SMF Rolling Software Update

- Feature Summary and Revision History, on page 1
- Feature Description, on page 2
- Updating SMF, on page 2

Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	SMF
Applicable Platform(s)	SMI
Feature Default Setting	Not Applicable
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

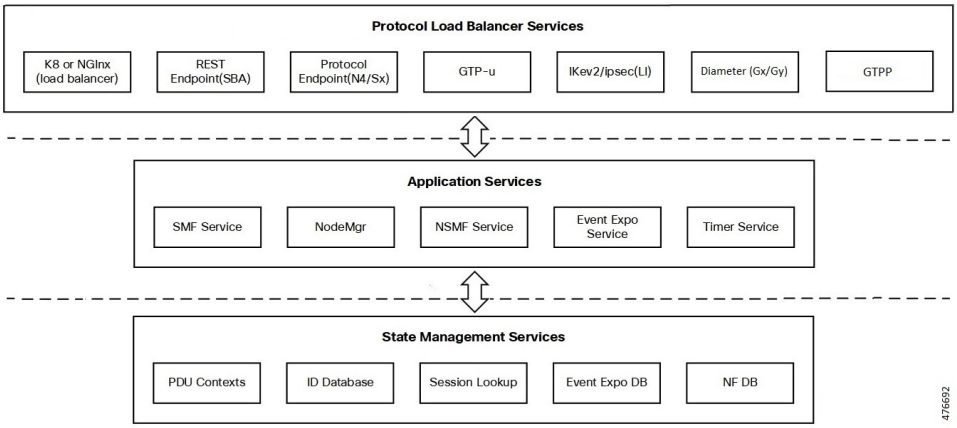
Revision Details	Release
Added Support for Diameter Gx, Gy, and GZ(GTP-Prime)	2023.02.0
First introduced.	Pre-2020.02.0

Feature Description

The Cisco SMF has a three-tier architecture consisting of Protocol, Service, and Session tiers. Each tier includes a set of microservices (pods) for a specific functionality. Within these tiers, there exists a Kubernetes Cluster comprising Kubernetes (K8s) master and worker nodes (including Operation and Management nodes).

For high availability and fault tolerance, a minimum of two K8s worker nodes are required for each tier. You can have multiple replicas for each worker node. Kubernetes orchestrates the pods using the StatefulSets controller. The pods require a minimum of two replicas for fault tolerance.

Figure 1: SMF Architecture



An SMF K8s Cluster contains 12 nodes:

- Three Master nodes.
- Three Operations and Management (OAM) worker nodes.

  OAM worker nodes host the Ops Center pods for configuration management and metrics pods for statistics and Key Performance Indicators (KPIs).
- Two Protocol worker nodes.

  Protocol worker nodes host the SMF protocol-related pods for service-based interfaces (N11, N7, N10, N40, NRF), UDP-based protocol interfaces (N4, S5/S8, RADIUS) and TCP-based interfaces Diameter (Gx/Gy), and GTPP (Gz).
- Two Service worker nodes.

  Service worker nodes host the SMF application-related pods that perform session management processing.
- Two Session (data store) worker nodes.

  Session worker nodes host the database-related pods that store subscriber session data.

Updating SMF

The following section describes the procedure involved in updating the SMF software.

Rolling Software Update Using SMI Cluster Manager

Rolling software upgrade is a process of upgrading or migrating the build from older to newer version or upgrading the patch for the prescribed deployment set of application pods.

Note The 2021.02 release does not support rolling upgrade or in-service upgrade in a non-HA deployment. To upgrade to release 2021.02 in a non-HA deployment, you must perform a fresh SMF deployment from the Ops Center.

