Pulse Secure Virtual Traffic Manager: Configuration Importer Guide

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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.

Convention	Description
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.

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.

Attention

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

Caution

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 Support Center. If you have a support contract, file a ticket support.

- Product warranties—For product warranty information, visit https://forums.ivanti.com/s/contactsupport?language=en_US/product-service-policies/

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

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

- Search the Knowledge Center for technical bulletins and security advisories: https://forums.ivanti.com/s/searchallcontent?language=en_US#t=KNOWLEDGE%20BASE&sort=relevancy
- Ask questions and find solutions at the Ivanti Community online forum: https://forums.ivanti.com/s/?language=en_US

Opening a Case with Support

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

- Use the Case Management tool in the support at https://forums.ivanti.com/s/contactsupport?language=en_US.

For international or direct-dial options in countries without toll-free numbers, see https://forums.ivanti.com/s/contactsupport?language=en_US

Introduction

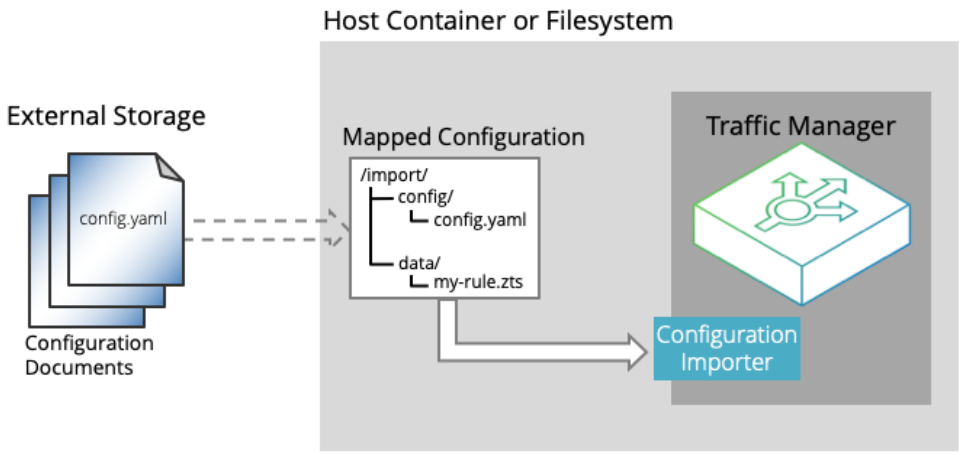
This chapter introduces the Pulse Secure Virtual Traffic Manager (the Traffic Manager) *Configuration Importer* tool.

About the Configuration Importer

The Configuration Importer is a tool that accepts administrator-supplied *configuration documents* and imports the configuration described in those documents into the Traffic Manager, replacing its previous running configuration. Configuration documents are intended to define the entire Traffic Manager configuration.

Configuration documents are typically stored in a system external to the Traffic Manager, and mounted or mapped into the Traffic Manager host's file system such that the Configuration Importer can read them.

The Configuration Importer supports two primary modes of operation:



- A one-time import
- Full configuration management

To learn more about both modes of operation, read the remainder of this chapter.

About the Configuration Importer

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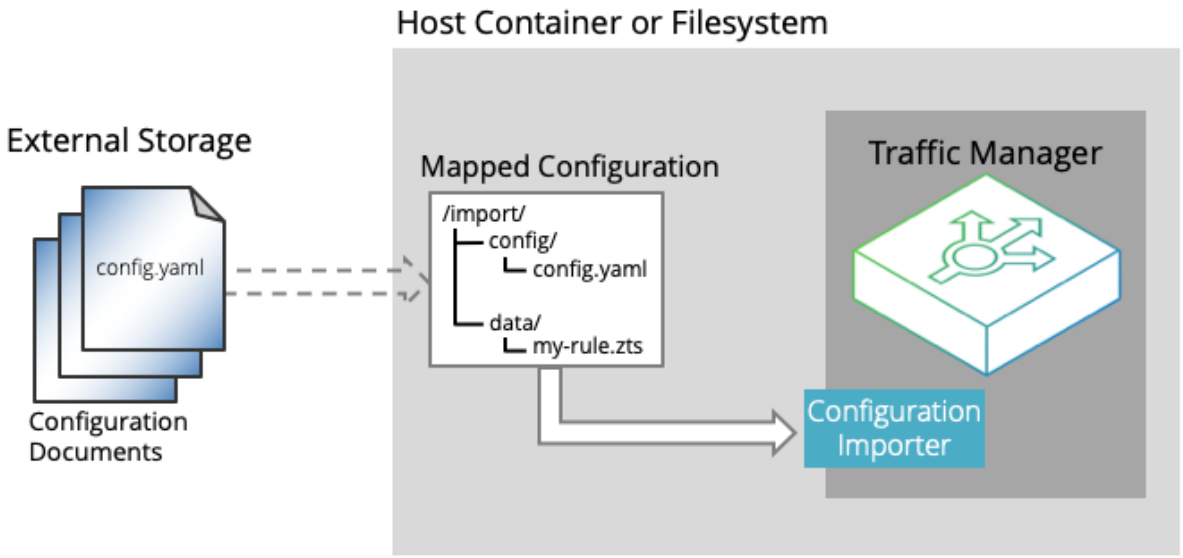


- A one-time import
- Full configuration management

To learn more about both modes of operation, read the remainder of this chapter.

