

# Release Notes for Contrail Release 2.22

**Release 2.22**  
**December 2015**

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## Introduction

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Juniper Networks Contrail is an open, standards-based software solution that delivers network virtualization and service automation for federated cloud networks. It provides self-service provisioning, improves network troubleshooting and diagnostics, and enables service chaining for dynamic application environments across enterprise virtual private cloud (VPC), managed Infrastructure as a Service (IaaS), and Networks Functions Virtualization (NFV) use cases.

These release notes accompany Release 2.22 of Juniper Networks Contrail. They describe new features, limitations, and known problems.

These release notes are displayed on the Juniper Networks Contrail Documentation Web page at

[http://www.juniper.net/techpubs/en\\_US/contrail222/information-products/topic-collections/release-notes/index.html](http://www.juniper.net/techpubs/en_US/contrail222/information-products/topic-collections/release-notes/index.html).

## New and Changed Features

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The features listed in this section are new or changed as of Contrail Release 2.22. A brief description of each new feature is included.

- [Flow Sampling on page 2](#)
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## Flow Sampling

The Contrail vRouter agent exports flow records to the Contrail Collector when a flow is created or deleted. It also updates flow statistics at regular intervals.



**NOTE:** In releases earlier than Contrail Release 2.22, all flow records were exported from the agent. Depending on the scale of flows, some of these exported flows might be dropped due to queue overflow.

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In Contrail Release 2.22 and later, flow records are sampled and exported to the Contrail Collector based on the sampling.

The flows that are exported are selected based on the following parameters used in the algorithm:

- The configured flow export rate. This is configured as part of the **global-vrouter-config** object.
- The actual flow export rate.
- The sampling threshold. This is a dynamic value calculated internally. If the flow statistics in a flow sample are above this threshold, the flow record is exported.

Each flow is subjected to the following algorithm at regular intervals. The algorithm determines whether to export the sample or not.

- Flows with traffic that is greater than or equal to the sampling threshold are always exported. The byte and packet counts are reported without modification.
- Flows with traffic that is less than the sampling threshold are exported according to the probability. The byte and packet counts are adjusted upwards according to the probability.

The probability is calculated as  $(\text{bytes during the interval}) / (\text{sampling threshold})$ .

- The system generates a random number less than the sampling threshold. If the byte count during the interval is less than the random number, then the flow sample is not exported.
- If none of these conditions are met, the flow sample is exported after normalizing the byte count and packet count during the interval. Normalization is done by dividing the byte count and packet count during the interval by the probability. This normalization is used as a heuristic to account for statistics of flow samples that are dropped.

The actual flow export rate is close to the configured export rate. If there is a large deviation, the sampling threshold is adjusted to bring the actual flow export rate close to the configured flow export rate.

## Flow Handling

When a virtual machine sends or receives IP traffic, forward and reverse flow entries are setup. When the first packet arrives, a flow key is used to hash into a flow table (identify a hash bucket). The flow key is based on five tuples consisting of source and destination IP addresses, ports, and the IP protocol.

A flow entry is created and the packet is sent to the Contrail vRouter agent. Configured policies are applied and the flow action is updated. The agent also creates a flow entry for the reverse direction where relevant. Subsequent packets match the established flow entries and are forwarded, dropped, NAT translated, and so on based on the flow action.

When the hash bucket is full, entries are created in an overflow table. In releases earlier than Contrail Release 2.22, the overflow table was a global table, which is searched sequentially. In Contrail Release 2.22 and later, the overflow entries are maintained as a list against the hash bucket.

By default, the maximum number of flow table and overflow table entries are 512,000 and 8000 respectively. These can be modified by configuring them as vRouter module parameters. For example; **vr\_flow\_entries** and **vr\_oflow\_entries**.

(For more information about the vRouter module parameters, see <https://github.com/Juniper/contrail-controller/wiki/Vrouter-Module-Parameters>).

## Flow Aging

Flows are aged out based on inactivity for a specified period of time. By default, the timeout value is 180 seconds. This can be modified by configuring the **flow\_cache\_timeout** parameter under the **DEFAULT** section in the **/etc/contrail/contrail-vrouter-agent.conf** file.

## TCP State-Based Flow Handling

In Contrail Release 2.22 and later, the Contrail vRouter monitors TCP flows to identify entries that can be reused without going through the standard aging cycle.