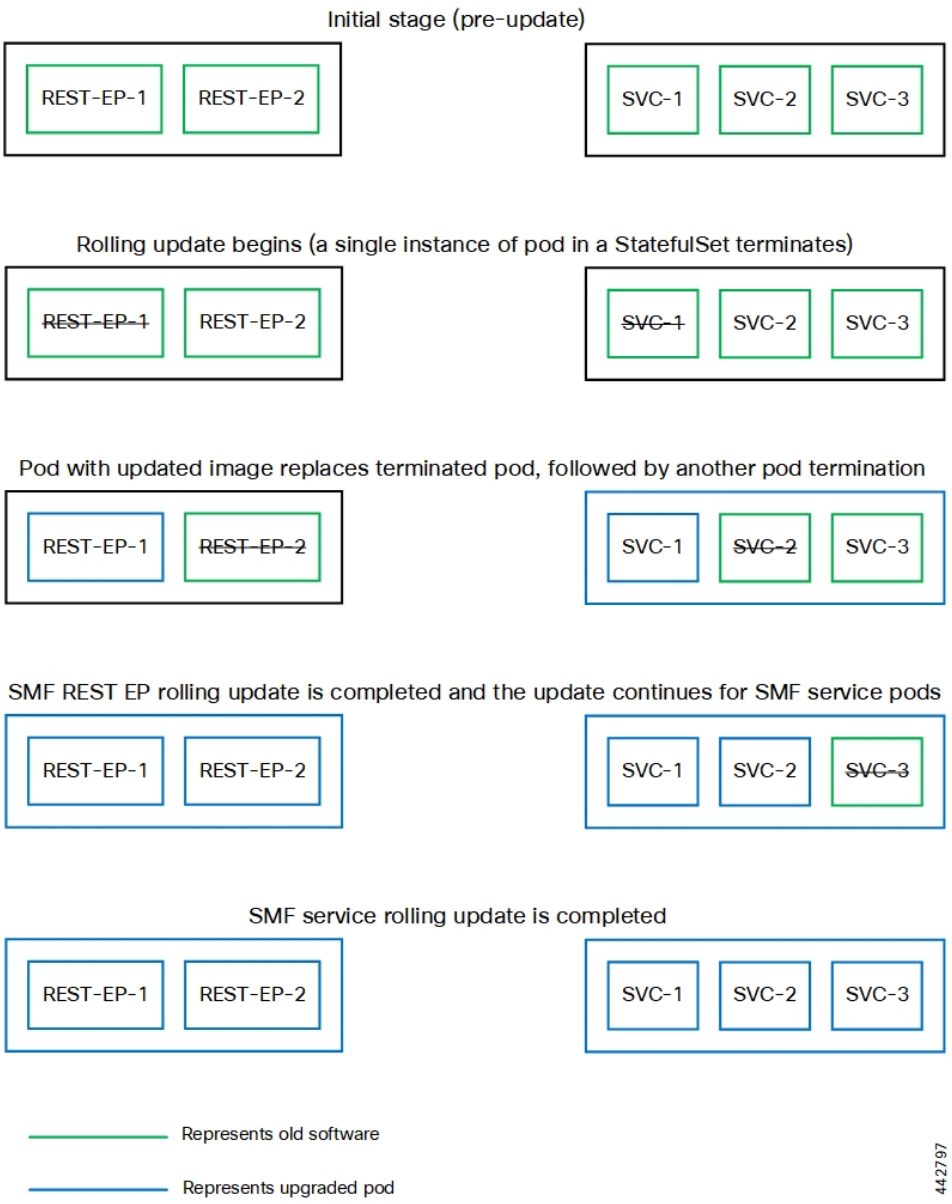
After the fresh deployment is complete, make sure that all the Geo Redundant (GR) instance-aware configuration changes are available. Also, make sure to clean up the etcd entries if the ***etcd persistence*** is enabled through ***k8s volume-claims true*** command. For the clean-up operation, use the ***kubectl exec -it etcd-<namespace>-etcd-cluster-0 -n cn-cn1 -- etcdctl del --prefix ""*** command.

The SMF software update or in-service update procedure utilizes the K8s rolling strategy to update the pod images. In K8s rolling update strategy, the pods of a StatefulSet are updated sequentially to ensure that the ongoing process remains unaffected. Initially, a rolling update on a StatefulSet causes a single pod instance to terminate. A pod with an updated image replaces the terminated pod. This process continues until all the replicas of the StatefulSet are updated. The terminating pods exit gracefully after completing all the ongoing processes. Other in-service pods continue to receive and process the traffic to provide a seamless software update. You can control the software update process through the Ops Center CLI.

