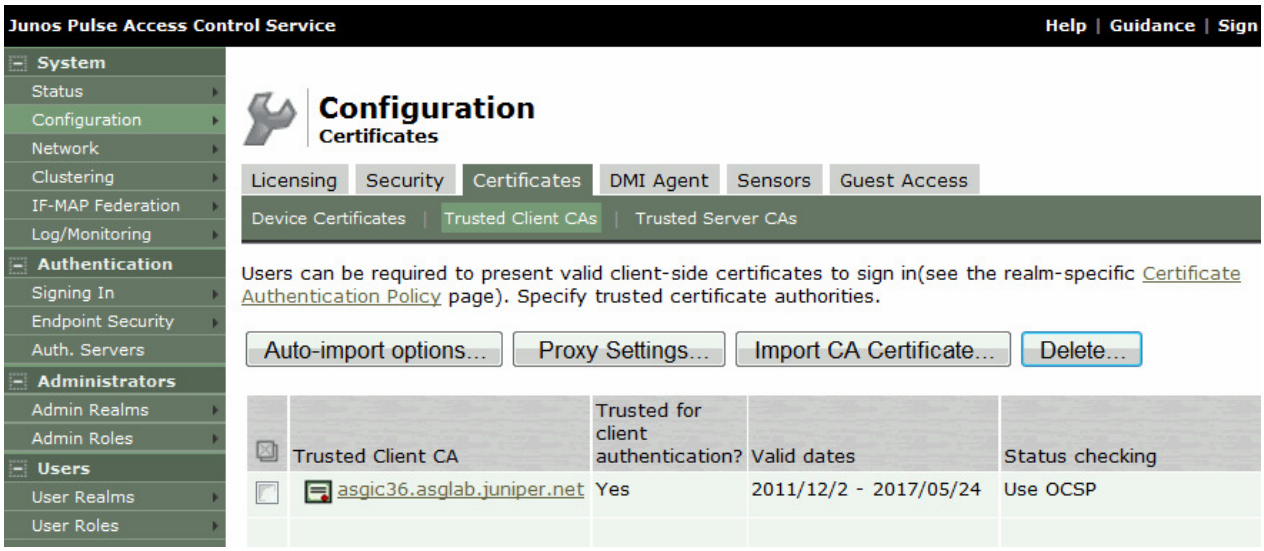
Adding the MDM Certificate to the Trusted Client CA Configuration

The system uses the uploaded certificate to verify that the browser-submitted certificate is valid. You must upload the MDM certificate that signed the client certificate that was pushed to the mobile devices. Typically, you obtain this certificate from the MDM when your company establishes its account with them.

To import a trusted client CA certificate:

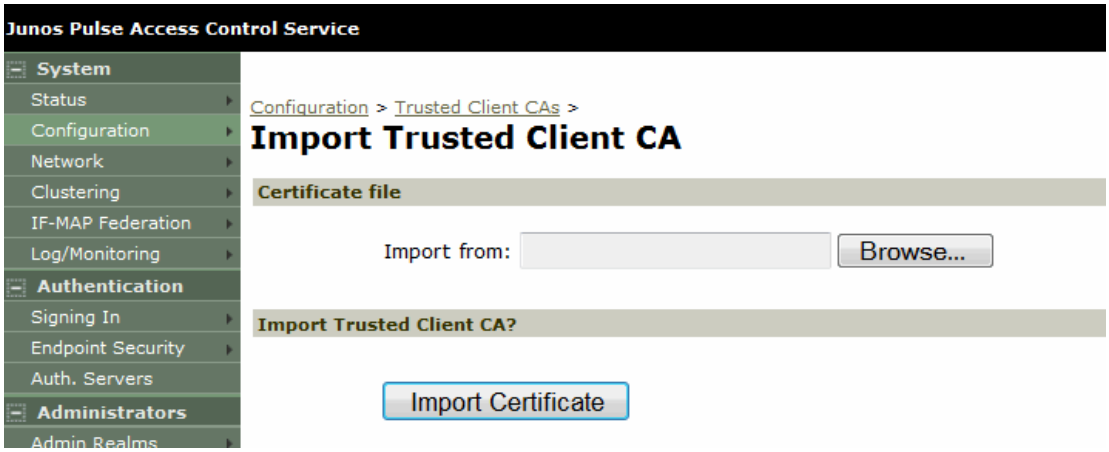
1. Select **System > Configuration > Certificates > Trusted Client CAs** to display the page shown in Figure 13.

   Figure 13: Trusted Client CA Management Page



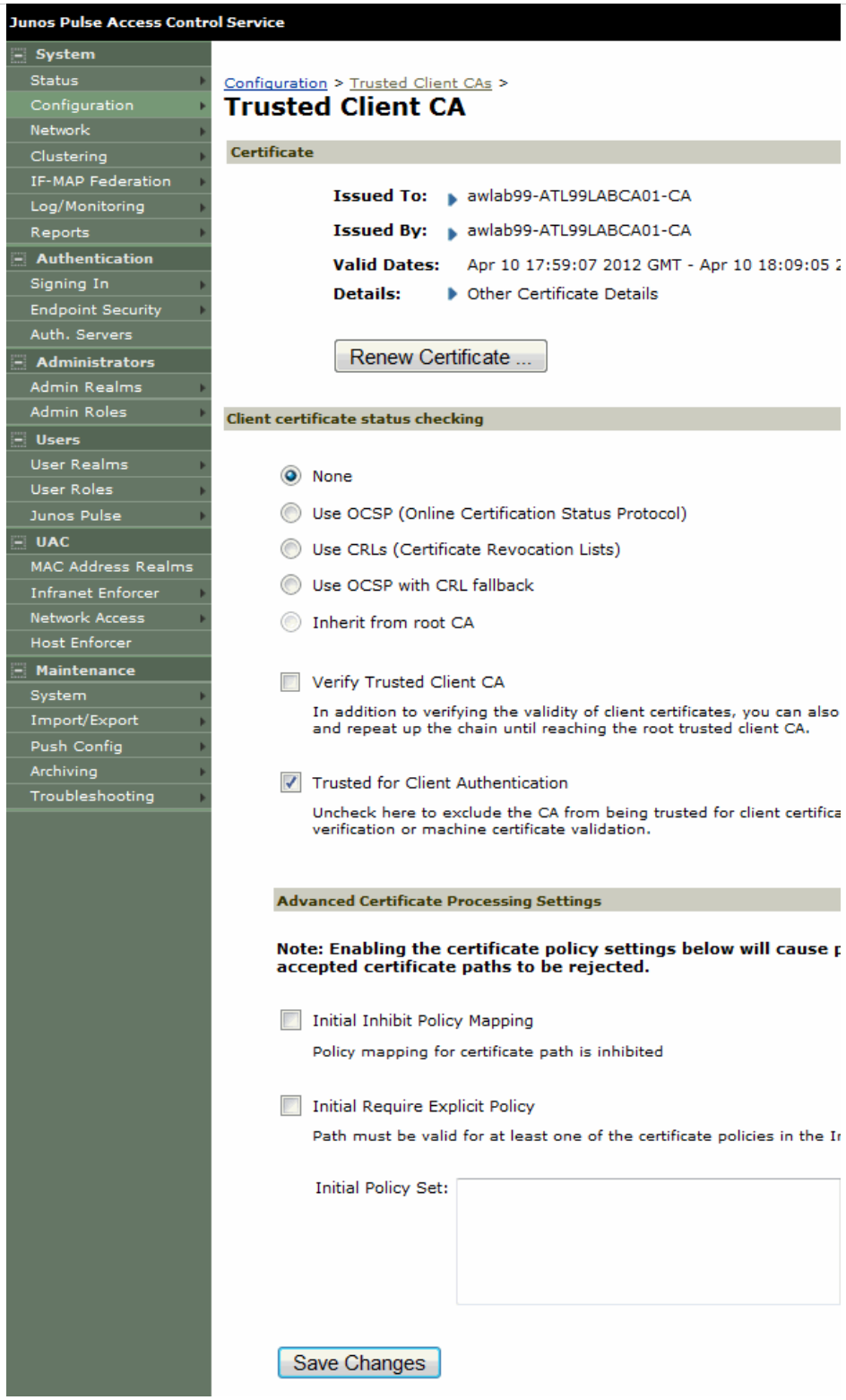
2. Click **Import CA Certificate** to display the page shown in Figure 14.

   Figure 14: Import Trusted Client CA Page



3. Browse to the certificate file, select it, and click **Import Certificate** to complete the import operation.
4. Click the link for the Trusted Client CA to display its details. Figure 15 shows the configuration for this example.

   Figure 15: Trusted Client CA Configuration for AirWatch



Configuring User Roles

User roles are classifiers for network access control policies. You create a set of roles to use in your classification scheme: device status is MDM enrollment complete or incomplete; device status is MDM-policy compliant or noncompliant; device is employee owned or company owned; device platform is iOS, Android, or neither; and so forth.

