# Templates Overview and Operations for ACI Fabrics, 4.2.1

# Table of Contents

# New and changed information

The following table provides an overview of the significant changes up to this current release. The table does not provide an exhaustive list of all changes or of the new features up to this release.

| Release Version | Feature | Description |
| --- | --- | --- |
| Nexus Dashboard 4.2.1 | There were no major changes from the previous release. | |

# Schema and Template Design Considerations

Nexus Dashboard provides a number of policy templates that allow you to define one or more policies together and deploy them to one or more fabrics at the same time. These include Application templates, Tenant Policies templates, Fabric Policies and Fabric Resources Policies templates, and Monitoring templates. A schema is a collection of Application templates, which are used for defining application policies, with each template assigned to a specific tenant; schemas apply to Application templates only. There are multiple approaches you can take when it comes to creating the templates configurations specific to your deployment use case. The following sections describe a few simple design directions you can take when deciding how to define the schemas, templates, and policies in your Multi-Fabric domain.

Keep in mind that when designing schemas, you must consider the supported scalability limits for the number of schemas, templates, and objects per schema. Detailed information on verified scalability limits is available in the *Nexus Dashboard Verified Scalability Guides* for your release.

## Application Templates

There are 3 types of schema templates, also known as application templates, available in Nexus Dashboard, each designed for a specific purpose:

- **ACI Multi-Fabric**-Template used for Cisco ACI on-premises. This template supports two deployment types:
  - Multi-Fabric - The template can be associated to a single fabric (fabric-local policies) or to multiple fabrics (stretched policies) and the option should be selected for Multi-Fabric Network (ISN) or VXLAN inter-fabric communication to allow template and object stretching between multiple fabrics.
  - Autonomous - The template can be associated to one or more fabrics that are operated independently and are not connected through an Inter-Fabric Network (no inter-fabric VXLAN communication).

    Because autonomous fabrics are by definition isolated and do not have any inter-fabric connectivity, there is no shadow object configuration across fabrics and no cross-programming of pctags or VNIDs in the spine switches for inter-fabric traffic flow.

    The autonomous templates also allow for significantly higher deployment scale.

  The following sections focus primarily on this type of templates.
- **NDFC**-Templates designed for Cisco Nexus Dashboard Fabric Controller (formerly Data Center Network Manager) fabrics.

When creating schemas and application templates, you can choose to adopt one of the following simple approaches:

- **Single Template Deployment**

  The simplest schema design approach is a single schema, single template deployment. You can create a single schema with a single template within it and add all VRFs, Bridge Domains, EPGs, Contracts and other elements to that template and deploy it to one or more fabrics.

This simplest approach to Multi-Fabric schema creation is to create all objects within the same schema and template. However, the supported number of schemas scalability limit may make this approach unsuitable for large scale deployments, which could exceed those limits.

Note also that with this approach all the objects defined in the template become "stretched objects" and all changes made to the template are always simultaneously deployed to all the fabrics associated to such template.

- **Multiple Templates with Network Separation**

  Another approach to schema design is to separate the networking objects from the application policy configuration. Networking objects include VRFs, Bridge Domains, and subnets, while the application policy objects include EPGs, Contracts, Filters, External EPGs, and Service Graphs.

  You begin by defining a schema that contains the network elements. You can choose to create a single schema that contains all the network elements or you can split them into multiple schemas based on which applications reference them or which fabrics the network is stretched to.

  You can then define one or more separate schemas which contain each application's policy objects. This new schema can reference the network elements, such as bridge domains, defined in the previous schema.

  After creating and deploying the policy schemas and templates, the networking objects in the networking schema will display the number of external references by the policy schema elements. The object with external references will also be denoted by the ribbon icon.

  Schemas designed this way provide logical separation of networking objects from the policy objects. However, this creates additional complexity when it comes to keeping track of externally referenced objects in each schema.

- **Multiple Templates Based On Object Relationships**

  When configuring multiple schemas with shared object references, it is important to be careful when making changes to those objects. For instance, making changes to or deleting a shared networking object can impact applications in one or more fabrics. Because of that, you may choose to create a template around each individual fabric that contains only the objects used by that fabric and its applications, including the VRFs, BDs, EPGs, Contracts, and Filters. And create different templates containing the shared objects.

  For example, you can create a Fabric1 template that contains only the objects that are local to Fabric1 and the template is deployed to only that fabric. Similarly, the Fabric2 template contains only the object relevant to fabric2 and is deployed to that fabric only. Any change made to any object in either of these templates has no effect on the other one. Then you can create a **Shared** template which contains objects that are shared between the fabrics.

  You can extend this scenario for an additional fabric with the following template layout:

  - Fabric 1 template
  - Fabric 2 template
  - Fabric 3 template
  - Fabric 1 and 2 shared template

- Fabric 1 and 3 shared template
- Fabric 2 and 3 shared template
- All shared template

Similarly, rather than separating objects based on which fabric they are deployed to, you can also choose to create schemas and templates based on individual applications instead. This would allow you to easily identify each application profile and map them to schemas and fabrics as well as easily configure each application as local or stretched across fabrics.

+ However, as this could quickly exceed the templates per schema limit (listed in the Verified Scalability Guide for your release), you would have to create additional schemas to accommodate the multiple combinations. While this creates additional complexity with multiple additional schemas and templates, it provides true separation of objects based on fabric or application.

# Fabric Policy Templates

In addition to the three types of application templates, Release 4.0(1) adds 3 new templates designed for fabric-wide policies:

- **Fabric Policies** templates can be used for managing the following fabric-wide policies:
  - VLAN Pool
  - Physical Domains
  - SyncE Interface Policies
  - Interface Settings
  - Node Settings
  - Pod Settings
  - MACsec
  - NTP Policies
  - PTP Policies
  - QoS DSCP Policies
  - QoS SR-MPLS Policies
  - QoS Class Policies

  For additional information, see the "Create fabric policies" section in Fabric Management Templates for ACI Fabrics.

- **Fabric Resources Policies** templates can be used for managing the following fabric-wide policies:
  - Physical Interfaces
  - Port Channel Interfaces
  - Virtual Port Channel Interfaces
  - Node Profiles

  These templates reference policies are defined in the Fabric Policies templates, so those templates must be created and deployed first. For additional information, see the "Create fabric

resources policies" section in Fabric Management Templates for ACI Fabrics.

- **Monitoring Policy** templates can be used for managing Tenant SPAN or Access SPAN policies.

  For additional information, see the "Create monitoring policies" section in Fabric Management Templates for ACI Fabrics.

# Template Design Best Practices

Nexus Dashboard validates and enforces a number of best practices when it comes to template design and deployment. Regardless of the type of template you are creating, keep in mind the following:

- All policy objects must be **deployed** in order according to their dependencies.

  For example, when creating a bridge domain (BD), you must associate it with a VRF. In this case, the BD has a VRF dependency so the VRF must be deployed to the fabric before or together with the BD. If these two objects are defined in the same template, then the Orchestrator will ensure that during deployment, the VRF is created first and associate it with the bridge domain.

  However, if you define these two objects in separate templates and attempt to deploy the template with only the BD first, the Orchestrator will return a validation error as the associated VRF is not yet deployed. In this case, you must deploy the VRF template first, followed by the BD template.

- All policy objects must be **undeployed** in order according to their dependencies, or in the opposite order in which they were deployed.

  As a corollary to the point above, when you undeploy templates, you must not undeploy objects on which other objects depend. For example, you cannot undeploy a VRF before undeploying the BD with which the VRF is associated.

- Specific cyclical dependencies are allowed across multiple templates.

  Consider a case of a VRF (vrf1) associated with a bridge domain (bd1), which is in turn associated with an EPG (epg1). If you create vrf1 in template1 and deploy that template, then create bd1 in template2 and deploy that template, there will be no validation errors since the objects are deployed in correct order. However, if you then attempt to create epg1 in template1, it would create a circular dependency between the two template, so the Orchestrator will not allow you to save template1 addition of the EPG.

# Concurrent Configuration Updates

The Nexus Dashboard GUI will ensure that any concurrent updates on the same fabric or schema object cannot unintentionally overwrite each other. If you attempt to make changes to a fabric or template that was updated by another user since you opened it, the GUI will reject any subsequent changes you try to make and present a warning requesting you to refresh the object before making additional changes; refreshing the template will lose any edits you made up to that point and you will have to make those changes again:


However, the default REST API functionality was left unchanged in order to preserve backward compatibility with existing applications. In other words, while the UI is always enabled for this protection, you must explicitly enable it for your API calls for Nexus Dashboard to keep track of configuration changes.

*When enabling this feature, note the following:*

- This release supports detection of conflicting configuration changes for Fabric and Schema objects only.
- Only PUT and PATCH API calls support the version check feature.
- If you do not explicitly enable the version check parameter in your API calls, Nexus Dashboard will not track any updates internally. And as a result, any configuration updates can be potentially overwritten by both subsequent API calls or GUI users.

To enable the configuration version check, you can pass the enableVersionCheck=true parameter to the API call by appending it to the end of the API endpoint you are using, for example:

```
https://__<mso-ip-address>__/mso/api/v1/schemas/__<schema-id>__?*enableVersionCheck=true*
```

## Example

We will use a simple example of updating the display name of a template in a schema to show how to use the version check attribute with PUT or PATCH calls.

First, you would GET the schema you want to modify, which will return the current latest version of the schema in the call's response:

```
{
   "id" : "601acfed38000070a4ee9ec0",
   "displayName" : "Schema1",
   "description" : "",
```

```
    " templates" : [
       {
          " name" : " Template1" ,
          *" displayName" : " current name" ,*
          [...]
       }
    ],
    *" _updateVersion" : 12,*
    " fabrics" : [...]
}
```

Then you can modify the schema in one of two ways appending enableVersionCheck=true to the request URL:

You must ensure that the value of the " _updateVersion" field in the payload is the same as the value you got in the original schema.

- Using the PUT API with the entire updated schema as payload:

```
PUT /v1/schemas/601acfed38000070a4ee9ec0*?enableVersionCheck=true*
```

```
{
    " id" : " 601acfed38000070a4ee9ec0" ,
    " displayName" : " Schema1" ,
    " description" : " " ,
    " templates" : [
       {
          " name" : " Template1" ,
          *" displayName" : " new name" ,*
          [...]
       }
    ],
    *" _updateVersion" : 12,*
    " fabrics" : [...]
}
```

- Using any of the PATCH API operations to make a specific change to one of the objects in the schema:

```
PATCH /v1/schemas/601acfed38000070a4ee9ec0*?enableVersionCheck=true*
```

```
[
```

```
    {
        " op" : " replace" ,
        " path" : " /templates/Template1/displayName" ,
        *" value" : " new name" ,**" _updateVersion" : 12*
    }
]
```

When the request is made, the API will increment the current schema version by 1 (from 12 to 13) and attempt to create the new version of the schema. If the new version does not yet exist, the operation will succeed and the schema will be updated; if another API call (with enableVersionCheck enabled) or the UI have modified the schema in the meantime, the operation fails and the API call will return the following response:

```
{
    " code" : 400,
    " message" : " Update failed, object version in the DB has changed, refresh your client and
retry"
}
```

# Template Renaming

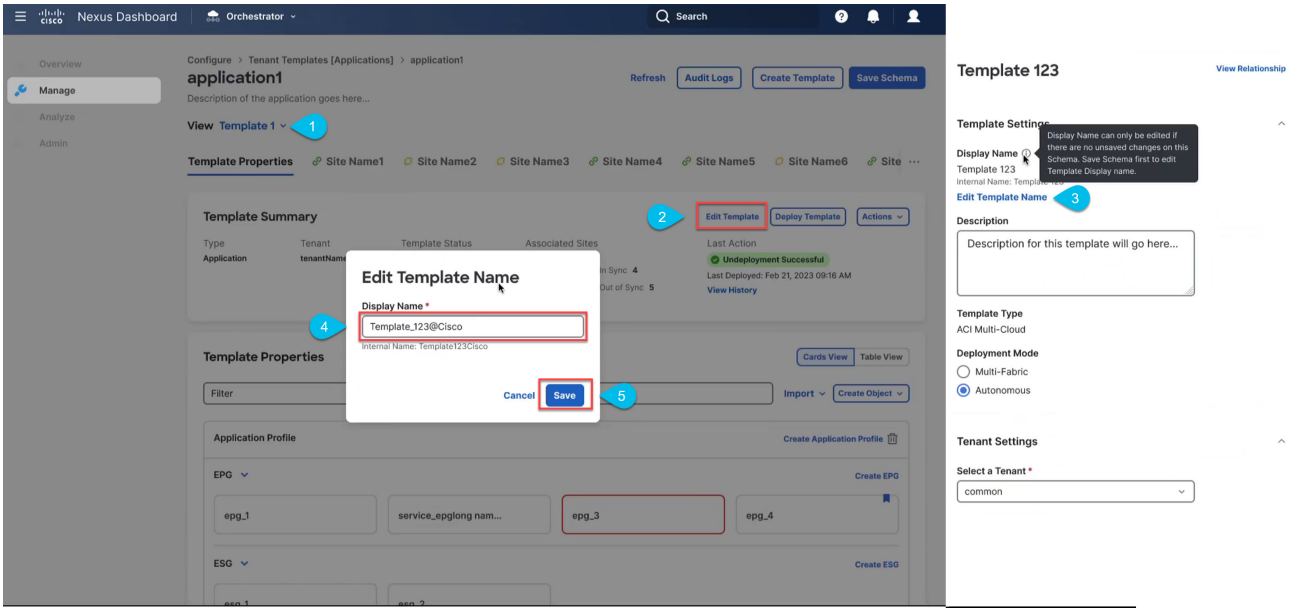
*Before you begin:*

- You must have the schema, template, and any objects you want to deploy to fabric already created, as described in previous sections of this document.
- Ensure that you understand the required deployment order and object dependencies that are described in Schema and Template Design Considerations.