Note Each pod needs a minimum of two pods for high availability. In the worst-case scenario, the processing capacity of the pod may reduce to 50% while the software update is in progress.

The following figure illustrates an SMF rolling update for SMF REST Endpoint pods (two replicas) on Protocol worker nodes along with SMF Service pods (three replicas) on Service worker nodes.

Figure 2: SMF Rolling Update



Prerequisites

The prerequisites for upgrading SMF are:

- All the nodes including the pods are active.
- A patch version of the SMF software.

Note Major versions does not support rolling upgrade.

Important Trigger rolling update only when the CPU usage of the nodes is less than 50%.

SMF Health Check

Before you perform health check, ensure that all the services are running and the nodes are in ready state. To perform health check, log on to master node and use the following configuration:

```
kubectl get pods -n smi
kubectl get nodes
kubectl get pod --all-namespaces -o wide
kubectl get pods -n smf-wsp -o wide
kubectl get pods -n cee-wsp -o wide
kubectl get pods -n smi-vips -o wide
helm list
kubectl get pods -A | wc -l
```

Preparing the Upgrade

This section describes the procedure for creating a backup configuration, logs, and deployment files. To backup the files:

1. Log on to the SMI Cluster Manager Node as an **ubuntu** user.
2. Create a new directory for deployment.

   Example:

   ```
   test@smismf-cm01:~$ mkdir -p "temp_$(date +'%m%d%Y_T%H%M')" && cd "$_"
   ```

3. Move all the working files into the newly created deployment directory.
4. Untar the *smf* deployment file.

   Example:

   ```
   test@smi1smf01-cm01:~/temp_08072019_T1651$ tar -xzvf smf.2020.01.0-1.SPA.tgz
   ./
   ./smf_REL_KEY-CCO_RELEASE.cer
   ./cisco_x509_verify_release.py
   ./smf.2020.01.0-1.tar
   ./smf.2020.01.0-1.tar.signature.SPA
   ./smf.2020.01.0-1.tar.SPA.README
   ```

5. Verify the downloaded image.

   Example:

   ```
   test@smi1smf01-cm01:~/temp_08072019_T1651$ cat smf.2020.01.0-1.tar.SPA.README
   ```

Important Follow the procedure mentioned in the *SPA.README* file to verify the build before proceeding to the Back Up Ops Center Configuration section.

Back Up Ops Center Configuration

This section describes the procedure for creating a backup of the Ops Center configurations.

To perform a backup of the Ops Center configurations, use the following steps:

1. Log on to SMI Cluster Manager node as an **ubuntu** user.
2. Run the following command to backup the SMI Ops Center configuration to `/home/ubuntu/smiops.backup` file.

   ssh -p *port_number* **admin@$(kubectl get svc -n smi | grep '.*netconf.*<port_number>' | awk '{ print $4 }') "show run | nomore" > smiops.backup_$(date +'%m%d%Y_T%H%M')**
3. Run the following command to backup the CEE Ops Center configuration to `/home/ubuntu/ceeops.backup` file.

   ssh admin@<cee-vip> "show run | nomore" > ceeops.backup_$(date +'%m%d%Y_T%H%M')
4. Run the following command to backup the SMF Ops Center configuration to `/home/ubuntu/smfops.backup` file.

   ssh admin@<smf-vip> "show run | nomore" > smfops.backup_$(date +'%m%d%Y_T%H%M')

Back Up CEE and SMF Ops Center Configuration

This section describes the procedure to create a backup of CEE and Ops Center configuration from the master node.

To perform a backup of CEE and Ops Center configuration, , use the following steps:

1. Log in to the master node as an **ubuntu** user.
2. Create a directory to backup the configuration files.

   mkdir backups_$(date +'%m%d%Y_T%H%M') && cd "$_"
3. Backup the SMF Ops Center configuration and verify the line count of the backup files.

   ssh -p *port_number* **admin@$(kubectl get svc -n $(kubectl get namespaces | grep -oP 'smf-(\d+|\w+)') | grep***port_number* **| awk '{ print $3 }') "show run | nomore" > smfops.backup_$(date +'%m%d%Y_T%H%M') && wc -l smfops.backup_$(date +'%m%d%Y_T%H%M')**