The user role configuration also includes options to customize user interface features that are appropriate for a particular role. For MDM deployments, you can use the Personalized Greeting UI option to send a notification message to the device when the role has been applied.

To configure user roles:

1. Select **Users > User Role** to navigate to the role configuration page.
2. Click **New Role** to display the configuration page shown in Figure 16.
3. Complete the configuration for general options as described in Table 6.
4. Save the configuration.
5. Click **UI options** to display the configuration page shown in Figure 17.
6. Complete the configuration for UI options as described in Table 6.
7. Save the configuration.
8. Click **Session Options** to display the configuration page shown in Figure 18.
9. Complete the configuration for session options as described in Table 6.

10. Save the configuration.
11. Click **Agentless** to display the configuration page shown in Figure 19.
12. Complete the configuration for agentless options as described in Table 6.
13. Save the configuration.

Figure 16: User Role Configuration Page – General Settings

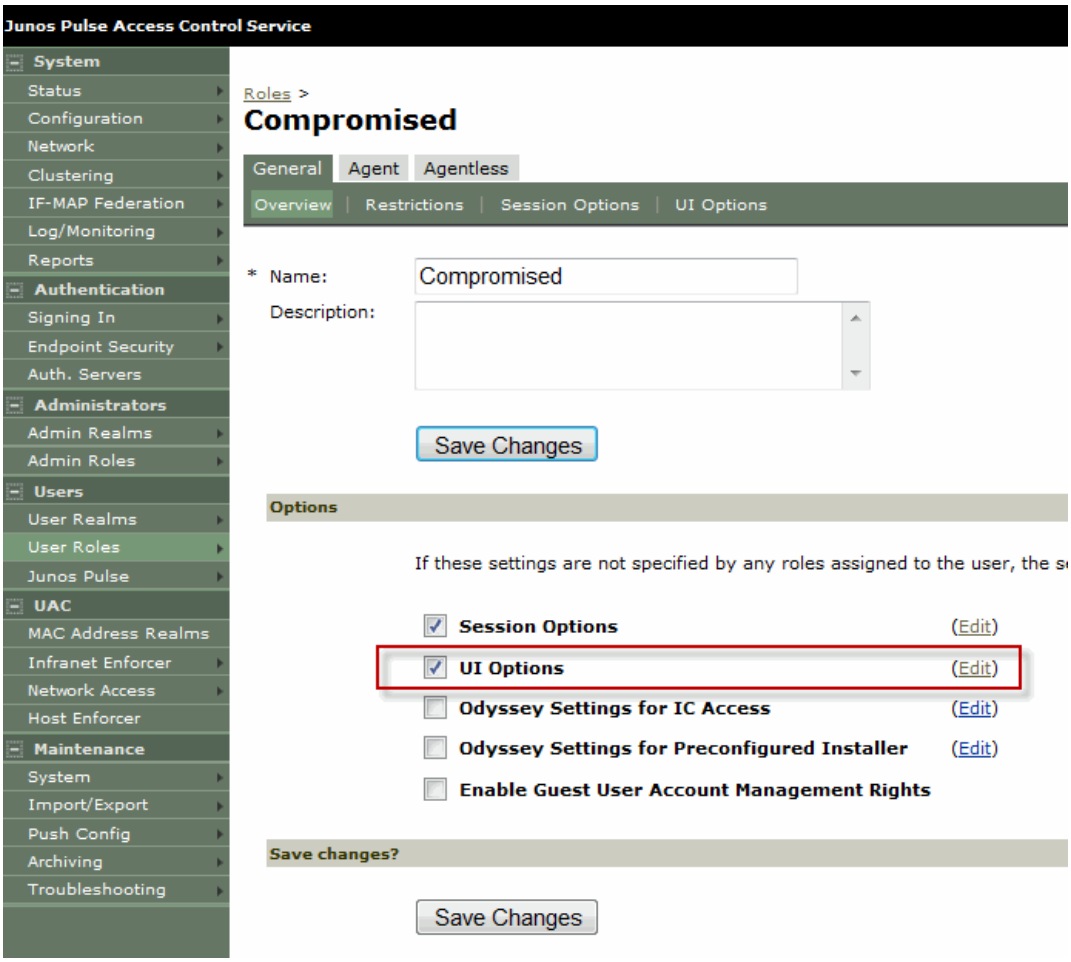


Figure 17: User Role Configuration Page – UI Options

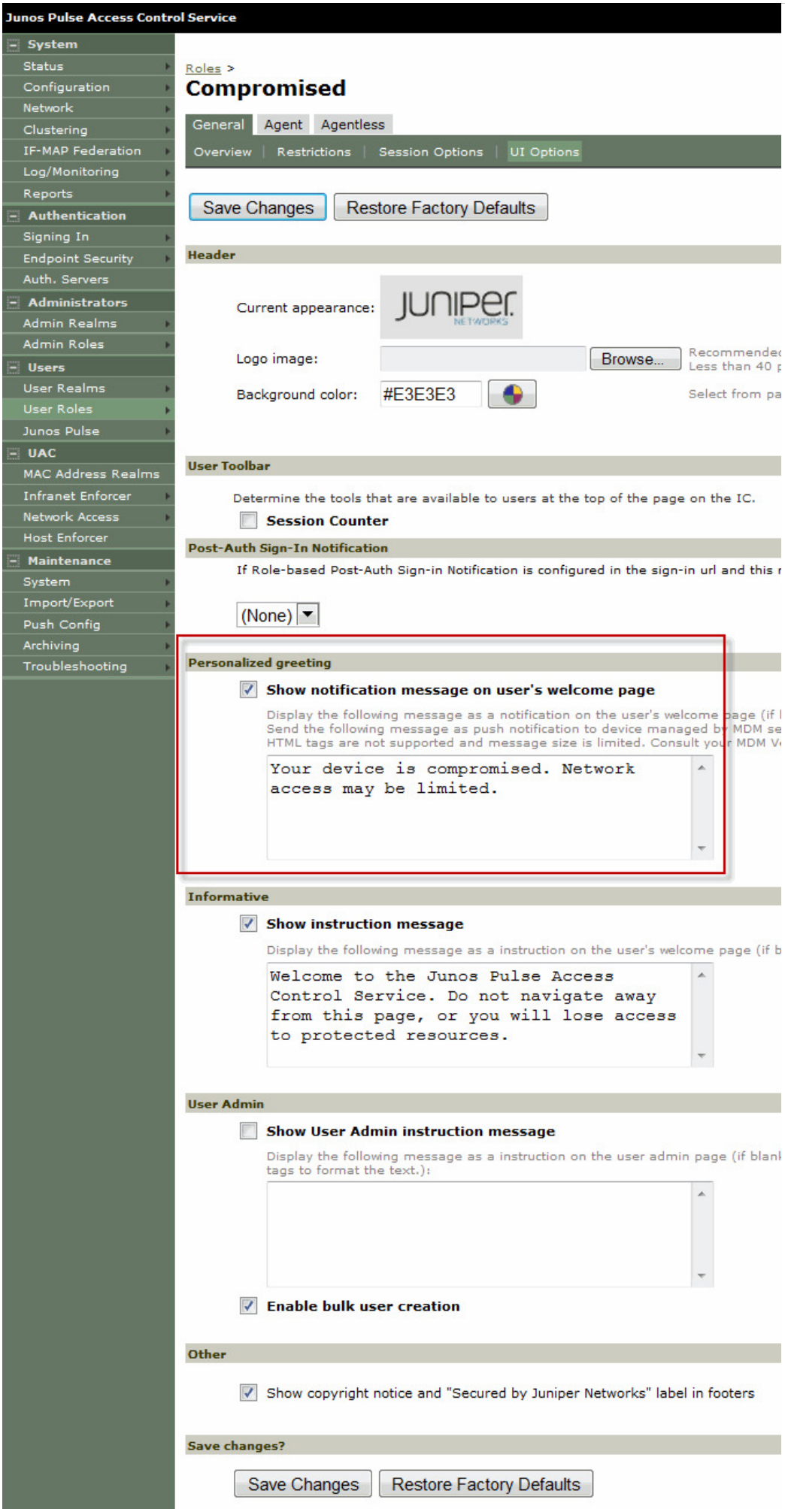


Figure 18: User Role Configuration Page – Session Options

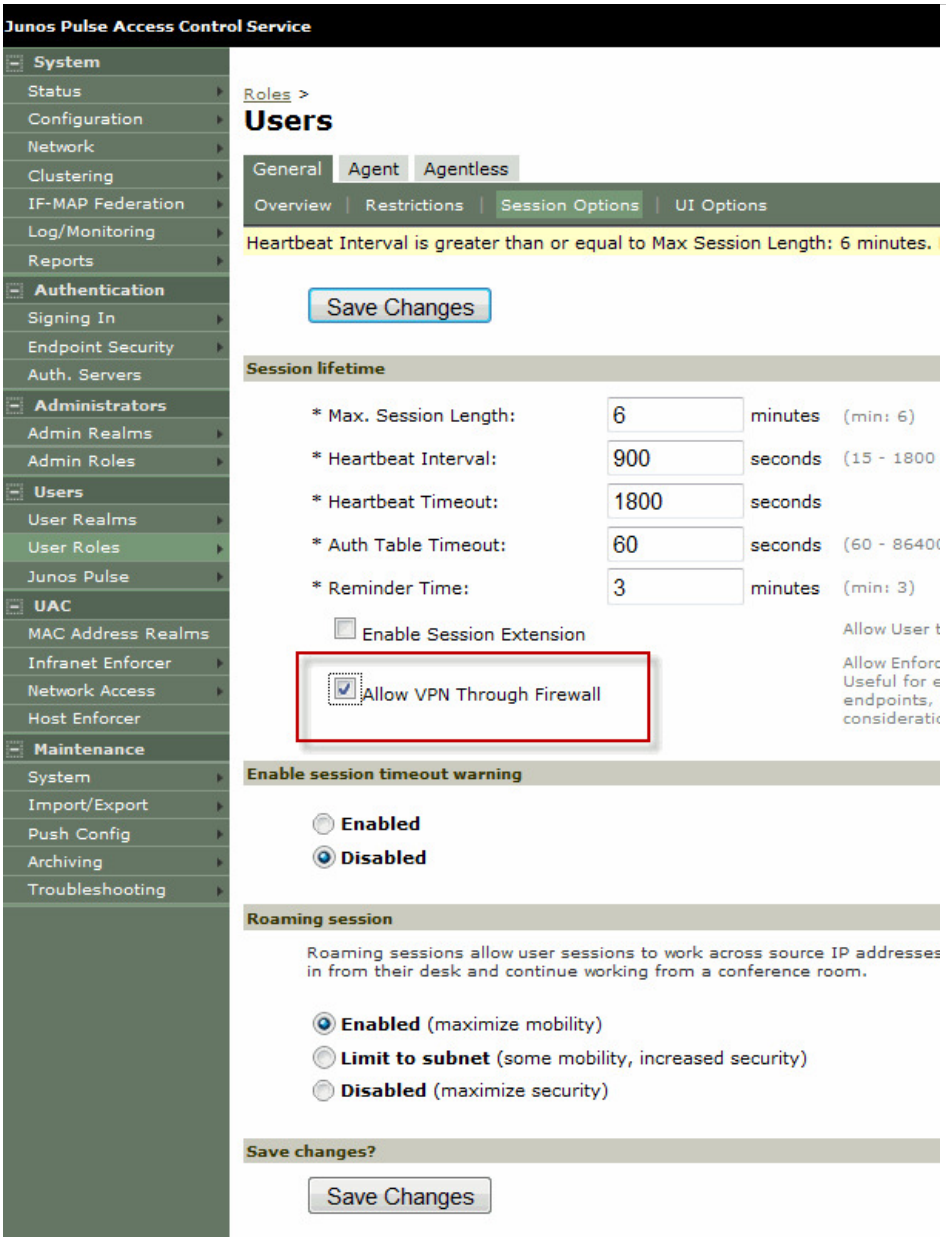


Figure 19: User Role Configuration Page – Agentless Access

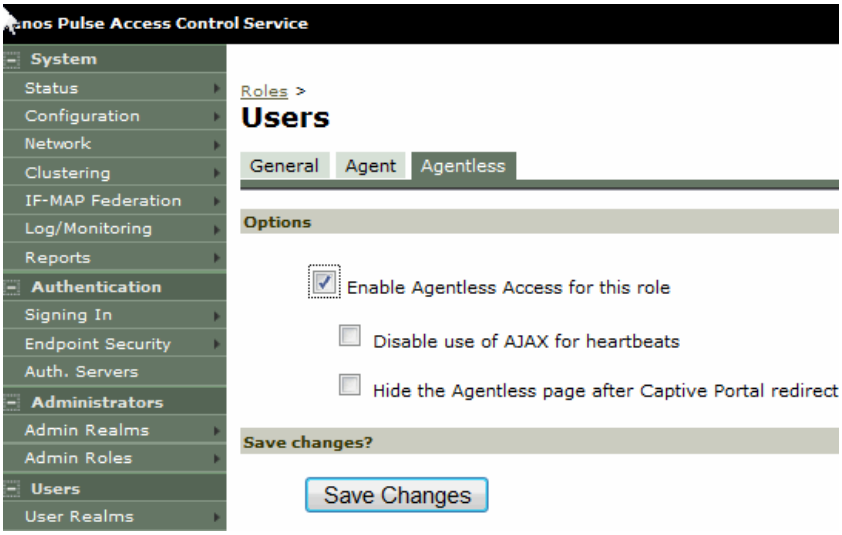


Table 6: User Role Configuration Guidelines

Settings	Guidelines
Overview tab	
Name	Specify a name for the configuration.
Description	Describe the purpose of the role so that other administrators are aware of it.
Options	Select **UI Options** so that you can customize a message to be sent to the device when the role is applied.
UI Options tab	

Settings	Guidelines
