Elastic Services Controller Overview

Cisco Elastic Services Controller (ESC) is a Virtual Network Functions Manager (VNFM) managing the lifecycle of Virtual Network Functions (VNFs). ESC provides agentless and multi vendor VNF management by provisioning the virtual services. ESC monitors the health of VNFs , promotes agility, flexibility, and programmability in Network Function Virtualization (NFV) environments. It provides the flexibility to define rules for monitoring and associate actions that are triggered based on the outcome of these rules. Based on the monitoring results, ESC performs scale in or scale out operations on the VNFs. In the event of a VM failure ESC also supports automatic VM recovery.

ESC fully integrates with Cisco and other third party applications. As a standalone product, the ESC can be deployed as a VNF Manager. ESC integrates with Cisco Network Services Orchestrator (NSO) to provide VNF management along with orchestration. ESC as a VNF Manager targets the virtual managed services and all service provider NFV deployments such as virtual packet core, virtual load balancers, virtual security services and so on. Complex services include multiple VMs that are orchestrated as a single service with dependencies between them.

Change History

Table 1: Change History for ESC 5.0

Date	Revision	Location
September 10, 2019	Updated with the affinity and anti-affinity for openstack.	Inter Group Anti-Affinity Policy
September 15, 2019	Updated with a note.	Deploying Virtual Network Functions on VMware vCenter
January 05, 2020	Updated with the notification for VM monitoring status.	Notification for VM Monitoring Status

Key Features of Elastic Services Controller

- Provides open and modular architecture, which allows multi-vendor OSS, NFVO, VNF and VIM support.
- Provides end-to-end dynamic provisioning and monitoring of virtualized services using a single point of configuration.
- Provides customization across different phases of lifecycle management; while monitoring the VM, service advertisement, and custom actions.
- Provides agentless monitoring with an integrated Monitoring Actions (MONA) engine. The monitoring engine provides simple and complex rules, to decide scale in and scale out of VMs.
- Provides scale in and scale out options based on the load of the network.
- Deploys, reboots or redeploys VMs based on the monitoring errors and threshold conditions detected as part of healing (also known as recovery).
- Supports service agility by providing faster VNF deployment and life cycle management.
- Supports multi-tenant environments.
- Supports deploying VMs on multiple VIMs (OpenStack only).
- Supports non admin roles for ESC users on OpenStack.
- Supports IPv6 on OpenStack.
- Supports dual stack network on OpenStack
- Supports REST and NETCONF / YANG interfaces providing hierarchical configuration and data modularity.
- Supports ETSI MANO interface for a subset of VNF lifecycle management operations.
- Supports ETSI performance reports.
- Supports deploying VMs on Single or multiple AWS VIMs.
- Supports deploying vApps on VMware vCloud Director VIM using both ESC REST and ETSI APIs.
- Supports deploying and monitoring D-MONA in an Active/Active setup. The Distributed Monitoring and Actions (D-MONA) is a standalone monitoring component for monitoring VNFs.

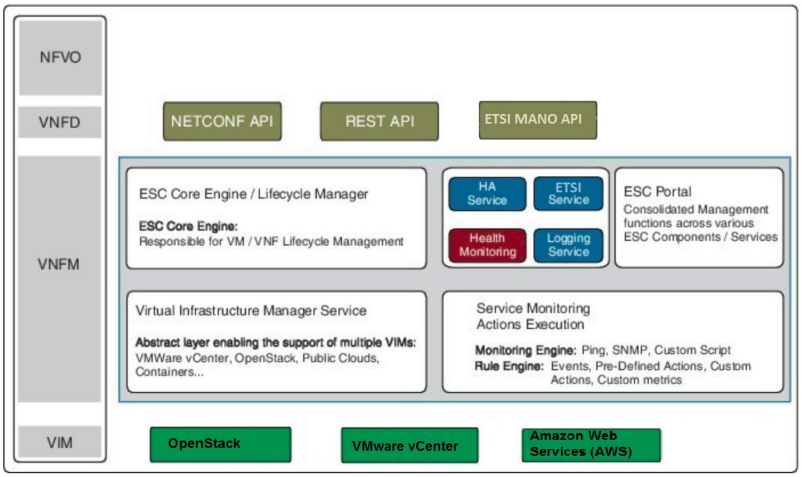
ESC Architecture

Cisco Elastic Services Controller (ESC) is built as an open and modular architecture, that allows multi-vendor support. It performs lifecycle management of the VNFs, that is, onboarding the VNFs, deploying, monitoring, and making VNF level lifecycle decisions such as healing and scaling based on the KPI requirements. ESC and its managed VNFs are deployed as VMs running within a Virtual Infrastructure Manager (VIM). Currently, OpenStack, VMware vCenter and AWS are the supported VIMs. The ESC core engine manages transactions, validations, policies, workflows, and VM state machines. The monitoring and actions service engine in ESC performs monitoring based on several monitoring methods. Events are triggered based on the monitoring actions. The monitoring engine also supports custom monitoring plugins.