This section describes how to rename a template. Both the "Display Name" and the "Internal Name" (i.e. the name in the Nexus Dashboard internal database) for the template are changed in this procedure.

In order to change the template name, ensure there are no unsaved changes in the schema.

1. From the **View** drop-down list, choose the template you want to rename.
2. Click on **Edit Template** to open the **Template Settings** page.
3. Click on **Edit Template Name** option to open the page.
4. Enter a new name for the template in the **Display Name** text box.
5. Click **Save** to confirm renaming the template.
6. Verify that the new name is shown in the **Display Name** text box and associated to the **Internal Name** label.




*Renaming the Template*

# Assigning Templates to Fabrics

*Before you begin:*

You must have the schema, template, and any objects you want to deploy to fabrics already created, as described in previous sections of this document.

This section describes how to assign a template to fabrics.

1. Navigate to the schema that contains one or more templates that you want to deploy.
2. In the left sidebar, select the template that you want to assign to fabrics.
3. In the **Template Summary** view, click **Actions** and choose **Add/ Remove Fabrics**.

   The **Add Fabrics to <template-name>** page opens.

4. In the **Add Fabrics** page, check the checkbox next to the fabrics where you want to deploy the template.

   Note that some fabrics may not be available for assignment depending on the type of the template you chose and the inter-fabric connectivity between fabrics:

- When assigning templates to multiple fabrics, the inter-fabric connectivity between those fabrics must be established using BGP-EVPN protocol. If you select a fabric that has partial mesh connectivity, any fabric to which there is no inter-fabric connectivity or inter-fabric connectivity is established using BGP-IPv4 will be grayed out and unavailable for assignment.

  1. Click **Ok**.

     You deploy one template at a time, so you must associate the template with at least one fabric before you can deploy it.

# Disassociating Template from Fabrics

*Before you begin:*

- The template and its configuration must already be deployed to a fabric.
- The template must be deployed to a single fabric only and not stretched across fabrics.
- The objects defined in the template must not be deployed as shadow objects in other fabrics.

You can choose to disassociate a template from a fabric without undeploying it. This allows you to preserve any configuration deployed to the fabric from Nexus Dashboard while removing the template-fabric association in the schema. The managed object and policy ownership is transferred from Nexus Dashboard to the fabric's controller.

Disassociate is supported on all templates.

When you use the Disassociate Fabric operation in the orchestrator, understand its effect on different template types:

- Templates that remain in the orchestrator: Application, fabric policy, fabric resource, service device, and tenant policy templates. Disassociating a fabric only removes the link to the fabric, so manually delete these templates for full removal.
- Templates that are fully removed from the orchestrator: L3out and monitoring policy templates (for tenant SPAN and access SPAN). Disassociating a fabric completely removes these templates and all their associated objects.

1. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click on the schema that contains the template you want to disassociate.
4. In the Schema UI text view drop-down list, choose the template under the specific fabric from which you want to disassociate it.
5. From the **Actions** menu, choose **Disassociate Fabric**.
6. In the confirmation page, click **Confirm Action**.

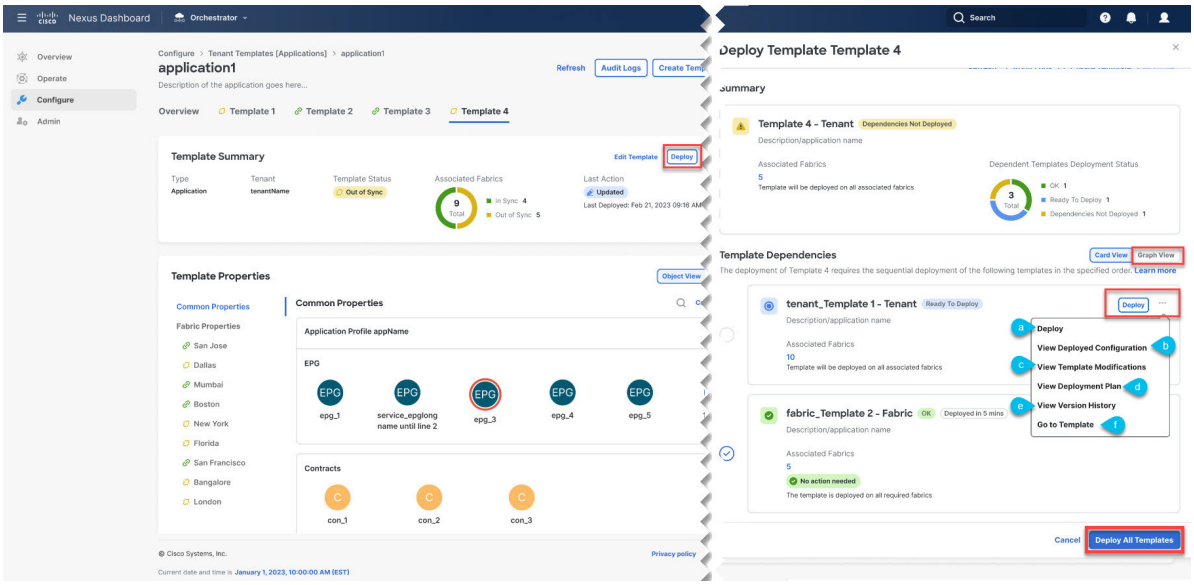
# Deploying Out of Sync Templates

*Before you begin:*

- You must have the schema, template, and any objects you want to deploy to Fabrics already created and the templates assigned to one or more Fabrics, as described in previous sections of this document.
- If template review and approval is enabled, the template must also be already approved by the required number of approvers as described in Template Review and Approval.
- You can deploy multiple templates and the deployment order is determined based on dependency. Ensure that you understand the required deployment order and object dependencies that are described in Schema and Template Design Considerations.

This section describes how to deploy new or updated policies to the ACI fabrics.

1. Navigate to the schema that contains the template that you want to deploy.
2. From the **View** dropdown menu, select the template you want to deploy.
3. In the template properties, click **Deploy Template**.
4. The Deploy template page opens that shows list of dependent templates that need to be successfully deployed in order to deploy this template. Here you can choose to deploy all the templates in one go, or deploy them individually:
    - To **Deploy All Templates**:
        a. Click on **Deploy Out of Sync Templates**.
        b. Nexus Dashboard will deploy all the templates based on their deployment sequence.




*Deploy to fabric*

Template dependencies are numbered in accordance of their deployment hierarchy, or in-order of their deployment sequence.

Color codes represent the individual template dependency status, implying:

- Green: OK or Deployed
- Orange: Dependent templates not deployed
- Blue: Dependencies not Deployed.

- To Deploy template dependency individually:

> Individual deployment will not be successful unless the underlying dependencies are fulfilled. Here you can choose to deploy out-of-sync templates to ensure all the required dependencies are fulfilled.

a. Click on the three dots **(...)** at the top-right corner of the individual template dependency and/or select **Deploy** to deploy any individual template dependency.

b. Select **View Deployed configuration** to see graphical representation of comparison between what is already deployed to the Fabric and what's defined in the template.

c. If you have made changes to your template, review the **View Template Modifications** to verify the new configuration.

   You can also filter the view using the filter options like:

   - Created
   - Modified
   - Deleted
   - Config Drift
   - Migrated
     Using checkboxes for informational purposes, but keep in mind that all of the changes are still deployed when you click **Deploy**.

d. Check the **Deployment Plan** to see a visualization and an JSON payload of the configuration that will be deployed from this template. This option will only show **Ready to Deploy** template dependencies.

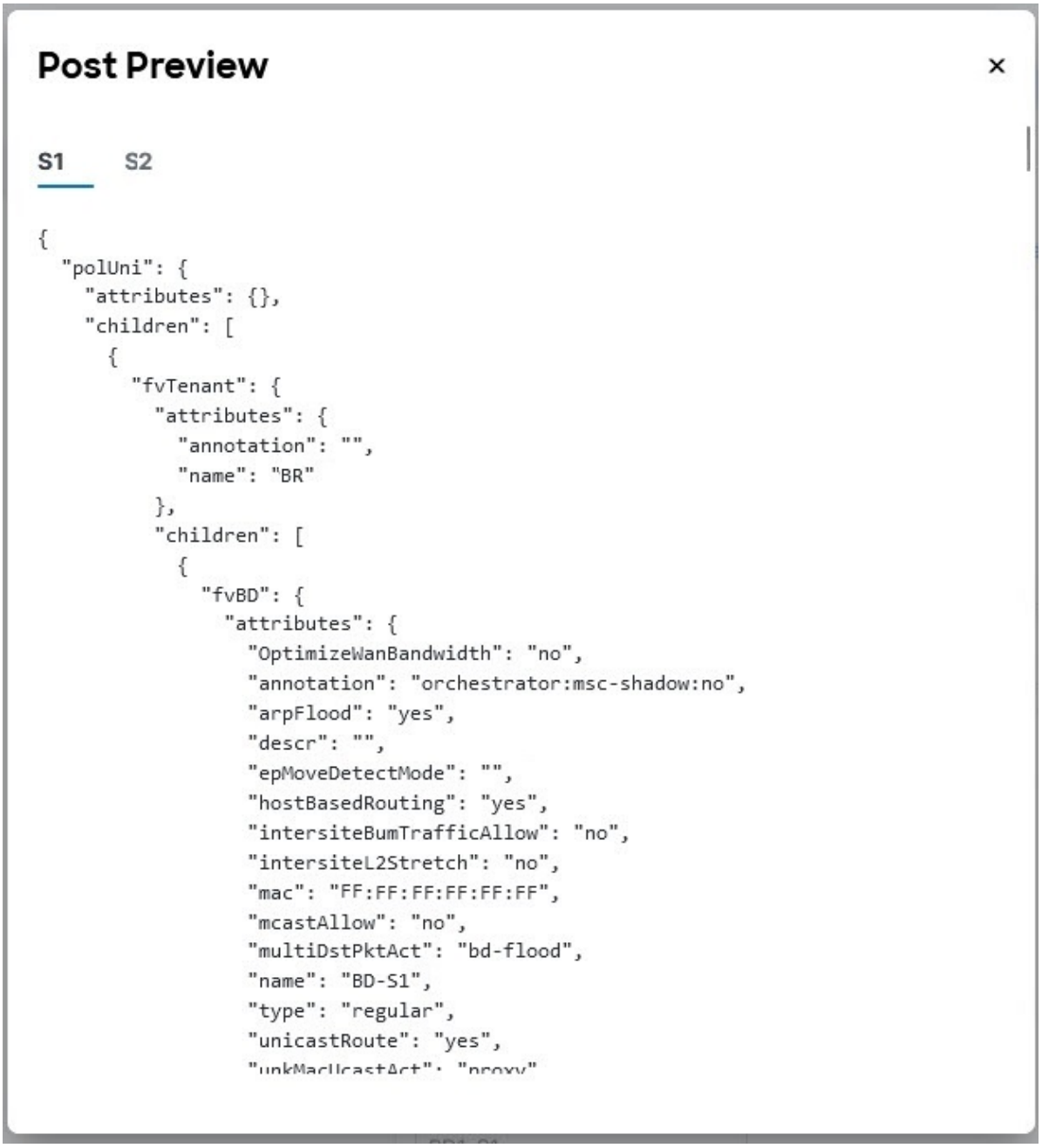
   This feature provides better visibility into configuration changes that the Orchestrator will provision to the different fabrics that are part of your Multi-Fabric domain after you make a change to the template and deploy it to one or more fabric.

   The Deployment Plan provides full visibility into all the objects that the deployment of the template would provision across the different fabrics. For example, depending on what change you make, shadow objects may be created in multiple fabrics even if the specific change is applied to only a single fabric.

   > We recommend verifying your changes using the Deployment Plan as described in this step before deploying the template. The visual representation of the configuration changes can help you reduce potential errors from deploying unintended configuration changes.

   (Optional) Click **View Payload** to see the JSON payload for each fabric.

   In addition to the visual representation of the new and modified objects, you can also choose to **Download Payload** to review the changes in each fabric:




*View Payload*

e. **View Version History** shows the complete version history and incremental changes made between versions. Additional information about version history is available in Viewing History and Comparing Previous Versions.

   If you have previously deployed this template but made no changes to it since, the **Re-Deploy Template** button indicates that there are no changes and you can choose to re-deploy the entire template.