Personalized greeting	Select the **Show notification message** option and enter a message to be sent to the device (through the MDM API) after sign-in and this role has been applied, or after role reevaluation if it results in a role change to this role. In this example, we are using the system to enforce MDM enrollment by flagging compromised devices. The message, therefore, is: `Your device is compromised. Network access may be limited.` The message is forwarded to the device using the MDM server Push Notification feature. The content of your notification message can vary depending on whether the switch or access point supports change of authorization (CoA). If the CoA is supported, reauthentication is automatic, so your message might simply state that “your level of access has changed.” If CoA is not supported, reauthentication needs to be done manually by the user in which case the message might state that “your level of access has changed, please reconnect.” **Note:** When multiple roles are assigned, UI options are not merged. The UI options for the first role that matches are applied.
Session Options	
Allow VPN Through Firewall	Enable this option to allow Infranet Enforcer traffic to act as a heartbeat and keep the session alive. This option is useful for iOS devices.
Agentless	
Enable agentless access	Select this option for roles that you provision to access the network from BYOD devices. The solution that integrates with MDMs depends on the native supplicant, not a Juniper agent.

Configuring a Realm and Role Mapping Rules

The user realm configuration associates the authentication server data and MDM server data with user roles.

To configure the realm and role mapping rules:

1. Select **Users > User Realms > New User Realm** to display the configuration page shown in Figure 20.
2. Complete the configuration as described in Table 7.
3. Save the configuration.
   Upon saving the new realm, the system displays the role mapping rules page.
4. Click **New Rule** to display the configuration page shown in Figure 21.
5. Complete the configuration as described in Table 8.
6. Save the configuration.
7. Click the **Authentication Policy** tab and then click the **Certificate** subtab to display the certificate restriction configuration page shown in Figure 22.
8. Complete the configuration as described in Table 10.
9. Save the configuration.