ESC can be configured for High Availability. For details, see the Cisco Elastic Services Controller Install and Upgrade Guide.

ESC interacts with the top orchestration layer using the REST, NETCONF/YANG and ETSI NFV MANO NB APIs (ETSI APIs). The orchestration layer can be a Cisco NSO or any third party OSS or NFV Orchestrator. ESC integrates with NSO using NETCONF/YANG northbound interface support. A configuration template, Virtual Network Function Descriptor (VNFD) file is used to describe the deployment parameters and operational behaviors of the VNFs. The VNFD file is used in the process of onboarding a VNF and managing the lifecycle of a VNF instance. The figure below represents the Cisco Elastic Services Controller architecture.

Figure 1: Cisco Elastic Services Controller Architecture



Understanding the ESC Lifecycle

Cisco Elastic Services Controller (ESC) provides a single point of control to manage all aspects of VNF lifecycle for generic virtual network functions (VNFs) in a dynamic environment. It provides advanced VNF lifecycle management capabilities through an open, standards-based platform that conforms to the ETSI VNF management and orchestration (MANO) reference architecture.

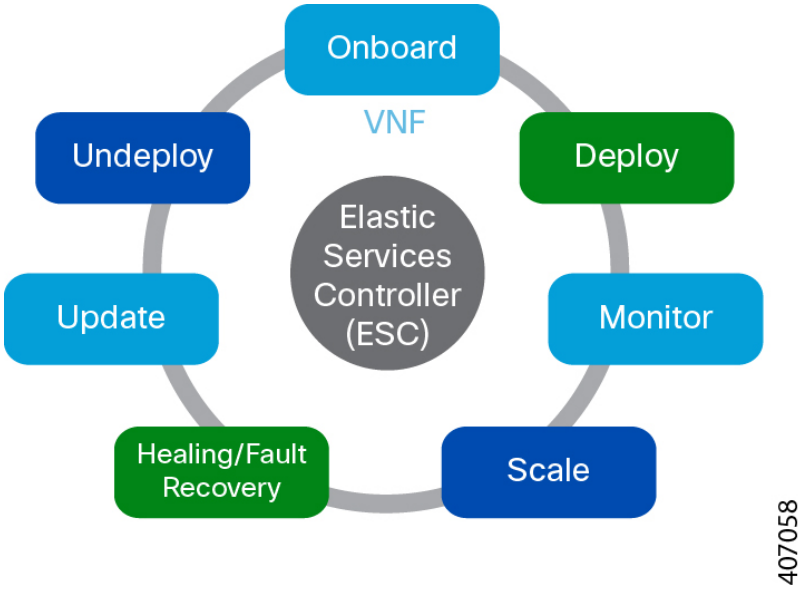
You can orchestrate VNFs within a virtual infrastructure domain—either on OpenStack or VMware vCenter. A VNF deployment is initiated as a service request. The service request comprises of templates that consist of XML payloads and configuration parameters.

Note You can deploy VNFs either on OpenStack or VMware vCenter. A hybrid VNF deployment is not supported.

ESC manages the complete lifecycle of a VNF. A VNF deployment is initiated as a service request through northbound interface or the ESC portal.

The figure explains the lifecycle management of ESC:

Figure 2: ESC Lifecycle



- **Onboarding**—In ESC, you can onboard any new VNF type as long as it meets the prerequisites for supporting it on OpenStack and VMware vCenter. For example on Openstack, Cisco ESC supports raw image, qcow2 and vmdk disk formats. ESC also supports config drive for the VNF bootstrap mechanism. You can define the XML template for the new VNF type to onboard the VNF with ESC.

  Using ETSI API, the VNF is onboarded to the NFVO. For more information, see prerequisites in the VNF Lifecycle Operations section in the *Cisco Elastic Services Controller ETSI NFV MANO User Guide*.

- **Deploying**—When a VNF is deployed, ESC applies Day Zero configuration for a new service. A typical configuration includes credentials, licensing, connectivity information (IP address, gateway), and other static parameters to make the new virtual resource available to the system. It also activates licenses for the new VNFs.

  An identifier is created using the ETSI API at this stage of the lifecycle. For more information, see the Creating VNF Identifier section in the *Cisco Elastic Services Controller ETSI NFV MANO User Guide*.