   Example:

   ```
   ubuntu@posmf-mas01:~/backups_09182019_T2141$ ssh -p 2024 admin@$(kubectl get svc -n
   $(kubectl get namespaces | grep -oP 'smf-(\d+|\w+)') | grep <port_number> | awk '{ print
    $3 }') "show run | nomore" > smfops.backup_$(date +'%m%d%Y_T%H%M') && wc -l
   smfops.backup_$(date +'%m%d%Y_T%H%M')
   admin@<ipv4address>'s password: smf-OPS-PASSWORD
   334 smfops.backup
   ```
4. Backup the CEE Ops Center configuration and verify the line count of the backup files.

   ssh -p *port_number* **admin@$(kubectl get svc -n $(kubectl get namespaces | grep -oP 'cee-(\d+|\w+)') | grep** *port_number* **| awk '{ print $3 }') "show run | nomore" > ceeops.backup_$(date +'%m%d%Y_T%H%M') && wc -l ceeops.backup_$(date +'%m%d%Y_T%H%M')**

   Example:

```
ubuntu@posmf-mas01:~/backups_09182019_T2141$ ssh -p <port_number> admin@$(kubectl get
svc -n $(kubectl get namespaces | grep -oP 'cee-(\d+|\w+)') | grep <port_number> | awk
'{ print $3 }') "show run | nomore" > ceeops.backup_$(date +'%m%d%Y_T%H%M') && wc -l
ceeops.backup_$(date +'%m%d%Y_T%H%M')
admin@<ipv4address>'s password: CEE-OPS-PASSWORD
233 ceeops.backup
```

5. Move the SMI Ops Center backup file from the SMI Cluster Manager to the backup directory.

   scp $(grep cm01 /etc/hosts | awk '{ print $1 }'):/home/ubuntu/smiops.backup_$(date +'%m%d%Y_T%H%M') .

   Example:

```
ubuntu@posmf-mas01:~/backups_09182019_T2141$ scp $(grep cm01 /etc/hosts | awk '{ print
$1 }'):/home/ubuntu/smiops.backup_$(date +'%m%d%Y_T%H%M') .
ubuntu@<ipv4address>'s password: SMI-CM-PASSWORD
smiops.backup                                                 100% 9346    22.3MB/s
   00:00
```

6. Verify the line count of the backup files.

   Example:

```
ubuntu@posmf-mas01:~/backups_09182019_T2141$ wc -l *
  233 ceeops.backup
  334 smfops.backup
  361 smiops.backup
  928 total
```

Staging a New SMF Image

This section describes the procedure for staging a new SMF image before initiating the upgrade.

To stage the new SMF image:

1. Download and verify the new SMF image.
2. Log in to the SMI Cluster Manager node as an **ubuntu** user.
3. Copy the images to **Uploads** directory.

   sudo mv *smf_new_image.tar* **/data/software/uploads**

Note The SMI uses the new image available in the **Uploads** directory to upgrade.

4. Verify whether the image is picked up by the SMI for processing from the **Uploads** directory.

   sleep 30; ls /data/software/uploads

   Example:

```
ubuntu@posmf-cm01:~/temp_08072019_T1651$ sleep 30; ls /data/software/uploads
ubuntu@posmf-cm01:~/temp_08072019_T1651$
```

5. Verify whether the images were successfully picked up and processed.

   Example:

```
auser@unknown:$ sudo du -sh /data/software/packages/*
1.6G /data/software/packages/cee.2019.07
```

```
5.3G /data/software/packages/smf.2019.08-04
16K /data/software/packages/sample
```

The SMI must extract the images into the **packages** directory to complete the staging.

Triggering the Rolling Software Upgrade

The SMF utilizes the SMI Cluster Manager to perform a rolling software update. To update SMF using SMI Cluster Manager, use the following configurations:

Important Before you begin, ensure that SMF is up and running with the latest version of the software.

1. Log in to SMI Cluster Manager Ops Center.
2. Download the latest TAR ball from the URL using the **software-packages download** *url* command.

   NOTES:

   software-packages download *url*: Specify the software packages to be downloaded through HTTP or HTTPS.
3. Verify whether the TAR balls are loaded.