One-Time Import

The Configuration Importer tool can initialize or reset a Traffic Manager's configuration to a pre-defined state in a single operation. This is known as a one-time import.

An administrator or orchestration tool (such as Docker or Kubernetes) might use a one-time import to deploy and configure a Traffic Manager in a single step. For example, a Traffic Manager Docker container can be deployed in a fully configured state from a single "docker run" command.

The one-time import can also be used to reset a running Traffic Manager's configuration to a specific state.

Full Configuration Management

The Traffic Manager can use the Configuration Importer tool for fully-managed configuration updates, where the Traffic Manager monitors mapped configuration documents and automatically updates its configuration when a change is detected.

In this mode of operation, the configuration documents become the primary definition of the entire Traffic Manager configuration. The Configuration Importer detects whenever the primary configuration documents change and automatically updates the Traffic Manager configuration accordingly.

Instead of making iterative sequential changes through the Traffic Manager's Admin UI or APIs, an administrator makes changes by editing the configuration documents to the desired new state.

This externally-maintained declarative configuration is often appropriate for environments that use automated deployment and orchestration tools. If a Traffic Manager needs to be destroyed and re-created, the information needed to recreate its configuration is not lost because the primary copy is held in an external location.

Configuration documents can be stored in, and deployed from, a version control system supporting a DevOps style of working that reduces the need for direct interaction with individual Traffic Manager instances.

Basic Usage

This chapter provides an overview of how to use the Configuration Importer.

Introducing Configuration Documents

Configuration documents describe Traffic Manager configuration in a syntax that allows an administrator to create, read, alter, and maintain configuration definitions within version control systems. The configuration is expressed in either YAML (YAML Ain't Markup Language) or JSON (JavaScript Object Notation) format, based upon the REST API schema defined in the *Pulse Secure Virtual Traffic Manager: REST API Guide*.

The following example configuration document describes a simple Traffic Manager configuration, containing a single virtual server and a TrafficScript rule, in both YAML and JSON formats:

example-config.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: discard
      request_rules: [ basic-
response ]

rules:
- name: basic-response
  content: |
    http.sendResponse("200 OK",
"text/plain",       "Hello
World\n",
      "X-Served-By: Ivanti vTM");
```

example-config.json

```
{
  "version": 6.1,
  "virtual_servers": [
    {
      "name": "example-service",
      "properties": {
        "basic": {
          "enabled": true,
          "port": 80,
          "protocol": "http",
          "pool": "discard",
          "request_rules": [
            "basic-response"
          ]
        }
      }
    }
  ],
  "rules": [
    {
      "name": "basic-response",
```

example-config.yaml	example-config.json
	<pre>"content": "http.sendResponse (\"200 OK\", \"text/plain\", \"Hello World\\n\", \"X-Served-By: Ivanti vTM\");\n" }] }</pre>

Configuration documents have a few key differences to the REST API format. The following table lists some key concepts and a comparison of how they are implemented in configuration documents and the REST API:

Concept	Configuration Documents	REST API
Configuring Multiple Objects	A configuration document can describe many resources of different types together in a single document.	Each object has its own API endpoint. Multiple API calls are needed to configure multiple objects.
Unstructured Resources	The content for unstructured resources, such as TrafficScript rules, is expressed inline in the "content" field.	The resource is uploaded to the object's API endpoint with a content-type of "octet-stream" instead of JSON.
Declarative VS Imperative	Configuration documents express the desired state of the Traffic Manager in its entirety.	REST API calls make incremental changes to the existing configuration.

For a more detailed description of the differences between configuration documents and the REST API, see Comparison with the REST API.

To learn more about YAML, see www.yaml.org. To learn more about JSON, see www.json.org.

Structuring Configuration Documents for Import

The Configuration Importer runs from a base directory and looks for configuration documents in a subdirectory named "config". Other supporting files and directories can be added to the base directory and referenced from the configuration documents. For more details on referencing external files from within configuration documents, see Object References.

The following is an example directory structure:

```
/import/
├── config/
|   ├── configuration-document-1.yaml
|   ├── configuration-document-2.yaml
|   ...
├── data/
|   ├── my-rule.zts
|   └── catalog.json
├── secrets/
|   └── db-password
└── tls/
    └── example-service/
        ├── tls.key
        └── tls.crt
```

When the Configuration Importer is fully managing the configuration, changes to any files under the base directory result in the Traffic Manager's configuration being updated.

The base directory must be visible in the file system of the Traffic Manager. The Configuration Importer expects that the contents of the directory are populated from an external system; for example, being mounted or mapped into the Traffic Manager's filesystem from a persistent volume, or pulled from an external repository.

One-time Configuration Import Example

The following example shows how to perform a one-time configuration import within Docker, and additionally how to invoke the Configuration Importer on standard deployments.

Save the following sample YAML configuration document as the file "./import/config/example-config.yaml":

example-config.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: discard
      request_rules: [ basic-response ]

rules:
- name: basic-response
  content: |
    http.sendResponse("200 OK", "text/plain", "Hello World\n", "X-Served-
By: Ivanti vTM");
```

Example Docker Deployment

When deploying the Traffic Manager container, mount the "import" directory as a volume and specify the mount path in the ZEUS_BASE_CONFIG environment variable. After installing the Traffic Manager, the container's startup script searches for configuration documents within the "config" subdirectory of the mounted volume and performs a one-time import of the configuration documents contained there.

