ALTEON KUBERNETES CONNECTOR USER GUIDE

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CHAPTER 1 – OVERVIEW

This document details the Alteon Kubernetes Connector operation.

The Alteon Kubernetes Connector

When running an application inside a Kubernetes cluster, you need to provide a way for external users to access the applications from outside the cluster.

You can use an ingress controller to route traffic from outside to your Kubernetes cluster through a load balancer. It simplifies the network traffic management for your Kubernetes cluster and directs the requests to the right services, in other words, it connects the incoming requests for your applications to the specific server that handles them.

The Alteon Kubernetes Connector (AKC) is a solution that integrates Alteon ADC with Kubernetes/ OpenShift orchestration, allowing you to automatically load balance traffic for your Kubernetes workloads.

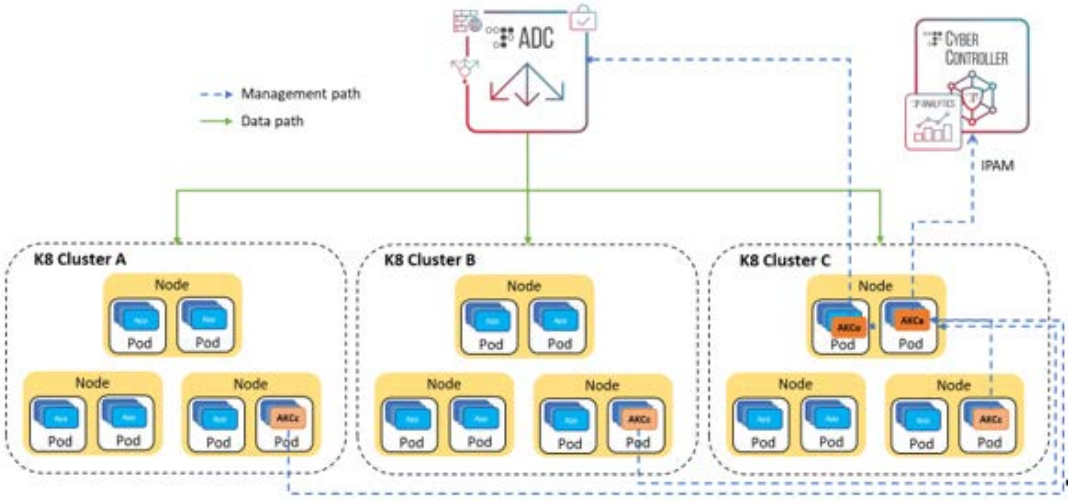
The Alteon Kubernetes Connector (AKC) discovers services in the Kubernetes cluster and translates them to Alteon ADC configuration. It also looks for the addition or removal of nodes/pods from the Kubernetes clusters and communicates the changes to Alteon to keep the Alteon configuration in sync.

Using AKC ability to discover and aggregate service that runs in multiple clusters, Alteon can provide load balancing and high availability between clusters.

The AKC has three components:

- The AKC Controller - discovers the service objects in the Kubernetes clusters. Such a component is required in each of the participating Kubernetes clusters.
- The AKC Aggregator - aggregates inputs from all the controllers and communicates the necessary configuration changes to AKC Configurator.
- The AKC Configurator - prepares Alteon configuration file and pushes it to the Alteon device.

In addition, the solution uses the vDirect module in Cyber Controller (or APSolute Vision), which handles IPAM service, required to allocate service IP (VIP) from an IP pool (currently a single pool is supported).



AKC Deployment Architecture

AKC Controller

The AKC controller fulfills the following tasks:

- It scans the cluster services and nodes to detect new services deployed in the cluster as well as changes in existing services, such as nodes being added or removed.
- When a service is being deployed, the controller also validates that the required parameters are valid - for example the specified SLB metric is available in Alteon, or the specified health check is configured in Alteon. If the validation fails, the operation on the service will not be permitted by Kubernetes and hence that service won't be opened in Alteon.
- It sends to the aggregator the map of services and nodes/pods relevant for Alteon.

Controller Reconciliation

To detect and correct any discrepancies that may arise due to failures or changes in the cluster's resources, the controller performs periodic cluster resync process. The controller retrieves the current state of the resources from the Kubernetes API server and compares it to its internal state. If there are any differences, the controller takes the necessary actions to bring its internal state in line with the current state of the resources. The interval at which AKC Controller performs reconciliation is defined during the controller deployment.

AKC Aggregator

The AKC Aggregator is deployed in one of the clusters and when it receives new configuration maps from the AKC controllers it performs the following tasks:

- If the namespace and service name combination is new, and if static IP was not mentioned in the service manifest, it contacts Cyber Controller vDirect module IPAM service to allocate an IP address for this new service (VIP).
- It prepares Alteon configuration updates (either new virtual service, group and servers, or just new servers for existing service, when the K8s service is already deployed in additional clusters) and sends it to the AKC Configurator.

  When the same service LoadBalancer resource, with the same service name and same namespace is deployed in multiple clusters, this component aggregates the nodes/pods relevant to this service from the different clusters as real servers belonging to the same service. This enables Alteon to distribute the service traffic between nodes/pods in different clusters. In such scenario it is important that the AKC annotations used for a service have the same value in all clusters deployment, otherwise there will be a conflict and service deployment on Alteon will fail.

  Note that same service aggregation over multiple clusters is only supported for service LoadBalancer resource deployment and not for ingress resource deployment.
- Once Alteon configuration is completed and applied, the Aggregator updates AKC Controller with the new service IP.

Aggregator Reconciliation

To ensure the aggregator recovers from unknown errors and missed events, it performs periodic reconciliation process with the AKC Controllers.

The aggregator clears its internal service tables and sends a request for configuration maps to all the controllers. It then aggregates all answers, rebuilds updated service tables and sends latest configuration to AKC Configurator.

AKC Configurator

The AKC Configurator is deployed in the same cluster as the AKC Aggregator. When it receives from the aggregator the necessary configuration changes:

- It translates them to Alteon configuration and prepares updated configuration file
- Pushes the new configuration file to the Alteon device
- Applies and saves the new configuration

The AKC creates and updates the following type of Alteon objects: virtual server, virtual service, group and server.

- The id of all the objects created by AKC for a service starts with AKC_<K8s service name>, for easy identification.
- Configuration of such objects should not be manually edited on Alteon - they will be overwritten on the next configuration update performed by the configurator.

Important! Only one Aggregator and one Configurator can operate vis-a-vis an Alteon device/pair. When an Alteon device/pair manages traffic to multiple Kubernetes clusters the Aggregator and Configurator components must be installed in only one of the clusters, and only the Controller component must be installed in all the clusters.

Related Alteon Documentation

Alteon Application Switches have the following related documentation, which is required to regularly manage the Alteon platform.