All flow entries that match TCP flows that have experienced a connection tear down, either through the standard TCP closure cycle (FIN/ACK-FIN/ACK) or the RST indicator, are torn down by the vRouter and are immediately available for use by new qualified flows.

The vRouter also keeps track of connection establishment cycles and exports the necessary information to the vRouter-agent (such as SYN/ACK and a digested established flag). This allows the vRouter-agent to tear down flows that do not experience a full connection cycle.

Flows that the vRouter identifies as reuse candidates, (eviction candidates), are marked as such in the flow entry. Flows are in the evicted state when they become available for other new flows to be reused.

This two-step transition is used so that the flow entry remains valid until the packet reaches the destination. Thus preventing the flow from getting remapped to another flow entry in the interim.

## Protocol Based Flow Aging

Although TCP flows are deleted based on TCP state, you are sometimes required to age out specific protocol flows more aggressively. One example is when a DNS server is run in one VM. In this case, multiple flows are set up for DNS. A pair of flows are set up to serve each query. Because the flows are no longer required after the query is served, the timeout can be lower for these flows. To handle these cases, protocol-based flow aging is used. With protocol-based flow aging the aging timeout can be configured per protocol. All other protocols continue to use the default aging timeout.

Protocol-based flow aging is supported in Contrail Release 2.22 and later.

The configuration for protocol-based flow aging can be done in the **global-vrouter-config** object. For example, to have all DNS flows aged out in five seconds, use the following entry: **protocol = udp, port = 53 will be set an aging timeout of 5 seconds,**

## Fat Flow

In Contrail Release 2.22 and later, Contrail supports optimization to reduce the number of flows setup by reusing a flow. That is, a single flow pair can be used for any number of sessions between two endpoints for the same application protocol.

Any number of DNS sessions from a client to the server can use a single flow pair. The effect is that the flow hash key is reduced from five-tuples to four-tuples consisting of source and destination IP addresses, the server port, and the IP protocol. The client port is not used in the flow key.

This feature can be configured by specifying the list of fat-flow protocols on a virtual machine interface. For each such application protocol, the list contains the protocol and port pairs. In the example, the server **virtual-machine-interface**, protocol **udp** and port **53** can be configured as a fat-flow-protocol.

If you want to enable the fat-flow feature on the client side, the configuration must be applied on the client virtual machine interface as well.

## vCenter Nova Compute Driver Beta

In Contrail Release 2.22, a beta version of a Nova compute driver (`nova-compute-driver`) for vCenter is available.

The Nova compute driver is responsible for creating the right port groups in vCenter for every port and interface with a vRouter agent on each ESXi platform.

The new driver is an extension to the open-source Nova compute driver for vCenter.



**NOTE:** The open-source Nova compute driver for vCenter does not support the pluggable architecture. Therefore, the driver is prepackaged with Contrail and dynamically loaded by the system configuration.

## Supported Platforms

Contrail Release 2.22, is supported on the OpenStack Juno and Icehouse releases. Juno is supported on Ubuntu 14.04.2 and Centos 7.1.

Contrail networking is supported on Red Hat RHOSP 5.0, which is supported only on OpenStack Icehouse

In Contrail Release 2.22, support for VMware vCenter 5.5. vCenter is limited to Ubuntu 14.04.2 (Linux kernel version: 3.13.0-40-generic).

Other supported platforms include:

- CentOS 6.5 (Linux kernel version: 2.6.32-358.el6.x86\_64)
- CentOS 7.1 (Linux kernel version: 3.10.0-229.el7)
- Redhat 7/RHOSP 5.0 (Linux kernel version: 3.10.0-299.el7.x86\_64)

- Ubuntu 12.04.04 (Linux kernel version: 3.13.0-34-generic)
- Ubuntu 14.04. (Linux kernel version: 3.13.0-40-generic)

## Known Behavior

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The following are known behaviors in this release of Contrail.

- DNS record updates from a controller DNS server to a named server might be missing even after repeated retries. This is because there is no infrastructure currently to sync records across named servers.
- DNS queries from an agent are now sent to both named servers that were learnt using discovery. There is a very low probability of records missing on both named servers.

The first good response from either of the named servers is used to update the DNS client that sent the DNS query request. If there is no good response, the last bad response is sent to the DNS client to inform the client of the error.

