Oracle® SD-WAN

CE Router Replacement within the APN Configuration Guide

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About This Document

This document describes the installation and configuration process for replacing a Customer Edge Router with a Talari Appliance.

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My Oracle Support (https://support.oracle.com) is your initial point of contact for all product support and training needs. A representative at Customer Access Support (CAS) can assist you with My Oracle Support registration.

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1. Select 2 for New Service Request.

2. Select 3 for Hardware, Networking, and Solaris Operating System Support.

3. Select one of the following options:

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A critical situation is defined as a problem with the installed equipment that severely affects service, traffic, or maintenance capabilities, and requires immediate corrective action. Critical situations affect service and/or system operation resulting in one or several of these situations:

- A total system failure that results in loss of all transaction processing capability

- Significant reduction in system capacity or traffic handling capability

- Loss of the system's ability to perform automatic system reconfiguration

- Inability to restart a processor or the system

- Corruption of system databases that requires service affecting corrective actions

- Loss of access for maintenance or recovery operations

- Loss of the system ability to provide any required critical or major trouble notification

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1. Access the Oracle Help Center site at http://docs.oracle.com.

2. Click Industries.

3. Click the Oracle Communications link.

   Under the SD-WAN header, select a product.

4. Select the Release Number.

   A list of the entire documentation set for the selected product and release appears.

5. To download a file to your location, right-click the PDF link, select Save target as (or similar command based on your browser), and save to a local folder.

References

The following documents are available:

- *Talari Glossary*
- *Talari WAN Implementation Guide*

Feature Overview

Talari Appliances can masquerade their source Autonomous System Number when peering with BGP neighbors on a per-neighbor basis.

The AS Masquerade feature allows Talari Appliances to replace Customer Edge (CE) Routers in a MPLS circuit by peering via eBGP to Provider Edge (PE) Routers. No modifications need to be made to the PE router configuration since the Talari Appliance will **masquerade its AS number** when peering with the PE router. In this way, the Talari uses the CE router's AS number as its local AS number. In addition, the Talari Appliance can peer with other neighbors via iBGP or eBGP using its default local AS number or a different masqueraded AS number.

The Talari Appliance BGP implementation is RFC compliant from end-to-end and supports the following BGP path-attributes:

- Well Known Mandatory: AS-Path, Next-hop, Origin
- Well Known Discretionary: Local Preference, Atomic Aggregate
- Optional Transitive: Community, Aggregator
- Optional Non-transitive: MED (Multi-exit discriminator)