To deploy a fully configured Traffic Manager inside a Docker container, use the following command:

```
# Assumes the sample configuration document is saved as
# /import/config/example-config.yaml

docker run --name=vtm-config-example \
            -v `pwd`/import:/import \
            -p 8080:80 \
            -p 9090:9090 \
            -e ZEUS_BASE_CONFIG=/import \
            -e ZEUS_EULA=accept \
            -e ZEUS_PASS=admin \
            --privileged \
```

```
--init \
-t \
-d \
pulsesecure/vtm:<version>
```

The above example launches a Traffic Manager container named "vtm-config-example" that is populated with the configuration specified in "/import/config/example-config.yaml". To verify that the deployment was successful, make an HTTP request to port 8080 on your Traffic Manager's primary IP address or hostname. This should result in a "Hello World" response.

To see that the configuration has been correctly applied, access the Administration Interface (Admin UI) of the Traffic Manager instance on port 9090.

Example for Standard Deployments

Standard software or virtual appliance deployments of the Traffic Manager include the Configuration Importer tool as standard, but without built-in support for invoking it at install time.

An administrator can invoke the Configuration Importer manually from the command-line using the following command:

```
# Assumes the sample configuration document is saved as
# /import/config/example-config.yaml

$ZEUSHOME/zxtm/bin/config-import --chdir /import ./config
```

In this example, the Configuration Importer uses "/import" as its base directory and imports the configuration specified in any documents found in the "/import/config" directory.

Fully Managed Configuration Example

The following example shows how to use the Configuration Importer to fully manage a Traffic Manager's configuration within Docker, and additionally how to invoke the Configuration Importer on standard deployments.

The example given here uses the same sample YAML configuration document shown in the one-time import example, saved at the same filesystem location: "./import/config/example-config.yaml".

Example Docker Deployment

When you deploy a Traffic Manager container, mount the import directory as a volume and specify the mount path in the ZEUS_WATCHED_CONFIG environment variable. After installing the Traffic Manager, the container imports the configuration documents stored in the "config" subdirectory of the mounted volume. The Configuration Importer continuously watches for changes in the ZEUS_WATCHED_CONFIG directory and automatically imports the updated configuration when such a change is detected.

To deploy a fully configuration-managed Traffic Manager inside a Docker container, use the following command:

```
# Assumes the sample configuration document is saved as
# /import/config/example-config.yaml

docker run --name=vtm-config-example \
            -v `pwd`/import:/import \
            -p 8080:80 \
            -p 9090:9090 \
            -e ZEUS_WATCHED_CONFIG=/import \
            -e ZEUS_EULA=accept \
            -e ZEUS_PASS=admin \
            --privileged \
            --init \
            -t \
            -d \
            pulsesecure/vtm:<version>
```

The above example launches a Traffic Manager container named "vtm-config-example" that is populated with the configuration specified in the watched directory (in this case, "/import/config/example-config.yaml"). To verify that the deployment was successful, make an HTTP request to port 8080 on your Traffic Manager's primary IP address or hostname. This should result in a "Hello World" response.

To see that the configuration has been correctly applied, access the Administration Interface (Admin UI) of the Traffic Manager instance on port 9090.

Next, edit "./import/config/example-config.yaml" and change the rules section to:

```
rules:
- name: basic-response
  content: |
```

```
    http.sendResponse("200 OK", "text/plain", "Hello New World\n",
"X-Served-By: Ivanti vTM");
```

Observe that the configuration has been updated by making a further HTTP request to port 8080, which should now return "Hello New World".

Example with Standard Deployments

To watch for changes to configuration documents with software or virtual appliance deployments, use the "watch-directory" tool supplied with the Traffic Manager. Specify the directory to watch, followed by the command to run when any files in the directory change.

To watch for changes in the "/import" directory, and then apply those changes, run the following command:

```
$ZEUSHOME/zxtm/bin/watch-directory /import --
$ZEUSHOME/zxtm/bin/config-import \
--chdir /import ./config
```

Object References

To dynamically fetch and include configuration values from external files into your configuration documents, use the "valueFrom" construct. Use this mechanism to store items such as TrafficScript rules and SSL certificates outside the main configuration document in their native format.

For example, a TrafficScript rule can be extracted into a separate file and accessed through "valueFrom", as follows:

/import/data/hello-world.zts

```
http.sendResponse("200 OK", "text/plain", "Hello New World\n", "X-Served-
By: Ivanti vTM");
```

/import/config/example-config.yaml

```
version: 6.1

virtual_servers:
```

/import/config/example-config.yaml

```
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: discard
      request_rules: [ basic-response ]

rules:
- name: basic-response
  content:
    valueFrom:
      fileRef:
        name: data/hello-world.zts
```

For more details on how to reference external data from configuration documents, see Object References.