Figure 20: Realm Configuration Page

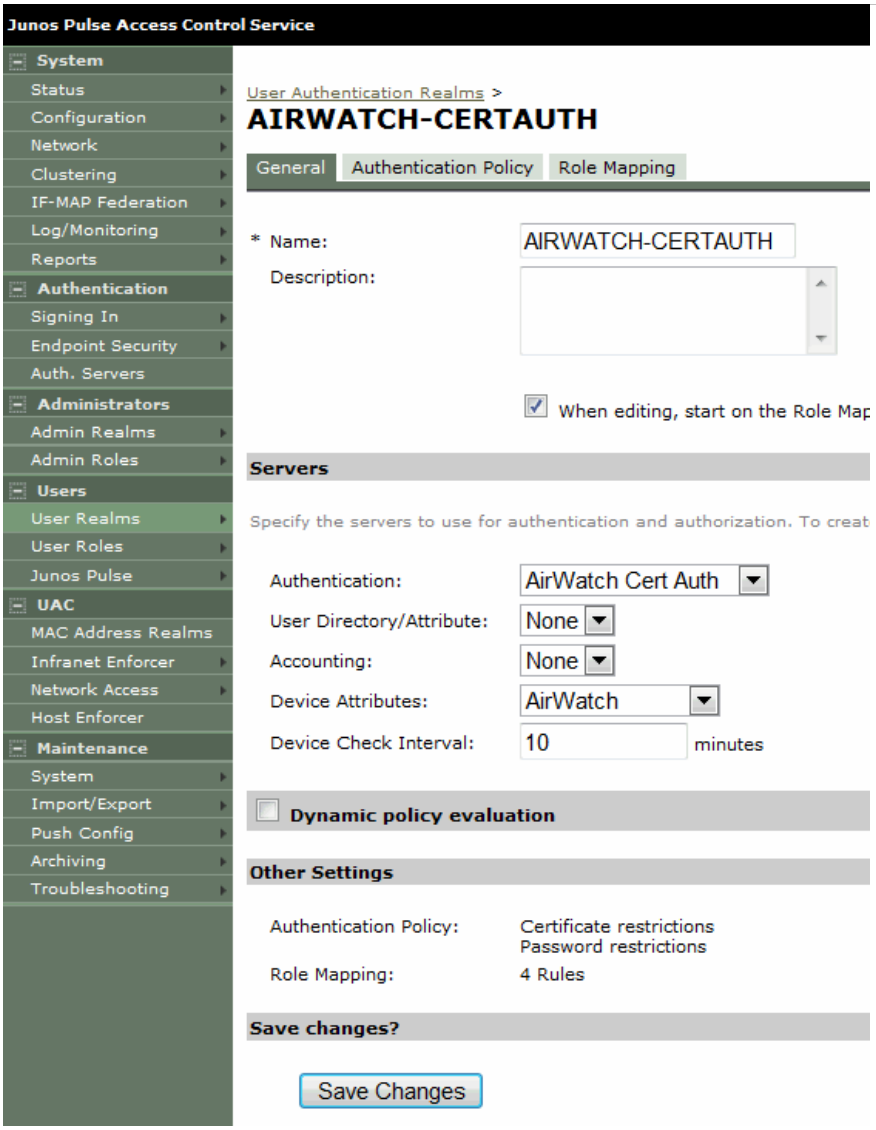


Table 7: Realm Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the realm. If you enable sign-in using a realm suffix in the sign-in policy configuration, the realm name must match the username realm suffix configured in the MDN Wi-Fi profile. See Figure 4.
Description	Describe the purpose of the realm so that other administrators are aware of it.
Servers	
Authentication	Select the user authentication server for this realm's users. This example uses the certificate server configured in the earlier step. When you use a certificate server, users are not prompted for their credentials. You can also select the authentication server used for employees. In that case, users are prompted by the sign-in page to provide their username and password.
User Directory/Attribute	Do not select.
Accounting	Do not select.
Device Attributes	Select the MDM server configured in the earlier step.
Device Check Interval	Select this feature to leverage the MDM posture assessment checks and enforce compliance. For example, the MDM might detect that a device is out of compliance with its security policies, such as a password policy. At the next device check interval, the Access Control Service queries the MDM for updated attribute data. In this example, it learns that a formerly compliant device is now noncompliant. It assigns the device the noncompliant role and sends the 802.1x authenticator the corresponding RADIUS attribute to place it in a remediation VLAN. Specify the interval at which to query the MDM for updated attribute data. Specify 0 to disable periodic queries. The minimum is 10 minutes and the maximum is 10080 minutes (7 days). Specify an interval that is appropriate for the MDM. Some MDMs, for example, update records every 4 hours, so a 10-minute interval would not be productive.
Dynamic Policy Evaluation	
Dynamic Policy Evaluation	Do not select this option. With MDM integration, role reevaluation occurs automatically if the queries return changed attribute values.
Refresh interval	Do not select.

Settings	Guidelines
Refresh roles	Do not select.
Refresh resource policies	Do not select.
Session Migration	
Session Migration	Do not select this option. Session migration is useful for endpoints running Junos Pulse client software, which is not the case for the endpoints in this MDM example.

Figure 21: Role Mapping Configuration Page

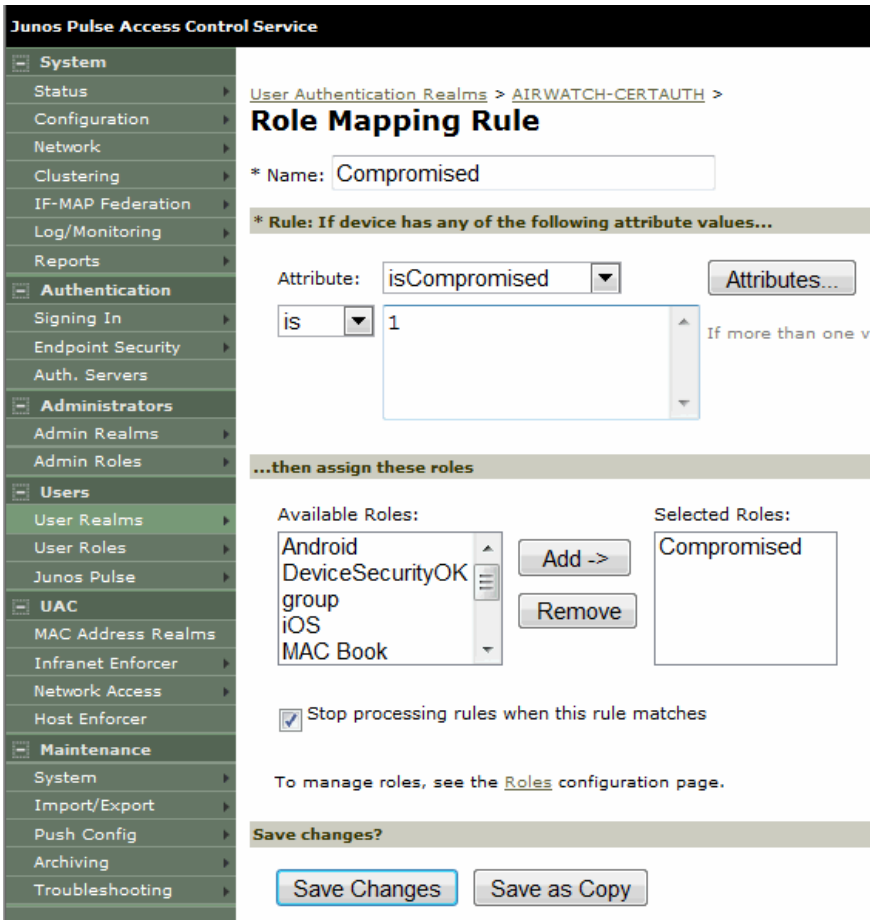


Table 8: Role Mapping Configuration Guidelines

Settings	Guidelines
Rule based on	Select **Device Attribute** and click **Update** to update the configuration page so that it displays settings for role mapping using device attributes.
Name	Specify a name for the configuration.
Rule	Select a device attribute (see Table 9) and a logical operator (is or is not), and type a matching value or value pattern. In this example, select **isCompromised** and the logical operator **is**, and enter the value **1** (true). This means that devices with a compromised status match the rule.
Role assignment	Select the roles to apply if the data matches the rule.

Tip: You likely are to create multiple roles and role-mapping rules to assign roles for different policy purposes. Your realm can have a set of rules based on user attribute, group membership, and device attribute. Be mindful that the user and device can map to multiple roles. Use stop rules and order your rules carefully to implement the policy that you want.

Table 9 describes the AirWatch record attributes that can be used in role mapping rules.

Table 9: AirWatch Device Attributes

Role Mapping Attribute Name	AirWatch Attribute Name	Description	Data Type
BlockLevelEncryption	BlockLevelEncryption	True if block-level encryption is enabled; false otherwise.	Boolean
complianceReason	ComplianceStatus	Values: Compliant, Non-Compliant.	String
CompromisedStatus	CompromisedStatus	True if the status is compromised; false otherwise.	Boolean
DataProtectionEnabled	DataProtectionEnabled	True if data protection is enabled; false otherwise.	Boolean

Role Mapping Attribute Name	AirWatch Attribute Name	Description	Data Type
deviceId	Id.Value	Device identifier.	String
deviceName	DeviceFriendlyName	The concatenated name used to identify the device/user combination.	String
FileLevelEncryption	FileLevelEncryption	True if file-level encryption is enabled; false otherwise.	Boolean
IMEI	Imei	IMEI number of the device.	String
isCompliant	ComplianceStatus	Values: Compliant.	String
isCompromised	CompromisedStatus	True if the device is compromised; false otherwise.	Boolean
isEnrolled	EnrollmentStatus	True if MDM value is Enrolled; false otherwise.	Boolean
IsPasscodeCompliant	IsPasscodeCompliant	True if the passcode is compliant with the MDM policy; false otherwise	Boolean
IsPasscodePresent	IsPasscodePresent	True if a passcode has been configured; false otherwise.	Boolean
LastComplianceCheckOn	LastComplianceCheckOn	The refresh date and timestamp of the last status reported.	Timestamp
LastCompromisedCheckOn	LastCompromisedCheckOn	The refresh date and timestamp of the last status reported.	Timestamp
lastSeen	LastSeen	Date and time the device last made successful contact with the MDM.	Timestamp
LocationGroupName	LocationGroupName	MDM location group configuration value.	String
macAdress	MacAddress	The Wi-Fi MAC address.	String
model	Model	Model is automatically reported by the device during registration.	String
osVersion	OperatingSystem	OS version.	String
ownership	Ownership	Values: C, E, or S (Corporate, Employee, or Shared).	String
phoneNumber	PhoneNumber	Phone number entered during registration.	String
platform	Platform	Platform specified during registration.	String
serialNumber	SerialNumber	Serial number.	String
UDID	Udid	Unique device identifier.	String
userEmail	UserEmailAddress	E-mail address of device user.	String
userName	UserName	Name of device user.	String
UUID	Uuid	Universal unique identifier.	String

Note: By design, you should be able to specify **true** or **false**, or **1** or **0**, for Boolean data types in your role mapping rules. Due to a issue in this release, you must use **1** for true and **0** for false.