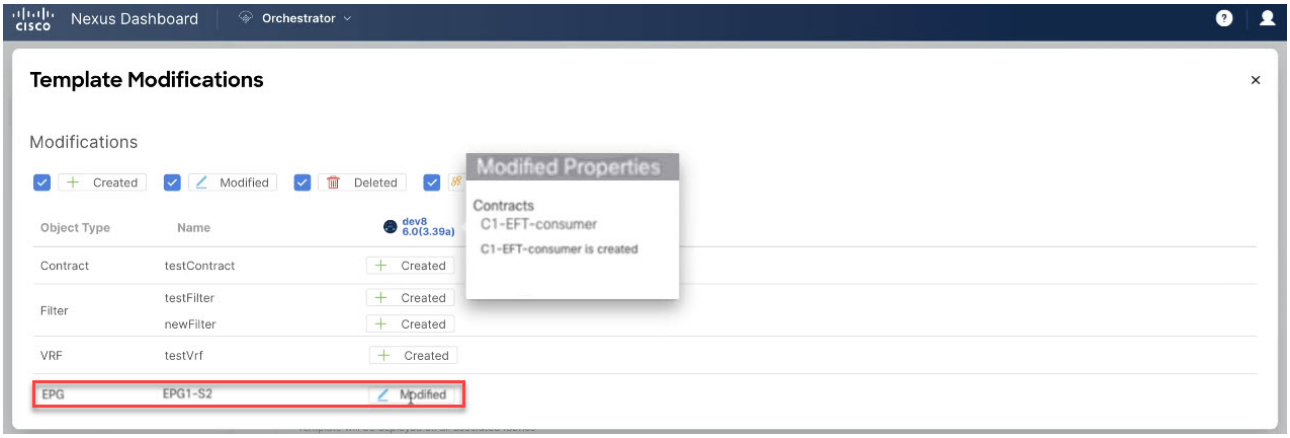
f. The **Go to Template** page takes you to the template page.

5. After you are done deploying the template, click the X icon to close the **Deploy Template** screen.

The following screenshots show a simple example of adding a consumer contract to an existing EPG (EPG1-S2) in S2.

In this case, only the difference in configuration is deployed to the fabric. If you want to re-deploy the entire template, you must deploy once to sync the

differences and then redeploy again to push the entire configuration as described previously.



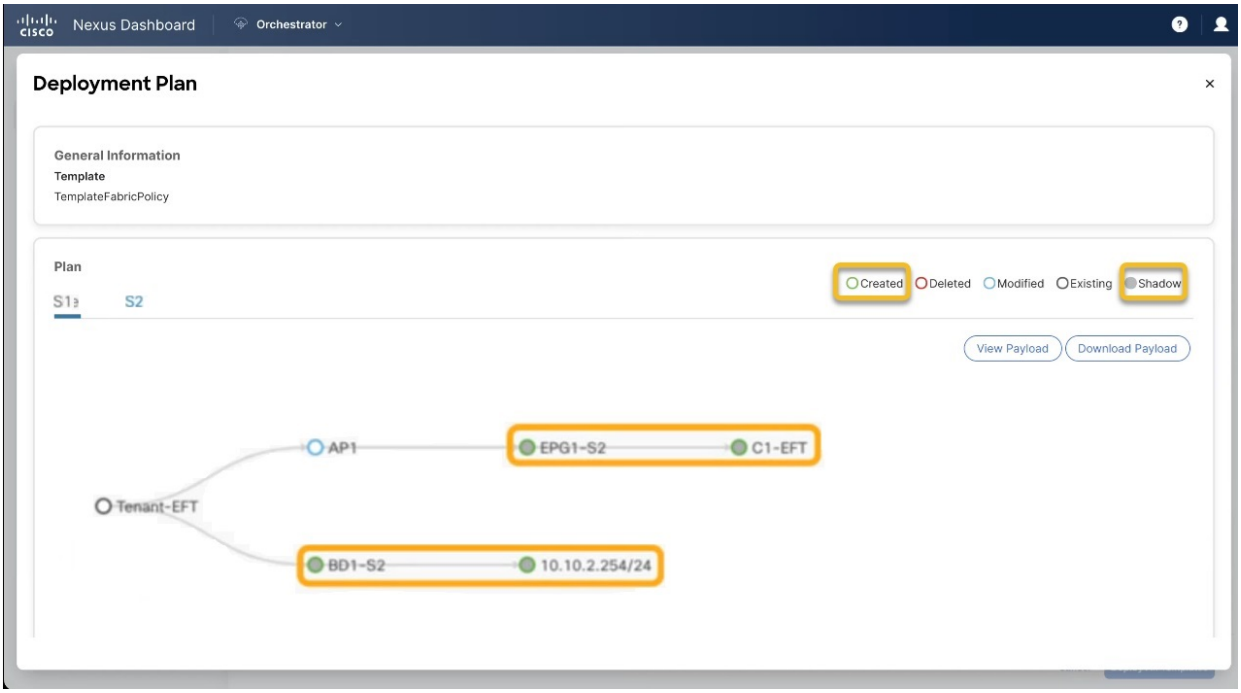

*Template Status*

- Click the **Deployment Plan** button.

  Here a consumer contract was added to an existing EPG in S2, the Deployment Plan allows you to also see that there are additional changes to be deployed to S1 as a result of the change to S2.

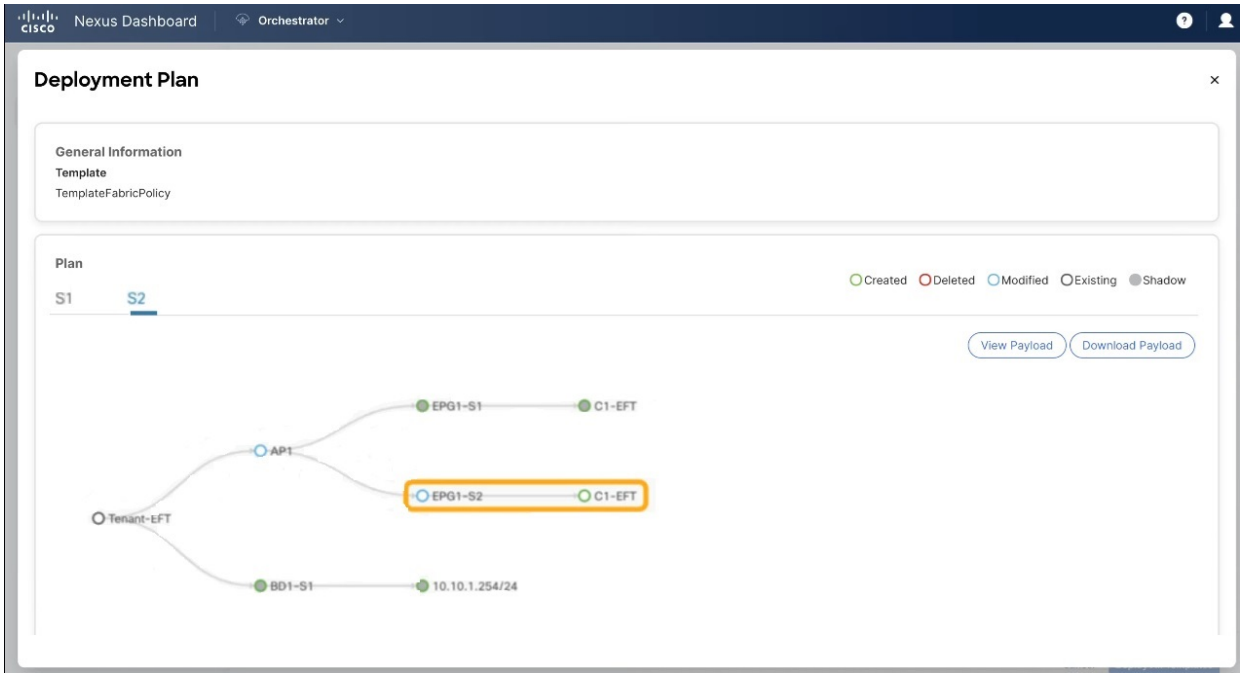
- Verify your changes in the first listed fabric.

  Based on the highlighted legend, you can see that the Orchestrator will create the shadow objects in S1 that are required by the contract you added to an EPG in S2.




- Repeat the previous substep to verify the changes in other fabric

  Here you can see the change you made explicitly to the EPG (EPG1-S2) in S2 when you assigned the contract (C1-EFT) to it, as well as the shadow objects for the EPG (EPG1-S1) in the other fabric, which is providing that contract.


Nexus Dashboard
Orchestrator
Deployment Plan
General Information
Template
TemplateFabricPolicy
Plan
S1
S2
Created
Deleted
Modified
Existing
Shadow
View Payload
Download Payload
Tenant-EFT
AP1
EPG1-S1
C1-EFT
EPG1-S2
C1-EFT
BD1-S1
10.10.1.254/24

# Undeploying templates

*Before you begin:*

- Ensure that you have not made any changes to the template since you last deployed it.

  Undeploying a template that was modified since it was last deployed may create a configuration drift because the set of objects deployed with the template would be different than the set of objects you try to undeploy after making changes to the template.

- If you are undeploying a template that contains VRFs that are used in route leak configurations, the route leaks must be deleted before you can undeploy that template.

This section describes how to undeploy a template from a fabric. Undeploying a template removes all configurations defined in that template from a specific fabric where the template is deployed.

This action removes managed objects (MOs) and their properties from the fabric's controller and can disrupt the network connectivity that depends on those configurations.

1. Choose the schema that contains the template you want to undeploy.
2. From the **View** drop-down list, choose the template you want to undeploy.
3. From the **Actions** menu, click **Undeploy template**.

# Remove fabrics from a template

*Before you begin:*

- Before removing a fabric from a template, undeploy the template from the fabric. This is required even for empty templates (templates without policies).

Follow these steps to remove fabrics from a template.

1. Navigate to the schema that contains the template you want to remove a fabric association.
2. Choose the template from the **Overview** drop-down list.

   The **Template Properties** page appears.

3. In the **Template Summary** view, click **Actions** and choose **Add/Remove Fabrics** from the drop-down list.
4. In the **Add Fabrics to *template-name*** page, uncheck the check box next to the fabric you want to remove from the template association.
5. Click **Ok**.

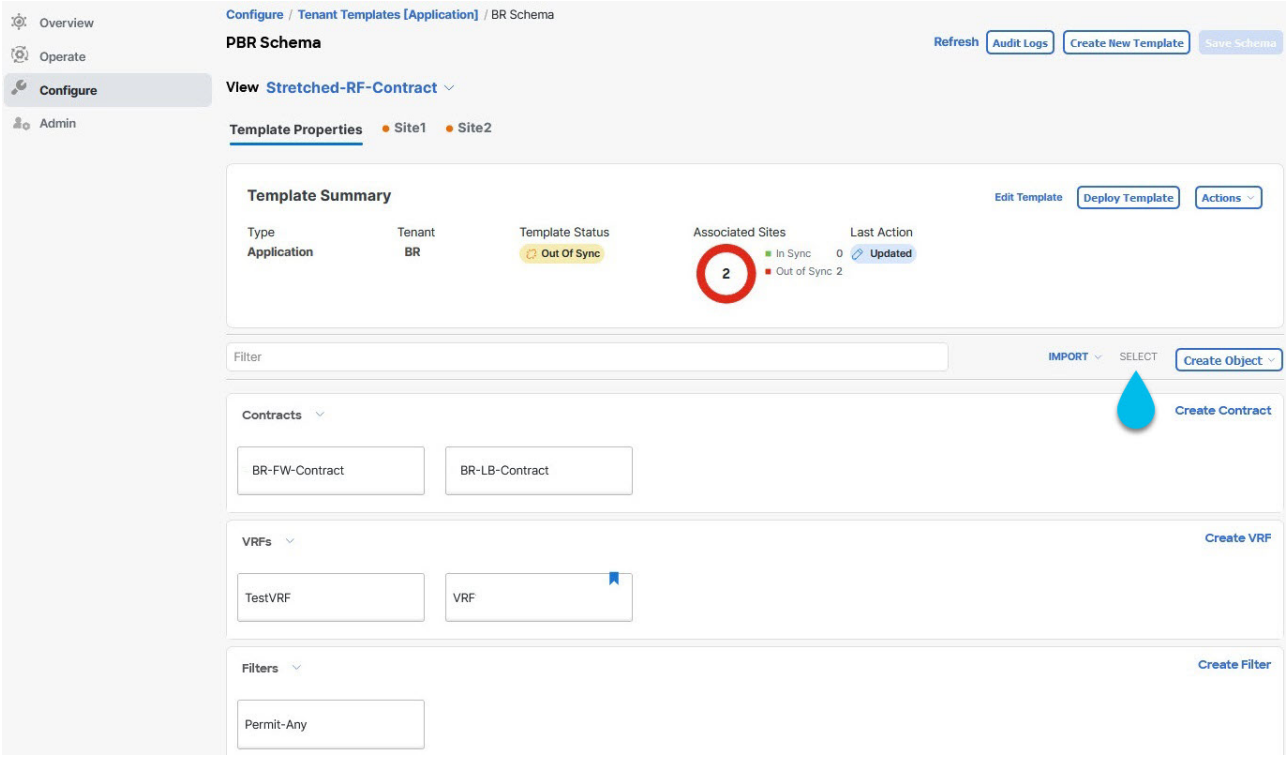
# Bulk Update for Template Objects

The bulk update feature allows you to update multiple properties on multiple different objects of the same type within a template at once. For example, you can enforce Infra EPG Isolation on two or more EPGs at the same time, instead of having to modify each object individually. When using this workflow, all selected objects must be of the same type, for example, you cannot choose to update an EPG and a BD simultaneously.