Troubleshooting

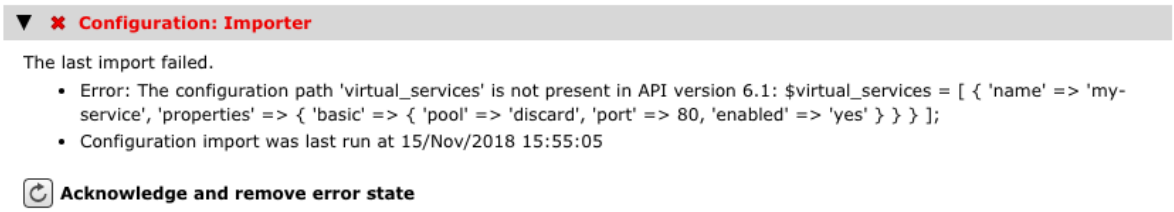
Syntax Errors

The Configuration Importer tool checks the syntax of configuration documents as they are processed. If there are syntax errors in any configuration document, the Configuration Importer detects them and reports an error in the container logs without changing the Traffic Manager's configuration.

The Traffic Manager also displays this error on the Diagnose page of the Admin UI.

To dismiss a reported import error and return the Traffic Manager to a normal running state, click **Acknowledge and remove error state**. An error is cleared automatically if a subsequent successful import occurs.

To view import error details when applying configuration to a Docker container, view the container logs.



For example, for a container named "vtm-config-example", run the command:

```
docker logs vtm-config-example
```

In this example, the configuration document incorrectly refers to "virtual_services" instead of "virtual_servers".

```
Removing inactive config 'conf_B'
Creating new config 'conf_B' from snapshot
Error: The configuration path 'virtual_services' is not present
in API version 6.1:
$virtual_services = [
                     {
                       'name' => 'my-service',
                       'properties' => {
                                         'basic' => {
                                                      'pool' => 'discard',
                                                      'port' => 80,
                                                      'enabled' => 'yes'
                                                    }
                                       }
                     }
                   ];
```

Semantic Errors

If a configuration document contains semantic errors such as a required setting not being present, the Configuration Importer continues to import the configuration to the Traffic Manager with an error shown in the import log. The Traffic Manager also shows a configuration error in the event log and Diagnose page.

To check if the configuration was applied as you expected, see the Configuration Importer log after you trigger an import:

Ivanti recommends frequently checking the Traffic Manager's event log and Diagnose page to ensure your configuration has been deployed correctly.

```
Removing inactive config 'conf_B'
Creating new config 'conf_B' from snapshot
Creating /usr/local/zeus/zxtm/conf_B/vservers/foo
Set 'conf_B' as the active configuration
There are configuration errors:
SERIOUS vservers/foo                    port
Required config key 'port' is missing
Tags: confrequired
```

Audit Logs

Successful and unsuccessful import attempts are logged to the Traffic Manager's Audit Log.

	Timestamp	User	Group	Auth	IP	Description
✔	15/Nov/2018:16:01:45 +0000	root	root	console	-	Config import completed successfully
✔	15/Nov/2018:16:01:45 +0000	root	root	console	-	File added: **vservers/my-service**
✔	15/Nov/2018:16:01:44 +0000	root	root	console	-	User initiated a config import: **config**

Relationship to Other Configuration Interfaces

The Traffic Manager has a number of other configuration interfaces, such as the Admin UI, the REST API, the CLI, and the SOAP API. All of these mechanisms rely on the Traffic Manager being deployed and then iteratively configured until it is in the desired state.

When fully managing the configuration of your Traffic Manager, the Configuration Importer is an alternative to, and a replacement for, these other configuration interfaces. The administrator makes changes by altering the primary configuration documents, automatically triggering the updated configuration to be applied to the Traffic Manager. The other configuration interfaces still provide the current state of the configuration and the health of the Traffic Manager, but an administrator should not normally update the configuration through these interfaces as any such changes are overwritten when the next import is triggered.

During a one-time import, an administrator uses the Configuration Importer in conjunction with the other configuration interfaces. After the one-time import supplies the initial configuration, the administrator makes any further iterative changes through the Traffic Manager's usual configuration interfaces.

Importing configuration is a similar operation to restoring a backup, however the format of the imported configuration is easier to maintain and version control than a backup file and follows the well-documented REST API configuration schema.

The Configuration Importer supports layering of configuration documents to allow multiple sources of Traffic Manager configuration to be merged together in a declarative way. This capability is similar to the Traffic Manager's "Partial Backups" feature and the "zconf" utility, both of which support backup and restore of subsets of the Traffic Manager configuration. However, partial backups do still build configuration iteratively and have an internal format that is not as suitable for editing and maintenance as configuration documents.

For more details on how to layer configuration across multiple documents, see Layering Configuration Documents.

Comparison with the REST API

Configuration documents follow the same configuration schema as the Traffic Manager's REST API, with a few notable differences described here.

YAML vs JSON

To write your configuration documents, use either YAML or JSON format. The Traffic Manager REST API supports only JSON. The examples used in this guide are based around YAML due to its human-readable format and suitability for storing configuration in a version control system.

Object Structure

When creating a new object using the REST API, you define the object's properties in the body data of an HTTP PUT request. The URL defines the API version and name of the new object.

For example, to create a new IP-based session persistence class using the REST API, you use a PUT request with the following object to an endpoint such as "/api/tm/8.3/config/active/persistence/my_persistence_class":

```
{
    "properties": {
        "basic": {
            "type": "ip"
        }
    }
}
```

The equivalent configuration document in YAML is as follows:

```
version: 6.1
persistence:
- name: my_persistence_class
  properties:
    basic:
      type: ip
```

The configuration definition in both cases contains a top level object named "properties", with all the configuration keys nested below it in one or more sections.