   Example:

   ```
   SMI Cluster Manager# software-packages list
   [ smf-2019-08-21 ]
   [ sample ]
   ```

   NOTES:

   software-packages list: Specify the list of available software packages.
4. Update the product repository URL with the latest version of the product chart.

Note If the repository URL contains multiple versions, the Ops Center automatically selects the latest version.

```
configure
  cluster cluster_name
   ops-centers app_name smf_instance_name
        repository url
         exit
       exit
```

Example:

```
SMI Cluster Manager# config
SMI Cluster Manager(config)# clusters test2
SMI Cluster Manager(config-clusters-test2)# ops-centers smf data
SMI Cluster Manager(config-ops-centers-smf/data)# repository <url>
SMI Cluster Manager(config-ops-centers-smf/data)# exit
SMI Cluster Manager(config-clusters-test2)# exit
```

NOTES:

clusters *cluster_name* : Specify the information about the nodes to be deployed. *cluster_name* is the name of the cluster.

5. Run the following command to update to the latest version of the product chart.

   clusters *cluster_name* **actions sync run**

   Example:

   ```
   SMI Cluster Manager# clusters test2 actions sync run
   ```

NOTES:

- **ops-centers** *app_name instance_name* : Specifies the product Ops Center and instance. *app_name* is the application name. *instance_name* is the name of the instance.
- **repository** *url*: Specify the local registry URL for downloading the charts.
- **actions** : Specify the actions performed on the cluster.
- **sync run** : Trigger the cluster synchronization.

Important

- The cluster synchronization updates the SMF Ops Center, which in turn updates the application pods (through **helm sync** command) one at a time automatically.
- When you trigger rolling upgrade on a specific pod, the SMF avoids routing new calls to that pod.
- The SMF honors in-progress call by waiting for 30 seconds before restarting the pod where rolling upgrade is initiated. Also, the SMF establishes all the in-progress calls completely within 30 seconds during the upgrade period (maximum call-setup time is 10 seconds).

Monitoring the Upgrade

Use the following sample configuration to monitor the status of the upgrade through SMI Cluster Manager Ops Center:

```
config
  clusters cluster_name actions sync run debug true
  clusters cluster_name actions sync logs
  monitor sync-logs cluster_name
  clusters cluster_name actions sync status
  exit
```

NOTES:

- **clusters** *cluster_name*: Specifies the information about the nodes to be deployed. *cluster_name* is the name of the cluster.
- **actions**: Specifies the actions performed on the cluster.
- **sync run**: Triggers the cluster synchronization.
- **sync logs**: Shows the current cluster synchronization logs.
- **sync status**: Shows the current status of the cluster synchronization. **debug true**: Enters the debug mode.

- **monitor sync logs**: Monitors the cluster synchronization process.

Example:

```
SMI Cluster Manager# clusters test1 actions sync run
SMI Cluster Manager# clusters test1 actions sync run debug true
SMI Cluster Manager# clusters test1 actions sync logs
SMI Cluster Manager# monitor sync-logs test1
SMI Cluster Manager# clusters test1 actions sync status
```

Important You can view the pod details after the upgrade through CEE Ops Center. For more information on pod details, see Viewing the Pod Details section.

Viewing the Pod Details

Use the following sample configuration to view the details of the current pods through CEE Ops Center in CEE Ops Center CLI:

`cluster pods` *`instance_name pod_name`* **`detail`**

NOTES:

- **cluster pods** – Specifies the current pods in the cluster.
- *instance_name* – Specifies the name of the instance.
- *pod_name* – Specifies the name of the pod.
- **detail** – Displays the details of the specified pod.

The following example displays the details of the pod named *alertmanager-0* in the *smf-data* instance.