- Alteon Installation and Maintenance Guide
- Alteon Command Line Interface Reference Guide
- Alteon Command Line Interface Application Guide
- Alteon Web-Based Management Application Guide
- Alteon Web-Based Management Getting Started Guide
- Alteon OS Release Notes

CHAPTER 2 – AKC DEPLOYMENT

This section describes the procedure required for deploying the AKC components, Aggregator, Configurator, and Controller, in a Kubernetes or OpenShift environment. It includes the following topics:

Note: Only one cluster should have all the AKC components deployed (Aggregator, Configurator, and Controller). All the other clusters should have only a Controller installed.

Deployment Prerequisites

Before deploying the Alteon Kubernetes Controller the following tasks are required:

1. The Alteon device that will be load balancing the K8s workloads is installed and its management interface accessible from the Kubernetes clusters.
2. If you wish to dynamically allocate service IPs (VIPs) make sure that:
   - Cyber Controller (or legacy APSolute Vision) is installed and is accessible from the Kubernetes clusters.
   - The IPAM service is up and running, an IPAM pool is configured, and an IPAM workflow created. See IPAM Service Configuration, page 12.
3. Ensure that you have the following versions installed:
   - OpenShift version 4.10 or later
   - Kubernetes version 1.24.2 or later
4. Prepare AKC files for installation:
   - Download the AKC package from the Radware Customer portal.
   - From the AKC package file (AKC_<version>.tgz) extract the AKC_<version>.tar file.
   - Extract the content of the AKC_<version>.tar.
5. Generate SSL key and certificate for AKC Controller use and create YAML secret for it. This is not required if you are deploying AKC in default namespace. See Non-Default Controller Key and Certificate Pair, page 16.

Deploying Aggregator, Configurator, and Controller on a Cluster

The following procedure is required for deploying the Aggregator and Controller on the same cluster.

1. Add the **akc_aggregator_<version>.tar, akc_configurator_<version>.tar** and **akc_controller_<version>.tar** container images provided in the AKC package (found under the **services** directory) to the Kubernetes/OpenShift environment image repository.
2. Install the Helm application on your cluster.

3. Copy the AKC Helm file (**akc-<version>.tgz** file found under Helm directory) to your local registry.
4. Connect to the cluster where you want to install the Aggregator and the Controller.
5. Install the helm chart. For an explanation on the helm parameters see Chapter 4. (An explanation is also available in the README file provided with the release.)

Below is an example for AKC version 1.4.0:

```
$ helm install radware-akc akc-1.4.0.tgz \
--set global.namespace=default \
--set controller.enabled=true \
--set controller.uid=akc_local \
--set controller.aggregator_ip=akc-aggregator.default.svc.cluster.local \
--set controller.image.repository=myrepository:8081/dev/akc-controller \
--set controller.image.tag=8 \
--set controller.controller_reconcile_period=3600 \
--set controller.webhook.enabled=true \
--set controller.secret.crt=base64 encoded certificate \
--set controller.secret.key=base64 encoded key
--set aggregator.enabled=true \
--set aggregator.configurator.ip=akc-configurator.default.svc.cluster
.local\
--set aggregator.configurator.port=30188 \
--set aggregator.configurator.protocol=http \
--set aggregator.ipam.workflow=ipam_workflow \
--set aggregator.ipam.pool=ipam_pool \
--set aggregator.ipam.ip=10.175.150.228 \
--set aggregator.ipam.port=2189 \
--set aggregator.ipam.protocol=https \
--set aggregator.ipam.user=admin \
--set aggregator.ipam.pass=radware \
--set aggregator.image.repository=myrepository:8081/dev/akc-aggregator \
--set aggregator.image.tag=latest \
--set configurator.enabled=true \
--set configurator.alteon.master_ip=10.175.101.203 \
--set configurator.alteon.backup_ip=10.175.101.205 \
--set configurator.alteon.user=admin \
--set configurator.alteon.pass=admin1 \
--set configurator.image.repository=myrepository:8081/dev/akc-configurator
--set configurator.image.tag=latest
```

Note: If service IPs will be manually allocated there is no need for the aggregator.ipam parameters.

Deploying the Controller

The following procedure is required for deploying the Controller only.

1. Add the **akc_controller_<version>.tar** files provided in the AKC package (found under the **services** directory) to the Kubernetes/OpenShift environment image repository.
2. Install the Helm application on your cluster.
3. Copy the AKC Helm file (**akc-<version>.tgz** file found under Helm directory) to your local registry.
4. Install the helm chart. For an explanation on the helm parameters please see Chapter 4. (An explanation is also available in the README file provided with the release.)

Below is an example for AKC version 1.4.0:

```
$ helm install radware-akc akc-1.4.0.tgz \
--set global.namespace=default \
--set controller.enabled=true \
--set controller.uid=akc_remote \
--set controller.aggregator_ip=10.2.2.2 \
--set controller.aggregator_port=30051 \
--set controller.image.repository=myrepository:8081/dev/akc-controller \
--set controller.image.tag=8 \
--set controller.controller_reconcile_period=3600 \
--set controller.webhook.enable=true \
--set controller.secret.crt=base64 encoded certificate \
--set controller.secret.key=base64 encoded key \
--set aggregator.enabled=false
```

Replacing a Cluster with Aggregator Deployment

The following procedure is required for replacing a faulty cluster that was deployed with an Aggregator, Configurator, and Controller.

1. If possible, uninstall the Aggregator, Configurator, and Controller on the cluster you want to replace, by entering the following command:

   ```
   helm uninstall radware-akc
   ```

2. If there is no communication to the cluster you want to replace, such that you cannot uninstall the helm, in order to avoid collisions, redeploy the Aggregator, Configurator, and Controller on the new cluster by using the procedure detailed in the section Deploying Aggregator, Configurator, and Controller on a Cluster, page 9 above.
3. Check the new Aggregator IP and redeploy the Controller with the new Aggregator IP on all other clusters that should have Controller only deployment by using the procedure detailed in the section Deploying the Controller, page 11 above.

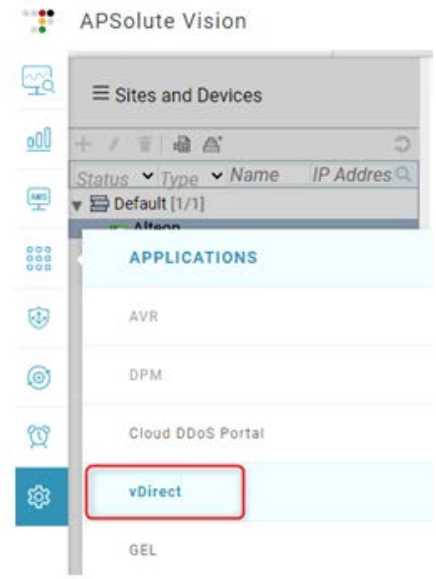
IPAM Service Configuration

The following procedure is required to allow AKC to allocate service IPs via IPAM (IP address management). If the service VIP is allocated manually upon service deployment this section is not required.