Figure 22: Realm Configuration Page – Certificate Restrictions

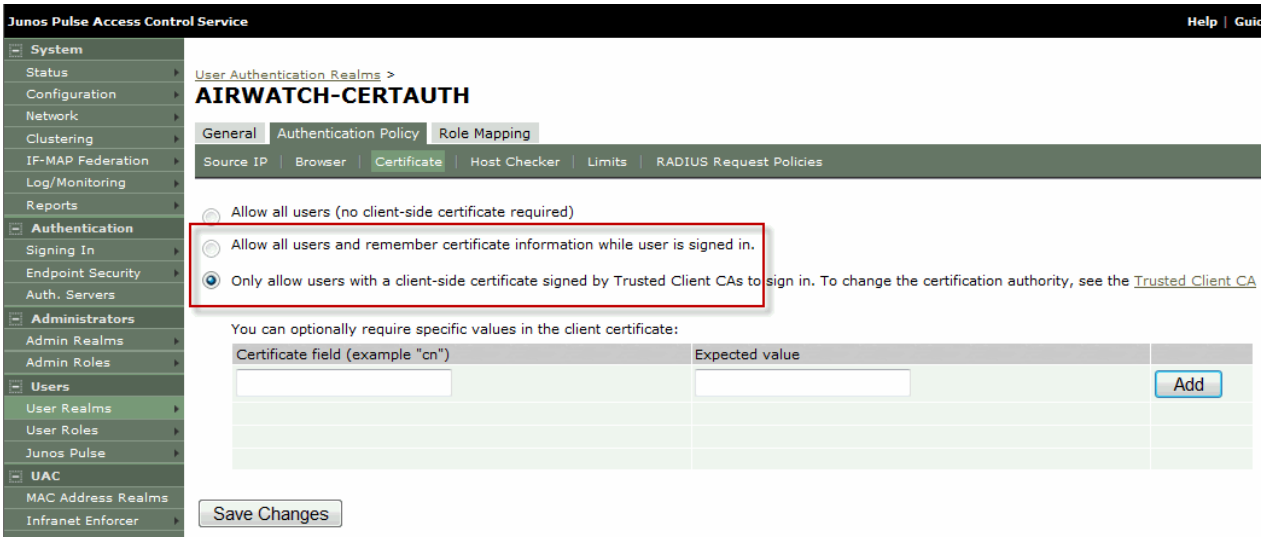


Table 10: Realm Configuration Certificate Restriction Guidelines

Settings	Guidelines
Allow all users	Do not select this option. If you select this option, the system does not request a client certificate during the TLS handshake.

Settings	Guidelines
Allow all users and remember certificate	If you select this option, the system requests a client certificate during the TLS handshake. It does allow endpoints to authenticate without a client certificate. For those with a client certificate, the certificate attributes are placed in the session context.
Only allow users with a client-side certificate	If you select this option, the system requests a client certificate during the TLS handshake. It does not allow endpoints to authenticate without a valid client certificate. If the realm is configured with a certificate server, like this example, this option is the only option that can be selected.

Configuring a Sign-In Policy

A sign-in policy associates devices with a realm.

To configure a sign-in policy:

1. Select **Authentication > Signing In > Sign-In Policies** to navigate to the sign-in policies configuration page.
2. Click **New URL** to display the configuration page shown in Figure 23.
3. Complete the configuration as described in Table 11.
4. Save the configuration.

Figure 23: Sign-In Policy Configuration Page

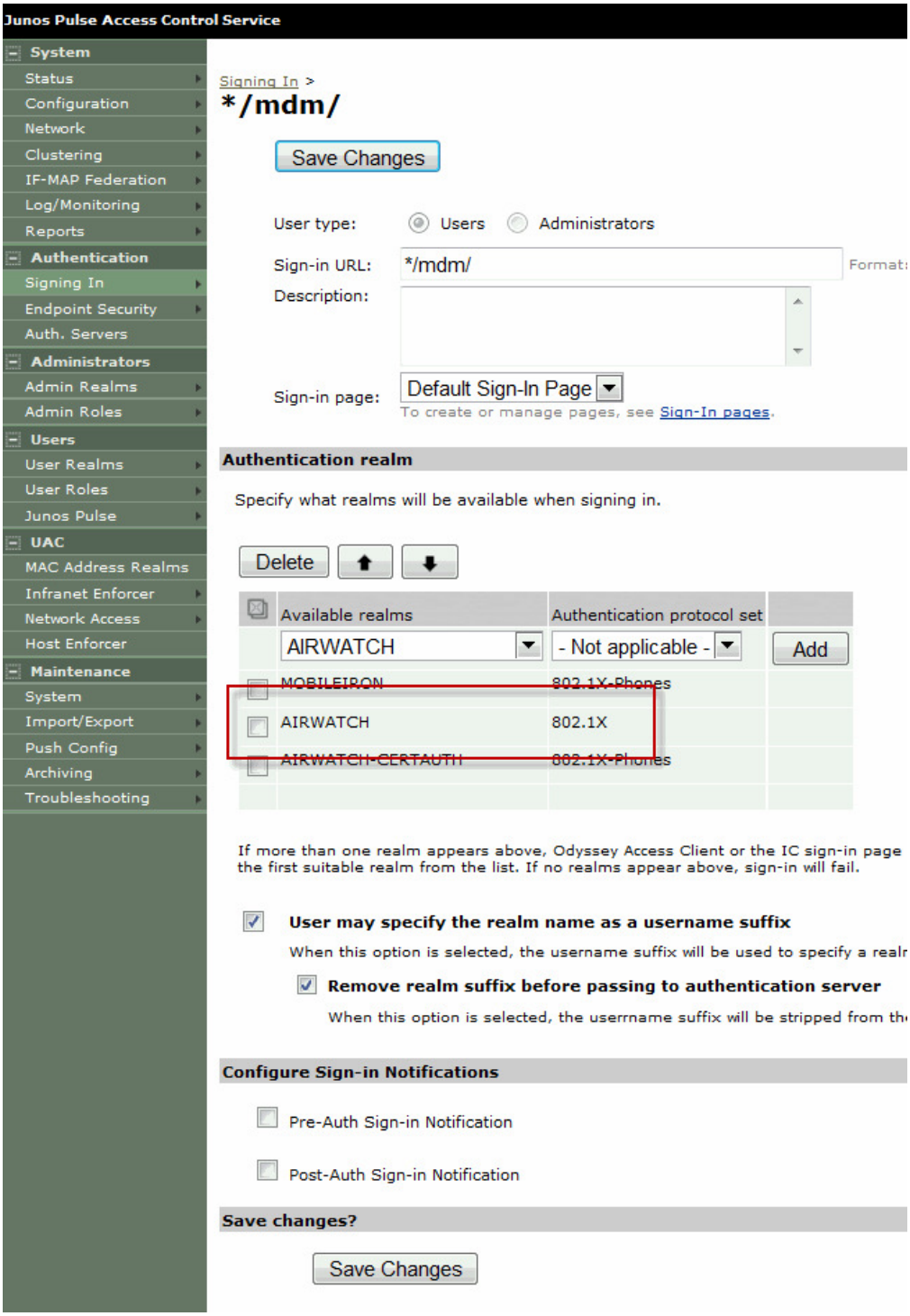


Table 11: Sign-In Policy Configuration Guidelines

Settings	Guidelines

Settings	Guidelines
User type	Select **Users**.
Sign-in URL	Enter a URL.
Description	Describe the purpose of the sign-in policy so that other administrators are aware of it.
Sign-In Page	Select a sign-in page.
Authentication Realm	
Realm	Select the realm you configured in the earlier step.
Authentication Protocol Set	Select the protocol you configured in the earlier step.
Realm name as a username suffix	Select this option if the username sent during sign-in includes a realm suffix. To use this option, the realm name must match the username realm suffix configured in the MDN Wi-Fi profile. See Figure 4. This configuration enables you to dedicate the realm to the MDM traffic. Non-MDM traffic passing through the same switch then belongs to a different realm. **Note:** In some cases, you can use authentication protocol sets to segregate traffic into a particular realm. For example, assuming only mobile endpoints use TLS and other endpoints do not, an authentication protocol set containing only TLS can be created and associated with a particular realm through a sign-in policy.
Remove realm suffix	Remove the realm suffix within system processes, such as rule processing and logs.
Configure Sign-in Notifications	
Pre-Auth Sign-in Notification	Not used in this scenario.
Post-Auth Sign-in Notification	Not used in this scenario.

Configuring an 802.1x Network Access Policy

The 802.1x network access policy framework is used for network communication between the wireless access point and the Access Control Service. This section describes the key configuration elements:

1. Configuring a Location Group
2. Configuring a RADIUS Client
3. Configuring a RADIUS Return Attributes Policy

Configuring a Location Group

A location group associates the RADIUS framework with sign-in pages.

To configure a location group:

1. Select **UAC > Network Access > Location Group** to navigate to the location group configuration pages.
2. Click **New Location Group** to display the configuration page shown in Figure 24.
3. Complete the configuration as described in Table 12.
4. Save the configuration.