If the selected objects already have different property values configured on them, the update will overwrite those properties with the values you provide. This feature allows you update template-level object properties for on-premises; updating fabric-local properties is not supported.

This feature is supported for Application templates only with Cisco NDFC fabrics; it is not supported for other template types, or Cisco APIC.

1. Navigate to the schema and template that contains the objects you want to update.
2. From the main pane, choose **Select**. It will allow you to choose multiple objects of same type.

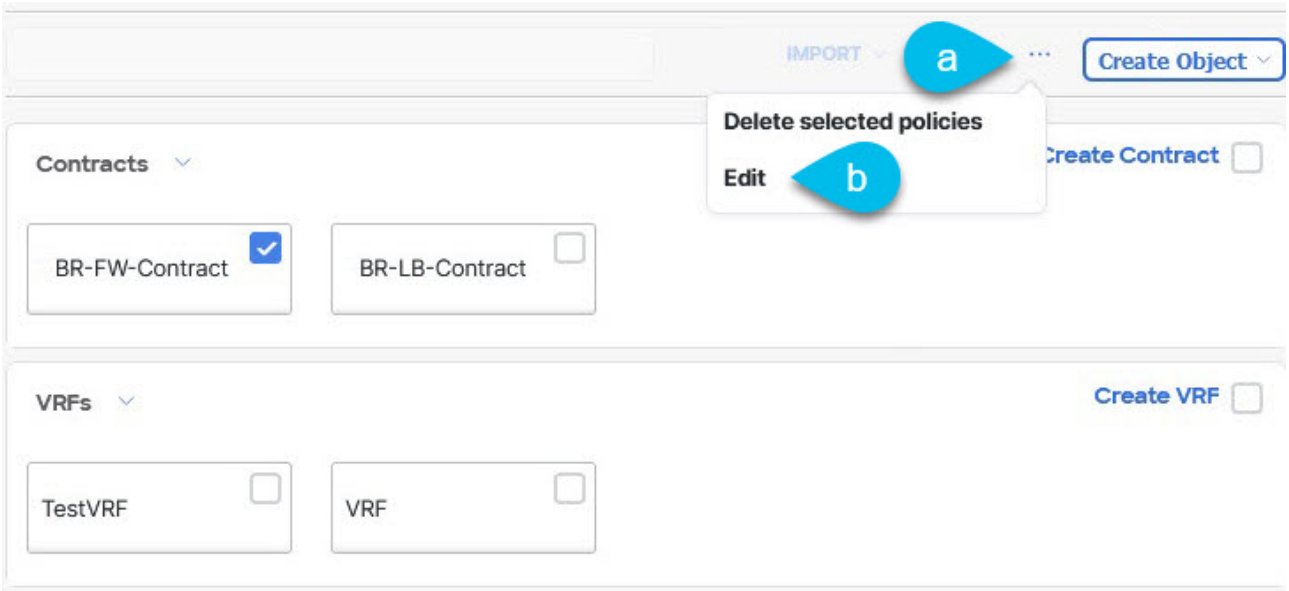



3. After selecting all the objects that you want to update.

   a. Choose " ..." right next to the cancel option.

   b. From the dropdown Choose " Edit" .

   If you choose objects of different type, you won't see the Edit option in the dropdown.




4. After choosing "**Edit**", a **Bulk Update** will show up. It will show you a subset of the properties for the objects you selected.

   You can **Select Properties** the following properties based on the type of objects you selected.

   a. **EPG**: Bridge Domain, Contract, EPG Type, Infra EPG, Preferred Group.

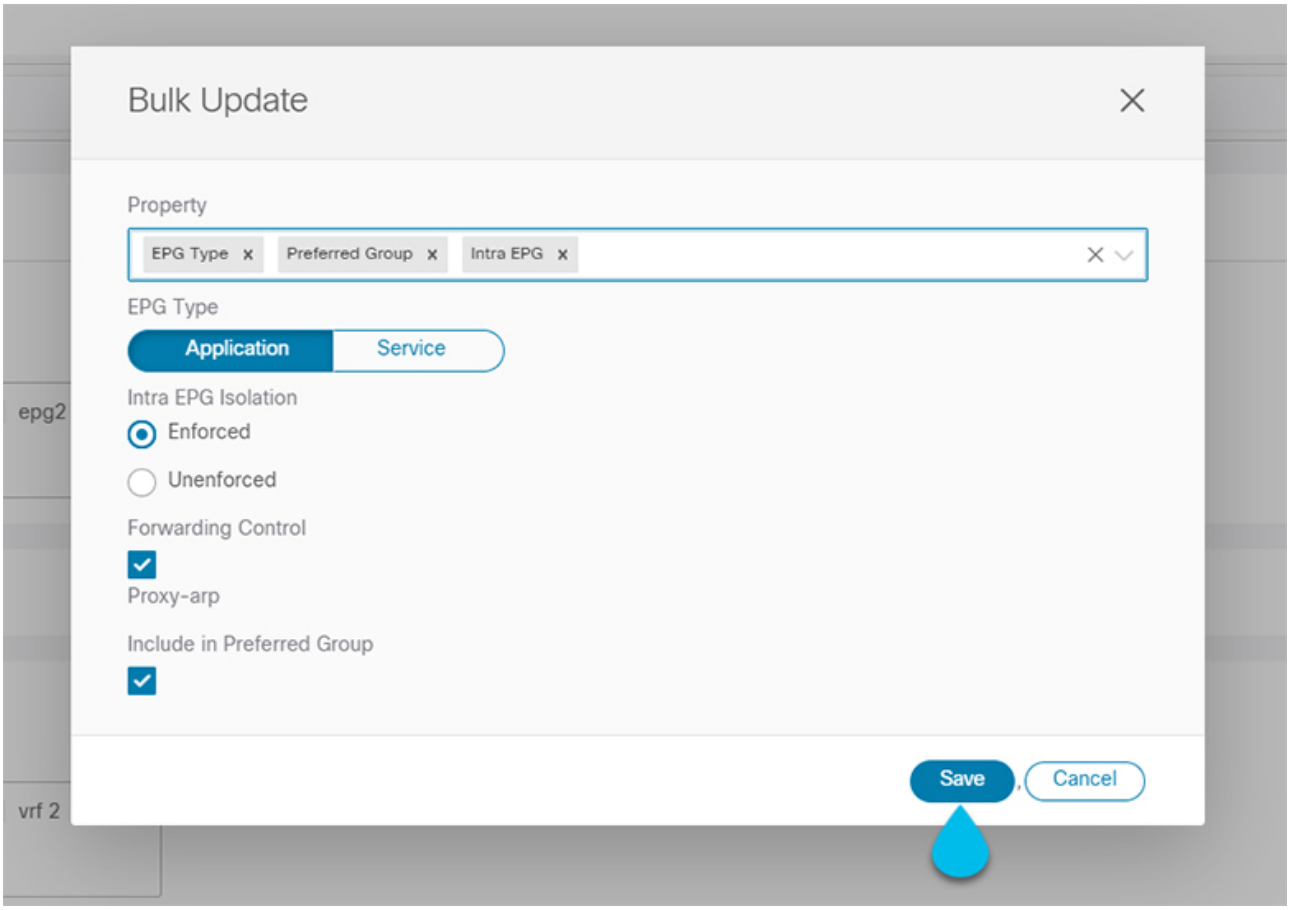
   b. **Contracts**: Scope, Filter Chain, QOS Level.

   c. **VRF**: IP Data-Plane Learning.

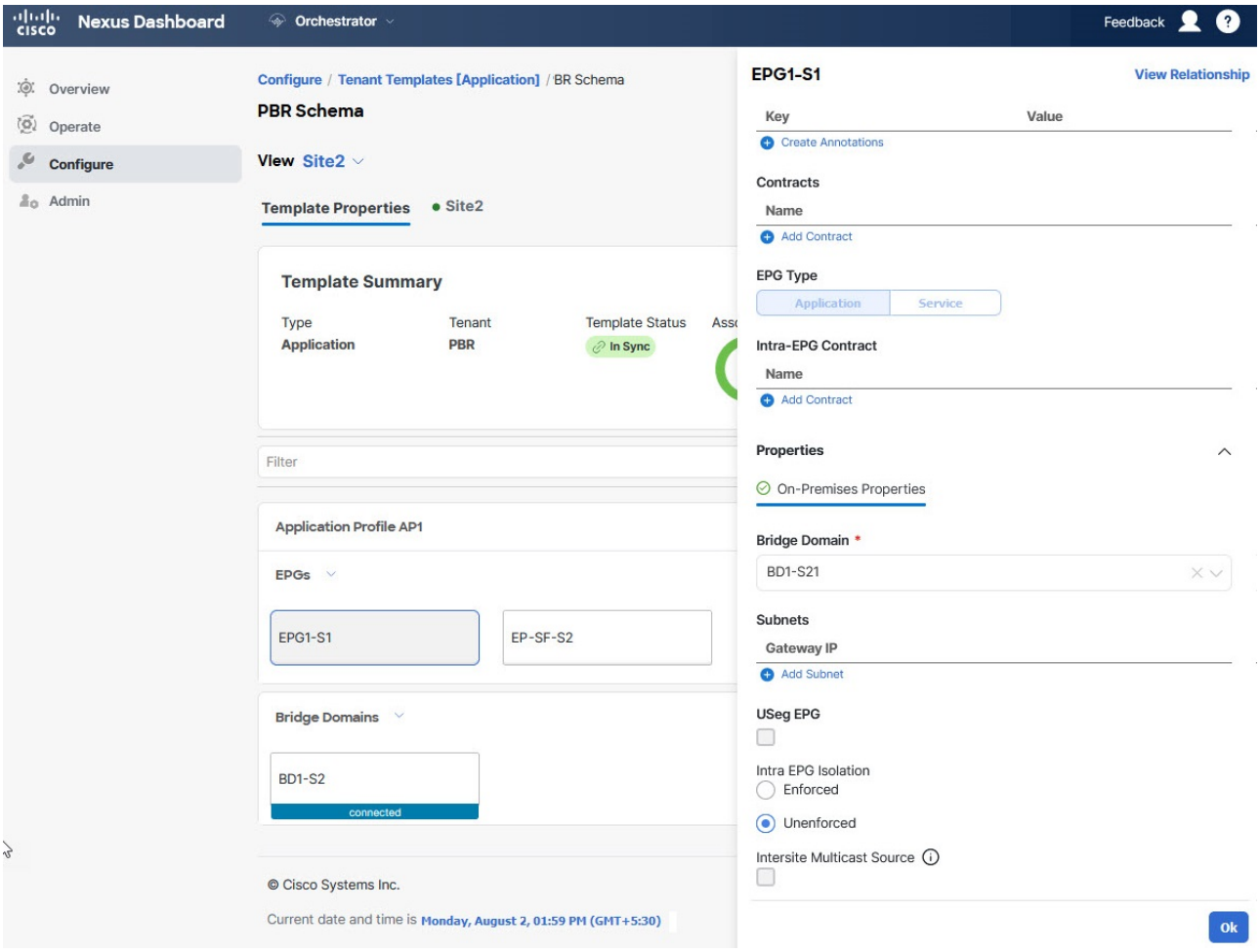
   d. **Bridge Domain**: Virtual Routing and Fowrwarding, L2 Stretch, L2 Unknown Unicast, Unkown Multicast Flooding, IPv6 Unkown Multicast Flooding, Multi Destination Flooding, DHCP Policies, Unicast Routing.

   e. **External EPG**: Contract, External EPG Type, Preferred Group.

5. After selecting all the fields, you wish to update. Choose "Save" which will implement the bulk update you just made.




6. As you save the updates, you can see the changes you've made.



# Template Versioning

A new version of the template is created every time it is saved. From within the Nexus Dashboard UI, you can view the history of all configuration changes for any template along with information about who made the changes and when. You can also compare any of the previous versions to the current version.

New versions are created at the template level, not schema level, which allows you to configure, compare, and roll back each template individually.

Template versions are created and maintained according to the following rules:

- All template versions are either Deployed or Intermediate.

  Deployed–versions of the template that have been deployed to fabrics.

  Intermediate–versions of the template that have been modified and saved, but not deployed to fabrics.

- A maximum of 20 Deployed and 20 Intermediate versions per template can be stored at any given time.
- When a new Intermediate version is created that would exceed the 20 version limit, the earliest existing Intermediate version is deleted.
- When a template is deployed and a new Deployed version is created, all Intermediate versions are deleted. If the new Deployed version exceeds the 20 version limit, the earliest existing Deployed version is deleted.
- Tagging a version Golden does not affect the number of stored template versions.
- A template that is tagged Golden cannot be deleted.

  You must untag the template first before you can delete it.

- When a template is modified and saved or deployed, any versions that exceed the 20 Deployed and 20 Intermediate scale are removed according to the above rules.
- When upgrading from a release prior to 4.0(1) to release 4.0(1) or later, only the latest versions of templates are preserved.