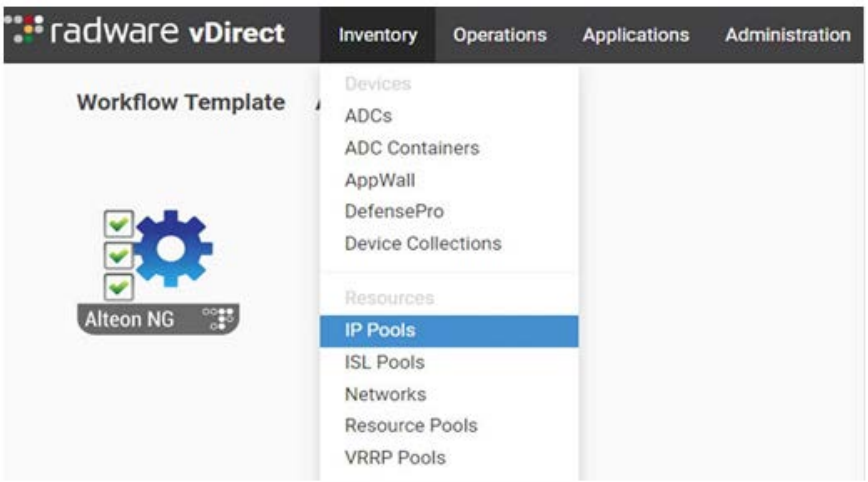
- Configure IP Pool
- Upload and activated the vDirect workflow that handles the IPAM.

To configure IPAM services

1. Login into Cyber Controller.
2. Open **vDirect** from the *Applications* menu.

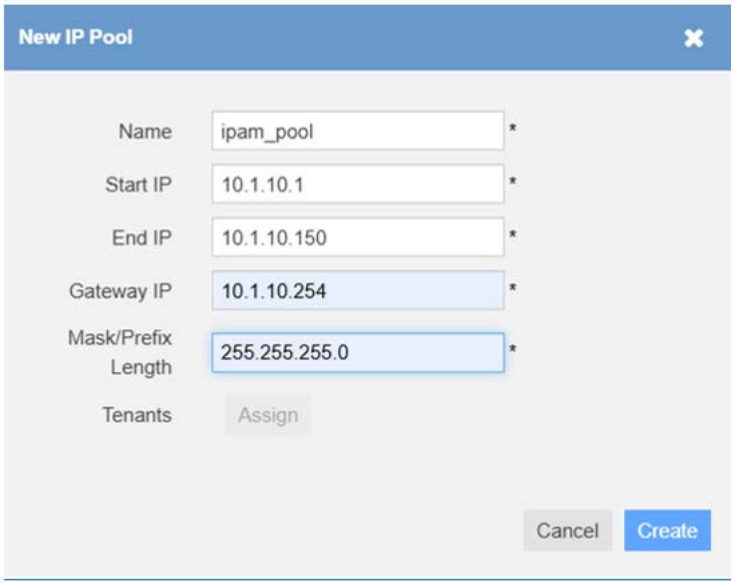


3. Go to **Inventory -> IP Pools.**



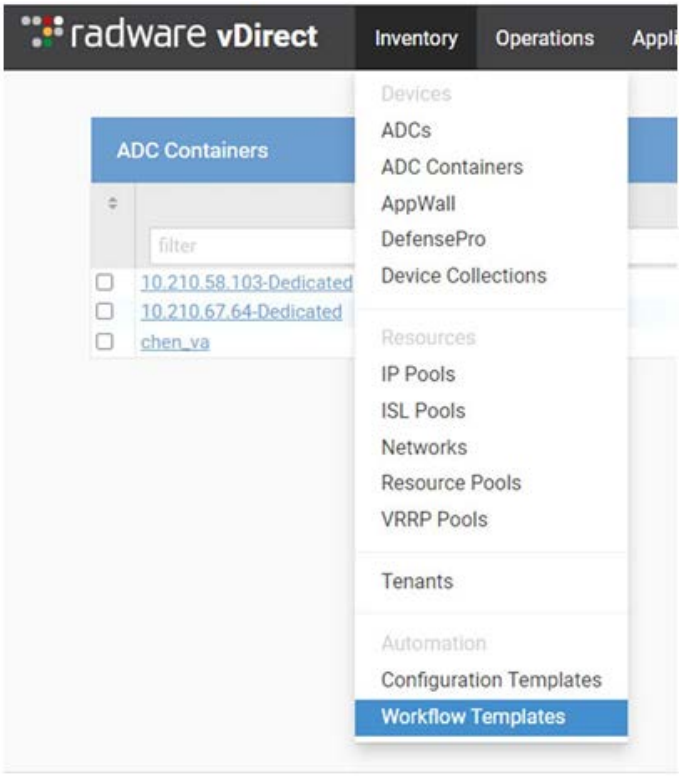
4. Click on the **+** icon to create a new IP Pool.

5. Provide a valid range of IP addresses.



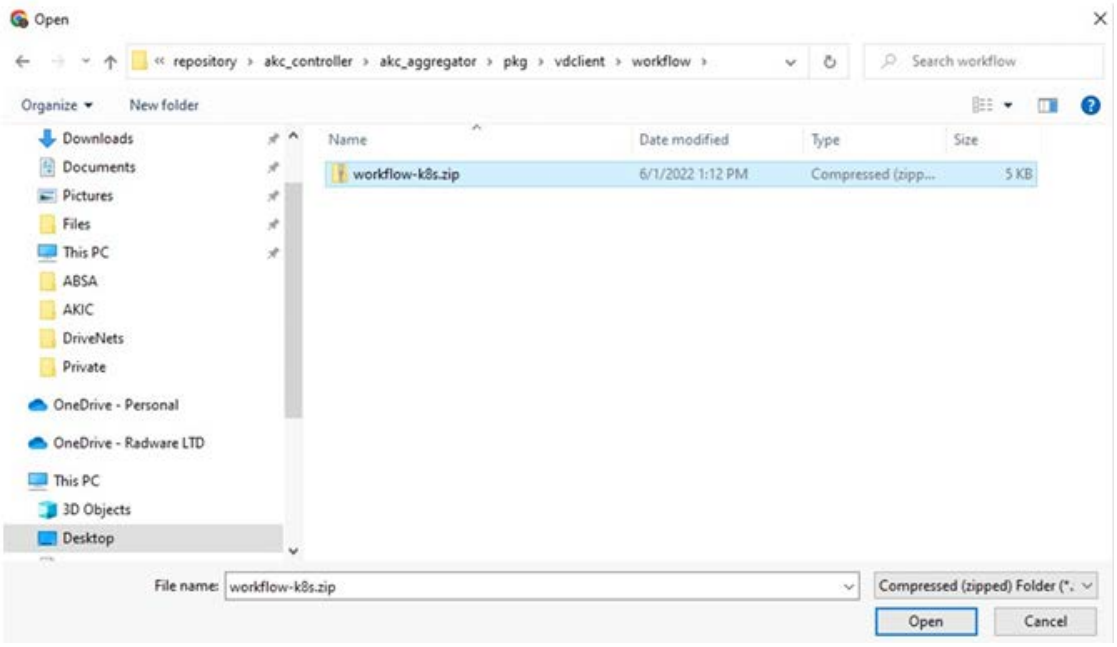
6. In OpenShift an External IP subnet must be added for this IP pool (see Appendix A. page 27).