All settings defined within the "properties" section follow the REST schema. To view the schema, see the *Pulse Secure Virtual Traffic Manager: REST API Guide*.

Creating Multiple Configuration Objects

The REST API requires a separate API call for each object you want to create, whereas a single configuration document can hold the definition for the entire Traffic Manager configuration.

Configuration documents can contain sections for multiple object types, and multiple objects of the same type can be specified as list items beneath the object type definition (using the "-" array item identifier in YAML, or array syntax in JSON). For example:

```
version: 6.1

bandwidth:
- name: my_bandwidth_class
  properties:
    basic:
      maximum: 10000
      sharing: machine

persistence:
- name: my_ip_persistence_class
  properties:
    basic:
      type: ip
- name: my_transparent_persistence_class
  properties:
    basic:
      type: transparent
```

Defining Configuration Specific to a Traffic Manager Instance

Configuration documents can include configuration specific to individual Traffic Managers through the "traffic_managers" section. Each named object in this section refers to the hostname of a Traffic Manager instance in the cluster. Such configuration can include, for example, networking or other system level settings.

To Identify the local Traffic Manager on which you run the import, without naming it explicitly, use the special object name "local_tm". This feature is useful for orchestration platforms such as Docker or Kubernetes where you might not know the instance hostname at the point you construct the configuration document. For example:

```
version: 6.1

traffic_managers:
- name: local_tm
  properties:
    snmp:
      community: body
      enabled: true
      security_level: noauthnopriv
```

Unstructured Resources

Some configuration objects are not expressed as key/value pairs, but rather inline as raw text. Examples of these include TrafficScript rules, SSL certificates, and custom monitor scripts.

When using the REST API, you upload such configuration objects using a PUT request with a content-type of "application/octet-stream".

To present the raw data in a configuration document, use a "content" field. Declare the data either inline or as an indented block using a YAML literal scalar (designated by the '|' indicator). The following example expresses a TrafficScript rule:

```
rules:
- name: basic-response
  content: |
    http.sendResponse("200 OK", "text/plain", "Hello World\n", "X-
Served-By: Ivanti vTM");
```

For binary files, content can be base64 encoded with an "encoding: base64" field added to the object definition. For details of the supported base64 type requirements, see RFC2045 (https://www.ietf.org/rfc/rfc2045.txt).

Alternatively, you can import values from an external file using the object reference syntax described in Object References.

Validation

The Configuration Importer always applies a configuration that is syntactically correct. A syntactically correct configuration with a semantic error, such as a port number being out of the valid port range, is still applied, but the Traffic Manager reports an error and does not start the affected service.

This behavior is designed to ensure that the Traffic Manager's configuration is consistent with the expected outcome of invoking the Configuration Importer, regardless of any historical state. The Configuration Importer does not assume that the entity that generated the configuration is checking to make sure it was accepted by the Traffic Manager.

In contrast, the REST API applies validation of individual configuration settings and rejects a PUT request if a setting is invalid. The REST API assumes that whatever invoked the PUT request is also checking to make sure it completed successfully.

Importing Configuration into a Cluster

When running as a cluster, all Traffic Managers must have an identical copy of the configuration. When using the Configuration Importer, the Traffic Manager supports two alternative methods of ensuring the configuration of all cluster members remains consistent:

Replicating Configuration

When an administrator makes a configuration change through the Admin UI or the REST API, they select a specific cluster member on which to make the change. The Traffic Manager then automatically replicates that change out to all other members of the cluster.

The Configuration Importer can also operate under the same principle. An administrator selects a cluster member on which to run the Configuration Importer, and the imported configuration is automatically replicated out to all other cluster members. When configuration is entirely managed through the Configuration Importer, you designate a single cluster member to watch for configuration changes and apply them to the whole cluster.

Independent Cluster Members

As an alternative, provided each Traffic Manager has access to the same configuration documents, you can instruct the Configuration Importer to not replicate configuration to the other cluster members. In this situation, each cluster member must maintain its own configuration independently.

For Docker deployments, to have each container independently manage its own configuration, launch the container with the ZEUS_CONFIG_IMPORT_ARGS environment variable set to "--no-replicate".

For other deployments, add the "--no-replicate" argument to the "config-import" tool when it is invoked. For example:

```
$ZEUSHOME/zxtm/bin/watch-directory /import --
$ZEUSHOME/zxtm/bin/config-import \
--chdir /import --no-replicate ./config
```

Changing Settings that Require a Restart

This chapter discusses the difference between Traffic Manager software restarts and full host reboots.

Software Restarts

The Configuration Importer automatically restarts the Traffic Manager software on all cluster members if a changed configuration setting requires a restart to take effect.

In some circumstances, you might want to disable this behavior and delay restarts to happen at a later time, such as during a maintenance window. To disable automatic restarting of the software, supply the "--no-restart" argument to the "config-import" tool, or add "--no-restart" to the ZEUS_CONFIG_IMPORT_ARGS environment variable when launching a Docker container. By using this argument, you must manually restart your Traffic Managers at the appropriate time for pending changes to take effect.

Host Instance Reboots

Some configuration changes might require a full host instance reboot to take effect. This is not an automatic process and must be performed manually on all cluster members. Ivanti recommends you schedule a full reboot to take place at a time of least impact to your services.