Example CE Router Replacement Topology

San Jose Client Site
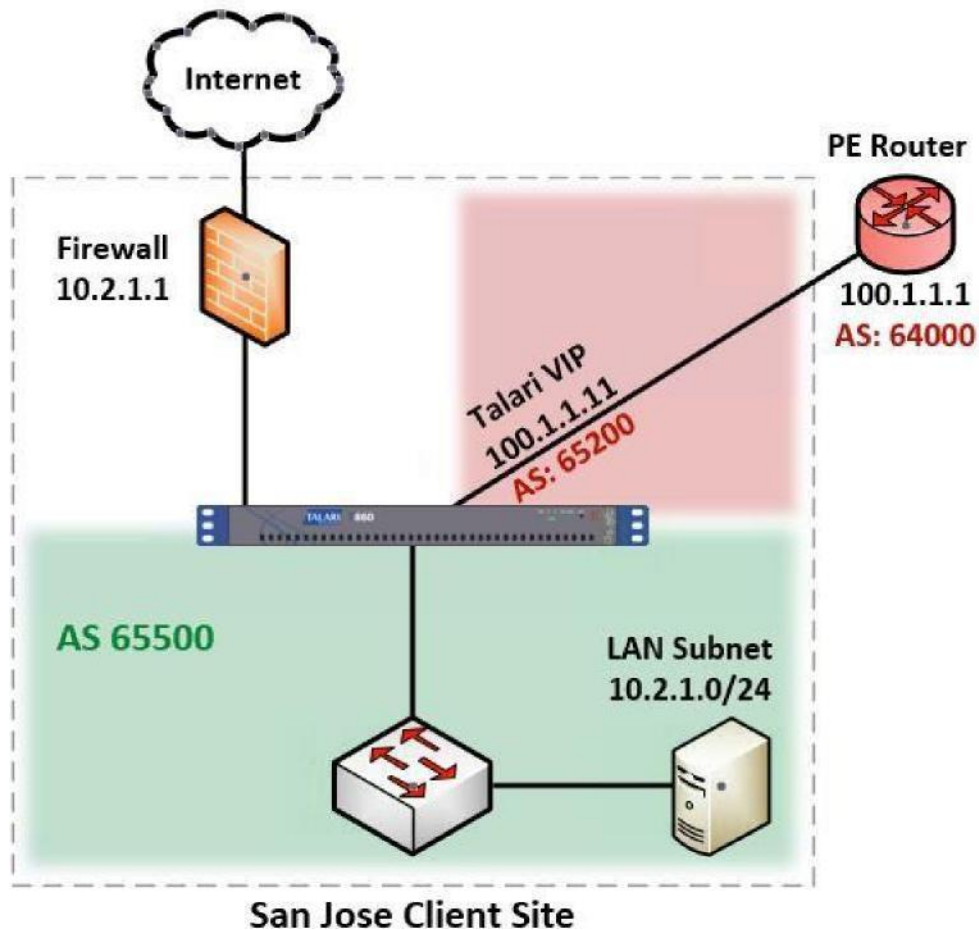
Configuration

Preparation

The following information will be required when configuring the Talari Appliance:

- AS number of the CE Router to be replaced
- AS number of the PE Router that the CE router peers with
- IP address used by the CE router to peer with the PE router
- IP address used by the PE router to peer with the CE router

Site Settings

From the Advanced view of the Talari Configuration Editor, navigate to and expand **Sites > [Site Name] > Interface Groups**.

The Talari Appliance needs to use the IP address that the CE router currently uses to peer with the PE router. A new **Virtual Interface** and **Virtual IP Address** will be created for this purpose.

Use the **Add** icon to the right of the Interface Groups label to create a new Interface Group.

Select the desired port under Ethernet Interfaces and set the Bypass Mode to Fail-to-Block. Expand the newly added Interface Group to expose more options. Click the **Add** icon to the right of **Virtual Interfaces** to add and name a Virtual Interface. Click **Apply** when complete.

Next, expand **Virtual IP Addresses** under the same site. If there is an existing **Virtual IP Address** associated with the CE router being replaced, delete the entry.

Use the **Add** icon to create a new Virtual IP Address entry. Under **IP Address / Prefix,** enter the IP address and Prefix used by the CE router to peer with the PE router, and set the **Virtual Interface** to the interface configured in the last step. Click **Apply** when finished.

Note: An old entry may remain in grey after clicking **Apply**, as shown below. This is because that VIP is still referenced by an existing WAN Link. This will be remedied in the next step.
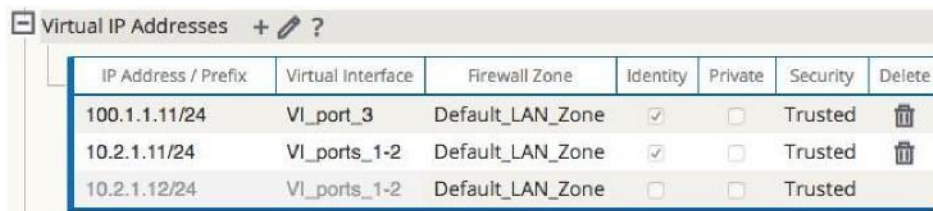
Next, expand the **WAN Links** section and expand the Wan Link that will be used to connect to the PE router. Remove any **Access Interfaces** configured for use with the CE router being replaced.

Now, use the **Add** icon to create a new **Access Interface** entry. Edit the **Name** if desired. Select the previously configured **Virtual Interface** from the dropdown. Enter the IP address of the CE router for the **IP Address** and the IP address of the PE router for the **Gateway IP Address**.

At this point, the basic configuration changes in preparation for CE Router replacement are complete. Next, BGP settings need to be configured for the Talari Appliance.

Connections Settings

While still in the Configuration Editor, proceed to the **Connections >** [Site Name] **> Route Learning > BGP** section to configure the Talari Appliance for BGP.

Expand **Basic Settings** under BGP, click the pencil icon to edit, and check the **Enable** box. If it is desirable to advertise Talari Appliance routes to BGP peers, check the **Advertise APN Routes** box. Enter a **Router ID** for BGP identification and enter a default **Local Autonomous System** number.

Next, expand the **Neighbors** section and click the **Add** icon to create a new neighbor entry. Select the previously configured **Virtual Interface** from the dropdown. Enter the AS number of the CE router that is being replaced in the **Local AS (AS Masquerade)** field. For the **Neighbor IP**, enter the IP address used by the PE router to peer with the CE router. For **Remote AS** enter the PE router AS number.

