



# **Networking requirements for Cloud Volumes ONTAP in GCP**

## **Cloud Manager**

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September 02, 2021

This PDF was generated from [https://docs.netapp.com/us-en/occm/reference\\_networking\\_gcp.html](https://docs.netapp.com/us-en/occm/reference_networking_gcp.html) on September 09, 2021. Always check docs.netapp.com for the latest.

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# Networking requirements for Cloud Volumes ONTAP in GCP

Set up your Google Cloud Platform networking so Cloud Volumes ONTAP systems can operate properly. This includes networking for the Connector and Cloud Volumes ONTAP.

If you want to deploy an HA pair, you should [learn how HA pairs work in GCP](#).

## Requirements for Cloud Volumes ONTAP

The following requirements must be met in GCP.

### Internal load balancers

Cloud Manager automatically creates three Google Cloud internal load balancers (TCP/UDP) that manage incoming traffic to the Cloud Volumes ONTAP HA pair. (Prior to 9.9.0, four load balancers were created.) No setup is required from your end. We've listed this as a requirement simply to inform you of the network traffic and to mitigate any security concerns.

One load balancer is for cluster management, one is for NAS traffic to node 1, and the last is for NAS traffic to node 2.

The setup for each load balancer is as follows:

- One shared private IP address
- One global health check

By default, the ports used by the health check are 63001, 63002, and 63003.

- One regional TCP backend service
- One regional UDP backend service
- One TCP forwarding rule
- One UDP forwarding rule
- Global access is disabled

Even though global access is disabled by default, enabling it post deployment is supported. We disabled it because cross region traffic will have significantly higher latencies. We wanted to ensure that you didn't have a negative experience due to accidental cross region mounts. Enabling this option is specific to your business needs.

### One or multiple zones for HA pairs

You can ensure the high availability of your data by deploying an HA configuration across multiple or in a single zone. Cloud Manager will prompt you to choose multiple zones or a single zone when you create the HA pair.

- Multiple zones (recommended)

Deploying an HA configuration across three zones ensures continuous data availability if a failure occurs within a zone. Note that write performance is slightly lower compared to using a single zone, but it's minimal.

- Single zone

When deployed in a single zone, a Cloud Volumes ONTAP HA configuration uses a spread placement policy. This policy ensures that an HA configuration is protected from a single point of failure within the zone, without having to use separate zones to achieve fault isolation.