Constructing Configuration Documents

This chapter describes how to set up configuration documents suitable for use with the Configuration Importer. Contructing Configuration Documents Manually

To construct a configuration document suitable for use with the Configuration Importer, Ivanti recommends using the following approaches:

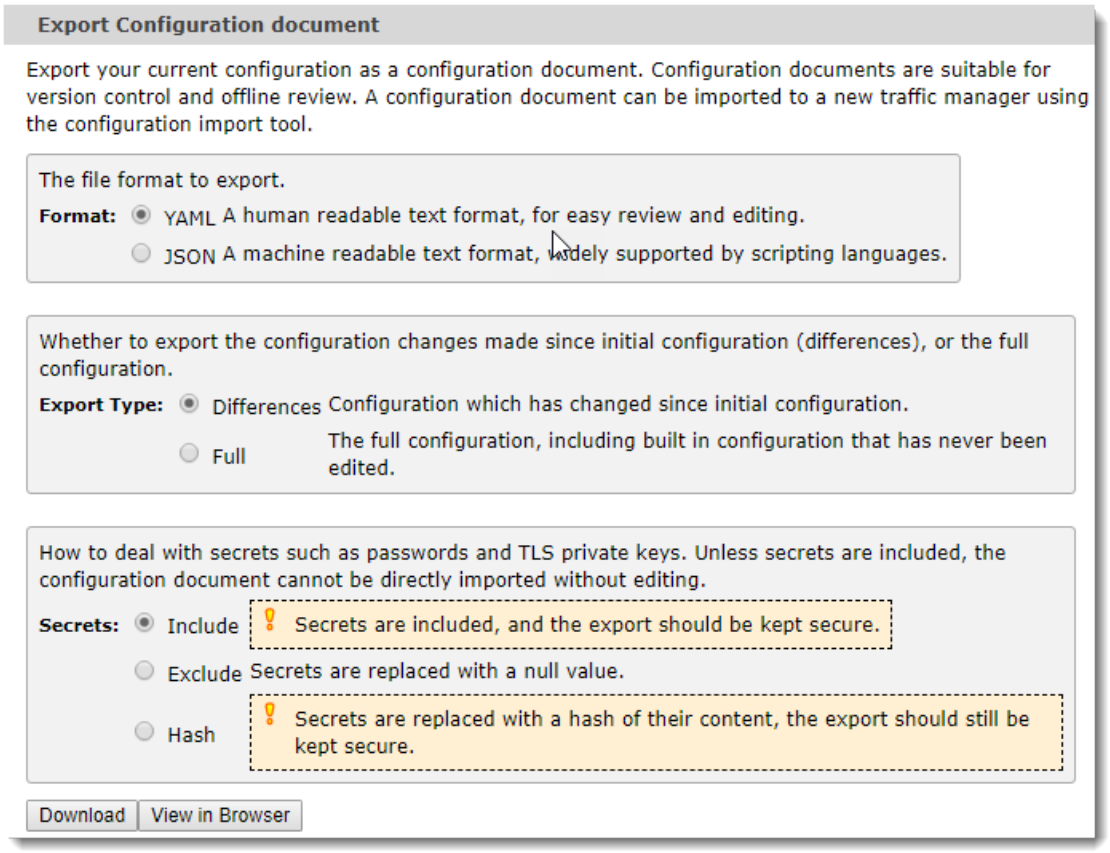
- **Using the REST API Guide**: Consult the Pulse Secure Virtual Traffic Manager: REST API Guide to find all the available configuration objects and their properties. This information can be used to construct appropriate configuration documents to represent the desired Traffic Manager configuration.
- **Admin UI**: Build and test the configuration using the Admin UI, then perform REST API calls to retrieve the configuration for each object and write it into a configuration document.

Exporting a Configuration Document From the Admin UI

To obtain a pre-constructed configuration document representing the configuration of the current Traffic Manager, click **Services > Configuration Summary** in the Admin UI. To generate a configuration document, use the "Export Configuration document" section.

This functionality is also available for previously-saved configuration backups, through the **System > Backups** page.

Exporting a configuration document representing the current configuration



To modify the appearance of a configuration document, use the following options:

Option	Value	Description
Format	YAML	Create the configuration document in human-readable YAML text format.
	JSON	Create the configuration document in machine-readable JSON text format.
Export Type	Differences	Include only those configuration changes made *since* the Traffic Manager was first configured.
	Full	Include all configuration present on the Traffic Manager, irrespective of whether the configuration was set during initial configuration or at some time since.
Secrets	Include	Include all secret data, such as passwords and TLS private keys.

Option	Value	Description
		A configuration document created with this option is complete and ready to be used with the Configuration Importer, but is unsafe to share publicly. Ivanti strongly recommends taking additional security measures when creating configuration documents with this option selected.
	Exclude	Redact all secret data. A configuration document created with this option is safe to share publicly (as allowed by your organizational security policy), or to check into a version control system. However, to properly configure a new Traffic Manager instance from this configuration document, you must first edit in all required secret data items.
	Hash	Replace all secret data items with a hash of their contents. Use this option to compare configuration document versions and to observe when secret data might have changed, without revealing the secrets to casual observers. Ivanti recommends that a document created with this option should be kept securely to minimize the risk of offline password cracking and other such attacks.