Use the following to display a list of named servers to which queries are sent:

**`http://x.x.x.x:8085/Snh_DnsInfo`**

Use the following to trace the queries sent and responses:

**`http://x.x.x.x:8085/Snh_SandeshTraceRequest?x=DnsBind`**

## Known Issues

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This section lists known limitations with this release. Bug numbers are listed and can be researched in [Launchpad.net](https://bugs.launchpad.net/) at <https://bugs.launchpad.net/>.

Storage:

- 1497047 In Contrail Release 2.20 and earlier, if a Cassandra node is offline for one minute or longer and then brought back online, it might corrupt the database.

In Contrail Release 2.21 and later, a Cassandra node can be offline for up to three hours and then brought back online without corrupting the database.

If the Cassandra node is offline for more than three hours, you need to perform the following procedure:

- After the Cassandra node joins the Cassandra cluster, you must use the **`nodetool repair`** command
- If the Cassandra node is offline for more than ten days, it should not be brought back online. Instead, you need to remove the Cassandra node using the **`nodetool removemode`** command and the associated procedure. The procedure can be accessed at:

[http://docs.datastax.com/en/cassandra/1.2/cassandra/operations/ops\\_remove\\_node\\_t.html](http://docs.datastax.com/en/cassandra/1.2/cassandra/operations/ops_remove_node_t.html)

- After the procedure is complete, you can add the node back as a new node.

#### Contrail Networking:

- 1525368 schema stuck in 'initializing' state after upgrade from r2.1-55.
- 1524582 With continuous TCP session setup/destroy over a long time, few flows stuck in Hold state.
- 1524535 Provisioning of Ubuntu 12.04 fails due to upgrade\_kernel and facter.
- 1514312 [2.21-Build 102] Can not create virtual-network by Web UI after updating project-name.
- 1496606 You use the **fab install\_new\_contrail** and **fab join\_cluster** commands to add a new control node to a cluster that is already provisioned.

The **fab join\_cluster** command succeeds only if the newly added control node is “up” in the **rabbitmqctl cluster\_status** command output. Also before purging an existing control node, you need to verify if the control node is displayed in the **rabbitmqctl cluster\_status** command output.

For example:

```
root@a12c4s2:/opt/contrail/utils# rabbitmqctl cluster_status
Cluster status of node 'rabbit@a12c4s2-ctrl' ...
[{"nodes":[{"disc":["rabbit@a12c3s3-ctrl","rabbit@a12c3s4-ctrl",
  "rabbit@a12c4s2-ctrl"]}],
 {"running_nodes":["rabbit@a12c3s4-ctrl","rabbit@a12c3s3-ctrl",
  "rabbit@a12c4s2-ctrl"]},
 {"cluster_name,<<"rabbit@a12c3s3">>},
 {"partitions,[]}]
```

```
root@a12c4s2:/opt/contrail/utils#
mysql -uroot -p$(cat /etc/contrail/mysql.token) -e "show status like 'wsrep%'"
| wsrep_cert_index_size | 41 |
| wsrep_causal_reads | 145146 |
| wsrep_incoming_addresses | 5.5.5.5:3306,5.5.5.6:3306,5.5.5.4:3306 |
| wsrep_cluster_conf_id | 60 |
| wsrep_cluster_size | 3 |
| wsrep_cluster_state_uuid | 3c0286
```

Verify that the hostname of the new control node is listed in the **rabbitmqctl cluster\_status** command output and the IP address of the new control node is listed in the **wsrep\_incoming\_addresses** field.

- 1496605 When adding a new control node using the **fab install\_new\_contrail** command, the command expects the new control node to be added to the end of each role definition in the **testbed.py** file.

For example, in the following **testbed.py** file example, host2 is the newly added control node.

```
# Role definition of the hosts.
env.roledefs = {
  'all': [ host3, host4, host5, host1, host2],
  'cfgm': [ host3, host5, host1, host2],
```

```
'openstack': [ host3,host5, host1,host2],
'control': [ host3,host5, host1,host2],
'compute': [host4],
'collector': [ host3,host5, host1,host2],
'webui': [ host3,host5, host1,host2],
'database': [ host3,host5, host1,host2],
'build': [host_build],
}
```

This constraint might be removed in a future release.

- 1491644 When bare metal servers are behind an MX Series router, MX redundancy is provisioned in the network, and a bare metal server pings another bare metal server, the ARP cache of the first bare metal server for the second bare metal server is poisoned with the vRouter compute node's MAC address. This leads to connectivity failure between the two bare metal server.