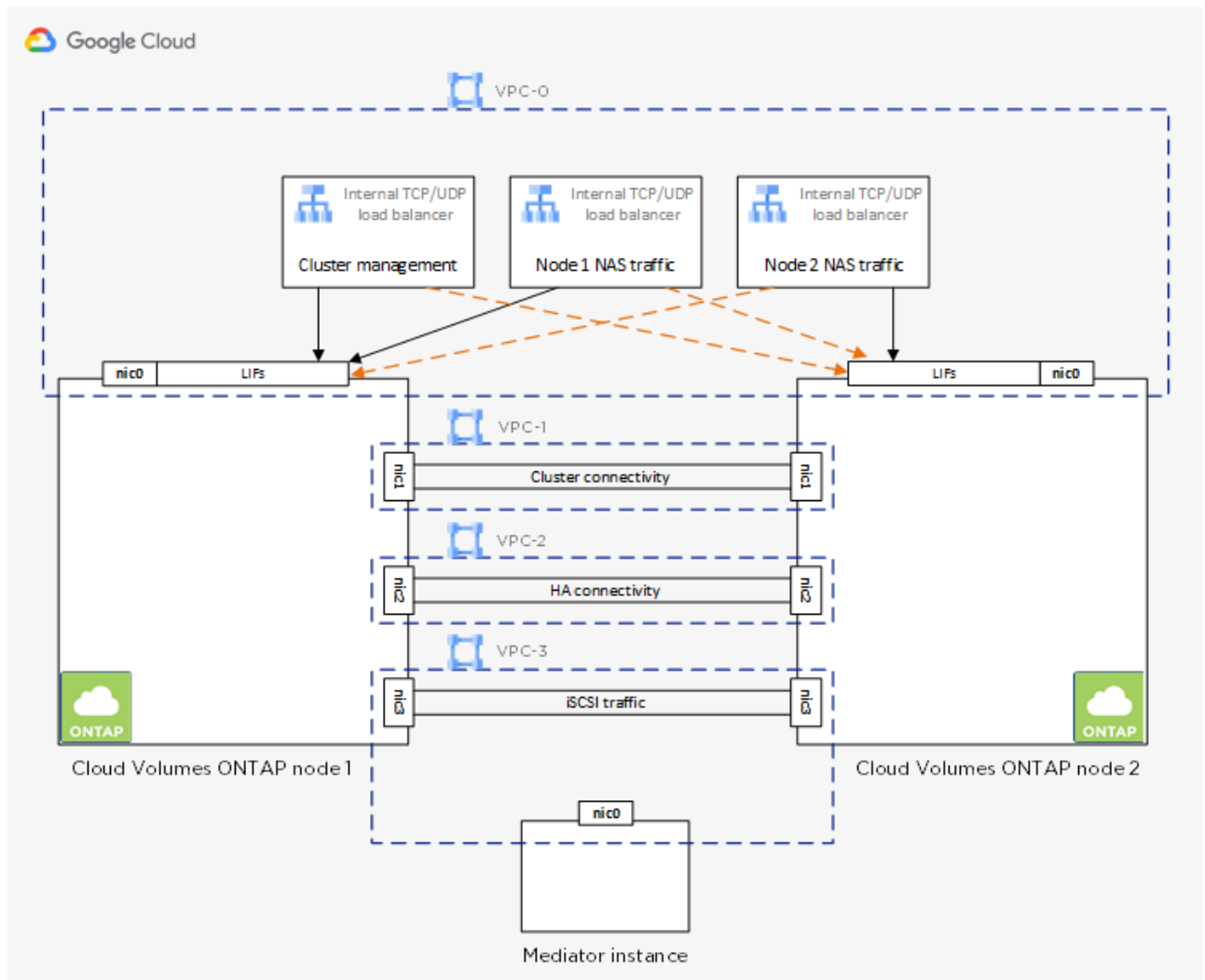
This deployment model does lower your costs because there are no data egress charges between zones.

### Four Virtual Private Clouds for HA pairs

Four Virtual Private Clouds (VPCs) are required for an HA configuration. Four VPCs are required because GCP requires that each network interface resides in a separate VPC network.

Cloud Manager will prompt you to choose four VPCs when you create the HA pair:

- VPC-0 for inbound connections to the data and nodes
- VPC-1, VPC-2, and VPC-3 for internal communication between the nodes and the HA mediator



### Subnets for HA pairs

A private subnet is required for each VPC.

If you place the Connector in VPC-0, then you will need to enable Private Google Access on the subnet to access the APIs and to enable data tiering.

The subnets in these VPCs must have distinct CIDR ranges. They can't have overlapping CIDR ranges.

## One Virtual Private Cloud for single node systems

One VPC is required for a single node system.

## Shared VPCs

Cloud Volumes ONTAP and the Connector are supported in a Google Cloud shared VPC and also in standalone VPCs.

For a single node system, the VPC can be either a shared VPC or a standalone VPC.

For an HA pair, four VPCs are required. Each of those VPCs can be either shared or standalone. For example, VPC-0 could be a shared VPC, while VPC-1, VPC-2, and VPC-3 could be standalone VPCs.

A shared VPC enables you to configure and centrally manage virtual networks across multiple projects. You can set up shared VPC networks in the *host project* and deploy the Connector and Cloud Volumes ONTAP virtual machine instances in a *service project*. [Google Cloud documentation: Shared VPC overview](#).