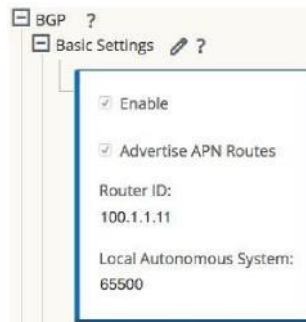**Note**: If the **Local AS (AS Masquerade)** or **Remote AS** fields are left blank, the configuration will default to the **Local Autonomous System** specified in **BGP > Basic Settings**.

Virtual Interface	Source IP	Local AS (AS Masquerade)	Neighbor IP	Remote AS	Hold Time(s)	Local Preference	IGP Metric	Route Reflector Client	Disable Local AS Loop Protection	Password	Delete
VI_port_3	100.1.1.11	65200	100.1.1.1	64000	180	100	☑	☐	☐		↩

Additional field descriptions:

- **Hold Time** - Time in seconds to wait before declaring a neighbor as DOWN. The default value is 180 seconds.
- **Local Preference** - Sets the BGP attribute "local preference" for routes learned from the neighbor specified.
- **Route Reflector Client** - The Talari Appliance will act as a route reflector and the neighbor will be treated as a route reflection client.
- **Disable Local AS Loop Protection** - By default, BGP routes learned that contain the Talari Appliance's local AS number in the AS path will be rejected to guard against routing loops. This can be disabled for situations in which learned routes are prepended with the APNA's local AS number for the purpose of influencing path selection in BGP.
- **Password** - Used if the BGP session requires MD5 authentication.

Next, collapse **BGP** and expand **Import Filters** to configure which routes will be learned by the Talari Appliance via BGP.

By default, no routes are imported into the Talari Appliance routing table until **Import Filters** have been added.

For each filter added, use any combination of the **Destination**, **Prefix**, and **Next Hop** fields to match the BGP routes to be learned. If these fields are left with their default value of *, *all* advertised BGP routes will be imported to the Talari Appliance.

Note: It is important to understand the effect of the **Include** and **Enabled** checkboxes. If **Include** is checked, routes matching the filter are be imported. If it is unchecked, the matching routes are not imported. The **Enabled** checkbox will enable or disable the filter entirely.

Expand any filter to reveal Talari APN specific options. Click the **Service Type** dropdown to select from the available options. Depending on the Service Type chosen, various additional options will be available:

- **Export Route to Talari Appliances:** If the Export Route to Talari Appliance function is not enabled, the Talari Appliance will not communicate route data to Talari Appliances at other Sites. This functionality is enabled by default and only applies for the following Service Types: Local, LAN GRE Tunnel.
- **Eligibility Based On Gateway:** If a Gateway is unreachable, traffic is not sent to matching routes.
- **APN Cost:** The cost to be applied to matched routes when importing into the Talari Appliance route table (default is 6).
- **Service Type:** Choose a Service Type from the existing, supported Talari Services.
- **Recursive Route:** When the service type is conduit, check this to allow the APN to find the conduit name from the imported route's source router automatically.
- **Service Name:** The name of the service that matching routes will use.
- **Eligibility Based on Path:** If enabled, the availability of a specified Path determines if the filter is used.
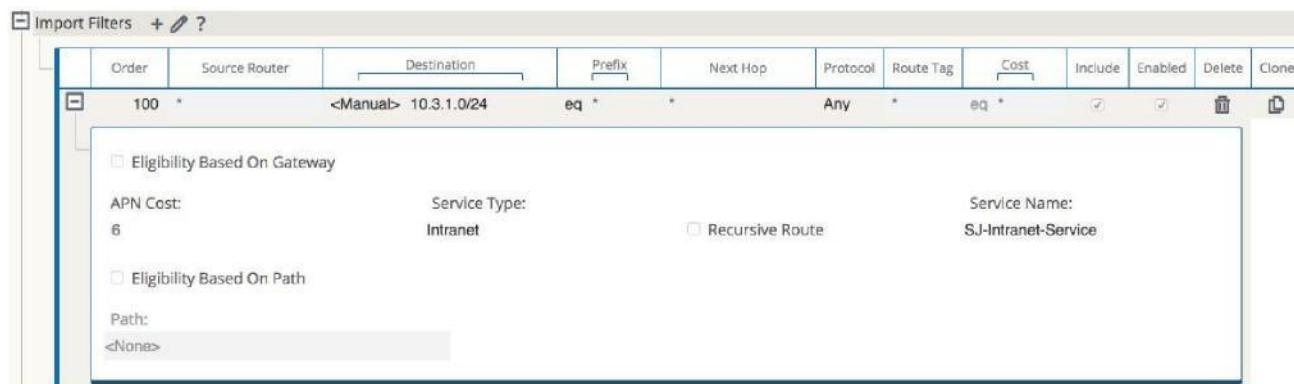
Once configuration of the Import Filters is complete, if desired, proceed to the **Export Filters** section. Export Filters can be added to restrict route advertisements from the Talari Appliance.
Note: The default behavior for export filters is to advertise all BGP learned routes.