The cause is that when the ARP request from BMS1 is flooded to a compute node by the MX Series router, the vRouter does the source IP address lookup for the bare metal server IP address in the inet (IPv4) route table. This lookup results in the subnet route pointing to the ECMP next hop of two MX Series routers. This makes the vRouter respond with the virtual host's MAC address to force the packets to Layer 3 processing though the ARP request is not meant for any VMs in that compute node.

- 1496609 For a control node to participate in high availability properly, all the control nodes must have a unique priority. When adding a new control node to an already provisioned high availability enabled cluster, the uniqueness in the priority across the control node is not automatic.

You need to adjust the values to ensure uniqueness as follows:

1. Stop the keepalived process using the **service keepalived stop** command
  2. Edit the `/etc/keepalived/keepalived.conf` file in all the control nodes and modify the priority under the `vrrp_instance INTERNAL*` and `vrrp_instance EXTERNAL*` configuration section, so that all the control nodes have unique values.
  3. Start the keepalived process using the **service keepalived start** command.
- 1495697 When you add a new control node using the **fab install\_new\_contrail** command to a cluster that is already provisioned, there is a possibility that the command might fail due to a timing issue. Even though this command reports failure, it actually does everything as expected. You can proceed using the **fab join\_cluster** command as the next step for adding a new control node.
  - 1404846 In Juno, VPC VM launch is failing VPC API is not supported with Juno. Its planned to be supported in subsequent release.
  - 1465744 Contrail/MX interop when a VM is using SNAT to reach a bare metal server floating IP address. This happens only in cases where a SNAT instance and destination Floating IP address are on the same compute node.
  - 1466777 There is a need to improve api-server and schema initialization times in a scaled setup. On highly scaled setups it takes up to 40 minutes for an API server and schema transformer to converge.



- 1466731 A QFX Series switch does not handle transient duplicate VxLAN IDs for two different VNs. If a VN is deleted and added quickly the TOR switch may go in to a bad state.
- 1468685 Centos6.5 icehouse - single node setup config processes are killed after a node reboot. A single node Centos installation runs into an API server exception.
- 1484600 When a device is moved from one QFX Series switch to another Series switch, the MAC address is not learned on the switch for a period up to 12 minutes.
- 1486387 If you configure compute and config services in the same node, you must use the **fab setup\_nova\_aggregate** command after the node is rebooted. If the command is not used, **setup\_nova\_aggregate** will never get executed.
- 1493861 When clearing the setup used for inter-VN communication, the compute node might crash.
- 1414850 Interfaces created for logical routers and other constructs that are not on vRouters, do not get accounted for in the dashboard.
- 1403348 If you attach and then detach a security group, the transparent firewall service interface does not have an internal security group.
- 1447401 On multiple VMs in a Docker cluster, they invariably end up on one compute only.
- 1454813 Setup of a vCenter fails if the same **dv\_port** or **dv\_switch** name is part of multiple data centers.
- 1455944 When creating nova instances in Docker containers, the user-data script is not executed.
- 1457854 If you try to create an analyzer VM with **contrail\_flavor\_small** configured, the VM is not created but multiple instances are respawned and all are in an error state.
- 1458794 DNS configuration in Docker container is wrong. A Docker instance does not learn the DNS address provided by the vVrouter.
- 1460241 If you create twelve virtual routers attached to a single logical router and then clear the router, Neutron experiences an error.
- 1461791 When servers in a cluster are reimaged with an ESX ISO image, only one server is successfully reimaged, all other servers in that cluster will be re-imaging in a loop.
- 1463622 If you create multiple compute nodes and multiple virtual machines, return traffic from server to client converges on a single label. Eventually, all the flows converge on one VM on each compute node.
- 1463786 If you create thousands of logical interfaces and thousands of virtual machine interfaces, deleting all the interfaces using the Web user interface might result in the **Too many pending updates to RabbitMQ: 4096** error.
- 1465372 If a bare metal server and a SNAT instance are attached to a public network and a packet is sent from the network namespace (netns) instance to the bare metal server, it gets Layer 3 lookups rather than a bridge table lookup.
- 1468420 If you create thousands of virtual machine interfaces and logical interfaces with a thousand virtual networks, and then push the configuration using the device

manager, the configuration might get repeatedly added and deleted on the MX Series router.