The only requirement when using a shared VPC is to provide the [Compute Network User role](#) to the Connector service account. Cloud Manager needs these permissions to query the firewalls, VPC, and subnets in the host project.

## Outbound internet access for Cloud Volumes ONTAP

Cloud Volumes ONTAP requires outbound internet access to send messages to NetApp AutoSupport, which proactively monitors the health of your storage.

Routing and firewall policies must allow HTTP/HTTPS traffic to the following endpoints so Cloud Volumes ONTAP can send AutoSupport messages:

- <https://support.netapp.com/aods/asupmessage>
- <https://support.netapp.com/asupprod/post/1.0/postAsup>

[Learn how to configure AutoSupport.](#)



If you're using an HA pair, the HA mediator doesn't require outbound internet access.

## Private IP addresses

Cloud Manager allocates the following number of private IP addresses to Cloud Volumes ONTAP in GCP:

- **Single node:** 3 or 4 private IP addresses

You can skip creation of the storage VM (SVM) management LIF if you deploy Cloud Volumes ONTAP using the API and specify the following flag:

```
skipSvmManagementLif: true
```

A LIF is an IP address associated with a physical port. A storage VM (SVM) management LIF is required for management tools like SnapCenter.

- **HA pair:** 15 or 16 private IP addresses

- 7 or 8 private IP addresses for VPC-0

You can skip creation of the storage VM (SVM) management LIF if you deploy Cloud Volumes ONTAP using the API and specify the following flag:

```
skipSvmManagementLif: true
```

- Two private IP addresses for VPC-1
- Two private IP addresses for VPC-2
- Three private IP addresses for VPC-3

## Firewall rules

You don't need to create firewall rules because Cloud Manager does that for you. If you need to use your own, refer to the firewall rules listed below.

Note that two sets of firewall rules are required for an HA configuration:

- One set of rules for HA components in VPC-0. These rules enable data access to Cloud Volumes ONTAP. [Learn more](#).
- Another set of rules for HA components in VPC-1, VPC-2, and VPC-3. These rules are open for inbound & outbound communication between the HA components. [Learn more](#).

## Connection from Cloud Volumes ONTAP to Google Cloud Storage for data tiering

If you want to tier cold data to a Google Cloud Storage bucket, the subnet in which Cloud Volumes ONTAP resides must be configured for Private Google Access (if you're using an HA pair, this is the subnet in VPC-0). For instructions, refer to [Google Cloud documentation: Configuring Private Google Access](#).

For additional steps required to set up data tiering in Cloud Manager, see [Tiering cold data to low-cost object storage](#).

## Connections to ONTAP systems in other networks

To replicate data between a Cloud Volumes ONTAP system in GCP and ONTAP systems in other networks, you must have a VPN connection between the VPC and the other network—for example, your corporate network.

For instructions, refer to [Google Cloud documentation: Cloud VPN overview](#).

# Requirements for the Connector

Set up your networking so that the Connector can manage resources and processes within your public cloud environment. The most important step is ensuring outbound internet access to various endpoints.



If your network uses a proxy server for all communication to the internet, you can specify the proxy server from the Settings page. Refer to [Configuring the Connector to use a proxy server](#).

## Connection to target networks

A Connector requires a network connection to the VPCs in which you want to deploy Cloud Volumes ONTAP. If you're deploying an HA pair, then the Connector needs a connection to all four VPCs.

## Outbound internet access

The Connector requires outbound internet access to manage resources and processes within your public cloud environment. A Connector contacts the following endpoints when managing resources in GCP:

Endpoints	Purpose
<a href="https://www.googleapis.com">https://www.googleapis.com</a>	Enables the Connector to contact Google APIs for deploying and managing Cloud Volumes ONTAP in GCP.
<a href="https://api.services.cloud.netapp.com:443">https://api.services.cloud.netapp.com:443</a>	API requests to NetApp Cloud Central.
<a href="https://cloud.support.netapp.com.s3.us-west-1.amazonaws.com">https://cloud.support.netapp.com.s3.us-west-1.amazonaws.com</a>	Provides access to software images, manifests, and templates.
<a href="https://cognito-idp.us-east-1.amazonaws.com">https://cognito-idp.us-east-1.amazonaws.com</a> <a href="https://cognito-identity.us-east-1.amazonaws.com">https://cognito-identity.us-east-1.amazonaws.com</a> <a href="https://sts.amazonaws.com">https://sts.amazonaws.com</a> <a href="https://cloud-support-netapp-com-accelerated.s3.amazonaws.com">https://cloud-support-netapp-com-accelerated.s3.amazonaws.com</a>	Enables the Connector to access and download manifests, templates, and Cloud Volumes ONTAP upgrade images.
<a href="https://cloudmanagerinfraproduct.azurecr.io">https://cloudmanagerinfraproduct.azurecr.io</a> <a href="https://blob.core.windows.net">*.blob.core.windows.net</a>	Access to software images of container components for an infrastructure that's running Docker and provides a solution for service integrations with Cloud Manager.
<a href="https://kinesis.us-east-1.amazonaws.com">https://kinesis.us-east-1.amazonaws.com</a>	Enables NetApp to stream data from audit records.
<a href="https://cloudmanager.cloud.netapp.com">https://cloudmanager.cloud.netapp.com</a>	Communication with the Cloud Manager service, which includes Cloud Central accounts.
<a href="https://netapp-cloud-account.auth0.com">https://netapp-cloud-account.auth0.com</a>	Communication with NetApp Cloud Central for centralized user authentication.
<a href="https://support.netapp.com:443">support.netapp.com:443</a> <a href="https://mysupport.netapp.com">https://mysupport.netapp.com</a>	Communication with NetApp AutoSupport. Note that the Connector communicates with <a href="https://support.netapp.com:443">support.netapp.com:443</a> , which redirects to <a href="https://mysupport.netapp.com">https://mysupport.netapp.com</a> .
<a href="https://support.netapp.com/svcgw">https://support.netapp.com/svcgw</a> <a href="https://support.netapp.com/ServiceGW/entitlement">https://support.netapp.com/ServiceGW/entitlement</a> <a href="https://eval.lic.netapp.com.s3.us-west-1.amazonaws.com">https://eval.lic.netapp.com.s3.us-west-1.amazonaws.com</a> <a href="https://cloud-support-netapp-com.s3.us-west-1.amazonaws.com">https://cloud-support-netapp-com.s3.us-west-1.amazonaws.com</a>	Communication with NetApp for system licensing and support registration.
<a href="https://client.infra.support.netapp.com.s3.us-west-1.amazonaws.com">https://client.infra.support.netapp.com.s3.us-west-1.amazonaws.com</a> <a href="https://cloud-support-netapp-com-accelerated.s3.us-west-1.amazonaws.com">https://cloud-support-netapp-com-accelerated.s3.us-west-1.amazonaws.com</a> <a href="https://trigger.asup.netapp.com.s3.us-west-1.amazonaws.com">https://trigger.asup.netapp.com.s3.us-west-1.amazonaws.com</a>	Enables NetApp to collect information needed to troubleshoot support issues.
<a href="https://ipa-signer.cloudmanager.netapp.com">https://ipa-signer.cloudmanager.netapp.com</a>	Enables Cloud Manager to generate licenses (for example, a FlexCache license for Cloud Volumes ONTAP)

Endpoints	Purpose
<p>Various third-party locations, for example:</p> <ul style="list-style-type: none"> <li>• <a href="https://repo1.maven.org/maven2">https://repo1.maven.org/maven2</a></li> <li>• <a href="https://oss.sonatype.org/content/repositories">https://oss.sonatype.org/content/repositories</a></li> <li>• <a href="https://repo.typesafe.com">https://repo.typesafe.com</a></li> </ul> <p>Third-party locations are subject to change.</p>	<p>During upgrades, Cloud Manager downloads the latest packages for third-party dependencies.</p>