Example:

```
cee# cluster pods smf-data alertmanager-0 detail
details apiVersion: "v1"
kind: "Pod"
metadata:
  annotations:
    alermanager.io/scrape: "true"
    cni.projectcalico.org/podIP: "<ipv4address/subnet>"
    config-hash: "5532425ef5fd02add051cb759730047390b1bce51da862d13597dbb38dfbde86"
  creationTimestamp: "2020-02-26T06:09:13Z"
  generateName: "alertmanager-"
  labels:
    component: "alertmanager"
    controller-revision-hash: "alertmanager-67cdb95f8b"
    statefulset.kubernetes.io/pod-name: "alertmanager-0"
  name: "alertmanager-0"
  namespace: "smf"
  ownerReferences:
  - apiVersion: "apps/v1"
    kind: "StatefulSet"
    blockOwnerDeletion: true
    controller: true
    name: "alertmanager"
    uid: "82a11da4-585e-11ea-bc06-0050569ca70e"
  resourceVersion: "1654031"
  selfLink: "/api/v1/namespaces/smf/pods/alertmanager-0"
  uid: "82aee5d0-585e-11ea-bc06-0050569ca70e"
```

```
spec:
  containers:
  - args:
    - "/alertmanager/alertmanager"
    - "--config.file=/etc/alertmanager/alertmanager.yml"
    - "--storage.path=/alertmanager/data"
    - "--cluster.advertise-address=$(POD_IP):6783"
    env:
    - name: "POD_IP"
      valueFrom:
        fieldRef:
          apiVersion: "v1"
          fieldPath: "status.podIP"
    image: "<path_to_docker_image>"
    imagePullPolicy: "IfNotPresent"
    name: "alertmanager"
    ports:
    - containerPort: 9093
      name: "web"
      protocol: "TCP"
    resources: {}
    terminationMessagePath: "/dev/termination-log"
    terminationMessagePolicy: "File"
    volumeMounts:
    - mountPath: "/etc/alertmanager/"
      name: "alertmanager-config"
    - mountPath: "/alertmanager/data/"
      name: "alertmanager-store"
    - mountPath: "/var/run/secrets/kubernetes.io/serviceaccount"
      name: "default-token-kbjnx"
      readOnly: true
  dnsPolicy: "ClusterFirst"
  enableServiceLinks: true
  hostname: "alertmanager-0"
  nodeName: "for-smi-cdl-1b-worker94d84de255"
  priority: 0
  restartPolicy: "Always"
  schedulerName: "default-scheduler"
  securityContext:
    fsGroup: 0
    runAsUser: 0
  serviceAccount: "default"
  serviceAccountName: "default"
  subdomain: "alertmanager-service"
  terminationGracePeriodSeconds: 30
  tolerations:
  - effect: "NoExecute"
    key: "node-role.kubernetes.io/oam"
    operator: "Equal"
    value: "true"
  - effect: "NoExecute"
    key: "node.kubernetes.io/not-ready"
    operator: "Exists"
    tolerationSeconds: 300
  - effect: "NoExecute"
    key: "node.kubernetes.io/unreachable"
    operator: "Exists"
    tolerationSeconds: 300
  volumes:
  - configMap:
      defaultMode: 420
      name: "alertmanager"
    name: "alertmanager-config"
  - emptyDir: {}
```

```
    name: "alertmanager-store"
  - name: "default-token-kbjnx"
    secret:
      defaultMode: 420
      secretName: "default-token-kbjnx"
status:
  conditions:
  - lastTransitionTime: "2020-02-26T06:09:02Z"
    status: "True"
    type: "Initialized"
  - lastTransitionTime: "2020-02-26T06:09:06Z"
    status: "True"
    type: "Ready"
  - lastTransitionTime: "2020-02-26T06:09:06Z"
    status: "True"
    type: "ContainersReady"
  - lastTransitionTime: "2020-02-26T06:09:13Z"
    status: "True"
    type: "PodScheduled"
  containerStatuses:
  - containerID: "docker://821ed1a272d37e3b4c4c9c1ec69b671a3c3fe6eb4b42108edf44709b9c698ccd"

    image: "<path_to_docker_image>"
    imageID: "docker-pullable://<path_to_docker_image>"
    lastState: {}
    name: "alertmanager"
    ready: true
    restartCount: 0
    state:
      running:
        startedAt: "2020-02-26T06:09:05Z"
  hostIP: "<host_ipv4address>"
  phase: "Running"
  podIP: "<pod_ipv4address>"
  qosClass: "BestEffort"
  startTime: "2020-02-26T06:09:02Z"
cee#
```