Pulse Secure Services Director: Advanced User Guide

21.1

Copyright Notice

Contents

Preface

Document Conventions

The document conventions describe text formatting conventions, command syntax conventions, and important notice formats used in Ivanti technical documentation.

Text Formatting Conventions

Text formatting conventions such as boldface, italic, or Courier font may be used in the flow of the text to highlight specific words or phrases.

Format	Description
bold text	Identifies command names
	Identifies keywords and operands
	Identifies the names of user-manipulated GUI elements
	Identifies text to enter at the GUI
italic text	Identifies emphasis
	Identifies variables
	Identifies document titles
`Courier Font`	Identifies command output
	Identifies command syntax examples

Command Syntax Conventions

Bold and italic text identify command syntax components. Delimiters and operators define groupings of parameters and their logical relationships.

Convention	Description
bold text	Identifies command names, keywords, and command options.
italic text	Identifies a variable.
[ ]	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
{ **x** | **y** | **z** }	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
x | **y**	A vertical bar separates mutually exclusive elements.
< >	Non-printing characters, for example, passwords, are enclosed in angle brackets.
...	Repeat the previous element, for example, member[member...].
\	Indicates a “soft” line break in command examples. If a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.
bold text	Identifies command names, keywords, and command options.

Notes and Warnings

Note, Attention, and Caution statements might be used in this document.

ⓘ A Note provides a tip, guidance, or advice, emphasizes important information, or provides a reference to related information.

An Attention statement indicates a stronger note, for example, to alert you when traffic might be interrupted or the device might reboot.

A Caution statement alerts you to situations that can be potentially hazardous to you or cause damage to hardware, firmware, software, or data.

Requesting Technical Support

Technical product support is available through the Ivanti Global Support Center (PSGSC). If you have a support contract, file a ticket with PSGSC.

- Product warranties—For product warranty information, visit https://support.pulsesecure.net/product-service-policies/

Self-Help Online Tools and Resources

For quick and easy problem resolution, Ivanti provides an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: https://support.pulsesecure.net
- Search for known bugs: https://support.pulsesecure.net
- Find product documentation: https://www.ivanti.com/support/product-documentation
- Download the latest versions of software and review release notes: https://support.pulsesecure.net
- Open a case online in the CSC Case Management tool: https://support.pulsesecure.net
- To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool:
  https://support.pulsesecure.net

For important product notices, technical articles, and to ask advice:

- Search the Pulse Secure Knowledge Center for technical bulletins and security advisories: https://kb.pulsesecure.net
- Ask questions and find solutions at the Pulse Community online forum: http://kb.pulsesecure.net

Opening a Case with PSGSC

You can open a case with PSGSC on the Web or by telephone.

- Use the Case Management tool in the PSGSC at https://support.pulsesecure.net.
- Call 1-844 751 7629 (Toll Free, US).

- For international or direct-dial options in countries without toll-free numbers, see https://support.pulsesecure.net/support/support-contacts/

Understanding the Services Director

The Services Director enables you to deploy, configure and manage your Traffic Manager instances. Specifically, you can:

- License your Traffic Manager instances.
- Register externally-deployed Traffic Manager instances.
- Configure the use of an external instance host by the Services Director.
- Deploy Traffic Manager instances using a configured instance host.
- Deploy cloud-based Traffic Manager instances on AWS.
- Transition deployed Traffic Manager instances through a lifecycle.
- Start, stop and restart your Services Director service.
- Protect your instance configurations (on a cluster basis) by taking automated and manual backups.
- Protect your Services Director configuration using a backup system.
- Protect your Traffic Manager passwords using encryption based on a Master Password.
- Perform health and monitoring reporting.
- Perform usage metering.
- Generate and view analytics information for the vTMs in the estate of the Services Director.
- Generate system logs and system dumps.

Support for individual functions depends on your license type, see "Overview of Services Director Licensing" on page 16.

Services Director Customer Types

The Services Director supports two kinds of customers.

Cloud Service Provider (CSP) customers are typically service providers and hosting organizations who want to use metered usage data to bill their end users. They can offer unlimited registration, deployment and licensing of Traffic Manager instances, and there are no limits on the bandwidth or Services Director features they can consume. Services Director collects metered usage data on a regular basis, and accumulates this for eventual download and end user billing. The same metering data is sent to Ivanti, Inc. to bill the CSP customer.

Enterprise customers are typically end users of Services Director who want to pre-pay all usage charges. They can allocate features and bandwidth up to the capacity they have purchased as Bandwidth Packs and Add-On Packs. At this point, additional Bandwidth Packs and Feature Packs can be purchased from Ivanti, Inc. to allow further allocation. No metering is supported, and Ivanti, Inc. does not bill the Enterprise customer.

See "Overview of Services Director Licensing" on page 16 for a description of the software license types that support these customers.

In this manual, a section that is relevant to only one customer license type will state this in its heading. For example:

- "Bandwidth Pack Licenses (Enterprise Customers Only)" on page 18.
- "Usage Metering and Activity Metrics (CSP Customers Only)" on page 236.

Services Director Form-Factors

The Services Director is available as two form-factors:

- Software form-factor - this is an installation of Pulse Secure Services Director on Ubuntu or RHEL/CentOS. This can be controlled using a Representational State Transfer (REST) API only.

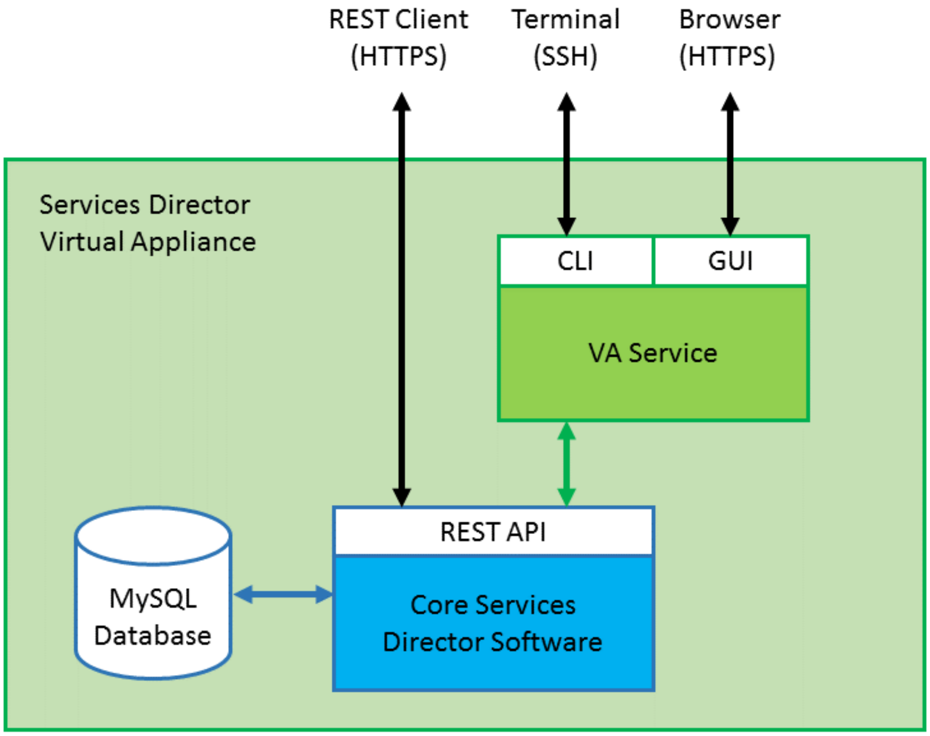
  This is the primary configuration described in this manual.

- Virtual appliance form-factor - this is an installation of Pulse Secure Services Director Virtual Appliance (Services Director VA) on any supported platform. This can be accessed using a REST API, a graphical user interface (GUI) and a Command-Line Interface (CLI).

  This is NOT the focus of this manual.

For detailed information about the Services Director VA, see the Pulse Secure Services Director Getting Started Guide.

For detailed information about the CLI, see the Pulse Secure Services Director Command Reference.



The Services Director stores information about deployed Traffic Manager instances, including the resources that it needs to manage in a MySQL inventory database.

Supported actions are triggered through the Services Director REST API, through a REST API instance resource. You issue a REST API request for the Services Director server to update the inventory database, which in turn queues an action to implement the requested operation before responding to the request. To avoid time-out issues, the response is returned before the action completes. After the action completes, the inventory database is updated. There is no progress callback from the Services Director; you must poll the Services Director to check for the status of the action. For detailed information about REST API resources, see "Using the ServURI Root Partsices Director REST API" on page 116.

Working with an Instance Host

An instance host is required for the creation/deployment of Traffic Managers by the Services Director. The instance host is a configured Linux machine - this is a generic Linux machine that has been configured to run as an instance host. This machine can be either virtual or physical, and can run either Ubuntu or RHEL/CentOS.

An instance host can be used with both Services Director form-factors:

- A software form-factor Services Director supports the use of a Linux machine as an instance host. This is described in "Using an Instance Host with a Software Services Director" on page 55.
- The Services Director VA supports the use of a configured Linux machine as an instance host. This is described in "Using an Instance Host with a Services Director VA" on page 82.

For detailed information about the Services Director VA, see the Pulse Secure Services Director Getting Started Guide.

For detailed information about the CLI, see the Pulse Secure Services Director Command Reference.

The Services Director stores information about deployed Traffic Manager instances, including the resources that it needs to manage in a MySQL inventory database.

Supported actions are triggered through the Services Director REST API, through a REST API instance resource. You issue a REST API request for the Services Director server to update the inventory database, which in turn queues an action to implement the requested operation before responding to the request. To avoid time-out issues, the response is returned before the action completes. After the action completes, the inventory database is updated. There is no progress callback from the Services Director; you must poll the Services Director to check for the status of the action. For detailed information about REST API resources, see "Using the ServURI Root Partsices Director REST API" on page 116.

Using the Advanced User Guide

This manual guides you through the installation and configuration of your software form-factor Services Director. It provides a reference guide for specific functional areas.

The structure of the manual is as follows:

- "Managing Services Director Licensing" on page 16 - This chapter describes Services Director licenses and how to install them.
- "Installing and Configuring the Software Services Director" on page 33 - This chapter describes how to install and configure the Services Director.
- "Using an Instance Host with a Software Services Director" on page 55 - This chapter describes how to deploy Traffic Manager instances with a combination of an instance host and the software form-factor Services Director.
- "Using an Instance Host with a Services Director VA" on page 82 - This chapter describes how to deploy Traffic Manager instances with a combination of an instance host and the Services Director VA.
- "Registering Externally-Deployed Traffic Managers" on page 109 - This chapter describes how to register externally-deployed Traffic Manager instances when using an instance host on either the software form-factor Services Director or the Services Director VA.
- "Using the ServURI Root Partsices Director REST API" on page 116 - This chapter describes the REST API, which is the primary means of communicating with the Services Director for all configuration and control purposes.
- "Metering and Monitoring the Services Director" on page 236 - This chapter describes how to configure metering and monitoring for the Services Director.
- "Upgrading the Services Director" on page 244 - This chapter describes the process for upgrading the Services Director VA.
- "Working with the Master Password" on page 249 - This chapter describes how to store, change and reset the Master Password.
- "Appendix: Deploying for Redundancy" on page 254 - This appendix describes how to implement high availability configurations for the Services Director.
- "Appendix: Managing the Services Director Using the CLI" on page 268 - This appendix describes the configuration of the Services Director using the Command-Line Interface (CLI) only.
- "Appendix: Email Notifications Generated By Services Director" on page 282 - This appendix describes the e-mails that can be generated by the Services Director.

Using INSTALLROOT in This Guide

This guide uses the term INSTALLROOT to refer to the location of the Services Director software installation directory. It is not an environment variable and is used in this guide for consistency only.

Previous versions of the Services Director used a deprecated environment variable, $SSCHOME, for this purpose. If this is still set in your environment, you must explicitly unset it prior to installing or upgrading the Services Director.

The default installation locations for the Services Director software package on the supported platforms are:

- Ubuntu: /opt/riverbed_ssc_21.1/
- RHEL/CentOS: /opt/riverbed-ssc/

Managing Services Director Licensing

Overview of Services Director Licensing

The Services Director supports the following Software Licenses:

- Cloud Services Provider (CSP) license - A CSP license supports all Services Director features (except vTM Analytics), and includes billing that is dependent on instance metering.

  The registration, deployment and licensing of any number of Traffic Manager instances are supported, and there are no limits on the supported features or bandwidth they can use. Using a CSP license, the Services Director implements a metering scheme to obtain throughput and other metrics from each Traffic Manager instance on a regular basis (typically, hourly) and records the data in central log files.

  Service providers and hosting organizations can use the metrics data to bill end users accordingly. Ivanti uses the same metrics data to charge the Services Director customer.

- Enterprise license - An Enterprise license supports all pre-paid bandwidth and features. That is, the customer purchases Bandwidth Pack licenses, Enterprise Management Resource Pack licenses and (historically) Add-On Pack licenses from Ivanti, Inc. to create licensed capacity which can be allocated to Traffic Managers. Bandwidth and features can be allocated up to the capacity purchased. Additional Bandwidth Packs, Enterprise Management Resource Packs and Add-On Packs can be purchased from Ivanti, Inc. to allow further allocation. An Enterprise license does not provide a billing option. There is no requirement to collect and returned metering data to Ivanti, Inc..

  - Bandwidth Pack - A Bandwidth Pack license is a secondary type of license for Enterprise customers. Each Bandwidth Pack license provides a specific amount of bandwidth (for example, 5 Gbps) for a Traffic Manager SKU. Each Bandwidth Pack is tied to a specific Services Director Enterprise license. See "Bandwidth Pack Licenses (Enterprise Customers Only)" on page 18.

  - Analytics Resource Pack - An Analytics Resource Pack license is a secondary type of license for Enterprise customers. Each Analytics Resource Pack license provides a specific amount of bandwidth (for example, 5 Gbps) to the ENT-ANALYTICS SKU. Each Bandwidth Pack is tied to a specific Services Director Enterprise license. See "Analytics Resource Pack Licenses (Enterprise Customers Only)" on page 21.

  - Enterprise Management Resource Pack - An Enterprise Management Resource Pack license is a *historical* secondary type of license for Enterprise customers. It enabled Enterprise Management Features on a fixed number of vTMs. Each Enterprise License Resource Pack is tied to a specific Services Director Enterprise license. See "Enterprise Management Resource Pack Licenses (Newer Licenses Only)" on page 22.

  - Add-On - An Add-On license is a *historical* secondary type of license that is compatible with older Services Director licenses only. It provides a mechanism for adding specific features. For example, Federal Information Processing Standards (FIPS), Ivanti, Inc. Application Firewall (WAF), and Ivanti, Inc. Aptimizer Web Accelerator. Each Add-On license is tied to a specific Enterprise License Key. See "Add-On Licenses (Older Licenses Only)" on page 22.

The Services Director also supports Traffic Manager Flexible Licensing Architecture (FLA) Licenses. These are intended for the Traffic Manager instances rather than Services Director itself. With the FLA license you do not have to obtain licenses for individual Traffic Manager instances. Instead, the Services Director applies a FLA license to each instance, and dynamically sets the feature set and bandwidth required for each instance.

- From Services Director v2.2 onwards, Universal FLA Licenses are provided with the installed product for both CSP and Enterprise customers. These are suitable for any Traffic Manager at version 10.1 or above which has its REST API enabled.

- From Services Director v2.2 onwards, the term Legacy FLA Licenses refer to FLA licenses for any Traffic Manager at version 10.0 or earlier, or which has its REST API disabled. That is, it is not suitable for use with Universal FLA Licensing. Legacy FLA licensing can be added for older Traffic Manager versions, and requires a self-signed (or equivalent) certificate to be generated prior to its generation.

Retrieving Ivanti, Inc. vTM and Services Director Product Licenses

1. License tokens are automatically emailed to you when you order your product. If you have not received your tokens, contact Ivanti, Inc. Support.

2. Redeem license tokens at Ivanti, Inc.’s website. To redeem tokens you must have a support site login and password. You can register for a new account at Ivanti, Inc. Support.

3. Licenses are emailed to you as attachments.

Licensing on a Cluster of Services Directors

You can use a cluster of Services Directors (two or more) to provide resilience to your system.

Before starting the first Services Director in a cluster of Services Directors, you must place a valid license key file in the INSTALLROOT/licenses directory. New licenses in this location are automatically added to the database when the Services Director reboots and communication is established. A newly-installed Services Director that is configured to use an existing inventory database containing valid license keys will use those keys to operate after it has started.

Ivanti, Inc. recommends that you install all subsequent Services Director licenses via the REST API's controller_license_key resource. For details, see "controller_license_key Resource" on page 152.

For detailed information about installing Services Director licenses, see "Installing the Services Director Software License" on page 45.

Bandwidth Pack Licenses (Enterprise Customers Only)

A Bandwidth Pack is a secondary type of license that is tied to a specific Enterprise Services Director license.

For software form-factor installations of Services Director, Ivanti, Inc. recommends that you add the Bandwidth Pack license to the shared database from a running Services Director using the REST API's bandwidth_pack_license_key resource. For details, see "bandwidth_pack_license_key Resource" on page 141. However, you can also place the Bandwidth Pack license in the INSTALLROOT/licenses directory and restart the Services Director. New licenses are automatically added to the database as they are discovered.

Each Bandwidth Pack enables a specific amount of bandwidth (typically, 5 Gbps) to a Traffic Manager SKU. The Bandwidth Pack license allows you to deploy and license Traffic Manager instances with an aggregate bandwidth allowance equal to that of the Bandwidth Pack.

Each Bandwidth Pack is associated with one Services Director license and cannot be used unless that Services Director license has been loaded and found to be valid. A Bandwidth Pack only allows the deployment and licensing of Traffic Manager instances with one SKU. If you want to deploy Traffic Manager instances with different SKUs, then they require multiple Bandwidth Packs.

Services Director licenses and Bandwidth Packs are perpetual or they can have start and end dates.

Multiple Bandwidth Packs can license bandwidth for a SKU; their allowances are added to determine the total. Bandwidth Packs can be upgraded from one SKU to another. Where an existing Bandwidth Pack license is upgraded, a new license is issued with the same serial number as the existing one, but licensing a different SKU. Only one of a set of Bandwidth Pack licenses with a shared serial number is used at any one time.

The declared bandwidth for a vTM instance is used for both traffic bandwidth and analytics bandwidth.

Where licensed capacity is exceeded for a given SKU, all licensing requests for instances using that SKU are rejected. This behavior is also true of instances using an Add-On license SKU with insufficient licensed bandwidth.

If you are using a Bandwidth Pack license (or bandwidth from an Analytics Resource Pack) the Services Director does not allow you to exceed the licensed bandwidth with your deployed Traffic Manager instances. Instances with a status of Deleted do not count towards deployed totals. Any instance whose status is not Deleted continues to consume licensing bandwidth. The same rules apply to the consumption for Add-On license SKUs bandwidth for instances using Add-On SKUs.

Installing the Bandwidth Pack License (Enterprise Customers Only)

1. Place the license on an accessible location in your infrastructure. For details about obtaining your license keys, see "Retrieving Ivanti, Inc. vTM and Services Director Product Licenses" on page 17.

2. Install and configure the Services Director. For details, see "Installing and Configuring the Software Services Director" on page 33.

3. Ivanti, Inc. recommends that you add the Bandwidth Pack license to the shared database from a running Services Director using the REST API’s bandwidth_pack_license_key resource. For details, see "bandwidth_pack_license_key Resource" on page 141.

   Alternatively, copy a Services Director license file containing the license key to the INSTALLROOT/licenses directory of an Services Director and restart the Services Director. New licenses are automatically added to the database as they are discovered.

Upgrading Bandwidth Pack Licenses (Enterprise Customers Only)

When your Services Director is using the Enterprise Licensing model, you can upgrade a bandwidth pack to support a different STM SKU. This supports the replacement of existing purchased licensing with the same quantity of a more feature-rich STM SKU.

For example, a deployment of Traffic Manager instances is using the STM-300 STM SKU, and an upgrade to the STM-400 STM SKU is required.

For each existing bandwidth pack license key being upgraded, the Administrator will be provided with two new bandwidth pack licenses keys:

- The first license will contain the same serial number as the existing bandwidth pack license key.

  Only one of these licenses can contribute licensed bandwidth in your Services Director deployment at any time.

- The second bandwidth pack license key will be a time-limited key which provides extra bandwidth used during the switchover.

  This provides a workaround for the Services Director’s protection against licensing compliance breaches.

To upgrade a Bandwidth Pack License:

1. Obtain the replacement (upgrade) license key and the supplementary temporary bandwidth pack license keys from Ivanti, Inc..
2. Install replacement and supplementary bandwidth pack license keys on the Services Director.

   It may be necessary to set the upgrade bandwidth pack license key(s) to an Active status after installation. Once complete, the controller_license_key resource's cluster_bandwidth property should show sufficient unused STM-400 bandwidth for the instances that are to be switched to use this STM SKU.

3. Create a feature_pack resource using the STM-400 STM SKU if one does not already exist.
4. Set the feature_pack property of each affected Traffic Managerinstance resource to the desired STM-400 feature_pack resource (as created in step 3).
5. Remove the supplementary bandwidth pack license keys.

If the Services Director does not allow removal of the supplementary license keys, it may indicate a licensing shortage. This situation may result in unlicensed Traffic Managers after these keys expire.

Analytics Resource Pack Licenses (Enterprise Customers Only)

An Analytics Resource Pack license is a secondary type of license for Enterprise customers that is supported on “new style” Services Director licenses (the Services Director license number begins "LK1-BR-ADC").

Each Analytics Resource Pack is associated with one Services Director license and cannot be used unless that Services Director license has been loaded and found to be valid.

For a vTM in the estate of the Services Director to support vTM Analytics, its Feature Pack must include the ENT-ANALYTICS add-on SKU, and one or more Analytics Resource Pack Licenses must be added to the Services Director.

Each Analytics Resource Pack license provides a specific amount of bandwidth (for example, 5 Gbps) to any vTM whose Feature Pack includes the ENT-ANALYTICS add-on SKU. An Analytics Resource Pack license allows you to perform Analytics on Traffic Manager instances with an aggregate bandwidth allowance equal to that of the Analytics Resource Pack.

The declared bandwidth for a vTM instance is used for both traffic bandwidth and analytics bandwidth.

Analytics Resource Pack licenses are either perpetual, or they can have start and end dates.

Multiple Analytics Resource Packs can be applied to a Services Director; their allowances are added to determine the total.

Where licensed capacity is exceeded for the ENT-ANALYTICS SKU, all licensing requests for vTM instances using that SKU are rejected.

Enterprise Management Resource Pack Licenses (Newer Licenses Only)

ⓘ An Enterprise Management Resource Pack Licenses is a *historical* license type that is supported on “new style” Services Director licenses (the Services Director license number begins "LK1-BR-ADC"). Enterprise Management Resource Pack Licenses are not compatible with “old style” Services Director licenses.

A Enterprise Management Resource Pack is a secondary type of license that is tied to a specific Enterprise Services Director license. It enables Enterprise Management Features on a fixed number of vTMs.

Features that require an Enterprise Management Resource Pack License are:

- vTM Analytics Export.

The SKUs from the Enterprise Management Resource Pack License can be combined with base SKUs when the user creates a Feature Pack to enable Enterprise Management features on any vTM (up to the defined limit) that uses the Feature Pack.

ⓘ Currently, Enterprise Management Resource Pack Licenses are available to Enterprise customers only.

Add-On Licenses (Older Licenses Only)

ⓘ An Add-On License is a historical license type, that is only supported on “old style” Services Director licenses (the Services Director license number begins "LK1-ERSSC"). Add-On Licenses is not compatible with “new style” Services Director licenses.

An Add-On license is a secondary type of license that is tied to a specific Enterprise License Key. Each Add-On license contributes license bandwidth for a single specific feature, known as an Add-On SKU. These Add-On SKUs can be combined with base SKUs when the user creates a Feature Pack. For an instance set to use such a Feature Pack, the feature capabilities of the base SKU are augmented by those of the Add-On SKU.

Add-On SKUs can be used with CSP licensing model, and do not require the use of an Add-On license.

The Services Director supports the following Add-On licenses:

- Federal Information Processing Standards (STM-B-ADD-FIPS, STM-CSP-U-ADD-FIPS)
- Ivanti, Inc. Application Firewall license (STM-B-ADD-WAF, STM-CSP-U-ADD-WAF)
- Ivanti, Inc. Aptimizer Web Accelerator (STM-B-ADD-WEBACCEL, STM-CSP-U-ADD-WEBACCEL)

Add-On licenses have unique serial numbers and do not support upgrades.

Installing an Add-On License

To retrieve an Add-On license, you are sent a token via email to redeem at Ivanti, Inc. Support.

1. Place the licenses on an accessible location in your infrastructure. For details about obtaining your license keys, see "Retrieving Ivanti, Inc. vTM and Services Director Product Licenses" on page 17.
2. Install and configure the Services Director.
3. Ivanti, Inc. recommends that you add the Add-On license to the shared database from a running Services Director using the REST API’s add_on_pack_license_key resource. For details, see "add_on_pack_license_key Resource" on page 126.

   Alternatively, copy a Services Director license file containing the license key to the INSTALLROOT/licenses directory of an Services Director and restart the Services Director. New licenses are automatically added to the database as they are discovered.

Working with Traffic Manager FLA Licenses

Traffic Manager Flexible Licensing Architecture (FLA) License - A Traffic Manager FLA license is intended for the Traffic Manager instances rather than Services Director itself. With the FLA license you do not have to obtain licenses for individual Traffic Manager instances. Instead, the Services Director applies a site-specific license to each instance and dynamically sets the feature set (SKU) and bandwidth desired for each instance. The FLA license requires a self-signed (or equivalent) certificate to be generated prior to its generation.

- From Services Director v2.2 onwards, Universal FLA Licenses are provided with the installed product for both CSP and Enterprise customers. These are suitable for any Traffic Manager at version 10.1 or above which has its REST API enabled.

- From Services Director v2.2 onwards, the term Legacy FLA Licenses refer to FLA licenses for any Traffic Manager at version 10.0 or earlier, or which has its REST API disabled. That is, it is not suitable for use with Universal FLA Licensing. Legacy FLA licensing can be added for older Traffic Manager versions.

  Universal FLA is available automatically when the product is installed, but all of the procedures in this section are supported by both Universal FLA and Legacy FLA.

Generating a Self-Signed SSL Server Certificate

ⓘ This section is supported by both Universal FLA and Legacy FLA. Universal FLA is available automatically when the product is installed, but you must still supply an SSL certificate for it.

The Services Director is commonly deployed using self-signed certificate/key pairs, using the self-signed server certificate in the FLA license.

The following information is required to generate a Legacy Traffic Manager FLA license:

- A list of the fully-qualified host names that is used for Services Directors acting as license servers, along with port numbers.
- The SSL server certificate that is used by all of the Services Directors (different controllers are not permitted to use different certificates).

  An FLA license attempts to contact each of the listed license servers in turn, until it makes a successful connection or has attempted and failed to contact each one.

  The SSL server certificate is verified by the FLA license. If an SSL server certificate does not match what is required by the FLA license, then that FLA license will not connect to the Services Director license servers. If this failure occurs, you may need to generate a new FLA license or correct the key/certificate used by the Services Director.

1. At the Linux prompt, enter:

```
$ openssl req -x509 -nodes -newkey rsa:2048 -keyout key.pem -out cert.pem -days 3650
```

Parameter	Description
req	Specifies an X509 certificate signing request management.
-x509	Specifies a self-signed certificate rather than a certificate request.

Parameter	Description
-nodes	Specifies that the private key will not be encrypted (otherwise, the server needs a password to start).
-newkey rsa:2048	Generates a new certificate request and sets the key size.
-keyout key.pem	Sets the target for the new private key.
-out cert.pem	Sets the target for the certificate.
-days 3650	Specifies the duration of the certificate (default is 30 days). A longer period may be desirable as a fresh FLA license will need to be generated and then deployed to all STM instances when the certificate expires.

The FLA license does not accept composite certificates that include a server certificate along with other information or certificates created by ssh-keygen.

Verifying the SSL Certificate

1. At the prompt, enter:

```
$ openssl x509 -in certificate.crt -noout
```

   This command succeeds silently for a valid certificate or report errors.

2. To verify signed certificates, at the system prompt, enter:

```
$ openssl verify <certificate name>
```

Installing FLA Licenses

Universal FLA is available automatically when the product is installed, but this section is supported by both Universal FLA licenses and Legacy FLA licenses.

The Traffic Manager FLA license is installed by placing the FLA license file in the configured sources directory (the location for the Traffic Manager image and FLA license files), and then creating a license resource via the Services Director REST API.

1. Choose a source location for FLA licenses. This is used during the installation process for the Services Director. For detailed information, see "Required Configuration Parameters" on page 38.

2. Place the license file in the location chosen in step 1. For details about obtaining your license keys, see "Retrieving Ivanti, Inc. vTM and Services Director Product Licenses" on page 17.

3. Install and configure the Services Director. For details, see "Installing and Configuring the Software Services Director" on page 33.

4. Create a REST API license resource in the Services Director REST API. For details, see "license Resource" on page 177.

Checking the Health of an FLA License Manually

This section is intended for use with Legacy FLA Licenses, and applies to all customers. No equivalent actions will be required for Universal FLA Licenses.

The Services Director supports an FLA Health Checker. This tool enables you to manually test the licensing of all your resources against an FLA license. This enables you to identify any licensing problems with the FLA before any instances start using it.

You will typically run the FLA Health Checker immediately after creating the dependent resources for instance deployment. That is, host, license, feature pack, and version.

The health of an FLA license is checked automatically under some circumstances. See "Checking the Health of an FLA License Automatically" on page 31.

You start the FLA health checker using the REST API. To do this, issue a GET REST API request for the license resource, including the URL parameter status_check=true.

The response from the GET request will depend on the success of this operation.

Initially, the health_check_status property indicates that the FLA health check has started in the background, and is in progress.

For example:

```
{ "generic_errors" : null,
  "health_check_results" : [  ],
  "health_check_status" : "In Progress",
  "info" : "",
  "last_health_check_time" : "<timestamp>",
  "status" : "Active"
}
```

You can then poll the URI with normal GET request until the health check completes.

Only one FLA health check can be running at any time.

- When a health check completes successfully:
  - the health_check_status is set to Completed.
  - the health_check_result is Passed.
  - the details property is empty.

    For example:

```
{ "generic_errors" : null,
  "health_check_results" : [ {
      "details" : {   },
      "health_check_result" : "Passed",
      "instance_host" : "<instance_host>.com",
      "services_director_host" : "<sd_host>:<port>",
      "services_director_port" : <port>
      } ],
  "health_check_status" : "Completed",
  "info" : "",
  "last_health_check_time" : "<timestamp>",
   "status" : "Active"
}
```

- When the health check completes with SSL connection errors:
  - the health_check_status is set to Completed.
  - the health_check_result is Failed.
  - the details property includes the SSL errors.

    For example:

```
{ "generic_errors" : null,
   "health_check_results" : [{
        "details" : {
             "ssl_errors" : {
                      "errors" : [{
                      "err_code" : 18,
                      "err_text" : "Services Director sent a self-signed
                                    certificate which cannot be trusted"
                    }],
                  "fla_certs" : [{
                      "common_name" : "<common_name>",
                      "issuer_common_name" : "<issuer_common_name>",
                      "not_after" : "20150529135614Z",
                      "not_before" : "20130529135614Z"
                    }],
                  "services_director_certs" : [{
                      "common_name" : "<common_name>",
                      "issuer_common_name" : "<issuer_common_name>",
                      "not_after" : "20240513142858Z",
                      "not_before" : "20140514142858Z"
                    }]
              }},
        "health_check_result" : "Failed",
        "instance_host" : "<instance_host>",
        "services_director_host" : "<sd_host>:<port>",
        "services_director_port" : <port>
      },
      { "details" : {
           "ssl_errors" : {
                "errors" : [{
                      "err_code" : 18,
                      "err_text" : "Services Director sent a self-signed
                                    certificate which cannot be trusted"
                      }],
           "fla_certs" : [{
                "common_name" : "",
                "issuer_common_name" : "",
                "not_after" : "20150529135614Z",
                "not_before" : "20130529135614Z"
                }],
            "services_director_certs" : [{
               "common_name" : "<common_name>",
               "issuer_common_name" : "<issuer_common_name>",
               "not_after" : "20240513142858Z",
               "not_before" : "20140514142858Z"
                   } ]
              } },
        "health_check_result" : "Failed",
        "instance_host" : "<instance_host>",
        "services_director_host" : "<sd_host>:<port>",
        "services_director_port" : <port>
        }
    ],
  "health_check_status" : "Completed",
  "info" : "test",
  "last_health_check_time" : "<timestamp>",
  "status" : "Active"
}
```

In the above response, the ssl_errors property included:

- the details of the errors (errors)
- the certificate embedded in the FLA (fla_certs).
- the details of the certificate sent by the Services Director (services_director_certs).
- When the health check completes with network related errors:

- the health_check_status is set to Completed.
- the health_check_result is Failed.
- the details property includes the network errors.

For example:

```
{ "generic_errors" : null,
  "health_check_results" : [{
       "details" : {
           "network_errors" : "Failed to resolve SSC host '<sd_host>':
                               Name or service not known"
        },
        "health_check_result" : "Failed",
        "instance_host" : "<instance_host>",
        "services_director_host" : "<sd_host>:<port>",
        "services_director_port" : <port>
      },
      { "details" : {
           "network_errors" : "Failed to resolve SSC host ‘<sd_host>':
                               Name or service not known"
         },
        "health_check_result" : "Failed",
        "instance_host" : "<instance_host>",
        "services_director_host" : "<sd_host>:<port>",
        "services_director_port" : <port>
      }
    ],
  "health_check_status" : "Completed",
  "info" : "test",
  "last_health_check_time" : "<timestamp>",
  "status" : "Active"
}
```

The generic_errors top level property specifies errors that may happen while carrying out FLA health checks, but which is not related to the actual FLA health check. For instance, if there are no active hosts to carry out the checks.

Checking the Health of an FLA License Automatically

ⓘ This section is intended for use with Legacy FLA Licenses, and applies to all customers. No equivalent actions will be required for Universal FLA Licenses.

The Services Director supports an automated FLA Health Checker. This tool tests the FLA license as part of the following activities:

- The deployment of a new Traffic Manager instance.
  - If the FLA license check fails, the deployment action status is Blocked, with a reason for the failure. The instance has a status of Failed to Deploy.
  - If the FLA license check succeeds, the deployment continues. Once this action completes, the instance has a status of Idle.

ⓘ When you create a service, the deployment of a new Traffic Manager service instance does not trigger the FLA Health Checker.

- Any attempt to transition a Blocked deployment action to a status of Waiting.
  - If the FLA license check fails, the deployment action remains Blocked, with a reason for the failure.
  - If the FLA license check succeeds, the deployment continues. Once this action completes, the instance has a status of Idle.
- Any change to the FLA license of a deployed Traffic Manager instance. When the new license is applied, the instance is checked against the new FLA license.
  - If the FLA license check fails, the update action for the instance is Blocked, with a reason for the failure. The status of the instance is unchanged.
  - If the FLA license check succeeds, the status of the instance is unchanged.

This enables you to prevent any FLA licensing problems before they occur.

When you perform a deployment manually through the REST API, you can specify a URL parameter ?override_fla_check=true to prevent the automatic FLA license check before deployment. This is not supported from the Services Director VA.

You are able to disable the operation of the FLA Health Checker at the Services Director level. See "Disabling the FLA Health Checker" below.

ℹ You can check the health of an FLA license manually at any time. See "Checking the Health of an FLA License Manually" on page 26.

Disabling the FLA Health Checker

To disable the FLA Health Checker at the Services Director level, either:

- In the REST API, make a call to the /api/tmcm/2.9/settings/fla_check resource, with the following JSON object:

  ```
  {"fla_checker_enabled": False}
  ```

- In the Services Director VA, disable the check from the System > Service Status page.

Reapplying a FLA License

If you want to re-license a Traffic Manager using its assigned FLA license, use the REST API. For example:

```
$ curl -v -k --basic -H "Content-Type: application/json" -H "Accept: application/json"
-u user:passwd https://x.x.x.x:8100/api/tmcm/2.9/instance/<instance_
name>?relicense=true -d '{ }'
```

Installing and Configuring the Software Services Director

Introduction

To install and configure a software form-factor Services Director, follow the instructions in the following sections:

- "Prerequisites" below.
- "Configuring the MySQL Database for the Services Director" on page 40.
- Either refer to "Installing and Configuring the Services Director on Ubuntu" on page 41 or "Installing and Configuring the Services Director on RHEL/CentOS" on page 43.
- "Installing the Services Director Software License" on page 45.
- To install an externally-deployed Traffic Manager with minimal supporting resources, refer to "Adding Resources Using the REST API" on page 46.
- "Starting and Stopping the Services Director" on page 49.

To add user authentication to your Services Director (either vTM user authentication or Services Director user authentication), you will need to:

- Review the user authentication material in the Pulse Secure Services Director Getting Started Guide.
- Create any required authenticators, refer to "authenticator Resource" on page 129.
- Create any required permission groups, refer to "permission_group Resource" on page 189.
- Create any required access profiles (vTM user authentication only), refer to "access_profile Resource" on page 122.

ℹ If you want to install and configure a Services Director Virtual Appliance (VA), see the Pulse Secure Services Director Getting Started Guide.

Prerequisites

The Services Director supports the following:

- Operating system: Ubuntu 18.04 (x86_64), RHEL/CentOS 6 (x86_64)

ⓘ Ivanti recommends that the Services Director machines and any instance hosts all use either Ubuntu or RHEL/CentOS.

- Database: MySQL 5.7

Required Linux Packages

Make sure the following Linux packages are installed before you start the installation process. The packages differ according to the operating system you are using.

Ubuntu 18.04 (64 bit)	RHEL/CentOS 6 (64 bit)
mysql-common	mysql
libmysqlclient20	glibc-devel (v2.12 or later)
mysql-client-5.7 and mysql-client-core-5.7	Python Argparse (required for an instance host)
OpenSSL (latest version for OS)	OpenSSL (latest version for OS)
libldap (v2.4 or later)	openldap (v2.4 or later)

ⓘ The latest version of OpenSSL is essential for security purposes.

ⓘ You must install and configure all software, including the Services Director, as superuser or a user account with administrator or equivalent access permissions.

Hardware Requirements

The Services Director requires the following hardware.

Hardware	Requirement
CPU	Intel Xeon / AMD Opteron
Minimum Memory	2 GB

Hardware	Requirement
Minimum Disk Space	10 GB (plus additional disk space for metering logs depending on number of instances metered)

Software and License Requirements

To install the Services Director, you need the following software and licenses:

- MySQL Database Server - The Services Director uses a MySQL database to store inventory data and other items relating to the deployment of your Traffic Manager instances. You must install and configure MySQL on your required platform. This must be accessible to Services Director using the configured credentials at the host and port specified. Consult the MySQL documentation for your platform to do this.
- Mail Server - The Services Director uses email to alert you of certain error conditions (for example, running low on log disk space). You must set up and provide SMTP mail server connection details to the Services Director for correct operation. The Services Director does not support SMTP connections that require authentication.
- Services Director Licenses - Before starting the first Services Director in a cluster of Services Directors, you must place a valid license key file in the INSTALLROOT/licenses directory. New licenses are automatically added to the database as they are discovered. The Services Director license is automatically copied to the inventory database after communication is established. A newly installed Services Director instance that is configured to use an existing inventory database containing valid license keys uses those keys to operate after it has started.

  Ivanti recommends that you install all subsequent Services Director licenses via the REST API’s controller_license_key resource. For details, see "controller_license Resource" on page 152.

Required Services Director Files

To install the Services Director, you need the following files:

- SSL Certificate/Key - The SSL certificate and key are used by the Services Director REST API to enable authentication of the Service Controller when it is being accessed by remote clients. An important client is the Traffic Manager FLA license, which requires that you generate a self-signed SSL certificate and key (or equivalent compatible certificate and key).

You must place these files on an accessible location in your infrastructure. For details, see "Generating a Self-Signed SSL Server Certificate" on page 24.

Required Traffic Manager Files

The Services Director requires a set of external Traffic Manager files to deploy Traffic Manager instances:

- Traffic Manager Image - The Traffic Manager image (that is, its tarball file) is required to create Traffic Manager instances in the Services Director.

  You must place this in the Source File Location that you provide when you install the Services Director.

- Traffic Manager FLA License - The Traffic Manager FLA license is required to create instances in the Services Director.

  You must place this in the Source File Location that you provide when you install the Services Director.

These external files are not part of the initial Services Director installation. You might require different versions of the Traffic Manager, and the license files are customized for each Services Director deployment in conjunction with your support provider.

You use the Services Director REST API to create an inventory of resources for the Traffic Manager image and its license files. The REST API does not import the actual files and does not, by default, verify that the files are present. For detailed information about checking the status of REST API resources, see "Using the REST API to Check Status" on page 232.

Services Director User Types

Within the Services Director, there are these types of users:

- MySQL Database User - When you create the inventory database required by the Services Director, you create a MySQL user that has access to the database. Ivanti recommends you create a specific Services Director user rather than using the database root user. You supply the name and password of this user when you install the Services Director so that it can access the database that you have pre-created. These credentials are recorded in the Services Director configuration file. See "Configuring the MySQL Database for the Services Director" on page 40.

- The Services Director Linux User - The Services Director software is run under a Linux user account. By default, this is the root user.
- The Services Director REST API User - To make Services Director REST API requests you must specify credentials for an admin user. This user is stored within the Services Director inventory database. You can create additional Services Director users or change the password using the REST API.
- Traffic Manager Instance Host User - When the Services Director carries out actions on its designated instance host, it does so by means of passwordless SSH access. You must create these users and provide credentials so that the Services Director can communicate with each instance host. Typically, you create this user as root, although you can specify in the REST API resource the name of the user for each host.
- Traffic Manager Admin and Service Users - see "Users in Deployed Traffic Manager Instances" below and "Users in Externally-Deployed Traffic Manager Instances" below.

Users in Deployed Traffic Manager Instances

When you deploy a Traffic Manager instance, the Services Director creates two default user accounts within the instance:

- admin - The administrative user for this instance, with full access to all features and capabilities.
- service - The service user, with privileges restricted to those required for service creation and management. That is, no system wide privileges.

You can change the password for each of these user accounts by updating the relevant password property in the instance resource.

Ivanti, Inc. strongly recommends that you do not provide admin user credentials to end-tenant users. You can safely provide the service user credentials, provided that the privileges for this account have not been altered from their default settings.

Users in Externally-Deployed Traffic Manager Instances

When you register an Externally-deployed Traffic Manager instance with the Services Director, it is not mandatory for the user to supply service user credentials.

Ivanti, Inc. recommends that you specify a username and password for an existing admin user when deploying an externally-deployed instance. This admin user (and a specified rest_address) for the instance resource enables monitoring of the externally-deployed instance, and provides access to its REST API proxy.

Ivanti, Inc. strongly recommends that you do not provide admin user credentials to end-tenant users.

Required Configuration Parameters

The Services Director installation prompts you to provide values for parameters used in setting up the software. Make sure you have access to all required information before you start the installation process.

The following table lists the required parameters to install the Services Director.

Parameter	Description
Database Host	The hostname or IP address of the server running the MySQL database server.
Database Port	The port number of the server running the MySQL database server.
Database Name	The name of the MySQL database used as the inventory database.
Database User	The name of a MySQL user authorized to use the inventory database. This username, along with the corresponding password, is used internally by the Services Director to access the MySQL database.
Database User Password	The password of the MySQL user. This password is used internally by the Services Director to access the MySQL database.
API Server Port	The number of the port on which the Services Director listens for REST API requests.
SSL Certificate File	The full path and filename of the certificate file to use for HTTPS connections to the REST API.
SSL Private Key File	The full path and filename of the private key file to use for HTTPS connections to the REST API.
Client Request Thread Pool Size	The maximum number of threads used for Services Director REST requests. This parameter limits the number of possible simultaneous HTTP requests.

Parameter	Description
Action Thread Pool Size	The maximum number of threads used for actions such as deploying, starting, and stopping Traffic Manager instances. Ivanti recommends that you set Action Thread Pool Size and Monitor Thread Pool Size such that the sum of both is no greater than the MySQL maximum connections limit. If you have other applications that query the same MySQL database, you must make allowances for these additional connection requirements in your calculations.
Monitor Thread Pool Size	The maximum number of threads used to monitor Traffic Manager instances and other Services Directors. If you experience warnings about overdue monitoring actions, increase this value. Ivanti, Inc. recommends that you set Action Thread Pool Size and Monitor Thread Pool Size such that the sum of both is no greater than the MySQL maximum connections limit. If you have other applications that query the same MySQL database, you must make allowances for these additional connection requirements in your calculations.
Source File Location	The name of a directory accessible by the Services Director in which the Traffic Manager image and license files are placed.
Log Output Location	The name of a directory accessible by the Services Director server in which log files and metering log files are placed.
Alert Message Email Addresses	A list of one or more email addresses to which warnings are sent in case of problems. You can also configure the "From" e-mail address of alert e-mails. This address can be set in INSTALLROOT/conf/email_config.txt , in the common section, as from_address. The symbol "$fqdn" will be replaced by the fully-qualified domain name of the instance host, or an IP address where Universal Licensing is used. The other sections in this file should not normally be modified. For Services Director installs on AWS it is likely that you will need to change this setting to be an address that is resolvable to the instance's public IP.
SMTP Relay Host	The hostname or IP address of the SMTP server used to send warnings.
SMTP Relay Port	The port number of the SMTP server used to send warnings.

You must configure the hostname of each Services Director server in your local DNS settings so that all Traffic Manager instances can correctly resolve the addresses of all Services Director servers.

Configuring the MySQL Database for the Services Director

These instructions assume you have already installed the MySQL server. For detailed instructions on installing the MySQL server, see the MySQL documentation for your platform.

You must create an empty MySQL database with an associated user account for use with the Services Director.

The Services Director requires information about the MySQL database during the installation process. Ivanti, Inc. recommends that you note the database name and the username and password before you start the installation process. For detail information about required installation parameters, see "Required Configuration Parameters" on page 38.

You can install the database on the same host as the Services Director if required.

You must configure the privilege settings for the MySQL user account to allow access to the database from all IP addresses (or at a minimum the IP addresses of the machines on which you install the Services Director).

To Create a MySQL Database with Access to all IP Addresses

1. Log in to the MySQL monitor client program.

2. To create a MySQL database named (for example) ssc with a user named (for example) ssc , execute the following SQL commands:

```
CREATE DATABASE ssc;
CREATE USER 'ssc'@'localhost' IDENTIFIED BY '<YOUR PW>';
GRANT ALL ON ssc.* TO 'ssc'@'%' IDENTIFIED BY '<YOUR PW>' \
WITH GRANT OPTION;
FLUSH PRIVILEGES;
```

3. Exit the MySQL monitor program.

Configuring the MySQL Database for Remote Availability

To allow two Services Directors to be placed in a cluster of Services Directors, the MySQL database must be set up to allow remote access. An example outlining one approach is below.

To Allow Database Access from a Remote IP Address on Ubuntu

1. Open the my.cnf configuration file (for example: /etc/mysql/my.cnf) in any text editor.
2. Set the option bind-address to the public IP address of the MySQL server
3. Close and save the file.
4. Restart the MySQL daemon, at the system prompt, enter:

```
$ service mysql restart
```

To Allow Database Access from a Remote IP Address on RHEL/CentOS

1. Open the my.cnf configuration file (for example: /etc/mysql/my.cnf) in any text editor.
2. Set the option bind-address to the public IP address of the MySQL server
3. Close and save the file.
4. Restart the MySQL daemon, at the system prompt, enter:

```
$ service mysqld restart
```

Installing and Configuring the Services Director on Ubuntu

For Ubuntu hosts, the Services Director software is provided in the form of a Debian package.

ⓘ For Ubuntu installations using Linux Containers (LXC), Ivanti, Inc. recommends LXC v0.7.5.

ⓘ recommends that the Services Director machines and any instance hosts all use either Ubuntu or RHEL/CentOS.

ⓘ recommends that you plan your LXC container deployment strategy before installing the Services Director to ensure adequate system resource availability. For more information about LXC, see the configuration and management instructions supplied with your Linux distribution.

To Install the Services Director on Ubuntu

1. As super user, use the standard dpkg command to install the Services Director. At the system prompt, enter:

   ```
   $ dpkg -i services-director_21.1_amd64.deb
   ```

   You are prompted for several configuration parameters. For detailed information, see "Required Configuration Parameters" on page 38.

In the event of a failure that leaves the package in a half-installed state, restart the process as follows:

```
$ dpkg -P --force-all riverbed-ssc
```

2. To initialize the software, execute the configuration script. At the system prompt, enter:

   ```
   $ /opt/riverbed_ssc_21.1/bin/configure_ssc –liveconfigonly
   ```

   You are prompted for the REST API administrative username and password. This login is the administrative user for the Services Director REST API using HTTP authorization. The configuration script validates whether you have configured all the required directories. The script also populates the contents of the Services Director database.

   The initial installation is complete. You can change the configuration parameters after the initial installation by re-running the configuration script.

To Change the Configuration Parameters

1. At the system prompt, enter:

   ```
   $ configure_ssc
   ```

2. For your changes to take effect, restart the Services Director. At the system prompt, enter:

   ```
   $ service ssc stop
   $ service ssc start
   ```

To Re-Enter Configuration Parameters

At the system prompt, enter:

```
$ dpkg-reconfigure riverbed-ssc
```

Login Settings

You can view and modify login settings for the Services Director in the /api/tmcm/2.9/settings/security resource. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You set login settings for the Services Director as follows:

- max_login_attempts - The maximum number of failed Services Director login attempts for a user. This has a default of zero, which indicates that there is no maximum.
- user_lockout_duration_minutes - A suspension lockout duration (in minutes). If the max_login_attempts threshold limit is reached, the suspension duration lockout is applied. This has a default of 1 minute, and a maximum of 1440 minutes (equal to one day).

Installing and Configuring the Services Director on RHEL/CentOS

For an RHEL/CentOS host, the Services Director software is provided as an RPM package.

ⓘ For RHEL/CentOS installations using Linux Containers (LXC), Ivanti, Inc. recommends LXC v0.7.5.

ⓘ recommends that the Services Director machines and any instance hosts all use either Ubuntu or RHEL/CentOS.

ⓘ recommends that you plan your LXC container deployment strategy before installing the Services Director to ensure adequate system resource availability. For more information about LXC, see the configuration and management instructions supplied with your Linux distribution.

ⓘ By default, RHEL/CentOS has more restrictive iptables rules than Ubuntu. These iptables rules must be amended to enable access to Services Directors and Instance Hosts, either on all or selected ports. For example, to configure an ssh port for an Instance Host.