# Tagging Templates

At any point you can choose to tag the current version of the template as "golden", for example for future references to indicate a version that was reviewed, approved, and deployed with a fully validated configuration.

1. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click the schema that contains the template you want to view.
4. In the Schema view, select the template you want to review.

5. From the template's actions (**...**) menu, select **Tag**.

   If the template is already tagged, the option will change to **Un-Tag** and allows you to remove the tag from the current version.

   Any version that was tagged will be indicated by a star icon in the template's version history screen.

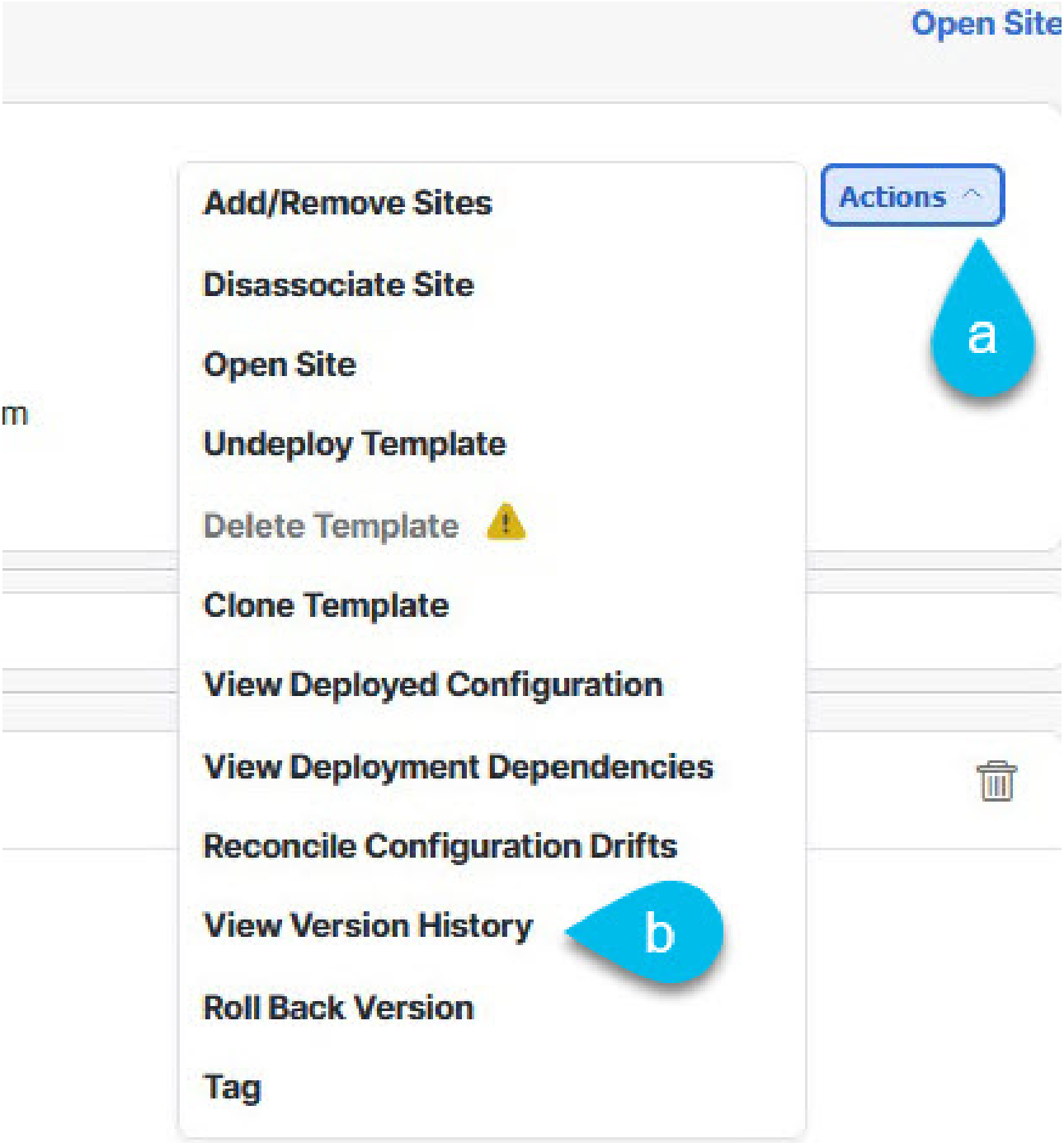
# Viewing History and Comparing Previous Versions

This section describes how to view previous versions for a template and compare them to the current version.

1. Navigate to the **Orchestration** page.

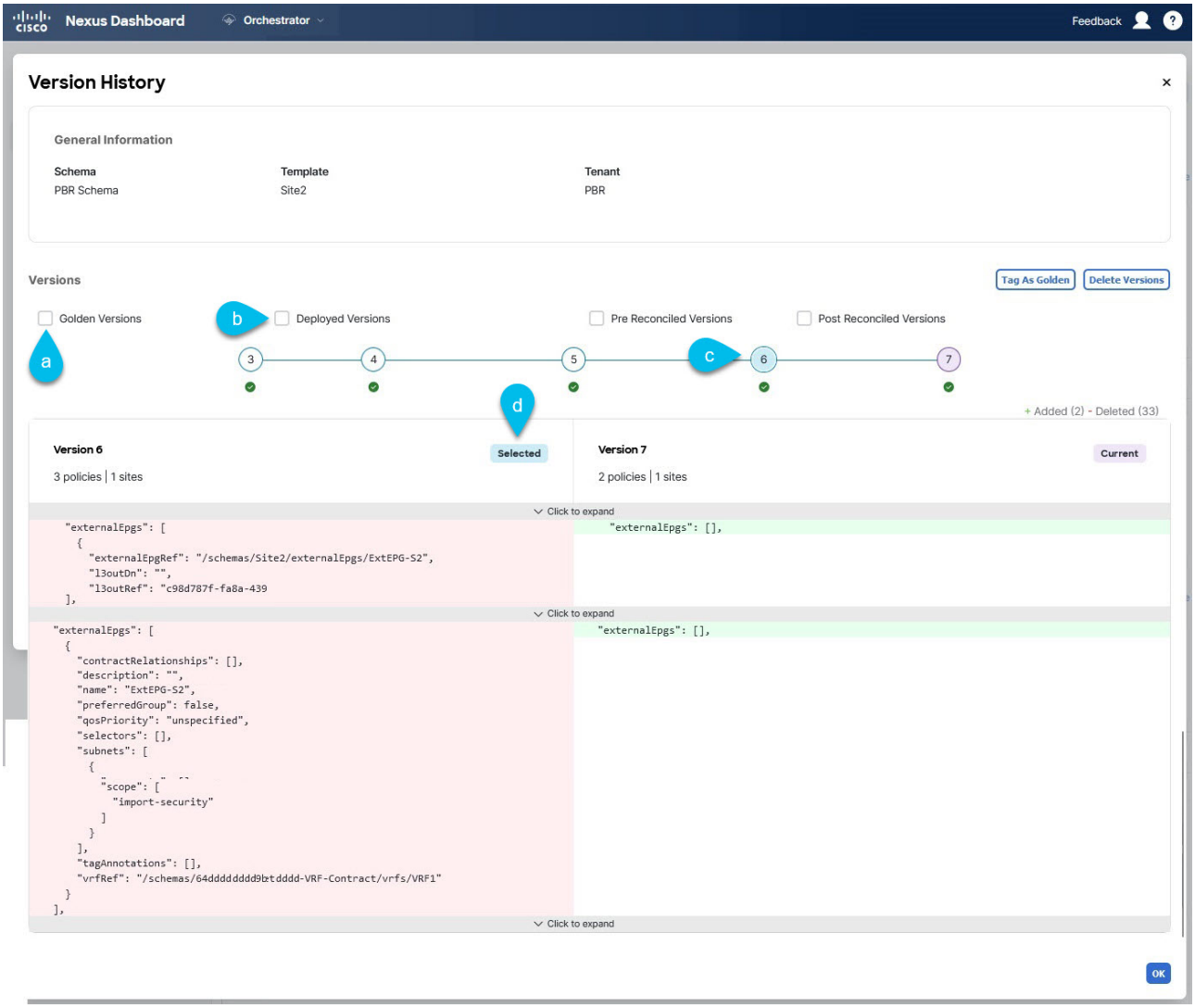
   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click the schema that contains the template you want to view.
4. In the Schema view, select the template you want to review.
5. From the template's actions (**...**) menu, select **View Version History**.




*View Version History*

6. In the **Version History** page, make the appropriate selections.




*Version History*

a. Enable the **Golden Versions** checkbox to filter the list of previous versions to display only the versions of this template that had been marked as Golden.

   Tagging a template as "Golden" is described in Tagging Templates.

b. Enable the **Deployed Versions** checkbox to filter the list of previous versions to display only the versions of this template that had been deployed to fabrics.

   A new template version is created every time the template is changed and the schema is saved. You can choose to only show the versions of the template that were actually deployed to fabrics at some point.

c. Click on a specific version to compare it to the current version.

   The version you select is always compared to the current version of the template. Even if you filter the list using the **Golden Versions** or **Deployed Versions** filters, the current version will always be displayed even if it was never deployed or tagged as golden.

d. Mouse over the **Edit** icon to see information about who created the version and when.

e. Enable the **Pre Reconciled Versions** checkbox to filter the list of previous versions to display only the versions of this template that had been marked as Reconciled

f. Enable the **Post Reconciled Versions** checkbox to filter the list of previous versions to display

only the versions of this template that had been marked as Reconciled

7. Click **OK** to close the version history page.

# Reverting Template to Earlier Version

This section describes how to restore a previous version of the template. When reverting a template, the following rules apply:

- If the target version references objects that are no longer present, restore operation will not be allowed.
- If the target version references fabrics that are no longer managed by Nexus Dashboard, restore operation will not be allowed.
- If the current version is deployed to one or more fabrics to which the target version was not deployed, restore operation will not be allowed.

  You must first undeploy the current version from those fabrics before reverting the template.

- If the target version was deployed to one or more fabrics to which the current version is not deployed, restore operation is allowed.

  1. Navigate to the **Orchestration** page.

     **Manage > Orchestration**

  2. Choose **Tenant Templates > Applications**.
  3. Click the schema that contains the template you want to view.
  4. In the Schema view, select the template you want to review.
  5. From the **Actions** (**...**) menu, select **Rollback Versions**.
  6. In the **Rollback** page, select one of the earlier versions to which you want to restore.

     You can filter the list of versions using the **Golden Versions**, **Pre Reconciled Versions**, **Post Reconciled Versions**, and **Deployed Versions** checkboxes.

     When you select a version, you can compare the template configuration of that version to the current version of the template.

  7. Click **Restore** to restore the selected version.

     When you restore a previous version, a new version of the template is created with the same configuration as the version you selected in the previous step.

     For example, if the latest template version is 3 and you restore version 2, then version 4 is created that is identical to the version 2 configuration. You can verify the restore by browsing to the template version history and comparing the current latest version to the version you had selected during restore, which should be identical.

     If template review and approval (change control) is disabled and your account has the correct privileges to deploy templates, you can deploy the version to which you reverted.

     However, if change control is enabled, then:

- If you revert to a version that had been previously deployed and your account has the correct privileges to deploy templates, you can immediately deploy the template.
- If you revert to a version that had not been previously deployed or your account does not have the correct privileges to deploy templates, you will need to request template approval before the reverted version can be deployed.

  Additional information about review and approval process is available in the Template Review and Approval section.

# Template Review and Approval

Template review and approval (change control) workflow allows you to set up designated roles for template designers, reviewers and approvers, and template deployers to ensure that the configuration deployments go through a validation process.

From within the Nexus Dashboard UI, a template designer can request review on the template they create, and also approve their own designed templates. Then reviewers can view the history of all configuration changes for the template along with information about who made the changes and when, at which point they can approve or deny the current version of the template. If the template configuration is denied, the template designer can make any required changes and re-request review; if the template is approved, it can be deployed to the fabrics by a user with Support Engineer role. Finally, the deployers themselves can deny deployment of an approved template and restart the review process from the beginning. Once deployed, the user with Support Engineer role cannot deny their own deployed template. You can redeploy or if any edits are made on the template, the approval process must be completed before a new deployment.

The workflow is done at the template level, not schema level, which allows you to configure, review, and approve each template individually.

## Enabling Template Approval Requirement

Before you can use the review and approval workflow for template configuration and deployment, you must enable the feature in the Nexus Dashboard's system settings.

1. From the left navigation menu, choose **Admin > System Settings > Fabric Management**.
2. On the **Change control** tile, click **Edit**.
3. In the **Change control** page, check the **Enable change control** check box to enable the feature.
4. Check the **Enable for Orchestration** check box.
5. In the **Required number of approvers** field, enter the number of unique approvals required before the templates can be deployed.
6. Check the **Allow self approval/deploy** check box to enable self approvals.
7. Click **Save** to save the changes.

## Create Users with Required Roles

Before you can use the review and approval workflow for template configuration and deployment, you must create the users with the necessary privileges in Nexus Dashboard.