- 1468474 TOR Agent Switchover: BUM/ARP traffic loss. Currently a control node does not implement the graceful restart feature, so MAC routes are immediately withdrawn on the TOR agent during switchover leading to traffic loss.
- 1468886 Sometimes it takes more than half an hour for cmon to bring up mysql during node failure scenarios.
- 1469296 When an MX Series router is providing NAT service for a bare metal server using floating IP addresses and the bare metal server belongs to overlapping subnets, their respective NAT configurations will collide in the NAT pool section of the config and get rejected.
- 1469312 When HAProxy is stopped on a virtual IP node, one out of three glance requests fail.
- 1480050 If you assign the same FIP address to two virtual machines, only the VM with an active VRRP address should get the FIP traffic.
- 1489610 If two DNS servers are configured and one is down, the DNS request should only be sent to the server that is up.
- 1492979 Broadcast routes are always programmed with the EVPN as the next hop. So even if there is no MX Series router to flood the traffic, it is still programmed in the composite next hop.

The Vrouter replicates the traffic for the EVPN next hop and eventually the traffic is discarded. This causes the drop statistics count to increase.

- 1469341 The Vcenter setup does not use the svc-monitor. The **contrail-svc-monitor** status needs to be removed from the **contrail-status** command output.
- 1493687 Fragment packets with partial TCP headers get dropped but the flow still gets created and the next fragment gets forwarded to the receiver.

When a packet fragment has a full TCP header and the next fragments offset is 1, then the Vrouter forwards this fragment.

When a fragment packet head is received after 3 or more fragments, it sometime leads to fragment loss.

- 1485754 When a virtual network is extended to a physical router, the Device Manager allocates an IP address for the IRB interface. If the virtual network to physical router association is broken, the Device Manager tries to free the allocated IP address. This call fails. As a result, the IP address that was previously allocated, is no longer available in the free pool.

## Upgrading Contrail Software from Release 2.00 or Greater to Release 2.20

Use the following procedure to upgrade an installation of Contrail software from one release to a more recent release. This procedure is valid for Contrail Release 2.00 and later.



**NOTE:** If you are installing Contrail for the first time, refer to the full documentation and installation instructions in *Installing the Operating System and Contrail Packages*.

Instructions are given for both CentOS and Ubuntu versions. The only Ubuntu versions supported for upgrading are Ubuntu 12.04 and 14.04.2.

To upgrade Contrail software from Contrail Release 2.00 or later:

1. Download the **contrail-install-packages-x.xx-xxx.xxx.noarch.rpm | deb** file from <http://www.juniper.net/support/downloads/?p=contrail#sw> and copy it to the **/tmp** directory on the config node, as follows:

**CentOS :** `scp <id@server>:/path/to/contrail-install-packages-x.xx-xxx.xxx.noarch.rpm /tmp`

**Ubuntu :** `scp <id@server>:/path/to/contrail-install-packages-x.xx-xx~havana_all.deb /tmp`



**NOTE:** The variables **xxx.-xxx** and so on represent the release and build numbers that are present in the name of the installation packages that you download.

2. Install the **contrail-install-packages**, using the correct command for your operating system:

**CentOS:** `yum localinstall /tmp/contrail-install-packages-x.xx-xxx.xxx..noarch.rpm`

**Ubuntu:** `dpkg -i /tmp/contrail-install-packages_x.xx-xxx~icehouse_all.deb`

3. Set up the local repository by running the **setup.sh**:

`cd /opt/contrail/contrail_packages; ./setup.sh`

4. Ensure that the **testbed.py** file that was used to set up the cluster with Contrail is intact in the **/opt/contrail/utills/fabfile/testbeds/** directory.

- Ensure that the **testbed.py** file has been set up with a combined **control\_data** section (required in Contrail Release 1.10 and later).

See *Populating the Testbed Definitions File*.

5. Upgrade the software, using the correct set of commands to match your operating system and vRouter, as described in the following:

Change directory to the **utils** folder:

```
cd /opt/contrail/utils; \
```

Select the correct upgrade procedure from the following to match your operating system and vRouter. In the following, *<from>* refers to the currently installed release number, such as 2.0, 2.01, 2.1:

*CentOS Upgrade Procedure:*

```
fab upgrade_contrail:<from>,/tmp/contrail-install-packages-x.xx-xxx.xxx.noarch.rpm;
```

*Ubuntu 12.04 Procedure:*

```
fab upgrade_contrail:<from>,/tmp/contrail-install-packages-x.xx-xxx~icehouse_all.deb;
```

*Ubuntu 14.04 Upgrade, Two Procedures:*

There are two different upgrade procedures for the Ubuntu 14.04 upgrade to Contrail Release 2.20, depending on which vRouter (**contrail-vrouter-3.13.0-35-generic** or **contrail-vrouter-dkms**) is installed in your current setup.