To Install the Services Director on RHEL/CentOS

1. If it is not already installed, install the GNU C Library. At the system prompt, enter:

```
$ yum install glibc-devel
```

2. At the system prompt, enter:

```
$ rpm -i services-director-21.1-0.x86_64.rpm
```

3. After installation, configure the Services Director software using the configuration script. At the system prompt, enter:

```
$ /opt/riverbed-ssc/bin/configure_ssc
```

You are prompted for several configuration parameters. For detailed information, see "Required Configuration Parameters" on page 38.

To Change the Configuration Parameters

1. To change configuration parameters after the initial installation, at the system prompt, enter:

```
$ /opt/riverbed-ssc/bin/configure_ssc
```

2. For your changes to take effect, restart the Services Director. At the system prompt, enter:

```
$ service stop ssc
$ service start ssc
```

Configuring a RHEL/CentOS Instance Host

For a RHEL/CentOS instance host, since the default Python version is 2.6, you must install the Python Argparse module.

On a Services Director instance host, enter:

```
$ yum install python-setuptools
$ easy_install argparse
```

Login Settings

You can view and modify login settings for the Services Director in the /api/tmcm/2.9/settings/security resource. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You set login settings for the Services Director as follows:

- max_login_attempts - The maximum number of failed Services Director login attempts for a user. This has a default of zero, which indicates that there is no maximum.

- user_lockout_duration_minutes - A suspension lockout duration (in minutes). If the max_login_attempts threshold limit is reached, the suspension duration lockout is applied. This has a default of 1 minute, and a maximum of 1440 minutes (equal to one day).

Installing the Services Director Software License

Your license file must be readable by the Services Director Linux user. For detailed information about Services Director licenses, see "Managing Services Director Licensing" on page 16.

To Install the Services Director License for the First Services Director

1. Place the licenses on an accessible location in your infrastructure. For details about obtaining your license keys, see "Retrieving Ivanti, Inc. vTM and Services Director Product Licenses" on page 17.

2. Copy a Services Director license file containing the license key to the INSTALLROOT/licenses directory. The Services Director scans the directory for changes at start up and at daily intervals. New licenses are automatically added to the database as they are discovered.

   To confirm that you have correctly installed your license, run the Services Director software manually. Any problems with the license will result in error messages being displayed on the command line. For detailed information about running the Services Director manually, see "Starting and Stopping the Services Director" on page 49.

   If the Services Director shuts down due to a licensing failure, the start and end dates of any decoded licenses are added as a warning to the event log.

To Install Services Director Licenses Once the First Services Director is Running

After you have installed your licenses and started the Services Director for the first time, you can use the REST API to update existing licenses and install new licenses.

```
POST /api/tmcm/2.9/controller_license_key HTTP/1.1 XX1-RSSC123456-3E33-3E3A-5-0123-4567-89AB
```

Creating Licensing Reports

The licensing decode tool (license_decode) produces a detailed report for all your license keys, including invalid ones. The license decode tool is part of the Services Director installation package; it is stored under the INSTALLROOT/bin/ directory.

Invalid license keys might be malformed or might have a dependency on a missing Services Director license key. For license keys listed as invalid, verify that the associated Services Director license key is present.

To create a licensing report, enter the following command at the prompt:

```
$ license_decode <KEY1> <KEY2> <KEY3>
```

You can decode multiple license keys by specifying each one in a space-separated argument list.

Adding Resources Using the REST API

For a minimal installation of Services Director with one or more externally-deployed Virtual Traffic Manager (vTM) instances, you must add a Feature Pack resource and an Owner resource to the Services Director, and then start adding vTMs.

The section that follows describes a basic installation of Feature Pack, Owner and vTM instance resources, based on the following assumptions:

- The Services Director is licensed and running.
- You are using Universal licensing for your vTM instances.
- You are using externally-deployed vTM instances, each of which has an enabled REST API.
- You are using standard ports for all operations. That is, 9090 for GUI, 9070 for REST, 161 for SNMP, and so on.
- You are not using instance-level authentication.

For a more detailed explanation of vTM deployment, refer to "Registering Externally-Deployed Traffic Managers" on page 109.

The examples in this section use CURL statements, but these can be adapted to suit your preferred way of accessing the REST API.

1. Create a Feature Pack using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password -d '{"stm_sku":"STM-300","excluded":""}'
https://localhost:8100/api/tmcm/2.9/feature_pack/STM_300_FP
```

In this example, a Feature Pack called "STM_300_FP" is created. This makes use of the "STM-300" SKU, excluding no features. For details of Feature Pack resources, refer to "feature_pack Resource" on page 157.

When this command completes, a result is displayed. For example:

```
{"info": "", "status": "Active", "stm_sku": "STM-300", "add_on_skus": [], "excluded":
""}
```

You may need to create additional Feature Packs for different vTM instances.

2. Create an Owner resource using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password -X POST -d '{"tag":"MegaCorp"}'
https://localhost:8100/api/tmcm/2.9/owner/
```

In this example, an Owner called "MegaCorp" is created. For details of Owner resources, refer to "owner Resource" on page 187.

When this command completes, a result is displayed. For example:

```
{"instances": [], "secret": "tt6YHDgj", "tag": "MegaCorp", "clusters": [], "timezone":
"Etc/UTC", "email_address": "", "owner_id": "Owner-BILV-LIKP-UOL2-DKFV"}
```

You may need to create additional Owners for different vTM instances.

3. Register an externally-deployed vTM instance ("vtm-01.cam.demo.com" in this example) with a POST request. This uses the "STM_300_FP" Feature Pack from step 1:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password -X POST -d '{"status":"Active","stm_feature_pack":"STM_300_
FP","owner":"MegaCorp","management_address":"vtm-
01.cam.demo.com","bandwidth":1000,"rest_enabled":true, "admin_
username":"admin","admin_password":"password","tag":"MyRegisteredVTM"}'
https://localhost:8100/api/tmcm/2.9/instance?managed=false
```

In this example, the instance is Active, and has its REST API enabled. For details of instance resources, refer to "instance Resource" on page 160.

When this command completes, a result is displayed. For example:

```
{"status": "Active", "config_options": "", "managed": false, "cpu_usage": "",
"license_name": "universal_v4", "rest_address": "vtm-01.cam.demo.com:9070",
"container_configuration_json": {}, "snmp_address": "vtm-01.cam.demo.com:161",
"creation_date": "2016-11-30 15:06:43", "bandwidth": 1000,"tag": "MyRegisteredVTM",
"cluster_id": "Cluster-RUZX-APUA-9XUF-9DXH", "container_name": "", "owner": "Owner-
BILV-LIKP-UOL2-DKFV", "service_username": "", "service_password": "", "config_options_
json": {},"admin_username": "admin", "instance_id": "Instance-HBBH-57JR-MHG0-60UL",
"stm_feature_pack": "STM_300_FP","stm_version": "", "host_name": "", "management_
address": "vtm-01.cam.demo.com", "container_configuration": "","rest_enabled": true,
"ui_address": "vtm-01.cam.demo.com:9090", "admin_password": "password"}
```

The cluster property is the retrieved cluster ID of the vTM. The owner property is set to the ID of the Owner resource rather than its tag.

The instance will have a license installed and will begin making licensing requests.

4. (Optional) Check the license for the instance at any point with the REST API. You can use either the instance's ID or tag. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password https://localhost:8100/api/tmcm/2.9/instance/Instance-HBBH-57JR-MHG0-
60UL

$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password https://localhost:8100/api/tmcm/2.9/instance/MyRegisteredVTM
```

5. (Optional) Extract the monitoring information for the instance at any point with the REST API. You can use either the instance's ID or tag. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password https://localhost:8100/api/tmcm/2.9/monitoring/instance/Instance-HBBH-
57JR-MHG0-60UL

$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -u
admin:password https://localhost:8100/api/tmcm/2.9/monitoring/instance/MyRegisteredVTM
```

Starting and Stopping the Services Director

You must select the appropriate method of running the Services Director depending on the status of your Services Director installation:

- *Manual* - If you are running the Services Director for the first time or if you are having problems with your Services Director at start up, run the Services Director manually to see additional diagnostic messages on the command line.
- *Systemd* - For an established and normally operating Services Director installation, run the Services Director as a systemd service.

Manually Starting the Services Director Software

At the prompt, enter:

```
$ run_ssc_server [-v/--version]
```

-v or --version - Displays the current version and build number of the Services Director software, but does not start the server.

Manually starting the Services Director provides output and startup messages that you can use to identify and resolve Services Director system configuration issues.

To perform a controlled shutdown of the Services Director from this state, you must press Ctrl+C.

Starting the Services Director as a Service (Normal Operation)

At the prompt, enter:

```
$ service start ssc
```

Stopping the Services Director Running as an Upstart Service

At the prompt, enter:

```
$ service stop ssc
```

Upgrading the Services Director on Ubuntu

For Ubuntu hosts, the Services Director software is provided in the form of a Debian package.

You can upgrade the Services Director software using the following procedure.

This procedure causes a loss of service from your Services Director deployment, although you should schedule the upgrade for a time of least interruption to your end users.

ⓘ Earlier versions of the Services Director used an environment variable called $SSCHOME to refer to the software installation directory. This is now deprecated. Before upgrading the Services Director to the latest version, you must make sure that this variable is unset.

ⓘ To support the encryption of stored passwords for Traffic Manager instances, Services Director encrypts passwords during the upgrade of the Virtual Appliance. A default master password of master1M@ is used to do this. It is strongly recommended that you update the master password after an upgrade. For a software install, this step is performed automatically after the package upgrade when configure_ssc --liveconfigonly is performed. This command prompts you to replace the default master password.

1. At the prompt, enter:

   ```
   $ dpkg -i services-director_21.1_amd64.deb
   ```

   This stops the Services Director software but does not restart it.

2. Ensure that the INSTALLROOT/licenses directory contains the correct license files, including any licenses for Bandwidth Packs.

3. At the prompt, enter:

   ```
   $ /opt/riverbed_ssc_21.1/bin/configure_ssc --liveconfigonly
   ```

   This command makes backward-compatible changes to the Services Director database, and prompts you to replace the default master password master1M@ that was assigned during the upgrade.

4. At the prompt, enter:

   ```
   $ service start ssc
   ```

5. Confirm that the Services Director has not shut down due to licensing issues and that the software has started by issuing a GET request via the Services Director REST API.

Upgrading the Services Director on RHEL/CentOS

For an RHEL/CentOS host, the Services Director software is provided as an RPM package. For RHEL/CentOS installations using Linux Containers (LXC), Ivanti, Inc. recommends LXC v0.7.5.

You can upgrade the Services Director software using the following procedure.

This procedure causes a loss of service from your Services Director deployment, although you should schedule the upgrade for a time of least interruption to your end users.

Earlier versions of the Services Director used an environment variable called $SSCHOME to refer to the software installation directory. This is now deprecated. Before upgrading the Services Director to the latest version, you must make sure that this variable is unset.

To support the encryption of stored passwords for Traffic Manager instances, Services Director encrypts passwords during the upgrade of the Virtual Appliance. A default master password of master1M@ is used to do this. It is strongly recommended that you update the master password after an upgrade. For a software install, this step is performed automatically after the package upgrade when configure_ssc is performed. This command prompts you to replace the default master password.

1. At the prompt, enter:

```
$ rpm -U services-director-21.1-0.x86_64.rpm
```

   This stops the Services Director software but does not restart it.

2. Make sure the INSTALLROOT/licenses directory contains the correct license files, including any licenses for Bandwidth Packs.

3. At the prompt, enter:

```
$ /opt/riverbed-ssc/bin/configure_ssc
```

   This command makes backward-compatible changes to the Services Director database, and prompts you to replace the default master password (master1M@) that was assigned during the upgrade.

4. At the prompt, enter:

```
$ service start ssc
```

5. To confirm that the Services Director has not shut down due to licensing issues and that the software has started by issuing a GET request via the Services Director REST API.

Upgrading Clustered Services Directors

Part of the upgrade process for a Services Director is to apply changes to the inventory database schema, in order to support additional features in newer versions. Since clustered Services Directors share the same inventory database, upgrades of these clustered Services Directors must be carefully sequenced to ensure that:

- inventory records are not locked during the upgrade of the database schema, as this will cause the upgrade to fail.
- once the database schema has been upgraded, changes made to the inventory by remaining pre-upgrade Services Directors are avoided.

To support these goals, it is recommended that the following sequence is used:

1. Before starting the upgrade, select one Services Director in your Services Director cluster as the upgrade master. This Services Director will be upgraded first and will be responsible for applying changes to the database schema.
2. Stop the other Services Director in the Services Director cluster.
3. Upgrade the upgrade master as instructed in "Upgrading the Services Director on Ubuntu" on page 50, and restart this Services Director once the upgrade is complete.

   Deactivation of the upgrade master Services Director may cause instances to briefly enter the licensing grace period (six weeks), but they will return to normal operation once the upgrade master is restarted.
4. Upgrade the second Services Director in the cluster as instructed in "Upgrading the Services Director on Ubuntu" on page 50, and restart this Services Director once the upgrade is complete.
5. Repeat step 4 until all clustered Services Directors are upgraded.

Downgrading the Services Director on Ubuntu

For Ubuntu hosts, the Services Director software is provided in the form of a Debian package.

To revert to the previous software version in a cluster of Services Directors, follow this procedure on all Services Directors in turn.

1. At the prompt, enter:

   ```
   $ service stop ssc
   ```

2. At the prompt, enter:

   ```
   $ dpkg --force-downgrade -i services-director_18.2_amd64.deb
   ```

   --force-downgrade - Downgrades to the desired software version. In this example, version 18.2. This includes a database schema downgrade.

3. Make sure that the INSTALLROOT/licenses directory in your downgraded software installation contain the required license keys compatible with the downgraded version of the Services Director.

4. At the prompt, enter:

   ```
   $ sudo INSTALLROOT/bin/configure_ssc --liveconfigonly
   ```

5. At the prompt, enter:

   ```
   $ service start ssc
   ```

Downgrading the Services Director on RHEL/CentOS

For an RHEL/CentOS host, the Services Director software is provided as an RPM package. For RHEL/CentOS installations using Linux Containers (LXC), Ivanti, Inc. recommends LXC v0.7.5.

To revert to the previous software version in a cluster of Services Directors, follow this procedure on all Services Directors in turn.

1. At the prompt, enter:

   ```
   $ service stop ssc
   ```

2. If you intend to revert to version 2.4 or earlier, enter the following command:

Do not use this command if you intend to revert to version 2.5 or later.

```
$ /opt/riverbed-ssc/bin/configure_ssc --liveconfigonly --to_version=2.1
```

--to_version=2.1 - Specifies the downgrade version. In this example, version 2.1. This includes a database schema downgrade.

You will be asked if you want to add another REST API user. You can add a user, but this is not needed for the downgrade process.

3. For all versions, enter:

```
$ rpm -U --oldpackage riverbed-ssc-2.1-0.x86_64.rpm
```

--oldpackage - Downgrades to the desired software version. In this example, 2.1.

4. Make sure that the INSTALLROOT/licenses directory in your downgraded software installation contain the required license keys compatible with the downgraded version of the Services Director.

5. At the prompt, enter:

```
$ sudo INSTALLROOT/bin/configure_ssc --liveconfigonly
```

6. At the prompt, enter:

```
$ service start ssc
```

Using an Instance Host with a Software Services Director

Introduction

This section describes how to deploy Traffic Managers to an instance host from a software form-factor Services Director.

Other form-factor configurations are supported:

- To deploy Traffic Managers to an instance host from a Services Director VA, see "Using an Instance Host with a Services Director VA" on page 82
- To register externally-deployed Traffic Managers, see "Registering Externally-Deployed Traffic Managers" on page 109.

See also "Services Director Form-Factors" on page 11 and "Working with an Instance Host" on page 13.

Overview: Using an Instance Host with a Software Services Director

This section describes how to deploy Traffic Manager instances from a system that combines a software form-factor Services Director with an instance host.

ⓘ This section assumes that you have installed, licensed and configured your software form-factor Services Director.

An instance host is an Ubuntu or RedHat / CentOS machine (virtual or physical) that is configured specifically for the purpose of allowing Services Director to deploy instances to it. Please see the release notes for details of currently supported versions. In this guide we have assumed the use of Ubuntu 14.04.

ⓘ If you want an instance host that will support interaction with a Services Director VA, see "Using an Instance Host with a Services Director VA" on page 82.

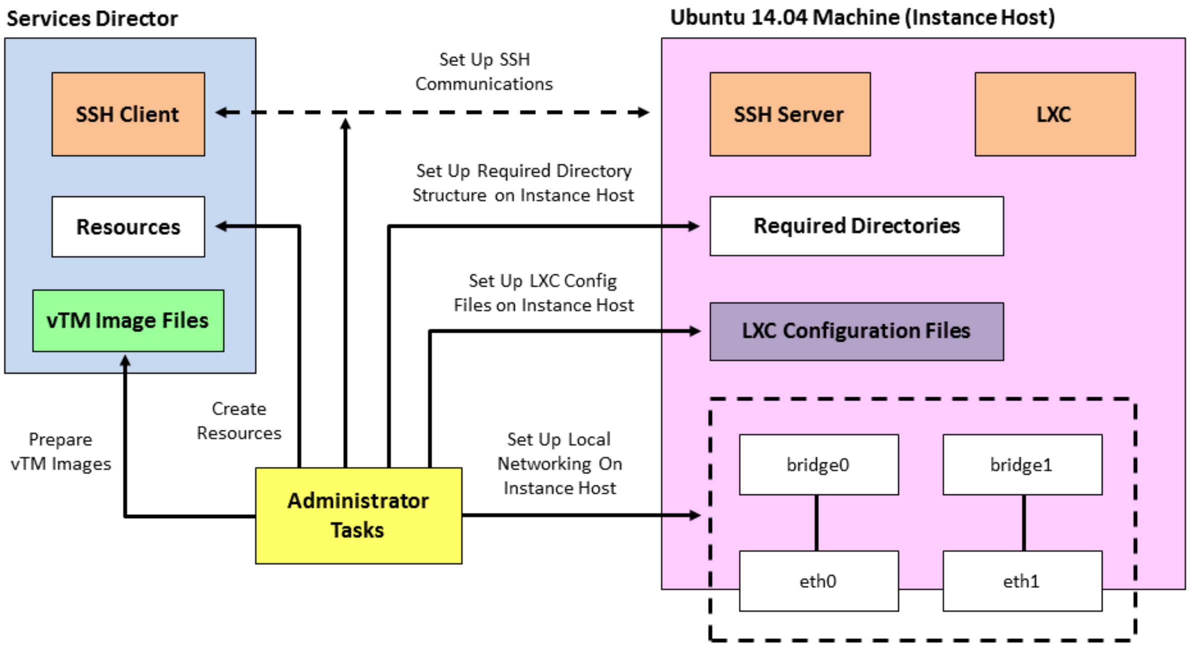
To create an instance host, the required steps are:

1. Create an Ubuntu 14.04 machine and its network interfaces, see "Creating the Instance Host" on page 86.

Ensure that an SSH Server is present on the Ubuntu 14.04 machine.

2. On the Ubuntu 14.04 machine, set up the required directory structures on the Ubuntu 14.04 machine, see "Preparing the Directory Structure" on page 87.
3. Set up local networking (interfaces/NICs and bridges) on the Ubuntu 14.04 machine, see "Configuring the Local Network" on page 88. Exact details will depend on your networking requirements (see example below).
4. On the Ubuntu 14.04 machine, set up an LXC configuration file for each required LXC container, see "Creating an LXC Container Configuration File" on page 89.
5. Establish SSH communications between the software form-factor Services Director and the Ubuntu 14.04 machine, see "Configuring Passwordless SSH" on page 100.
6. Transfer any required Virtual Traffic Manager (vTM) images onto the Services Director, see "Preparing Traffic Manager Images" on page 65.
7. Create any required resources (versions, feature packs and legacy FLA if required) on the Services Director VA, see "Creating Required Resources" on page 90.
8. Register the instance host on the Services Director, see "Adding an Instance Host to the Software Services Director" on page 69.

   For example:

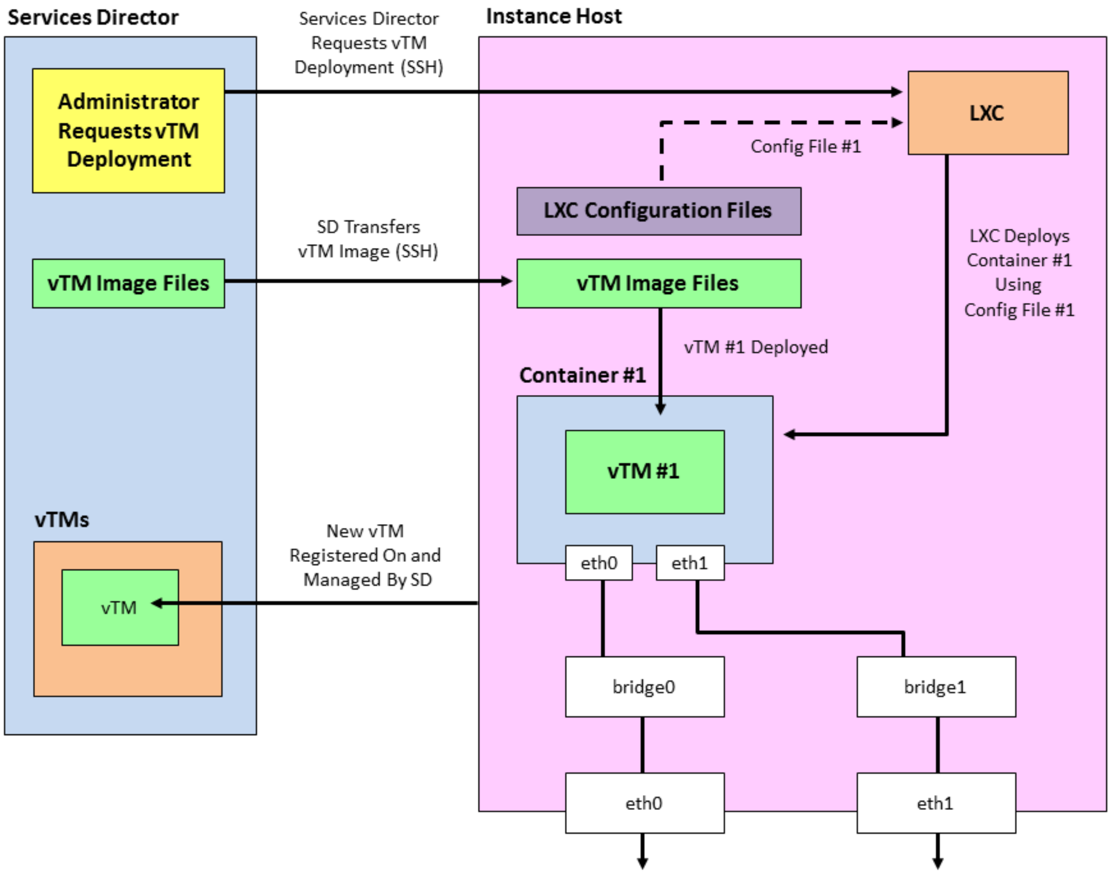

Services Director
SSH Client
Resources
vTM Image Files
Ubuntu 14.04 Machine (Instance Host)
SSH Server
LXC
Required Directories
LXC Configuration Files
bridge0
bridge1
eth0
eth1
Set Up SSH Communications
Set Up Required Directory Structure on Instance Host
Set Up LXC Config Files on Instance Host
Set Up Local Networking On Instance Host
Create Resources
Prepare vTM Images
Administrator Tasks

Once these steps are complete the instance host is ready.

To create a vTM on the instance host, request the deployment from the Services Director, see "Deploying a Traffic Manager to an Instance Host" on page 70. The following events then occur automatically:

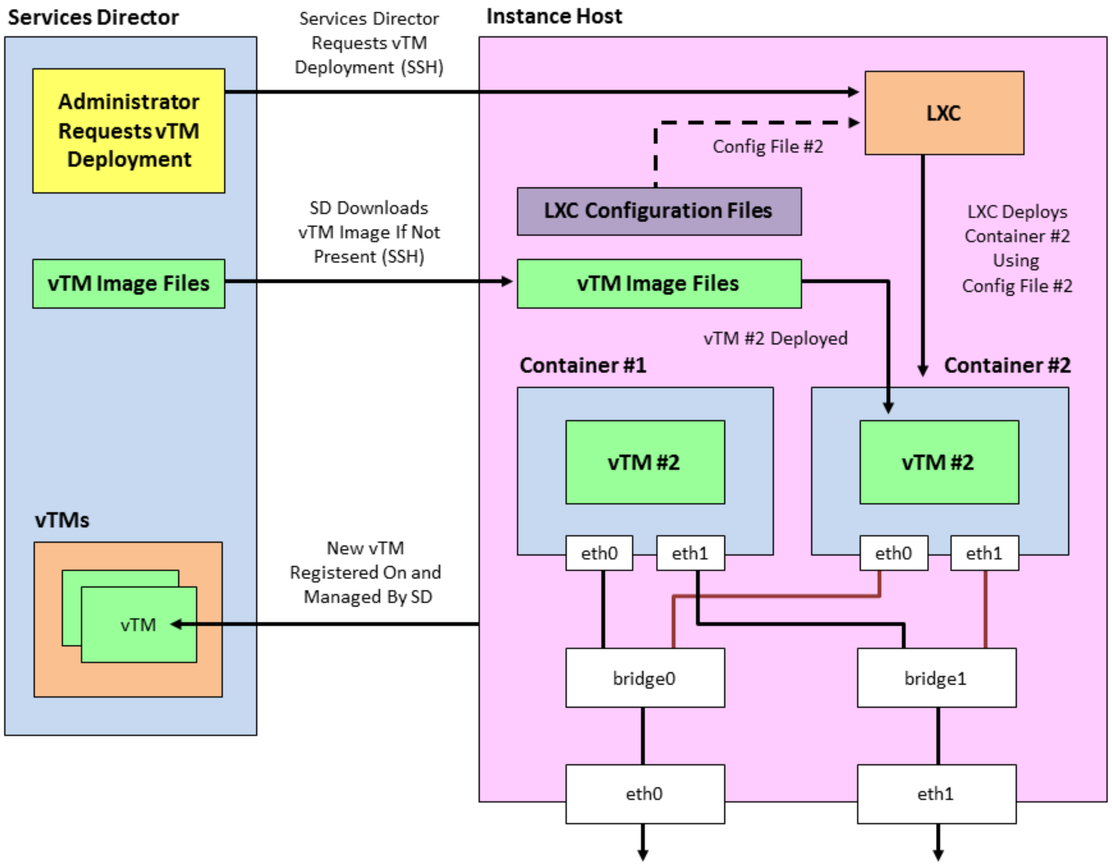
- The Services Director contacts the instance host using SSH to request that LXC deploys a vTM on the instance host.
- Services Director transfers the required vTM image file to the instance host.
- LXC retrieves the required LXC configuration file based on the information passed from the Services Director.
- LXC uses the LXC configuration file to create an LXC container and configure its interfaces.
- The instance host uses the required vTM image to deploy a vTM to the LXC container.
- The new vTM is added to the list of vTMs that are in the estate of the Services Director.

Once these events are complete, the first vTM is ready for use.


Services Director
Services Director Requests vTM Deployment (SSH)
Instance Host
Administrator Requests vTM Deployment
LXC
Config File #1
LXC Configuration Files
SD Transfers vTM Image (SSH)
vTM Image Files
vTM Image Files
LXC Deploys Container #1 Using Config File #1
vTM #1 Deployed
Container #1
vTM #1
vTMs
New vTM Registered On and Managed By SD
vTM
eth0
eth1
bridge0
bridge1
eth0
eth1

You can repeat this process to deploy a second (and subsequent) vTMs onto the same instance host. This is broadly similar to the first vTM. Please note that:

- This requires a different LXC configuration file.
- A second container configuration file must already exist or be created. You cannot deploy a second vTM to the same container as the first vTM.
- A vTM image file is only transferred to the instance host if the vTM image file is not already cached there.
- All other events are the same as for the first vTM.


Services Director
Administrator Requests vTM Deployment
vTM Image Files
vTMs
vTM
Services Director Requests vTM Deployment (SSH)
SD Downloads vTM Image If Not Present (SSH)
New vTM Registered On and Managed By SD
Instance Host
LXC
Config File #2
LXC Configuration Files
vTM Image Files
LXC Deploys Container #2 Using Config File #2
vTM #2 Deployed
Container #1
Container #2
vTM #2
vTM #2
eth0
eth1
eth0
eth1
bridge0
bridge1
eth0
eth1

Creating and Configuring an Instance Host

You can use an instance host (either virtual or physical) with both the software form-factor Services Director and the Services Director VA.

Creating the Instance Host

To create an instance host, you must first create an Ubuntu 14.04 machine. During this process, you will need:

- The IP address and hostname that is required for the instance host.
- The IP address for the management interface (eth0).
- An IP address for each of the required network interfaces (eth1, eth2, and so on).

At least two network cards are required for the host. In the case of virtual machine the second network card must have the promiscuous flag enabled so that it can receive all packets from the hypervisor.

- Optionally, the IP address(es) of the DNS name server(s).

Perform the following steps:

1. Create a machine to contain the Ubuntu 14.04 operating system. This machine can be either virtual or physical.

   The machine's management network interface must be accessible from the Services Director.

2. Install the Ubuntu 14.04 operating system using the standard set-up software.
3. Ensure that the Ubuntu 14.04 machine has SSH server installed and running.
4. Install LXC and bridge utilities on the Ubuntu 14.04 machine to enable container deployment:

```
$ apt-get update
$ apt-get install lxc bridge-utils
```

Preparing the Directory Structure

You must prepare the Ubuntu 14.04 instance host directory structure to receive the required Traffic Manager files. These are required when you register the instance host on the Services Director.

1. On the instance host, create a directory to place files for use. For example, for Traffic Manager image files and license files. For example:

```
/var/cache/ssc
```

2. Then, create a parent directory for all deployed Traffic Managers. For example:

```
/root/install
```

3. Check that suitable permissions are set for both of the new directories (from steps 1 and 2).

   Services Director assumes that all required directories on the instance host have read/write/execute permissions for the root user / group. Check this on the instance host:

```
$ stat --format=%a <directory>
```

And set if required by using:

```
$ chmod 770 <directory>
```

Configuring the Local Network

Configure a virtual network on the instance host for the Traffic Manager instance. Typically, this configuration requires setting up a virtual bridge (using, for example, Linux bridge or Open vSwitch), then configuring the Linux container to attach to the bridge when running Traffic Manager.

You must disable the default bridge configured by LXC. This is unsuitable for Services Director operations.

1. On the instance host, edit the /etc/network/interfaces file and configure the network interfaces and bridges as required. For example:

```
# The loopback network interface
auto lo
iface lo inet loopback
```

```
# The primary network interface
auto eth0
iface eth0 inet static
 address XX.XX.XX.XX
 netmask YY.YY.YY.YY
 gateway BB.BB.BB.BB
    # dns-* options are implemented by the resolvconf package, if installed
    dns-nameservers DD.DD.DD.DD
    dns-search cam.demo.com
# The primary bridge
auto br0
iface br0 inet static
    bridge_ports eth1
    bridge_fd 0
    address EE.EE.EE.EE
    netmask FF.FF.FF.FF
# The secondary network interface
auto eth1
iface eth1 inet static
    address 0.0.0.0
```

In this example, there is a Linux bridge setup to which LXC containers can attach virtual network interfaces.

2. You must now disable the LXC default bridge. Edit the /etc/default/lxc-net file and set the following:

```
USE_LXC_BRIDGE="false"
```

Also comment out any other lines that contain 'LXC_*='.

3. You must now turn off strict return path filtering. Edit the /etc/sysctl.conf file:

```
net.ipv4.conf.default.rp_filter=2
net.ipv4.conf.all.rp_filter=2
```

4. Either reboot, or restart the networking services. This ensures that the networking configuration is correct and the default LXC bridge is removed.

Creating an LXC Container Configuration File

Traffic Manager instances can cohabit on an instance host using LXC containers.

LXC containers support network isolation and a degree of resource isolation. The software form-factor Services Director expects prepared container configuration files in advance of instance deployment. You must put these files in the installation root directory of the instance host.

Before you create an LXC container for a Traffic Manager, you must create an LXC configuration file. This file describes the properties for the container.

1. On the instance host, create an LXC configuration text file.

   This must be located in the parent directory for installations (see "Preparing the Directory Structure" on page 87). For example, in the /root/install directory.

   The container configuration file must include networking entries for your Traffic Manager instance IP address. You can use either Linux virtual networking or Open vSwitch to set up network isolation for your Traffic Manager instance.

   The filename of the container configuration file must match the FQDN or IP address of the required container. That is: <container-fqdn-or-ip>.conf.

This filename must be specified as the container_name property when you deploy the instance.

For Instance resources that are not able to use the Universal FLA License, <container-fqdn-or-ip>.conf must match the value of the lxc.utsname used in the file, and the management_address specified in the REST request.

2. Create contents for the LXC container configuration file. For example:

```
lxc.network.type = veth
lxc.network.flags = up
lxc.network.link = br0
lxc.network.ipv4 = XX.XX.XX.XX/SS
lxc.network.ipv4.gateway = YY.YY.YY.YY
lxc.utsname = vtm-mgmt.example.com
```

   In this example:

- XX.XX.XX.XX/SS is the IP address and subnet mask of the LXC container network.
- YY.YY.YY.YY is the IP address of the subnetwork gateway inside the LXC container.
- If the Legacy FLA License is in use for this instance, the filename of the container configuration file must be vtm-mgmt.example.com.conf.

Configuring the Services Director Software

Before you register the instance host and deploy Traffic Managers to it, you must perform the following tasks:

- Enable passwordless SSH communication between the Services Director and the instance host, see "Enabling Passwordless SSH Communication" below.
- Transfer any required Traffic Manager images to the Services Director, see "Preparing Traffic Manager Images" on the next page.
- Create any required version resources on the Services Director, see "Creating a Version Resource" on page 66.
- If you cannot use Universal FLA Licensing, create any required Legacy FLA license resources on the Services Director, see "Creating a Legacy FLA License Resource" on page 66.
- Create any required feature pack resources on the Services Director, see "Creating a Feature Pack Resource" on page 67.

You can also verify that these have been created, see "Verifying a Resource" on page 68.

Enabling Passwordless SSH Communication

The Services Director uses passwordless SSH to communicate with your instance host. Passwordless SSH enables the Services Director to copy files and remotely run commands to deploy, start, stop, upgrade, and delete Traffic Manager instances.

Each Services Director in a cluster of Services Directors has its own unique SSH authentication key pair.

When you add a new instance host to the Services Director, you must set up passwordless SSH between each Services Director and the new instance host.

1. If do not yet have an SSH authentication key pair for your Services Director, run the following command on the Services Director.

   You must be logged in as the user used to run the Services Director software.

   ```
   ssh-keygen -t rsa
   ```

   When prompted, enter a blank pass-phrase, and accept the default key location. This operation results in the generation of these key files:

   - ~/.ssh/id_rsa (certificate)
   - ~/.ssh/id_rsa.pub (public key)

   This SSH authentication key pair will be used for SSH passwordless communication between this Services Director and any instance hosts.

2. Use the ssh-copy-id command (included in the openssh-client package) to install your public key to the instance host authorized_keys file. For example:

   ```
   ssh-copy-id root@<instancehost>
   ```

3. Return to the command line of the Services Director and connect to the new instance host by SSH as the root user. If you are successful, the credentials for passwordless SSH are correctly set up.

   After these credentials have been set up, you can add the host to the Services Director system by means of a REST request. See "Adding an Instance Host to the Software Services Director" on page 69.

Preparing Traffic Manager Images

1. Obtain your Virtual Traffic Manager (vTM) installation image (that is, a .TGZ file) from Ivanti Support and store them locally.

2. Log into the Services Director and transfer the local .TGZ image files into the directory you created to place files for use, see "Preparing the Directory Structure" on page 87. For example: /var/cache/ssc.

The vTM image files are not replicated automatically between the Services Director nodes. You must manually transfer the files into both nodes.

Creating Required Resources

You must create any required version, and feature pack resources.

Also, if you are unable to use Universal FLA Licensing, you must create a Legacy FLA License resource.

Creating a Version Resource

After you have added the required Virtual Traffic Manager (vTM) installation images to the Services Director, you can create all required version resources.

Each version resource represents a software version number for a vTM release. This is associated with the image file that is used to deploy a Traffic Manager that has this version.

Perform the following procedure to create a REST API version resource. For detailed information about the properties for this resource, see "version Resource" on page 231.

1. To create a version resource, perform a PUT request:

```
https://<sdhost>:<port>/api/tmcm/2.9/version/11.0
```

   Use the following JSON structure as the body of your request:

```
{
   "version_filename" : "ZeusTM_110_Linux-x86_64.tgz",
   "info" : "Version 11.0"
}
```

   In this example, the 11.0 version resource is associated with the ZeusTM_110_Linux-x86_64.tgz image file.

Creating a Legacy FLA License Resource

If you unable to use Universal FLA Licensing, you must create a Legacy FLA license resource using the REST API. For detailed information about the properties for this resource, see "license Resource" on page 177.

1. Obtain all required FLA-style license keys. For details about retrieving your licenses, see "Retrieving Ivanti, Inc. vTM and Services Director Product Licenses" on page 17.
2. Put the retrieved license keys into the directory you created to place files for use, see "Preparing the Directory Structure" on page 87. For example: /var/cache/ssc.

3. To create a license resource for an FLA-style license key file (for example flexlic1), perform a PUT request:

```
https://<sdhost>:<port>/api/tmcm/2.9/license/flexlic1
```

   Include the following JSON structure as the body of your request:

```
{
   "info" : "This is the resource for the flexlic1 license"
}
```

   You can pass an empty JSON structure ({}) to the license resource because there are no mandatory properties for this resource type.

Creating a Feature Pack Resource

To complete the set of supporting resources required by a Traffic Manager instance, you must specify one or more feature packs with the required feature sets. The value of the property of the feature pack resource must be the name of one of the available sku resources created when the Services Director was installed. The choice of SKU depends on a combination of:

- the features you want to enable on the instances that will use the feature pack.
- the available licensed bandwidth for the SKU (for Enterprise Licensed customers).
- the metered cost of the SKU (for Cloud Service Provider licensed customers).

Perform the following procedure:

1. To create a feature_pack resource (for example, STM-U-CSP-200-FP), perform a PUT request:

```
https://<sdhost>:<port>/api/tmcm/2.9/feature_pack/STM-U-CSP-200-FP
```

   Use the following JSON structure as the body of your request to define the SKU:

```
{
    "stm_sku" : "STM-U-CSP-200",
    "excluded" : ""
}
```

The excluded property is a space-separated list of features that are specifically excluded from the default list of features specific to each SKU, see the "feature_pack Resource" on page 157.

In this example, STM-U-CSP-200 represents an available sku resource in the Services Director that is compatible with your Services Director base license.

2. When complete, the following response is displayed:

```
{
    "info": "",
    "status": "Active",
    "stm_sku": "STM-400",
    "add_on_skus": [],
    "excluded": ""
}
```

Verifying a Resource

You can use the Services Director REST API to verify that all the required files are present and accessible. Perform a file status check GET request to verify that the Services Director can find and access the files that are referred to in any of the defined resources.

To verify that the Services Director can find and access the Traffic Manager package and license key files, perform a file status check GET request:

```
https://<sdhost>:<port>/api/tmcm/2.9/status/files
```

The following output is displayed:

```
{
    "licenses": [{
        "href": "/api/tmcm/2.9/license/flexlic1",
        "name": "flexlic1",
        "present": true,
        "filename": "/var/lib/ssc/flexlic1"
    }],
    "versions": [{
        "href": "/api/tmcm/2.9/version/11.0",
        "name": "11.0",
        "present": true,
        "filename": "/var/lib/ssc/ZeusTM_110_Linux-x86_64.tgz"
    }]
}
```

In the above example, the present property showing as true indicates that the file is in place. If it is false, the file must be placed in the location indicated.

Adding an Instance Host to the Software Services Director

To complete the introduction of an instance host, you must register it on your software form-factor Services Director.

Once all preparations are complete, perform the following procedure:

1. To create the instance host, perform a PUT request:

```
https://myssccontroller.mydomain.com:8000/api/tmcm/2.9/host/ myhost-01.mydomain.com
```

   Include the following JSON structure as the body of your request:

```
{
  "cpu_cores":"0-3",
  "work_location":"/space/workspace",
  "install_root":"/space/install",
  "username":"root",
  "retained_info_dir":"/space/retain",
}
```

2. Test the registered host by making a REST request to get the host resource, with the addition of the ?status_check=true query parameter. For example, make the request to:

   ```
   https://mysscontroller.mydomain.com:8100/api/tmcm/2.9/host/myhost-
   01.mydomain.com?status_check=true
   ```

   The response will include a status_check property that will be an empty object if the host is correctly configured for deployments.

   If not, status_check will have a further setup_errors property describing the problems found with the host.

Deploying a Traffic Manager to an Instance Host

After you have completed preparations to deploy a Traffic Manager instance, you can deploy it to the instance host.

You will need to be aware of:

- The properties required when deploying the instance, see "Properties for a Deployed Instance" on the next page.
- The configuration and container options you want to specify when deploying the instance, see "Specifying Configuration Options and Container Options" on page 75.

There are two common deployment scenarios:

- Deploying a Traffic Manager instance with a fixed unique identifier and a changeable user-facing name. This enables Traffic Manager names to be changed and for names of deleted Traffic Manager instances to be re-used under most circumstances. See "Deploying a Traffic Manager Instance with a UUID and a Tag" on page 76.

ⓘ Ivanti, Inc. recommends this approach wherever possible.

- Deploying a Traffic Manager instance with a permanent chosen name. See "Deploying a Traffic Manager Instance with a Chosen Name" on page 79.

ⓘ As a part of the deployment process for all deployed instances, a check of the FLA license is performed automatically, although this feature may optionally be disabled. See "Checking the Health of an FLA License Automatically" on page 31.

ⓘ Instances can be also be registered using the procedures described in the Pulse Secure Services Director Getting Started Guide.

Properties for a Deployed Instance

The table below describes the REST API properties for a deployed instance in an LXC container.

When you create the instance, make sure you assign the same name to both the instance and the container, because the instance uses the container name as its hostname.

For details of all instance properties, see "instance Resource" on page 160.

Property	Description
host_name	The name of the Traffic Manager instance host on which you deploy the instance. This name must match the name of the instance host that was created. This property is a fully-qualified domain name, or may optionally be an IP address where Universal Licensing is used. You must create a host entry before you create an instance.
container_name	The name of the LXC container for the Traffic Manager instance. This name must match the name of the required container configuration (.conf) file in the installation directory. Do not include the .conf file extension. You must create an appropriate container configuration file of the form <containername>.conf in the install_root directory of the container host. For example, a container_name of stm1.example.com requires a container configuration file named stm1.example.com.conf. The container configuration file must set lxc.utsname to the container name for the licensing server to operate correctly.
container_configuration	A space-separated string used to set up the default network gateway inside the LXC container. See "Specifying Container Options" on page 75. Use this format: `"{\"gateway\":\"<ip_address>\"}"` This is the IP address raised on the bridge interface to which this container is connected.

Property	Description
	Ivanti recommends the use of the container_configuration_json property instead of this property. When you specify this property, do not specify the container_configuration_json property.
container_configuration_json	A JSON data structure that is equivalent to the container_configuration property, but which avoids the need to perform JSON escaping. Ivanti recommends the use of this property rather than container_configuration. See "Specifying Container Options" on page 75. When you specify this property, do not specify the container_configuration property.
owner	Specify who owns the instance.
stm_version	The name of the Traffic Managerversion resource for the instance.
stm_feature_pack	The name of the feature_pack resource associated with the Traffic Manager instance. This feature pack represents the set of features that are available for the instance.
license_name	The name of the FLA license resource you want to use for this instance. When you modify this property, the Services Director updates the license on the Traffic Manager instance.
rest_enabled	Should set to true. This is required to enable monitoring and to allow licenses to be pushed to instances, and for the use of Universal FLA licensing.
config_options	A space-separated string used to define configuration options. See "Specifying Configuration Options" on page 75. If you specify the cluster_id property, then you must also set the config_options property to include admin_ui=yes and start_flipper=yes.

Property	Description
	The config_options property is visible in the graphical user interface of the Services Director VA. It is listed for an expanded instance on the vTM Instances page as **Extra Options**. Refer to the Pulse Secure Services Director Getting Started Guide. Ivanti recommends the use of the config_options_json property instead of this property. Whenever the config_options property is set, all currently modified options must be specified again in the REST call. Any options that are not specified will lose their current value and be reset to their default value. Any change to the config_options settings on a deployed instance will cause a restart of the instance. Externally-deployed instances are not affected. When you specify this property, do not specify the config_options_json property.
config_options_json	A JSON data structure that is equivalent to the config_options property. See "Specifying Configuration Options" on page 75. Ivanti recommends the use of this property rather than config_options property. When you specify this property, do not specify the config_options property.
bandwidth	The maximum allowed bandwidth for the Traffic Manager instance (in Mbps).
tag	A text property which provides an alternative way of referring to an instance. Unlike the unique ID for an instance, the tag value can be changed or re-used, subject to some restrictions. See "Understanding the Tag Property" on page 122.
cpu_usage	A string that describes which CPUs are used for this Traffic Manager instance.

Property	Description
	The CPU affinity is defined using the lxc.cgroups.cpuset setting in the container configuration file, in which case cpu_usage is set to an empty string. Any change to the cpu_usage settings of a deployed instance will cause a restart of the instance. Externally-deployed instances are not affected.
cluster_id	Optionally, the name of a cluster resource to which the instance belongs. If you specify an entry for this property, it must refer to a cluster resource. This must be a User-Created cluster, and not a Discovered cluster. The cluster_id property cannot be changed after you create an instance. Instances must be added to a cluster when you create them. (This requirement also applies to the first instance in a cluster.) If you specify the cluster_id property , then you must also set the config_options property to include admin_ui=yes and start_ flipper=yes.

management_address	When using Legacy licensing, the management_address property is typically the same as the lxc.utsname and the container configuration filename (minus the .conf file extension).
	This property is a fully-qualified domain name, or an IP address where Universal Licensing is used.
	For example, if the container configuration filename is:
	`stm1.example.com.conf`
	and the lxc.utsname is defined as follows:
	`lxc.utsname = stm1.example.com`
	then the management_address is defined as follows:
	`management_address = stm1.example.com`

Specifying Configuration Options and Container Options

When deploying and configuring either deployed and externally-deployed instances, you can specify two sets of options:

- Configuration options, see "Specifying Configuration Options" below.
- Container options, see "Specifying Container Options" below.

These option sets can be specified as either a space-separated string, or as a JSON data structure.

Specifying Container Options

When you specify container options, you can use either the container_configuration or container_configuration_json properties.

For example, for the container_configuration property, you can specify:

```
"container_configuration": "{\"gateway\":\"10.62.128.1\"}"
```

Alternatively, you can specify this as a JSON data structure in the container_configuration_json property:

```
"container_configuration_json": {"gateway": "10.62.128.1" }
```

Ivanti, Inc. recommends the use of the container_configuration_jsonproperty rather than container_configuration property.

Once one of these properties is set, the result of any GET will show the container_configuration and container_configuration_json properties set to equivalent values. See "instance Resource" on page 160.

Specifying Configuration Options

When you specify container options, you can use either the config_options or config_options_ json properties.

For example, for the config_options property, you can specify:

```
"config_options": "admin_ui=yes start_flipper=no java!enabled=yes
        webcache!size=5mb flipper!monitor_interval=1000 snmp!community=notpublic "
```

Alternatively, you can specify this as a JSON data structure in the config_options_json property:

```
"config_options_json": {
       "admin_ui": true,
       "start_flipper": false,
       "java": {
           "enabled": true
       },
       "webcache": {
           "size": "5mb"
       },
       "flipper": {
           "monitor_interval": 1000
       },
       "snmp": {
           "community": "notpublic"
        }
  }
```

ⓘ Ivanti, Inc. recommends the use of the config_options_json property rather than the config_options property.

Once one of these properties is set, the result of any GET will show the config_options and config_options_json properties set to equivalent values. See "instance Resource" on page 160.

Deploying a Traffic Manager Instance with a UUID and a Tag

Perform this procedure to create a Traffic Manager instance whose name can be changed, and may be re-used for another instance after deletion.

ⓘ Ivanti, Inc. recommends the use of tags when creating an instance.

The resource name for the instance is an automatically-generated unique identifier. This cannot be changed after it is assigned, and is unique among all Traffic Manager instances (included deleted instances).

However, the Traffic Manager instance also has a "user-facing" name stored as its tag property. This can be changed as required, but it must always be unique among non-deleted Traffic Manager instances, see "Understanding the Tag Property" on page 122. The tag must be a valid alphanumeric name suitable for use in a URI. For example, stm1.

1. Choose a Traffic Manager instance host to which you want to deploy the instance. This is the fully-qualified domain name for your LXC container, or may optionally be the IP address of your container if Universal FLA Licensing is used.

2. To create the instance resource with a unique identifier, perform a POST request. For example, the URI for a POST request to create an instance with an automatically-generated unique identifier is:

```
https://<sdhost>:<port>/api/tmcm/2.9/instance
```

This request supports the following URL parameters:

- ?managed=true to indicate that this is a deployed instance. However, this is the default setting, and can be omitted for deployed instances.

- ?override_fla_check=true to prevent an automatic FLA license check before deployment. The default setting is false. That is, an automatic FLA license check is performed. You can also disable the FLA license check at the Services Director level. See "Disabling the FLA Health Checker" on page 32.

Use the following example JSON structure as the body of your request:

```
{
    "owner" : "Demo Corp",
    "stm_version" : "11.0",
    "host_name": "1h1.mydomain.com",
    "container_name": "1c1.mydomain.com",
    "container_configuration": "{\"gateway\": \"XX.XX.XX.XX\" }",
    "config_options": "admin_ui=yes",
    "cpu_usage": "0",
    "stm_feature_pack": "STM-U-CSP-400-FP",
    "bandwidth": 100,
    "tag": "stm1",
    "rest_enabled": true,
    "license_name": "flexlic1",
    "management_address": "1m1.mydomain.com"
}
```

In this example:

- XX.XX.XX.XX is the IP address of your gateway.
- When the container_name and container_configuration properties are used, the container_name_json and container_configuration_json properties are not required. See "Specifying Configuration Options and Container Options" on page 75.
- 1c1.mydomain.com is the LXC container. This property is a fully-qualified domain name, or an IP address where Universal Licensing is used.
- 1m1.mydomain.com is the management host. This is the same as 1c1.mydomain.com.
- The tag property is set to stm1.

The REST API response indicates that the instance is scheduled to deploy.

3. A check of the FLA license is performed automatically, unless prevented in step 2 by the ?override_fla_check=true URL parameter.

   - If the license check fails, this procedure ends. The instance has a status of Failed to Deploy, and a deployment action shows as Blocked.
   - If the license check succeeds, this procedure continues.

   See "Checking the Health of an FLA License Automatically" on page 31.

4. To poll the Services Director until the instance is successfully deployed, perform a GET request for the URI of the instance that you created, using its tag to identify it. For example:

   ```
   https://<sdhost>:<port>/api/tmcm/2.9/instance/stm1
   ```

   The response to this request contains a JSON structure representing the instance resource. This contains additional properties, one of which gives the status of the instance.

If the deployment fails, you will first need to identify and resolve the the issue identified in the block_reason property of the associated deployment action. Then, you must remove the installation directory for the instance. You are then able to re-attempt the deployment by setting the Blocked deployment action to a Waiting state.

Deploying a Traffic Manager Instance with a Chosen Name

Perform this procedure to create a Traffic Manager instance when you have chosen a permanent unique identifier (name) for instance. Your chosen name must use a valid alphanumeric name suitable for use as a directory name and as part of a URI. For example, stm1.

ⓘ Ivanti, Inc. recommends the use of tags when creating an instance, see "Deploying a Traffic Manager Instance with a UUID and a Tag" on page 76.

1. Choose a Traffic Manager instance host to which you want to deploy the instance. This is the fully-qualified domain name for your LXC container, or may optionally be the IP address of your container if Universal FLA Licensing is used.

2. To create the named instance resource, perform a PUT request. For example, the URI for a PUT request to create an instance called stm1 is:

```
https://<sdhost>:<port>/api/tmcm/2.9/instance/stm1
```

   This request supports the following URL parameters:

   - ?managed=true to indicate that this is a deployed instance. However, this is the default setting, and can be omitted.

   - ?override_fla_check=true to prevent an automatic FLA license check before deployment. The default setting is false. That is, an automatic FLA license check is performed. You can also disable the FLA license check at the Services Director level. See "Disabling the FLA Health Checker" on page 32.

   Use the following example JSON structure as the body of your request:

```
{
    "owner" : "Demo Corp",
    "stm_version" : "11.0",
    "host_name": "1h1.mydomain.com",
    "container_name": "1c1.mydomain.com",
    "container_configuration": "{\"gateway\": \"XX.XX.XX.XX\" }",
    "config_options": "admin_ui=yes",
    "cpu_usage": "0",
    "stm_feature_pack": "STM-U-CSP-400-FP",
    "bandwidth": 100,
    "tag": "",
    "rest_enabled": true,
    "license_name": "flexlic1",
    "management_address": "1m1.mydomain.com"
}
```

In this example:

- XX.XX.XX.XX is the IP address of your gateway.
- When the container_name and container_configuration properties are used, the container_name_json and container_configuration_json properties are not required. See "Specifying Configuration Options and Container Options" on page 75.
- 1c1.mydomain.com is the LXC container. This property is a fully-qualified domain name, or an IP address where Universal Licensing is used.
- 1m1.mydomain.com is the management host. This is the same as 1c1.mydomain.com.
- tag is an optional text property which provides an alternative way of referring to an instance in the URI. In this example, the fixed (permanent) resource name of stm1 is sufficient, and the tag is not set. You can set the tag (and use it to refer to the instance) later if required. See "Understanding the Tag Property" on page 122.

The REST API response indicates that the instance is scheduled to deploy.

3. A check of the FLA license is performed automatically, unless prevented in step 2 by the ?override_fla_check=true URL parameter.

    - If the license check fails, this procedure ends. The instance has a status of Failed to Deploy, and a deployment action shows as Blocked.
    - If the license check succeeds, this procedure continues.

See "Checking the Health of an FLA License Automatically" on page 31.

4. To poll the Services Director until the instance is successfully deployed, perform a GET request for the URI of the instance that you created. For example:

```
https://<sdhost>:<port>/api/tmcm/2.9/instance/stm1
```

The response to this request contains a JSON structure representing the instance resource. This contains additional properties, one of which gives the status of the instance.

If the deployment fails, you will first need to identify and resolve the the issue identified in the block_reason property of the associated deployment action. Then, you must remove the installation directory for the instance. You are then able to re-attempt the deployment by setting the Blocked deployment action to a Waiting state.

Making Database-Only Updates

The Services Director uses the inventory database to store and maintain information about the state of each Traffic Manager instance it is aware of. This information includes the current status of each instance. For example, Inactive or Active.

However, the Services Director does not actively monitor this state. If you start or stop a Traffic Manager instance outside of the Services Director, it is unaware of this change of state.

You can use these techniques to resolve this monitoring issue:

- Issue a GET REST API request for the Traffic Managerinstance resource, including the URL parameter status_check=true. The Services Director actively checks the state of the Traffic Manager instance and updates the stored status where it can determine that the stored state is incorrect.
- Issue a PUT REST API request to modify the Traffic Managerinstance resource and set the status property to the known correct state with URL parameter deploy=false. The Services Director updates the status of the Traffic Manager instance in the inventory database but does not attempt to start or stop the instance itself.

You can also use a database-only update if you need to update the recorded admin user password. This action is useful if the password has been set or changed on the Traffic Manager instance directly.

Using an Instance Host with a Services Director VA

Introduction

This section describes how to deploy Traffic Managers to an instance host from a Services Director VA.

ⓘ Other form-factor configurations are supported:

- To deploy Traffic Managers to an instance host from a software form-factor Services Director, see "Using an Instance Host with a Software Services Director" on page 55.
- To register externally-deployed Traffic Managers, see "Registering Externally-Deployed Traffic Managers" on page 109.

See also "Services Director Form-Factors" on page 11 and "Working with an Instance Host" on page 13.

Overview: Using an Instance Host with a Services Director VA

This section describes how to deploy Traffic Manager instances from a system that combines a Services Director VA with an instance host.

ⓘ The following Services Director VA functions are known to have issues when using an instance host, see "Deploying a vTM Instance" on page 102:

- Deploying Traffic Managers. You must deploy from the REST API.
- Editing properties of deployed instances. Only container properties can be edited through the GUI. For all other properties, you must use the CLI or REST API.
- The **vTM Instance Host** page displays warning information about instance host limitations.

An instance host is an Ubuntu or RedHat / CentOS machine (virtual or physical) that is configured specifically for the purpose of allowing Services Director to deploy instances to it. Please see the release notes for details of currently supported versions. In this guide we have assumed the use of Ubuntu 14.04.

If you want an instance host that will support interaction with a software form-factor Services Director, see "Using an Instance Host with a Software Services Director" on page 55.

This section assumes that you have already installed and configured your Services Director VA.

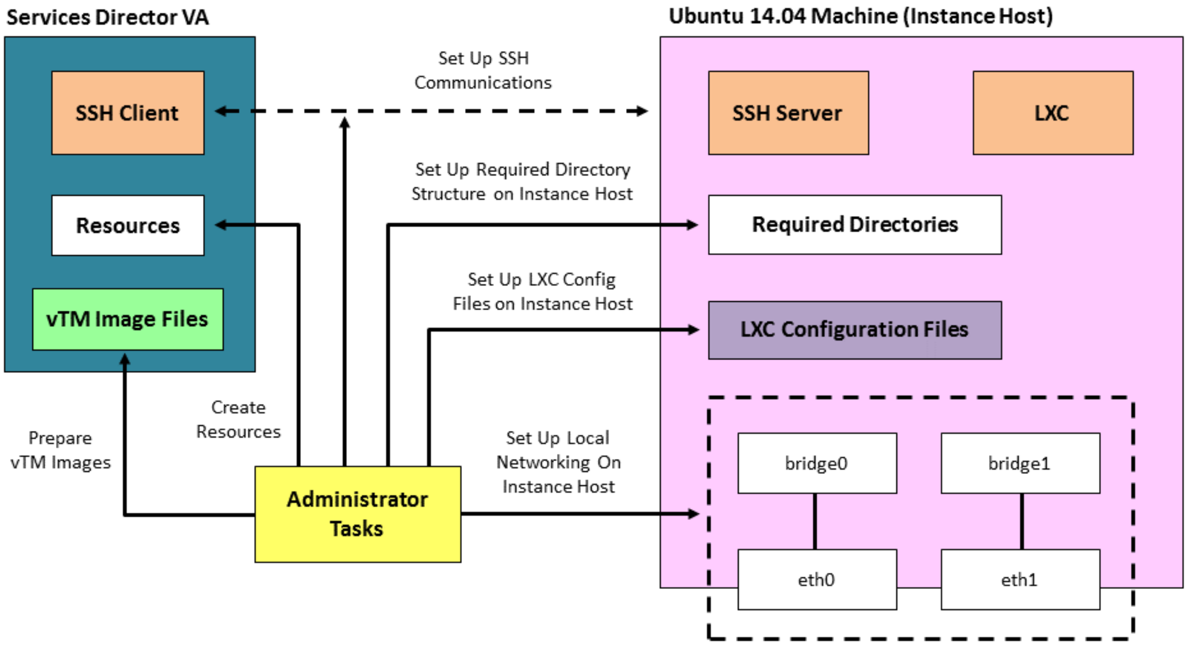
To create an instance host, the required steps are:

1. Create an Ubuntu 14.04 machine and its network interfaces, see "Creating the Instance Host" on page 86.

Ensure that an SSH Server is present on the Ubuntu 14.04 machine.

2. On the Ubuntu 14.04 machine, set up the required directory structures on the Ubuntu 14.04 machine, see "Preparing the Directory Structure" on page 87.
3. Set up local networking (interfaces/NICs and bridges) on the Ubuntu 14.04 machine, see "Configuring the Local Network" on page 88. Exact details will depend on your networking requirements (see example below).
4. On the Ubuntu 14.04 machine, set up an LXC configuration file for each required LXC container, see "Creating an LXC Container Configuration File" on page 89.
5. Establish SSH communications between the Services Director VA and the Ubuntu 14.04 machine, see "Configuring Passwordless SSH" on page 100.
6. Create any required resources (feature packs and legacy FLA if required) on the Services Director VA, see "Creating Required Resources" on page 90.
7. Create any required version resources on the Services Director VA by the upload of any required Virtual Traffic Manager (vTM) images, see "Uploading a Traffic Manager Image" on page 99.
8. Register the instance host on the Services Director VA, see "Adding the Instance Host to the Services Director VA" on page 101.

   For example:

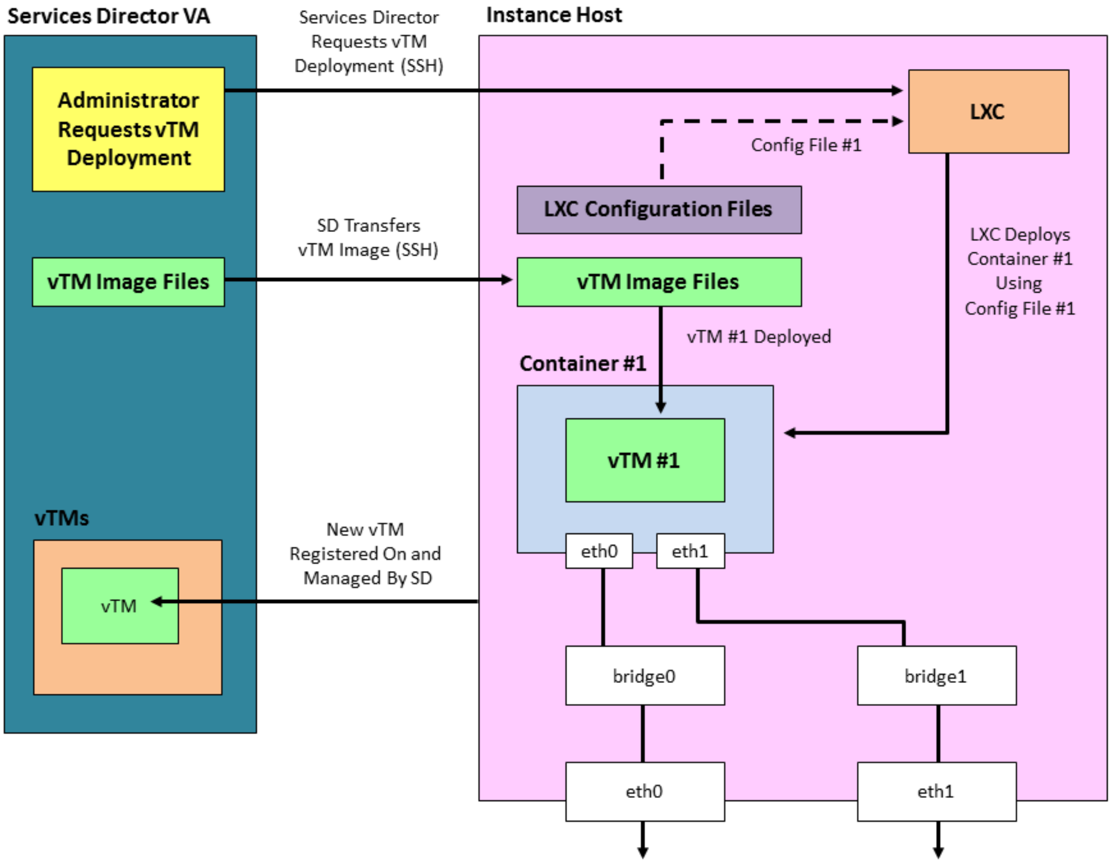

Services Director VA
SSH Client
Resources
vTM Image Files
Ubuntu 14.04 Machine (Instance Host)
SSH Server
LXC
Required Directories
LXC Configuration Files
bridge0
bridge1
eth0
eth1
Set Up SSH Communications
Set Up Required Directory Structure on Instance Host
Set Up LXC Config Files on Instance Host
Set Up Local Networking On Instance Host
Create Resources
Prepare vTM Images
Administrator Tasks

Once these steps are complete the instance host is ready.

To create a vTM on the instance host, request the deployment from the Services Director REST API, see "Deploying a vTM Instance" on page 102. The following events then occur automatically:

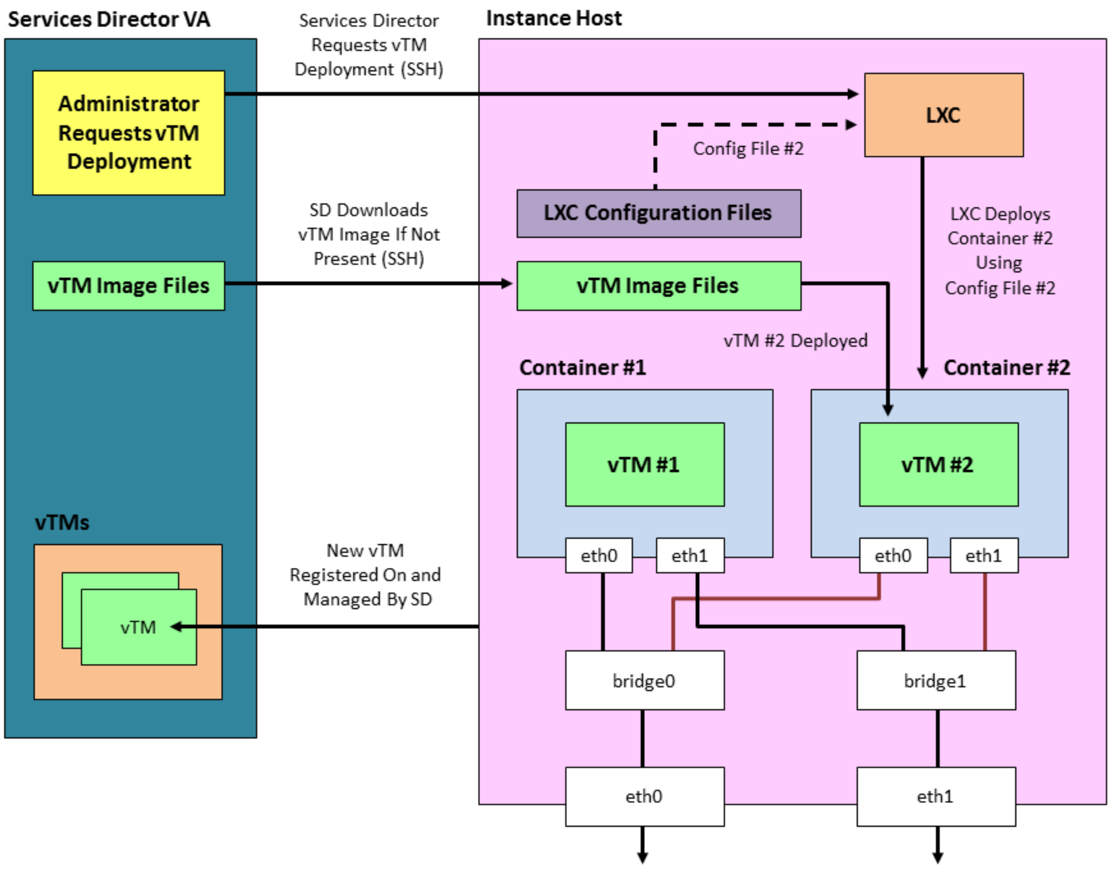
- The Services Director VA contacts the instance host using SSH to request that LXC deploys a vTM on the instance host.
- The Services Director VA transfers the required vTM image file to the instance host.
- On the instance host, LXC retrieves the required LXC configuration file based on the information passed from the Services Director VA.
- On the instance host, LXC uses the LXC configuration file to create an LXC container.
- The instance host uses the required vTM image to deploy a vTM to the LXC container, and then configures its interfaces.
- The new vTM is added to the list of vTMs that are in the estate of the Services Director VA.

Once these events are complete, the first vTM is ready for use.


Services Director VA
Services Director Requests vTM Deployment (SSH)
Instance Host
Administrator Requests vTM Deployment
LXC
Config File #1
LXC Configuration Files
SD Transfers vTM Image (SSH)
vTM Image Files
vTM Image Files
LXC Deploys Container #1 Using Config File #1
vTM #1 Deployed
Container #1
vTM #1
vTMs
New vTM Registered On and Managed By SD
eth0
eth1
vTM
bridge0
bridge1
eth0
eth1

You can repeat this process to deploy a second (and subsequent) vTMs onto the same instance host. This is broadly similar to the first vTM. Please note that:

- This requires a different LXC configuration file.
- A second container configuration file must already exist or be created. You cannot deploy a second vTM to the same container as the first vTM.
- A vTM image file is only transferred to the instance host if the vTM image file is not already cached there.
- All other events are the same as for the first vTM.


Services Director VA
Administrator Requests vTM Deployment
vTM Image Files
vTMs
vTM
Services Director Requests vTM Deployment (SSH)
SD Downloads vTM Image If Not Present (SSH)
New vTM Registered On and Managed By SD
Instance Host
LXC
Config File #2
LXC Configuration Files
vTM Image Files
LXC Deploys Container #2 Using Config File #2
vTM #2 Deployed
Container #1
Container #2
vTM #1
vTM #2
eth0
eth1
eth0
eth1
bridge0
bridge1
eth0
eth1

Creating and Configuring an Instance Host

You can use an instance host (either virtual or physical) with both the software form-factor Services Director and the Services Director VA.

Creating the Instance Host

To create an instance host, you must first create an Ubuntu 14.04 machine. During this process, you will need:

- The IP address and hostname that is required for the instance host.
- The IP address for the management interface (eth0).
- Optionally, an IP address for each of the required network interfaces (eth1, eth2, and so on).
- Optionally, the IP address(es) of the DNS name server(s).

Perform the following steps:

1. Create a machine to contain the Ubuntu 14.04 operating system. This machine can be either virtual or physical.

   The machine's management network interface must be accessible from the Services Director

2. Install the Ubuntu 14.04 operating system using the standard set-up software.

3. Ensure that the Ubuntu 14.04 machine has SSH server installed and running.

4. Install LXC and bridge utilities on the Ubuntu 14.04 machine to enable container deployment:

   apt-get install lxc bridge-utils

Preparing the Directory Structure

You must prepare the Ubuntu 14.04 instance host directory structure to receive the required Traffic Manager files. These are required when you register the instance host on the Services Director.

1. On the instance host, create a directory to place files for use. For example, for Traffic Manager image files and license files. For example:

```
/var/cache/ssc
```

2. Then, create a parent directory for all deployed Traffic Managers. For example:

```
/root/install
```

3. Check that suitable permissions are set for both of the new directories (from steps 1 and 2).

   Services Director assumes that all required directories on the instance host have read/write/execute permissions for the root user / group. Check this on the instance host:

```
$ stat --format=%a <directory>
```

   And set if required by using:

```
$ chmod 770 <directory>
```

Configuring the Local Network

Configure a virtual network on the instance host for the Traffic Manager instance. Typically, this configuration requires setting up a virtual bridge (using, for example, Linux bridge or Open vSwitch), then configuring the Linux container to attach to the bridge when running Traffic Manager.

You must disable the default bridge configured by LXC. This is unsuitable for Services Director operations.

1. On the instance host, edit the /etc/network/interfaces file and configure the network interfaces and bridges as required. For example:

```
# The loopback network interface
auto lo
iface lo inet loopback
# The primary network interface
auto eth0
iface eth0 inet static
 address XX.XX.XX.XX
 netmask YY.YY.YY.YY
 network ZZ.ZZ.ZZ.ZZ
 broadcast AA.AA.AA.AA
    gateway BB.BB.BB.BB
    # dns-* options are implemented by the resolvconf package, if installed
    dns-nameservers DD.DD.DD.DD
    dns-search cam.demo.com
# The primary bridge
auto br0
iface br0 inet static
    bridge_ports eth1
    bridge_fd 0
    address EE.EE.EE.EE
    netmask FF.FF.FF.FF
    network GG.GG.GG.GG
# The secondary network interface
auto eth1
iface eth1 inet static
    address 0.0.0.0
```

In this example, there is a Linux bridge setup to which LXC containers can attach virtual network interfaces.

2. You must now disable the LXC default bridge. Edit the /etc/default/lxc-net file and set the following:

```
USE_LXC_BRIDGE="false"
```

   Also comment out any other lines that contain 'LXC_*='.

3. You must now turn off strict return path filtering. Edit the /etc/sysctl.conf file:

```
net.ipv4.conf.default.rp_filter=2
net.ipv4.conf.all.rp_filter=2
```

4. Either reboot, or restart the networking services. This ensures that the networking configuration is correct and the default LXC bridge is removed.

Creating an LXC Container Configuration File

Traffic Manager instances can cohabit on an instance host using LXC containers.

LXC containers support network isolation and a degree of resource isolation. The software form-factor Services Director expects prepared container configuration files in advance of instance deployment. You must put these files in the installation root directory of the instance host.

Before you create an LXC container for a Traffic Manager, you must create an LXC configuration file. This file describes the properties for the container.

1. On the instance host, create an LXC configuration text file.

   This must be located in the parent directory for installations (see "Preparing the Directory Structure" on page 87). For example, in the /root/install directory.

   The container configuration file must include networking entries for your Traffic Manager instance IP address. You can use either Linux virtual networking or Open vSwitch to set up network isolation for your Traffic Manager instance.

   The filename of the container configuration file must match the FQDN or IP address of the required container. That is: <container-fqdn-or-ip>.conf.

This filename must be specified as the container_name property when you deploy the instance.

For Instance resources that are not able to use the Universal FLA License, <container-fqdn-or-ip>.conf must match the value of the lxc.utsname used in the file, and the management_address specified in the REST request.

2. Create contents for the LXC container configuration file. For example:

```
lxc.network.type = veth
lxc.network.flags = up
lxc.network.link = br0
lxc.network.ipv4 = XX.XX.XX.XX/SS
lxc.network.ipv4.gateway = YY.YY.YY.YY
lxc.utsname = vtm-mgmt.example.com
```

In this example:

- XX.XX.XX.XX/SS is the IP address and subnet mask of the LXC container network.
- YY.YY.YY.YY is the IP address of the subnetwork gateway inside the LXC container.
- If the Legacy FLA License is in use for this instance, the filename of the container configuration file must be vtm-mgmt.example.com.conf.

Creating Required Resources

You must create the following resources using the Services Director VA.

- Feature Packs, see "Creating a Feature Pack Resource" below.
- Legacy FLA licenses (where required), see "Creating a Legacy FLA Resource" on page 94.
- vTM Clusters, see "Creating a vTM Cluster" on page 97.

A Version resource is also required, but that is created when you upload a Traffic Manager image to the Services Director VA, see "Uploading a Traffic Manager Image" on page 99.

Creating a Feature Pack Resource

Before you register a Traffic Manager, you must define a Feature Pack for the Traffic Manager.

When you install a primary Services Director VA, you provide a software license. This license is based on a single Stock-Keeping Unit (SKU).

Your choice of SKU determines whether you are a Cloud Service Provider (CSP) or Enterprise customer. It also defines the features that are available on your Services Director VA.

A SKU is used when you create a Feature Pack. Each Feature Pack is a subset (or total set) of the available features in a SKU.

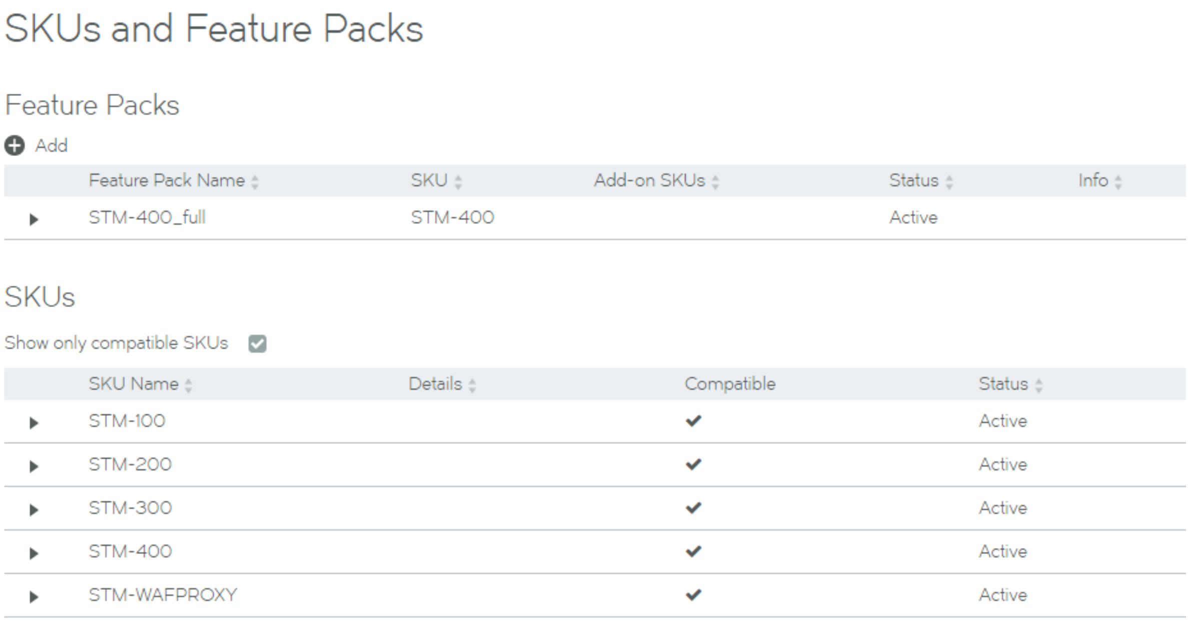
To create a Feature Pack, you must select your SKU (historical SKUs that are still supported are also listed) and then identify any features from your SKU that are excluded in your Feature Pack. All other features supported by your SKU are included in the Feature Pack.

When you register a Traffic Manager, you select a single Feature Pack.

A default Feature Pack (typically a SKU with no exclusions) is created automatically when you install the Services Director VA.

1. Access your Services Director VA from a browser, using its Service Endpoint IP Address.
2. Log in as the administration user. The **Home** page appears.
3. Click the **Catalogs** menu, and then click **SKUS and Feature Packs**.

   The **SKUS and Feature Packs** page appears.



SKUs and Feature Packs

Feature Packs

	Feature Pack Name	SKU	Add-on SKUs	Status	Info
▸	STM-400_full	STM-400		Active	

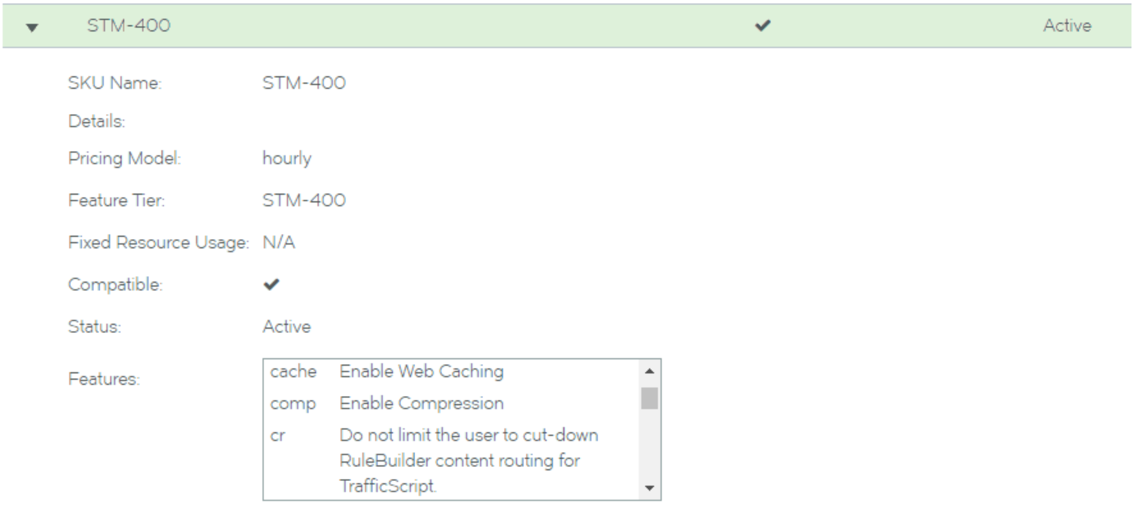
SKUs

Show only compatible SKUs ☑

	SKU Name	Details	Compatible	Status
▸	STM-100		✓	Active
▸	STM-200		✓	Active
▸	STM-300		✓	Active
▸	STM-400		✓	Active
▸	STM-WAFPROXY		✓	Active

4. In the table of SKUs, locate the SKU from which you wish to create a Feature Pack.

5. Expand this SKU to view its supported features. For example, the STM-400 SKU:



STM-400 ✓ Active

SKU Name: STM-400

Details:

Pricing Model: hourly

Feature Tier: STM-400

Fixed Resource Usage: N/A

Compatible: ✓

Status: Active

Features:

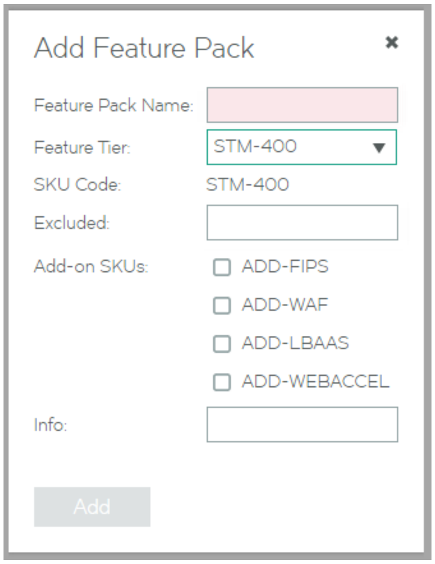
cache	Enable Web Caching
comp	Enable Compression
cr	Do not limit the user to cut-down RuleBuilder content routing for TrafficScript.

6. Locate the function(s) that you wish to exclude, and make a note of the feature name. For example, the Lbrnd (Random Load Balancing) feature. That is, this Feature Pack will not support the Random load balancing feature. Other load balancing features, such as Round Robin, will still be supported.

7. Collapse the SKU in the table.

8. Click the **Add** button.

   The **Add Feature Pack** dialog appears.



Add Feature Pack

Feature Pack Name:

Feature Tier: STM-400

SKU Code: STM-400

Excluded:

Add-on SKUs: ☐ ADD-FIPS ☐ ADD-WAF ☐ ADD-LBAAS ☐ ADD-WEBACCEL

Info:

9. Enter a **Feature Pack Name**.

   This name will appear in the table of Feature Packs.

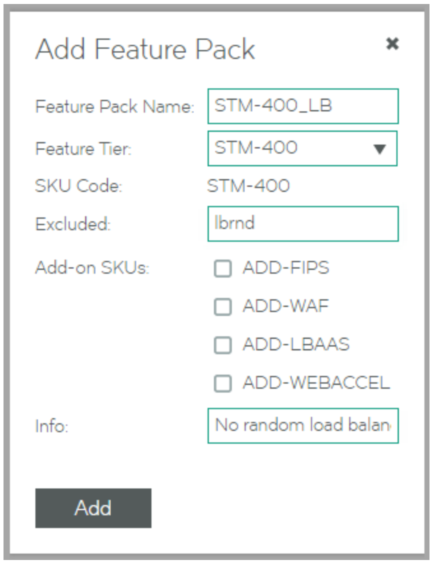
10. Select the required feature tier from your SKU.

11. Enter a space-separated list of excluded features.

12. Select any required add-on SKUs.

13. Enter a description for the Feature pack as **Info**.

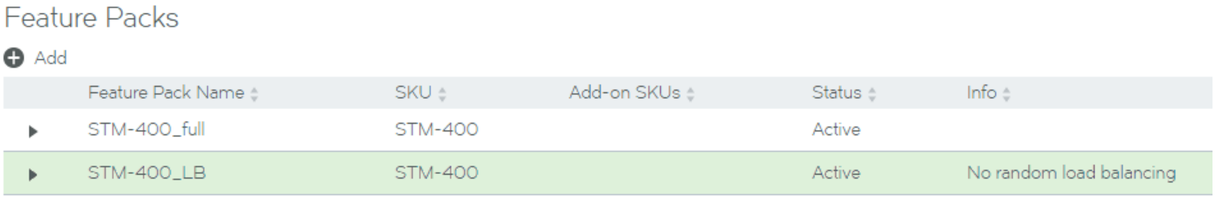
    This description will appear in the table of Feature Packs.



Add Feature Pack

Feature Pack Name:	STM-400_LB
Feature Tier:	STM-400
SKU Code:	STM-400
Excluded:	lbrnd
Add-on SKUs:	□ ADD-FIPS □ ADD-WAF □ ADD-LBAAS □ ADD-WEBACCEL
Info:	No random load balan

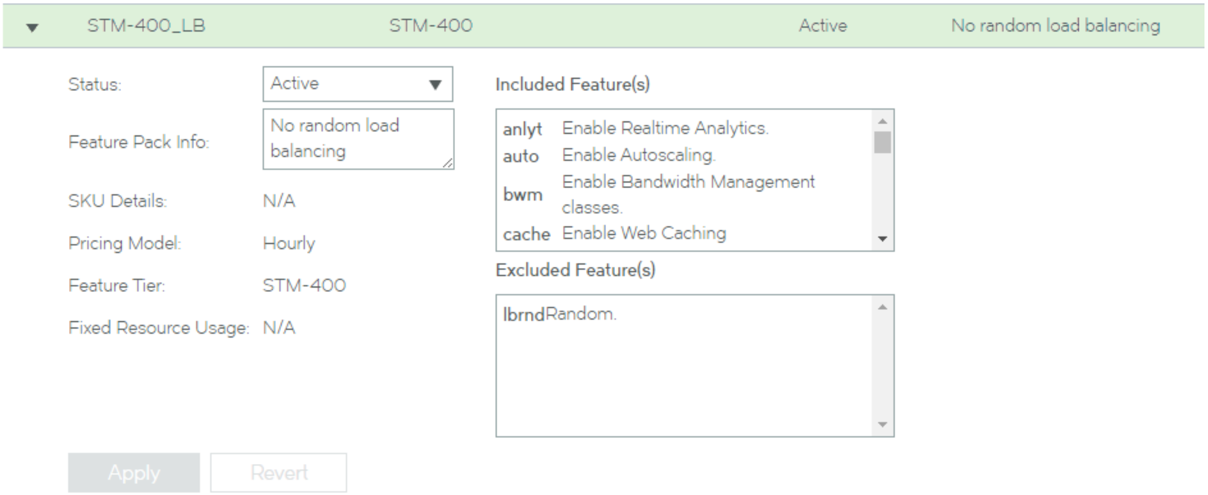
14. Click **Add**. The new Feature Pack is added to the table of Feature Packs.



Feature Packs

	Feature Pack Name	SKU	Add-on SKUs	Status	Info
▸	STM-400_full	STM-400		Active	
▸	STM-400_LB	STM-400		Active	No random load balancing

15. Expand the Feature Pack to view its full details.



STM-400_LB STM-400 Active No random load balancing

Status: Active

Feature Pack Info: No random load balancing

SKU Details: N/A

Pricing Model: Hourly

Feature Tier: STM-400

Fixed Resource Usage: N/A

Included Feature(s)

anlyt	Enable Realtime Analytics.
auto	Enable Autoscaling.
bwm	Enable Bandwidth Management classes.
cache	Enable Web Caching

Excluded Feature(s)

lbrnd	Random.

16. Repeat this process to create all required Feature Packs.

    Once you have created all required Feature Packs, you can use these to register and deploy Traffic Managers.

Creating a Legacy FLA Resource

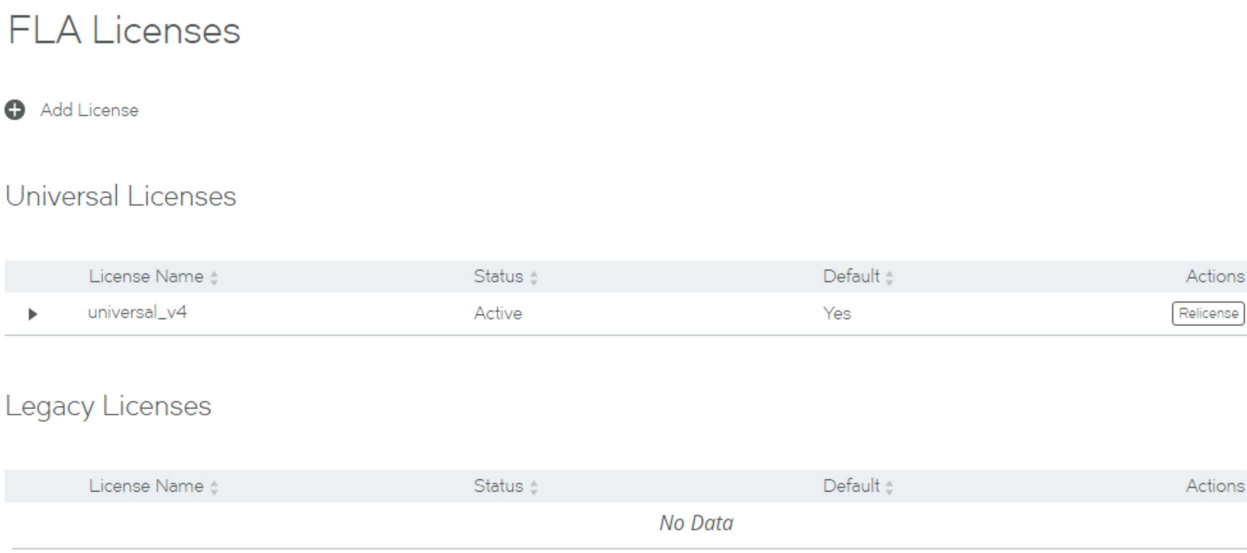
The Services Director comes with a pre-installed Universal FLA License. This is suitable for any Traffic Manager at version 10.1 with an active REST API. In all other cases, a Legacy FLA License is required. That is:

- The Traffic Manager version is 10.0 or earlier.
- The Traffic Manager (any version) has its REST API disabled.

You can install a Legacy FLA License using the Services Director VA, after which you can install either of these Traffic Manager types.

1. Access your Services Director VA from a browser, using its Service Endpoint IP Address.
2. Log in as the administration user. The **Home** page appears.
3. Click the **Catalogs** menu, and then click **Licensing: FLA Licenses**. The **Flexible Licenses** page appears.

   When the Services Director is first installed, only the pre-installed Universal FLA License is shown on this page; no Legacy FLA Licenses are present.



FLA Licenses

⊕ Add License

Universal Licenses

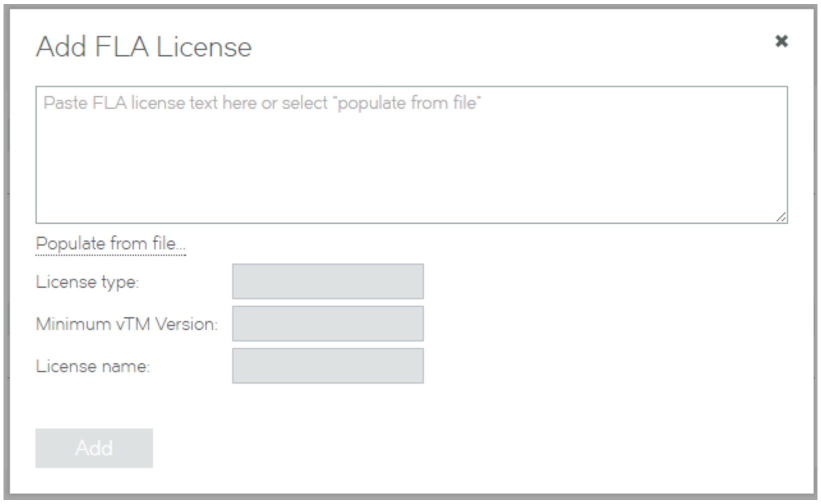
	License Name	Status	Default	Actions
▸	universal_v4	Active	Yes	Relicense

Legacy Licenses

License Name	Status	Default	Actions
No Data			

4. Click the **Add License** plus symbol.

   The **Add FLA License** dialog appears.



Add FLA License ✖

Paste FLA license text here or select "populate from file"

Populate from file...

License type:

Minimum vTM Version:

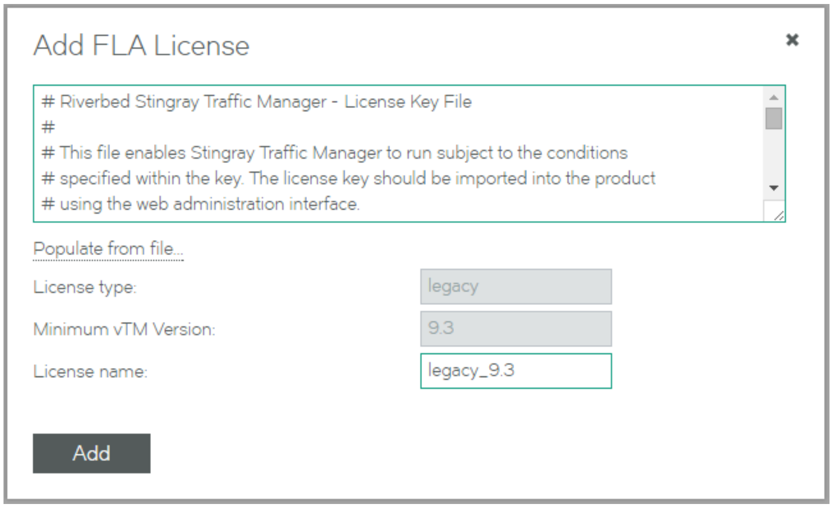
License name:

Add

5. Either:

   - Paste the text of the Legacy FLA License into the text box, OR
   - Click **Populate from File**, select the file and then click **Upload**. This will populate the text box.

   The remainder of the fields in the dialog will then update to provide license information:



Add FLA License

```
# Riverbed Stingray Traffic Manager - License Key File
#
# This file enables Stingray Traffic Manager to run subject to the conditions
# specified within the key. The license key should be imported into the product
# using the web administration interface.
```

Populate from file...

License type: legacy

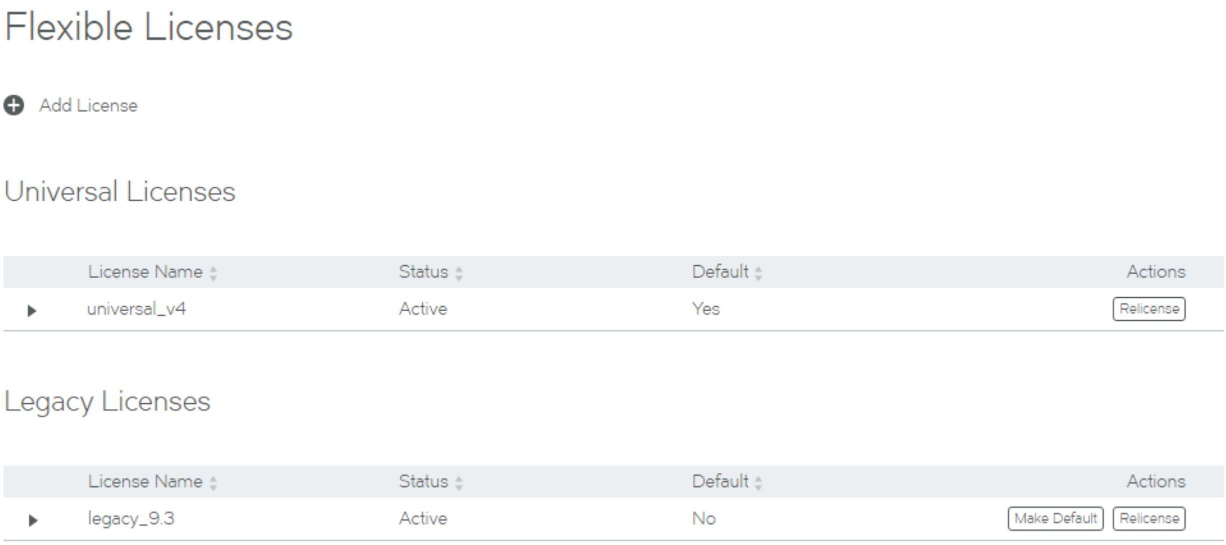
Minimum vTM Version: 9.3

License name: legacy_9.3

6. Click **Add**. A relicensing dialog appears.

7. Click **Later**.

   The new license is added to the **FLA Licenses** page.



Flexible Licenses

Universal Licenses

	License Name	Status	Default	Actions
▸	universal_v4	Active	Yes	Relicense

Legacy Licenses

	License Name	Status	Default	Actions
▸	legacy_9.3	Active	No	Make Default Relicense

8. Repeat this procedure if you require additional licenses.

9. Both Legacy FLA Licenses and Universal FLA Licenses have a default FLA. If you have more than one FLA license for either type, and want to make it the default license for that type, click **Make Default**.

Creating a vTM Cluster

There are two types of clusters used by the Services Director VA:

- Discovered - this is a cluster present on one or more externally-deployed Traffic Managers. When an externally-deployed Traffic Manager is registered, a cluster name is displayed automatically. See the Pulse Secure Services Director Getting Started Guide for details.

  This cluster type cannot be used by Traffic Managers that you deploy from the Services Director VA.

You cannot create a Discovered cluster from the **vTM Clusters** page.

Services Director's awareness of Discovered clusters is limited to Traffic Managers at version 10.2 or above with an enabled REST API.

- User Created - this is a cluster that you create manually on the **vTM Clusters** page, see "Creating a vTM Cluster for Deployed vTM Instances" on the next page. This cluster type can only be used for Traffic Managers that you deploy from the Services Director VA.

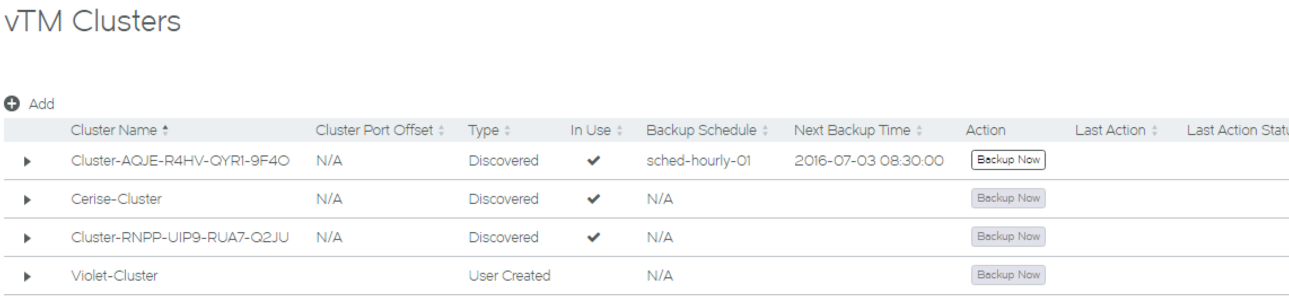
You must select a cluster when you deploy a Traffic Manager if you want to use cluster-level backup and restore. See the Pulse Secure Services Director Getting Started Guide for full details.

Services Director supports backup and restore for cluster configurations.

Viewing vTM Clusters

The **vTM Cluster** page displays a list of all clusters known to the Services Director VA.

The **vTM Cluster** page also enables you to assign a backup schedule to each cluster, and to inspect the details of the cluster backups taken. See the *Pulse Secure Services Director Getting Started Guide*.



vTM Clusters

⊕ Add

	Cluster Name	Cluster Port Offset	Type	In Use	Backup Schedule	Next Backup Time	Action	Last Action	Last Action Statu
▸	Cluster-AQJE-R4HV-QYR1-9F4O	N/A	Discovered	✓	sched-hourly-01	2016-07-03 08:30:00	Backup Now		
▸	Cerise-Cluster	N/A	Discovered	✓	N/A		Backup Now		
▸	Cluster-RNPP-UIP9-RUA7-Q2JU	N/A	Discovered	✓	N/A		Backup Now		
▸	Violet-Cluster		User Created		N/A		Backup Now		

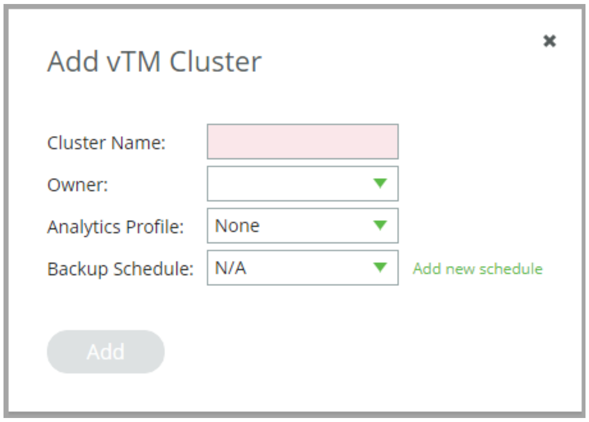
Creating a vTM Cluster for Deployed vTM Instances

1. Start your Services Director VA from a browser, accessing it using its Service Endpoint IP Address.

2. Log in as the administration user. The **Home** page appears.

3. Click the **Services** menu, and then click **Services Director: vTM Clusters**. The **vTM Clusters** page appears.

4. Click the **Add** button above the cluster table. The **Add vTM Cluster** dialog appears.



Add vTM Cluster

Cluster Name:	
Owner:	
Analytics Profile:	None
Backup Schedule:	N/A

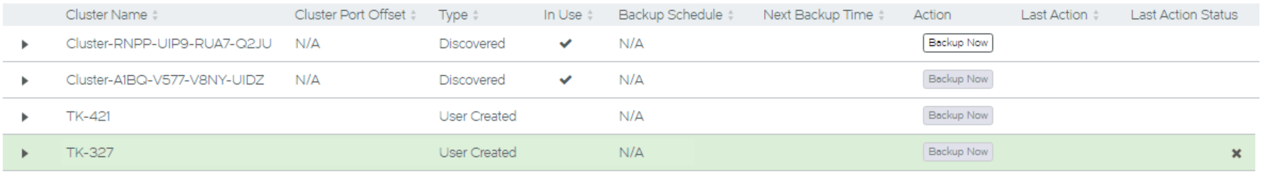
5. Provide a vTM **Cluster Name**. This will be available as the **vTM Cluster ID** when you deploy a Traffic Manager. This name must be unique within the current subnet.

6. Enter an **Owner**.

7. (Optional) Specify an **Analytics Profile** for the cluster. See the Pulse Secure Services Director Getting Started Guide for full details.

8. (Optional) Specify a **Backup Schedule**. See the Pulse Secure Services Director Getting Started Guide for full details.

9. Click **Add**. The new *User Created* cluster is added.



	Cluster Name	Cluster Port Offset	Type	In Use	Backup Schedule	Next Backup Time	Action	Last Action	Last Action Status
▸	Cluster-RNPP-UIP9-RUA7-Q2JU	N/A	Discovered	✓	N/A		Backup Now		
▸	Cluster-A1BQ-V577-V8NY-UIDZ	N/A	Discovered	✓	N/A		Backup Now		
▸	TK-421		User Created		N/A		Backup Now		
▸	TK-327		User Created		N/A		Backup Now		✖

10. Repeat for any other required vTM clusters.

    All User Created clusters are available for use as the **vTM Cluster ID** when you deploy a Traffic Manager. See "Deploying a vTM Instance using the Services Director VA GUI" on page 102.

Uploading a Traffic Manager Image

Before you can deploy a Traffic Manager, you must upload the required Traffic Manager image onto the Services Director VA. During this process, you also specify the required version resource for the image.

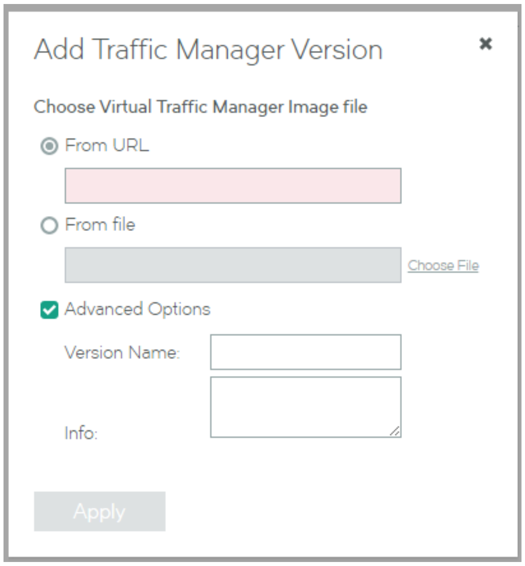
The Traffic Manager image files are not replicated automatically between the Services Director nodes. You must manually transfer the files into both nodes.

1. Access your Services Director VA from a browser, using its Service Endpoint IP Address.

2. Log in as the administration user. The **Home** page appears.

3. Access the **vTM Images** page from the menus using **System > Deployment > vTM Images**.

4. Click the plus symbol above the table of images. The **Add Traffic Manager Version** dialog appears.



Add Traffic Manager Version

Choose Virtual Traffic Manager Image file

● From URL

○ From file

☑ Advanced Options

Version Name:

Info:

5. Click **From file** and then **Choose File**. Then, select the required local Traffic Manager image file. This is in TGZ format.

6. Specify the required **Version Name**. Typically, this is the version number, for example 11.0.

7. Optionally, complete the Info property.

8. Click **Apply**.

   The image file is uploaded to the Services Director VA. When complete, it is displayed in the **vTM Images** page. This may take several minutes.

Configuring Passwordless SSH

The Services Director VA uses passwordless SSH to communicate with any instance hosts. Passwordless SSH enables the Services Director VA to copy files and remotely run commands to deploy, start, stop, upgrade, and delete Traffic Manager instances.

Each Services Director VA in an HA pair has its own unique SSH authentication key pair. When you add a new instance host to the Services Director VA, you must set up passwordless SSH between each Services Director VA and the new instance host.

The following is a general procedure for configuring the establishing passwordless SSH between the Services Director VA and an instance host.

1. Once your VA is configured, licensed, and running, SSH into the VA as admin, and generate the SSH key pair that will be used for passwordless SSH access to the instance host:

```
> enable
# configure terminal
# ssh client generate identity user root
# show ssh client private
```

2. Copy the listed public key and paste it into the /root/.ssh/authorized_keys file on the instance host.

3. Test the password-less connection from the Services Director VA:

```
ssh slogin root@<instance host>
```

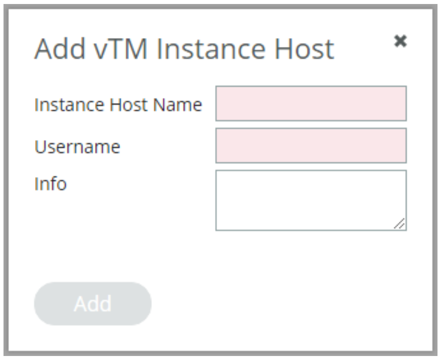
Adding the Instance Host to the Services Director VA

Perform the following procedure to add the instance host to the Services Director VA.

1. Log into the Services Director VA.

2. Access the **vTM Instance Hosts** page from the menus using **System > Deployment > vTM Instance Hosts**.

3. Click the plus sign above the table of instance hosts. The **Add vTM Instance Host** dialog appears.



4. On the **Add vTM Instance Host** dialog, specify the **Instance Host Name**. This is either a hostname or an IP address.

5. Specify the administrative **Username** for the instance host.

6. (Optional) Specify **Info** to provide a description for the instance host.

7. Click **Add** to add the instance host. The instance host is added to the **vTM Instance Hosts** page

8. To test the registered Host, make a REST request to:

```
https://<Services Director>:8100/api/tmcm/2.9/host/<hostname>?status_check=true
```

The response will include a status_check property that will be an empty object if the Host is correctly configured for deployments.

If not, status_check will have a further **setup_errors** property describing the problems found with the Host.

Deploying a vTM Instance

Once you have registered an instance host on the Services Director VA, you can deploy vTM instances on the instance host.

The default method for deploying a vTM instance to an instance host is by using the Services Director VA GUI, see "Deploying a vTM Instance using the Services Director VA GUI" below.

However, you can use the REST API to do this if required, see "Deploying a vTM Instance Using the REST API" on page 106.

Deploying a vTM Instance using the Services Director VA GUI

To deploy a vTM instance on a registered instance host, perform the following procedure:

1. Before starting the VA GUI, create a container configuration file on the instance host(?). This must be in the/root/install directory, with filename:

```
<container-fqdn-or-ip>.conf.
```

The `<container-fqdn-or-ip>` element of the filename must be used as the **Container Name** property of the Instance resource in a later step.

For vTM instances that will not be able to use the Universal FLA License, the hostname/IP part of the container configuration filename must match the value of the *lxc.utsname* property in the file and the **Management Address** of the Instance resource.

2. Create the contents of the container configuration file. For example:

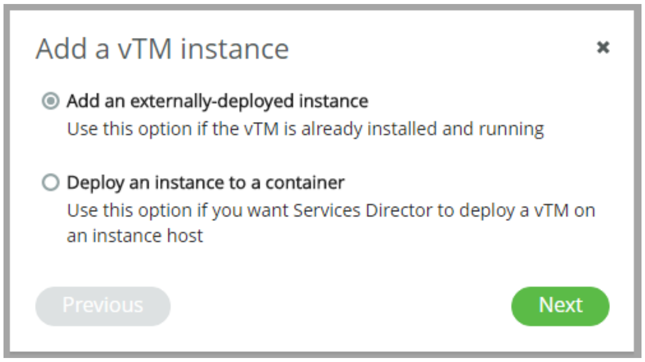
```
lxc.network.type = veth
lxc.network.flags = up
lxc.network.link = br0
lxc.network.ipv4 = XX.XX.XX.XX/XX
lxc.network.ipv4.gateway = YY.YY.YY.YY
lxc.utsname = djones-04.cam.demo.com
```

3. Access your Services Director VA from a browser, using its Service Endpoint IP Address.

4. Log in as the administration user. The **Home** page appears.

5. Click the **Services** menu, and then click **Services Controller: vTM Instances**. The **vTM Instances** page appears.

6. Click the plus symbol above the table. The **Add a vTM instance** dialog box appears:



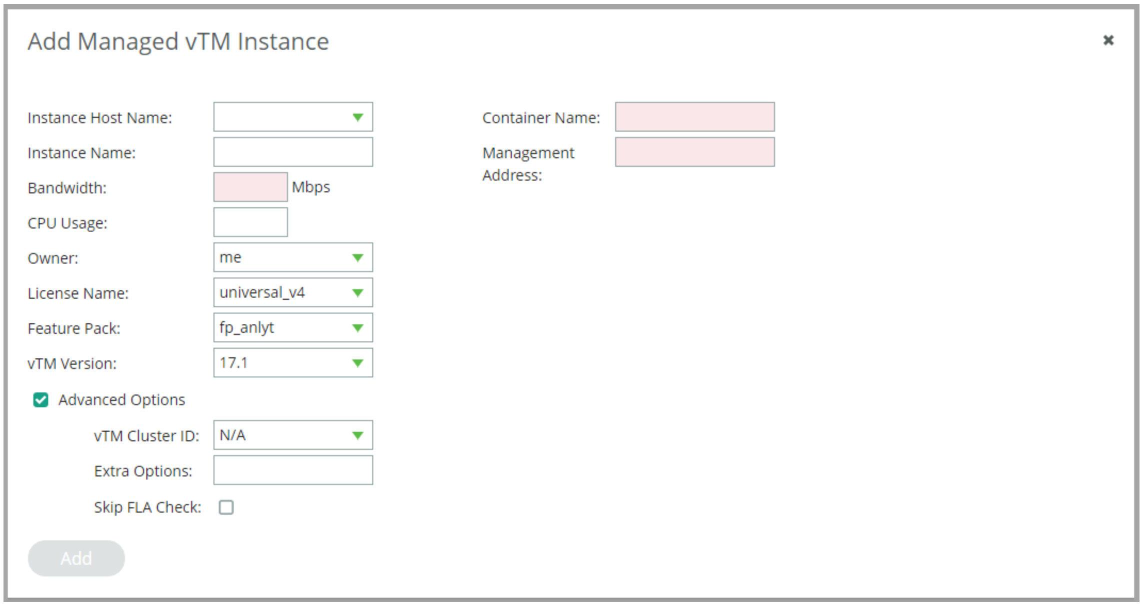
Add a vTM instance

● Add an externally-deployed instance
Use this option if the vTM is already installed and running

○ Deploy an instance to a container
Use this option if you want Services Director to deploy a vTM on an instance host

7. Click **Deploy an instance to a container**, and then click **Next**.

   The **Add Managed vTM Instance** dialog appears.



Add Managed vTM Instance

Instance Host Name:	
Instance Name:	
Bandwidth:	Mbps
CPU Usage:	
Owner:	me
License Name:	universal_v4
Feature Pack:	fp_anlyt
vTM Version:	17.1
Container Name:	
Management Address:	

☑ Advanced Options

vTM Cluster ID:	N/A
Extra Options:	
Skip FLA Check:	□

8. Select an instance host from the **Instance Host Name** list.

9. Specify an **Instance Name** for the new instance.

10. Specify a **Bandwidth** for the vTM instance.

11. (Optional) Specify the **CPU Usage** for the vTM instance.

12. Select an **Owner** for the vTM instance.

13. Select an **License Name** for the vTM instance.

14. Select an **Feature Pack** for the vTM instance.

15. Select an **vTM Version** for the vTM instance.

16. (Optional) In the **Advanced Options:**

    - Select a **vTM Cluster ID** if required. This must be a User Created vTM Cluster, which are visible on the **vTM Clusters** page, see "Viewing vTM Clusters" on page 97.

    - Select **Extra Options** as required. These are described under the config_options property in "Properties for a Deployed Instance" on page 71.

    - Select **Skip FLA Check** if required, see "Checking the Health of an FLA License Automatically" on page 31.

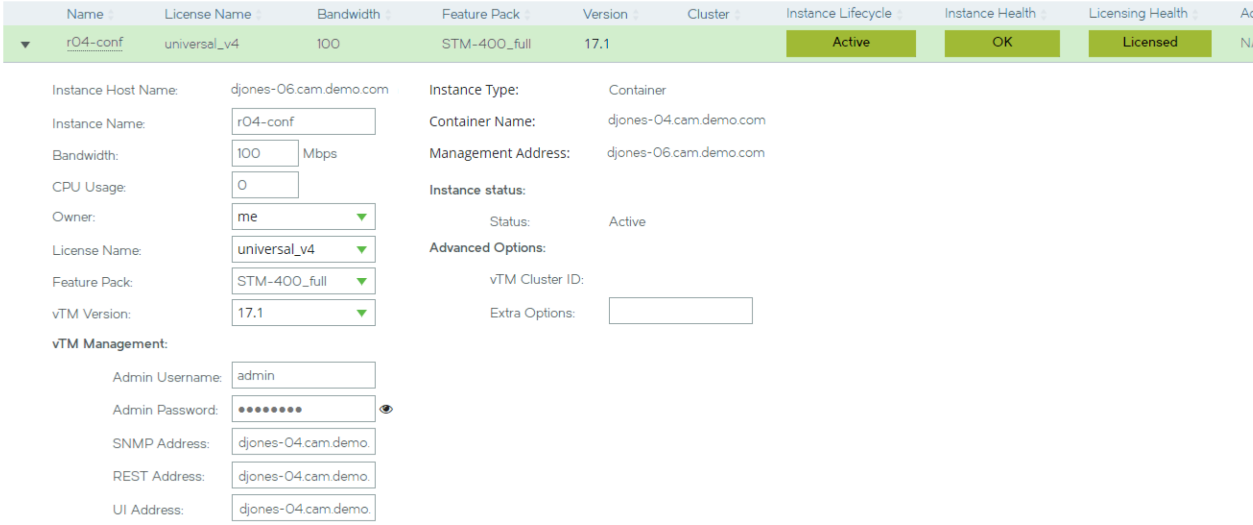
17. Specify a **Container Name** for the new instance. This must be the `<container-fqdn-or-ip>` element of the configuration file name from step 1.

18. Specify the **Management Address** for the new instance.

19. Click **Add**.

It may take a long time to perform the first deployment, as the vTM image needs to be copied to the instance host, extracted from its TAR file, and installed.

Once complete, the instance appears in the **vTM Instances** page of the VA GUI.



	Name	License Name	Bandwidth	Feature Pack	Version	Cluster	Instance Lifecycle	Instance Health	Licensing Health	Ac
▼	r04-conf	universal_v4	100	STM-400_full	17.1		Active	OK	Licensed	N

Instance Host Name: djones-06.cam.demo.com

Instance Name: r04-conf

Bandwidth: 100 Mbps

CPU Usage: 0

Owner: me

License Name: universal_v4

Feature Pack: STM-400_full

vTM Version: 17.1

vTM Management:

Admin Username: admin

Admin Password: ●●●●●●●●

SNMP Address: djones-04.cam.demo.

REST Address: djones-04.cam.demo.

UI Address: djones-04.cam.demo.

Instance Type: Container

Container Name: djones-04.cam.demo.com

Management Address: djones-06.cam.demo.com

Instance status:

Status: Active

Advanced Options:

vTM Cluster ID:

Extra Options:

The **Instance Type** is correctly described as *Container*, but the container properties may be undefined.

The Instance **Lifecycle**, **Instance Health** and **Licensing Health** columns on the **vTM Instances** page will operate as expected. Similarly, monitoring and metering function correctly with vTM instances that are deployed on instance hosts.

The **Extra Options** property is for optional advanced configuration options. These are described under the config_options property in "Properties for a Deployed Instance" on page 71.

Any attempt to perform non-container updates will throw the error 'Failed to update Instance (Unknown container flavor ())'. Instead, use the REST API or CLI for any required property updates.

Any attempt to perform container property updates through the CLI will fail.

Deploying a vTM Instance Using the REST API

The default method for deploying a vTM instance to an instance host is by using the Services Director VA GUI, see "Deploying a vTM Instance using the Services Director VA GUI" on page 102.

However, you can use the REST API to do this if required.

You cannot use the VA CLI to deploy a containerised vTM instance to an instance host.

Non-containerised Instances that are deployed via the REST API will show as having an Instance Type of 'Externally Deployed' in the Services Director UI.

The following worked example uses the two-NIC example host configuration from above, to deploy a simple containerised Instance:

1. Create a container configuration file, in the/root/install directory, with filename:

   ```
   <container-fqdn-or-ip>.conf.
   ```

   This filename must be the value specified for the container_name property of the Instance resource. For Instance resources that will not be able to use the Universal FLA License, the hostname/IP part of the container configuration filename must match the value of the lxc.utsname used in the file and the management_address specified in the REST request (see the example below).

2. Create contents for the container configuration file. For example:

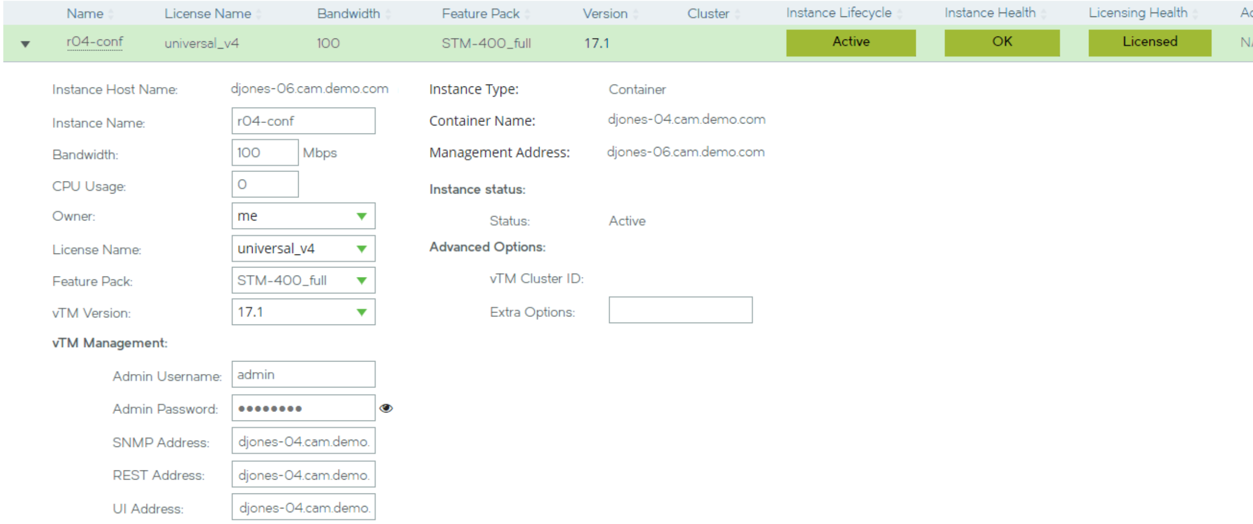
   ```
   lxc.network.type = veth
   lxc.network.flags = up
   lxc.network.link = br0
   lxc.network.ipv4 = XX.XX.XX.XX/XX
   lxc.network.ipv4.gateway = YY.YY.YY.YY
   lxc.utsname = djones-04.cam.demo.com
   ```

3. Use an HTTP client (for example, POSTMAN) to PUT the Instance resource:

```
$ curl -k -u admin:password https://djones-
02.cam.demo.com:8100/api/tmcm/2.9/instance/r04-conf -X PUT -H "Content-type:
application/json"
-d '{"management_address": "djones-06.cam.demo.com", "container_name": "djones-
04.cam.demo.com", "owner": "me", "bandwidth": 100,
"stm_feature_pack": "STM-400_full", "stm_version": "17.1", "host_name": "djones-
06.cam.demo.com", "cpu_usage": "0"}'
```

It may take a long time to perform the first deployment, as the vTM Image needs to be copied to the Host, un-tarred, and installed.

Once complete, the instance appears in the vTM Instances page of the VA GUI.



	Name	License Name	Bandwidth	Feature Pack	Version	Cluster	Instance Lifecycle	Instance Health	Licensing Health	Ac
▼	r04-conf	universal_v4	100	STM-400_full	17.1		Active	OK	Licensed	N/

Instance Host Name:	djones-06.cam.demo.com	Instance Type:	Container
Instance Name:	r04-conf	Container Name:	djones-04.cam.demo.com
Bandwidth:	100 Mbps	Management Address:	djones-06.cam.demo.com
CPU Usage:	0	Instance status:	
Owner:	me	Status:	Active
License Name:	universal_v4	Advanced Options:	
Feature Pack:	STM-400_full	vTM Cluster ID:	
vTM Version:	17.1	Extra Options:	
vTM Management:			
Admin Username:	admin		
Admin Password:	••••••••		
SNMP Address:	djones-04.cam.demo.		
REST Address:	djones-04.cam.demo.		
UI Address:	djones-04.cam.demo.		

The **Instance Type** is correctly described as *Container*, but the container properties may be undefined.

The Instance **Lifecycle**, **Instance Health** and **Licensing Health** columns on the **vTM Instances** page will operate as expected. Similarly, monitoring and metering function correctly with vTM instances that are deployed on instance hosts.

The **Extra Options** property is for optional advanced configuration options. These are described under the config_options property in "Properties for a Deployed Instance" on page 71.

ⓘ Any attempt to perform non-container updates will throw the error 'Failed to update Instance (Unknown container flavor ())'. Instead, use the REST API or CLI for any required property updates.

ⓘ Any attempt to perform container property updates through the CLI will fail.

Registering Externally-Deployed Traffic Managers

Introduction

This section describes how to register externally-deployed Traffic Managers from a software form-factor Services Director.

ⓘ You cannot register an externally-deployed Traffic Manager that is in a private network behind a NAT device.

To register Traffic Managers from the Services Director VA, see the Pulse Secure Services Director Getting Started Guide.

When the Services Director accesses an externally-deployed instance, it is only able to manages licenses and provide metering capabilities for billing; it does not support Services Director life-cycle operations on externally-deployed instances.

ⓘ Deployment options are also supported:

- To deploy Traffic Managers to an instance host from a software form-factor Services Director, see "Using an Instance Host with a Software Services Director" on page 55.
- To deploy Traffic Managers to an instance host from a Services Director VA, see "Using an Instance Host with a Services Director VA" on page 82.

See also "Services Director Form-Factors" on page 11 and "Working with an Instance Host" on page 13.

Properties for an Externally-Deployed Instance

The table below describes the REST API properties for an externally-deployed instance.

Property	Description
owner	The owner resource for this instance. See "owner Resource" on page 187.

Property	Description
stm_feature_pack	The name of the feature_pack resource associated with the Traffic Manager instance. This represents the set of features that are available for the instance.
license_name	The name of the FLA license resource you want to use for this instance. For an externally-deployed instance, this property will not update the licenses on the Traffic Manager instance.
rest_enabled	Should set to true. This is required to enable monitoring and to allow licenses to be pushed to instances.
bandwidth	The maximum allowed bandwidth for the Traffic Manager instance (in units of Mbps).
tag	A text property which provides an alternative way of referring to an instance. Unlike the unique ID for an instance, the tag value can be changed or re-used, subject to some restrictions. See "Understanding the Tag Property" on page 122.
management_ address	The hostname used to address the Traffic Manager instance. The hostname must be a fully-qualified domain name, or an IP address where Universal Licensing is used. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). If you modify this property, the host component of the rest_address , ui_ address , and snmp_address properties is also updated. These values must be fully-qualified domain name, or an IP address where Universal Licensing is used.
ui_address	The address (host or IP address plus port number) of the Traffic Manager instance Administration UI. If you do not enter a value, the UI address defaults to :9090. If you use a hostname instead of an IP address, you must use a fully-qualified domain name, or an IP address where Universal Licensing is used. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request).
admin_username	The user name for the admin account for the externally-deployed instance.

Property	Description
	This is essential for communication between the Services Director and the externally-deployed instance.
admin_password	The password for the admin account for the externally-deployed instance. This is essential for communication between the Services Director and the externally-deployed instance.
rest_address	The hostname or IP address and port number of the Traffic Manager instance configuration REST API. If left blank, it defaults to :9070. The rest_address property must match the instance hostname. If you use a hostname instead of an IP address, you must use a fully-qualified domain name. The rest_address property must be unique and accurate to identify a Traffic Manager instance for licensing purposes. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). This is essential for communication between the Services Director and the externally-deployed instance.
snmp_address	The hostname or IP address and port number of the Traffic Manager instance SNMP responder. This setting enables you to set the SNMP address used for metering. See "Enabling Metering for an Externally-Deployed Instance" on page 114. If you use a hostname instead of an IP address, you must use a fully-qualified domain name. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request).
config_options	A space-separated string used to define configuration options. See "Specifying Configuration Options" on page 75. A single configuration option is supported:

Property	Description
	snmp!community - The SNMP v2 community setting for this externally-deployed instance. This must be set to the same value as the equivalent snmp!community property on the instance resource (default: "public"). The config_options property is visible in the graphical user interface of the Services Director VA. It is listed for an expanded instance on the vTM Instances page as **Extra Options**. Refer to the Pulse Secure Services Director Getting Started Guide. Whenever the config_options property is set, all currently modified options must be specified again in the REST call. Any options that are not specified will lose their current value and be reset to their default value. Unlike deployed instances, externally-deployed instances do not restart when config_options are changed. When you specify this property, do not specify the config_options_json property.
config_options_json	A JSON data structure that is equivalent to the config_options property. See "Specifying Configuration Options" on page 75. When you specify this property, do not specify the config_options property.
access_profile	Identifies an access_profile resource (see "access_profile Resource" on page 122). The authenticator and permission_group resources referenced by this resource are then applied to the Traffic Manager instance to set its user authentication. See "Applying User Authentication to a vTM" on page 124.

Registering an Externally-Deployed Instance

When you register an externally-deployed instance using the REST API, you POST an instance resource.

You cannot register an externally-deployed Traffic Manager that is in a private network behind a NAT device.

The request supports a URL parameter ?managed=false. Include this to indicate that the new instance is an externally-deployed instance. For example:

```
https://<sdhost>:<port>/api/tmcm/2.9/instance/stm1?managed=false
```

For details of all instance properties, see "instance Resource" on page 160.

For details of the instance properties, see "Properties for an Externally-Deployed Instance" on page 109.

Making Database-Only Updates to an Externally-Deployed Instance

You can register externally-deployed instances with the Services Director with a database-only update or a direct update to the Traffic Manager.

If you issue a database-only REST API PUT request (either when initially creating an instance record or when modifying one), you can set a number of properties that are otherwise managed directly by the Services Director. These properties are:

- rest_address
- admin_username
- admin_password
- snmp_address
- rest_enabled
- ui_address

Setting any of these properties through a database-only REST API PUT request does not result in changes being passed to the Traffic Manager instance; only the Services Director database is affected. You can use these techniques to resolve this monitoring issue:

- Issue a GET REST API request for the Traffic Managerinstance resource, including the URL parameter status_check=true. The Services Director actively checks the state of the Traffic Manager instance and updates the stored status accordingly.

- Issue a PUT REST API request to modify the Traffic Managerinstance resource and set the status property to the known correct state with URL parameter deploy=false. The Services Director updates the status of the Traffic Manager instance in the inventory database but does not attempt to start or stop the instance itself.

  The admin_username , admin_password , and rest_address properties are essential for communication between the Services Director and the externally-deployed instance.

Enabling Monitoring and the REST API for an Externally-Deployed Instance

To enable both monitoring and the REST API proxy for an externally-deployed Traffic Manager instance, you must configure:

- The instance resources in the Services Director. Provide values for the admin_username, admin password and rest_address properties. See "Properties for an Externally-Deployed Instance" on page 109.
- The externally-deployed Traffic Manager instance. Enable the REST API.

Enabling Metering for an Externally-Deployed Instance

The Services Director collects metering data from Traffic Manager instances as follows:

- Instances that are at version 9.4 or earlier (or have no REST API enabled) have their metering collected through SNMP.
- Instances that are at version 9.5 or later with the REST API enabled have their metering collected through their REST API. If REST-based metering fails (or is not possible), the Services Director falls back to collecting using SNMP. Any metering issues will be included in the warning logs, as before.

  To enable metering for an externally-deployed Traffic Manager instance, you must first configure the instance resource in the Services Director. Provide a value for the following properties:

- snmp_address.
- snmp!community. This config_options setting must match the snmp!community setting on the instance itself.

  See "Properties for an Externally-Deployed Instance" on page 109.

You must then configure the externally-deployed Traffic Manager instance itself:

- Enable SNMP.
- The snmp!community setting must match the snmp!community setting in the config_options on the instance resource.

When you are configuring an externally-deployed instance, an Instance Host resource is not required.

Using the ServURI Root Partsices Director REST API

Introducing REST

Representational State Transfer (REST) is an architectural style for API design. It is based on the standard HTTP protocol and supports the GET, POST, PUT and DELETE methods.

A REST interface partitions the API into a series of resources, each of which you can access using one or more HTTP methods. With the Services Director, only the GET, PUT, and POST methods are used. (The action resource also supports the DELETE method due to the transient nature of the data contained within it. For more details, refer to "action Resource" on page 125. Each method operates on the Services Director as follows:

- GET - Obtain a representation of the resource without modifying the server state (except perhaps for logging purposes).
- PUT - Create a new resource or apply some change to a resource. If the resource exists, only those properties specified in the request are modified; all others remain unchanged. If a resource object does not exist, a new one is created.
- POST - Create a new resource based on the details contained in the request body. If the resource exists, it is overridden. This method applies to the controller_license_key and bandwidth_pack_license_key resources only. The add_on_pack_license_key resource also supports the POST method for resource creation.

You cannot delete resources for auditing purposes (with the exception of the action resource). Instead, mark a resource as inactive by altering its status property. You cannot mark a resource as Inactive if it is in use, and it cannot be altered after you mark it as Inactive (the name cannot be re-used).

An Accept header, if present, provides a list of acceptable MIME types. If you specify an Accept header in your request, it must allow a MIME type of application/json for all resource types except license.

```
Accept: application/json
```

The license resource allows a MIME type of either application/json or text/plain. This can be used to extract the raw text of the FLA license file if required. See "license Resource" on page 177.

The Content-type header when using PUT and POST methods matches the content type expected by each resource, which is typically application/json. However, when you POST license keys to <license type>_license_key resources, you must set the Content header to plain text.

```
Content-Type: text/plain
```

Each resource is uniquely identified with an address or uniform resource identifier (URI). In other words, if you know the URI, you can access the Authentication resource (subject to the authorization and authentication process).

Because all resources have URIs, resources can point to other resources by embedding the URIs of related resources within their representations.

In the Services Director, all resources are represented as JavaScript Object Notation (JSON) structures. Requests and responses that interact with the Services Director through the REST API must adopt the same format.

The full range of HTTP return codes is available in REST, although in practice you can identify and apply a useful subset consistently. For example, the response can tell you whether a request has succeeded or not without any need for parsing the body of the response. However, the Services Director always attempts to provide extra information regarding a failure into the response body.

Authentication

All requests to the Services Director REST API must be authenticated by means of HTTP Basic Authentication. You must create an initial Services Director user outside of the REST API, but you can create and manage other users using the REST API. You must access the Services Director REST API through HTTPS. Client certificates are not checked for validity, and HTTPS is used only for encryption and to allow the FLA license to verify the server identity.

URI Root Parts

All inventory database resources are provided through a common base URI that identifies the root of the resource model

```
https://<host>:<port>/api
```

There are three main versioned branches beneath this:

```
https://<host>:<port>/api/sd/1.1
https://<host>:<port>/api/tmcm/2.9
https://<host>:<port>/api/tmpl/1.0
```

In these examples, <host> is the hostname of the server containing the inventory database, and <port> is the port that the REST API is published on. You can find all inventory resources at this URI. You can perform a GET request on any level of the base URI to obtain a list of the child elements it contains.

Inventory Resources

This table summarizes inventory resources. Each of the inventory resources is located under a specific URI.

Resource URI	Description
action	The list of pending, blocked, or waiting deployment actions. See "action Resource" on page 125.
add_on_pack_license_key	The list of installed Add-On license keys. This resource is only supported by "old-style" Services Director licenses. See "add_on_pack_license_key Resource" on page 126.
add_on_sku	The list of supported Add-On SKUs. This resource is only supported by "old-style" Services Director licenses that use the add_on_pack_license_key resource. See "add_on_sku Resource" on page 127.

Resource URI	Description
config/analytics/splunk[1]/collection_endpoint	The list of collection endpoints to support vTM analytics. See "collection_endpoint Resource" on page 149. See also "search_endpoint Resource" on page 208.
config/analytics/splunk/log_export	The list of log export types to support vTM analytics. See "log_export Resource" on page 179.
config/analytics/splunk/profile	The list of analytics profiles to support vTM analytics. See "profile Resource" on page 197.
config/analytics/splunk/search_endpoint	The list of search endpoints to support vTM analytics. See "search_endpoint Resource" on page 208. See also "collection_endpoint Resource" on page 149.
config/authentication/access_profile	The list of access profiles to support user authentication on Traffic Manager instances. See "access_profile Resource" on page 122.
config/authentication/authenticator	The list of authenticators to support user authentication on Traffic Manager instances. See "authenticator Resource" on page 129.
config/authentication/permission_group	The list of permission groups to support user authentication on Traffic Manager instances. See "permission_group Resource" on page 189.
config/backup	The list of cluster backups. See "backup Resource" on page 140.
bandwidth_pack_license_key	The list of installed Bandwidth Pack license keys. See "bandwidth_pack_license_key Resource" on page 141.
cluster	The list of defined Services Director clusters. See "cluster Resource" on page 146.
controller_license	The list of installed Services Director licenses. See "controller_license Resource" on page 152.

[1] Splunk is a registered trademark of Splunk Inc. in the USA and other countries.

Resource URI	Description
controller_license_key	The list of installed Services Director license keys. See "controller_license_key Resource" on page 152.
dashboard	A summary view of certain Services Director operations. See "dashboard Resource" on page 156.
feature_pack	The list of feature packs that you can apply to Traffic Manager instances. See "feature_pack Resource" on page 157.
host	The list of Traffic Manager instance hosts on which you can deploy Traffic Manager instances. See "host Resource" on page 159.
instance	The list of Traffic Manager instances. See "instance Resource" on page 160.
license	The list of license files that you can apply to instances. See "license Resource" on page 177.
manager	The list of individual Services Director instances that share the same database. The list also contains mode settings that you can manipulate to achieve HA for the Services Director. See "manager Resource" on page 181.
monitoring	A read-only resource containing monitoring state data on Services Directors and Traffic Manager instances in your deployment. See "monitoring Resource" on page 182.
ping	This can be used in a GET to confirm the service is running.
registration	This is used during self-registration of Traffic Manager instances. See "registration Resource" on page 199.
resource_pack_license_key	The list of installed Resource license keys. See "resource_pack_license_key Resource" on page 204.

Resource URI	Description
schedule	The list of defined backup schedules. These can be assigned to clusters to create automatic cluster backups. See "schedule Resource" on page 205.
settings	Various settings for Services Director functions. See "settings Resources" on page 210.
sku	The list of SKUs that you can use to create feature packs to apply to Traffic Manager instances. See "sku Resource" on page 219.
status	This enables you to check the status of other inventory resources. See "Using the REST API to Check Status" on page 232.
template	An application template. See "template Resource" on page 223.
template_instance	An instance of an application template. See "template_ instance Resource" on page 226.
user	The set of Services Director administrative users. See "user Resource" on page 228.
version	The list of Traffic Manager versions you can apply to instances. See "version Resource" on page 231.

All resource names can be any acceptable URL part. URL encoding allows characters such as spaces. These might not be legitimate user or hostnames in the underlying system, but this is not checked or enforced by the REST API.

Resource Reference

This section contains a full description of the resource objects that you can obtain data from the Services Director REST API. Each resource contains properties and a set of rules governing how you can interact with its properties.

Understanding the Tag Property

Every resource has a unique ID. Many resources also have a tag property which provides an alternative way of identifying the resource.

A tag is a user-friendly name which, unlike the unique ID for a resource, can be changed or re-used (subject to some restrictions).

A tag is useful in the situation where you want to identify a resource by a consistent name. For example, if an error occurs that requires a Traffic Manager instance to be deleted, the unique ID is no longer available, as the instance persists with a Deleted status. The tag, however, can be re-used on a new instance, enabling consistent naming.

Restrictions to tag values are as follows:

- A tag cannot be the same as a unique ID of any resource (except itself).

This restriction includes Deleted Traffic Manager instances.

- A tag must be unique among the tags of all resources.

This restriction does not include Deleted Traffic Manager instances.

- The tag can contain:
  - the characters a-z, A-Z and 0-9.
  - other ASCII character between 32 (space) and 126 (tilde), excluding reserved gen-delims punctuation.
  - the tag can include spaces, but cannot be made entirely of spaces.
  - other characters can be included, but will be displayed using their ANSI escape sequences. That is, the ä character is displayed as \xe4. The same limitation applies to the \ character, which displays as \x5c.

access_profile Resource

An access_profile resource combines an authenticator resource (see "authenticator Resource" on page 129) with one or more permission_group resources (see "permission_group Resource" on page 189) for the purposes of user authentication.

This information is applied to a Virtual Traffic Manager (vTM) when the vTM's user authentication is set from the Services Director. See "Applying User Authentication to a vTM" on the next page.

There are no default access profiles.

You cannot delete authenticator resources or permission_group resources that are included in an access_profile resource.

The access_profile resource is located under the */api/tmcm/2.9/config/authentication* resource.

The access_profile resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

An access_profile resource contains the following properties.

Property	Description
tag	(Optional) If unset, this is set to the ID of the access profile. The name of the access profile. This must be unique amongst IDs and tags of access_profile resources, except when empty or set to its own ID.
authenticator_id	The ID of the authenticator for the access profile.
permission_group_ids	(Optional) A list of permission group IDs. Typically, there will be one or more.

Create an access_profile resource using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json"
-D headers.txt -u admin:adminPassword -X POST -d '{"authenticator_id":"Authenticator-
X1UB-AAC1-2WQ6-X1SN","permission_group_ids":["Permission-Group-0XZS-8EIJ-420T-T59D"]}'
https://servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/access_
profile
```

The response body to a POST contains the properties of the created access_profile resource. For example:

```
{"access_profile_id": "Access-Profile-IPLT-UFHD-327L-OVAB", "tag": "Access-
Profile-IPLT-UFHD-327L-OVAB", "permission_group_ids": ["Permission-Group-0XZS-
8EIJ-420T-T59D"], "authenticator_id": "Authenticator-X1UB-AAC1-2WQ6-X1SN"}
```

Applying User Authentication to a vTM

You can specify an access_profile when you first register an externally-deployed vTM, see "instance Resource" on page 160.

You can also define the user authentication for a registered vTM from the Services Director as follows:

1. Create the required authenticator resource, see "authenticator Resource" on page 129.
2. Create any required permission_group resources, see "permission_group Resource" on page 189.
3. Create an access_profile resource, combining an authenticator with the required permission groups, see "access_profile Resource" on page 122.
4. Reference the access_profile resource in the required instance resource as follows:

```
/api/tmcm/2.9/instance/<instance>?access_profile=<access_profile_id>
```

For example:

```
/api/tmcm/2.9/instance/my_instance_07?access_profile=Access-Profile-2JSI-1XKF-CZZT-
AM9P
```

The authenticator and permission groups are then applied to the vTM. Existing authenticators and permission groups may be overwritten, but none will be deleted. All members of a cluster are affected.

To be eligible for this process, a vTM instance must be marked as Active and have its REST API enabled.

A registered instance cannot be relicensed and have an access profile applied as a single request; licensing will take priority.

action Resource

An action resource describes a deployment action. Whenever a REST request that affects an instance resource triggers a deployment action, an action resource is created. The resource is removed when the action is completed. An action resource can persist for the following reasons:

- If the Services Director experiences a failure or interruption before an action is completed, an action resource is retained and is retried when the Services Director recovers.
- If an action fails, the action resource is retained and marked as Blocked. It is not automatically retried, but it can be queued for implementation after any underlying problem has been addressed.
- The REST API does not allow direct creation of an action resource. However, you can delete an action resource by making a DELETE request. You cannot recover a deleted action.

An action resource contains the following properties.

Property	Description	Actions
request_user	The name of the user whose request triggered the action.	Read Only
request_ip	The IP address of the request that triggered the action.	Read Only
action_type	A string representation of the action: DEPLOY, START, STOP, UPGRADE, or DELETE.	Read Only
action_args	A string representation of the arguments to the action.	Update
status	The status of the action resource: Waiting - Scheduled and waiting to be implemented. Pending - Currently being processed. Blocked - An error occurred.	Update
created	A timestamp string representation of the date and time that the action was created.	Read Only
instance	A structure with the name and href of the Traffic Manager instance that the action is intended to change.	Read Only

Property	Description	Actions
blocked	A string representation of the date and time when the action was blocked (only applicable when the status is Blocked).	Read Only
block_reason	A description of the reason the action was blocked, intended to aid in debugging and fixing the problem (only applicable when the status is Blocked).	Read Only

You can change the status of an action resource from Blocked to Waiting using a PUT request (which causes the request to be reattempted). You can also change its action_args property. No other property changes are supported.

add_on_pack_license_key Resource

ⓘ This resource is only supported by "old-style" Services Director licenses.

An add_on_pack_license_key resource describes the contents of a decoded Services Director Add-On license key.

An add_on_pack_license_key resource contains the following properties.

Property	Description	Actions
bandwidth	The bandwidth limit for this license.	Read Only
controller_license	The optional associated Services Directorcontroller_license_key resource.	Read Only
feature_sku	The feature sku resource this key applies to.	Read Only
license_key	The license key string.	Read Only
serial	The serial number of this license	Read Only
timestamp	A timestamp encoded in this license.	Read Only
valid	Describes whether the key was successfully validated (with a currently active controller license key): true or false.	Read Only
valid_from	The license start date (Perpetual).	Read Only
valid_until	The license end date (Perpetual).	Read Only

Create a new add_on_pack_license_key resource by making a POST request to the resource with the license key text in the request body.

```
POST /api/tmcm/2.9/add_on_pack_license_key HTTP/1.1
Content-Type: text/plain
LK1-ERSSCAPFIPS:1:VXTNN000C5725:20130808T0931351375969495-0000-0000-5-ACB8-AE89-67EE
```

You must include a Content-Type header set to text/plain.

add_on_sku Resource

ⓘ This resource is only supported by "old-style" Services Director licenses.

An add_on_sku resource defines a set of additional licensable features that can be added to those of an stm_sku to extend Traffic Manager or Services Director functionality. You do not apply an add_on_sku directly to a Traffic Manager instance, but you can use it in a feature_pack to apply additional functionality to the base stm_sku of the pack.

The add_on_sku resources are pre-installed in the Services Director software, based on sets of features described by existing Traffic Manager template licenses and additional Services Director features. The add_on_sku resource is read-only; PUT and POST HTTP requests to create or modify add_on_sku resources are not possible.

An add_on_sku resource contains the following properties.

Property	Description	Actions
info	An optional descriptive string.	Read Only
features	The features enabled by this add_on_sku. The features property is a string containing a space-separated list of licensable Traffic Manager or Services Director feature names that the add_on_sku enables. See "sku Resource" on page 219.	Read Only
status	The status of this resource: Active or Inactive.	Read Only

admin_ca Resource

An admin_ca resource specifies a CA certificate. This certificate is required to communicate with a secure LDAP server used for either vTM or Services Director authentication, see "authenticator Resource" on the next page.

- The admin_ca resource for a Services Director is located under the */api/sd/1.1/* resource.
- The admin_ca resource for a vTM is located under the */api/tmcm/2.9/config/authentication* resource.

The admin_ca resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

An admin_ca resource contains the following properties.

Property	Description
tag	(Optional) If unset, this is set to the ID of the access profile. The name of the CA certificate. This must be unique amongst IDs and tags of admin_ca resources, except when empty or set to its own ID.
admin_ca_id	The ID of the CA certificate.
certificate_authority	The text of the CA certificate.

Create an admin_ca resource for a Services Director using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json"
-D headers.txt -u admin:adminPassword -X POST -d '{"admin_ca_id": "Admin-CA-5XJ0-HP0Y-
YQAX-69O2", "tag": "Test_3", "certificate_authority": "-----BEGIN CERTIFICATE----
-...<cert_text>...-----END CERTIFICATE-----"}'
https://servicesdirector1.demo.com:8100/api/sd/1.1/admin_ca
```

The response body to a POST contains the properties of the created admin_ca resource. For example:

```
{"certificate_authority": "-----BEGIN CERTIFICATE-----...<cert_text>...-----END
CERTIFICATE-----", "admin_ca_id": "Admin-CA-5XJ0-HP0Y-YQAX-6902", "tag": "Test_3"}
```

Create an admin_ca resource for a vTM using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json"
-D headers.txt -u admin:adminPassword -X POST -d '{"admin_ca_id": "Admin-CA-4JD0-SD01-
123Y-223J", "tag": "Test_2", "certificate_authority": "-----BEGIN CERTIFICATE----
-...<cert_text>...-----END CERTIFICATE-----"}'
https://servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/admin_ca
```

The response body to a POST contains the properties of the created admin_ca resource. For example:

```
{"certificate_authority": "-----BEGIN CERTIFICATE-----...<cert_text>...-----END
CERTIFICATE-----", "admin_ca_id": "Admin-CA-4JD0-SD01-123Y-223J", "tag": "Test_
2"}
```

authenticator Resource

There are two different authenticator API resources:

- An authenticator resource for vTM user authentication, refer to "authenticator Resource (vTM User Authentication)" below.
- An authenticator resource for Services Director user authentication, refer to "authenticator Resource (Services Director User Authentication)" on the next page.

authenticator Resource (vTM User Authentication)

An authenticator resource for vTM user authentication defines an external user authentication service. This information is applied to a Virtual Traffic Manager (vTM) when the vTM's user authentication is set from the Services Director.

An access_profile resource (see "access_profile Resource" on page 122) combines an authenticator resource with one or more permission_group resources (see "permission_group Resource" on page 189) for the purposes of user authentication.

Three proprietary authentication services are supported:

- LDAP. See "Properties for LDAP Authenticators" on page 131.

- RADIUS. See "Properties for RADIUS Authenticators" on page 135.
- TACACS+. See "Properties for TACACS+ Authenticators" on page 138.

There are no default authenticators.

The authenticator resource for vTM user authentication is located under the */api/tmcm/2.9/config/authentication* resource, and will accept the following HTTP methods:

- POST, for creation.
- PUT, for update. You cannot update the authenticator type.
- GET.
- DELETE. This can only succeed if the authenticator resource is not in use by an access_profile resource (see "access_profile Resource" on page 122).

To enable testing of authenticators without necessarily creating them, the **'?test=username:password'** query parameter is supported. This query parameter turns a request into a synchronous test of the authenticator. When the query parameter is used in combination with a POST request (because the resource does not yet exist), the resource is not created. Instead, the output of the test is logged and a 202 response is sent back with the output of the test. In case of existing resources, the user is expected to update the properties before issuing a GET request using the query parameter. Other requests will silently ignore the query parameter.

authenticator Resource (Services Director User Authentication)

An authenticator resource for Services Director user authentication defines an external user authentication service.

Three proprietary authentication services are supported:

- LDAP. See "Properties for LDAP Authenticators" on the next page.

Both secure and non-secure LDAPS authenticators are supported.

- RADIUS. See "Properties for RADIUS Authenticators" on page 135.
- TACACS+. See "Properties for TACACS+ Authenticators" on page 138.

There are no default authenticators.

The authenticator resource for Services Director user authentication is located under the */api/sd/1.1/authentication* resource, and will accept the following HTTP methods:

- POST, for creation.
- PUT, for update. You cannot update the authenticator type.
- GET.
- DELETE.

To enable testing of authenticators without necessarily creating them, a query parameter ('?test=username:password') is supported. This query parameter turns a request into a synchronous test of the authenticator. When the query parameter is used in combination with a POST request (because the resource does not yet exist), the resource is not created. Instead, the output of the test is logged and a 202 response is sent back with the output of the test. In case of existing resources, the user is expected to update the properties before issuing a GET request using the query parameter. Other requests will silently ignore the query parameter.

Properties for LDAP Authenticators

The following table describes all possible properties for an LDAP authenticator resource. There are some differences between vTM authenticators and Services Director authenticators.

Both secure and non-secure LDAPS authenticators are supported.

Property	Description
tag	(Optional) If unset, this is set to the ID of the authenticator. The name of the authenticator. This must be unique amongst IDs and tags of authenticator resources, except when empty or set to its own ID.
type	The user authentication service for the authenticator. Set this to ‘ldap’. Not allowed on update.
server	The IPv4 address or resolvable hostname/FQDN of the user authentication server.
port	The port used to connect to the user authentication server. Default is 389 for LDAP.

Property	Description
timeout	(Optional) The timeout period (in seconds) for a connection to the user authentication server. For vTM user authorisation, this value must be an integer between 0 and 4294967295. The default is 30. For Services Director user authorisation, this value must be 30 or less. The default is 10.
fallback_group	(Optional) The permissions group to which a valid user will belong if its group is not identified. Set this to the ID of a permission group resource. Required for LDAP unless group_attribute is set.
group_attribute	(Optional) The LDAP attribute that gives a user's group. For example: "memberOf". If multiple values are returned by the LDAP server the first valid one will be used. Default is an empty string for LDAP. Required unless fallback_group is set.
group_field	(Optional) The sub-field of the group_attribute that gives a user's group. For example: if group_attribute is "memberOf" which delivers "CN=mygroup, OU=groups, OU=users, DC=mycompany, DC=local", set group_field to "CN". The first matching field will be used. Default is an empty string for LDAP.
base_dn	The base DN (Distinguished Name) for directory searches. Cannot be empty.
bind_dn	(Optional) A template to construct the bind DN from the username. This is only used (and is required) when the dn_method is ‘construct’. The string "%u" is replaced by the username. For example: "%u@mycompany.local", OR "cn=%u, dn=mycompany, dn=local".
dn_method	Value determines relevance/requirement of bind_dn and search_dn. Can be set as follows: ‘construct’ - the bind DN for a user can be constructed from a known string. See the bind_dn property.