7. Upload to vDirect the workflow file received with the installation package.
   a. Select **Inventory -> Workflow Templates**.

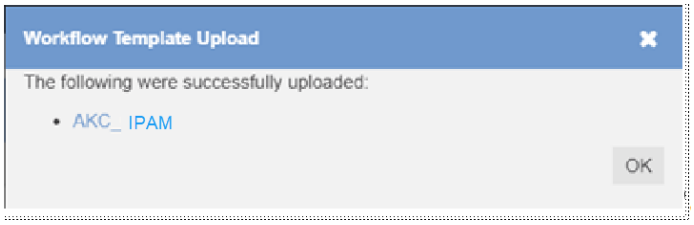


   b. On the right side of the screen click on the arrow button and select **Upload workflow template ZIP archive(s)**.

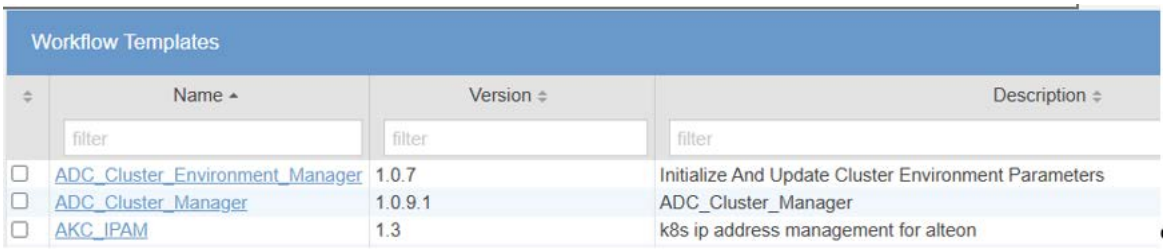
c. Select the **akc_vd_files.zip** workflow file to upload and click **Open**.



d. On the *Workflow* Template Upload screen, click **OK**.



e. Now you should be able to see the uploaded workflow in the list of workflow templates.

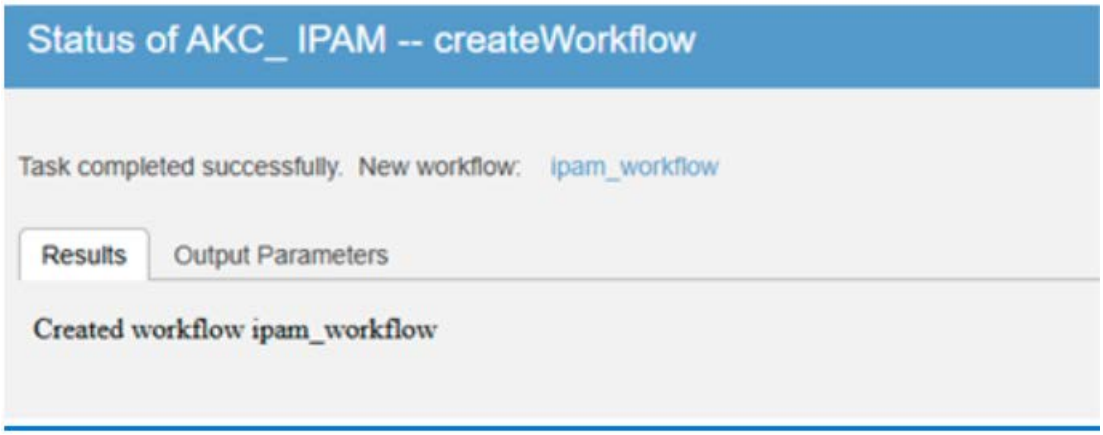


8. Activate the vDirect workflow:
   a. From the list of workflow templates select **AKC_IPAM**.
   b. Click on the **Create Workflow** button.

c. Select the Alteon device (or pair of Alteon devices for HA), select the IP Pool defined for IPAM, and click Run.

Note: Currently activation of this workflow requires to select an Alteon device from the Cyber Controller inventory. Please ensure that the Alteon device is in the Cyber Controller inventory.

d. A workflow instance will be created.



Non-Default Controller Key and Certificate Pair

The AKC Controller validation webhook acts as an HTTPS server and receives validation requests from Kubernetes api-server. As an HTTPS server it is required to associate an SSL certificate and private key to it.

By default, the AKC controller will include an SSL key/cert pair generated with 2K RSA key and 10 years validity. This default key/certificate pair is relevant only if the controller is deployed in default namespace. If you want to deploy the controller on different namespace, you have to provide your own key & certificate.

To configure user-defined key and certificate pair

1. Generate key and certificate pair using any method or tool. The common name and SAN used in the certificate should be **akc-controller.<namespace>.svc** (for default namespace it would be **akc-controller.default.svc**)

   OpenSSL example: **openssl req -new -x509 -subj "/CN=akc-controller.default.svc" -addext "subjectAltName=DNS: akc-controller.default.svc " -nodes -newkey rsa:2096 -keyout tls.key -out tls.crt -days 3650**

2. Generate the "secret" YAML using the certificate and key that was generated in the step 1.

   kubectl create secret generic alteon-svc-validator-cert -n default --from-file tls.crt --from-file tls.key --dry-run=client -oyaml > AlteonSvcValidator_secret.yaml

   The secret YAML will be generated in the below format.

   ```
   apiVersion: v1
   data:
     tls.crt: "base64 encoded certificate"
     tls.key: "base64 encoded key"
   kind: Secret
   metadata:
     creationTimestamp: null
     name: alteon-svc-validator-cert
     namespace: default
   ```

3. Use the certificate and key during AKC Controller deployment or update existing deployment. Copy the base64 encoded certificate & base64 encoded key into the controller secret HELM variables **controller.secret.crt** and **controller.secret.key**.
   (The HELM will update the webhook manifest internally).

CHAPTER 3 – SERVICE LOAD BALANCER DEPLOYMENT

A Service is an abstract way to expose an application running on a set of Pods as a network service.

When there is a need to expose a Service to an external IP address that is outside of your cluster, Kubernetes ServiceTypes allow you to specify what kind of Service you want (default is ClusterIP). On cloud providers which support external load balancers, ServiceType LoadBalancer is used to provision the load balancer.

When AKC (Alteon Kubernetes Connector) is deployed in your Kubernetes clusters, it allows to provision Alteon as an external load balancer and provide load balancing between multiple clusters and cluster nodes.

In addition, Alteon can provide SSL offload as well as application security (WAF, API protection and BotM) for the deployed Kubernetes services.