Figure 24: Location Group Configuration Page

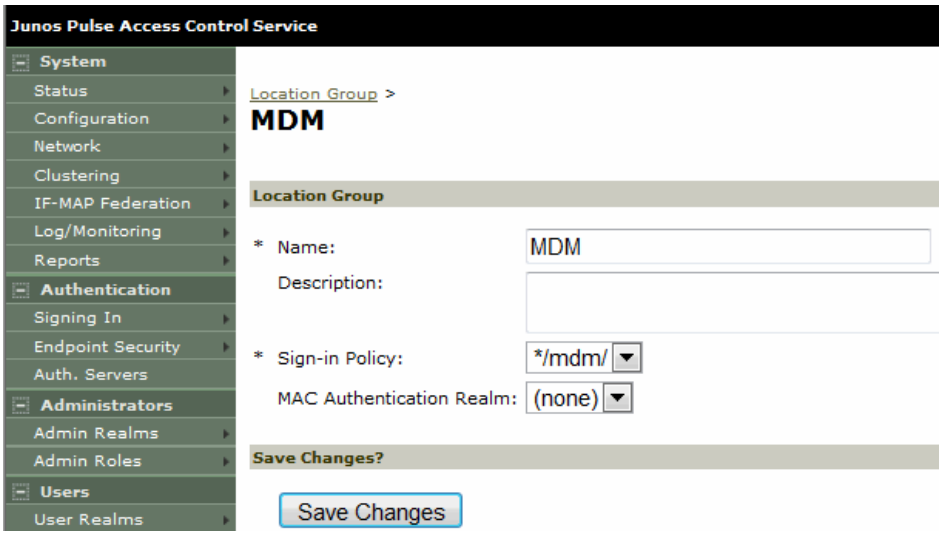


Table 12: Location Group Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the configuration.

Settings	Guidelines
Description	Describe the purpose of the location group so that other administrators are aware of it.
Sign-In Policy	Select the sign-in policy you configured in the earlier step.
MAC Authentication Realm	Do not select for this solution.

Configuring a RADIUS Client

The RADIUS client configuration is used for communication with the 802.1x authenticator—in this case, the wireless access point.

To configure a RADIUS client:

1. Select **UAC > Network Access > RADIUS client** to display the RADIUS client configuration pages.
2. Click **New RADIUS Client** to display the configuration page shown in Figure 25.
3. Complete the configuration as described in Table 13.
4. Save the configuration.

Figure 25: RADIUS Client Configuration Page

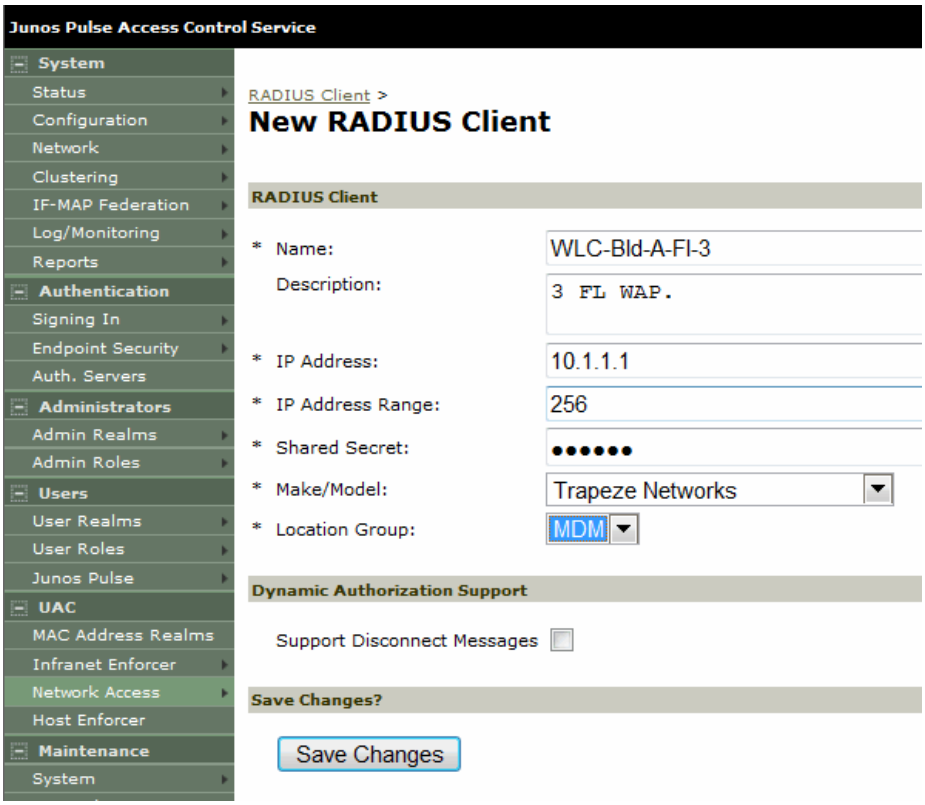


Table 13: RADIUS Client Configuration Guidelines

Settings	Guidelines
RADIUS Client	
Name	Specify a name for the configuration.
Description	Describe the purpose of the configuration so that other administrators are aware of it.
IP Address	Specify the IP address for the RADIUS authenticator.
IP Address Range	Specify the number of IP Addresses for the RADIUS authenticator.
Shared Secret	Specify the shared secret that matches the shared secret in the RADIUS authenticator configuration.
Make/Model	Select the Make/Model of the RADIUS authenticator.
Location Group	Select the location group you configured in the earlier step.
Dynamic Authorization Support	
Support Disconnect Messages	Send disconnect messages to supplicants if access is no longer authorized.

Configuring a RADIUS Return Attributes Policy

The RADIUS return attributes policy is a framework for role-based assignment of traffic to VLANs. The policy specifies the return list attributes to send to an 802.1X network access device, such as which VLAN that endpoints must use to access the network. If no policy applies, Open Port is the default action.

To configure a RADIUS return attributes policy:

1. Select **UAC > Network Access > RADIUS Attributes > Return Attributes** to display the RADIUS return attributes policy configuration pages.
2. Click **New Policy** to display the configuration page shown in Figure 26.