Property	Description
	'search' - the bind DN for a user can be searched for in the directory. This is necessary if you have users under different directory paths. See the search_dn and search_password fields. 'none'. This setting is not supported for Services Director user authentication.
filter	A filter that uniquely identifies a user located under the base_dn. The string "%u" will be substituted with the username. For example: "sAMAccountName=%u" (Active Directory), OR "uid=%u" (Unix LDAP) Cannot be empty.
group_filter	(Optional) If the user record returned by the filter does not contain the required group information, you can specify an alternative group search filter here. This will typically be required if you have Unix/POSIX-style user records. If multiple records are returned, the list of group names will be extracted from all of them. The string "%u" will be replaced by the username. For example: "(&(memberUid=%u)(objectClass=posixGroup))"
ssl	(Optional) Specify the required LDAP security type: *none*. Select this if your LDAP server does not support secure connections. *starttls*. Select this if your LDAP server supports STARTTLS secure connections. You must ensure that a matching admin_ca resource is present to use this option, see "admin_ca Resource" on page 128. *ldaps*. Select this if your LDAP server supports LDAPS secure connections. You must ensure that a matching admin_ca resource is present to use this option, see "admin_ca Resource" on page 128.
search_dn	(Optional) The DN to use when searching the directory for a user's bind DN (see also search_password). You can leave this blank if it is possible to perform the bind DN search using an anonymous bind. Only relevant if dn_method is 'search'.

Property	Description
search_password	(Optional) The password to use when searching the directory for a user's bind DN (see also search_dn). You can leave this blank if it is possible to perform the bind DN search using an anonymous bind. Only relevant if dn_method is 'search'.
status	(Services Director user authorisation only). Indicates whether the authenticator is enabled or disabled. Only one Services Director authenticator can be enabled. If status is enabled, the status for all other Services Director authenticators are disabled automatically.

You create an LDAP authenticator resource for vTM user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept:
application/json" -D headers.txt -u admin:adminpassword -X POST -d '{"base_
dn":"OU=users, DC=demo, DC=local", "bind_dn":"%u@demo.local", "dn_
method":"construct", "fallback_group":"admin", "filter":"sAMAccountName=%u",
"group_attribute":"memberOf", "group_field":"CN", "group_filter":"(&
(memberUid=%u)(objectClass=posixGroup))", "port":389, "search_dn":"", "search_
password":"", "server":"xx.xx.xx.xx", "tag":"MyLDAPServer", "timeout":30,
"type":"ldap", "ssl":"none"}'
https://servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/auth
enticator
```

The response body to this POST contains the properties of the created LDAP authenticator resource. For example:

```
{"search_dn": "", "group_field": "CN", "authenticator_id": "Authenticator-I8EX-
9PNE-3TR5-ZMW4", "bind_dn": "%u@demo.local", "dn_method": "construct", "group_
attribute": "memberOf", "group_filter": "(&(memberUid=%u)
(objectClass=posixGroup))", "server": "xx.xx.xx.xx", "filter":
"sAMAccountName=%u", "tag": "MyLDAPServer", "timeout": 30, "base_dn":
"OU=users, DC=demo, DC=local", "fallback_group": "admin", "search_password":
"", "type": "ldap", "port": 389, "ssl":"none"}
```

You create an LDAP authenticator resource for Services Director user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept:
application/json" -D headers.txt -u admin:adminpassword -X POST -d '{"base_
dn":"OU=users, DC=demo, DC=local", "bind_dn":"%u@demo.local", "dn_
method":"construct", "fallback_group":"", "filter":"sAMAccountName=%u", "group_
attribute":"memberOf", "group_field":"CN", "group_filter":"(&(memberUid=%u)
(objectClass=posixGroup))", "port":389, "search_dn":"", "search_password":"",
"server":"xx.xx.xx.xx", "tag":"MyLDAPServer", "timeout":30, "type":"ldap",
"ssl":"starttls"}' https://
servicesdirector1.demo.com:8100/api/sd/1.1/authentication/authenticator
```

The response body to this POST contains the properties of the created LDAP authenticator resource. For example:

```
{"status": "enabled", "group_filter": "(&(memberUid=%u)
(objectClass=posixGroup))", "search_dn": "", "tag": "MyLDAPServer", "base_dn":
"OU=users, DC=demo, DC=local", "port": 389, "group_field": "CN",
"authenticator_id": "Authenticator-NMBT-7B4Y-4BE7-HEUS", "bind_dn":
"%u@demo.local", "server": "10.62.169.170", "filter": "sAMAccountName=%u",
"group_attribute": "memberOf", "timeout": 30, "dn_method": "construct",
"fallback_group": "", "search_password": "", "type": "ldap", "ssl":"starttls"}
```

Properties for RADIUS Authenticators

The following table describes all possible properties for a RADIUS authenticator resource. There are some differences between vTM authenticators and Services Director authenticators.

Property	Description
tag	(Optional) If unset, this is set to the ID of the authenticator. The name of the authenticator. This must be unique amongst IDs and tags of authenticator resources, except when empty or set to its own ID.
type	The user authentication service for the authenticator. Set this to ‘radius’. Not allowed on update.

Property	Description
server	The IPv4 address or resolvable hostname/FQDN of the user authentication server.
port	The port used to connect to the user authentication server. Default is 1812 for RADIUS.
timeout	(Optional) The timeout period (in seconds) for a connection to the user authentication server. For vTM user authorisation, this value must be an integer between 0 and 4294967295. The default is 30. For Services Director user authorisation, this value must be 30 or less. The default is 10.
fallback_group	(Optional) The permissions group to which a valid user will belong if its group is not identified. Set this to the ID of a permission_group resource. Required for RADIUS unless group_attribute is set.
group_attribute	(Optional) The attribute that specifies an account's group. For RADIUS, must be an integer between 0 and 4294967295 inclusive. Default is 1. Required unless fallback_group is set.
secret	(Optional) The secret key shared with the RADIUS server.
group_vendor	(Optional) The RADIUS identifier for the vendor of the RADIUS attribute that specifies an account's group. Must be an integer between 0 and 4294967295. Default is 7146. Leave blank if using a standard attribute such as Filter-Id.
nas_identifier	(Optional) A string identifying the Network Access Server (NAS) which is requesting authentication of the user. This value is sent to the RADIUS server. If left blank, the address of the interface used to connect to the server will be used.
status	(Services Director user authorisation only). Indicates whether the authenticator is enabled or disabled. Only one Services Director authenticator can be enabled. If status is enabled, the status for all other Services Director authenticators are disabled automatically.

You create a RADIUS authenticator resource for vTM user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept:
application/json" -D headers.txt -u admin:adminpassword -X POST -d '{
"fallback_group": "admin", "group_attribute": 1, "group_vendor": 1476, "nas_
identifier": "Internal RADIUS", "nas_ip_address": "127.0.0.1", "port": 1812,
"secret": "*", "server": "xx.xx.xx.xx", "tag": "RADIUS Server", "timeout": 30,
"type": "radius"}' https://
servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/authenticato
r
```

The response body to this POST contains the properties of the created RADIUS authenticator resource. For example:

```
{"authenticator_id": "Authenticator-IYGN-4BW2-M9FF-FW3O", "nas_ip_address":
"127.0.0.1", "group_vendor": 1476, "group_attribute": 1, "server":
"xx.xx.xx.xx", "secret": "*", "tag": "RADIUS Server", "timeout": 30, "fallback_
group": "admin", "type": "radius", "port": 1812, "nas_identifier": "Internal
RADIUS"}
```

You create a RADIUS authenticator resource for Services Director user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept:
application/json" -D headers.txt -u admin:adminpassword -X POST -d '{
"fallback_group": "", "group_attribute": 1, "group_vendor": 1476, "nas_
identifier": "Internal RADIUS", "nas_ip_address": "127.0.0.1", "port": 1812,
"secret": "*", "server": "xx.xx.xx.xx", "tag": "RADIUS Server", "timeout": 30,
"type": "radius"}' https://
servicesdirector1.demo.com:8100/api/sd/1.1/authentication/authenticator
```

The response body to this POST contains the properties of the created RADIUS authenticator resource. For example:

```
{"status": "enabled", "group_vendor": 1476, "tag": "RADIUS Server", "port":
1812, "authenticator_id": "Authenticator-VPCA-QDSS-HS77-38HL", "nas_ip_
address": "127.0.0.1", "server": "xx.xx.xx.xx", "secret": "*", "group_
attribute": 1, "timeout": 30, "fallback_group": "", "type": "radius", "nas_
identifier": "Internal RADIUS"}
```

Properties for TACACS+ Authenticators

The following table describes all possible properties for a TACACS+ authenticator resource. There are some differences between vTM authenticators and Services Director authenticators.

Property	Description
tag	(Optional) If unset, this is set to the ID of the authenticator. The name of the authenticator. This must be unique amongst IDs and tags of authenticator resources, except when empty or set to its own ID.
type	The user authentication service for the authenticator. Set this to ‘radius’. Not allowed on update.
server	The IPv4 address or resolvable hostname/FQDN of the user authentication server.
port	The port used to connect to the user authentication server. Default is 49 for TACACS+.
timeout	(Optional) The timeout period (in seconds) for a connection to the user authentication server. For vTM user authorisation, this value must be an integer between 0 and 4294967295. The default is 30. For Services Director user authorisation, this value must be 30 or less. The default is 10.
fallback_ group	(Optional) The permissions group to which a valid user will belong if its group is not identified. Set this to the ID of a permission group resource. Required for TACACS+ unless group_service is set.
secret	(Optional) The secret key shared with the TACACS+ server.
auth_type	The TACACS+ authentication type, either ‘pap' (default) or 'ascii'.
group_service	The TACACS+ "service" that identifies a user's group field. Required unless fallback_group is set.
status	(Services Director user authorisation only). Indicates whether the authenticator is enabled or disabled. Only one Services Director authenticator can be enabled. If status is enabled, the status for all other Services Director authenticators are disabled automatically.

You create a TACACS+ authenticator resource for vTM user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept:
application/json" -D headers.txt -u admin:adminPassword -X POST -d '{"auth_
type": "pap","fallback_group": "admin","group_field": "mygrp","group_service":
"demo","port": 49,"secret": "mysecret","server": "xx.xx.xx.xx","tag": "TACACS_
plus_Server","timeout": 30,"type": "tacacs_plus"}' https://
servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/authenticato
r/
```

The response body to this POST contains the properties of the created TACACS+ authenticator resource. For example:

```
{"auth_type": "pap", "group_field": "mygrp", "authenticator_id":
"Authenticator-X1UB-AAC1-2WQ6-X1SN", "server": "10.62.164.80", "group_service":
"demo", "secret": "mysecret", "tag": "TACACS_plus_Server", "timeout": 30,
"fallback_group": "admin", "type": "tacacs_plus", "port": 49}
```

You create a TACACS+ authenticator resource for Services Director user authentication using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -D
headers.txt -u admin:adminPassword -X POST -d '{"auth_type": "pap","fallback_
group":"","group_field": "permission-group","group_service": "zeus","port":
4900,"secret": "mysecret","server": "auth.demo.com","tag": "demoservice","timeout":
10,"type": "tacacs_plus"}'
https://servicesdirector1.demo.com:8100/api/sd/1.1/authentication/authenticator/
```

The response body to this POST contains the properties of the created TACACS+ authenticator resource. For example:

```
{ "auth_type":"pap", "authenticator_id":"Authenticator-FP2J-MFG0-J8VK-I8QK",
"fallback_group":"","group_field":"permission-group", "group_service":"zeus",
"port":4900,"secret":"mysecret","server":"auth.demo.com","status":"enabled","ta
g":"demoservice","timeout": 10,"type":"tacacs_plus"}
```

backup Resource

A backup resource is a backup of a cluster configuration. A backup resource is created automatically for the Services Director for each cluster resource that has an assigned backup schedule resource. The schedule for each cluster defines the frequency of backups. You can also create a immediate cluster backup manually. See the Pulse Secure Services Director Getting Started Guide for full details of cluster backup and restore.

The backup resource is located under the */api/tmcm/2.9/config* resource.

The backup resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for backup.

Property	Description
backup_id	The UUID of the backup.
cluster_id	The UUID of the cluster that requested the backup.
date	A timestamp for the date/time of the backup.
description	A description of the backup. By default, this is the cluster name plus the sequence_number.
retain	A Boolean flag, indicating if the backup is Retained. This should be set to true if the backup is to be kept indefinitely, and considered as a candidate for deletion as part of the automated backup rotation.
sequence_num	The sequence number of this backup, incremented for every backup taken
size	The size of the backup.
tag	The user-facing (and reusable) cluster backup resource name. This field can be set by the user at any time.

The response body to a POST contains a JSON structure representing the properties of the created backup resource. For example:

```
{
    "backup_id": "Backup-9URJ-UQJM-RP10-8I42",
    "cluster_id": "Cluster-21TN-WWC0-EH2J-Z5RY",
    "date": "2016-07-06 12:15",
    "description": "Radegund Cluster#2",
    "retain": false,
    "sequence_num": 2,
    "size": 133120,
    "tag": "Backup-9URJ-UQJM-RP10-8I42"
}
```

See "cluster Resource" on page 146 for details of a cluster that can be backed up.

See "schedule Resource" on page 205 for details of backup schedules that control the creation of backups for a cluster.

bandwidth_pack_license_key Resource

A bandwidth_pack_license_key resource describes the contents of a decoded Services Director Bandwidth Pack license key.

A bandwidth_pack_license_key resource contains the following properties.

Property	Description	Actions
valid	Determines whether the key was successfully validated (with the currently active Services Director license): true or false.	Read Only
status	Determines whether the key is currently in use by the Services Director: Active or Inactive. You can set this property to Active only.	Update
valid_from	The license start date (Perpetual).	Read Only
valid_until	The license end date (Perpetual).	Read Only
stm_sku	The sku resource this license applies to.	Read Only

Property	Description	Actions
bandwidth	The bandwidth limit for this license.	Read Only
serial	The serial number of the Bandwidth Pack license.	Read Only
timestamp	The timestamp of the Bandwidth Pack license.	Read Only
controller_license_ serial	The serial number of the associated Services Director license.	Read Only
controller_licenses	An optional list of associated Services Directorlicense resources.	Read Only
license_key	The license key string.	Read Only
expiry_warning_days	The number of days warning that is given for an impending license expiry.	Read Only

Create a new bandwidth_pack_license_key resource by making a POST request to the resource with the license key text in the request body.

```
POST /api/tmcm/2.9/bandwidth_pack_license_key HTTP/1.1
Content-Type: text/plain
LK1-ERSSCTPSTM_B_200:1:VXTNN000C5725:20131351375969495-0000-0000-5-ACB8-AE89-67EE
```

You must include a Content-Type header set to text/plain.

Unlike other REST API resources, the Services Director determines the name of the created resource and the content of each property based on the license key you use. If successful, the Services Director returns a standard POST response of HTTP/1.1 201 Created and the resource name in the Content-Location header.

The response body contains a JSON structure representing the properties of the created resource:

```
{
   "valid": "true",
   "status": "Active",
   "valid_from": "Perpetual",
   "valid_until": "Perpetual",
   "stm_sku": "STM-B-200",
   "bandwidth": "1",
   "serial": "VXTNN000C5725",
   "timestamp": "2013-08-08T09:31:35.1375969495",
   "controller_license_serial": "00003",
   "controller_license": "ERSSC00003-XXXX-YYYY",
   "license_key": "LK1-ERSSCTPSTM_B_
200:1:VXTNN000C5725:20130808T0931351375969495-0000-0000-5-ACB8-AE89-67EE"
}
```

The request body in a POST request to the bandwidth_pack_license_key resource must contain exactly one valid Bandwidth Pack license key.

The bandwidth property of the controller_license_key resource on which it depends is updated as appropriate.

After a bandwidth_pack_license_key resource has been created, the Services Director typically activates it automatically. The exception to this is when activation would cause the current deployment to have insufficient licensed bandwidth; this is the case when an existing Bandwidth Pack license provides bandwidth, in use by the Services Director, that would not be provided by the new Bandwidth Pack license.

Activation also fails in the following circumstances:

- A license has a valid_from date in the future.
- A license has a valid_until date in the past.
- Activating a license would result in the Services Director deployment having insufficient licensed bandwidth for its current Traffic Manager instance configuration. (This is the case when multiple Bandwidth Packs have been issued with the same license key; activating one pack requires deactivation of whichever pack is currently active.)
- The license is invalid.

You can activate a Bandwidth Pack license manually by setting the status property to Active using a PUT request:

```
PUT /api/tmcm/2.9/bandwidth_pack_license_key/VXTNN000C572-1234567890 HTTP/1.1
{"status": "Active"}
```

After the license has been activated, you cannot set this property back to Inactive.

ⓘ You cannot activate invalid license keys (including those keys that do not validate against any installed Services Director license). These keys have their valid property set to false.

The Services Director populates the controller_license property with any matching controller_license resource this Bandwidth Pack license is validated against. The bandwidth licensed by the Bandwidth Pack is listed in the controller_license_key resource when queried. If no matching Services Director license is found, valid is set to false and controller_license is left blank.

If you attempt to reinstall an existing Bandwidth Pack license, the Services Director license state is unchanged. If you attempt to install a malformed or invalid key, the Services Director responds with HTTP/1.1 400 Bad Request and an appropriate error message in the response body.

To view existing licenses, perform a GET request for the bandwidth_pack_license_key resource:

```
https://<sdhost>:<port>/api/tmcm/2.9/bandwidth_pack_license_key
```

The response to this request contains a JSON structure representing the list of installed licenses:

```
{
   "children" : [
      {
         "href" : "/api/tmcm/2.9/bandwidth_pack_license_key/VXTNN000C572-
1234567890",
         "name" : "VXTNN000C572-1234567890"
      },
      {
         "href" : "/api/tmcm/2.9/bandwidth_pack_license_key/VXTNN000C573-
1234567890",
         "name" : " VXTNN000C573-1234567890"
      },
      {
         "href" : "/api/tmcm/2.9/bandwidth_pack_license_key/VXTNN000C574-
1234567890",
         "name" : " VXTNN000C574-1234567890"
      }
   ]
}
```

To view the details for an individual Bandwidth Pack license key, perform a GET request for the specific license resource:

```
https://<sdhost>:<port>/api/tmcm/2.9/bandwidth_pack_license_key/ VXTNN000C572-
1234567890
```

The response to this request contains a JSON structure representing the license resource. The properties displayed are the decoded contents of the license key:

```
{
   "valid": "true",
   "status": "Active",
   "valid_from": "Perpetual",
   "valid_until": "Perpetual",
   "stm_sku": "STM-B-200",
   "bandwidth": "1",
   "serial": "VXTNN000C5720",
   "timestamp": "2013-08-08T09:31:35.1375969495",
   "controller_license_serial": "00003",
   "controller_license": "ERSSC00003-XXXX-YYYY",
   "license_key": "LK1-ERSSCTPSTM_B_200:1:VXTNN000C5720:20130808T0931351375969495-
      0000-0000-5-ACB8-AE89-67EE"
}
```

To delete a Bandwidth Pack license, use the DELETE request method with the desired bandwidth_pack_license_key resource in the URI:

```
DELETE /api/tmcm/2.9/bandwidth_pack_license_key/VXTNN000C572-1234567890 HTTP/1.1
```

If you attempt to delete a Bandwidth Pack license key that is used to provide bandwidth for the Services Director's current configuration of Traffic Manager instances, the request is rejected with an HTTP/1.1 400 Bad Request status code.

cluster Resource

A cluster resource describes a Traffic Manager cluster. You put the name of the cluster resource into the cluster_id property of each Traffic Managerinstance resource you want to add to that cluster.

Creating a cluster resource does not automatically create the actual Traffic Manager cluster. You must first create the Traffic Managerinstance resources (which in turn triggers deployment of your Traffic Manager instances) with the cluster_id property set to the name of the cluster resource.

The Services Director automatically clusters together all Traffic Managerinstance resources using the same cluster_id property during deployment.

ⓘ Instances in a cluster must use the same feature pack. Not doing so will lead to the instances running with disparate features across the cluster which could mean that some features will not work as expected.

ⓘ When adding a Traffic Manager instance to an existing cluster, you must have at least one Traffic Manager instance already running (with a status property of Active) within the cluster; otherwise, resource creation fails.

When creating a cluster resource, you can specify the following properties.

Property	Description	Actions
cluster_type	This field is populated by Services Director when the cluster resource is created. There are two types: Discovered -for cluster records which were created by Services Director for the purposes of cluster awareness, User Created - for cluster records created via the Services Director REST API.	Read-Only
in_use	This Boolean field is populated by the Services Director during response generation. It is true for cluster records which have dependent vTM Instance records (excluding Instance records in status Deleted or Failed_to_deploy).	Read-Only
members	A list of all vTMs in the cluster.	Create/Update
next_backup_time	The time at which the next backup is due, according to the backup_schedule.	Read-Only
number_backups	The number of non-retained backups that should be stored for this cluster. When a new backup is being made, if the number of non-retained backups for the cluster exceeds <number_backups>, one will be deleted.	Create/Update

Property	Description	Actions
owner	The owner resource for the instance. See "owner Resource" on page 187.	Create/Update
schedule_id	(Optional) The automated backup schedule associated with this cluster. See "schedule Resource" on page 205.	Create/Update
status	The status of this resource: Active or Inactive.	Update
tag	The user-facing (and reusable) cluster resource name. This field can be set by the user at any time.	Create/Update
task	A href and task ID for the most recent user triggered backup/restore/upload action.	Read-Only
analytics_profile_id	The ID of the analytics profile for the vTM cluster, where used. Refer to "profile Resource" on page 197.	Read-Only
user_data	The user data for the cluster. This is replaces the user data from the cloud registration resource when you are creating additional cluster members on AWS. See the Pulse Secure Services Director Getting Started Guide for full details of this process.	Read-Only

There are no required properties for this resource, but the request body must be a valid JSON object. The cluster name is the resource name.

The response to a GET request for a cluster resource contains an additional read-only list members property. This list contains the names of all Traffic Manager instances in the cluster.

```
{
    "status": "Active",
    "share_tips": true,
    "in_use": true,
    "cluster_type": "Discovered",
    "number_backups": 5,
    "tag": "Cluster1",
    "members": ["Instance-MXP8-575A-VL1A-VU5P","Instance-OKKT-9MU0-DTZH-70YF"],
    "owner": "Owner-X287-ZB46-SCYV-HEZT",
    "analytics_profile_id": "Analytics-Profile-V5PM-QWI8-2L1C-UTLP"
}
```

You can set the owner property only when first creating a cluster resource. You cannot update this property in an existing cluster resource.

You can mark a resource as inactive by changing the status property to Inactive.

You can delete an empty resource by sending a DELETE http request with an empty request body to *api/tmcm/2.9/cluster/<cluster id>*.

See "owner Resource" on page 187 for details of owner resources.

See "schedule Resource" on page 205 for details of backup schedules that are available to a cluster.

See "backup Resource" on page 140 for details of backups taken for a cluster.

collection_endpoint Resource

An collection_endpoint resource on the Services Director records details for a collection endpoint from your analytics system. This is assigned automatically when vTM analytics is activated on a vTM cluster.

The Services Director uses two kinds of endpoints for vTM analytics:

- Collection endpoints, described in this section.
- Search endpoints, described in "search_endpoint Resource" on page 208.

See the Pulse Secure Services Director Getting Started Guide for full details of vTM analytics.

The collection_endpoint resource is located under the */api/tmcm/2.9/config/analytics/splunk* resource.

The collection_endpoint resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for collection_endpoint.

Property	Description
transaction_export_ address	The address that transaction data is exported to, in the form <server>:<port>. For example: `example.com:7090`
transaction_export_tls	Boolean. Indicates whether transaction data requires secure transmission.
transaction_tls_verify	(Optional) Boolean. If *true*, indicates that verification of the secure connection to the transaction collection endpoint is required. If true, you must also specify transaction_endpoint_certificate, and you can optionally specify transaction_tls_verify. This can only be specified if transaction_export_tls is true.
transaction_endpoint_ certificate	The certificate of the transaction export collection endpoint. This is required if transaction_tls_verify is is *true*.
auth_type	The required authorisation. This can be set to: "None": This indicates no authorisation is required. "Basic": This indicates that basic HTTP authorisation is required. You must also specify auth_username and auth_password. "Splunk": This indicates that authorisation is performed on the Splunk platform. You must also specify auth_token.

log_export_address	The address that log data is exported to, in the form:
	`<protocol><server>:<port><filepath>`
	where <protocol> can be either *http://* or *https://*.
	For example:
	`http://example.com:8080/logs/collector`
	If protocol is set to *https://*, you must also specify log_endpoint_ certificate.

Property	Description
auth_username	The username for HTTP Basic authentication. This is required when auth_type is "Basic".
auth_password	The password for HTTP Basic authentication. This is required when auth_type is "Basic".
auth_token	The HEC authorisation token required by the Splunk platform. This is required when auth-type is "Splunk".
log_tls_verify	(Optional) Boolean. If *true*, indicates that verification of the secure connection to the log collection endpoint is required.
log_endpoint_certificate	The certificate of the log export collection endpoint. This is required if the <protocol> in log_export_address is *https://*.
tag	(Optional) The customer-facing name for the resource. If this is not set, the tag is set to the UUID value for the resource automatically.
analytics_endpoint_id	The UUID of the resource.

The response body to a POST contains a JSON structure representing the properties of the created backup resource. For example:

```
{
    "transaction_tls_verify": true,
    "auth_type": "basic",
    "transaction_export_address": "example.com:7070",
    "log_export_address": "https://example.com:8080/logs/collector",
    "auth_token": "",
    "analytics_endpoint_id": "Analytics-Endpoint-VWX7-SMLI-SB51-M5QK",
    "transaction_endpoint_certificate": "LS0tLS1CRUdJTi...UgS0VZLS0tLS0=",
    "transaction_export_tls": true,
    "log_endpoint_certificate": "LS0tLS1CRUdJTiBDR...ZBVEUgS0VZLS0tLS0=",
    "tag": "JK-EP-Collection-01",
    "log_tls_verify": true,
    "auth_password": "password",
    "auth_username": "admin"}
}
```

See also the following analytics resources:

- "profile Resource" on page 197.
- "log_export Resource" on page 179.
- "search_endpoint Resource" on page 208.

controller_license Resource

A controller_license resource describes the license being used by the Services Director to which you send the REST request. The resource only supports the GET method and is typically used only for identifying the license currently in use by a particular Services Director.

The controller_license_key resource is used to install Services Director licenses, but Bandwidth Pack license must be installed using the bandwidth_pack_license_key resource.

A controller_license resource contains the following properties.

Property	Description	Actions
license_key	The full license key for this Services Director license.	Read Only
license_key_valid_from	The license start date.	Read Only
license_key_valid_until	The license end date.	Read Only

controller_license_key Resource

A controller_license_key resource describes the contents of a decoded Services Director license key.

A controller_license_key resource contains the following properties.

Property	Description	Actions
add_on_packs	The list of Add-On license keys associated with this Services Director license key. This property is applicable to Enterprise license keys only; for CSP license keys, this property is omitted.	Read Only
bandwidth	The dictionary of licensed SKUs and the bandwidth allowance supplied to each one by this license and associated Add-On and Bandwidth Packs. This property is applicable to Enterprise license keys only; for CSP license keys, this property is omitted.	Read Only
bandwidth_packs	The list of Bandwidth Packs associated with this Services Director license key. This property is applicable to Enterprise license keys only; for CSP license keys, this property is omitted.	Read Only
cluster_ bandwidth	The dictionary of licensed SKUs and the total bandwidth allowance supplied for each one by all valid license keys and associated Add-On and Bandwidth Packs. This property is applicable to Enterprise license keys only; for CSP license keys, this property is omitted.	Read Only
license_key	The license key string.	Read Only
license_type	The type of this license: Enterprise or Cloud Service Partner.	Read Only
serial	The serial number of this license	Read Only
status	Determines whether the key is currently in use by the Services Director: Active or Inactive.	Read Only
valid	Indicates whether this license is a valid license. That is, whether the license is in the correct format and the checksum is correct.	Read Only
valid_from	The license start date (Perpetual).	Read Only
valid_until	The license end date (Perpetual).	Read Only
bandwidth	The list of licensed SKUs and the bandwidth limit applicable to each one under this license. For Enterprise Licensing keys, it also lists dependent Bandwidth Packs.	Read Only
cpsh	Data model changes for a future release.	

Property	Description	Actions
cspm	Data model changes for a future release.	

Create a new controller_license_key resource by performing a POST request to the resource with the license key text (such as LK1-RSSC123456-3E30-3E8A-5-0123-4567-89AB) in the request body.

```
POST /api/tmcm/2.9/controller_license_key HTTP/1.1
Content-Type: text/plain
LK1-RSSC123456-3E30-3E8A-5-0123-4567-89AB
```

You must include a Content-Type header set to text/plain.

Unlike other REST API resources, the Services Director determines the name of the created resource and the content of each property based on the license key you use. If successful, the Services Director returns a standard POST response of HTTP/1.1 201 Created and the resource name in the Content-Location header.

The response body contains a JSON structure representing the properties of the created resource.

For example (Enterprise license):

```
{
    "add_on_packs": [],
    "bandwidth": [],
    "bandwidth_packs": [],
    "license_key": "LK1-XX_XXX_XXXX_XXXXXX_C_01:114-41A1-38BB-5-D4D5-6A97-
69BC",
    "license_type": "Enterprise",
    "serial": "123456",
    "status": "Active",
    "valid": true,
    "valid_from": "2013-01-01",
    "valid_until": "2013-12-31",
}
```

For example (CSP license):

```
{
    "csph": xxxxx,
    "cspm": xxxxx,
    "license_key": "LK1-XX_XXX_XXXX_XXXXXX_C_01:114-47B1-42DEF-5-D4D5-6A97-
69BC",
    "license_type": "Cloud Service Partner",
    "serial": "123",
    "status": "Active",
    "valid": true,
    "valid_from": "2016-01-01",
    "valid_until": "2016-11-30"
}
```

The request body in a POST request to the controller_license_key resource must contain exactly one valid Services Director license key. License keys you have installed via the REST API in a clustered Services Director deployment might need to be validated by a different cluster member and might not be immediately activated as a result.

If you attempt to reinstall an existing controller license key, the Services Director license state is unchanged. If you attempt to install a malformed or invalid license key, the Services Director responds with HTTP/1.1 400 Bad Request and an appropriate error message in the response body.

To view existing licenses, perform a GET request for the controller_license_key resource:

```
https://<sdhost>:<port>2.8/controller_license_key
```

The response to this request contains a JSON structure representing the list of installed licenses:

```
{
   "children" : [
      {
         "href" : "2.8/controller_license_key/XYZ123",
         "name" : "XYZ123"
      },
      {
         "href" : "2.8/controller_license_key/ABC123",
         "name" : "ABC123"
      }
   ]
}
```

To view the details for an individual controller license key, perform a GET request for the specific license resource:

```
https://<sdhost>:<port>2.8/controller_license_key/ABC123
```

The response to this request contains a JSON structure representing the license resource. The properties displayed are the decoded contents of the license key.

To delete a Services Director license, use the DELETE request method with the desired controller_license_key resource in the URI:

```
DELETE 2.8/controller_license_key/ABC123 HTTP/1.1
```

If you attempt to delete an enterprise license key used to provide licensed bandwidth for the current deployment, the request is rejected with a HTTP/1.1 400 Bad Request status code.

You cannot delete cloud service provider license keys, for metering reasons, until their valid_until date is at least 180 days in the past.

dashboard Resource

A dashboard resource provides a summary view of certain Services Director operations. This is compiled automatically by the Services Director, and is read-only.

Currently, only a summary of the metering health information for the Services Director is included in the dashboard resource.

The dashboard resource is located under the *2.8/* resource.

The dashboard resource will only accept GET methods.

A dashboard resource contains the following properties.

Property	Description	Actions
metering_health	A parent property for the remaining properties.	Read-Only
alert_level	A summary alert level for the Services Director's instances. This can be 1 (all instances report 1 = "OK") or 3 (one or more instances report 3 = "Warning").	Read-Only
alert_level_short_text	A summary text for the Services Director's instances . This can be either "OK" (all instances report this) or "Warning" (one or more instances report this).	Read-Only
alert_reason	Only present if alert_level is 3. When present, this is always "Possible accounting discrepancy".	Read-Only

The response body to a GET contains a JSON structure representing the properties of the dashboard resource. For example, if one or more instances report a metering discrepancy:

```
{
   "metering_health": {
      "alert_level": 3,
      "alert_level_short_text": "Warning"
      "alert_reason": "Possible accounting discrepancy"
   }
}
```

feature_pack Resource

A feature_pack resource describes a set of licensable features that you can apply to a Traffic Manager instance. A feature pack is defined relative to a SKU.

A feature pack is defined by a list of features excluded from a SKU (the list is empty). Therefore, the feature pack is always the same as a SKU or a strict subset of a SKU. When you deploy or modify a Traffic Manager instance, the feature pack controls which licensable features are allowed (but does not specify bandwidth limits).

The add_on_sku field of the feature_pack resource is used to specify a list of one or more Add-On SKUs to the feature pack. Similar to base SKUs (that is, the stm_sku field), these are paid for via an Add-On license for Enterprise licensed customers and via metered usage for CSP licensed customers.

When creating a feature_pack resource, you can specify the following properties.

Property	Description	Actions
add_on_skus	Optionally, a list of Add-On SKUs used by this feature pack. It might be an empty list if no Add-On SKUs are included.	Create
excluded	A space-separated list of features excluded from the parent SKU. The excluded property is an empty list (in which the feature_pack includes all features from the parent SKU). The feature names in the excluded list must be only those from the parent SKU features property.	Create
info	An optional descriptive string. You can change the info property by updating an existing feature_pack resource, but you cannot change the stm_sku and excluded properties.	Create/Update
status	The status of this resource: Active or Inactive. You can mark the resource as inactive by changing the status property to Inactive.	Update
stm_sku	The name of the parent SKU.	Create

The response body to a GET contains a JSON structure representing the properties of the feature_pack resource. For example:

```
{
    "add_on_skus": [],
    "excluded": "auto",
    "info": "",
    "status": "Inactive",
    "stm_sku": "STM-400"
}
```

host Resource

A host resource describes a Traffic Manager instance host you can use to deploy Traffic Manager instances. The host must have specific directories set up and an SSH user enabled for access from the Services Director servers. These requirements are of the Services Director user.

If you use a host to deploy Traffic Manager instances outside containers, you must name the resource using the FQDN of the Traffic Manager instance host to allow the licensing server to operate correctly, or an IP address where Universal Licensing is used.

If you create host resources solely for use with externally-deployed instances, the Services Director does not use the username and install_root properties. In this case, you do not need to set up passwordless SSH access if the host is solely to be used by externally-deployed instances. For more information about externally-deployed instances, see "Properties for an Externally-Deployed Instance" on page 109.

When creating a host resource, specify the following properties.

Property	Description	Actions
info	An optional descriptive string.	Create/Update
work_location	The absolute path of a temporary directory to which you can copy and create files.	Create
install_root	The absolute path of a directory under which Traffic Manager instances are created. Do not set the path to /var/lib/lxc/.	Create
retained_info_dir	This property is currently not in use.	Create/Update

Property	Description	Actions
username	The name of a user that is used by means of passwordless SSH to carry out actions on the host. For several purposes, the user should be root.	Create/Update
usage_info	This property is currently not in use.	Create/Update
size	Defines the size (in instances) of the host	Create/Update
cpu_cores	This property is currently not in use.	Create/Update
status	The status of this resource: Active or Inactive.	Update

The hostname is the name of the host resource, and this must be resolvable in the local network environment.

The Services Director does not perform checks on the validity of the work_location and install_root directories, and there is not a check that the directories are absolute directories. Once defined, you cannot change the work_location and installation_root directories.

You can mark the resource as inactive by changing the status property to Inactive.

The host REST API supports a single query parameter, status_check=true or status_check=false , on GET requests. The default is false; however status_check=true causes a check of the host for network connectivity, user validity, and the state of the install_root and work_location directory.

If status_check=true is set on a GET request for a host resource, an extra property is included in the response:

- status_check - A string that is empty (if there are no problems) or that contains a description of any problems found.

Ivanti recommends that you perform this check after creating a host resource.

instance Resource

An instance resource describes a Traffic Manager instance. Creating or altering an instance resource causes the Traffic Manager instance to be deployed, deleted, or altered.

A REST request to create or alter an instance returns promptly before the action is carried out (to avoid timeouts). You can then use a GET request to verify the status of the instance resource.

When you create an instance using the REST API, the request supports a URL parameter ?managed=[true/false]. This is used as follows:

- Include ?managed=true to indicate that you are creating a deployed instance. For example:

```
https://<sdhost>:<port>2.8/instance/stm1?managed=true
```

- Include ?managed=false to indicate that you are creating an externally-deployed instance. For example:

```
https://<sdhost>:<port>2.8/instance/stm1?managed=false
```

When creating and deploying an instance resource, you can specify the following properties.

Property	Description	Actions
owner	The owner resource for the instance. See "owner Resource" on page 187.	Create/Update
cluster_id	The optional name of a cluster resource to which the instance belongs. If you specify an entry for this property, it must refer to a cluster resource. You must also set the config_options (or config_ options_json) property to include admin_ui=yes and start_flipper=yes.	Create
stm_version	The name of the Traffic Managerversion resource for the instance. If you modify this property, the Services Director upgrades the Traffic Manager instance to the new version. You can change this property only if the instance status is Idle.	Create/Update
observed_version	When an instance resource is created, this is populated automatically from the version of the externally-deployed Traffic Manager. This also occurs during licensing and monitoring operations.	Read Only

Property	Description	Actions
host_name	The name of the Traffic Manager instance host on which you deploy the instance. This name must match the FQDN of the instance host that was created, or an IP address where Universal Licensing is used.	Create
container_name	The name of the LXC container for the Traffic Manager instance. If this is an empty string or set to none, the Traffic Manager is not run inside a container. If you specify a name, you must create an appropriate container configuration file of the form <containername>.conf in the install_root directory of the container host. For example, a container_name of stm1.example.com requires a container configuration file named stm1.example.com.conf. The container configuration file must set lxc.utsname to the container name for the licensing server to operate correctly.	Create
container_configuration	A space-separated string used to set up the default network gateway inside the LXC container. See "instance Resource" on page 160. Use this format: `"{\"gateway\":\"<ip_address>\"}"` For LXC deployments, this is the IP address raised on the bridge interface to which this container is connected. When you specify this property, do not specify the container_configuration_json property.	Create/Update
container_ configuration_json	A JSON data structure that is equivalent to the container_configuration property. See "Specifying Container Options" on page 75.	Create/Update

Property	Description	Actions
	When you specify this property, do not specify the container_configuration property.	
config_options	A space-separated string used to define configuration options. See "Specifying Configuration Options" on page 75. default - This option has no effect and is used to avoid an empty string. If this is option is used, no other options can be specified in the config_ options. admin_ui=yes/no - Start or bypass the Administration UI for the Traffic Manager instance (default: yes). You must set this to yes if you use the cluster_id property. maxfds=<number> - The maximum number of file descriptors. This setting must be consistent between all instances in a cluster. (See Notes, below). webcache!size=<number> - The size of RAM for the web cache (default: 0). This value can be specified in %, MB, GB by appending the corresponding unit symbol to the end of the value when not specifying a value in bytes. For example, 100%, 256MB, 1GB, and so on. This setting must be consistent between all instances in a cluster. (See Notes, below). java!enabled=yes/no - Start or bypass the Java server (default: no). This setting must be consistent between all instances in a cluster. (See Notes, below).	

Property	Description	Actions
	statd!rsync_enabled=yes/no - Synchronize historical activity data within a cluster. If this data is unwanted, disable this setting to save CPU and bandwidth (default: yes). This setting must be consistent between all instances in a cluster. (See Notes, below). snmp!community - The SNMP v2 community setting for this instance resource. For metering of externally-deployed instances, this must be set to the same value as the equivalent snmp!community property on the instance itself (default: "public"). num_children=<number> - The number of child processes (default: 1). start_flipper=yes/no - Start or bypass the flipper process (default: yes). You must set this to yes if you use the cluster_id property. port_offset=<number> - Offset control port values by a fixed amount. When network isolation is not provided by a container configuration, each Traffic Manager instance on a particular host should be allocated a unique port offset to avoid port clashes. The offset range is from 0 and 499. afm_deciders=<number> - The number of application firewall decider processes. If 0 is specified, the application firewall is not installed (default: 0). You cannot update this option after the instance has been deployed.	

Property	Description	Actions
	flipper!frontend_check_addrs=<host> - Check instance front-end connectivity with a specific host. When the Services Director deploys an instance, it checks connectivity to the default gateway of the instance host by sending ICMP requests to it. If the default gateway is protected by a firewall or blocks ICMP requests, instance deployment can fail. To disable deployment connectivity checks, use flipper!frontend_check_addrs="". This setting must be consistent between all instances in a cluster. (See Notes, below).	
config_options (continued)	flipper!monitor_interval=<number> - The interval, in milliseconds, between flipper monitoring actions. (default: 500 ms). For higher density Traffic Manager instance deployments, use a larger value such as 2000ms. This setting must be consistent between all instances in a cluster. (See Notes, below). Any change to the config_options settings will cause a restart of the instance. Some configuration options, if specified here, must be consistent between all Traffic Manager instances in a cluster: maxfds webcache!size java!enabled statd!rsync_enabled flipper!monitor_interval flipper!frontend_check_addrs	Create/Update

Property	Description	Actions
	If you set or update the value in one instance resource, the Services Director replicates this update automatically to the other instance resources. The instance will restart whenever these are changed, but other instances in the cluster must be restarted manually. Whenever the config_options property is set, all currently modified options must be specified again in the REST call. Any options that are not specified will lose their current value and be reset to their default value. When you specify this property, do not specify the config_options_json property.	
config_options_json	A JSON data structure that is equivalent to the config_options property. See "instance Resource" on page 160. When you specify this property, do not specify the config_options property.	Create/Update
cpu_usage	A string that describes which CPUs are used for this Traffic Manager instance. If used, you must either: specify a value in a form that is used by the taskset command. For example, "0,3,5-7". set this property to an empty string. This indicates that the host is not limited in its use of CPU cores (unless it is deployed within an LXC container). This is the default setting for the property if you do not specify a string. Any change to the cpu_usage settings will cause a restart of the instance.	Create/Update

Property	Description	Actions
stm_feature_pack	The name of the feature_pack resource associated with the Traffic Manager instance.	Create/Update
bandwidth	How much bandwidth the Traffic Manager instance is allowed (in Mbps).	Create/Update
license_name	The name of the license resource you want to use for this instance. When you modify this property, the Services Director updates the license on the Traffic Manager instance.	Create/Update
management_address	The hostname used to address the Traffic Manager instance. The hostname must be an FQDN, or an IP address where Universal Licensing is used. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). If you update this property, the host component of the rest_address , ui_address , and snmp_address properties is also updated. These values must be FQDNs, or IP address where Universal Licensing is used.	Create
status	The status of this resource: New - An instance that has been created by the REST API but has not yet been successfully deployed. Idle - An instance that has been deployed but is not currently running. Note that this is the only status from which you can delete the instance. Active - An instance that is currently running. Deleted - An instance that has been deleted. Starting - An instance that is waiting to start.	Update

Property	Description	Actions
	Failed to start - An instance that has failed to start. Stopping - An instance that is waiting to stop. Failed to stop - An instance that has failed to stop. Deleting - An instance that is waiting to be deleted. Failed to delete - An instance whose deletion failed. Failed to deploy - An instance that has failed to deploy. See "Understanding the State Transition Model for Instances" on page 176.	
creation_date	A string representation of the date and time of creation of this Traffic Managerinstance resource.	Read Only
admin_username	The primary admin username for the Traffic Manager instance. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request).	Create/Update
admin_password	The password (unencrypted) of the specified admin user.	Create/Update
service_username	The primary service username for the Traffic Manager instance. This property cannot be modified and is not applicable to externally-deployed instances.	Read Only
service_password	The password (unencrypted) of the specified service user. This property is not applicable to externally-deployed instances.	Create/Update
rest_address	The address (host or IP address plus port number) of the Traffic Manager instance configuration REST API. The rest_address property must match the instance hostname.	Create/Update

Property	Description	Actions
	You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). If you use a hostname instead of an IP address, you must use an FQDN.	
ui_address	The address (host or IP address plus port number) of the Traffic Manager instance Administration UI. This is blank if the instance does not have an active Administration UI. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). If you use a hostname instead of an IP address, you must use an FQDN.	Create/Update
snmp_address	The address (host or IP address plus port number) of the Traffic Manager instance SNMP responder. This enables you to set the SNMP address used for metering. You can modify this property only for an externally-deployed Traffic Manager instance (or in a database-only request). If you use a hostname instead of an IP address, you must use an FQDN.	Create/Update
licensed_date	A string representation of the date and time of the latest successful license validation (if any). This is blank if the Traffic Manager instance has never had a license validated.	Read Only
metrics_date	A string representation of the date and time of the latest successful metrics collection (if any). This is blank if the instance has never had metrics collected.	Read Only

Property	Description	Actions
metrics_throughput	The latest collected metrics figure, in bytes, for throughput. This is blank if the Traffic Manager instance has never had metrics collected.	Read Only
metrics_peak_ throughput	The latest collected metrics figure, in bytes per second, for peak throughput (for example, the highest figure in the previous hour). This is blank if the Traffic Manager instance has never had metrics collected.	Read Only
metrics_peak_RPS	The latest collected metrics figure for peak RPS (for example, the highest figure in the previous hour). This is blank if the Traffic Manager instance has never had metrics collected.	Read Only
metrics_peak_SSL_TPS	The latest collected metrics figure for peak SSL TPS (for example, the highest figure in the previous hour). This is blank if the Traffic Manager instance has never had metrics collected.	Read Only
pending_action	A structure that contains the name and href for the pending or blocked action. This is applicable only if a Traffic Manager instance is associated with a failed or blocked action (caused by deployment, start, stop, and so on).	Read Only
access_profile	Identifies an access_profile resource (see "access_profile Resource" on page 122). The authenticator and permission_group resources referenced by this resource are then applied to the Traffic Manager instance to set its user authentication. See "Applying User Authentication to a vTM" on page 124.	Create/Update
aws_instance_id	The instance ID for an AWS cloud-based instance.	Read Only
aws_vpc_id	The ID for the chosen Virtual Private Cloud for an AWS cloud-based instance.	Read Only

Property	Description	Actions
uuid	The unique identifier for the vTM instance. This property is only present when the vTM instance uses vTM Communications Channel.	Read Only
client_cert	The unique identifier required by the Services Director to authenticate the vTM instance. This property is only present when the vTM instance uses vTM Communications Channel.	Read Only

The response from a REST API GET request will include:

- both the container_config and container_config_json properties. Their values are equivalent.
- both the config_options and config_options_json properties. Their values are equivalent.

The instance REST API supports a single query parameter, status_check=true or status_check=false , on GET requests. The default is false; however, status_check=true causes an activity check for the instance. The Services Director carries out this check synchronously with the request handling, the duration of which can vary with load. If status_check=true is set on a GET request for an instance resource, an extra property is included in the response:

- status_check - A string that is empty (if there are no problems) or contains a description of any problems found.

The Services Director performs this check automatically after starting an instance resource. Any fault found is recorded as a blocking reason for the action.

If you make changes to feature_pack or bandwidth , the Services Director invokes changes to the licensed behavior of the deployed Traffic Manager instance.

Use the status property to track the state of a Traffic Manager instance.If you modify this property, the Services Director starts, stops, or deletes the Traffic Manager instance accordingly.

The Services Director processes state transitions separately from the REST request, using a separate thread of execution.

You can make a PUT request to change the status of a resource. The Services Director immediately returns an intermediate status, subsequently applies the change, and finally updates the status property.

You can poll for changes. The change has succeeded when you see the status property change to the expected value:

- If you deploy a Traffic Manager instance, this results in an immediate status of New. When the Services Director has successfully deployed the instance, status changes to Idle.
- You can start an instance when it has a status of Idle (or Failed to start or Failed to stop) by updating status to Active. The Services Director responds with an immediate status of Starting. When the instance has been successfully started, status is updated to Active.
- You can stop an instance when it has a status of Active (or Failed to start or Failed to stop) by updating status to Idle. The Services Director responds with an immediate status of Stopping. When the instance has been successfully stopped, its status is updated to Idle.
- You can uninstall an instance when it has a status of Idle by updating status to Deleted. The Services Director responds with an immediate status of Deleting. When the instance has been successfully uninstalled, its status is updated to Deleted. An instance in this state cannot be changed further.

  When the Traffic Manager instance in is one of the failed states (Failed to deploy, Failed to start, Failed to stop, or Failed to delete), you are not able to return it to an Idle state using defined state transitions. You must therefore change the status of the Traffic Manager instance to Idle manually. To do this, issue a PUT request to the REST API with a URL parameter of deploy=false and a property of status=Idle. The deploy setting ensures that this is a database-only change. (See "Using INSTALLROOT in This Guide" on page 15 for details)

  Once this is complete, you are then able to delete the Traffic Manager instance.
- You can upgrade an instance by changing the stm_version property, but only when the instance has a status of Idle. The Services Director responds with an immediate status of Upgrading. When the instance has been successfully upgraded, its status returns to Idle. The following procedure describes how to upgrade an instance in a cluster using the stm_version property.

Proxying a Traffic Manager REST API

A running Traffic Manager instance maintains its own REST API for configuration purposes. You can access this directly using the rest_address property along with the admin_username and admin_password properties. However, for convenience, the Services Director provides proxy access to the instance REST API through the URI of the instance resource.

ⓘ You can access the instance REST API only if the instance itself is active. Proxy requests are otherwise rejected with an informative error message.

You can make proxy requests by appending the following to the URI of the Traffic Managerinstance resource:

```
/tm/2.0/config/active
```

ⓘ You must not include the initial /api component when accessing a proxied instance REST API. This is necessary only if you access the API directly.

For example, the full URI to access the REST API of a running Traffic Manager instance called stm1 is:

```
https://<host>:<port>2.8/instance/stm1/tm/2.0/config/active
```

The Services Director interprets such longer URIs as proxy requests for the named instance. The above example lists the top level configuration objects for the Traffic Manager instance stm1. The exact URL depends on the URLs allowed by the Traffic Manager configuration REST API and are not documented here.

In this situation, the Traffic Manager configuration REST API is aware that it is serving a proxied request and automatically adjusts any href properties so you can use them directly through the proxy without requiring editing.

The Services Director does not interpret or amend the request or response bodies for proxy requests; however, it does provide appropriate authentication information based on the admin_username and admin_password properties. If the Traffic Manager REST API returns an error, it is returned unchanged to the client. The exception to this is an authentication error. These are reinterpreted as 500-series errors (with an informative error message), because it implies the Services Director has applied the wrong credentials.

Proxy requests allow additional content types or accept types , because the Services Director is unable to determine for itself which types might be acceptable to the Traffic Manager REST API.

The Services Director does not attempt to stream large requests or responses. Therefore, you should make such requests or responses directly to the appropriate Traffic Manager REST API.

Upgrading Instances in a Traffic Manager Cluster

1. Start with all instances in the cluster in Active status.

2. For one instance in the cluster:

   - Change the status of the instance to Idle.

   - Upgrade the instance by changing the stm_version property.