While you should perform almost all tasks from the SaaS user interface, a local user interface is still available on the Connector. The machine running the web browser must have connections to the following endpoints:

Endpoints	Purpose
The Connector host	<p>You must enter the host's IP address from a web browser to load the Cloud Manager console.</p> <p>Depending on your connectivity to your cloud provider, you can use the private IP or a public IP assigned to the host:</p> <ul style="list-style-type: none"> <li>• A private IP works if you have a VPN and direct connect access to your virtual network</li> <li>• A public IP works in any networking scenario</li> </ul> <p>In any case, you should secure network access by ensuring that security group rules allow access from only authorized IPs or subnets.</p>
<a href="https://auth0.com">https://auth0.com</a> <a href="https://cdn.auth0.com">https://cdn.auth0.com</a> <a href="https://netapp-cloud-account.auth0.com">https://netapp-cloud-account.auth0.com</a> <a href="https://services.cloud.netapp.com">https://services.cloud.netapp.com</a>	<p>Your web browser connects to these endpoints for centralized user authentication through NetApp Cloud Central.</p>
<a href="https://widget.intercom.io">https://widget.intercom.io</a>	<p>For in-product chat that enables you to talk to NetApp cloud experts.</p>

## Firewall rules for Cloud Volumes ONTAP

Cloud Manager creates GCP firewall rules that include the inbound and outbound rules that Cloud Volumes ONTAP needs to operate successfully. You might want to refer to the ports for testing purposes or if you prefer your to use own firewall rules.

The firewall rules for Cloud Volumes ONTAP requires both inbound and outbound rules.

If you're deploying an HA configuration, these are the firewall rules for Cloud Volumes ONTAP in VPC-0.



## Inbound rules

The source for inbound rules in the predefined firewall is 0.0.0.0/0.

To create your own firewall, ensure that you add all networks that need to communicate with Cloud Volumes ONTAP, but also ensure to add both address ranges to allow the internal Google Load Balancer to function correctly. These addresses are 130.211.0.0/22 and 35.191.0.0/16. For more information, refer to [Google Cloud documentation: Load Balancer Firewall Rules](#).

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the System Manager web console using the IP address of the cluster management LIF
HTTPS	443	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
SSH	22	SSH access to the IP address of the cluster management LIF or a node management LIF
TCP	111	Remote procedure call for NFS
TCP	139	NetBIOS service session for CIFS
TCP	161-162	Simple network management protocol
TCP	445	Microsoft SMB/CIFS over TCP with NetBIOS framing
TCP	635	NFS mount
TCP	749	Kerberos
TCP	2049	NFS server daemon
TCP	3260	iSCSI access through the iSCSI data LIF
TCP	4045	NFS lock daemon
TCP	4046	Network status monitor for NFS
TCP	10000	Backup using NDMP
TCP	11104	Management of intercluster communication sessions for SnapMirror
TCP	11105	SnapMirror data transfer using intercluster LIFs
TCP	63001-63050	Load balance probe ports to determine which node is healthy (required for HA pairs only)
UDP	111	Remote procedure call for NFS
UDP	161-162	Simple network management protocol
UDP	635	NFS mount
UDP	2049	NFS server daemon
UDP	4045	NFS lock daemon
UDP	4046	Network status monitor for NFS
UDP	4049	NFS rquotad protocol

## Outbound rules

The predefined security group for Cloud Volumes ONTAP opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

### Basic outbound rules

The predefined security group for Cloud Volumes ONTAP includes the following outbound rules.

Protocol	Port	Purpose
All ICMP	All	All outbound traffic
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

### Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by Cloud Volumes ONTAP.



The source is the interface (IP address) on the Cloud Volumes ONTAP system.