To generate a configuration document based on the selected options, click one of the following buttons:

- To download the configuration document to your local workstation, click **Download**.
- To display the configuration document in your browser, click **View in Browser**.

Exporting a Configuration Document From the Command-line

An administrator can also generate a configuration document from the command-line using the Traffic Manager's config-export program. For example:

```
# Exports a configuration document to /import/config/example-
config.yaml

$ZEUSHOME/zxtm/bin/config-export --filename "example-config.yaml"
                                 --format yaml
                                 --secrets exclude
                                 --chdir /import
                                 ./config
```

For a complete list of the available options, type:

```
$ZEUSHOME/zxtm/bin/config-export --help
```

Layering Configuration Documents

The Configuration Importer can collect together and import multiple configuration documents at the same time if instructed to import from a directory. The Configuration Importer orders the documents alphabetically, and then constructs the configuration by layering the documents one on top of the other. You can build up configuration for the same object, such as a virtual server, over multiple documents, with later documents masking settings applied by earlier documents.

The following two example configuration documents reference the same "example-service" virtual server object. The "10-base-service.yaml" file is applied first and creates the base configuration for the service. The file "20-set-rules.yaml" is alphabetically second in order of priority and layered on top of the base configuration to add a TrafficScript rule to the virtual server, and to disable web caching.

10-base-service.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: example-pool
    web_cache:
      enabled: true

pools:
- name: example-pool
  properties:
    basic:
      passive_monitoring: true
      monitors: [ "Simple HTTP" ]
      nodes_table:
      - node: application-server-1:8080
      - node: application-server-2:8080
```

20-set-rules.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      request_rules: [ set-host ]
    web_cache:
      enabled: false

rules:
 - name: set-host
   content: |
     http.setHeader("Host", "app1.example.com");
```

Importing the two documents applies configuration equivalent to the following single document:

flattened-config.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: example-pool
      request_rules: [ set-host ]
    web_cache:
      enabled: false

pools:
- name: example-pool
  properties:
    basic:
```

flattened-config.yaml

```
      passive_monitoring: true
      monitors: [ "Simple HTTP" ]
      nodes_table:
      - node: application-server-1:8080
      - node: application-server-2:8080

rules:
 - name: set-host
   content: |
     http.setHeader("Host", "app1.example.com");
```

Observe that both files specify the "virtual_servers.properties.web_cache.enabled" setting, although the Configuration Importer applies the "false" value in "20-set-rules.yaml" last, so this is the resultant setting applied to the Traffic Manager.

Ivanti recommends limiting overlaying of specific settings within an object to basic scalar values. Layering semantics for non-scalar settings, such as lists or tables, is presently unspecified.

Object References

This chapter describes how to reference external data and objects from within your configuration definition.

Referencing External Objects

The Configuration Importer enables you to reference externally-stored data in your configuration documents. This method can help keep your configuration documents neater, and allows configuration such as TrafficScript rules and certificates to be stored in their native format. It also allows data to be pulled in from other sources when needed. For example, in a Kubernetes environment, passwords and certificates could be mounted from Secret objects and referenced inside your Traffic Manager configuration definition.

To reference externally-stored data in your configuration, use the "valueFrom" construct. The example that follows shows how to import a TrafficScript rule stored in a separate file:

/import/config/rule-config.yaml

```
rules:
- name: example-rule
  content:
    valueFrom:
      fileRef:
        name: data/example-rule.zts
```

/import/data/example-rule.zts

```
log.info("Hello World");
http.sendResponse("200 OK", "text/plain", "Hello World", "X-Served-By:
Ivanti vTM");
```

The Configuration Importer replaces the valueFrom statement in the configuration document with the literal text of the rule and applies the resulting configuration to the Traffic Manager.

Supported valueFrom Methods

The Configuration Importer supports the following valueFrom methods:

Supported valueFrom Methods	
fileRef	Import all data from the file found at the path specified in the "name" property. Path references are relative to the directory from which the Configuration Importer was invoked, or relative to the "--chdir" argument if one was specified. When launching a Docker container, path references are relative to the ZEUS_BASE_CONFIG or ZEUS_WATCHED_CONFIG environment variable.

Changes to Referenced Objects

If a referenced object is inside the directory being watched for changes, a subsequent change to the object causes the Configuration Importer to automatically update the Traffic Manager's configuration. If the referenced object is outside the watched directory, changes are picked up the next time the Configuration Importer runs for any other reason.

Example: Importing TLS Certificates from Kubernetes Secrets

A common way to manage TLS keys and certificates in Kubernetes is to store them in *Secret* objects and then mount those secrets into the container that uses them. In Kubernetes, mounting a TLS Secret results in the private key being mounted as "tls.key" and the certificate being mounted as "tls.crt". For example, the configuration document and TLS files for the service could be mounted as follows:

```
/import/
├── config/
|   └── vtm-config.yaml
└── tls/
    └── example-service/
        ├── tls.key
        └── tls.crt
```

Based on this file structure, the following configuration document configures a virtual server to present the certificate and decrypt the incoming traffic:

vtm-config.yaml