AKC supports the following connectivity options between Alteon and the service pods:

- **NodePort:** By default, when a service of type LoadBalancer is deployed, a NodePort is created for that service. Therefore, the default AKC mode connects to the NodePort on cluster nodes. This is done by configuring the cluster nodes as real servers on Alteon, with the NodePort as the server port. Currently, AKC configures real servers on Alteon for each node in the cluster, which can result in a large number of real servers per service, particularly in multi-cluster environments. This could limit the number of services Alteon can handle. To manage this, the number of nodes for which real servers will be created can be limited by configuring the aggregator.max_nodes_per_cluster parameter during AKC Aggregator installation.
- **Direct Pod Access:** In this mode, AKC configures the IPs of the relevant service pods as real servers, using the target port as the server port. To enable this mode, the controller.direct_access parameter must be set during AKC Controller deployment. Additionally, to allow Alteon to reach the pod IPs, a static route must be configured on Alteon for each node's pod network, with the node's IP serving as the gateway.

  This mode is supported from AKC version 1.5.0 and up.

When a new service of type LoadBalancer is deployed in the cluster, the following occurs:

- If the service has the label **AlteonDevice: "true"**, the AKC Controller communicates with the AKC aggregator and provides the service parameters.
- If this namespace and service name combination is new, and a static IP is not mentioned in the service manifest, the Aggregator contacts Cyber Controller module IPAM service to allocate an IP address for service (VIP).
- The AKC Aggregator prepares Alteon configuration updates and sends it to the AKC Configurator
- The AKC Configurator prepares the configuration file and applies it to Alteon.
- Once Alteon configuration is completed and applied, the Aggregator updates AKC Controller with the new service IP.
- The AKC Controller updates the service IP address in the Kubernetes cluster. The kubectl get service -o yaml command can be used to see the allocated external IP address, if it was allocated from IPAM.

AKC Controller discovers resources that have the following parameters:

- The resource type is Service (kind: Service)
- The Service type is LoadBlancer (type:LoadBalancer)
- Alteon label (AlteonDevice): "true"

In addition, the following annotations are supported:

Annotation	Description	Example	Default Behavior	Required/ Version
akc.radware.com/ static-ip: <virtual-ip>	Allows to specify the IP to be used as service Virtual IP (VIP).	akc.radware.com/ static-ip: 192.1681.10	VIP is allocated from the IPAM pool.	Optional Version 1.4.0
akc.radware.com/lb-algo: <metric>	Allows to specify load balancing algorithm other than default.	akc.radware.com/ lb-algo: lestconns		Required Version 1.0.0
akc.radware.com/lb-health-check: <hc id>	Allows to specify health check other than default. The health check id must exist on Alteon (either pre-defined or user-defined health checks).	akc.radware.com/ lb-health-check: http	TCP health check is used	Optional Version 1.0.0
akc.radware.com/ sslpol: <ssl policy id>	Allows to specify an SSL Policy ID on Alteon device that should be attached to this service. The SSL Policy can be configured directly on Alteon or via CRD (see SSL Policy Custom Resource, page ??). Note: An SSL policy configured via CRD can be specified in one of two ways: • Using the full Alteon name, AKC_<namespace>_ <CR name> • Using the custom resource name (CR name). In this case AKC will first search Alteon configuration for this name, since SSL policy can also be directly configured on Alteon. If not found, AKC will add the "AKC_<namespace>_ _" prefix and search again. Valid only for service port 443.	akc.radware.com/ sslpol: akc-default		Required if **cert** annotation is present Version 1.3.0

Annotation	Description	Example	Default Behavior	Required/ Version
akc.radware.com/ cert: <cert id>	Allows to specify a certificate and key pair on Alteon device to be attached to this service. The SSL certificate and key can be generated or imported directly on Alteon or via K8 TLS secret. When using K8 TLS secret, the secret must be pre-defined in the K8 cluster with the AlteonDevice: "true" label, for the configuration import to succeed. Only after a certificate and key are created in Alteon, user can provide the secret name, as it appears in Alteon and not K8 (AKC_<namespace>__<K8 secret name>,) to the service configuration. Valid only for service port 443.	akc.radware.com/ cert: WebManagement Cert		Required if **sslpol** annotation is present Version 1.3.0
akc.radware.com/ secpath: <secpath policy id>	Allows to specify a SecurePath Policy ID on Alteon device that should be attached to this service. Valid only for service port 80 or 443. SecurePath connector provides application security (Cloud WAF, API protection & BoTM) for the deployed service. This parameter must come together with Sideband policy.	akc.radware.com/ secpath: secpath1		Mandatory only if **sideband** annotation is present Version 1.3.0
akc.radware.com/ sideband: <sideband policy id>	Allows to specify a Sideband Policy ID on Alteon device that should be attached to this service. This parameter is required for SecurePath connector. Valid only for service port 80 or 443.	akc.radware.com/ sideband: sideband1		Mandatory only if **secpath** annotation is present Version 1.3.0

Annotation	Description	Example	Default Behavior	Required/ Version
akc.radware.com/ secwa: <inline|outofpath>	Allows to enable integrated WAAP application protection and specify the required operation mode – inline or out-of-path. Notes: -The AppWall module must be enabled on the Alteon device before deploying Kubernetes services with this capability. - The name of the Secure Web Application (secwa) created on Alteon is AKC_<first 11 namespace chars>_<hash (16chars>. - The detailed WAAP security policies for this service must be configured directly on Alteon device.c	akc.radware.com/ secwa:outofpath		Optional Version 1.6.0
akc.radware.com/ http2https-redirect: '[<http port>]:<https port>'	Allows to specify for an HTTPS service that is deployed, that traffic that arrives as HTTP must be redirected to HTTPS. The HTTPS port must be specified and must appear as service port in the manifest. The default for HTTP port is 80.	akc.radware.com/ http2https-redirect:'80:443' Note: Default source port (80) can also be presented without a value: http2https-redirect: :443		Optional Version 1.5.0
akc.radware.com/ appshape-scripts:<script1, script2, …>	Allows to attach AppShape++ scripts available in Alteon to the service. The scripts priority in the service is determined by their order in the annotation. It supports to attach up to 16 scripts per service (up to 15 if SecurePath is enbled on the service).	akc.radware.com/ appshape-scripts: redirecttogoogle, addheaders		Optional Version 1.6.0

Annotation	Description	Example	Default Behavior	Required/ Version
akc.radware.com/ appshape-alwayson: <enble|disable>	Specifies whether a virtual service should always be available, even if all servers are down, when an AppShape++ script is attached to the service. This parameter must only be enabled when one of the attached AppShape++ scripts contains treatment for the “no server available” state (such as returning the Sorry page or redirecting to a special URL).	akc.radware.com/ appshape-alwayson:enable	disable	Optional Version 1.6.0

Following is an example of a deployment of a service with SSL offload and SecurePath connector:

```
apiVersion: v1
kind: Service
metadata:
  annotations:
    akc.radware.com/lb-algo: leastconns
    akc.radware.com/lb-health-check: http
    akc.radware.com/sslpol: AKC_default_policy
    akc.radware.com/cert: cert1
    akc.radware.com/sideband: sideband1
    akc.radware.com/secpath: secpath1

  labels:
    AlteonDevice: “true”
  name: test-service-http
  namespace: default
spec:
  ports:
    - name: https
      port: 443
      targetPort: 8080
  selector:
    app: lab
  type: LoadBalancer
```