1. From the main navigation menu, choose **Admin > Users and Security**.
2. Click the **Users** tab.
3. In the main pane, click **Create local user**.
4. Create the required users.

   The workflow depends on three distinct user roles: template designer, approver, and deployer. You can assign each role to a different user or combine the roles for the same user; users with Observer privileges can only view the screens.

In addition to the default Observer user role:

- Designer should be used when the designer needs to make changes to templates associated only to a specific tenant (or a subset of tenants). In this case, the user should be mapped to the specific tenants.
- Designer should be used when the designer needs to make changes to templates assigned to them.

  In contrast to the Designer role, there are pre-defined Approver and Support Engineer roles on the Nexus Dashboard that can be associated to the users. Approver and Support Engineer roles are not bound to specific tenant(s) by design. However, when creating a user role with both designer and approver (or designer and deployer) rights, follow the same guidelines as listed above.

  Detailed information about configuring users and their privileges for local or remote Nexus Dashboard users is described in the Configuring Users and Security.

  You must have at least as many unique users with Approver role as the minimum number of approvals required, which you configured in Enabling Template Approval Requirement.

  If you disable the **Change Control Workflow** feature, an Approver user will have read-only access to the Nexus Dashboard. But a Support Engineer can continue to deploy templates.

# Requesting Template Review and Approval

*Before you begin:*

You must have:

- Enabled the global settings for approval requirement, as described in Enabling Template Approval Requirement.
- Created or updated users in Nexus Dashboard with Approver and Support Engineer roles, as described in Create Users with Required Roles.
- Created a template with one or more policy configurations and assigned it to one or more fabrics.

This section describes how to request template review and approval.

1. Log in to your Nexus Dashboard GUI as a user with the Designer or Super Administrator role.
2. If you assigned the Designer role, associate the user with the tenants.

   If you used the Super Administrator role, skip this step.

   If you assign the Super Administrator role, you must also associate the user with the specific tenants they will manage. This is a one-time activity.

   a. From the left navigation menu, choose **Manage > Orchestration > Tenants**.
   b. Select the tenant which the user will manage.
   c. Check the box next to the designer user you created in Nexus Dashboard.
   d. Repeat this step for all other tenants the user will manage.

3. From the left navigation menu, select **Configure > Tenant Template**.
4. Click the schema that contains the template for which you want to request approval.
5. In the schema view, select the template.
6. In the main pane, click **Send for Approval**.

   Note that the **Send for Approval** button will not be available in the following cases:

   - The global change control option is not enabled
   - The template has no policy configurations or is not assigned to any fabrics
   - Your user does not have the right permissions to edit templates
   - The template has already been sent for approval
   - The template was denied by the approver user

# Reviewing and Approving Templates

*Before you begin:*

You must have:

- Enabled the global settings for approval requirement, as described in Enabling Template Approval Requirement.
- Created or updated users in Nexus Dashboard with Approver and Support Engineer roles, as described in Create Users with Required Roles.
- Created a template with one or more policy configurations and assigned it to one or more fabrics.
- Had the template approval requested by a designer, as described in Requesting Template Review and Approval.

This section describes how to request template review and approval.

1. Log in to your Nexus Dashboard GUI as a user with the Approver or Observer role.
2. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

3. Choose **Tenant Templates > Applications**.
4. Click the schema that contains the template you want to review and approve.
5. In the schema view, select the template.
6. In the main pane, click **Approve**.

   If you have already approved or denied the template, you will not see the option until the template designer makes changes and re-sends the template for review again.

7. In the **Approving template** page, review the template and click **Approve**.

   The approval screen will display all the changes which the template would deploy to the fabrics.

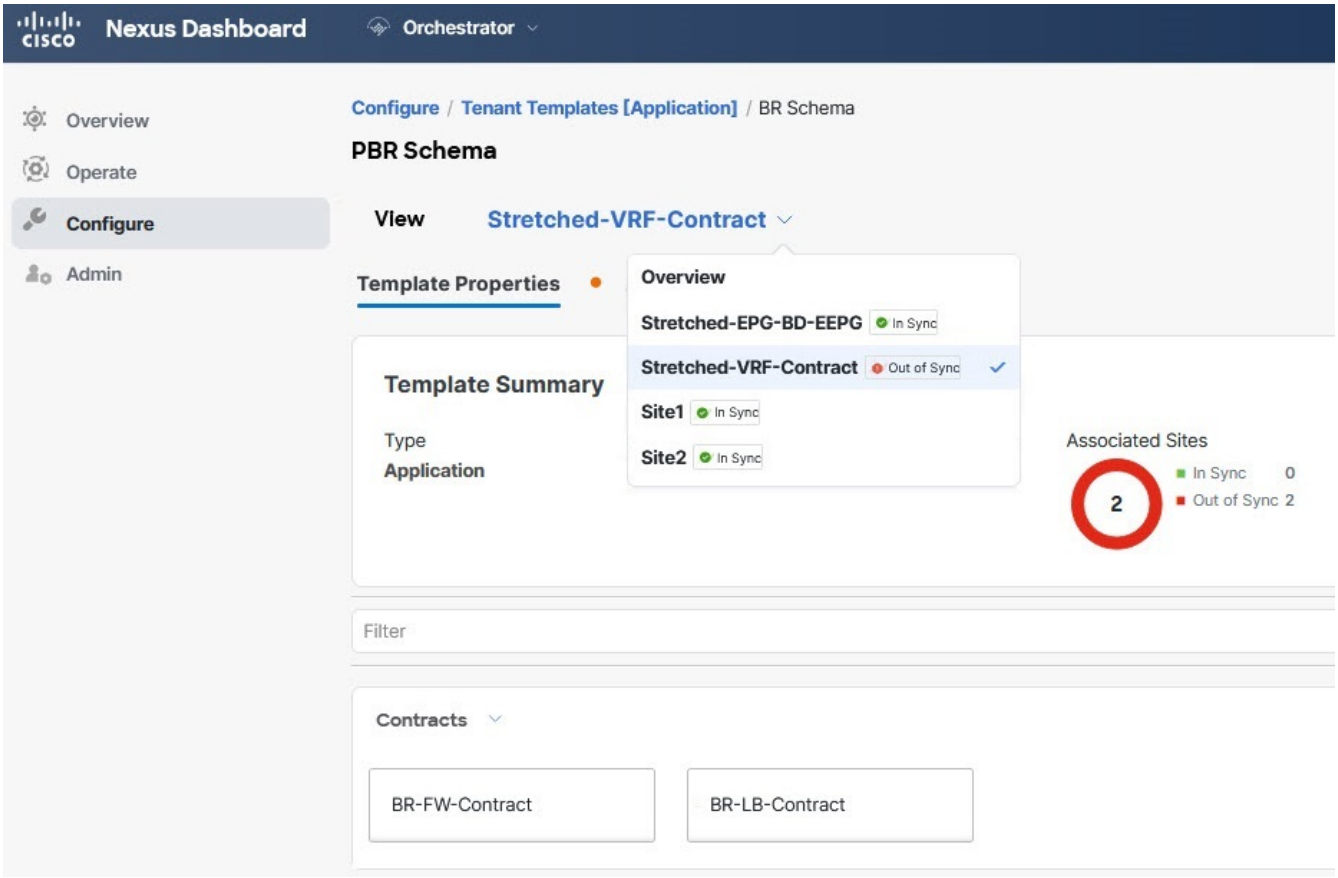
   You can click **View Version History** to view the complete version history and incremental changes made between versions. Additional information about version history is available in the "Viewing

History and Comparing Previous Versions" section in Templates Overview and Operations.

You can also click **Deployment Plan** to see a visualization and a JSON of the configuration that would be deployed from this template. The functionality of the "Deployment Plan" view is similar to the "Deployed View" for already-deployed templates, which is described in Viewing Currently Deployed Configuration.

# Configuration Drifts

Occasionally, you may run into a situation where the configuration actually deployed to an APIC domain is different from the configuration defined for that domain in the Nexus Dashboard. These configuration discrepancies are referred to as **Configuration Drifts** and are indicated by an Out of Sync warning next to the fabric name in the template view page as shown in the following figure:




*Configuration Drifts*

- In certain cases, the template-level notification of a configuration drift shown above may not trigger if the configuration of properties of objects managed by Nexus Dashboard is modified directly in the fabric's controller. Specifically, addition (and subsequent removal) of the following properties do not show drift notification on Nexus Dashboard:
  - Subnets for EPGs or BDs
  - Bridge Domain DHCL Labels
  - Static Ports configuration for EPGs
  - Contract Relationships between EPGs

In these cases, you can still check for configuration drift by manually running drift reconciliation workflow as described in Reconciling configuration drifts in application templates.

- When you deploy a template from Nexus Dashboard, drift notification for objects in that template is disabled for 60 seconds.

# Configuration Drift Causes

Configuration drifts can manifest due to a number of different reasons. Specific steps required to resolve a configuration drift depends on its cause. Most common scenarios and their resolutions are outlined below:

- **Configuration is modified in Nexus Dashboard**—When you modify a template in Nexus Dashboard GUI, it will show as configuration drift until you deploy the changes to the fabrics.

  To resolve this type of configuration drift, either deploy the template to apply the changes to the fabrics or revert the changes in the schema.

- **Configuration is modified directly in the fabric's APIC**—While the objects deployed from Nexus Dashboard are indicated by a warning icon and text in the fabric's APIC, an admin user can still make changes to them causing the configuration drift.

  Every time an object is modified on APIC, APIC sends a notification to Nexus Dashboard. On receiving the notification, Nexus Dashboard starts a 30 second timer (waiting for further notifications to arrive) and at the expiration of such timer then makes API calls to APIC to retrieve detailed information about the changes made all the objects for which it received a notification. This allows the Nexus Dashboard to display the drift symbol on the UI for all the templates where those objects are defined. The only exception to this behavior is when Nexus Dashboard deploys the configuration for all (or of a subset of) the objects defined in a specific template. In that case, for 60 seconds Nexus Dashboard would ignore any notification received from APIC relative to those specific objects and, as a consequence, it would not be able to display the drift symbol on the UI.

- **Nexus Dashboard configuration is restored from backup**—Restoring configuration from a backup in Nexus Dashboard restores only the objects and their state as they were when the backup was created, it does not automatically re-deploy the restored configuration. As such, if there were changes made to the configuration and deployed on APIC since the backup was created, restoring the backup would create a configuration drift.
- **Nexus Dashboard configuration is restored from a backup created on an older release**—If the newer release added support for object properties which were not supported by the earlier release, these properties may cause configuration drift warning. Typically, this happens if the new properties were modified directly in the fabric's APIC GUI and the values are different from the defaults assumed by the Nexus Dashboard
- **Nexus Dashboard is upgraded from an earlier release**—This scenario is similar to the previous one where if new object properties are added in the new release, existing configuration may indicate a drift.

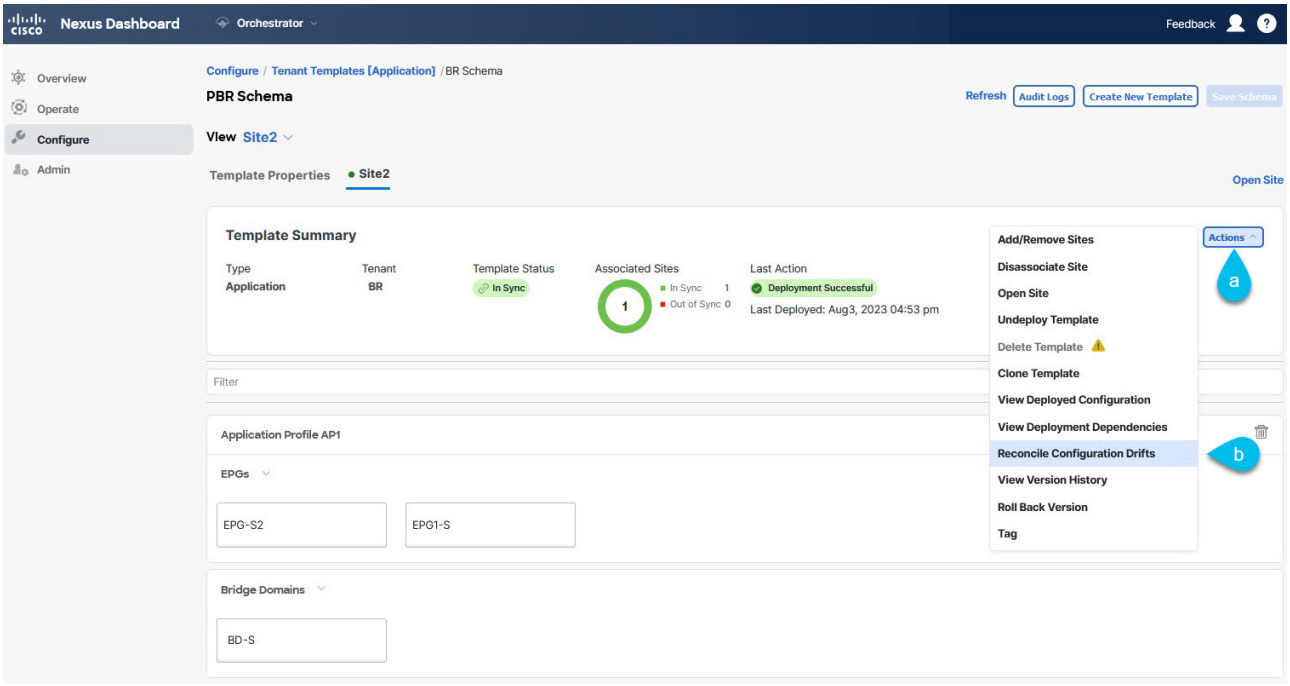
We recommend that you check for configuration drifts and, if necessary, run the "Reconcile Drift" workflow for templates, to have more visibility into the causes of the drift and be able to reconcile it. This recommendation applies to all the drift scenarios previously described in this section.