3. Complete the configuration as described in Table 14.
4. Save the configuration.

Figure 26: RADIUS Return Attributes Policy Configuration Page

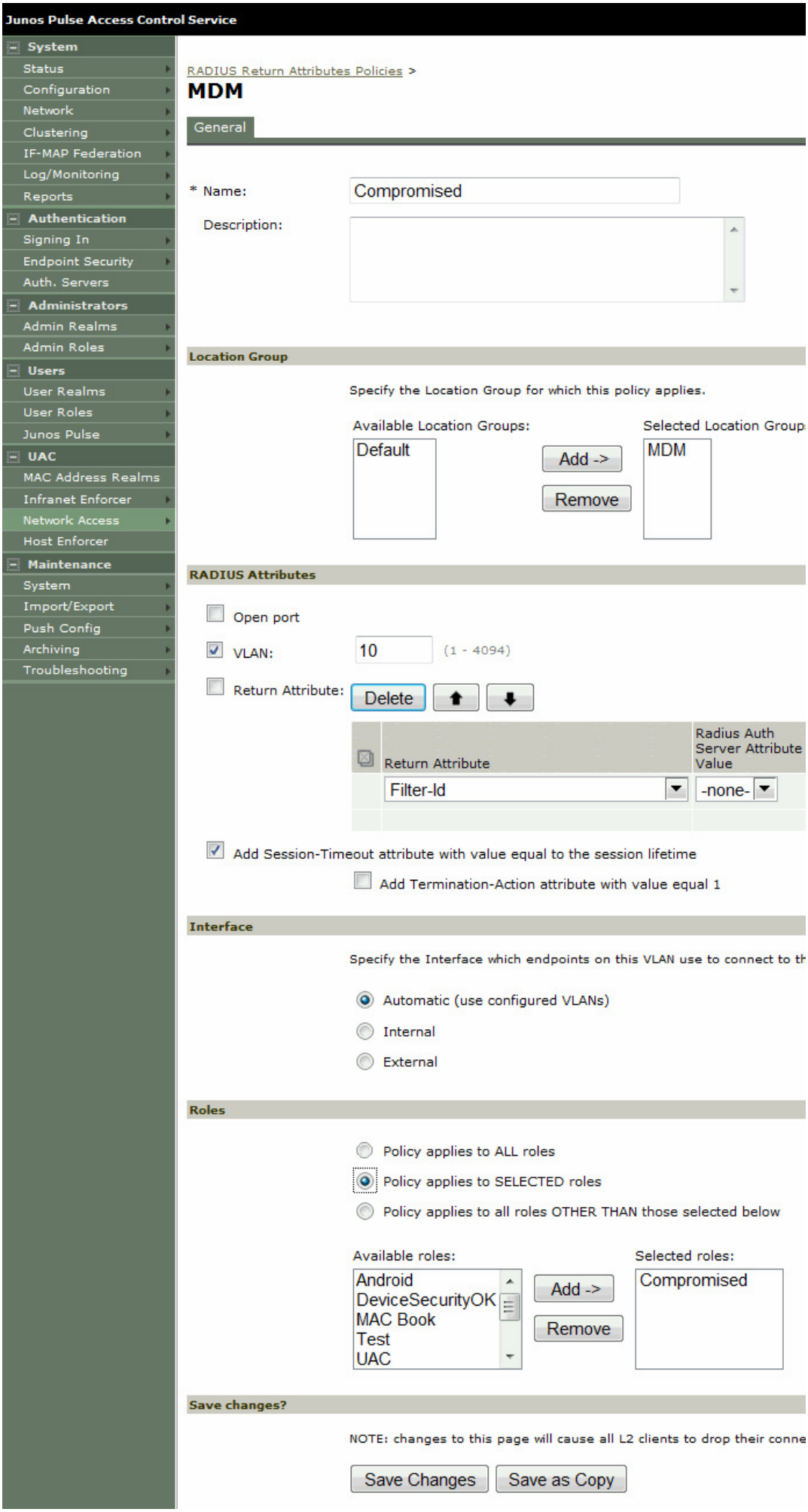


Table 14: RADIUS Return Attributes Policy Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the configuration.
Description	Describe the purpose of the configuration so that other administrators are aware of it.
Location Group	Select the location groups for which this policy applies. In this example scenario, select the location group you configured in the earlier step.
RADIUS Attributes	
Open port	Return authorization to open the port. This option does not restrict access to a particular VLAN.
VLAN	Return a VLAN ID that designates the VLAN for the session. In this example, the VLAN option is configured to place noncompliant traffic in a remediation VLAN.
Return Attribute	Select and configure other RADIUS attributes to send in the return message. None are configured for this example.
Add Session-Timeout attribute	Select this option to specify a session timeout. You can also use the role configuration to specify a session timeout.
Add Termination-Action attribute	Select this option to attempt reauthentication after session termination.
Interface	
Interface	Select the interface endpoints use to connect to the system.
Roles	
Roles	Select the roles to which the policy applies.

Configuring a Resource Access Policy

A resource policy enforces role-based access to resources protected by an Infranet Enforcer firewall. You use the device access management framework to assign roles to devices, and you use the resource policy to deny access to resources that should not be downloaded onto a specific device platform—in this example, Android devices.

This example assumes you have deployed Infranet Enforcers to protect Web servers in your network. This example does not explain how to deploy an Infranet Enforcer. For information on the Infranet Enforcer, refer to its documentation.

In this scenario, the role configuration and role mapping configuration create a classification for Android devices. Figure 27 shows the user role configuration.

Figure 27: User Role Configuration Page – General Settings

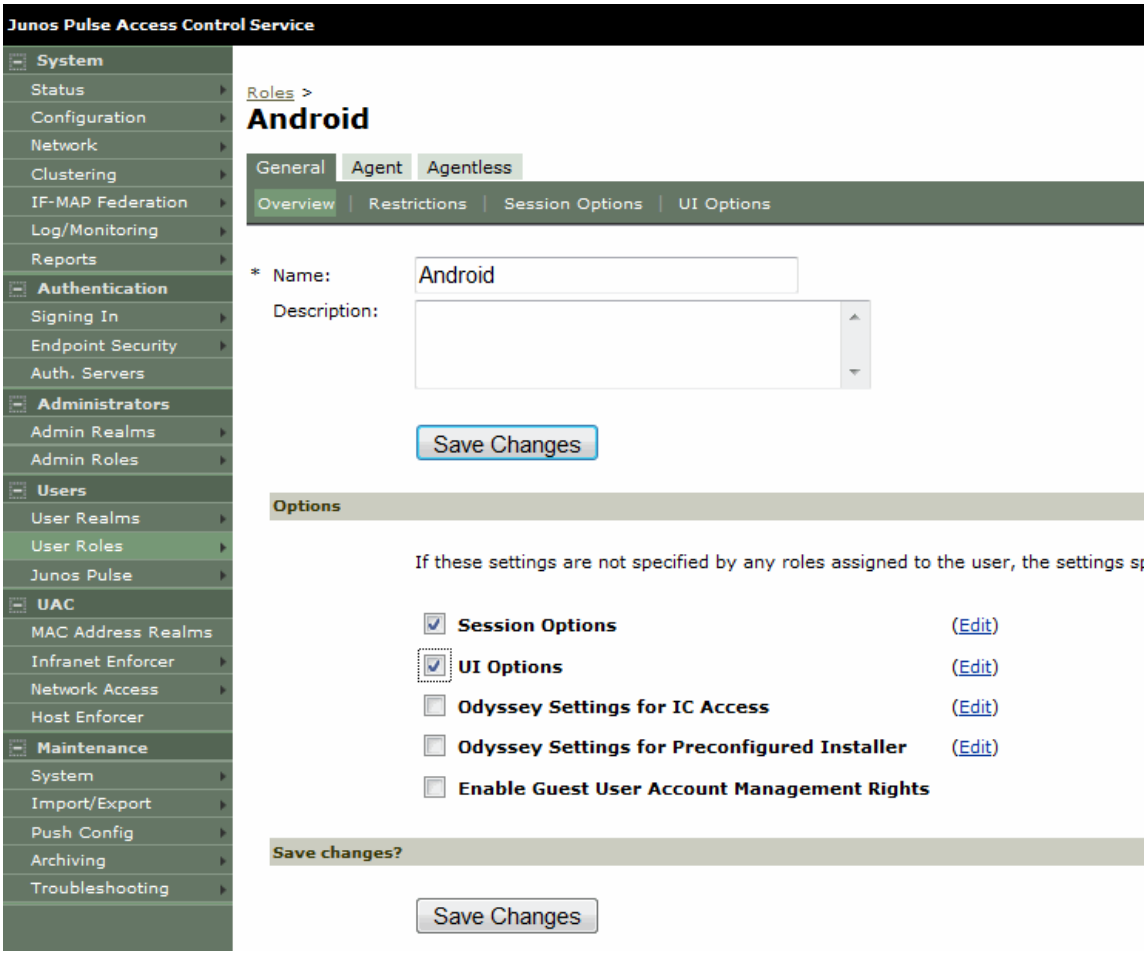
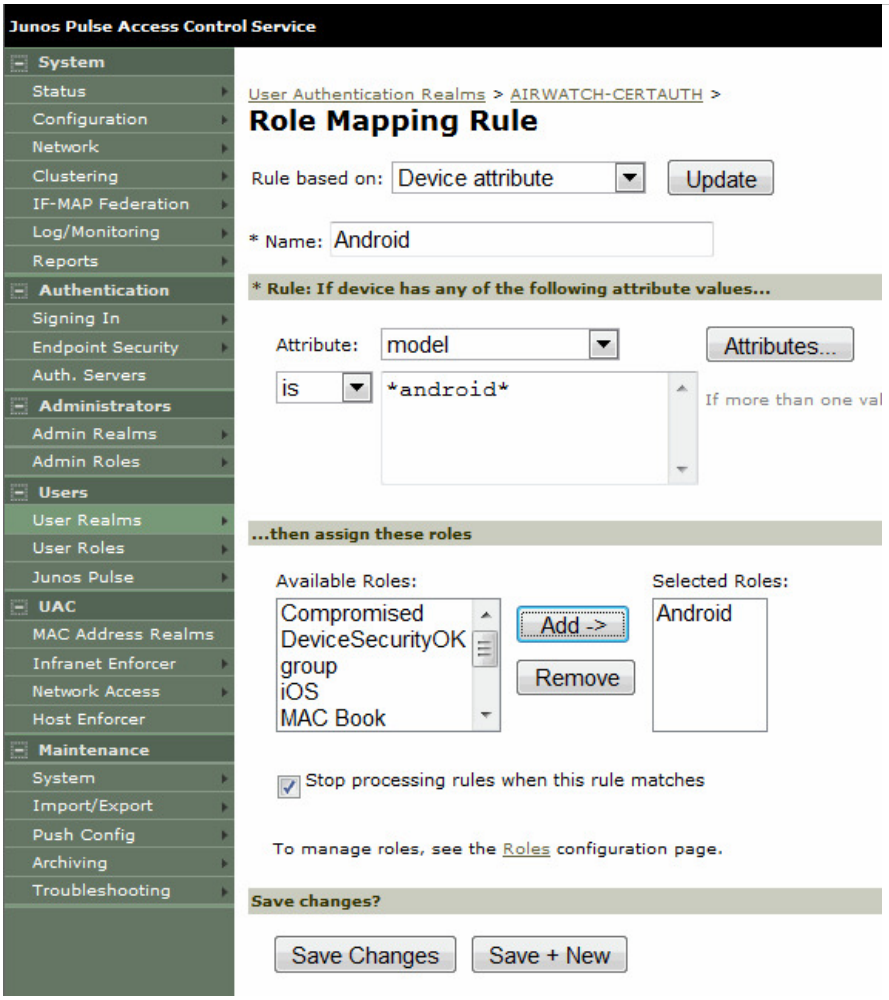


Figure 28 shows the role mapping configuration.