Service	Protocol	Port	Source	Destination	Purpose
Active Directory	TCP	88	Node management LIF	Active Directory forest	Kerberos V authentication
	UDP	137	Node management LIF	Active Directory forest	NetBIOS name service
	UDP	138	Node management LIF	Active Directory forest	NetBIOS datagram service
	TCP	139	Node management LIF	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Node management LIF	Active Directory forest	LDAP
	TCP	445	Node management LIF	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Node management LIF	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Node management LIF	Active Directory forest	Kerberos key administration
	TCP	749	Node management LIF	Active Directory forest	Kerberos V change & set Password (RPCSEC_GSS)
	TCP	88	Data LIF (NFS, CIFS, iSCSI)	Active Directory forest	Kerberos V authentication
	UDP	137	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS name service
	UDP	138	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS datagram service
	TCP	139	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Data LIF (NFS, CIFS)	Active Directory forest	LDAP
	TCP	445	Data LIF (NFS, CIFS)	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos key administration
	TCP	749	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (RPCSEC_GSS)

Service	Protocol	Port	Source	Destination	Purpose
Cluster	All traffic	All traffic	All LIFs on one node	All LIFs on the other node	Intercluster communications (Cloud Volumes ONTAP HA only)
	TCP	3000	Node management LIF	HA mediator	ZAPI calls (Cloud Volumes ONTAP HA only)
	ICMP	1	Node management LIF	HA mediator	Keep alive (Cloud Volumes ONTAP HA only)
DHCP	UDP	68	Node management LIF	DHCP	DHCP client for first-time setup
DHCPS	UDP	67	Node management LIF	DHCP	DHCP server
DNS	UDP	53	Node management LIF and data LIF (NFS, CIFS)	DNS	DNS
NDMP	TCP	1860 0–18 699	Node management LIF	Destination servers	NDMP copy
SMTP	TCP	25	Node management LIF	Mail server	SMTP alerts, can be used for AutoSupport
SNMP	TCP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	TCP	162	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	162	Node management LIF	Monitor server	Monitoring by SNMP traps
SnapMirror	TCP	1110 4	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror
	TCP	1110 5	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer
Syslog	UDP	514	Node management LIF	Syslog server	Syslog forward messages

## Firewall rules for VPC-1, VPC-2, and VPC-3

In GCP, an HA configuration is deployed across four VPCs. The firewall rules needed for the HA configuration in VPC-0 are [listed above for Cloud Volumes ONTAP](#).

Meanwhile, the predefined firewall policy that Cloud Manager creates for instances in VPC-1, VPC-2, and VPC-3 enables ingress communication over *all* protocols and ports. These rules enable communication between HA nodes.

Communication from the HA nodes to the HA mediator takes place over port 3260 (iSCSI).

## Firewall rules for the Connector

The firewall rules for the Connector requires both inbound and outbound rules.

### Inbound rules

Protocol	Port	Purpose
SSH	22	Provides SSH access to the Connector host
HTTP	80	Provides HTTP access from client web browsers to the local user interface
HTTPS	443	Provides HTTPS access from client web browsers to the local user interface

### Outbound rules

The predefined firewall rules for the Connector opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

#### Basic outbound rules

The predefined firewall rules for the Connector includes the following outbound rules.

Protocol	Port	Purpose
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

#### Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by the Connector.



The source IP address is the Connector host.

Service	Protocol	Port	Destination	Purpose
Active Directory	TCP	88	Active Directory forest	Kerberos V authentication
	TCP	139	Active Directory forest	NetBIOS service session
	TCP	389	Active Directory forest	LDAP
	TCP	445	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	TCP	749	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	UDP	137	Active Directory forest	NetBIOS name service
	UDP	138	Active Directory forest	NetBIOS datagram service
	UDP	464	Active Directory forest	Kerberos key administration
API calls and AutoSupport	HTTPS	443	Outbound internet and ONTAP cluster management LIF	API calls to GCP and ONTAP, and sending AutoSupport messages to NetApp
API calls	TCP	3000	ONTAP cluster management LIF	API calls to ONTAP
DNS	UDP	53	DNS	Used for DNS resolve by Cloud Manager

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