# Reconciling configuration drifts in application templates

You can use the drift reconciliation workflow to compare the template's configuration as it is defined in Nexus Dashboard to the configuration rendered in the APIC controllers of the fabrics that are part of your Multi-Fabric domain. This provides better visibility into changes that may have been made in Nexus Dashboard or in APIC directly and give you an opportunity to correctly resolve those drifts.

Configuration drift reconciliation is supported only for Application templates.
The templates are updated and saved only after you choose **Save** or **Deploy** at the end of the reconciliation workflow. If at any time during the workflow you want to undo the changes you already chose, you can close and re-open the schema to restore the original configurations. You can then re-run the workflow from the start.

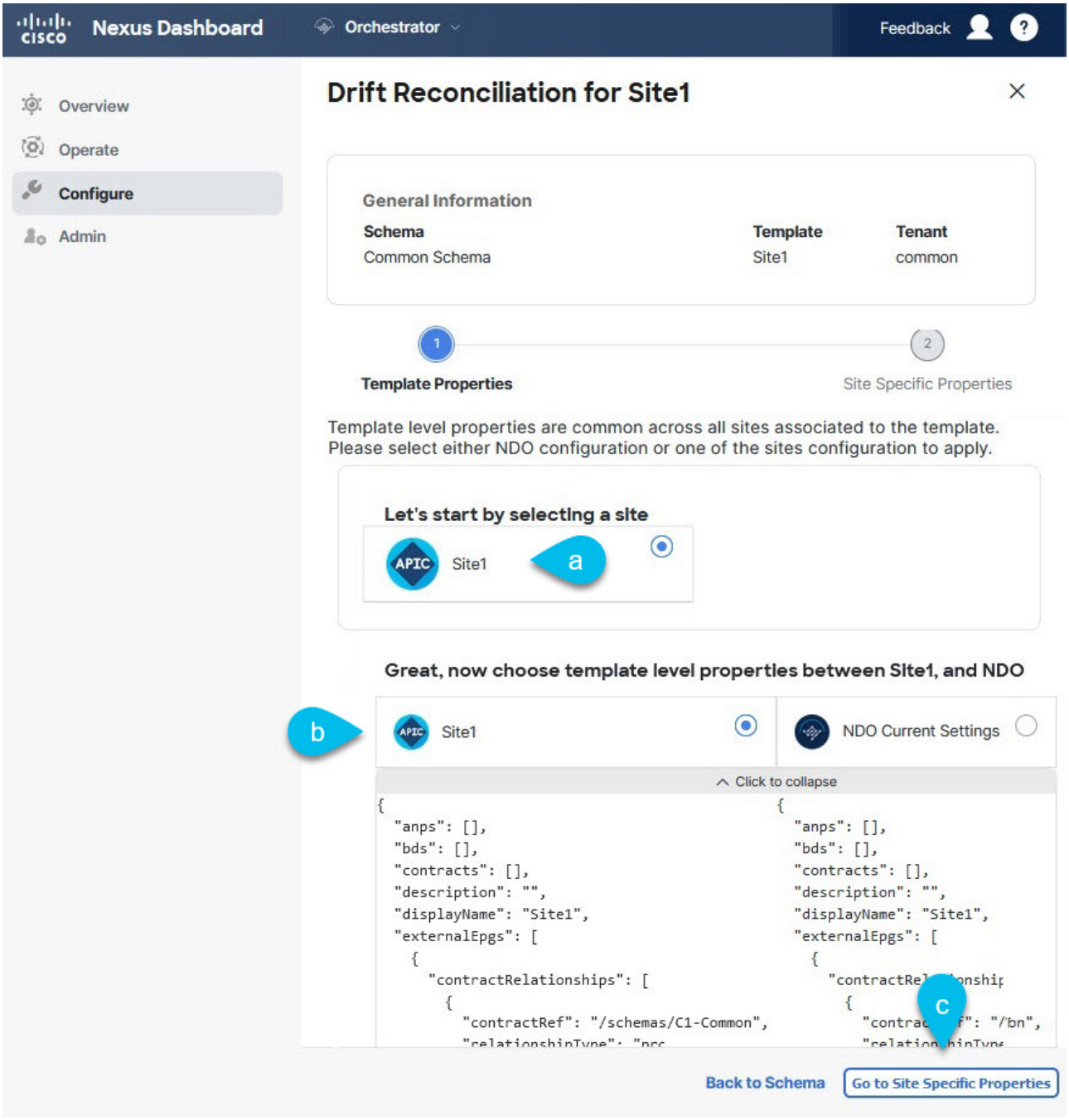
1. Navigate to the schema that contains the template you want to check for configuration drifts.
2. From the template's **Actions** menu, select **Reconcile Configuration Drift**.




*Reconcile Configuration Drift*

The **Drift Reconciliation** wizard opens.

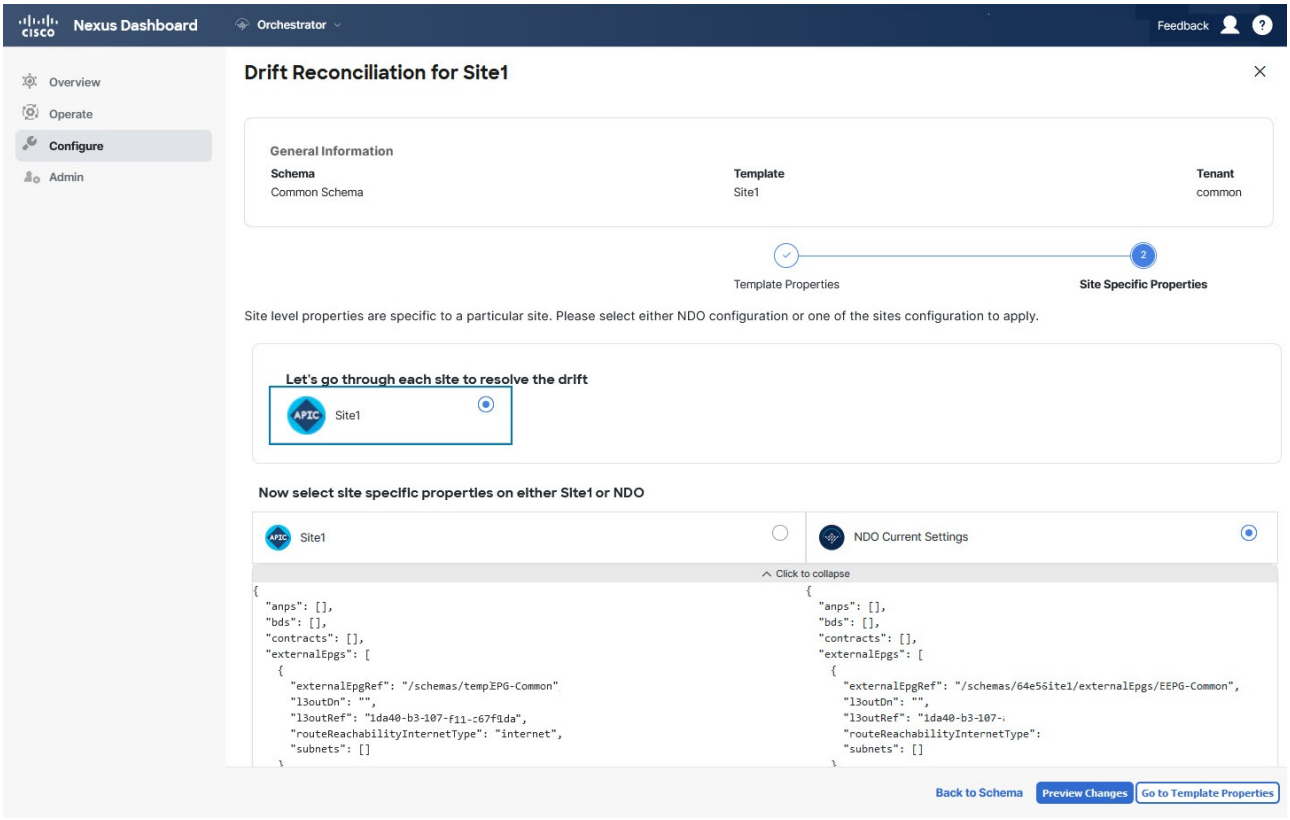
3. In the **Drift Reconciliation** screen, compare the template-level configurations for each fabric and choose the one you want.




*Drift Reconciliation*

Template-level properties are common across all fabrics associated to the template. You can compare the template level properties defined on Nexus Dashboard with the configuration rendered in each fabric and decide what should become the new configuration in the Nexus Dashboard template. Selecting the fabric configuration will modify those properties in the existing Nexus Dashboard template, whereas selecting the Nexus Dashboard configuration will keep the existing Nexus Dashboard template settings as is.

4. Click **Go to Fabric Specific Properties** to switch to fabric-level configuration.




*Fabric Specific Properties*

You can choose a fabric to compare that specific fabric's configuration. Unlike template-level configurations, you can choose either the Nexus Dashboard-defined or actual existing configurations for each fabric individually to be retained as the template's fabric-local properties for that fabric.

Even though in most scenarios you will make the same choice for both template-level and fabric-level configuration, the drift reconciliation wizard allows you to choose the configuration defined in the fabric's controller at the "Template Properties" level and the configuration defined in Nexus Dashboard at the "Fabric Local Properties" level or vice versa.

5. Click **Preview Changes** to verify your choices.

   The preview will display full template configuration adjusted based on the choices picked in the **Drift Reconciliation** wizard. You can then click **Deploy to fabrics** to deploy the configuration and reconcile the drift for that template.

## APIC configuration using Nexus Dashboard API Broker

Nexus Dashboard as an API Broker centralizes APIC configuration management. It operates in **APIC Proxy Mode**, allowing you to directly import, push, retrieve, and manage APIC Managed Objects (MOs) through API calls. Only **Super-Admin** users can access this functionality.

Use Nexus Dashboard as API Broker to: * Push custom APIC configurations. * Edit or add fields to existing APIC MOs. * Centralize APIC configuration deployments.

### Configure APIC Proxy Mode

The **APIC Proxy Mode** defines how Nexus Dashboard authenticates to your APIC instances when using the API Broker. This setting impacts the credentials used for API calls.

1. Navigate to **Admin > System Settings > Fabric Management** page.
2. Click **Edit** in **Management**.

   The **Management** page appears.

3. From **APIC Proxy Mode** choose one of the following options:
   a. **Proxy with ND Service User**: Nexus Dashboard uses its internal service account credentials to authenticate with APIC. This provides a consistent identity for API Broker operations.
   b. **Disable**: APIC Proxy Mode is turned off. The Nexus Dashboard as API Broker feature may not function if this mode is disabled.
   c. **Proxy with remote users credential (default)**: Nexus Dashboard uses the credentials you provide for the remote APIC instances to authenticate. This is the default behavior and means the API Broker acts as a pass-through for your specified APIC credentials.

**Accessing the APIC API Proxy page**

You can access the **APIC API Proxy** page to view the endpoints.

1. Go to the Nexus Dashboard homepage.
2. Click the **Help Center** icon.
3. Choose **API reference: Swagger (In-product)**.

   The **APIC API Proxy** page appears within **Nexus Dashboard One Manage**.

Request options:

- Specify the fabric name.
- **POST**: Push the user payload to APIC.
- **DELETE**: Delete a MO and its child objects.
- **GET**: Get the details of a MO.

Request status: POST status shows per site. If an error occurs, the status indicates the error. You can retry after correcting the payload. Sequential POSTs: The system processes multiple POSTs sequentially.

**Push configurations**

You can execute JSON or XML snippets to push new or modify existing APIC configurations directly from the **APIC API Proxy** page.

1. Click POST on the APIC API Proxy page.

   The **POST** details section expands.

2. Click **Try it out** in the **Parameters** section.
3. Modify or paste the JSON or XML snippets in the **Examples** text box.
4. Enter the APIC URL and the target site.
5. Click **Execute**.

6. From the Broker API view, post the entry.

**Payloads** The Nexus Dashboard as API Broker does not validate your uploaded JSON or XML payload. Ensure your configuration is correctly structured and valid for the target APIC. Retrieve existing Managed Objects (MOs) from APIC using Nexus Dashboard as API Broker.

#### Retrieve configurations

Retrieve existing MOs from APIC using Nexus Dashboard as API Broker.

1. Go to the **Get API** page.
2. Enter the **MO (Poluni/Tenant/ParentDN)** to retrieve.
3. Enter the target site to fetch data from.