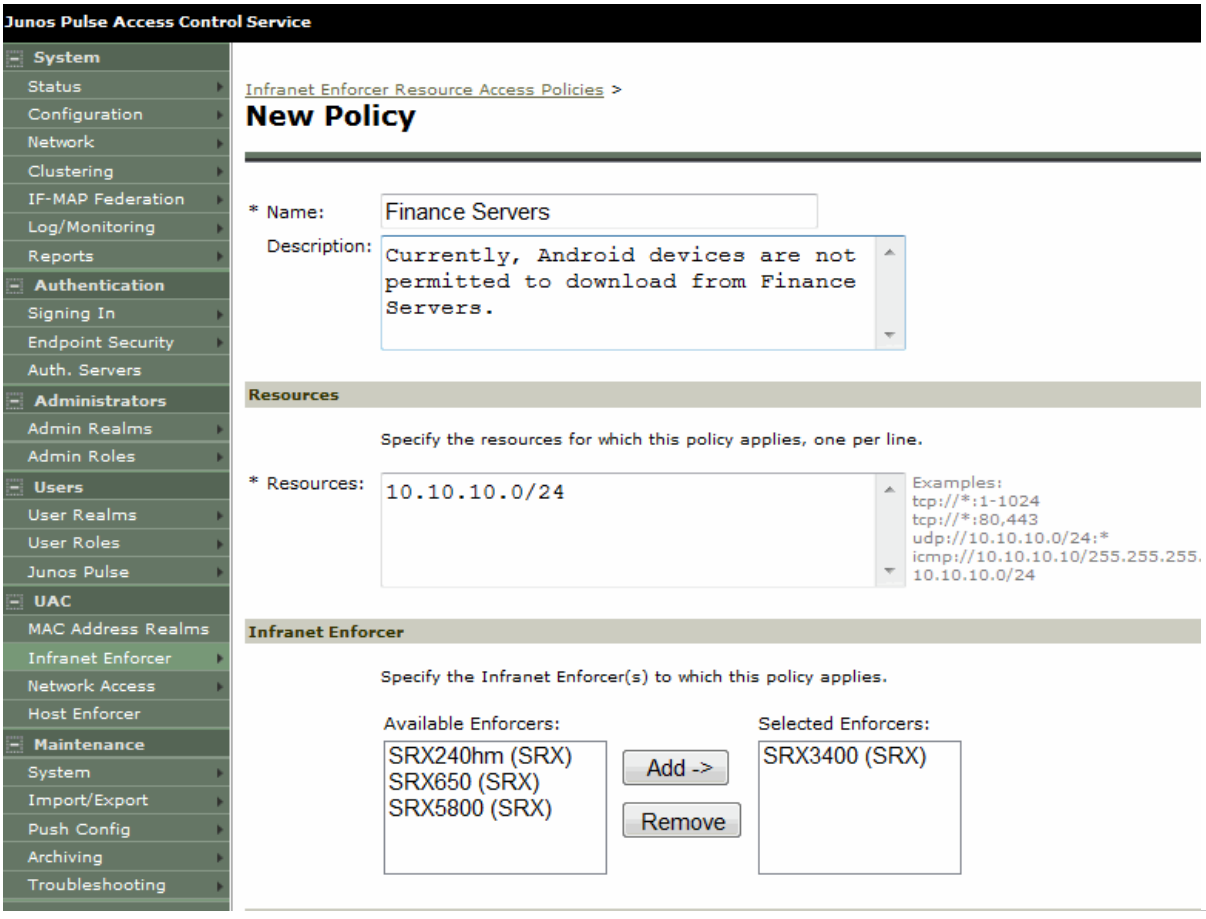
Figure 28: Role Mapping Configuration Page



To configure a resource access policy:

1. Select **UAC > Infranet Enforcer > Resource Access** to display the resource access policy configuration pages.
2. Click **New Policy** to display the configuration page shown in Figure 29.
3. Complete the configuration as described in Table 15.
4. Save the configuration.

Figure 29: Resource Access Policy Configuration Page



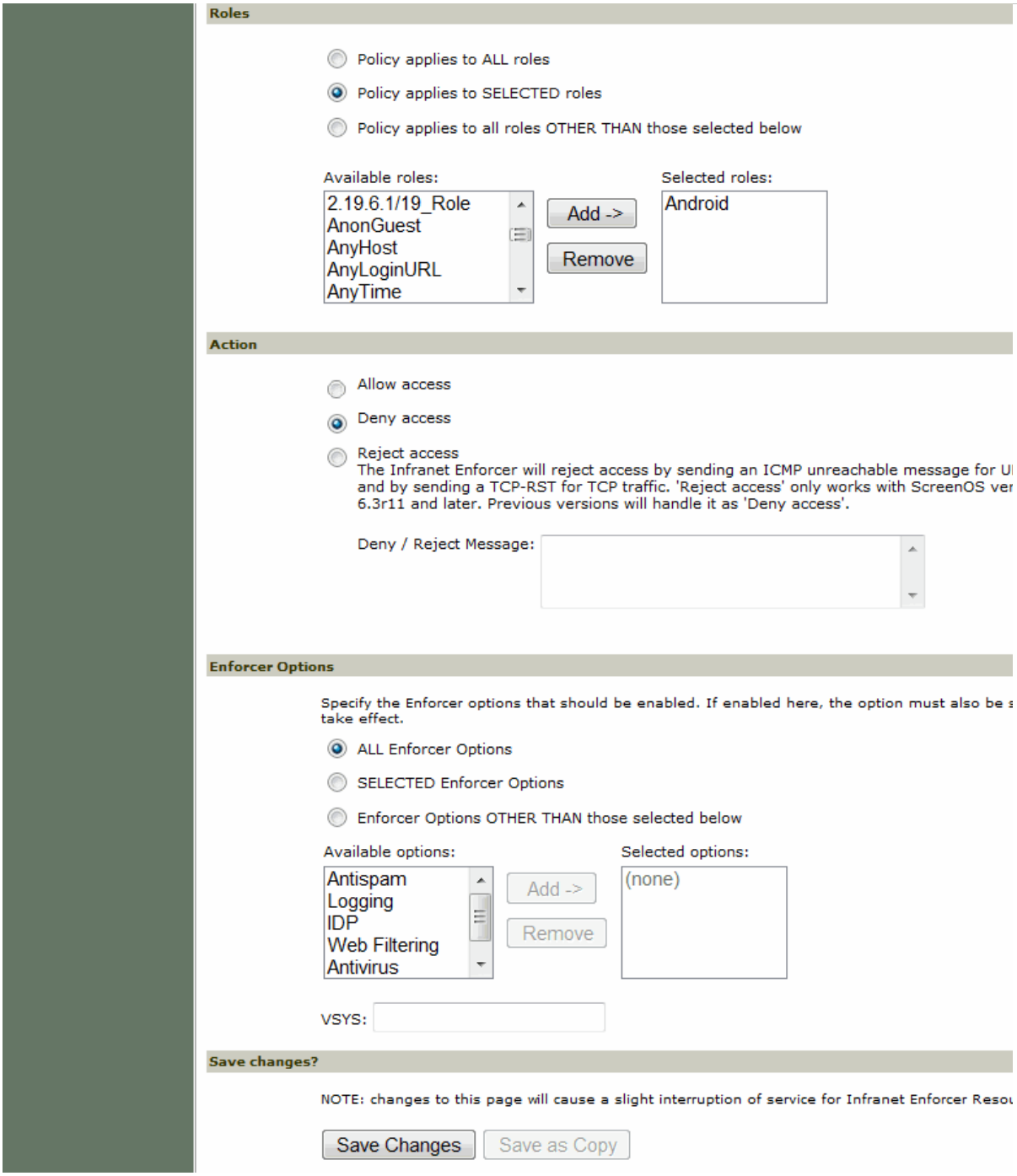


Table 15: Resource Access Policy Configuration Guidelines

Settings	Guidelines
Name	Specify a name for the configuration.
Description	Describe the purpose of the configuration so that other administrators are aware of it.
Resources	
Resources	Specify the resources for which this policy applies, one per line.
Infranet Enforcer	
Infranet Enforcer	Select the Infranet Enforcer that is deployed to protect the specified resources.
Roles	
Roles	Select the roles to which the policy applies. In this example, **Android** is selected.
Action	
Action	Select one of the following actions: ▪ **Allow Access** ▪ **Deny Access** ▪ **Reject Access** In this example, we deny access from Android devices.
Enforcer Options	
Enforcer Options	Select all Infranet Enforcer features that should be applied to matching sessions.

Related Documentation

IC, MAG, SA Series

- Using Logs to Verify Proper Configuration
- Using Policy Tracing and Debug Logs
- Understanding the Device Access Management Framework

IC, MAG Series

- User and Policy Administration Overview

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