- **Monitoring**—ESC monitors the health of virtual machines using various methodologies including ICMP Ping, SNMP and so on. It tracks performance metrics such as CPU use, memory consumption, and other core parameters. The requester can specify all of the characteristics (for example, vCPU, memory, disk, monitoring KPIs, and more) typically associated with spinning up and managing a virtual machine in an XML template. It also provides an elaborate framework to monitor service performance-related metrics and other key parameters that you define.

- **Healing**—ESC heals the VNFs when there is a failure. The failure scenarios are configured in the KPI section of the data model. ESC uses KPI to monitor the VM and the events are triggered based on the KPI conditions. The actions to be taken for every event that is triggered is configured in the rules section during the deployment.

- **Updating**—ESC allows deployment updates after a successful deployment. You can either perform all the updates (that is, add or delete a vm_group, add or delete an ephemeral network in a vm_group, and add or delete an interface in a vm_group) in a single deployment or individually.

- **Undeploy**—ESC allows you to undeploy an already deployed VNF. This operation is either done using the northbound APIs or through the ESC portal.

  While deleting VNFs using the ETSI API, any associated identifier is also deleted.

Note For the complete VNF lifecycle operations using the ETSI API, see the *Cisco Elastic Services Controller ETSI NFV MANO User Guide*.

The following section explains how to deploy VNFs on OpenStack and VMware vCenter:

Deploying VNFs on OpenStack

In ESC, VNF deployment is initiated as a service request either originating from the ESC portal or the northbound interfaces. The service request comprises of templates that consist of XML payloads. These resources must either be available on OpenStack or can be created in ESC using the ESC portal or the northbound interfaces. For more information on managing resources in ESC, see Managing Resources Overview. The *deployment data model* refers to the resources to deploy VNFs on OpenStack.

Based on how the resources are setup, you can deploy VNFs in one of the following ways:

Scenarios	Description	Resources	Advantages
Deploying VNFs on a single VIM by creating images and flavors through ESC	The *deployment data model* refers to the images and flavors created and then deploys VNFs.	Images and Flavors are created through ESC using NETCONF/REST APIs.	• The images and flavors can be used in multiple VNF deployments. • You can delete resources (images, flavors, and volumes) created by ESC.
Deploying VNFs on a single VIM using out-of-band images, flavors, volumes, and ports	The *deployment data model* refers to the out-of-band images, flavors, volumes, and ports in OpenStack and then deploys VNFs.	Images, Flavors, Volumes, and Ports are not created through ESC.	• The images, flavors, volumes, ports can be used in multiple VNF deployments. • You cannot delete resources that are not created by through ESC.
Deploying VNFs on multiple VIMs using out-of-band resources	The *deployment data model* refers to out-of-band images, flavors, networks and VIM projects and then deploys VNFs.	Images, Flavors, VIM projects (specified in the locators) and Networks are not created through ESC. They must exist out-of-band in the VIM.	You can specify the VIM (to deploy VMs) that needs to be configured in ESC within a deployment.

Note For more information on Deploying VNFs on OpenStack, see Deploying Virtual Network Functions on OpenStack .

Deploying VNFs on VMware vCenter

In ESC, VNF deployment is initiated as a service request either originating from the ESC portal or the Northbound interface. The service request comprises of templates that consist of XML payloads such as Networks, Images, and so on. These resources must be available on VMware vCenter. For more information on managing VM resources in ESC, see Managing Resources Overview. The *deployment data model* refers to the resources to deploy VNFs on VMware vCenter.

When you deploy VNFs on VMware vCenter, you can either use the out-of-band images that are already available on VMware vCenter or create an image in the ESC portal or using REST APIs. For more information on creating images in the ESC portal, see Managing Images. The *deployment data model* refers to these images to deploy VNFs.

Scenarios	Description	data model templates	Images	Advantages
Deploying VNFs on a single VIM by creating Images through ESC **Important** Images are also referred to as Templates on VMware vCenter.	The process of VNF deployment is as follows: 1. VNF Deployment- The *deployment data model* refers to the images created and then deploys VNFs.	• *deployment data model* • *image data model*	Images are created through ESC using REST APIs.	• The images can be used in multiple VNF deployments. • You can add or delete image definitions through ESC.
Deploying VNFs on a single VIM using out-of-band images	1. VNF Deployment- The *deployment data model* refers to the out-of-band images on VMware vCenter and then deploys VNFs.	• *deployment data model* • Image on VMware vCenter	Images cannot be created or deleted through ESC.	• The images can be used in multiple VNF deployments. • You can view images through ESC portal. • During out-of -band deployment, you can choose images.

For more information on Deploying VNFs on VMware vCenter, see Deploying Virtual Network Functions on VMware vCenter.