```
virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 443
      protocol: http
      pool: example-service-pool
      ssl_decrypt: true
    ssl:
      server_cert_default: example-service-cert


ssl:
  server_keys:
  - name: example-service-cert
    properties:
      basic:
        public:
          valueFrom:
            fileRef:
              name: tls/example-service/tls.crt
        private:
          valueFrom:
            fileRef:
              name: tls/example-service/tls.key
```

Snapshots

This chapter discusses configuration snapshots and how to create them in Docker and other environments.

Introducing Configuration Snapshots

The Traffic Manager takes a snapshot of its configuration when it is first deployed. This *base configuration snapshot* incorporates all the environment-specific configuration that is established during initial configuration, such as the host's timezone, the ports on which administrative services are listening, and tunings to support particular cloud environments.

When the Configuration Importer runs, the Traffic Manager's configuration is reset to this initial state before the imported configuration is applied.

If you need to change this base configuration, you can apply static configuration to your Traffic Manager such as logging endpoints, security settings, and cache sizes, and then create an updated snapshot. Your changes become part of the base configuration snapshot and do not need to be specified in imported configuration documents.

Snapshotting Configuration in Docker

If you deploy a Docker container with the ZEUS_BASE_CONFIG environment variable set, the Traffic Manager creates a configuration snapshot after the base configuration has been applied. Any additional configuration imported from the directory specified in the ZEUS_WATCHED_CONFIG environment variable is layered on top of this base configuration.

In practice, this is relevant only if the base configuration and watched configuration directories are different, such that the watched configuration is applied on top of the base configuration. For example:.

/base/config/system-settings.yaml

```
version: 6.1

global_settings:
  properties:
    session:
      ip_cache_size: 65535
    web_cache:
```

/base/config/system-settings.yaml

```
      size: 2GB
      max_file_size: 50MB
```

/watched/config/my-service.yaml

```
version: 6.1

virtual_servers:
- name: example-service
  properties:
    basic:
      enabled: true
      port: 80
      protocol: http
      pool: discard
      request_rules: [ basic-response ]

rules:
- name: basic-response
  content: |
    http.sendResponse("200 OK", "text/plain", "Hello World\n", "X-Served-
By: Ivanti vTM");
```

Deploying a container in Docker using these configuration documents results in the base configuration in "system-settings.yaml" being applied to the Traffic Manager initially, the base configuration snapshot being updated, and then the configuration in "my-service.yaml" being applied on top of that base configuration. Any changes to configuration in the "watched" directory are applied on top of the base configuration. However, changes to configuration in the "base" directory after the container is launched have no effect as that directory is not being watched for changes.

To deploy the container, use the following command

Deploy container with base and watched configuration

```
# Assumes the sample configuration documents shown above are saved as
./base/config/system-settings.yaml and ./watched/config/my-service.yaml

docker run --name=vtm-config-example \
            -v `pwd`/base:/base \
            -v `pwd`/watched:/watched \
            -p 8080:80 \
            -p 9090:9090 \
            -e ZEUS_BASE_CONFIG=/base \
            -e ZEUS_WATCHED_CONFIG=/watched \
            -e ZEUS_EULA=accept \
            -e ZEUS_PASS=admin \
            --privileged \
            --init \
            -t \
            -d \
            pulsesecure/vtm:<version>
```

Snapshotting Configuration in Other Deployments

For other deployment types, take a snapshot after the Traffic Manager has been deployed to create a new base configuration snapshot.

To snapshot the current Traffic Manager configuration, run the following command:

```
$ZEUSHOME/zxtm/bin/config-snapshot
```

Stateful Settings

A small number of configuration settings are considered "stateful" and are not reset to a previous value when reverting to the snapshot configuration. Such settings are generally managed by an external entity, such as Pulse Secure Services Director.

You can override stateful settings in configuration documents, but if the setting is later removed from the configuration document its value is not reverted in the Traffic Manager's configuration.

Some examples of stateful settings that the Configuration Importer does not reset include:

- An FLA license pushed by the Services Director
- Analytics Export configuration
- Management-plane user groups
- Management-plane user authenticators
- The cluster ID

Upgrades

This chapter discusses the effect of Traffic Manager version upgrades on the Configuration Importer.

Importing Configuration to Upgraded Traffic Managers

As described in Snapshots, the Configuration Importer requires a snapshot of the configuration when the Traffic Manager is first deployed in order to establish a baseline on which to apply the imported configuration. As such, the Configuration Importer is not able to apply configuration to a Traffic Manager that was upgraded from a version prior to present version as no such snapshot was taken at the time the Traffic Manager was first deployed.

Ivanti recommends you deploy a new Traffic Manager instance at the latest version and use the Configuration Importer with the new instance. However, if necessary, create a snapshot manually on the upgraded instance using the instructions described in Snapshotting Configuration in Other Deployments.

Upgrading Traffic Managers with Imported Configuration

Ivanti recommends that upgrades are performed by creating a new Traffic Manager instance at the latest version and using the Configuration Importer to apply the same configuration as applied to the older instance.

Configuration Document Versioning

Each configuration document contains a "version" field that references the API schema version for the configuration in the document. The Traffic Manager into which the configuration is imported must support the API schema version of the configuration in the document.

Where possible, the Configuration Importer translates configuration from the version of the API schema referenced in the configuration document to the latest supported API schema version. If the conversion cannot be performed (for example, if a configuration setting is removed from the API), the Configuration Importer logs a warning and does not alter the current running configuration.

This version of the Traffic Manager supports only API schema version 8.3.