#### Configuration drift and reconciliation

Orchestrator monitors for configuration drift. If the API Broker (or direct APIC configuration) overwrites an orchestrator-pushed MO, orchestrator detects and shows this drift. When drift is detected, orchestrator provides options for you to reconcile it.

#### APIC identification

The user fields in APIC audit logs for API calls made through Nexus Dashboard depends on the **APIC Proxy Mode** configuration:

- Proxy with Nexus Dashboard Service User: The user field contains the Nexus Dashboard service user.
- Proxy with remote user credential (default): The user field contains the APIC user.

# Cloning Templates

This section describes how to create a copy of an existing template using the "Clone Template" feature in the Schema view.

Before deploying a cloned template, change its site association. You cannot deploy templates with identical object names to the same site, regardless of their source template. To avoid deployment failure, rename the objects or associate the cloned template with a different site.

1. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click the schema that contains the template you want to clone.
4. On the **View** menu, select a template to open it.
5. From the **Actions** menu, select **Clone Template**.
6. Provide the clone destination details.
   a. From the **Destination Schema** dropdown, select the name of the Schema where you want to create the clone of the template.

      You can select the same or a different schema to contain the clone of this template. If you want to clone the template into a schema that doesn't already exist, you can create a new schema by typing in the name of the schema and selecting Create <schema-name> option from the dropdown.

      When cloning across different schemas, the template must not have any objects that reference objects in other templates.

   b. In the **Cloned Template Name** field, provide the name for the new template.
   c. Click **Save** to create the clone.

      A new template will be created in the destination schema, with the tenant you selected and the exact same object and policy configurations as the original template.

      If the destination schema you chose was the same schema as the source template, the schema view will reload and the new template will be displayed in the left sidebar. If you chose a different schema, you can navigate to that schema to see and edit the new template.

      Note that while the template objects and configurations are copied, the fabric association is not preserved and you will need to re-associate the cloned template with any fabrics where you want to deploy it. Similarly, you will need to provide any fabric-specific configurations for the template objects after you associate it with the fabrics.

# Migrating objects between templates

This section describes how to move objects between templates or schemas. In Nexus Dashboard 4.1.1, you can now manage and migrate VRF, EPG, External EPG, ESG, contracts, filters, and bridge domain objects.

These restrictions apply when moving objects:

- The source and destination templates can be in the same schema or in different schemas, but the templates must be assigned to the same tenant.
- The destination template must have been created and assigned to at least one fabric.
- If the destination template is not deployed and has no other objects, the template will be automatically deployed after the objects are migrated.
- Within an active migration, you can add more objects from the same source to the same target. Reverse migration of the policies, that is from destination template to source template is supported Nexus Dashboard Release 4.2.1.

1. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click the schema that contains the objects you want to migrate.
4. In the **Schema** view, choose the template that contains the objects you want to migrate.
5. In the main pane, click **Select**.

   This allows you to choose one or more objects to migrate.

6. Click each object that you want to migrate.

   A check mark appears on the chosen objects.

7. In the main pane, click the actions (**...**) ellipsis icon and choose **Migrate objects**.
8. In the **Migrate Objects** wizard, choose the destination schema and template where you want to move the objects.

   Only templates with at least one attached fabric are displayed. If your target template is not in the list, exit the wizard and assign the template to at least one fabric.

9. Click **OK**, and then **Yes** to confirm object migration.

   The selected objects are migrated to the destination template. During configuration deployment, the objects are removed from any fabric using the source template and added to the fabric using the destination template.

10. Bulk deploy both the source and destination templates after migration.

When you migrate a VRF from a stretched template to a newly created un-stretched template, the template modifications for the destination template may incorrectly display as 'Created' instead of 'Migrated' after you deploy the source

template.

a. Select the target template and click **Deploy template**.

b. In the **Summary** page, click **Deploy out of sync templates**.

c. In the **Deploy out of sync templates** page, review the information and click **Deploy out of sync templates** to bulk deploy both the source and destination templates after migration.

# Policy migration and deployment

When migrating policies between templates, both the source and destination templates are deployed together automatically. This ensures that the migration changes are applied consistently across both templates and ensures migration-related dependencies are handled automatically during bulk deployment. However, the validations continue to remain applicable as per the previous behavior for stretched and un-stretched scenarios.

It is recommended to complete the deployment of one migration pair before starting another migration.

# Viewing Currently Deployed Configuration

You can view all objects currently deployed to fabrics from a specific template. Even though any given template can be deployed, undeployed, updated, and re-deployed any number of times, this feature will show only the final state that resulted from all of those actions. For example, if Template1 contains only VRF1 object and is deployed to Fabric1, the API will return only VRF1 for the template; if you then add BD1 and redeploy, the API will return both objects, BD1 and VRF1, from this point on.

This information comes from the Orchestrator database, so it does not account for any potential configuration drifts caused by changes done directly in the fabric's controller.

1. Navigate to the **Orchestration** page.

   **Manage > Orchestration**

2. Choose **Tenant Templates > Applications**.
3. Click the schema that contains the template you want to view.
4. In the left sidebar, select the template.
5. Open the **View Deployed Configuration** for the template.
   a. Click the **Actions** menu next to the template's name.
   b. Click **Deployed View**.
6. In the **Deployed View** screen, select the fabric for which you want to view the information.

   You will see a graphical representation of the template configuration comparison between what's already deployed to the fabric and what's defined in the template.


*Deployment View*

   a. The color-coded legend indicates which objects would be created, deleted, or modified if you were to deploy the template at this time.

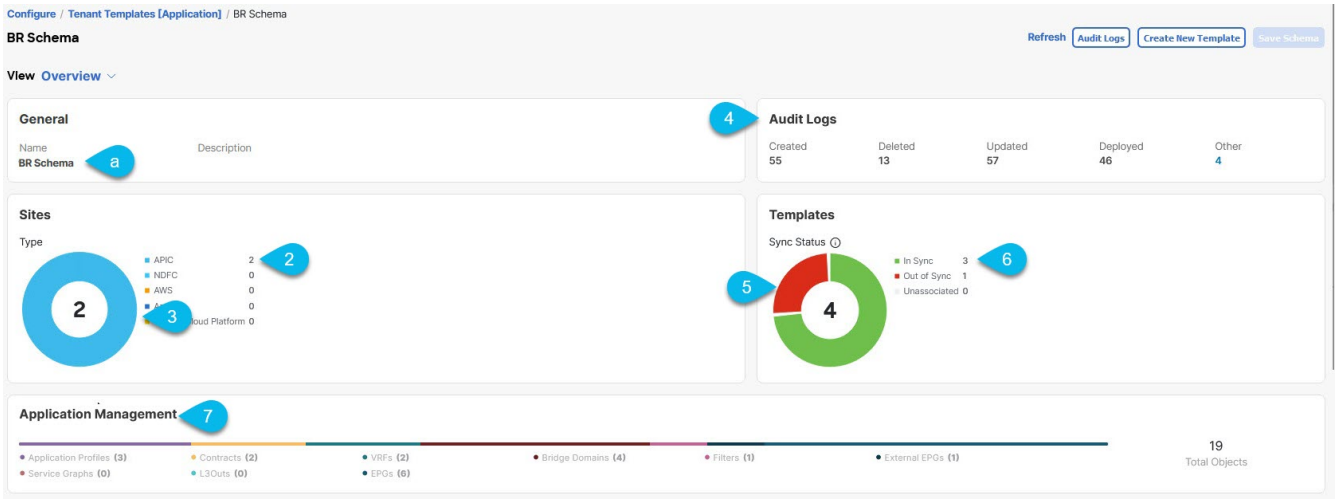
If the latest version of the template is already deployed, the view will not contain any color-coded objects and will simply display the currently deployed configuration.

b. You can click on a fabric name to show configuration for that specific fabric.

c. You can click **View Payload** to see the JSON config of all the objects that are deployed to the selected fabric.

# Schema Overview and Deployment Visualizer

When you open a schema with one or more objects defined and deployed to one or more ACI fabrics, the schema **Overview** page will provide you with a summary of the deployment.




*Schema Overview and Deployment Visualizer*

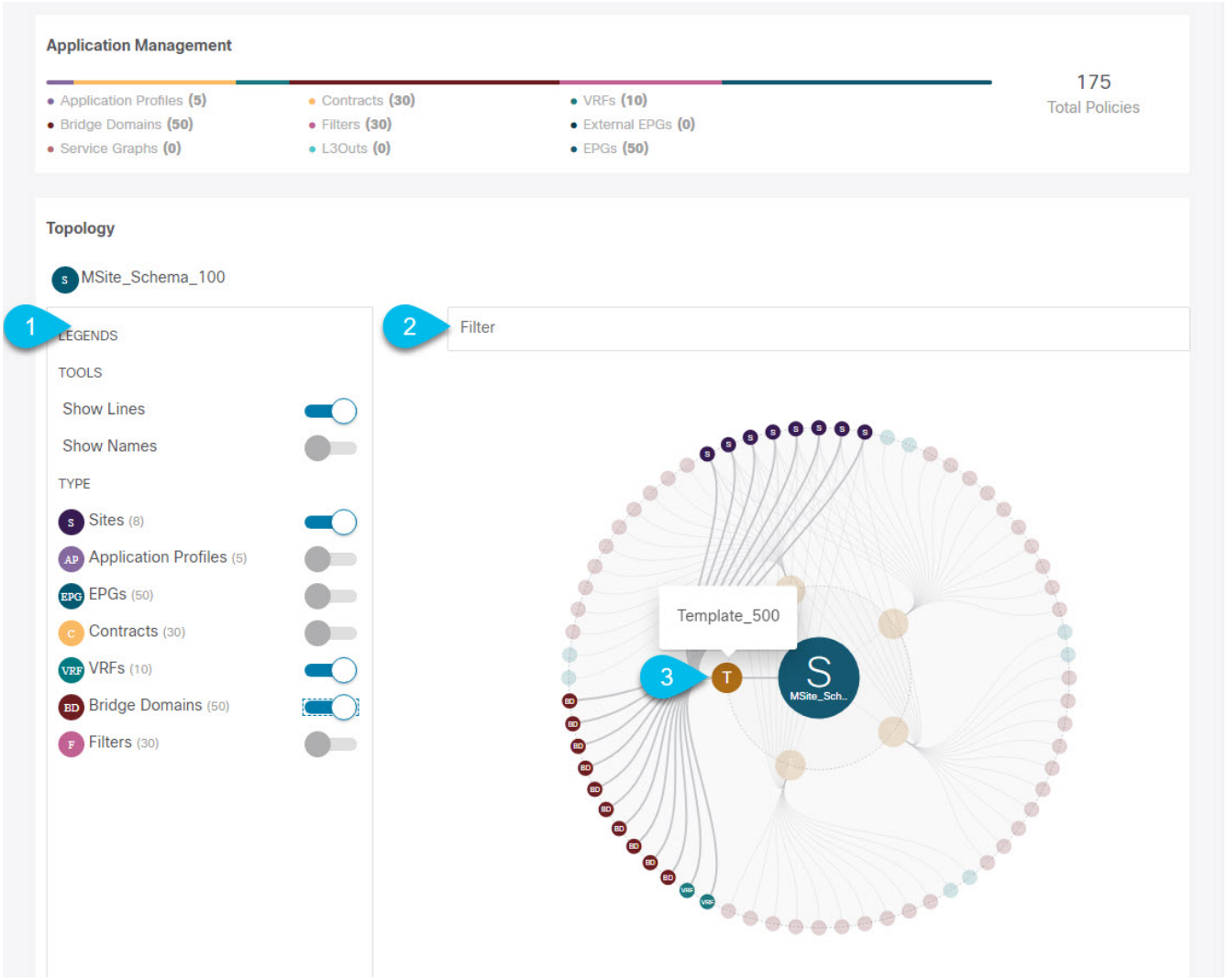
The following details are provided on this page:

1. **General**—Provides general information of the schema, such the name and description.
2. **Deployment Logs**—Provides deployment log summary of the actions performed on the schema.
3. **Fabrics > Health**—Provides the number of fabrics associated with the templates in this schema sorted by the fabric's health status.

   **Type**—Provides the number of fabrics associated with the templates in this schema sorted by the fabric's type.
4. **Templates > Sync Status**—Provides the number of templates in this schema that are associated with one or more fabrics and their deployment status.

   **Fabric Associations > Consistency**—Provides the number of consistency checks performed on the deployed templates and their status.
5. **Application Management**—Provides a summary of individual objects contained by the templates in this schema.

The **Topology** tile allows you to create a topology visualizer by selecting one or more objects to be displayed by the diagram as shown in the following figure.




*Deployment Visualizer*

1. **Legend**—Allows you to choose which policy objects to display in the topology diagram below.
2. **Filter**—Allows you to filter the displayed objects based on their names.
3. **Topology Diagram**—Provides visual representation of the policies configured in all of the Schema's templates that are assigned to fabrics.

   You can choose which objects you want to display using the **Configuration Options** above.

   You can also mouse over an objects to highlight all of its dependencies.

   Finally, you can click on any object in the diagram to zoom in to see only its relationships with other objects. For example, clicking a Template will display all objects within that specific template only.

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