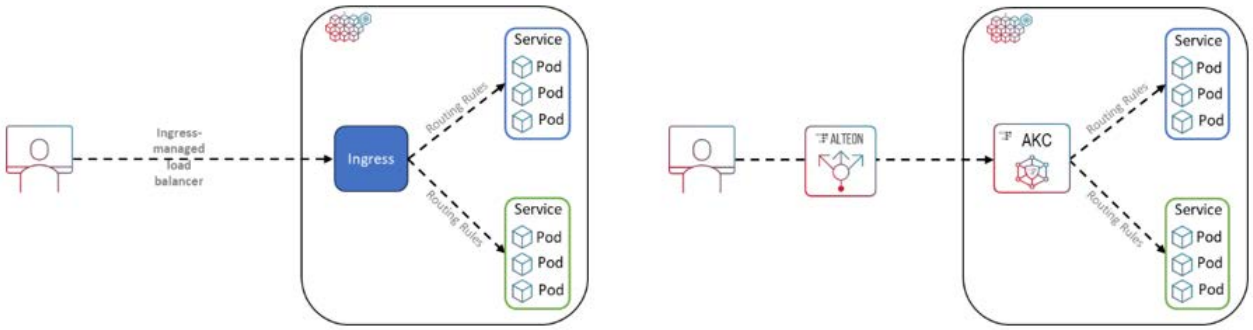
Note: The port number that appears in the deployment yaml in parameter "port" is configured as the virtual service port in Alteon.

Note: When a service is deployed in multiple clusters, ensure that the service is defined identically in all the clusters. When AKC identifies a multi-cluster mismatch, such as multi cluster service parameters (metric, health check, etc.), new configuration will not be sent to Alteon until this mismatch is resolved

CHAPTER 4 – INGRESS SERVICE DEPLOYMENT

The Ingress resource in Kubernetes allows external access to services within the cluster by exposing HTTP and HTTPS routes. The routing of traffic is governed by rules defined on the Ingress resource.

An Ingress may be configured to provide services with externally-reachable URLs, load balance traffic, terminate SSL/TLS, and offer name-based virtual hosting. An Ingress controller is responsible for fulfilling the Ingress, usually with a load balancer, for example Alteon.



To create an Ingress object, you need to specify the apiVersion, kind, metadata and spec fields. The name of the Ingress object should follow the rules of a valid DNS subdomain name. The spec field contains all the details for configuring a load balancer or proxy server. The most important part is a list of HTTP rules that match the incoming requests and direct them to the appropriate services.

An HTTP rule contains the following information:

- A host (optional). If a host is provided (for example, foo.bar.com), the rules apply to that host. If no host is specified, the rule applies to all inbound HTTP traffic through the IP address specified.
- A list of paths (for example, /foo). Each path has an associated backend defined, that includes service.name and a service.port.name or service.port.number. Both the host and path must match the content of an incoming request before the load balancer directs traffic to the referenced Service.

A defaultBackend is often configured in an Ingress controller to service any requests that do not match a path in the spec.

When AKC (version 1.4.0 or higher) is deployed in your Kubernetes clusters, it allows you to provision Alteon as an external load balancer fulfilling the ingress. A Content Rule is automatically configured on Alteon for each HTTP rule.

To make an Ingress secure, you need to provide a Secret that has a TLS private key and certificate. The Ingress resource can only use one TLS port, 443, and it assumes that the TLS connection ends at the ingress point (Alteon in our case), the traffic to the Service and its Pods is not encrypted. The TLS secret must have keys named tls.crt and tls.key that have the certificate and private key for TLS.

A secret must be pre-defined in the Kubernetes cluster with the AlteonDevice: "true" label, for the configuration import to succeed. Only after a cert and a key are created in Alteon, user can provide the secret name (as it appears in the Kubernetes cluster) to the ingress tls configuration.

If you have different hosts in the TLS configuration section of an Ingress, they share the same port based on the hostname given by the SNI TLS extension (AKC uploads all the private keys and certificates specified via TLS secret to Alteon and aggregates them in a certificate group attached to the HTTPS virtual service).

When fulfilling ingress Alteon provides load balancing at pod level. Alteon sends traffic directly to the Pods, bypassing the internal load balancing mechanism of the Kubernetes cluster.

This can be achieved in one of two ways:

- **BGP** - Relevant for Kubernetes cluster only (and not Openshift), requires the Calico Container Network Interface (CNI) plugin.
- **Direct Pod Access** - Relevant for both Kubernetes and Openshift (OVN) clusters, requires configuring a static route on Alteon for each node's pod network, with the node's IP serving as the gateway.

When a new Ingress service is deployed in the cluster , with ingressClasName set to "akc", the following occurs:

- The AKC Controller communicates with the AKC aggregator and provides the service parameters.
- If the namespace and service name combination is new, and a static IP is not mentioned in the service manifest, the Aggregator contacts Cyber Controller or vDirect module IPAM service to allocate an IP address for service (VIP).
- The AKC Aggregator prepares Alteon configuration updates and sends it to the AKC Configurator
- The AKC Configurator prepares the configuration file and applies it on the Alteon.
- Once Alteon configuration is completed and applied, the Aggregator updates AKC Controller with the new service IP.
- The AKC Controller updates the service IP address in the Kubernetes cluster.
  The **`kubectl get service -o yaml`** command can be used to see the allocated external IP address.

AKC Controller discovers resources that have the following parameters:

- The resource type is Ingress (kind: Ingress)
- The ingress class is akc (ingressClassName: akc)

In addition, the following annotations are supported with Ingress resource:

- Service IP (VIP on Alteon): akc.radware.com/static-ip: <virtual-ip>. If this annotation is not present, AKC allocates IP using the IPAM service.