   - Change the instance status back to Active.

3. If the upgrade is successful, repeat Step 2 for every other instance in the cluster.

   Upgrading a Traffic Manager cluster where all instances are Idle is not possible. At least one instance must be made Active before the other Idle instances are upgraded. In addition, one of the upgraded instances must be made Active so that the remaining instance can be made Idle and upgraded. This action is required because cluster replication must occur as part of a successful upgrade for a cluster member.

Do not make any configuration changes to the Traffic Manager instances during this cluster upgrade procedure.

You can deploy a Traffic Manager instance in a HA scenario by creating a cluster resource and then specifying the name of this resource in the cluster_id property of each Traffic Manager instance you create. However, you must ensure the following:

- clustered instances must all share the same license and version number.

- clustered instances must have the admin_ui and start_flipper options set to Yes in config_options.

The Traffic Manager instance REST API supports a query parameter on PUT requests, deploy=true or deploy=false. The default is true; however, deploy=false causes the Services Director to apply changes to the inventory database, but no deployment changes are made. This supports testing and database reconciliation. If status is set with deploy=false , then that status is applied directly; no actions are carried out and no intermediate status is set. If a new instance resource is created with deploy=false , then the status is set to Idle on creation.

The Traffic Manager instance REST API supports a query parameter on PUT or POST requests when an instance is created, managed=true , or managed=false. The default is true. Creating an instance with managed=false (an externally-deployed instance) means that the instance is never managed by the Services Director in terms of deployment, starting, stopping, upgrading, reconfiguring, or deleting. The instance can make normal license requests and is metered. You can change its status, but this is stored and no attempt is made to alter the actual instance.

This option is for instances that you manually deploy, but for which you want to use the licensing and metering abilities of the Services Director. After you create an externally-deployed instance, any PUT or POST request is automatically considered to have the deploy=false parameter set. This means that you can change the database representation of the instance (and this can affect the features that are enabled through licensing and whether or not the instance is considered active for metering).

Because an externally-deployed instance is not deployed by the Services Director, you must set the snmp_address property (which cannot be set for a deployed instance) to enable metering. You can omit the host_name , license_name , stm_version , and cpu_usage properties, because these are not required for an Externally-deployed instance. If you do specify any of these properties, they must contain valid values. However, they are stored as empty strings in the inventory database.

You cannot update these properties with empty strings for an existing instance.

Any changes to the properties of an Externally-deployed instance affect only licensing or metering. For example, changes to the version or any configuration options have no effect.

You can modify admin_username, admin_password, management_address, rest_address, ui_address, and snmp_address for an externally-deployed Traffic Manager instance only (or in a database-only request).

Updating management_address for an externally-deployed Traffic Manager instance automatically updates the host or IP component of rest_address , ui_address , and snmp_address. These values must be FQDNs, or IP addresses where Universal Licensing is used.

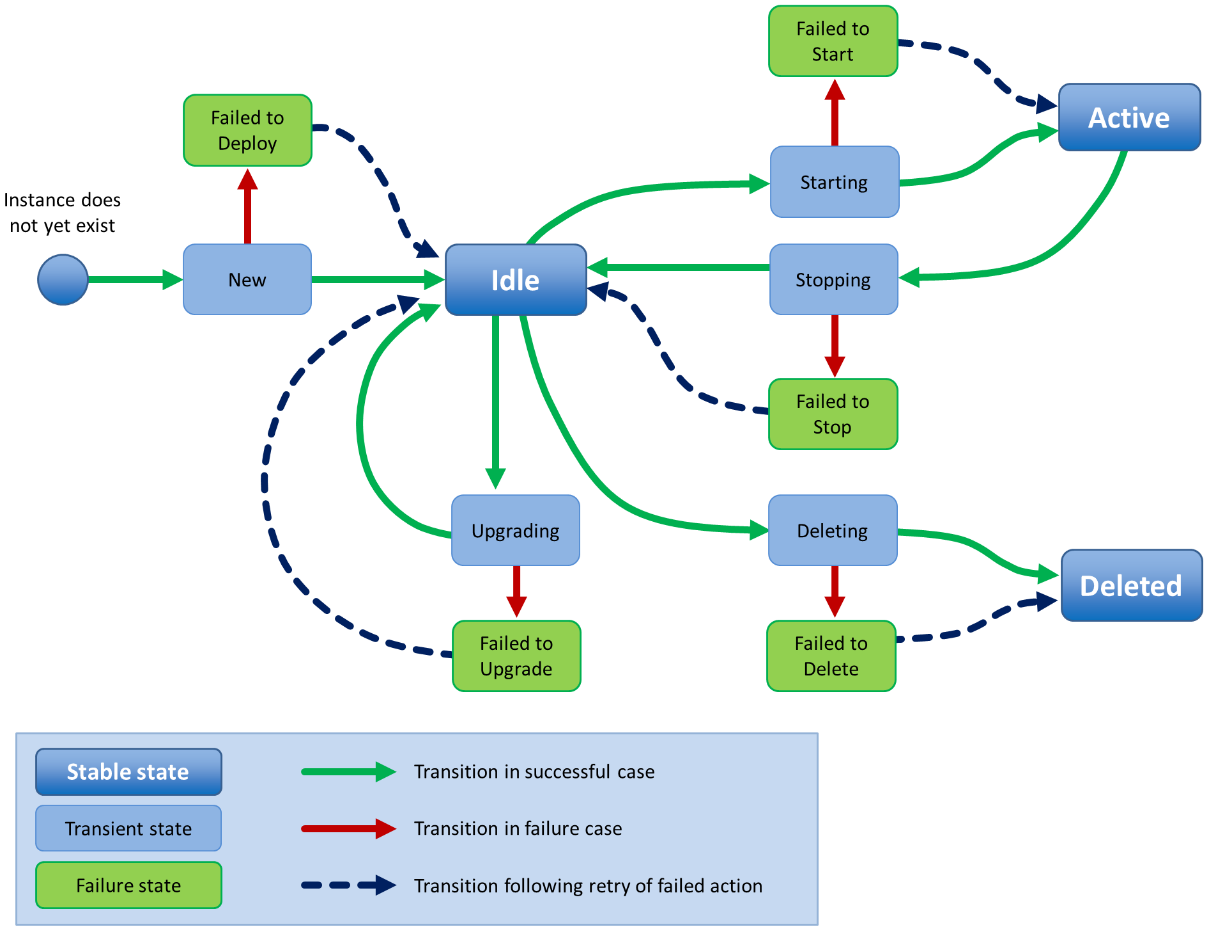
If a deployment, start, stop, or delete action (generated by a PUT request to create a new record or change the status property) fails, it can be traced through the pending_action property. You can analyze problems based on the action resource (see "Proxying a Traffic Manager REST API" on page 173).

After you fix any underlying problems, you can retry the action in one of two ways:

- You can change the status of the original action to Waiting. This causes the action to be re-queued and retried.
- You can change the status of the Traffic Manager instance to a new value; the system deletes the old action and queues an entirely new action based on the status you set.

Understanding the State Transition Model for Instances

The following diagram summarizes the stable states for an Instance resource, and the transient states that connect them.



license Resource

A license resource describes an FLA license file that you can use to deploy a Traffic Manager instance. Creating, altering, or deleting the license resource does not affect the existence of the actual license file. You are responsible for ensuring that the license file is available to all Services Director servers.

If you create license resources solely for use with externally-deployed instances, the Services Director does not require a corresponding license file to exist. For more information about externally-deployed instances, see "Properties for an Externally-Deployed Instance" on page 109.

Unlike all other resource types, the Accept header for a license resource allows a MIME type of either application/json or text/plain. Where text/plain is allowed but application/json is not, the returned data from a GET or PUT is the raw text of the FLA license file. Where no corresponding FLA license file exists, an error is returned instead.

When creating a license resource, you can specify the following properties.

Property	Description	Actions
info	An optional descriptive string.	Create/Update
status	The status of this resource: Active or Inactive.	Update

There are no required properties in this resource, but the request body must be a valid JSON object. The license filename is the resource name.

The response body to a GET contains a JSON structure representing the properties of the license resource. For example:

```
{
    "default": true,
    "generic_errors": null,
    "health_check_results": [],
    "health_check_status": "Not yet run",
    "info": "Universal license",
    "last_health_check_time": null,
    "status": "Active",
    "type": "universal"
}
```

You can change the info property by updating an existing license resource.

You can mark the resource as inactive by changing the status property to Inactive.

Reapplying a FLA License

If you want to re-license a Traffic Manager using its assigned FLA license, use the REST API. For example:

```
$ curl -v -k --basic -H "Content-Type: application/json" -H "Accept: application/json"
-u user:passwd https://x.x.x.x:8100/api/tmcm/2.9/instance/<instance_
name>?relicense=true -d '{ }'
```

log_export Resource

A log_export resource defines one (or more) log or system files that will be exported by a vTM that is configured for vTM analytics.

See the Pulse Secure Services Director Getting Started Guide for full details of vTM analytics.

The log_export resource is located under the *2.8/config/analytics/splunk* resource.

The log_export resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for backup.

Property	Description
files	A comma-separated list of log files. The files identified by this list will be sent by the vTM to its assigned collection endpoint. You can include wildcards if required. You can also include the **%ZEUSHOME%** variable if required, which represents the Services Director's home directory. For example: `%ZEUSHOME%/zxtm/log/stingrayafm/log-master/*`
appliance_only	(Optional) a Boolean setting that indicates log-export usage: *true*: the log_export is only supported on virtual appliance installations, and not on software installations. *false*: the log_export is supported on all installations. This is the default setting.

Property	Description
tag	(Optional) The customer-facing name for the resource. If this is not set, the tag is set to the UUID value for the resource automatically.
built_in	Boolean that indicates if the log_export resource was supplied with the Services Director product. You cannot change this property.
history	(Optional) Identifies how much historic activity should be exported for this log. Use one of the following settings: *None*. This indicates that only current activity logs will be exported. All historic activity logs will not be included. This is the default setting. *All*. This indicates that all current and historic activity logs will be exported.
log_export_id	The UUID of the resource.

The response body to a POST contains a JSON structure representing the properties of the created backup resource. For example:

```
{
    "files": ["%ZEUSHOME%/zxtm/log/stingrayafm/log-master/*",
       "%ZEUSHOME%/zxtm/log/stingrayafm/log/*"],
    "appliance_only": false,
    "tag": "Application Firewall",
    "built_in": true,
    "log_export_id": "Application Firewall",
    "history": "none"}
}
```

See also the following analytics resources:

- "profile Resource" on page 197.
- "collection_endpoint Resource" on page 149.
- "search_endpoint Resource" on page 208

manager Resource

A manager resource represents an instance of the Services Director and contains properties that apply specifically to that instance. You can use the resource properties, known as mode settings , to provide HA to a Services Director deployment. The name of a manager resource is its hostname.

You do not need to create a manager resource to use an installation of the Services Director. If a manager resource does not already exist, it is created with reasonable default mode settings when the Services Director starts.

A manager resource contains the following properties.

Property	Description	Actions
management	Determines whether or not the named Services Director is accessible through the REST API. This is set to enabled or disabled. To recover from the scenario where every Services Director in your deployment has its management property set to disabled, or has failed, Ivanti provides a script, INSTALLROOT/bin/toggle_ management , that is used to read and update the management property for the Services Director on which it is run.	Update
metering	Determines whether the named Services Director meters all Traffic Manager instances or none. This is set to none or all.	Update
licensing	Determines whether and how the named Services Director responds to license requests from Traffic Manager instances. You can set this to enabled, disabled, or enabledwithalerts. In enabledwithalerts mode, Services Director alert messages are sent to all configured alert email addresses when the rate at which license requests are being received exceeds a specified threshold setting.	Update
monitoring	Determines the monitoring mode for this Services Director. This mode is one of the following: all - This Services Director monitors all other Services Directors and all Traffic Manager instances, regardless of the mode setting on any other Services Director in the cluster.	Update

Property	Description	Actions
	shared - This Services Director monitors all other Services Directors, but together with other Services Directors in the same mode, each one monitors only a proportion of all active Traffic Manager instances. none - This Services Director does not perform any monitoring.	
external_ip	If the Services Director Service Endpoint Address is in a private network behind a NAT device, this string property is set to the external IP address for the Services Director Service Endpoint Address. Otherwise, this property is null.	Update

Deleting Manager Resources

You can delete a manager resources in the following ways:

- You can issue a DELETE request via the REST API to a manager resource that monitoring has marked as failed. This enables you to de-cluster unhealthy Services Directors. To do this, issue an HTTP DELETE request to:

  ```
  https://<SD-host:port>2.8/manager/<manager-ref>
  ```

- You can issue a forced DELETE request via the REST API to a manager resource that monitoring has not marked as failed. This enables you to de-cluster any Services Directors. To do this, issue an HTTP DELETE request with a force query parameter set:

  ```
  https://<SD-host:port>2.8/manager/<manager-ref>?force=true
  ```

monitoring Resource

The monitoring resource contains stored monitoring state data. This is a read-only resource and accepts only the GET request method.

The monitoring resource contains the following properties.

Property	Description	Actions
manager	Contains monitoring state data for all Services Director nodes. A request for this URI returns an array of JSON objects containing properties (see below) that describe the monitoring state for all Services Director nodes in your cluster. Append the name of a specific Services Director to the URI (for example, /monitoring/manager/sd1) to retrieve its properties alone.	Read Only
instance	Contains monitoring state data for all Traffic Manager instances. A request for this URI returns an array of JSON objects containing properties (see below) that describe the monitoring state for all Traffic Manager instances in your cluster. Append the name of a specific instance to the URI (for example, /monitoring/instance/tm1) to retrieve its properties alone.	Read Only
failures	Contains monitoring state data for all failed Services Director nodes and Traffic Manager instances. This property returns a JSON structure with two elements, managers and instances. Each of these is an array of objects, one for each currently failed Services Director or Traffic Manager instance.	Read Only

Each object returned from a request contains properties that describe the monitoring state for Services Directors or Traffic Manager instances in your cluster. These properties are listed below.

Property	Description	Actions
name	The name of the Services Director or Traffic Manager instance.	Read Only
monitor_date	The time stamp of the latest monitoring action.	Read Only
monitor_health	A string representation of the health of this Services Director or Traffic Manager instance.	Read Only
gone_down_date	The time stamp of when the Services Director or Traffic Manager instance was first detected to have failed. This property is present only for items in the failures array.	Read Only

Property	Description	Actions
notified_down_ date	The time stamp of when the Services Director or Traffic Manager instance was considered to have failed. This property is present only for items in the failures array.	Read Only
cpu_idle_percent	The time, in percent (%), that CPUs are idle on the Traffic Manager instance's host. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
mem_free_ percent	The percentage (%) of free memory available on the Traffic Manager instance's host. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
current_conn	The number of current connections for the Traffic Manager instance. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
total_bytes_in	The total number of connections the Traffic Manager instance is currently handling. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
total_bytes_out	The cumulative total of bytes received by the Traffic Manager instance from its clients.	Read Only

Property	Description	Actions
	This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	
throughput_in	The average throughput, in bytes per second, received by the Traffic Manager instance from its clients, calculated between the previous two monitoring events. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
throughput_out	The average throughput, in bytes per second, sent by the Traffic Manager instance to its clients, calculated between the previous two monitoring events. This property is present only for items in the instance array. It is available only for Traffic Manager instances with a status of Active and running a software version that supports performance monitoring.	Read Only
licensing_activity	A summary of licensing activity for the Traffic Manager instance. This includes: alert_level - The reported alert level. This can be 0, 1, 2, 3 or 4. Each setting corresponds to an alert_level_short_text. When alert_level is either 3 or 4, an alert_reason is also included. alert_level_short_text - A text summary. This can be either "N/A", "Licensed", "Pending", "Grace period" or "Expired". Each setting corresponds to an alert_level. alert_reason - This is only present when alert_level is either 3 or 4.	Read Only
metering_health	A summary of metering health for the Traffic Manager instance, which reflects possible billing discrepancies based on instance activity. This includes:	Read Only

Property	Description	Actions
	alert_level - The reported alert level. This can be 1 (for "OK") or 3 (for "Warning"). alert_level_short_text - A text summary. This can be either "OK" or "Warning". alert_reason - Only present if alert_level is 3. Can be either "Possible under-accounting" or "Possible uptime over-accounting". alert_resolution_text - Only present if alert_level is 3. A potential solution for the billing discrepancy. Can be "Enable REST or SNMP connectivity for this instance" (for under-accounting) or "Mark instance as deleted if no longer in use" (for over-accounting". See the Pulse Secure Services Director Getting Started Guide for a full description of metering warnings for billing discrepancies.	
rest_access	A REST access summary for the Traffic Manager instance. This includes: alert_level - The reported alert level. This can be 0, 1, 2, 3 or 4. Each setting corresponds to an alert_level_short_text. When alert_level is either 3 or 4, an alert_reason is also included. alert_level_short_text - A text summary. This can be either "N/A", "OK", "Pending", "Unhealthy" or "Failed". Each setting corresponds to an alert_level. alert_reason - This is only present when alert_level is either 3 or 4.	Read Only
id_health	A summary of instance health for the Traffic Manager instance. This includes: alert_level - The reported alert level. This can be 0, 1, 2, 3 or 4. Each setting corresponds to an alert_level_short_text. When alert_level is either 3 or 4, an alert_reason is also included.	Read Only

Property	Description	Actions
	alert_level_short_text - A text summary. This can be either "N/A", "OK", "Pending", "Unverified" or "Unavailable". Each setting corresponds to an alert_level. alert_reason - This is only present when alert_level is either 3 or 4. See the Pulse Secure Services Director Getting Started Guide for a full description of instance health.	
traffic_health	A summary of traffic health for the Traffic Manager instance. This includes: errors - a list of errors for the instance. failed_nodes - a list of failed instance nodes. license - the license name for the instance. For example: Universal_v4. tip_errors - a list of tip errors for the instance. error_level - the reported error level. For example: 1 virtual_servers - a list of virtual servers for the instance. See the Pulse Secure Services Director Getting Started Guide for a full description of traffic health.	Read Only
em_licensing_ compliant	Boolean. Indicates whether the Traffic Manager instance supports Enterprise Management features.	Read Only

owner Resource

There are several Services Director resources that require an owner. This property identifies a person or organisation that is associated with a resource, and optionally includes contact information.

A single owner entry might be used for all resources owned by a Enterprise customer. Alternatively, an owner entry might be created to identify individual customers for resources supplied by a Cloud Service Provider.

The following resources require an owner:

- An externally-deployed vTM Traffic Manager instance. See "Registering Externally-Deployed Traffic Managers" on page 109.
- A vTM Traffic Manager instance that is deployed using an instance host. See "Using an Instance Host with a Services Director VA" on page 82.
- A vTM Cluster. See "cluster Resource" on page 146.

The owner resource has the following properties.

Property	Description	Actions
clusters	A list of clusters that have this owner.	Read Only
email_address	An optional e-mail address for the owner.	Create/Update
instances	A list of instances that have this owner.	Read Only
owner_id	The ID of the owner.	Read Only
secret	An optional password for the owner.	Create/Update
tag	(Optional) If unset, this is set to the ID of the owner. The name of the owner. This must be unique amongst IDs and tags of owner resources, except when empty or set to its own ID.	Create/Update
timezone	The timezone occupied by the owner.	Create/Update

The response body to a GET contains a JSON structure representing the properties of the owner resource. For example:

```
{
    "clusters": [],
    "email_address": "",
    "instances": [],
    "owner_id": "Owner-0003-F9E3-UQW5-QONU",
    "secret": "",
    "tag": "Bernie",
    "timezone": "Europe/London"
}
```

permission_group Resource

There are two different permission_group API resources:

- A permission_group resource for vTM user authentication, refer to "permission_group (vTM User Authentication)" below.
- A permission_group resource for Services Director user authentication, refer to "permission_group (Services Director User Authentication)" on page 196.

permission_group (vTM User Authentication)

A permission_group resource for vTM user authentication defines what a user in the group can do, by combining permission names with access levels. This information is applied to a Virtual Traffic Manager (vTM) when the vTM’s user authentication is set from the Services Director.

There are four default permission groups:

- admin - this group has full access to all vTM pages.
- Demo - this group has full access, except to user management / system.
- Monitoring - this group has access only to config summary / monitoring pages.
- Guest - this group has read-only access.

You can update these permission groups, or create additional permission groups.

An access_profile resource (see "access_profile Resource" on page 122) combines an authenticator resource (see "authenticator Resource" on page 129) with one or more permission_group resources for the purposes of user authentication.

The permission_group resource for vTM user authentication is located under the *2.8/config/authentication* resource, and will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE. This can only succeed if the permission_group resource is not in use by an access_profile resource (see "access_profile Resource" on page 122).

A permission_group resource for vTM user authentication contains the following properties.

Property	Description
tag	(Optional) If unset, this is set to the ID of the permission group. The name of the permission group. This must be unique amongst IDs and tags of permission_group resources, except when empty or set to its own ID.
description	(Optional) A description for the permission group.
timeout	(Optional) The timeout period (in minutes) for a connection. Must be an integer between 0 and 4294967295. Default is 30.
permissions	A list of paired objects. Each pair is a permission and its access level for users of the permission_group. The pairs are as follows: access_level: a string, set to 'none', 'ro' (read-only) or 'full'. name: the name of a permission. For a full list of permissions, see "Permissions for permission_group Resources" on the next page.

Create a permission_group resource using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -D
headers.txt -u admin:adminPassword -X POST -d '{"description":"VServer admin",
"permissions":[{"access_level":"full","name":"Virtual_Servers"},{"access_level":
"ro","name": "Pools"},{"access_level": "ro","name":"Traffic_IP_Groups"}, {"access_
level":"ro","name":"Monitors"}],"tag":"VSAdmin","timeout":30}'
https://servicesdirector1.demo.com:8100/api/tmcm/2.9/config/authentication/permission_
group/
```

The response body to a POST contains the properties of the created permission_group resource. For example:

```
{"description":"VServer admin","permission_group_id":"Permission-Group-0XZS-8EIJ-420T-
T59D","permissions":[{"access_level":"ro","name":"Pools"},{"access_level":"full",
"name":"Virtual_Servers"},{"access_level":"ro","name":"Traffic_IP_Groups"},
{"access_level":"ro","name":"Monitors"}],"tag":"VSAdmin","timeout":30}
```

Permissions for permission_group Resources

The permission_group resource for vTM user authentication can reference any permission that is supported by the Virtual Traffic Manager (vTM). Each such permission can be used as the name in a permissions pair. The list of supported permissions changes between vTM releases, and so each specified name is not verified by the Services Director; the vTM performs this function when the permission group is applied to the vTM. Any name that is not recognised when received by the vTM is ignored.

A current list of permissions is shown below:

```
all
Access_Management
Access_Management!AuthenticationMethods
Access_Management!AuthenticationMethods!Edit
Access_Management!Groups
Access_Management!Groups!Edit
Access_Management!LocalUsers
Access_Management!LocalUsers!Edit
Access_Management!LocalUsers!EditOtherUsers
Access_Management!LocalUsers!PasswordPolicy
Access_Management!Suspended_Users
AFM
AFM!Administration
Alerting
Alerting!Actions
Alerting!Actions!Edit
Alerting!Event_Types
Alerting!Event_Types!Edit
Appliance_Console
Aptimizer
Aptimizer!Aptimizer_Profiles
Aptimizer!Aptimizer_Profiles!Edit
Aptimizer!URL Sets
```

```
Aptimizer!URL Sets!Edit
Audit_Log
Audit_Log!Audit_Archive
Authenticators
Authenticators!Edit
Backup
Backup!Compare
Backup!Edit
Backup!Partial
Bandwidth
Bandwidth!Edit
Bandwidth!Edit!CopyClass
Catalog
Cloud_Credentials
Cloud_Credentials!Edit
Config_Summary
Connections
Connections!Details
Custom
DateTime
Diagnose
Diagnose!Replicate
DNS_Server
DNS_Server!Zone_Files
DNS_Server!Zones
DNS_Server!Zones!Edit
Draining
Event_Log
Event_Log!Clear
Event_Log!Event_Archive
Extra_Files
Extra_Files!Action_Programs
Extra_Files!ExternProgMonitors
Extra_Files!Miscellaneous_Files
Fault_Tolerance
Fault_Tolerance!BGP_Neighbors
Fault_Tolerance!BGP_Neighbors!Edit
GLB_Services
GLB_Services!Edit
GLB_Services!Edit!DNS_Settings
GLB_Services!Edit!DNSSEC
```

```
GLB_Services!Edit!Load_Balancing

GLB_Services!Edit!Locations

GLB_Services!Edit!Request_Logging

GLB_Services!Edit!Rules

Global_Settings

Global_Settings!Restore_Defaults

Help

Java

Java!Edit

Kerberos

Kerberos!Kerberos_Keytabs

Kerberos!Kerberos_Principals

Kerberos!Kerberos_Principals!Edit

Kerberos!krb5confs

License_Keys

License_Keys!Install_New

License_Keys!Register

License_Keys!Remove

Locations

Locations!Edit

Log_Viewer

Log_Viewer!View

MainIndex

Map

Monitoring

Monitoring!Edit

Monitors

Monitors!Edit

Monitors!Edit!CopyMonitor

Networking

Networking!NAT

Persistence

Persistence!Edit

Persistence!Edit!CopyClass

Pools

Pools!Edit

Pools!Edit!Autoscaling

Pools!Edit!Bandwidth

Pools!Edit!Connection_Management

Pools!Edit!DNSAutoscaling

Pools!Edit!Kerberos_Protocol_Transition
```

```
Pools!Edit!Load_Balancing

Pools!Edit!Monitors

Pools!Edit!Persistence

Pools!Edit!SSL

Rate

Rate!Edit

Reboot

Request_Logs

Restart

Rollback

Routing

Rules

Rules!Edit

Rules!Edit!CheckSyntax

Rules!Edit!SaveAs

Rules!GEdit

Rules!GEdit!AddAction

Rules!GEdit!AddCondition

Rules!GEdit!Convert

Security

Service_Protection

Service_Protection!Edit

Service_Protection!Edit!CopyClass

Shutdown

SLM

SLM!Edit

SLM!Edit!CopyClass

SNMP

SOAP_API

SSL

SSL!CAs

SSL!CAs!Edit

SSL!CAs!Import

SSL!Client_Certs

SSL!Client_Certs!Edit

SSL!Client_Certs!Edit!Chain

SSL!Client_Certs!Edit!CopyCert

SSL!Client_Certs!Edit!Sign

SSL!Client_Certs!Import

SSL!Client_Certs!New

SSL!DNSSEC_Keys
```

```
SSL!SSL_Certs
SSL!SSL_Certs!Edit
SSL!SSL_Certs!Edit!Chain
SSL!SSL_Certs!Edit!CopyCert
SSL!SSL_Certs!Edit!Sign
SSL!SSL_Certs!Import
SSL!SSL_Certs!New
Statd
Steelhead
Support
Support!TSR
Support_Files
Sysctl
Traffic_IP_Groups
Traffic_IP_Groups!Edit
Traffic_IP_Groups!Networking
Traffic_Managers
Traffic_Managers!AddRemove
Traffic_Managers!Upgrade
Virtual_Servers
Virtual_Servers!Edit
Virtual_Servers!Edit!Aptimizer_Settings
Virtual_Servers!Edit!Classes
Virtual_Servers!Edit!Connection_Management
Virtual_Servers!Edit!Content_Caching
Virtual_Servers!Edit!Content_Compression
Virtual_Servers!Edit!DNS_Server
Virtual_Servers!Edit!GLB_Services
Virtual_Servers!Edit!Kerberos_Protocol_Transition
Virtual_Servers!Edit!Request_Logging
Virtual_Servers!Edit!Request_Tracing
Virtual_Servers!Edit!Rules
Virtual_Servers!Edit!Rules!EnableDisable
Virtual_Servers!Edit!Rules!Move
Virtual_Servers!Edit!Rules!OnceEvery
Virtual_Servers!Edit!Rules!Remove
Virtual_Servers!Edit!SSL_Decryption
Web_Cache
Web_Cache!Clear
Wizard
Wizard!AptimizeService
```

```
Wizard!Backup
Wizard!ClusterJoin
Wizard!DisableNode
Wizard!DrainNode
Wizard!EnableRule
Wizard!FreeDiskSpace
Wizard!NewService
Wizard!ReactivateNode
Wizard!RemoveNode
Wizard!Restore
Wizard!SSLDecryptService
```

permission_group (Services Director User Authentication)

A permission_group resource for Services Director user authentication defines what a Services Director user in the group can do.

Typically, there is a single permission group for Services Director user authentication with access to all permissions. The name of this permission group must match the group returned by the authenticator.

The permission_group resource for Services Director user authentication is located under the */api/sd/1.1/authentication/* resource, and will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

A permission_group resource for Services Director user authentication contains the following properties.

Property	Description
tag	(Optional) If unset, this is set to the ID of the permission group. The name of the permission group. This must be unique amongst IDs and tags of permission_group resources for Services Director user authentication, except when empty or set to its own ID.

Property	Description
description	(Optional) A description for the permission group.

Create a permission_group resource using the REST API. For example:

```
$ curl -k --basic -H "Content-Type: application/json" -H "Accept: application/json" -D
headers.txt -u admin:adminPassword -X POST -d '{"description":"administration group
example","tag":"admin_grp"}'
https://servicesdirector1.demo.com:8100/api/sd/1.1/authentication/permission_group/
```

The response body to a POST contains the properties of the created permission_group resource. For example:

```
{"permission_group_id": "Permission-Group-9XTL-5BXH-I8CI-D2FB", "tag": "admin_grp",
"description": "administration group example"}
```

profile Resource

A profile resource is an analytics profile that can be applied to a vTM cluster to enable vTM analytics.

See the Pulse Secure Services Director Getting Started Guide for full details of vTM analytics.

The profile resource is located under the *2.8/config/analytics/splunk/* resource.

The profile resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for backup.

Property	Description
enable_transaction_export	If *true*, the analytics profile will record that transaction data is enabled. This ensures that any vTM configured using this profile will transmit transaction data (in addition to its assigned logs) to its assigned collection endpoint.
vtm_logs_to_export	A comma-separated list of identifiers for log-export resources. By default, this list can include the following log-export resources: Audit Log Application Firewall Process Monitor Admin Server Access System - syslog Event Log Routing Software Data Plane Acceleration System - authentication log For example: `["Audit Log","Event Log","System - authentication log"]` For details of these logs, see the Pulse Secure Virtual Traffic Manager: User's Guide.
tag	(Optional) The customer-facing name for the resource. If this is not set, the tag is set to the UUID value for the resource automatically.
analytics_profile_id	The UUID for the resource.

The response body to a POST contains a JSON structure representing the properties of the created backup resource. For example:

```
{
    "enable_transaction_export": true,
    "tag": "Audit_and_Event",
    "vtm_logs_to_export": ["Audit Log", "Event Log"],
    "analytics_profile_id": "Analytics-Profile-GRHL-E0QO-DCOK-TXAV"}
}
```

See also the following analytics resources:

- "log_export Resource" on page 179.
- "collection_endpoint Resource" on page 149.
- "search_endpoint Resource" on page 208

registration Resource

A registration resource is created automatically by the Services Director in response to a Traffic Manager instance sending a self-registration request. See the Pulse Secure Services Director Getting Started Guide for full details of self-registration.

The registration resource is located under the *2.8/* resource.

The registration resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE. This can only succeed if the permission_group resource is not in use by an access_ profile resource (see "access_profile Resource" on page 122).

You cannot use the POST method to create a registration resource. The use of POST for an existing registration will be ignored, unless the details of the registration request have changed. If the registration token matches (implying that the vTM has received at least one response from the Services Director) then the user credentials stored by the Services Director are not updated.

The 2.8/settings collection includes a registration end-point resource, refer to "settings Resources" on page 210.

The following table lists properties for registrations.

Property	Description
instance_uuid	The UUID of the instance that made the registration request.
registration_time	The Services Director local time and date of creation of this registration record.
pending_time	The Services Director local time and date of when this record was set to Pending. This is used to calculate when a registration should be automatically blacklisted (see blacklist_timeout in the "settings Resources" on page 210). Blacklisting can be overridden by user setting this record to Pending once more.
status	The state of the registration request – Pending, Accepted, Blacklisted, Declined.
instance_version	The version number of the instance making the registration request, in the format "<major>.<minor>r<revision>".
cluster_identifier	Cluster ID supplied by the instance making the registration request. Can be empty.
management_ip	The IP address of the instance’s management interface.
hostname	The IPv4 address/hostname at which the vTM can be found.
rest_address	The IPv4 address/hostname and port at which the vTM can be contacted by REST.
admin_address	The IPv4 address/hostname and port at which the vTM Admin GUI can be reached.
snmp_address	The IPv4 address/hostname and port at which the vTM can be contacted via SNMP.
snmp_community	The community string for the instance’s SNMP server.
email_address	(Optional) Email address of the person (typically the instance’s Administrator) who is seeking acceptance of this registration.
registration_message	Message from the person (typically the instance’s Administrator) who is seeking acceptance of this registration. This is seen by the Services Director Administrator.

Property	Description
declined_reason	(Optional) Only relevant when a registration transitions to ‘Declined’. Human-readable string describing the reason for declination of this registration.
feature_pack	Required when a registration transitions to 'Accepted'. Must be a valid feature pack resource for the instance.
bandwidth	Required when a registration transitions to 'Accepted'. The bandwidth for the instance.
owner	Required when a registration transitions to 'Accepted'. The owner resource for the instance. See "owner Resource" on page 187.
valid_owner	Indicates whether the owner is valid.
instance_name	Required when a registration transitions to 'Accepted'. The tag or ID of the instance.
access_profile	(Optional) Only used when a registration transitions to 'Accepted'. The user authentication defined by the access profile is applied to the instance. Existing authenticators and permission groups may be overwritten, but none will be deleted. All members of a cluster are affected. See "access_profile Resource" on page 122.
analytics_profile	(Optional) Only used when a registration transitions to 'Accepted'. The settings defined by the analytics profile are applied to the instance. Existing resources may be overwritten, but none will be deleted. All members of a cluster are affected. See "profile Resource" on page 197.
aws_instance_id	The instance ID for an AWS cloud-based instance. Read Only.
aws_vpc_id	The ID for the chosen Virtual Private Cloud for an AWS cloud-based instance. Read Only.
client_cert	The unique identifier required by the Services Director to authenticate the vTM instance. This property is only present when the vTM instance uses vTM Communications Channel.

The response body to a POST contains a JSON structure representing the properties of the created registration resource.

For example:

```
{
    "access_profile": "",
    "admin_address": "10.8.2.10:9090",
    "analytic_profile": "",
    "aws_instance_id": "i-7e23cef1",
    "aws_vpc_id": "vpc-ec1da988",
    "cluster_identifier": "",
    "email_address": "",
    "hostname": "10.8.2.10",
    "instance_version": "11.1b3",
    "management_ip": "10.8.2.10",
    "owner": "Owner-X287-ZB46-SCYV-HEZT",
    "pending_time": "2016-09-28 14:57:23",
    "registration_message": "",
    "registration_time": "2016-09-28 14:57:23",
    "rest_address": "10.8.2.10:9070",
    "snmp_address": "10.8.2.10:161",
    "snmp_community": "public",
    "status": "Accepted",
    "uuid": "128c4184-b967-3401-8f35-0a0947d1967b",
    "valid_owner": true
}
```

registration_policy Resource

This resource describes an auto-accept policy. This is used for automatic self-registration of Traffic Managers.

The registration_policy resource has the following properties.

Property	Description	Actions
bandwidth	The bandwidth that will be applied to instances that are self-registered using this policy.	Create/Update
feature_pack	The feature pack that will be applied to instances that are self-registered using this policy.	Create/Update

Property	Description	Actions
instance_version_range_high	The highest version number that is accepted for instances that are self-registered using this policy.	Create/Update
instance_version_range_low	The lowest version number that is accepted for instances that are self-registered using this policy.	Create/Update
management_ip_subnet	The management subnet to which instances must belong for them to be accepted for self-registeration using this policy.	Create/Update
policy_id	The ID of the registration policy.	Read Only
access_profile	(Optional) The Access Profile that will be applied to instances that are self-registered using this policy. All cluster members are affected by his change. See "access_profile Resource" on page 122.	Create/Update
analytics_profile	(Optional) The Analytics Profile that will be applied to instances that are self-registered using this policy. All cluster members are affected by his change. See "profile Resource" on page 197.	Create/Update
tag	(Optional) If unset, this is set to the policy ID. The name of the registration policy. This must be unique amongst IDs and tags of registration_policy resources, except when empty or set to its own ID.	Create/Update

The response body to a GET contains a JSON structure representing the properties of the registration_policy resource. For example:

```
{
    "bandwidth": 1000,
    "feature_pack": "STM-400-FP",
    "instance_version_range_high": "11.0",
    "instance_version_range_low": "11.0",
    "management_ip_subnet": "10.8.0.0/16",
    "policy_id": "Policy-T1HN-946O-EO5T-25Z8",
    "access_profile": "",
    "analytic_profile": "",
    "tag": "AWS-Accept"
}
```

resource_pack_license_key Resource

A resource_pack_license_key resource describes the contents of a decoded Services Director Resource license key.

The resource_pack_license_key resource is located under the */api/tmcm/2.9/* resource.

A resource_pack_license_key resource contains the following properties.

Property	Description	Actions
valid_from	The license start date (Perpetual).	Read Only
valid_until	The license end date (Perpetual).	Read Only
stm_sku	A list of skus resource supported by this key.	Read Only
timestamp	A timestamp encoded in this license.	Read Only
license_key	The license key string.	Read Only
controller_license	The name of the optional associated Services Director controller_license_key resource.	Read Only
controller_license_serial	The serial number of the optional associated Services Director controller_license_key resource.	Read Only
resource_amount	The resource limit for this license.	Read Only
serial	The serial number of this license.	Read Only

Property	Description	Actions
valid	Describes whether the key was successfully validated (with a currently active controller license key): true or false.	Read Only

Create a new resource_pack_license_key resource by making a POST request to the resource with the license key text in the request body.

```
POST /api/tmcm/2.9/resource_pack_license_key HTTP/1.1
Content-Type: text/plain
LK1-BR_ADC_ADD_EM5N_S_01:5:897189:2018016872516-0000-449E-5-7640-31FB-5970
```

You must include a Content-Type header set to text/plain.

schedule Resource

A schedule resource is a definition of when a cluster backup will be created. This includes general frequency (hourly, daily, weekly, monthly, and instant backups) and information to specify an exact backup time. Any cluster backup will be performed for any resource that is associated with a schedule resource.

See the Pulse Secure Services Director Getting Started Guide for full details of cluster backup and restore.

The schedule resource is located under the *2.8/config/backup* resource.

The schedule resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for schedule.

Property	Description
backup_time	The time (hh:mm) at which the backup will be taken. This is not needed for daily and user-defined frequencies.
frequency	The frequency of the schedule. This can be: hourly - this schedule will be performed once every hour. By default, this is on the hour. You can also choose an offset to schedule at 15, 30 and 45 minutes past the hour. The default is represented by 0. daily - this schedule will be performed once per day. By default, this is at midnight (00:00). Alternatively, you choose to schedule at a specific backup_time. No offset is supported. weekly - this schedule will be performed once per week. By default, this is on Monday at midnight. Alternatively, you can choose to schedule it on the required offset day (Monday to Sunday are numbered 0 to 6) at a different backup_time. monthly - this schedule will be performed once per month. By default, this is on the first at midnight. Alternatively, you can choose to schedule it on the required offset day (typically 1-28) at a different backup_time. userdefined - this schedule will be performed at a custom frequency. Instead of specifying an exact time, the first backup will be taken immediately when the schedule is applied to a cluster resource, and then at a defined offset frequency, expressed in minutes.
info	A text description for the schedule resource.
offset	A difference between the default start time and the actual start time of the backup. Settings for this depend on the schedule's frequency.
schedule_id	The UUID of the schedule.
tag	The user-facing (and reusable) schedule resource name. This field can be set by the user at any time.

The response body to a POST for an hourly schedule resource contains a JSON structure representing the properties of the resource. The offset represents the number of minutes past the hour (0, 15, 30, and 45) at which the backup will be taken. For example:

```
{
    "backup_time": "N/A",
    "frequency": "hourly",
    "info": "Every hour at 15 mins past",
    "offset": 15,
    "schedule_id": "BackupSchedule-QWXN-VU4Z-QHMH-7HS0",
    "tag": "Quarter past the hour"
}
```

The response body to a POST for a daily schedule resource contains a JSON structure representing the properties of the resource. The offset is a default value (100) that is unused for this schedule. For example:

```
{
    "backup_time": "02:00",
    "frequency": "daily",
    "info": "Backup daily the small hours",
    "offset": 100,
    "schedule_id": "BackupSchedule-SM57-DZJH-O7FB-M86C",
    "tag": "Daily at 2am"
}
```

The response body to a POST for a weekly schedule resource contains a JSON structure representing the properties of the resource. The offset represents a day, where Monday to Sunday are numbered 0 to 6. For example:

```
{
    "backup_time": "03:00",
    "frequency": "weekly",
    "info": "For medium-churn systems",
    "offset": 1,
    "schedule_id": "BackupSchedule-50DF-FDNA-SVV2-U222",
    "tag": "Tuesday at 3am"
}
```

The response body to a POST for a monthly schedule resource contains a JSON structure representing the properties of the resource. The offset represents a day number, typically 1 to 28. For example:

```
{
    "backup_time": "23:30",
    "frequency": "monthly",
    "info": "For very low churn setups",
    "offset": 1,
    "schedule_id": "BackupSchedule-BP3X-UPFA-CBFS-GXWZ",
    "tag": "First of the month, 11.30pm"
}
```

The response body to a POST for a user-defined schedule resource contains a JSON structure representing the properties of the resource. The offset represents the number of minutes between scheduled backups. For example:

```
{
    "backup_time": "N/A",
    "frequency": "userdefined",
    "info": "For high churn systems",
    "offset": 120,
    "schedule_id": "BackupSchedule-FJO6-T9M3-72D4-1D9E",
    "tag": "Frequent periodic"
}
```

See "cluster Resource" on page 146 for details of a cluster that can be backed up.

See "backup Resource" on page 140 for details of backups taken for a cluster.

search_endpoint Resource

A search_endpoint resource on the Services Director records the search endpoint from your analytics system.

The Services Director uses two kinds of endpoints for vTM analytics:

- Collection endpoints, described in "collection_endpoint Resource" on page 149.

- Search endpoints, described in this section.

See the Pulse Secure Services Director Getting Started Guide for full details of vTM analytics.

The search_endpoint resource is located under the *2.8/config/analytics/splunk* resource.

The search_endpoint resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The following table lists properties for search_endpoint.

Property	Description
search_endpoint_address	The address of the search endpoint on the Splunk platform, in the form <server>:<port>. For example: `example.com:2020`
use_tls	Boolean. Indicates whether queries require secure transmission. If true, you must also specify both search_endpoint_certificate and specify verify_tls.
verify_tls	Boolean. If *true*, indicates whether queries require verification. This can only be specified if use_tls is true.
transaction_index	This is the index used for transactions on the Splunk platform. For example, "zxtm_transactions"
logs_index	This is the index used for logs on the Splunk platform. For example, "zxtm_logs"
search_endpoint_certificate	The certificate of the transaction export collection endpoint. This is required if transaction_export_tls is *true*.
auth_username	The username for HTTP Basic authentication.

Property	Description
auth_password	The password for HTTP Basic authentication.
tag	(Optional) The customer-facing name for the resource. If this is not set, the tag is set to the UUID value for the resource automatically.
search_endpoint_id	The UUID of the resource.

The response body to a POST contains a JSON structure representing the properties of the created backup resource. For example:

```
{
    "search_endpoint_address": "example.com:2020"
    "use_tls": true,
    "verify_tls": true,
    "transaction_index": "zxtm_transactions",
    "logs_index": "zxtm_logs",
    "search_endpoint_certificate": "LS0tLS1CRUdJTiBDRVJUS…VEUgS0VZLS0tLS0K",
    "auth_password": "password",
    "auth_username": "admin",
    "tag": "JK-EP-Search-01",
    "search_endpoint_id": "Search-Endpoint-8PC9-T1V6-BH8D-PDZ9",
}
```

See also the following analytics resources:

- "profile Resource" on page 197.
- "log_export Resource" on page 179.
- "collection_endpoint Resource" on page 149.

settings Resources

There is a collection of settings end-point resources that control certain aspects of Services Director operation.

The following resources are collected under the */api/tmcm/2.9/settings/* resource:

- backup_scheduler

- bandwidthpack_licensing
- cluster
- controller_licensing
- deployment
- external_ip
- fla_check
- licensing
- logging
- master_password
- metering
- monitoring
- phone_home
- registration
- security
- telemetry

These resources exist automatically whenever a Services Director is installed, and will accept the following HTTP methods:

- GET, for inspection.
- POST or PUT, for updates.

You cannot DELETE a settings resource.

The following table lists properties for all settings resources.

Settings Resource	Property	Description	Actions
backup_scheduler	scheduler_interval	The number of seconds between checks for backup jobs being due.	Update

Settings Resource	Property	Description	Actions
		The default is 300.	
bandwidthpack_ licensing	expiry_warning_days	The number of days warning that is given for an impending bandwidth pack license expiry. The default is 30.	Update
cluster	cluster_id	The cluster ID of the Primary Services Director node.	Update
controller_licensing	expiry_warning_days	The number of days warning that is given for an impending controller license expiry. The default is 30.	Update
deployment	max_instances	The maximum number of Traffic Manager instances that can be deployed from an instance host. The default is 0, which indicates that there is no limit. Ivanti recommends that the default value is used.	Update
external_ip	external_ip	When the Services Endpoint Address of the Services Director is in a private network behind a NAT device, this is the external IP address of the Services Endpoint Address. The default is unset.	Update
fla_check	fla_check_enabled	A Boolean that controls whether FLA checking is enabled. The default is true.	Update

Settings Resource	Property	Description	Actions
licensing	alert_threshold	The threshold number of alerts that can be raised before an alarm is raised. The default is 1. This property is only used when the licensing property of the manager resource is set to "enabledwithalerts."	Update
	alert_threshold_interval	The minimum interval (in seconds) between threshold alarms. The default is 300. This property is only used when the licensing property of the manager resource is set to "enabledwithalerts."	Update
logging	authentication_logging	This property should only be used by Ivanti Support.	N/A
	monitoring_logging	This property should only be used by Ivanti Support.	N/A
	metering_logging	This property should only be used by Ivanti Support.	N/A
	inventory_logging	This property should only be used by Ivanti Support.	N/A
	license_logging	This property should only be used by Ivanti Support.	N/A
	backupschedule_ logging	This property should only be used by Ivanti Support.	N/A
master_password	status	Indicates the status of master password usage. The default is Active.	Update

Settings Resource	Property	Description	Actions
metering	alerts_and_ notifications	A Boolean that controls whether metering alerts and notifications are handled. The default value is true, which indicates that the metering health icon will be displayed in the header for the Services Director VA graphical user interface, and that daily emails about metering warnings will be sent.	Update
	meter_interval	The period of time, in seconds, between metering actions. The range is from 1-3600. The default value is 3600 (1 hour).	Update
	snmp_enabled	A Boolean that controls whether SNMP can be used to gather certain types of information (such as metering) from the Traffic Managers in the estate of the Services Director. The default is false. That is, SNMP is disabled by default. SNMP is only used after attempts to gather information via the REST API have failed.	Update
	log_check_interval	The period of time, in seconds, between checks for log space. The range is from 1-3600. The default is 3600 (1 hour).	Update

Settings Resource	Property	Description	Actions
monitoring	controller_failure_ period	The number of seconds that a Services Director must be unavailable before it is flagged as Failed. The default is 180.	Update
	instance_failure_period	The number of seconds that a Traffic Manager instance must be unavailable before it is flagged as Failed. The default is 180.	Update
	host_failure_period	The number of seconds that an instance host must be unavailable before it is flagged as Failed. The default is 180.	Update
	overdue_monitoring_ warning_period	The period of time, in seconds, that must elapse before any pending monitoring actions are considered overdue. This might occur during periods of unusually heavy load. If defined, a breach of this interval causes the Services Director to issue an alert. The default is 300.	Update
	instance_monitor_ interval	The number of seconds between monitoring cycles for Traffic Manager instances. The default is 60.	Update
	host_monitor_interval	The number of seconds between monitoring cycles for instance hosts.	Update

Settings Resource	Property	Description	Actions
		The default is 60.	
	controller_monitor_ interval	The number of seconds between monitoring cycles for Services Directors. The default is 60.	Update
	monitor_email_interval	The mimimum number of seconds between email notifications. The default is 60.	Update
	auto_cleanup_vtms	The auto cleanup setting. Can be *off* (default), *self_registered_vtms*, or *all_vtms*.	Update
	purge_deleted_vtm	Boolean. If *True*, deleted vTMs will be purged, subject to the purge_ deleted_vtm_interval and purge_ deleted_vtm_check_period settings. Default is *False*.	Update
	purge_deleted_vtm_ interval	The period of time, in days, after which vTMs deleted from the Services Director are purged. Default is 42.	Update
	purge_deleted_vtm_ check_period	The purge check period, in seconds. Default is 86400.	Update
monitoring (continued)	auto_cleanup_vtms	Indicates auto-cleanup configuration for when a vTM fails monitoring. Supported values are: *off* (default), *all_vtms*, *self_reg_auto_accept_ vtms*.	Update

Settings Resource	Property	Description	Actions
	purge_deleted_vtm_ interval	The period of time (in days) after which deleted vTMs are purged from the database. The default is 42.	Update
	purge_deleted_vtm	Boolean. If *True*, deleted vTMs will be purged from the database after a number of days defined by purge_deleted_vtm_interval.	Update
	purge_deleted_vtm_ check_ period	The scheduled of time (in seconds) between vTM purges. The default is one day (86400 seconds).	Update
phone_home	username	The user name on the phone home server. The default is sftpuserssc.	Update
	server_address	The phone home server. The default is 64.13.174.195.	Update
	password	The password on the phone home server.	Update
	phone_home_enabled	A Boolean that controls whether phone home is enabled. The default is false.	Update
	server_port	The phone home server port. The default is 22.	Update

Settings Resource	Property	Description	Actions
registration	validate_owners	A Boolean that controls whether self-registration requests must have an owner_id/tag and secret properties set correctly before registration can succeed. The default is true.	Update
	blacklist_timeout	A timeout period (in seconds) for the automatic transition of a Pending registration request to Blacklisted. The default is 86400, equivalent to one day.	Update
security	user_lockout_duration_ minutes	A suspension lockout duration (in minutes). If the max_login_ attempts threshold limit is reached, the suspension duration lockout is applied. The default is 1 minute, and the maximum is 1440 minutes (equal to one day).	Update
	max_login_attempts	The maximum number of failed Services Director login attempts for a user. The default is 0, which indicates that there is no maximum.	Update
	auth_success_cache_ time_ seconds	The lifetime, in seconds, of authentication cache entries for the success of logins. The default is 30.	Update

Settings Resource	Property	Description	Actions
	auth_failure_cache_time_seconds	The lifetime, in seconds, of authentication cache entries for the failure of logins. The default is 10.	Update
telemetry	destination	The URL to which telemetry is sent at Pulse Secure.	Update
	phone_home_enabled	A Boolean that controls whether usage information is collected and exported to Pulse Secure. The default is true.	Update

The response body to a POST contains a JSON structure representing the properties of the updated resource. For example, a monitoring resource:

```
{
    "controller_failure_period": 150,
    "instance_failure_period": 150,
    "host_failure_period": 150,
    "overdue_monitoring_warning_period": 200,
    "instance_monitor_interval": 45,
    "controller_monitor_interval": 45,
    "monitor_email_interval": 45,
    "host_monitor_interval": 45,
    "auto_cleanup_vtms": off,
    "purge_deleted_vtm": false,
    "purge_deleted_vtm_interval": 30,
    "purge_deleted_vtm_check_period": 86400
}
```

sku Resource

A sku resource contains a SKU that defines a set of licensable features. You do not apply a SKU directly to a Traffic Manager instance, but you can use it as the basis for a feature pack.

The sku resources are pre-installed in the Services Director software, based on sets of features described by existing Traffic Manager template licenses. The sku resource is read-only; PUT and POST HTTP requests to create or modify sku resources are not possible.

A sku resource contains the following properties.

Property	Description	Actions
add_on_skus	Add-on SKUs that are compatible with the SKU. For example, for the STM-400 SKU, the ADD-FIPS, ADD-WAF, ADD-WEBACCEL add-on SKUs are supported.	Read Only
csp	Indicates if this SKU is for CSP customers.	Read Only
ent	Indicates if this SKU is for Enterprise customers.	Read Only
features	The features enabled for this SKU. (see below)	Read Only
info	An optional descriptive string.	Read Only
status	The status of this resource: Active or Inactive.	Read Only
feature_tier	A data model change for a future release.	
pricing_model	A data model change for a future release.	
stm_sku	A data model change for a future release.	
resource_unit	A data model change for a future release.	
fixed_resource_usage	A data model change for a future release.	

The features property is a string containing a space-separated list of licensable feature names that the SKU enables. This list is supplied by Ivanti as part of a contractual definition. The possible feature names are listed below.

Feature	Description
afm	Enable Ivanti Application Firewall.
anlyt	Enable Realtime Analytics.
apt	Enable Advanced Web Accelerator.
auto	Enable Autoscaling.

Feature	Description
bwm	Enable Bandwidth Management classes.
cache	Enable Web Caching.
comp	Enable Compression.
cr	Do not limit the user to cut-down RuleBuilder content routing for TrafficScript.
evnts	Enable Events and Actions.
glb	Enable Global Load Balancing.
java	Enable Java.
kcd	Enable Kerberos Constrained Delegation support.
loca	Enable Location support.
moni	Enable Active Monitors.
rate	Enable Rate Shaping classes.
rb	Do not limit the user to RuleBuilder for TrafficScript.
rhi	Enable Route Health Injection support.
safpx	Enable Ivanti Application Firewall Proxy.
slm	Enable Service Level Monitoring.
ssl	Enable Secure Socket Layer (SSL).
svcprt	Enable Service Protection classes.
ts	Enable TrafficScript.
xml	Enable XML functions in TrafficScript.

The list below provides licensable features for allowed session persistence algorithms.

Feature	Description
spasp	ASP session persistence.
spip	IP-based session persistence.
spj2	J2EE session persistence.

Feature	Description
spkip	Application cookie session persistence.
spnam	Named node session persistence.
spsar	Transparent session affinity.
spssl	SSL session ID session persistence.
spuni	Universal session persistence.
spxze	X-Zeus-backend cookie session persistence.

The list below provides licensable features for allowed load balancing algorithms.

Feature	Description
lbrnd	Random.
lbrob	Round robin.
lbwrob	Weighted round robin.
lbcon	Least connection based.
lbwcon	Weighted least connection based.
lbrsp	Fastest response times.
lbcel	Array of cells.
lbfail	Balance failure class (used only for testing and debugging purposes).
lbone	Always choose first node in a pool (used only for testing and debugging purposes).

The response body to a GET contains a JSON structure representing the properties of the sku resource. For example:

```
{
    "add_on_skus": [
        "ADD-FIPS",
        "ADD-WAF",
        "ADD-WEBACCEL"
    ],
    "csp": xxxxx,
    "ent": xxxxx,
    "feature_tier": "STM-400",
    "features": "rb anlyt loca java ts cr comp moni ssl svcprt evnts cache xml glb
        bwm rate slm auto rhi kcd spxze spsar spkip spip spssl spuni spnam spj2 spasp
        lbrnd lbrob lbwrob lbcon lbwcon lbrsp lbcel lbfail lbone",
    "info": "",
    "pricing_model": "xxxxxx",
    "status": "Active",
    "stm_sku": "STM-400"
}
```

template Resource

A template resource on the Services Director records the parameters that can be set during the creation of a vTM instance resource.

The template resource is located under the */api/tmpl/1.0/* resource.

The */api/tmpl/1.0/* resource is only exposed for the VA form factor of Services Director.

The template resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The structure of a template resource is variable, as it uses two arrays. That is:

- A template resource contains an array of one or more parameter groups.
- A parameter group contains an array of one or more parameters.

The following table lists properties for the template resource.

Property	Description
name	The customer-facing name for the template. This appears as **Name** in the **Application Template** page.
required_features	This property is not used at this release. vvv
author	The creator of the template.
min_vtm_version	The minimum vTM version required for the template.
version	The template version. This appears as **Version** in the **Application Template** page.
date_created	A timestamp for the creation of the template. This appears as **Date created** in the **Application Template** page.
parameters	This property is an array of *parameter groups*. See the next table for a description of a parameter group.
template_id	The customer-facing tag for the template.
description	A text description of the template. This appears as **Description** in the **Application Template** page.

The following table lists properties for individual parameter groups.

One or more parameter groups are required for the parameters array in the template resource.

Property	Description
name	The customer-facing name of the parameter group. This appears in italics above its collected parameters in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*.
parameters	This property is an array of individual *parameters*.

Property	Description
	See the next table for a description of an individual parameter.

The following table lists properties for individual parameters, as displayed in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*.

ⓘ One or more parameters are required for each parameter group in the template resource.

Property	Description
default	The default value(s) for the parameter. The formatting of this property depends on the parameter type. (see below) This property appears in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*.
type	The type of the parameter. That is, *number*, *string*, *array*, and so on.
description	This text description appears at the beginning of the displayed text for the parameter in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*.
name	The customer-facing name of the parameter. This property appears at the end of the displayed text (in brackets) for the parameter in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*.

The response body to a POST contains a JSON structure representing the properties of the created template resource. For example:

```
{
   "name": "HTTP Service",
   "required_features": [""],
   "author": "www.pulsesecure.net",
   "min_vtm_version": "18.2",
   "version": "1.0",
   "date_created": "2019-05-16 12:55:56",
   "parameters": [
      {
         "name": "Specify the back-end nodes",
         "parameters": [
           {
              "default": ["127.0.0.1:80", "127.0.0.2:80"],
              "type": "array",
              "description": "Please enter the hostname and port of each node",
              "name": "nodes_list"
           } ]
      },
      {
         "name": "Specify the service",
         "parameters": [
           {
              "default": "Service Name",
              "type": "string",
              "description": "A brief name to identify the service you would
               like to balance",
              "name": "instance_name"
           },
           {
              "default": 80,
              "type": "number",
              "description": "Please specify a port for the service to listen on",
              "name": "public_port"
           } ]
      } ],
"template_id": "HTTP Service__1.0",
"description": "A basic HTTP web service"
```

See also:

- "template_instance Resource" below.

template_instance Resource

A template instance resource on the Services Director records a single vTM-specific use of an application template to configure a cluster of vTMs.

The template_instance resource is located under the */api/tmpl/1.0/* resource.

ⓘ The */api/tmpl/1.0/* resource is only exposed for the VA form factor of Services Director.

The template resource will accept the following HTTP methods:

- POST, for creation.
- PUT, for update.
- GET.
- DELETE.

The structure of a template_instance resource is variable, as it uses an array to store one or more parameters and their values.

The following table lists properties for the template resource.

Property	Description
template_instance_id	The unique identifier for the template instance.
tag	The customer-facing name for the template instance. This is created as the **Name** in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*. This appears as **Name** in the **vTM Template Instances** page. If no name is specified, the template_instance_id is used.
cluster_id	The cluster to which the template instance applies.
template_id	The customer-facing tag for the template.
parameters	This property is an array of *parameters* and their values. Each parameter is one that was defined in the template resource, see "template Resource" on page 223. Each parameter was listed in the **Instantiate a Template** wizard, see the *Services Director Getting Started Guide*. The array includes all parameters, even where default values were retained.

The response body to a POST contains a JSON structure representing the properties of the created template_instance resource. For example:

```
{
  "template_instance_id": "Template-Instance-RIO1-R5UO-4MVI-FVRJ",
  "tag": "HTTP-Service-01",
  "cluster_id": "Cluster-CRCF-9WDA-T1HE-Z5WS",
  "template_id": "HTTP Service__1.0",
  "parameters":
    {
       "instance_name": "Service Name",
       "nodes_list": ["127.0.0.1:80", "127.0.0.2:80"],
       "public_port": 80
    }
}
```

See also:

- "template Resource" on page 223.

user Resource

A user resource describes a Services Director administrative user. There is no system of privileges; all active Services Director users have full read and write access to the inventory database.

The user also stores AWS credentials for the user.

The user resource supports the following properties:

Property	Description	Supported
aws_access_key	(Optional) The user name for AWS operations.	Create/Update
aws_secret_access_key	(Optional) The password for AWS operations.	Create/Update
password	Mandatory when creating a user. Cannot be empty.	Create/Update

Property	Description	Supported
	The user password string. This is supplied in clear text, although it is stored as a salted hash value. This is not included in output from a GET command.	
status	The user status: Active or false. A non-active user cannot be used for requests.	Update

It is unlikely that you will create a user.

The password property is mandatory when creating a user, and it must not be empty. There are no other quality constraints.

For internal implementation reasons, user resource names are effectively case-insensitive, although other resource names are case-sensitive. Therefore, resources named admin and Admin refer to the same underlying user resource.

The response body to a GET contains a JSON structure representing the properties of the user resource. For example:

```
{
    "aws_access_key": "XXXXXXXXXXXXXXXXXXXX",
    "aws_secret_access_key": "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx",
    "status": "Active",
    "username": "admin"
}
```

user_data Resource

A user_data resource describes a cloud registration. This includes the user data required to create the first instance in a cluster.

The user_data resource supports the following properties:

Property	Description	Supported
date_created	The timestamp for the creation of the cloud registration.	Read Only.

Property	Description	Supported
owner	The owner resource for the cloud registration. See "owner Resource" on page 187.	Create/Update
registration_ policy	The registration policy for this cloud registration.	Create/Update
tag	The display name for the cloud registration.	Create/Update
user_data	The user data for the cloud registration, presented with base64 encoding.	Read Only.
user_data_id	The ID for the cloud registration.	Read Only.

The response body to a GET contains a JSON structure representing the properties of the user_ data resource. For example:

```
{
    "date_created": "2016-09-26 08:53:08",
    "owner": "Owner-X287-ZB46-SCYV-HEZT",
    "registration_policy": "Policy-T1HN-946O-EO5T-25Z8",
    "tag": "ClusterFirst",
    "user_data": "dGltZXpvbmU9IkV0Yy9VVEMi...<truncated>...1VC0yNVo4Ig==",
    "user_data_id": "UserData-42RL-FJA6-11T5-HHCX"
}
```

When a GET is performed, a new password is assigned automatically, and the encoded user data updates.

Ivanti recommends that you perform a GET between each deployment, to ensure that the password is not re-used.

version Resource

A version resource describes a specific Traffic Manager installation file. A version resource is specific to a Traffic Manager version and architecture, and you can have multiple version resources for the same Traffic Manager version number (corresponding to different architectures). Creating, altering, or deleting the version resource does not affect the existence of the actual version file. You are responsible for ensuring that the Traffic Manager installation file is available to the Services Director servers.

If you create version resources solely for use with externally-deployed instances, the Services Director does not use the version_filename property. In this case, you do not need to make the Traffic Manager installation file available. For more information about externally-deployed instances, refer to "Properties for an Externally-Deployed Instance" on page 109.

When creating a version resource, you can specify the following properties.

Property	Description	Actions
info	An optional descriptive string.	Create/Update
version_filename	The Traffic Manager installation file (not the complete path).	Create/Update
status	The status of this resource: Active or Inactive.	Update
md5sum	The md5sum of the version tarball. This is an optional field that is used to validate STM tarballs during deployment. If you do not provide a value, the Services Director will calculate the md5sum itself during the first deployment of that version, and continue to use that value for later validations.	Create/Update

You can change the version_filename and info properties by updating an existing version resource.

You can mark the resource as inactive by changing the status property to Inactive.

When deploying a Traffic Manager instance, if a Traffic Manager installation file with the same filename as the version_filename property is already present on the target instance host, it is re-used to save both time and bandwidth. The Services Director does not attempt to verify the metadata or content of the installation file. As such, if you replace an installation file with different content under the same filename, you should manually remove any cached installation files with that name from your instance hosts.

Using the REST API to Check Status

You can check the status of various entities through the REST API. Some of these are directly associated with inventory items, while others are more universal:

- files
- threads
- email

Checking the Status of Files

You can check the state of the files associated with the current Services Director deployment by performing a GET request on the following URI:

```
/api/tmcm/2.9/status/files
```

This URI supports only GET requests.

Example output is shown below:

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   615    0   615    0     0   2266      0 --:--:-- --:--:-- --:--:--  2383
{ "licenses" : [ { "filename" : "/var/cache/ssc/fla-ssl",
        "href" : "2.8/license/fla-ssl",
        "name" : "fla-ssl",
        "present" : true
      } ],
  "versions" : [ { "filename" : "/var/cache/ssc/ZeusTM_101_Linux-x86_64.tgz",
        "href" : "2.8/version/ZeusTM_103_Linux-x86_64",
        "name" : "ZeusTM_101_Linux-x86_64",
        "present" : true
      },
      { "filename" : "/var/cache/ssc/ZeusTM_100_Linux-x86_64.tgz",
        "href" : "2.8/version/ZeusTM_103_Linux-x86_64",
        "name" : "ZeusTM_100_Linux-x86_64",
        "present" : true
      },
      { "filename" : "/var/cache/ssc/ZeusTM_98_Linux-x86_64.tgz",
        "href" : "2.8/version/STM98",
        "name" : "STM98",
        "present" : true
      }
    ]
}
```

This URI produces a response with the following properties:

- licenses - An array of objects, one for each active license, each with the following properties:
  - name - The name of the license.
  - href - The URI of the license resource.
  - filename - The absolute path of the file associated with the license.
  - present - true if the file is found or false if not.
- versions - An array of objects, one for each active version, each with the following properties:
  - name - The name of the version.

- href - The URI of the version resource.
- filename - The absolute path of the file associated with the version.
- present - true if the file is found or false if not.

This operation applies to only the specific Services Director on which the REST request is run.

Checking the Status of Threads

You can view a summary of the threads associated with the current Services Director deployment by performing a GET request on the following URI:

```
/api/tmcm/2.9/status/threads
```

This URI supports only GET requests.

Example output is shown below:

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100    84    0    84    0     0    465      0 --:--:-- --:--:-- --:--:--   491
{ "active_thread_count" : 0,
  "queue_length" : 0,
  "thread_count" : 54,
  "thread_info" : {   }
}
```

Sending a Test Notification Email

You can send a test email to the configured notification email address by performing a GET request on the following URI:

```
/api/tmcm/2.9/status/email
```

This URI supports only GET requests.

Understanding REST Request Errors

If the Services Director REST service is unable to handle or interpret a request, it returns a HTTP response with an appropriate HTTP error code. The response body contains a JSON data structure that describes the error:

```
{
   "error_id": <error identifier>,
   "error_text": <error description>,
   "error_info": {<error-specific data structure, optional>}
}
```

For certain error conditions, the error_info property can contain a data structure to further describe the error.

Metering and Monitoring the Services Director

Usage Metering and Activity Metrics (CSP Customers Only)

The Services Director automatically meters usage on a regular basis, and it optionally sends this information to Ivanti for billing purposes. By default, it records this information once per hour.

If a Traffic Manager instance is active, the Services Director polls it to obtain total throughput and peak activity metrics. The Services Director creates a metrics log file with one line of metrics data for each Traffic Manager instance. Each line of metrics data records the name of the instance, the time elapsed since the resource was created, and the polled metrics. If an instance is not active, only the elapsed time is recorded.

If you want to generate usage or billing information, typically you process all metering log files and aggregate the results. You should use caution when aggregating data results for billing since metering records include failed deployments.

ⓘ Generating log files has a cumulative impact on disk space.

The Services Director collects metering data from Traffic Manager instances as follows:

- Instances that are at version 9.4 or earlier (or have no REST API enabled) have their metering collected through SNMP.
- Instances that are at version 9.5 or later with the REST API enabled have their metering collected through their REST API. If REST-based metering fails (or is not possible), the Services Director falls back to collecting using SNMP. Any metering issues will be included in the warning logs, as before.

The Services Director records the most recent metrics information for each instance in the inventory database. You can obtain this data using the REST API. The REST API does not supply bulk metrics data.

The Metering Log file is structured as follows:

- The first row contains version data for the metering log format. This first line can be ignored by customers. Ignore this line when you aggregate data for billing.

- Each subsequent row records one set of metrics for a Traffic Manager instance, in comma-separated value (CSV) format.
- The final line contains an MD5 hash of the previous lines. Ignore this line when you aggregate data for billing.

Each line of metrics contains the following fields:

Field	Description
Timestamp	The date and time, in UTC format, that the line was written.
Instance ID	The unique instance ID for the Traffic Manager instance.
Instance Tag	This information may be empty but it is included, even if empty.
Owner	Optionally, the owner of the Traffic Manager instance.
Cluster ID	The cluster for the Traffic Manager instance.
Management IP	The management IP address of the Traffic Manager instance.
Instance SKU	The SKU (or SKU combination) assigned to the Traffic Manager instance (at the time of writing to the log). The SKU might vary between readings, and variations are not recorded in the metrics log file. This property includes a hash of features applicable to the SKU. Ignore these features for billing purposes.
Feature Pack	The feature pack assigned to the Traffic Manager instance (at the time of writing to the log).
Deploy Time	The length of time (in days, hours and minutes) since the instance was deployed.
Throughput	The number of bytes sent by the Traffic Manager instance, as recorded in the SNMP counter. This number is cumulative and is reset whenever the Traffic Manager instance is restarted. It is not the throughput since the latest metering action. To generate usage or billing information based on throughput, you should set your aggregating script to detect a drop in throughput and designate this as a restart.

Field	Description
	This property is applicable to active Traffic Manager instances only. For Idle or Inactive instances, it contains a value of 0 (zero) in the log. For uncontactable instances, it contains a value of -1 in the log.
Peak Throughput	The highest number of bytes sent by the Traffic Manager instance in any second of the previous hour. This property is applicable to active Traffic Manager instances only. For Idle or Inactive instances, it contains a value of 0 (zero) in the log. For uncontactable instances, it contains a value of -1 in the log.
Peak Requests	The highest number of requests received by the Traffic Manager instance in any second of the previous hour. This property is applicable to active Traffic Manager instances only. For Idle or Inactive instances, it contains a value of 0 (zero) in the log. For uncontactable instances, it contains a value of -1 in the log.
Peak SSL Requests	The highest number of Secure Socket Layer (SSL) requests received by the Traffic Manager instance in any second of the previous hour. This property is applicable to active Traffic Manager instances only. For Idle or Inactive instances, it contains a value of 0 (zero) in the log. For uncontactable instances, it contains a value of -1 in the log.
Instance Bandwidth	The bandwidth (in Mbps) allocated to the Traffic Manager instance.
Record Hash	An MD5 or similar hash of the record from the Services Director license file for tamper detection. Ignore this for billing purposes.

If metrics are not collected for a period of time, peaks for the missing time are not recorded. If you reduce the metering interval, the peak values are still relative to the previous hour rather than the time since metrics were last collected.

Creating Metering Logs (CSP Customers Only)

By default, the Services Director retains and archives metering log files in the /var/log/ssc/metering directory. You define the log output location when you first configure the Services Director.

To allow the Services Director to send metering logs to Ivanti, enable the phone home feature through the REST API or Services Director VA. See the Pulse Secure Services Director Getting Started Guide.

The metering phone home service requires DNS to find the phone home server. If you do not have DNS enabled on your Services Director, add the phone home IP address (currently 67.199.253.230), to the VA's static hosts mapping.

To enable the phone home feature through the REST API, perform a PUT request on the settings/phone_home resource, setting the phone_home_enabled property to true. This property is set to false by default.

A warning e-mail will be sent every 24 hours if phone-home is enabled and Services Director is unable to connect to the phone-home server.

If the phone home feature is disabled, you must manually extract the metering log files and send them to Ivanti. Employing phone home on your system ensures that the process is entirely automatic, secure, and without staffing overhead.

The Services Director employs a cron job, created during installation, to run a script that prepares a metering data archive file in this format:

```
<sd_hostname><controller_license_name>.zip
```

The script sends this file to a secure SFTP server at Ivanti. The cron job runs once a month, at a randomly selected date and time. The Services Director authenticates the destination SFTP server against a pre-configured locally stored host key. You can change this key by placing a new value in:

```
~/.ssh/known_hosts
```

If the host key is not found, or does not match the SFTP server, the phone home process stops.

The Services Director makes two attempts to send the log file. If the first attempt fails, the Services Director waits a random period of up to 12 hours and then tries again. If the second attempt fails, the Services Director sends an alert to the email notification list. Equally, if the file is successfully sent, the Services Director sends an alert to the email notification list announcing the success.

Errors and warnings pertaining to the phone home mechanism are all logged to the file metering_phone_home.log. This file provides a source of debugging information for problem resolution.

You can also extract metering logs using the Services Director VA. See the Pulse Secure Services Director Getting Started Guide.

Metering Settings

You can view and modify various metering settings Services Director in the /api/tmcm/2.9/settings/metering resource. These settings do not normally need to be modified from their default values. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You set metering settings for the Services Director as follows:

- alerts_and_notifications - A Boolean that controls how metering alerts and notifications are handled. The default value is true. This indicates that the metering health icon will be displayed in the header for the Services Director VA graphical user interface, and that daily emails about metering warnings will be sent.
- meter_interval - The period of time, in seconds, between metering actions. The range is from 1-3600. The default value is 3600 seconds (1 hour).
- snmp_enabled - A Boolean that controls whether SNMP is used. SNMP is used to gather certain types of information (such as metering) from the Traffic Managers in the estate of the Services Director. The default value is true.
- log_check_interval - The period of time, in seconds, between checks for log space. The range is from 1-3600. The default value is 3600 seconds (1 hour).

Creating Metering Records Manually

The Services Director includes a command line utility, prepare_metering_records , to manually prepare metering records for processing. You can use this script to create the metering archive file ready for transmission to Ivanti.

To create metering records

- At the system prompt, enter:

```
prepare_metering_records [--help] [--force]
```

--force - Runs the script without prompting for user input.

Creating Metering Records Using the Phone Home Script

You can run the metering_phone_home script to manually perform a phone home operation. This script is stored in the bin directory of the Services Director installation directory. For example, in:

```
INSTALLROOT/bin
```

To run the metering phone home script, at the system prompt, enter:

```
metering_phone_home -v/--verbose -n/--noretry
```

-v/--verbose - Redirects logging to stdout instead of a file.

-n/--noretry - Prevents further attempts at sending.

Health and Performance Monitoring

Each Services Director in your deployment monitors the health of all other peer Services Directors and deployed Traffic Manager instances recorded in the inventory database. If a failure occurs, the Services Director records a warning entry in the event log and sends an email notification to any system administrators declared in the database.

ⓘ You can configure the "From" e-mail address of alert e-mails. This address can be set in INSTALLROOT/conf/email_config.txt, in the common section, as from_address. The symbol "$fqdn" will be replaced by the fully-qualified domain name of the instance host, or an IP address where Universal Licensing is used. The other sections in this file should not normally be modified. For Services Director installs on AWS it is likely that you will need to change this setting to be an address that is resolvable to the instance's public IP.

The Services Director also monitors supported versions of deployed Traffic Manager instances for a number of key performance metrics. You can obtain these metrics through the REST API monitoring resource.

A series of inter-controller REST API requests are used to identify the status of each Services Director and Traffic Manager instance in your deployment. You must make sure that each Services Director has network access to all other Services Directors and instance hosts. You must also enable the REST service on your running Traffic Manager instances and record the REST access details in the inventory database.

ⓘ This process is performed automatically for Traffic Manager instances that are deployed by the Services Director. However, you must enable and record REST API credentials for externally-deployed instances manually to allow monitoring to take place for these instances.

Your Services Directors in an Active state are monitored.

Monitoring Settings

By default, all active Services Directors share the task of monitoring. You can alter this behavior by modifying the Services Director's monitoring mode settings in the REST API manager resource. These settings do not normally need to be modified from their default values. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You select whether each Services Director individually monitors all other Services Directors and Traffic Manager instances in the deployment, shares the responsibility of monitoring a proportion of Traffic Manager instances with other Services Directors, or performs no monitoring actions at all.

You can view and modify various monitoring interval settings for the Services Director in the REST API monitoring resource. These settings do not normally need to be modified from their default values. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You set distinct interval values for monitoring the Services Directoras follows:

- Monitoring Interval - The period of time, in seconds, that must elapse between health checks. The default value is 60. A setting of 0 forces the Services Director to use a predefined short interval suitable for deployments that require very frequent monitoring.
- Failure Identification Interval - The period of time, in seconds, that must elapse between continuous health check failures before your Services Director determines that a service failure has occurred. This setting helps to prevent against transient network errors being incorrectly identified as service outages. The default value is 180.
- Overdue Monitoring Warning Interval - The period of time, in seconds, that must elapse before any pending monitoring actions are considered overdue. This might occur during periods of unusually heavy load. If defined, a breach of this interval causes the Services Director to issue an alert. The default value is 300.
- Warning Email Interval - The period of time, in seconds, that must elapse before subsequent email alerts are sent. You can use this setting to avoid large numbers of emails being sent, one for each occasion a warning is triggered. A new email is sent only after this interval has passed. This email contains all monitoring events since the previous email was sent.

Retrieving Monitoring Data

You can retrieve stored monitoring state data from the Services Director by using the REST API monitoring resource. This resource is read-only and supports only the REST API GET request method. For details, see "Using the ServURI Root Partsices Director REST API" on page 116.

You can access the following child elements through the REST API monitoring resource:

- /monitoring/manager - This element contains monitoring state data for all of your Services Directors, whether or not they have failed.
- /monitoring/host - This element contains monitoring state data for all of your service hosts, whether or not they have failed.
- /monitoring/instance - This element contains monitoring state data and key performance metrics for your Traffic Manager instances, whether or not they have failed.
- /monitoring/failures - This element contains a pair of arrays for failed Services Directors and Traffic Manager instances. You can use this element to retrieve a list of currently failed devices without needing to check the status of each one individually.

Upgrading the Services Director

Upgrading the Services Director VA (v2.1 and Earlier)

The required procedure depends on whether your current database is internal or external, and whether you want to use High Availability at Services Director v2.3 (or later).

- If you have an external database and want to use High Availability on your upgraded system, you must convert to using an internal database. High Availability is not supported for external databases. See "Upgrading your Services Director VA (External DB and HA required)" below
- If you have an external database but do not want to use High Availability, no special steps are required. See "Upgrading your Services Director VA" on the next page.
- If you have an internal database, no special steps are required. See "Upgrading your Services Director VA" on the next page.

Upgrading your Services Director VA (External DB and HA required)

This procedure converts your external database to an internal database, and upgrades your Services Director VA. This enables you to use your existing Services Director VA in an HA pair.

1. Upgrade your Services Director VA (version 2.1 or earlier) to the Services Director VA v2.1r1 release. See "Upgrading your Services Director VA" on the next page.
2. Upgrade your Services Director VA v2.1r1 to the Services Director VA v2.4 release. To do this, repeat the procedure described in "Upgrading your Services Director VA" on the next page.

ⓘ To support the encryption of stored passwords for Traffic Manager instances, Services Director will encrypt passwords during the upgrade of the Virtual Appliance. A default master password of master1M@ is used to do this. It is strongly recommended that you update the master password after an upgrade. For a Services Director VA installation, this process is performed from the **System > Security** page. See also "Working with the Master Password" on page 249.

3. Take a mysqldump of the external database (.sql extension).
4. Log into your upgraded Services Director VA and start the CLI:

```
login as: admin
Ivanti Services Director
Last login: Tue Apr 8 22:17:09 2014 from 10.32.26.136
amnesiac > enable
amnesiac # configure terminal
amnesiac (config) #
```

5. Reconfigure the VA to use an internal database, using the CLI command:

   ```
   amnesiac (config) # ssc database use-local
   ```

6. Import the database dump file with the CLI command:

   ```
   amnesiac (config) # ssc database local db-file import
     scp://<user>:<password>@<host+path to file> force
   ```

7. Log in to the Services Director VA, and navigate to the **Services** > **Manage HA** page.

8. Use the **Create Primary** command to upgrade your upgraded Services Director to a Primary Services Director node. This node is then ready for High Availability. For details, see Pulse Secure Services Director Getting Started Guide.

Upgrading your Services Director VA

To upgrade a Services Director VA from 2.1 (or earlier), you must perform two upgrades:

- First, you must upgrade your Services Director VA to version 2.1 r1.
- Then, you must upgrade your Services Director VA to the required later release.

You cannot upgrade Services Director VA v2.1 (or earlier) directly to version 2.2 or later.

During an upgrade to version 2.3 or later, the cluster_type property is added to each existing Cluster resource and set to User Created.

To support the encryption of stored passwords for Traffic Manager instances, Services Director will encrypt passwords during the upgrade of the Virtual Appliance. A default master password of master1M@ is used to do this. It is strongly recommended that you update the master password after an upgrade. For a Services Director VA installation, this process is performed from the **System** > **Security** page. See also "Working with the Master Password" on page 249.

The procedure below can be used for both steps:

1. Download the required Services Director VA upgrade image from the Ivanti Support site.

2. Place the image file on a server that is accessible with HTTP, SCP, or FTP.

3. Connect to the Services Director VA using a terminal session and start enable mode :

```
login as: admin
Ivanti Services Director
Last login: Tue Apr 8 22:17:09 2014 from 10.32.26.136
amnesiac > enable
amnesiac #
```

4. Locate the upgrade image, and retrieve it:

```
amnesiac # image fetch http://<host-name>/<path>/<image-name> <local-name>
```

   Where:

   - <image-name> is the name of the file you want to fetch.

   - <local-name> is an optional local name for the downloaded image file. This takes the form "<name>.img". For example, "ssc_23.img". If this is not specified, the downloaded image is renamed to "image.img" once it downloads.

5. Apply the upgrade, using the local name from step 4. For example, "image.img":

```
image upgrade image.img
```

   The image upgrade may take a long time and the session will remain unresponsive during this step. However, the Services Director itself will remain operational for instance licensing, monitoring, and so on.

   Once the process is complete, a message is displayed:

```
"Installed image 'image.img' on partition 2. The 'reload' command will load software
version '<version details>'"
```

6. Restart the node:

```
reload
```

7. Wait for the image to reload.

The Services Director VA will restart at this point. This may cause instances to briefly enter the licensing grace period (six weeks), but they will return to normal operation once the restart is completed.

8. Access the Services Director VA via Web UI or command line interface to check that the node is operational. The version on the title bar should indicate the new software version.

Upgrading an HA Pair of Services Director VAs (v2.2 or Later)

A High Availability pair of Services Director VAs must be upgraded using the procedure below.

The same general procedure can be used for a standalone Services Director VA.

1. Download the Services Director VA upgrade image from the Ivanti Support site.

2. Place the image file on a server that is accessible with HTTP, SCP, or FTP.

3. Connect to the Active node using a terminal session and start enable mode :

```
login as: admin
Ivanti Services Director
Last login: Tue Apr 8 22:17:09 2014 from 10.32.26.136
amnesiac > enable
amnesiac #
```

4. Locate the upgrade image, and retrieve it:

```
amnesiac # image fetch http://<host-name>/<path>/<image-name> <local-name>
```

Where:

- <image-name> is the name of the file you want to fetch.
- <local-name> is an optional local name for the downloaded image file. This takes the form "<name>.img". For example, "ssc_23.img". If this is not specified, the downloaded image is renamed to "image.img" once it downloads.

5. Apply the upgrade, using the local name from step 4. For example, "image.img":

```
image upgrade image.img
```

The image upgrade may take a long time and the session will remain unresponsive during this step. However, the Services Director itself will remain operational for instance licensing, monitoring, and so on.

Once the process is complete, a message is displayed:

```
"Installed image 'image.img' on partition 2. The 'reload' command will load software
version '<version details>'"
```

6. Restart the node:

```
reload
```

7. Wait for the Active node to reload the upgraded image.

   The node will restart at this point. This may cause instances to briefly enter the licensing grace period (six weeks), but they will return to normal operation once the restart is completed.

ⓘ During an upgrade, the cluster_type property is added to each existing Cluster resource and set to User Created.

ⓘ To support the encryption of stored passwords for Traffic Manager instances, Services Director will encrypt passwords during the upgrade of the Virtual Appliance. A default master password of master1M@ is used to do this. It is strongly recommended that you update the master password after an upgrade. For a Services Director VA installation, this process is performed from the **System** > **Security** page. See also "Working with the Master Password" on the next page.

8. Access the Services Director VA (using its Service Endpoint Address) via Web UI or command line interface to check that the node is operational. The version on the title bar should indicate the new software version.

9. Repeat steps 3-7 on the Standby node. Do not repeat step 8.

10. Access the Services Director VA (using its IP Address) via Web UI or command line interface to check that the node is operational. The version on the title bar should indicate the new software version.

    The upgrade of the HA pair is complete.

Working with the Master Password

Services Director v2.3 and later uses a master password to encrypt the passwords for Traffic Manager instances.

Storing the Master Password

It is essential that the master password (whether it is the default, chosen yourself or generated automatically) is recorded and can be retrieved. Ivanti recommends that this password is recorded in a secure location that is separate from the Services Director.

However, you can also choose to store this password internally:

- If you choose to store the master password internally, the password will be automatically used whenever the Services Director's Virtual Machine restarts. However, you must enter the master password manually when you recover a Services Director from a backup file.
- If you choose to not store the password internally, you must enter the master password manually whenever the Services Director's Virtual Machine restarts, and whenever you recover a Services Director from a backup file.

You can change your decision as follows:

- If your software is configured to store the master password, and you wish to change this, delete the file $SSCHOME/etc/master.
- If your software is configured NOT to store the master password, and you wish to change this, run one of the following commands:
  - Ubuntu: Run $SSCHOME/bin/configure_ssc --liveconfigonly
  - RHEL/CentOS: Run $SSCHOME/bin/configure_ssc

In both cases, you are asked whether you wish to store the master password.

Changing the Master Password

If you want to reset the master password (that is, you do not know what the current master password is), see "Resetting the Master Password" on the next page.

You can change the master password in the following ways:

- In the Services Director VA for the Active Services Director, from the **Security Settings** page. After you complete this task, you must re-enter the new master password on the Standby Services Director VA. See the Pulse Secure Services Director Getting Started Guide.
- In the Command-Line Interface (CLI) on the Active Services Director VA, using the ssc settings master-password update command. See the Pulse Secure Services Director Command Reference.

ⓘ You must do this on both Services Director nodes in an HA pair, starting with the Active node.

- For a software-only installation, you must issue a PUT request to the Services Director. The body of the PUT request to the REST API has the following format:

```
{
"current_password": "<current password>",
"new_password": "<new password>"
}
```

Where you have additional Services Directors, run the following command on all other Services Directors:

- Ubuntu: $SSCHOME/bin/configure_ssc -liveconfigonly
- RHEL/CentOS: $SSCHOME/bin/configure_ssc

In both cases, enter the new master password and confirm it when prompted.

ⓘ You do not need to stop and restart Services Directors when modifying the master password on multiple Services Directors.

Resetting the Master Password

ⓘ If you wish to change the master password (that is, you know what the current master password is), see "Changing the Master Password" on the previous page.

In the event that a master password is lost, as a final resort there are two ways to reset the master password:

- From the Command-Line Interface (CLI) on each Services Director in an HA pair. See "Resetting the Master Password from the Services Director VA CLI" below.
- From a software-only installation on Ubuntu or RHEL/CentOS for each Services Director. See "Resetting the Master Password on Ubuntu or RHEL/CentOS" on the next page.

  In both cases, the encrypted administration password for each Traffic Manager is lost. These administration passwords must be set manually after the master password is reset.

Resetting the Master Password from the Services Director VA CLI

From the Services Director VA CLI, you must use the ssc settings master-password reset password command on the Active Services Director in the HA pair (or standalone Services Director).

This procedure should only be used as a final resort to re-establish a master password. The encrypted administration password for each Traffic Manager known to the Services Director is lost. These individual administration passwords must be set manually after the master password is reset.

1. Start a terminal session on your Active Services Director (or standalone Services Director) using its Service Endpoint Address, and login as the admin user.
2. In the Services Director terminal session, start a CLI session:

```
amnesiac > enable
amnesiac # configure terminal
amnesiac (config) #
```

3. Reset the master password for this Services Director:

```
gold-01 (config) # ssc settings master-password reset password New_pass_22
   force true
Successfully reset master password
You must manually update all passwords for registered instances
```

   If you do not include force true the reset will fail, as the password cannot be reset on a Services Director with one or more registered/deployed Traffic Managers.

4. Repeats steps 1-3 for your Standby Services Director.

5. On your Active Services Director, reset the administration password for your first Traffic Manager instance. For example, for a Traffic Manager instance called Cobalt-01:

```
gold-01 (config) #  ssc instance update instance-name cobalt-01
   admin-password Admin_PW_01
```

   The output of this command will show the full status of the Traffic Manager instance (not shown).

You can also perform this step by updating the details for the Traffic Manager from the Services Director VA. See the Pulse Secure Services Director Getting Started Guide.

6. Repeat step 5 for each of the Traffic Managers on the Active Services Director.

   The process is complete.

You do not need to repeat the password reset process on the Standby Services Director.

Resetting the Master Password on Ubuntu or RHEL/CentOS

On a software form-factor installation on Ubuntu or RHEL/CentOS, you must use the reset_master_password command on the Services Director.

This procedure should only be used as a final resort to re-establish a master password. The encrypted administration password for each Traffic Manager known to the Services Director is lost. These individual administration passwords must be set manually after the master password is reset.

1. Log into your Services Director.
2. Shutdown the Services Director. For example:

```
$ sudo stop ssc
```

3. Reset the password on the Services Director:

```
$SSCHOME/bin/reset_master_password --force <new password>
```

4. Restart the Services Director. For example:

```
$ sudo start ssc
```

5. Set each vTM password via a PUT request to its instance resource via the REST API.

   For Traffic Managers that were deployed by the Services Director, you must include a URL parameter of deploy=false to ensure a database-only update. This is not required for externally-deployed Traffic Managers.

6. Log out of the Services Director.

   The process is complete.

ⓘ If you have a more than one Services Directors configured, perform this procedure for each Service Director. However, do not restart any Services Directors until the master password has been reset on all Services Directors.

Appendix: Deploying for Redundancy

Deploying High Availability for the Software Services Director

To create a high availability installation of the software form-factor Services Director, you require:

- Two or more host machines (either virtual or physical) running supported versions of Ubuntu/CentOS Linux. Each will contain a software form-factor Services Director.
- Two or more clustered software form-factor Services Directors, that are installed and licensed. These can operate in either an Active/Passive or an Active/Active configuration.
- A MySQL database for the Services Directors. Replication of this database is recommended, else the database will be a single point of failure.
- Two clustered front-end virtual Traffic Managers (vTMs) in an Active/Passive configuration. These vTMs ensure that manually-issued requests to the REST API of the Services Director will be directed to an Active Services Director. The configured vServer and pools on these vTMs control how traffic reaches your Services Directors.
- A vTM Traffic IP (TIP) address, which acts as the Service Endpoint Address (SEA) for manually-issued REST API requests to the Services Directors.

ⓘ The TIP/SEA can be in a private network behind a Network Address Translation (NAT) device. Where this is the case, the external SEA is used for all service requests.

Each element of your Services Director installation can be deployed as required within your network, using any combination of virtual machines, physical machines and data centres. Physical diversity of elements (for example, spreading elements across data centres) is likely to increase the resilience of the installation.

The Services Director and its front-end vTMs can be in a private network behind a NAT device. However, the vTMs that will be added to the estate of the Services Director at a later stage cannot be behind a NAT.

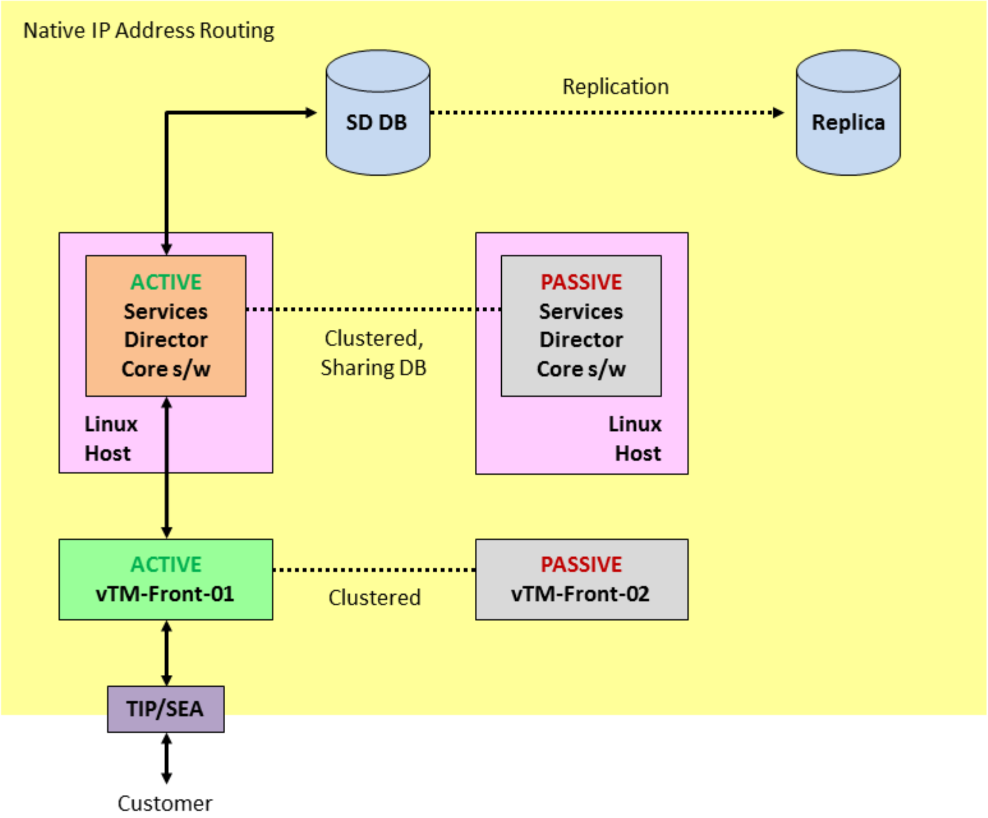
Technologies allowing routable connections between native IP addresses in disparate networks (for example, Virtual Private Networks) are supported.

After you have completed your high availability installation of the software form-factor Services Director, you can add Traffic Managers to the estate of your Services Directors, see "Populating the Estate of the Services Directors" on page 262.

You must ensure that the master password for the Services Directors is recorded securely. This is required during any recovery from failure, see "Disaster Recovery for the Software Services Director" on page 264.

Example Deployment: Active/Passive Services Directors

A network topology with Active/Passive Services Directors is shown below. Other network topologies are supported.



In this example, there are:

- Two clustered software form-factor Services Directors, each of which is installed on its own Linux machine.

- A MySQL database that is shared by the clustered Services Directors. This database is replicated.
- Two clustered Virtual Traffic Managers (vTMs), which act as a resilient front-end to the Services Directors.
- A known Service Endpoint Address (SEA) for the clustered Services Directors.
- A customer who wants to manually send REST API requests to the clustered Services Directors using the SEA.

Each element of your Services Director installation can be deployed as required within your network, using any combination of virtual machines, physical machines and data centres. Physical diversity of elements (for example, spreading elements across data centres) is likely to increase the resilience of the installation. Technologies allowing routable connections between native IP addresses in disparate networks (for example, Virtual Private Networks) are supported.

In this example, the Services Directors are required to act as an Active/Passive high availability pair. That is, all requests must go exclusively to the Active Services Director until it fails, at which point the Passive Services Director becomes the Active node. To achieve this Active/Passive configuration, a vServer and two pools are required on the Active front-end vTM:

- A default pool identifies the management address/port for the first Services Director only.
- A failure pool for the first pool identifies the management address/port for the second Services Director only.

A default monitoring mechanism for the pools is provided. This is ping-based, and operates at a machine level. You may choose to replace this with your chosen monitoring mechanism. Refer to the Ivanti, Inc. Virtual Traffic Manager documentation.

The Active front-end vTM raises a Traffic IP (TIP) address, which acts as the SEA for the clustered Services Directors.

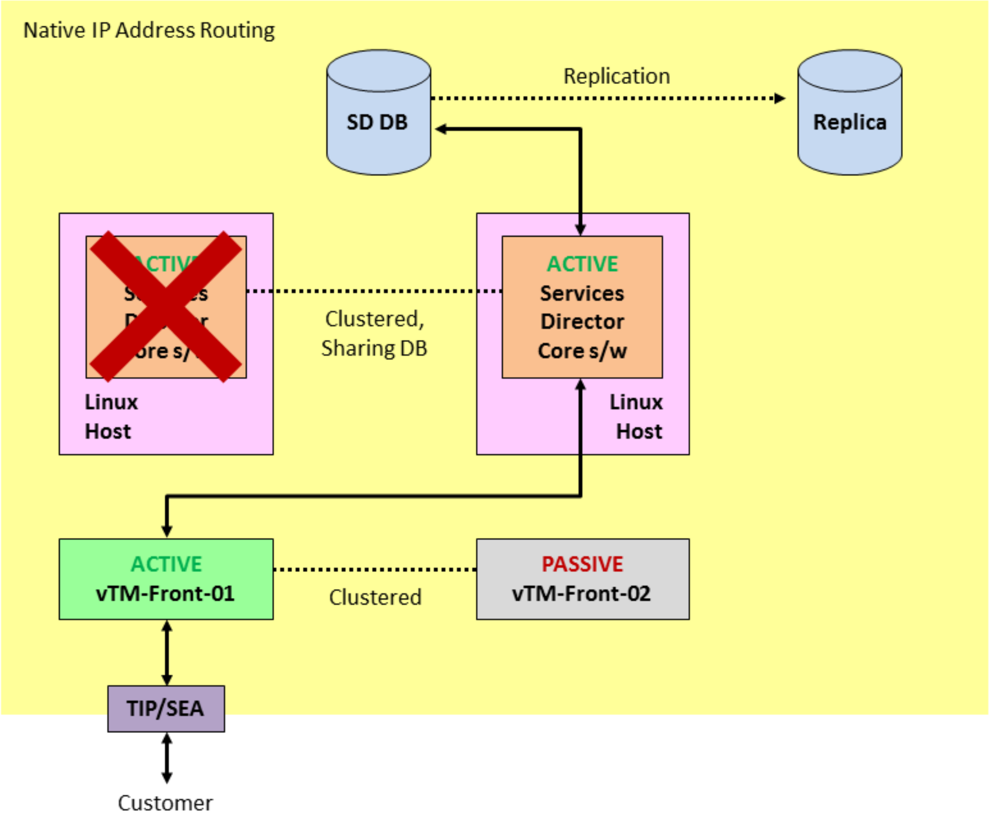
The customer sends a request to the SEA, which reaches the Active vTM. This is routed to the Active Services Director to process the request, and a response is returned to the customer.

The SEA for the clustered Services Director can be in a private network behind a NAT device. However, the vTMs that will be added to the estate of the Services Director at a later stage cannot be behind a NAT.

In this example, both Services Directors are configured to perform licensing, metering and monitoring.

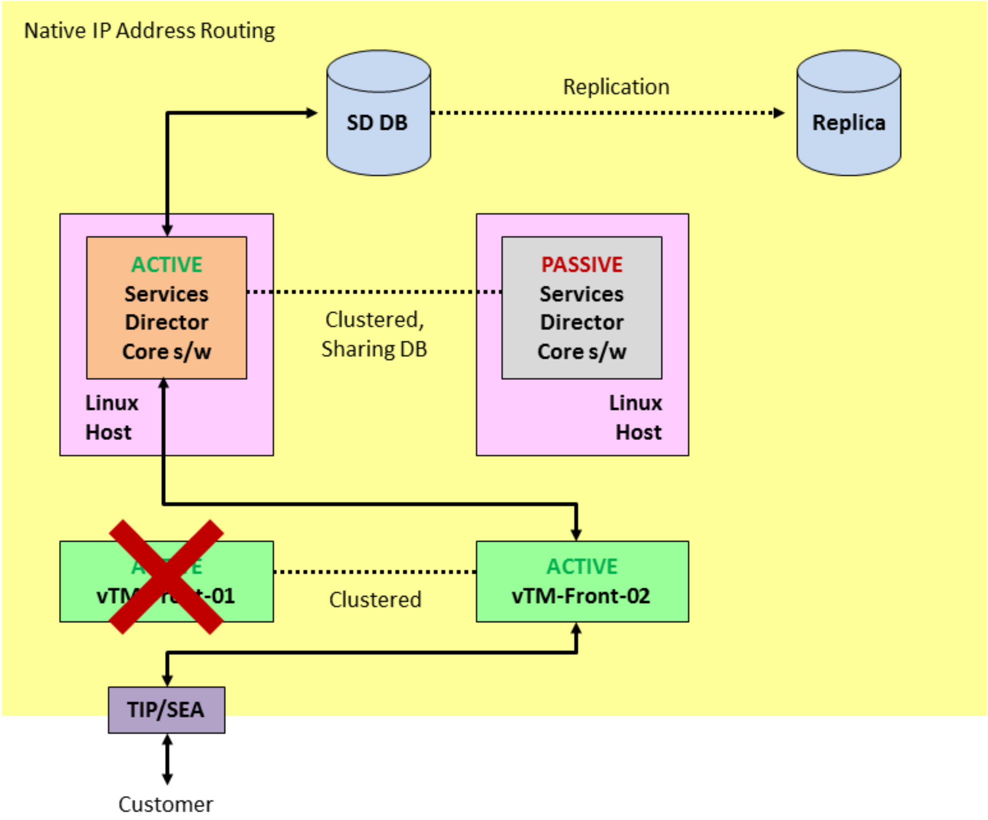
In the event of the failure of the Active Services Director:

- The front-end vTM routes all requests to the Passive Services Director, which becomes the new Active Services Director.
- All requests are routed to the Active Services Director until it fails.
- Licensing, metering and monitoring are performed by the remaining Services Director only.
- The customer continues to manually issue REST API requests to the Services Director using its SEA.



In the event of the failure of the Active front-end vTM:

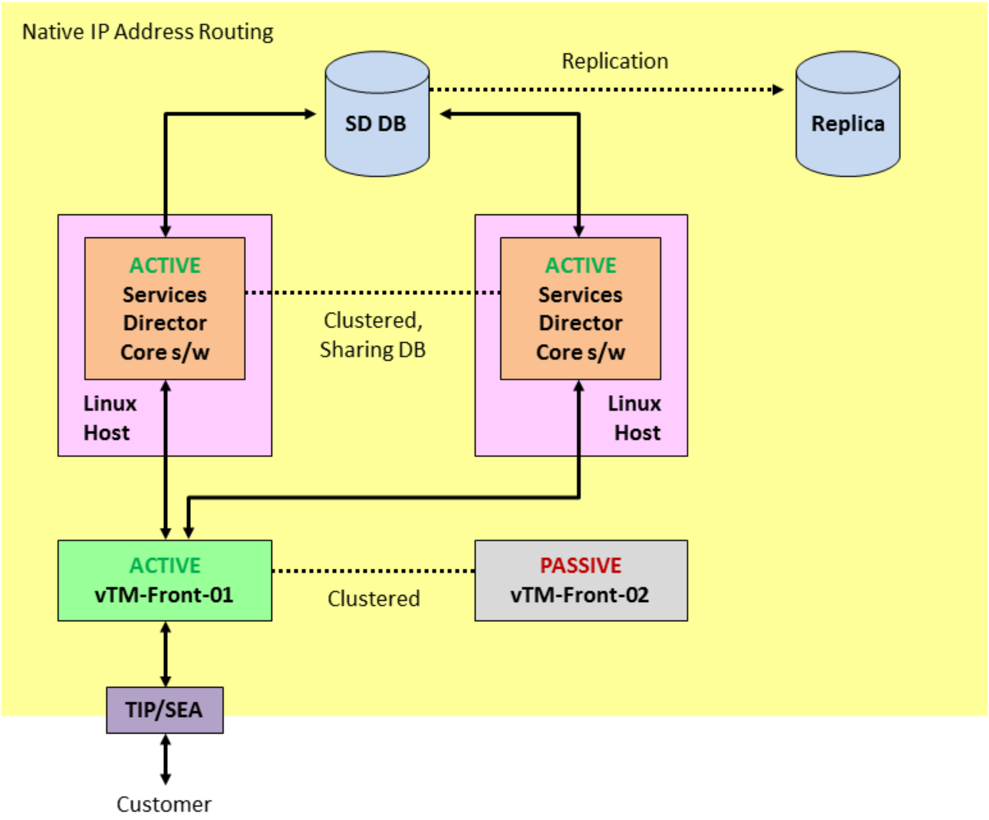
- The Passive front-end vTM becomes the Active front-end vTM. This is configured with the same vServer pools as the failed front-end vTM.
- The new Active front-end vTM raises a TIP, which matches the SEA for the clustered Services Directors.
- The customer continues to manually issue REST API requests to the Services Director using its SEA.
- The new Active front-end vTM continues to route all requests to the Active Services Director.
- Licensing, metering and monitoring on the Services Directors are unaffected.



In the event of a failure of the main Services Director database, manually switch the Services Director configuration to use the replica database. *note:* Depending on database activity and the replication schedule, the replica may be behind the main database; re-apply any lost configuration changes. When the main database becomes available again (or you have replaced it with a new database based on the replica), manually switch the Services Director configuration back, and re-apply any lost configuration changes.

Example Deployment: Multiple Active Services Directors

A network topology with two Active Services Directors is shown below. Additional Active Services Directors can be used if required. Other network topologies are also supported.



In this example, there are:

- Two clustered software form-factor Services Directors, each of which is installed on its own Linux machine.

Additional Services Directors can be added to the cluster if required.

- A MySQL database that is shared by the clustered Services Directors. This database is replicated.
- Two clustered Virtual Traffic Managers (vTMs), which act as a resilient front-end to the Services Directors.
- A known Service Endpoint Address (SEA) for the clustered Services Directors.

- A customer who wants to manually send REST API requests to the clustered Services Directors using the SEA.

Each element of your Services Director installation can be deployed as required within your network, using any combination of virtual machines, physical machines and data centres. Physical diversity of elements (for example, spreading elements across data centres) is likely to increase the resilience of the installation. Technologies allowing routable connections between native IP addresses in disparate networks (for example, Virtual Private Networks) are supported.

In this example, requests are load-balanced between the Services Directors. If one Services Director fails, all requests will be routed to the remaining Services Director. To achieve this configuration, a single vServer and pool is required on the Active front-end vTM. This identifies the management address/ports for both Services Directors, and operates according to the chosen load-balancing algorithm. For example, "round-robin".

A default monitoring mechanism for the pool is provided. This is ping-based, and operates at a machine level. You may choose to replace this with your chosen monitoring mechanism. Refer to the Ivanti, Inc. Virtual Traffic Manager documentation.

The Active front-end vTM raises a Traffic IP (TIP) address, which matches the SEA for the clustered Services Directors.

The customer sends a request to the SEA, which reaches the Active vTM. This is routed to a Services Director according to the chosen load-balancing algorithm. The Services Director processes the request, and a response is returned to the customer.

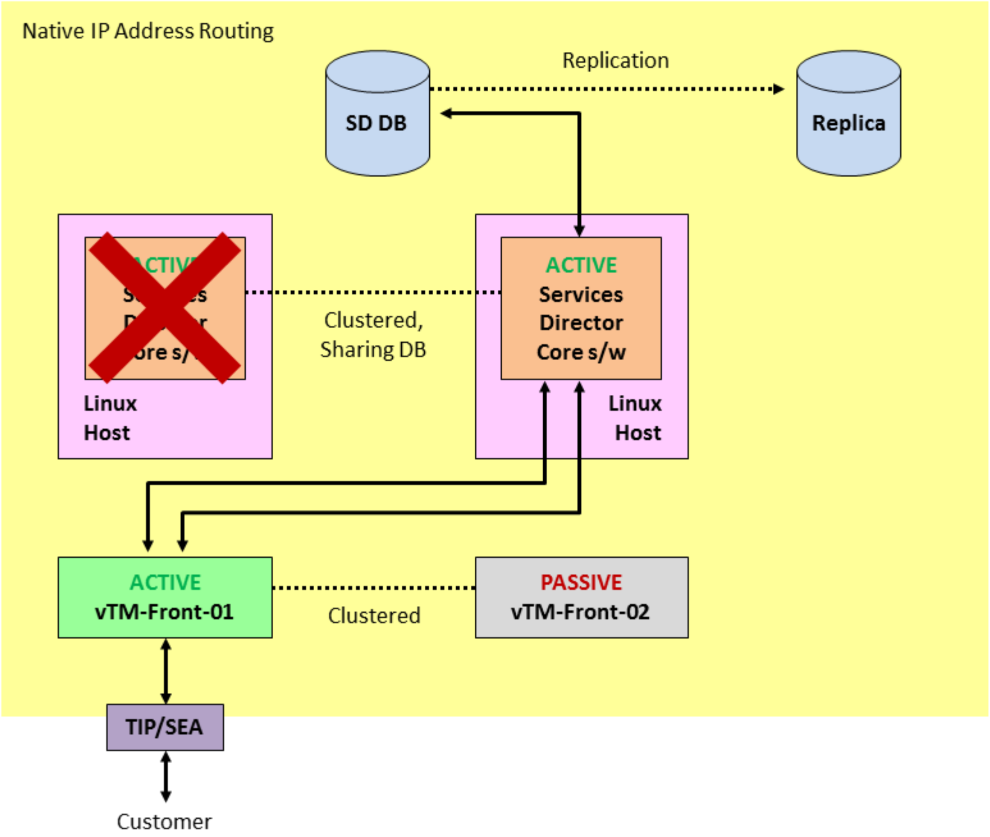
The SEA for the clustered Services Director can be in a private network behind a NAT device. However, the vTMs that will be added to the estate of the Services Director at a later stage cannot be behind a NAT.

In this example, both Services Directors are configured to perform licensing, metering and monitoring.

In the event of the failure of any Services Director:

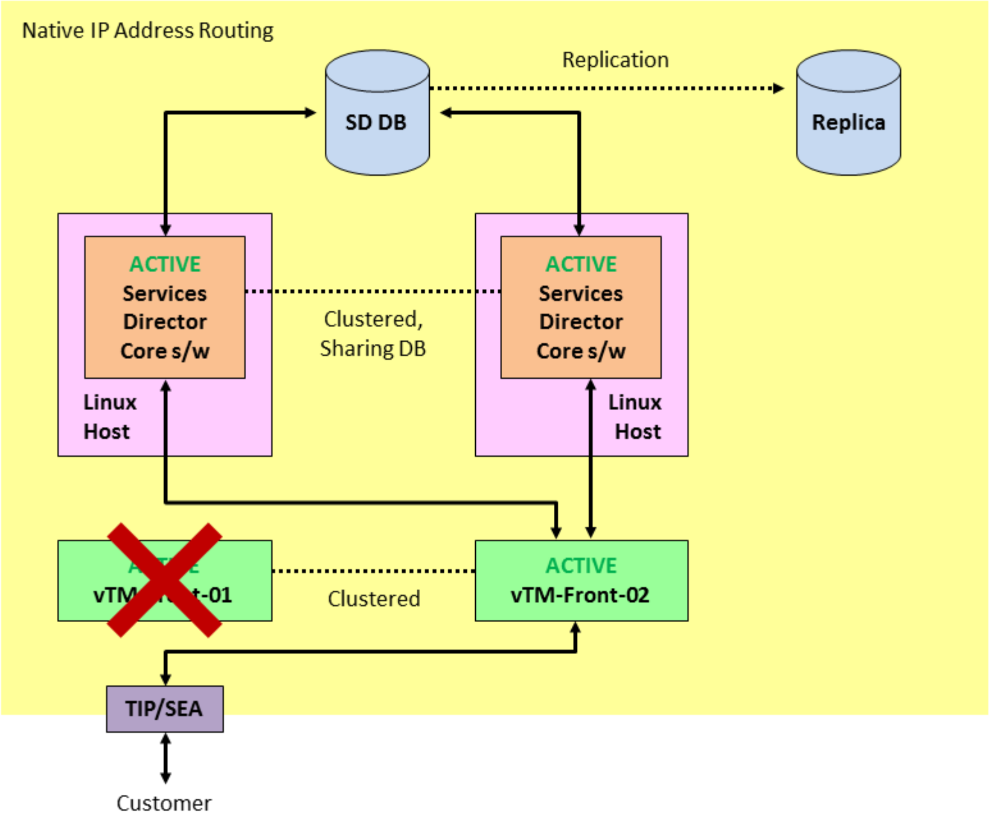
- The front-end vTM routes all requests away from the failing Services Director. In this case, to the other Services Director.
- Licensing, metering and monitoring are performed by the remaining Services Director only.

- The customer continues to manually issue REST API requests to the Services Director using its SEA.



In the event of the failure of the Active front-end vTM:

- The Passive front-end vTM becomes the Active front-end vTM. This is configured with the same vServer pools as the failed front-end vTM.
- The new Active front-end vTM raises a TIP, which matches the SEA for the clustered Services Directors.
- The customer continues to manually issue REST API requests to the Services Director using its SEA.
- The new Active front-end vTM routes all requests to the assigned Services Directors.
- Licensing, metering and monitoring are unaffected.



In the event of a failure of the main Services Director database, manually switch the Services Director configuration to use the replica database. *note:* Depending on database activity and the replication schedule, the replica may be behind the main database; re-apply any lost configuration changes. When the main database becomes available again (or you have replaced it with a new database based on the replica), manually switch the Services Director configuration back, and re-apply any lost configuration changes.

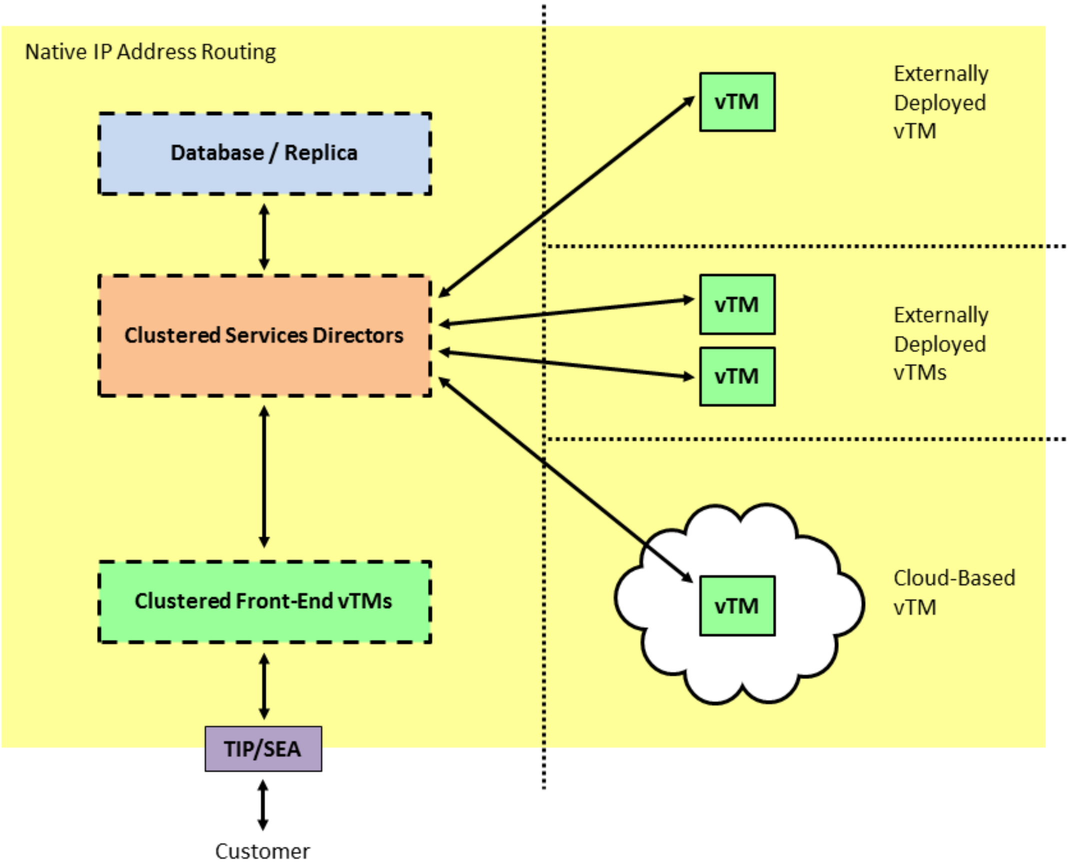
Populating the Estate of the Services Directors

Once your high availability installation is complete, you can start adding vTMs to the estate of the Services Directors. That is:

- Externally-deployed vTMs, see "Registering Externally-Deployed Traffic Managers" on page 109.
- vTMs that are deployed using an instance host, see "Using an Instance Host with a Software Services Director" on page 55.
- Cloud-based vTMs, such as those deployed on AWS.

Cloud-based vTMs are not supported when the Services Director is in a private network behind a NAT device.

For example (using generalisations to represent your chosen Services Director configuration):



You create the required resources using manually-issued REST API requests to the SEA of the Services Directors.

You can use any combination of virtual machines, physical machines and data centers to achieve this. Physical diversity of elements (for example, spreading elements across data centers) is likely to increase the resilience of the installation.

The Services Director and its front-end vTMs can be in a private network behind a NAT device. However, the vTMs that will be added to the estate of the Services Director at a later stage cannot be behind a NAT.

Technologies allowing routable connections between native IP addresses in disparate networks (for example, Virtual Private Networks) are supported.

Disaster Recovery for the Software Services Director

The software form-factor Services Director does not support:

- Scheduled backups of the Services Director configuration.
- Scheduled backups of individual vTM configurations.

If your Services Director installation is lost, you will require the MySQL database (or its replica) to recover the installation. This will enable the Services Director's configuration, including records of all vTMs in its estate, to be recovered.

The master password for the Services Directors is required during any recovery from failure.

The Services Director MySQL database includes:

- Software licenses for the software form-factor Services Directors.
- All information about the vTMs in the estate of the Services Directors, including administration credentials.
- All information for any instance hosts known to the Services Directors.
- Universal FLA licenses for vTMs in your estate.

The Services Director MySQL database does not include:

- Any information about the front-end vTMs; you will need to deploy and configure these manually.
- Any Legacy FLA licenses for older vTMs in your estate.
- Any vTM images that you had loaded to enable vTM deployments using an instance host.

For example, if all of your Services Directors are lost:

- Recreate all elements (and clustering) of your original installation except for the MySQL database.

- Configure the Services Directors to use the existing MySQL database (or its replica). It is recommended that you establish a database replication regime for your chosen database.
- Re-install any Legacy FLA licenses as required.
- Configure the front-end vTMs to match your original installation.
- (Optional) Re-install any instance host and vTM images as required. You must do this before further vTMs can be deployed.

The recovered installation will be broadly similar to your original, but may require specific minor configuration.

Deploying High Availability for the Services Director VA

To create a high availability installation of the Services Director VA, you must:

- Install a Primary and a Secondary Services Director VA. See the Pulse Secure Services Director Getting Started Guide.

ⓘ The Services Director VAs will automatically act as an Active/Standby HA pair, and automatically create the required MySQL database.

ⓘ You must ensure that the master password for the Services Directors is recorded securely. This is required during any recovery from failure, see "Disaster Recovery for the Software Services Director" on the previous page.

- Specify a Service Endpoint Address (SEA) for the HA pair. The Services Director VA is always accessed by its SEA.

ⓘ The SEA for the Services Director HA pair can be in a private network behind a NAT device. However, the vTMs that will be added to the estate of the Services Director at a later stage cannot be behind a NAT.

- (Optional) Add one or more Legacy FLA licenses if required.

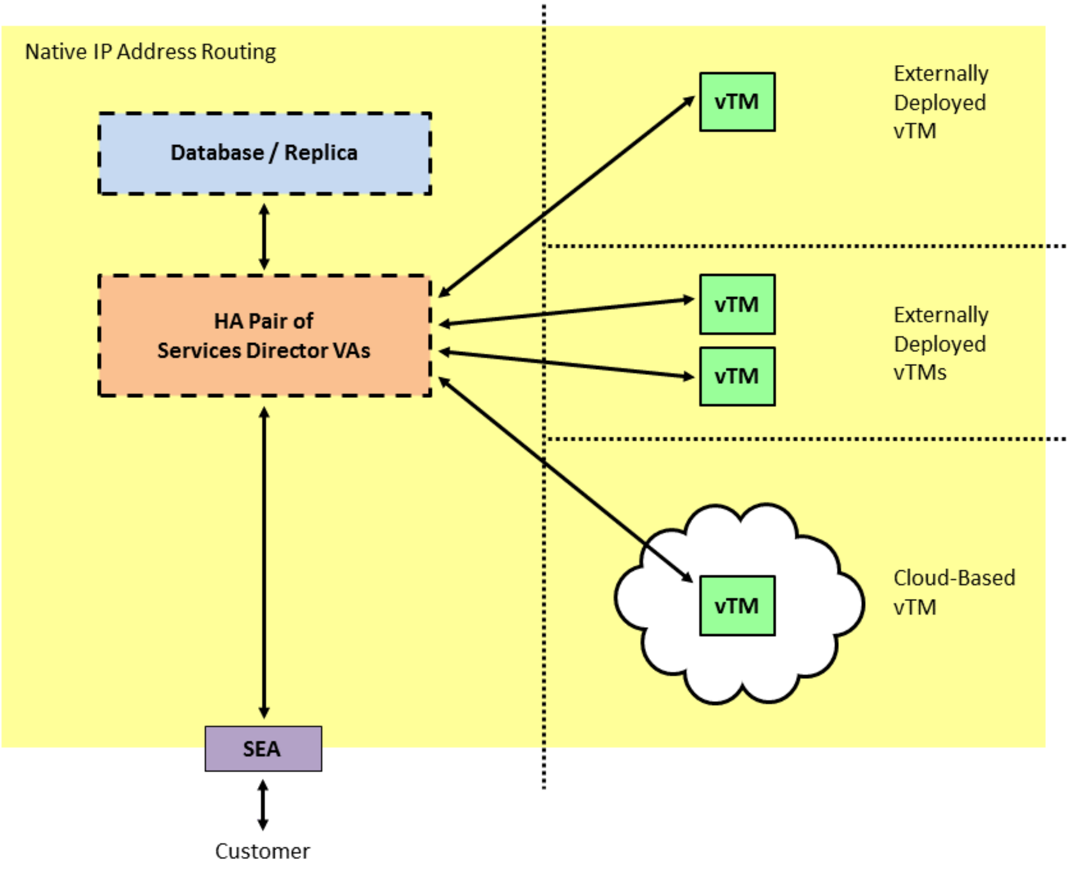
ⓘ Universal FLA licenses are included in the Services Director VA product.

- (Optional) Install an instance host if required.

Your Services Director VAs can be deployed as required within your network. Each element of your Services Director installation must be able to route to each other element using native IP address routing only. The use of Network Address Translation (NAT) between the Services Director and other elements is not supported; technologies allowing routable connections between native IPs in disparate networks (for example, Virtual Private Networks) may be used.

If your Active Services Director VA fails, you must manually failover the Standby Services Director VA so that it becomes Active. The customer continues to access the Services Director VA using its SEA. Once you have performed all repairs, you can revert to the original Services Director VA. See the Pulse Secure Services Director Getting Started Guide.

After you have completed your high availability installation of the Services Director VAs, you can add Traffic Managers to the estate of your Services Directors. As with the Services Director VA installation, physical and virtual diversity is likely to increase the resilience of your estate. For example:



You can create backups for various configurations from the Services Director VA:

- The configuration of the Services Director VA can be backed up automatically to a local or remote location according to a user-defined schedule.
- The configuration of individual vTM clusters can also be backed up automatically according to a user-defined schedule.

  You can use these backups to recreate a Services Director VA installation in the event of a failure.

  For example, if your Services Director installation is lost:

- Create a new Primary Services Director VA, and choose to create it from a backed up configuration.
- Create a new Secondary Services Director VA, connecting it to the recovered Primary.

Do not create this Services Director from a backup; the configuration is automatically retrieved from the Primary Services Director VA.

- Recreate any configuration that is not included in the restore. For example, re-load any required vTM images that were previously used for deployments using an instance host.
- (Optional) Reload any Legacy FLA licenses if required.
- View the vTMs in the estate of the Services Director VA, and ensure they are licensed correctly.
- Recover the configuration of the vTM clusters from their backups.

The master password for the Services Directors is required during any recovery from failure.

The recovered installation will be broadly similar to your original, but may require specific minor configuration.

See the Pulse Secure Services Director Getting Started Guide for details of all processes listed above.

Appendix: Managing the Services Director Using the CLI

Starting the CLI

After you have created the virtual appliance in vSphere, you can administer and manage the Services Director using the CLI or GUI. This chapter describes how to perform configuration tasks using the CLI only.

For the purposes of this chapter, it is assumed that the hostname of your Services Director is amnesiac , and that a DNS server is in place.

Logging in to the CLI

1. Open the Services Director in a Telnet or SSH client program such as PuTTy.
2. Log into the Services Director as an administrator:

```
login as: admin
Ivanti, Inc. Services Director
admin@amnesiac:<password specified in the graphical Setup Wizard>
Last login: Tue Aug 4 10:09:03 2015 from <IP-address>
amnesiac >
```

3. Start configuration mode:

```
amnesiac > enable
amnesiac # configure terminal
amnesiac (config) #
```

You can now enter CLI commands.

Importing the SSL Certificate, Key, and Licenses

If you did not complete licensing using the graphical Setup Wizard (see the Pulse Secure Services Director Getting Started Guide), you must import the following files into the Services Director before you can create instances:

- SSL certificate and key

- Services Director license
- Bandwidth license key
- Legacy FLA license (if you are not using the pre-installed Universal License)
- Traffic Manager images, if required.

If you have not received your license files, contact Ivanti Licensing for assistance.

1. Log into the Services Director and start the CLI. See "Starting the CLI" on the previous page.
2. To import an SSL certificate and key, you must provide the file path to the certificate and key file. For example, an http, ftp, or scp URL (scp://username:password@host/path).

```
amnesiac (config) # ssc import-cert-key scp://username:pwd@sfhost.example.com/sd_
archive/cert_key.pem
Certificate and Private Key imported successfully
amnesiac (config) # show ssc certificate
>>certificate and key is displayed
```

3. To import a Services Director (Enterprise) license, you must provide the file path to the license file. For example, an http, ftp, or scp URL (scp://username:password@host/path).

```
amnesiac (config) # ssc import-lic file scp://username:pwd@sfhost.example.com/sd_
archive/ent-license
License imported successfully
amnesiac (config) # show ssc license-file
XXX-XXXXXXX-XXXX-X-XXXX-XXXX-XXXX
```

4. Import the enterprise bandwidth license key into the Services Director. To do this, provide the license key you obtained from your account representative.

```
amnesiac (config) # ssc license enterprise throughput add XXX-XXXXXX-XXXX-X-XXXX-XXXX-
XXXX
```

Importing a Legacy FLA License

If you intend to use Traffic Managers whose version is below 10.1, or Traffic Managers for which the REST API is disabled, you must now install a Legacy FLA license, and create a license resource for it inside the Services Director.

1. To import a Legacy FLA License (for example fla-ssl-ssc), you must provide the file path. For example, an http, ftp, or scp URL (scp://username:password@host/path).

```
amnesiac (config) # ssc stm import-lic file scp://username:pwd@sfhost.example.com/sd_
archive/fla-ssl-ssc
License imported successfully
amnesiac (config) # show ssc stm license-file
>>the license file is displayed
```

2. To create a license resource:

```
amnesiac (config) # ssc license create license-name fla-ssl-ssc
+--------+--------+
| Field  | Value  |
+--------+--------+
| info   | Active |
| status | Active |
+--------+--------+
```

3. You can confirm that the Services Director process is running:

```
amnesiac (config) # show ssc service
SSC service status: running
```

Importing a Traffic Manager Image

If you want to create and configure Traffic Managers on an external instance host, you must load one or more Traffic Manager images onto the Services Director.

1. You must import the Traffic Manager image (that is, the tarball) and create a version resource for the software image. (For example, stm101.) To import an image, you must provide the file path. For example, an http, ftp, or scp URL (scp://username:password@host/path).

```
amnesiac (config) # ssc stm import-image file scp://root@sf.test.com/sd_
archive/ZeusTM_101_Linux-x86_64.tgz
amnesiac (config) # show ssc stm images
Imported Ivanti, Inc. Traffic Manager Images
----------------------------------------
ZeusTM_101_Linux-x86_64.tgz
```

2. To create a version resource:

```
amnesiac (config) # ssc version create version-name stm101 vfilename ZeusTM_101_Linux-
x86_64.tgz vdirectory ZeusTM_101_Linux-x86_64.tgz
+-------------------+----------------------------+
| Field             | Value                      |
+-------------------+----------------------------+
| info              | Active                     |
| status            | Active                     |
| version_filename  | ZeusTM_101_Linux-x86_64.tgz |
| version_directory | None                       |
+-------------------+----------------------------+
```

Where:

- version-name is a unique name for the Traffic Manager image.
- vfilename is the name of the Traffic Manager image.
- vdirectory is the name of directory to which tarball extracts; if none, specify the tarball name.

To delete an image, run the command: no ssc stm image-file <image name>.

Enabling Passwordless SSH Communication

You must create a public SSH key to enable passwordless communication between the Services Director and an instance host. This SSH key will be used for all instance hosts.

1. In a terminal session for the Primary Services Director, create an SSH public key for the administrator user to perform passwordless communication to the instance host.

```
amnesiac (config) # show ssh client private
No user identities configured.
SSH authorized keys:
amnesiac (config) # ssh client generate identity user root
amnesiac (config) # show ssh client private
User Identities:
     User admin:
>>ssh public and private keys are displayed
```

2. In a terminal session for the instance host (user sscadmin), inject the SSH public key for the Services Director’s admin user into the instance host:

```
$ user root sshkey "ssh-rsa <public_key> admin"
Added public SSH key for user (root)
```

3. Repeat steps 1) and 2) for the Secondary Services Director.

Creating a Feature Pack for Instances

You must create a feature pack in the Services Director before you can create instances. A feature pack describes a set of licensable features that you can apply to a Traffic Manager instance. A feature pack is the same as a SKU or a subset of features in a SKU.

When you deploy or modify a Traffic Manager instance, the feature pack controls what licensable features are allowed (but does not specify bandwidth limits). Creating a feature pack in the Services Director requires you to base the pack on a SKU and to give it a unique name.

```
amnesiac (config) # ssc feature-pack create fpname default-fp stm-sku STM-400
+---------- ----------------+
| Field    | Value          |
+----- ---------------------+
| info     | Active         |
| status   | Active         |
| stm_sku  | STM-400        |
| excluded | None           |
+-----------+---------------+
```

Syntax: **ssc feature-pack create fpname <resource-unique-name> stm-sku <SKU-for-feature-pack>**

Working with User Authentication for a vTM

You can apply user authentication to a vTM from the Services Director VA CLI in two ways:

- During the self-registration of a vTM, see "Working with User Authentication for a vTM" on the next page.
- After registration of the vTM, see "Working with User Authentication for a vTM" on page 274.

Both of these methods require the user authentication resources to already be configured.

Defining User Authentication Using the CLI

1. Create the required authenticator resource using the following CLI commands:

   - **ssc authenticator create ldap**
   - **ssc authenticator create radius**
   - **ssc authenticator create tacacs_plus**

   For a detailed description of authenticator resource properties, see "authenticator Resource" on page 129.

2. Create any required permission_group resources using the following CLI command:

   - **ssc permission-group create**

   For a detailed description of permission_group resource properties, see "permission_group Resource" on page 189.

3. Create an access_profile resource, combining an authenticator with the required permission groups. To do this, use the following CLI commands:

   - **ssc access-profile create**
   - **ssc access-profile add-perm-group**

   For a detailed description of access_profile properties, see "access_profile Resource" on page 122.

   See Pulse Secure Services Director Command Reference for details of all CLI commands.

Working with User Authentication for a vTM

Self-registration is described in the Pulse Secure Services Director Getting Started Guide.

Self-registration requests are generated by the vTM itself, and cannot be created using the CLI.

To change the state of a self-registration request, use the following CLI commands:

- **ssc registration update registration-id <reg-id> state decline reason <reason>**
- **ssc registration update registration-id <reg-id> state blacklist**
- **ssc registration update registration-id <reg-id> state pending**

However, when you transition the request to Accepted, in addition to several extra mandatory parameters, you can also specify the required access profile:

- **ssc registration update registration-id <reg-id> state accept instance-name <name> owner <owner> feature-pack <feature_pack> bandwidth <bandwidth> access_profile <access_profile>**

See the Pulse Secure Services Director Command Reference for details of all commands.

For a detailed description of all registration resource properties, see "registration Resource" on page 199.

Working with User Authentication for a vTM

To apply user authentication to a registered vTM, update the instance resource to include the access_profile property:

```
ssc instance update instance-name <instance_id> access-profile <access_profile>
```

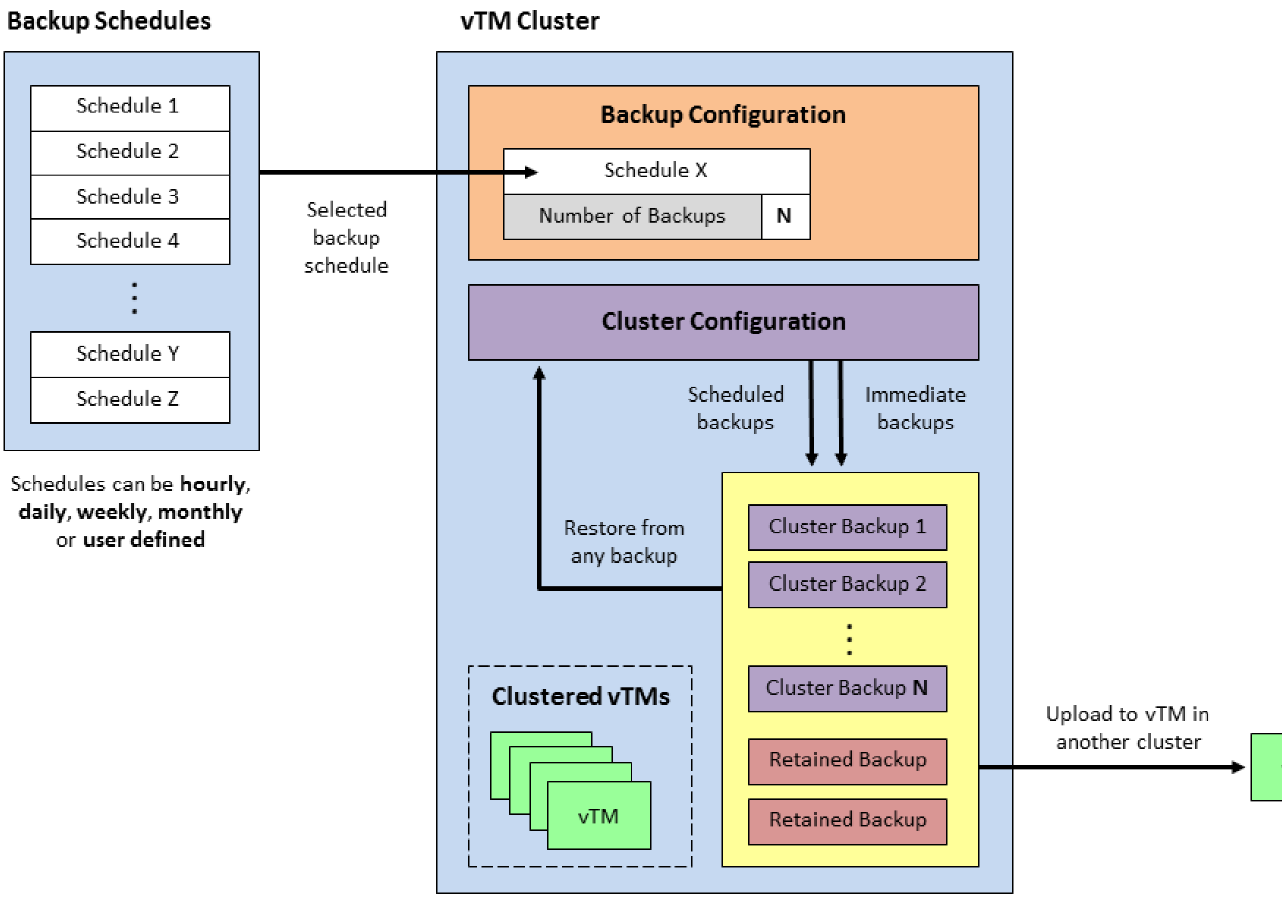
When you do this, the authenticator and permission groups in the access profile are applied to the vTM. Existing authenticators and permission groups may be overwritten, but none will be deleted. All members of a cluster are affected.

Working with Backup Schedules and Cluster Backups

A Traffic Manager cluster gathers Virtual Traffic Managers (vTMs) together and operates them under a shared cluster configuration.

The configuration of the cluster can be backed up automatically on a regular basis according to a backup schedule.

The following provides an overview of automatic cluster backup operations.



See the Pulse Secure Services Director Getting Started Guide for a full description of these workflows.

You can view clusters with the following commands:

- **ssc cluster list** - displays a list of all clusters names.
- **show ssc cluster cluster-name** - displays full details for a specified cluster.

You can create, update and view cluster backup schedules with the following commands:

- **ssc backup vtm-cluster create schedule** - creates a new cluster backup schedule.
- **ssc backup vtm-cluster update schedule** - updates a specified cluster backup schedule.
- **show ssc backup vtm-cluster schedules** - displays a list of all cluster backup schedule names.
- **show ssc backup vtm-cluster schedule** - displays a specified cluster backup schedule.

You can associate a cluster with a cluster backup schedule with the following commands:

- **ssc cluster create cluster-name schedule** - creates a new cluster that is associated with the specified cluster backup schedule.
- **ssc cluster update cluster-name schedule** - updates a specified cluster to associate it with the specified cluster backup schedule.

You can view cluster backups with the following commands:

- **show ssc backup vtm-cluster cluster-name backups** - displays a list of all backup names for a specified cluster.
- **show ssc backup vtm-cluster cluster-name backup-name** - displays a specified backup.

You can perform manual cluster backup operations with the following commands:

- **ssc backup vtm-cluster cluster-name backup now** - this requests an immediate manual backup for a cluster.
- **ssc backup vtm-cluster cluster-name restore backup-name** - this requests a restore to a specified cluster of a specified backup.
- **ssc backup vtm-cluster cluster-name upload backup-name** - this requests an upload of a specified backup to a specified Traffic Manager instance.

Each of these commands creates a backup task. You can view tasks and re-attempt failed tasks with the following commands:

- **show ssc backup vtm-cluster cluster-name tasks** - displays a list of all task IDs for a specified cluster.
- **show ssc backup vtm-cluster cluster-name task** - displays a specified task.
- **ssc backup vtm-cluster cluster-name task retry** - re-attempts a failed specified task.

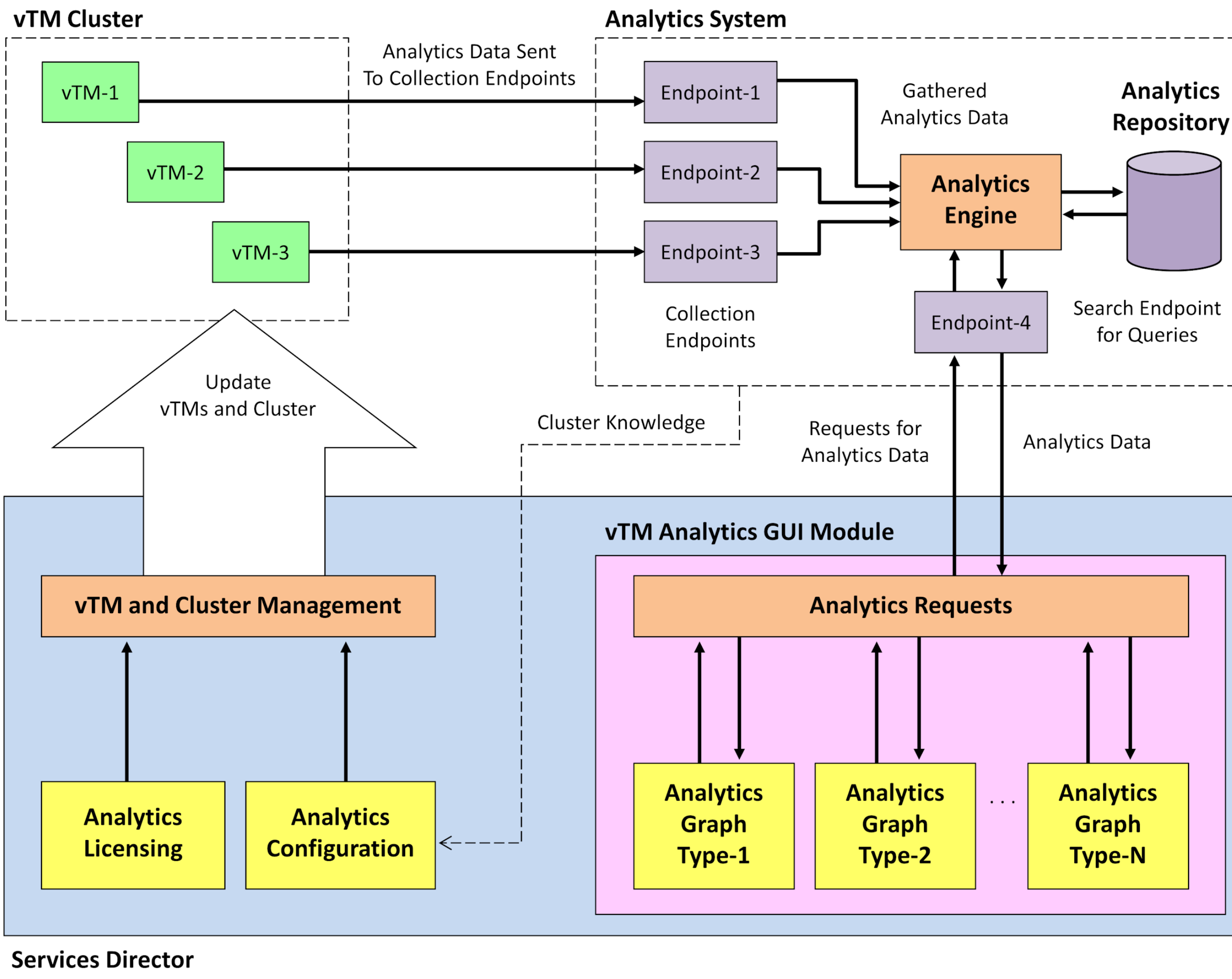
For full details of all commands, refer to the Pulse Secure Services Director Command Reference.

Working with vTM Analytics

Services Director supports the configuration and implementation of analytics on a cluster of externally-deployed Virtual Traffic Managers (vTMs).

Each Pulse Secure Virtual Traffic Manager at version 17.2 or later supports vTM Analytics. vTM Analytics enables a vTM to send operational data to an Analytics System. This cluster can then be queried by the Services Director, which can then display tailored graphical reports about the vTMs in its estate.

The vTM Analytics process proceeds as follows:



See the Pulse Secure Services Director Getting Started Guide for a full description of these workflows.

On the Services Director, you create:

- Collection Endpoints and a single Search Endpoint that record the interfaces to your Analytics System. In the Command Line Interface, use the following commands:

  - **show ssc search-endpoint**
  - **show ssc collection-endpoint**
  - **ssc search-endpoint list**
  - **ssc collection-endpoint list**
  - **ssc search-endpoint create**
  - **ssc collection-endpoint create**
  - **ssc search-endpoint delete**
  - **ssc collection-endpoint delete**
  - **ssc search-endpoint update**
  - **ssc collection-endpoint update**
- Log Export Types to define the files and transaction data that will be exported. In the Command Line Interface, use the following commands:
  - **show ssc log-export**
  - **ssc log-export list**
  - **ssc log-export create**
  - **ssc log-export delete**
  - **ssc log-export update**
- An Analytics Profile collects the Log Export Types that are required on your vTM cluster. In the Command Line Interface, use the following commands:
  - **show ssc analytics-profile**
  - **ssc analytics-profile list**
  - **ssc analytics-profile create**
  - **ssc analytics-profile delete**
  - **ssc analytics-profile update**

You can then apply an Analytics Profile to the vTM cluster from your Services Director. This configures all vTMs in the vTM cluster to communicate with your Analytics System using the provided interfaces, and starts the export of the specified files and transaction data.

In the Command Line Interface, use the following commands to view and update your *Discovered* vTM cluster to include an Analytics Profile. This will initiate the automatic configuration of the vTMs in your cluster.

- **show ssc cluster cluster-name**
- **ssc cluster list**
- **ssc cluster update cluster-name**

For full details of all commands, refer to the Pulse Secure Services Director Command Reference.

Exporting a Database

To export the MySQL inventory database from the CLI:

```
ssc database local db-file export
```

The name of the exported database file is chosen automatically, using the following format:

```
sscdb_dump_<VA_version>_<timestamp>.sql
```

Generating a Self-Signed SSL Server Certificate

The Services Director is commonly deployed using self-signed certificate/key pairs, using the self-signed server certificate in the Legacy FLA License. Ivanti recommends that you do not use a CA-signed certificate.

The Setup Wizard enables you to generate a self-signed certificate. However, you can choose to generate a self-signed SSL certificate before starting the Setup Wizard. To do this, at the Linux prompt, enter:

```
$ openssl req -x509 -nodes -newkey rsa:2048 -keyout key.pem -out cert.pem -days 3650
```

Parameter	Description
req	Specifies an X509 certificate signing request management.
-x509	Specifies a self-signed certificate rather than a certificate request.
-nodes	Specifies that the private key will not be encrypted (otherwise, the server needs a password to start).
-newkey rsa:2048	Generates a new certificate request and sets the key size.
-keyout key.pem	Sets the target for the new private key.
-out cert.pem	Sets the target for the certificate.
-days 3650	Specifies the duration of the certificate (default is 30 days). A longer period may be desirable as a fresh FLA license will need to be generated and then deployed to all STM instances when the certificate expires.

The FLA license does not accept composite certificates that include a server certificate along with other information or certificates created by ssh-keygen.

Verify the SSL Certificate

1. At the Linux prompt, enter:

```
$ openssl x509 -in certificate.crt -noout
```

This command either succeeds silently for a valid certificate, or reports errors.

2. To verify a signed certificate, enter:

```
$ openssl verify <certificate name>
```

Generating Metering Logs

To extract metering logs using the Services Director VA CLI, use the following command:

```
amnesiac (config) # ssc log metering generate [backup [yes|no]]
```

In this example, the backup switch indicates whether to regenerate all logs up to the most recent log generation. Any new logs since the most recent log generation will always be included. A maximum of ten metering logs can be generated by this process.

To generate metering logs using the Services Director VA, see the Pulse Secure Services Director Getting Started Guide.

Accessing the Operating System Shell

The operating system shell is available so that you can issue commands.

Once you have accessed the operating system shell, the **OS Shell** function is automatically enabled in the Services Director VA GUI. This cannot be disabled once enabled.

1. Connect to the CLI:

```
login as: admin
Pulse Services Director
admin@10.62.167.199's password:
Last login: Tue Sep 11 09:43:12 2016 from 10.62.134.242
amnesia > enable
amnesia # configure terminal
amnesia (config) #
```

2. Start the OS shell:

```
amnesia (config) # _shell
[admin@amnesia ~]#
```

You are now in the operating system shell.

3. To exit the OS shell, type ctrl + D.

Appendix: Email Notifications Generated By Services Director

Notifications/Alerts from the Services Director Core Software

The following notifications are generated from the core Services Director software. They are common to both the software-only and VA form factors of Services Director.

Only email subject lines are shown. Email bodies will normally contain further detail related to the reason for the notification/alert.

Functionality	Area Email Subject Line	Event Description
Licensing	Ivanti Services Director: License is due to expire on <Services Director host>	Sent on a daily basis when a Services Director controller license is due to expire within the license expiry warning period (this warning period is configurable, but defaults to 30 days).
	Ivanti, Inc. Services Director: Required bandwidth/add-on pack is due to expire on <Services Director host>	Sent on a daily basis when a Services Director bandwidth pack license is due to expire within the bandwidth license expiry warning period (this warning period is configurable, but defaults to 30 days).
Monitoring	Ivanti, Inc. Services Director Monitoring has detected <failure / recovery events>	Sent as a result of monitoring detecting that connectivity to vTM instances or Services Director controllers have either failed or recovered after a failure.

Functionality	Area Email Subject Line	Event Description
vTM Self-Registration	Instance <Instance name> has registered itself and requires your attention.	Sent when a self-registering instance has sent a registration request that the Services Director Administrator may wish to manually accept.
	Instance <instance name> has re-registered itself and requires your attention.	Sent when a self-registering instance has been declined but has attempted to self-register again with different parameters.
	Instance <instance name> has registered itself and was auto-accepted by policy <policy name>	Sent when a self-registering instance has been received by Services Director, and automatically accepted by an auto-acceptance policy.
	Instance <instance name> registered itself and failed to be auto-accepted by <policy name>	Sent when a self-registering instance has been received by Services Director, but for some reason failed to be automatically accepted by an auto-acceptance policy.
Metering	Services Director: Metering Warnings have been found for instances on <Services Director host>	Sent periodically if potential metering discrepancies are identified.
	Ivanti, Inc. Services Director: Log space low on <Services Director host>	Sent periodically if available log space has dropped below 512 MB (the period is configurable, but set to one hour by default).
	Ivanti, Inc. Services Director: Log space critical on <Services Director host>	Sent periodically if available log space has dropped below 256 MB (the period is configurable, but set to one hour by default).
	Metering phone-home successful	Sent to confirm that Services Director has successfully sent a set of metering logs back to Ivanti, Inc..
	Metering phone-home failure	Sent if Services Director has been unable to send a set of metering logs back to Ivanti, Inc..

Notifications/Alerts from the Services Director VA

The following notifications are sent from the Services Director VA. These are in addition to those sent from the Core software.

ⓘ Only email subject lines are shown. Email bodies will normally contain further detail related to the reason for the notification/alert.

Event Description	Functionality	Area Email Subject Line
Local Services Director Process Failure (Killed or Crashed)	Services Director service	Local Services Director Failure Notification
Local Services Director Process Recovery		Local Services Director Recovery Notification
Local DB Failure	Database	Local Database Failure Notification
Local DB Recovery		Local Database Recovery Notification
Peer Services Director Failure	High Availability	Peer Services Director Connectivity Failure Notification
Peer Services Director Recovery		Peer Services Director Connectivity Recovery Notification
Local Gluster Failure		Local File System Replication Failure Notification
Local Gluster Recovery		Local File System Replication Recovery Notification
Services Director Backup Generation Failure	Disaster Recovery	Backup Generate Operation Failure Notification
Services Director Backup Generation Recovery		Backup Generate Operation Recovery Notification
Services Director Backup Transfer Failure		Backup Transfer Operation Failure Notification
Services Director Backup Transfer Recovery		Backup Transfer Operation Recovery Notification

Event Description	Functionality	Area Email Subject Line
Master Password Missing	Master Password	Master password Operation Failure Notification
Master Password Recovery		Master password Operation Recovery Notification
Crash Core Generated	System	Core file found for process: <Process Name>
High CPU Usage		CPU utilization too high
High CPU Usage Recovery		CPU utilization alarm clearing
Paging Alarm		Paging activity too high
Paging Alarm Cleared		Paging activity alarm clearing
File Systems Mount Failures		File System %s is full
File System Mount Recovery		File System %s is no longer full
Link State		Linkstate alarm triggered
Link State Cleared		Linkstate alarm cleared
Link Duplex		Link duplex alarm triggered
Link Duplex Clear		Link duplex alarm cleared
Link IO Errors		Link I/O errors alarm triggered
Link IO Errors Recovery		Link I/O errors alarm cleared
Memory Error		Memory Error Detected
Memory Error Cleared		Memory error alarm cleared
Unexpected Shutdown		Unexpected shut down
Secure Vault Locked		Secure vault must be unlocked
Secure Vault Unlocked		Secure vault has been unlocked
Process Crash		Process failure: %s
Process Unexpected Exit		Process exit: %s