In Contrail Release 2.20 and later, the recommended kernel version for an Ubuntu 14.04-based system is 3.13.0-40. Both procedures can use the command **fab upgrade\_kernel\_all** to upgrade the kernel.

#### **Ubuntu 14.04 Upgrade Procedure For a System With contrail-vrouter-3.13.0-35-generic:**

Use the following upgrade procedure for Contrail Release 2.20 systems based on Ubuntu 14.04 with the **contrail-vrouter-3.13.0-35-generic** installed. The command sequence upgrades the kernel version and also reboots the compute nodes when finished.

```
fab install_pkg_all:/tmp/contrail-install-packages-x.xx-xxx~icehouse_all.deb;

fab migrate_compute_kernel;

fab
upgrade_contrail:<from>,/tmp/contrail-install-packages-x.xx-xxx~icehouse_all.deb;

fab upgrade_kernel_all;

fab restart_openstack_compute;
```

#### **Ubuntu 14.04 Upgrade Procedure For System with contrail-vrouter-dkms:**

Use the following upgrade procedure for Contrail Release 2.20 systems based on Ubuntu 14.04 with **contrail-vrouter-dkms** installed. The command sequence upgrades the kernel version and also reboots the compute nodes when finished.

```
fab
upgrade_contrail:<from>,/tmp/contrail-install-packages-x.xx-xxx~icehouse_all.deb;
```

All nodes in the cluster can be upgraded to kernel version 3.13.0-40 by using the following **fab** command:

```
fab upgrade_kernel_all
```

6. On the OpenStack node, soft reboot all of the virtual machines.

You can do this in the OpenStack dashboard or log into the node that uses the **openstack** role and issue the following commands:

```
source /etc/contrail/openstackrc ; nova reboot <vm-name>
```

You can also use the following fab command to reboot all virtual machines:

```
fab reboot_vm
```

7. Check to ensure that the **nova-novncproxy** service is still running:

```
service nova-novncproxy status
```

If necessary, restart the service:

```
service nova-novncproxy restart
```

8. *(For Contrail Storage option, only.)*

Contrail Storage has its own packages.

To upgrade Contrail Storage, download the file:

```
contrail-storage-packages_x.x-xx*.deb
```

from <http://www.juniper.net/support/downloads/?p=contrail#sw>

and copy it to the **/tmp** directory on the config node, as follows:

```
Ubuntu: scp <id@server>:/path/to/contrail-storage-packages_x.x-xx*.deb /tmp
```



**NOTE:** Use only Icehouse packages (for example, **contrail-storage-packages\_2.0-22~icehouse\_all.deb**) because OpenStack Havana is no longer supported.

Use the following statement to upgrade the software:

```
cd /opt/contrail/utlis; \
```

```
Ubuntu: fab
```

```
upgrade_storage:<from>,/tmp/contrail-storage-packages_2.0-22~icehouse_all.deb;
```

```
fab setup_nfs_livem
```

or

```
fab setup_nfs_livem_global
```

Related  
Documentation

## Documentation Updates

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### Documentation Feedback

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We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page at the Juniper Networks Technical Documentation site at <http://www.juniper.net/techpubs/index.html>, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at <http://www.juniper.net/techpubs/feedback/>.
- E-mail—Send your comments to [techpubs-comments@juniper.net](mailto:techpubs-comments@juniper.net). Include the document or topic name, URL or page number, and software version (if applicable).

### Requesting Technical Support

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Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

### Self-Help Online Tools and Resources

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

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>

- Search technical bulletins for relevant hardware and software notifications: <http://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

## Opening a Case with JTAC

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

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <http://www.juniper.net/support/requesting-support.html>.

## Revision History

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December 2015—Revision 1, Contrail 2.22

October 2015—Revision 1, Contrail 2.21

August 2015—Revision 1, Contrail 2.20

April 2014—Revision 1, Contrail 1.05

18 March 2014—Revision 1, Contrail 1.04

January 2014—Revision 1, Contrail 1.03

21 October 2013—Revision 1, Contrail 1.02

16 September 2013—Revision 1, Contrail 1.0

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