Following is an example of a deployment of a simple ingress service secured with TLS:

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: simple-fanout-example-1
spec:
  ingressClassName: akc
  tls:
  - hosts:
    - foo.bar.com
    secretName: my-secret
  defaultBackend:
    service:
      name: test-ingress
      port:
        number: 80
```

```
rules:
- host: foo.bar.com
  http:
    paths:
    - path: /foo
      pathType: Prefix
      backend:
        service:
          name: test-ingress
          port:
            number: 80
```

AKC supports ingress resource per cluster, multi-cluster ingress resource is not currently supported.

CHAPTER 5 – CUSTOM RESOURCE DEFINITIONS

Custom Resource Definitions (CRDs) are a powerful feature in Kubernetes that allow users to extend the Kubernetes API by defining their own custom resource types. This capability enables the management of application-specific objects as if they were native Kubernetes resources. By creating a CRD, you can introduce new resource types that suit your application's needs, such as a custom database or a specific configuration object. Once a CRD is defined and applied to the cluster, Kubernetes will recognize and manage instances of the custom resource. CRDs are fully integrated with Kubernetes tools like kubectl, allowing for declarative management of these resources.

Additionally, custom controllers can be developed to automate the desired state management of custom resources, ensuring that the actual state of the cluster matches the specified state. This extensibility makes CRDs a versatile tool for developers looking to tailor Kubernetes to their specific use cases, providing a seamless way to incorporate custom logic and workflows into the Kubernetes ecosystem.

SSL Policy Custom Resource

When deploying a service of type Load Balancer you can request that Alteon perform SSL offload by specifying an SSL policy and server certificate.

The SSL Policy can be configured directly on the Alteon device, or it can be configured via AKC using a CRD.

Radware provides a Kubernetes CustomResourceDefinitions (CRDs) called AlteonSSLPolicy that you can use with the Alteon Kubernetes Controller to configure an SSL policy on the Alteon devices.

The Alteon SSL Policy CRD provides attributes for the various options that are required to define the SSL policies on Alteon.

Table 1: AlteonSSLPolicy Components

Parameter	Type	Default	Description
secRenegotiation	Integer	5	Specifies the maximum number of allowed secure renegotiations per SSL session. Values: 0 - 1024.
frontEndSSL	Object	N/A	Parameters for the client side SSL connection
backEndSSL	Object	N/A	Parameters for the server side SSL connection

Table 2: frontEndSSL Components

Parameter	Type	Default	Description
encryption	String	Enable	Specifies whether to establish an SSL connection with the client and allow decryption/encryption of client traffic. Allowed options are Enable and Disable.

Table 2: frontEndSSL Components

Parameter	Type	Default	Description
supportedCiphers	String	Main	Allows to specify the cipher suite to propose during SSL handshake, as a list of specific ciphers, in OpenSSL format, delimited by ":". Example: "TLS_AES_256_GCM_SHA384:TLS_AES_128_GCM_SHA256". The default is Alteon pre-defined list of ciphers called Main.
allowedSSLVersions	Object	N/A	Allows to specify the SSL/TLS versions acceptable.
sessionReuse	String	Inherit	Specifies whether to enable or disable front-end session reuse for this policy, or to inherit the globally defined setting. Allowed options are Enable, Disable and Inherit.

Table 3: backEndSSL Components

Parameter	Type	Default	Description
encryption	String	Disable	Specifies whether to establish an SSL connection towards the server and allow decryption/encryption of server traffic. Allowed options are Enable and Disable.
includeSNI	String	Enable	Specifies whether to include or not SNI in ClientHello message to the backend server. Allowed options are Enable and Disable.
supportedCiphers	String	Main	Allows to specify the cipher suite to support during SSL handshake, as a list of specific ciphers, in OpenSSL format, delimited by ":". Example: "TLS_AES_256_GCM_SHA384:TLS_AES_128_GCM_SHA256". The default is Alteon pre-defined list of ciphers called Main.
allowedSSLVersions	Object	N/A	Allows to specify the SSL/TLS versions to be used on the backend SSL connection.
sessionReuse	String	Inherit	Specifies whether to enable or disable back-end session reuse for this policy, or to inherit the globally defined setting. Allowed options are Enable, Disable and Inherit.

Table 4: allowedSSLVersions Parameters

Parameter	Type	Default	Description
TLS1_0	String	Disable	Specifies whether to allow TLS 1.0 SSL handshakes. Allowed options are Enable and Disable.

Table 4: allowedSSLVersions Parameters

Parameter	Type	Default	Description
TLS1_1	String	Disable	Specifies whether to allow TLS 1.1 SSL handshakes. Allowed options are Enable and Disable.
TLS1_2	String	Enable	Specifies whether to allow TLS 1.2 SSL handshakes. Allowed options are Enable and Disable.
TLS1_3	String	Enable	Specifies whether to allow TLS 1.3 SSL handshakes. Allowed options are Enable and Disable.

In order for AKC to recognize an SSL policy CRD, the following values are required for apiVersion and kind parameters:

apiVersion:alteon.radware.com/v1

kind:alteonsslpolicy

Example:

```
apiVersion:alteon.radware.com/v1
kind:alteonsslpolicy
metadata:
  name: example_ssl_policy
  namespace:alteonexamples
spec:
  frontEndSSL:
    supportedCiphers:
"TLS_AES_256_GCM_SHA384:TLS_CHACHA20_POLY1305_SHA256:TLS_AES_128_GCM_SHA256
"
    allowedVersions:
      TLS1_2: "Disable"
  backEndSSL:

    encryption: "Enable"
```

The above example will result on Alteon in an SSL policy with ID AKC_alteonexamples__example_ssl_policy, that enables SSL for both client side and server side and allows only TLS 1.3 version and ciphers on the client side.

Important: The ID of the SSL Policy configured in Alteon is "AKC_<namespace>__<custom resource name>" and it allows for the maximum namespace length (63 chars) and custom resource names of up to 59 characters (maximum Alteon SSL Policy ID is 128 chars). During service LoadBalancer deployment if the SSL policy specified in annotations is one configured via CRD, the SSL policy can be specified in one of two ways:

- The full Alteon name, for example *AKC_alteonexamples__example_ssl_policy*
- The custom resource name, for example *example_ssl_policy*. In this case AKC will first search Alteon configuration for this name, since SSL policy can also be directly configured on Alteon and referenced in Kubernetes. If not found, AKC will add the "*AKC_<namespace>__*" prefix and search again.

APPENDIX A – HELM CHARTS PARAMETERS

Option Name	Description
Global Options – valid for all components	
global.namespace	The namespace in which to install the AKC components.
Aggregator Options	
aggregator.enable	Specifies whether to install the aggregator. Values are true and false. Note: When only installing the controller, this parameter must also be present, with value false.
aggregator.image.repository	The name of the docker image.
aggregator.image.pullPolicy	The imagePullPolicy for a container and the tag of the image affect when the kubelet attempts to pull (download) the specified image.
aggregator.image.tag	The tag of the docker image (e.g., latest).
aggregator.service.nodePort	The port via which the aggregator service can be accessed from outside the cluster. The same port is used for the connection between controllers installed in different clusters than the aggregator, and the aggregator. Should have the same value as the "controller.aggregator_port" parameter for those controllers. Default value: 30051
aggregator.env.max_inactivity	The time the aggregator waits from the last update from any controller until it applies the configuration on Alteon. Default: 30 sec.
aggregator.env.max_delay	The time the aggregator waits from receiving the first controller update until it applies the configuration on Alteon. Default: 120 sec.
aggregator.env.apply_retry	The time the aggregator waits from the last Alteon Apply failure until it retries to Apply the configuration on Alteon. Default: 600 sec.
aggregator.env.reconciliation_to	The interval between reconciliation processes, in seconds. Default: 43,200 seconds (12 hours).
aggregator.env.ageout_to	The time, in seconds, that the aggregator waits for keep-alive message from a controller before considering the controller cluster as down and removing it from its database. Default: 120 sec
aggregator.env.assets_sync_period	The time interval, in minutes, at which the aggregator will synchronize assets with Alteon configuration. Default: 2 min.
aggregator.grpc_conn.is_grpc_encrypted	Defines whether the GRPC connection between controller and aggregator is encrypted. Default: false.

Option Name	Description
aggregator.rest_conn.is_rest_encrypted	Defines whether the REST connection between controller and aggregator is encrypted. Default: false.
aggregator.configurator.client	Define type of configurator client. The options are: -configurator module within the aggregator (cfgclient) -vDirect module in Vision/Cyber Controller as configurator (vdcclient) - legacy option. Default: cfgclient
aggregator.configurator.ip	The IP/hostname of the AKC configurator service. Because the configurator is running on the same cluster as the aggregator, this parameter should be set to the configurator's default service name - "akc-configurator.[namespace].svc.cluster.local". This is mandatory when is_rest_encrypted=true
aggregator.configurator.port	The port on which AKC configurator service listens for aggregator messages. Default: 30188
aggregator.configurator.protocol	The protocol (HTTP or HTTPS) the aggregator uses to communicate with the configurator service.
aggregator.ipam.workflow	The name of the workflow in Cyber Controller/Vision used to manage IPAM.
aggregator.ipam.pool	The name of the IP pool configured for IPAM.
aggregator.ipam.ip	The IP/hostname of the Cyber Controller/Vision device where the IPAM workflow resides.
aggregator.ipam.user	The user the configurator uses to log in to the Cyber Controller/Vision device used to manage IPAM.
aggregator.ipam.password	The password the configurator uses to log in to the Cyber Controller/Vision device used to manage IPAM. **Important!** If the password is changed for this user, it requires to update the configurator deployment using the helm upgrade -install command with the user and password options.
aggregator.ipam.port	The port on which Cyber Controller/Vision listens for aggregator messages to the IPAM workflow.
aggregator.ipam.protocol	The protocol (HTTP or HTTPS) the aggregator uses to communicate with Cyber Controller
aggregator.args.verbose	Set the verbosity level. Values: 1 to 3 (1 for least verbose)
aggregator.max_nodes_per_cluster	Set the node limitation. The maximum nodes (reals per cluster) that will be configured in Alteon. Values: >= 1 (int), 0 (unlimited) **Note:** Supported in versions 1.5.0 and up.
Configurator Options	
configurator.enable	Specifies whether to install configurator. Values are true and false.
configurator.image.repository	The name of the docker image.

Option Name	Description
configurator.image.pullPolicy	The imagePullPolicy for a container and the tag of the image affect when the kubelet attempts to pull (download) the specified image.
configurator.loglevel	Set the verbosity level ("INFO" or "DEBUG")
configurator.image.tag	The tag of the docker image (e.g., latest).
configurator.alteon.master.ip	The IP or host name of the primary Alteon device.
configurator.alteon.backup_ip	The IP or host name of the secondary (backup) Alteon device.
configurator.alteon.adcSecretCredential	The name of the user-defined secret that contains Alteon device credentials (username and password). See how to create the secret at **Alteon Credentials Secret** below. **Note:** Supported in versions 1.5.0 and up.
configurator.alteon.user	The user the configurator uses to log in to the Alteon device. **Note:** To specify the Alteon device credentials you can either use secret (configurator.adcSecredCredential) or configurator.alteon.user and configurator.alteon.password parameters
configurator.alteon.pass	The password the configurator uses to log in to the Alteon device. Important! If the password is changed for this user, it requires to update the configurator deployment using the helm upgrade -install command with the user and password options. Note: When using HA, the credentials for the backup ADC should be identical to the master ADC.
configurator.alteon.pip	Specifies the IP address/subnet that should be used by Alteon to perform Client NAT on traffic towards the real servers (K8 nodes).
configurator.alteon.pip_mask	Specifies the mask for the PIP address/subnet
Controller Options	
controller.enable	Specifies whether to install controller. Values are true and false.
controller.image.repository	The name of the docker image.
controller.image.pullPolicy	The imagePullPolicy for a container and the tag of the image affect when the kubelet attempts to pull (download) the specified image.
controller.image.tag	The tag of the docker image (e.g., latest).
controller.uid	The identifier the controller will use when communicating with the aggregator.
controller.aggregator_ip	The IP or host name of the aggregator. When running on the same cluster as the aggregator, use aggregator's default service name - "akc-aggregator.[namespace].svc.cluster.local".

Option Name	Description
controller.aggregator_port	The port of the aggregator. This parameter is only needed when the AKC controller and the AKC aggregator are on different clusters. In case a hostname is specified for aggregator_ip the port range must be in the range 30000-32767. Default value: 30051.
controller.controller_reconcile_period	Controller reconciliation period. Default 3600 seconds (1 hour).
controller.webhook.enabled	Enables/disables service parameters validation using admission control webhook. Default: true.
controller.direct_access	Enables/disables the direct pod access. When enabled, the real servers configured are pods (with their configured target port) and not nodes (node port). **Note:** Supported in versions 1.5.0 and up.
controller.secret.crt	User-defined SSL certificate used by webhook in base64 encoded format.
controller.secret.key	User defined SSL key used by webhook in base64 encoded format.
controller.args.verbose	Set the verbosity level. Values: 1 to 3 (1 for least verbose)
controller.grpc_conn.is_grpc_encrypted	Defines whether the GRPC connection between controller and aggregator is encrypted. Default: false.

Alteon Credentials Secret

This section describes how to create an Alteon credentials secret. The Alteon credentials secret is the user-defined secret that contains Alteon device credentials (username and password).

To create a secret for Alteon credentials

1. Create two environment variables for username and password:

```
U=$(echo -n "username" | base64)
P=$(echo -n "password" | base64)
```

2. Create the secret where the data section contains two fields with required names: 'u' - <username> and 'p'-<password>

```
echo "
apiVersion: v1
kind: Secret
metadata:
```

```
  name: customer-adc-secret-name
data:
  u: ${U}
  p: ${P}
" | kubectl apply --filename=- --namespace="configurator name space"
```

APPENDIX B – ALLOCATING EXTERNAL IPS IN OPENSHIFT SETUP

In order to allocated external IPs in OpenShift setup for any Alteon load balancing service, for each OpenShift cluster type the **oc edit network cluster** under Spec.externalIP instead of it being set to an empty value of {}.

```
spec:
  clusterNetwork:
  - cidr: 10.128.0.0/14
    hostPrefix: 23
  externalIP: {}
  networkType: OpenShiftSDN
  serviceNetwork:
  - 172.30.0.0/16
```

Add the following (for example in case the needed external IP subnet is 10.175.130.0):

```
spec:
  clusterNetwork:
  - cidr: 10.128.0.0/14
    hostPrefix: 23
  externalIP:
    policy:
networkType: OpenShiftSDN
  serviceNetwork:
  - 172.30.0.0/16
  - 10.175.130.0/24
```

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