Verification

login to the web console of the Talari Appliance and navigate to **Monitor > Statistics** to verify that the replacement is successful.

Once the Talari configuration updates are complete and the new configuration has been This will bring up the **Paths (Summary)** statistics page. Verify that Path State and Conduit

pushed out via Change Management, physically Appliance. After the replacement, State report GOOD for each WAN Link. replace the CE Router with the Talari

From the dropdown, select **Routes** to verify that the Talari Appliance is learning the appropriate route(s) from the PE Router. The **Type** for the route(s) should be Dynamic and **Protocol** should be BGP. Also, verify that the **Reachable** column indicates YES.

Num ▲	Network Addr	Gateway IP Address	Service	Firewall Zone	Reachable	Site IP Address	Site	Type	Protocol
0	100.1.1.0/24	*	Local	Default_LAN_Zone	YES	*	Sanjose-CLI	Static	-
1	10.2.1.0/24	*	Local	Default_LAN_Zone	YES	*	Sanjose-CLI	Static	-
2	10.1.1.0/24	*	RAL-NCN-Sanjose-CLI	Default_LAN_Zone	YES	*	RAL-NCN	Static	-
3	10.3.1.0/24	100.1.1.12	SJ-Intranet-Service	Default_LAN_Zone	YES	*	*	Dynamic	BGP

The CE Router replacement is now complete.

BGP troubleshooting

The Talari Appliance's web-based GUI provides tools to gather information about dynamic routing protocols. These tools can be found by navigating to **Diagnose > Dynamic Routing Protocols** and selecting an option under **View**.

Below are descriptions of each option. When a view allows filtering, enter the Network Address and Mask in the format shown below:

- **BGP State** - Shows an overview of the current state of each Dynamic Routing Protocol instance.
- **BGP Show Route Table Protocol** - Shows prefixes associated with each BGP instance/neighbor.
- **BGP Show Route NWAddress/Mask Table** – Shows prefixes associated with each BGP instance/neighbor and allows filtering for specific prefixes. Will provide APN and BGP routes.
- **BGP Show Route Table Protocol NWAddress/Mask -** Shows prefixes associated with each BGP instance/neighbor and allows filtering for specific prefixes. Provides BGP routes only.

- **BGP Show Route Export** - Shows routes being advertised from the Talari Appliance.
- **BGP Show Route Export (detailed)** - Shows routes being advertised from the Talari Appliance, as well as routing protocol attributes.
- **BGP Show Route Preexport** - Shows all applicable routes for advertisement.
- **BGP Show Route Preexport (detailed)** - Shows all applicable routes for advertisement, as well as routing protocol attributes.
- **Show Route Table**- Provides an overview of each route prefix.
- **Show Route Table (detailed)** - Provides an overview of each route prefix and protocolspecific attributes such as Next Hop, Local Preference, AS Path, etc.
- **Show Route Count in Table** - Gives a count of all entries in the routing table (BGP and APN).
- **Show Protocol** - Outputs a list of routing protocols that are currently running and their states.
- **Talari Protocol Table -** Shows only the Talari APN routing table.
- **Appliance ifconfig** - Shows the output of the "ifconfig" command to provide the user detailed information about each active interface port.

Conclusion

The configuration techniques outlined in this document allow the user to configure a Talari Appliance for CE router replacement while also providing building blocks for further customization in large, complex networks that utilize BGP for dynamic routing.

Appendix A: Static Routes File

The **Static Routes** file can be edited to define routes that should persist through software and/or configuration changes made to the APN. The file inserts static routes into the dynamic routing table, and not the APN routing table. In this way, it ensures that any necessary static routes are advertised to the PE router, regardless of changes to the APN configuration.

Note: By default, static routes defined in this file will be advertised to all neighbors within the specified routing domain. This can be disabled by following the instructions given at the top of the example static routes file.

The static routes file can be edited by logging into the command line of the Talari Appliance (via SSH, or physically with a monitor and keyboard), and issuing the following command:

> sudo vim /home/talariuser/bird/etc/apn_bird_static_routes.conf If nano is preferred for editing:

> sudo nano /home/talariuser/bird/etc/apn_bird_static_routes.conf

The file includes an example configuration that can be modified as needed. Instructions for modification are included in the file.

Default example:

```
        # Routing domain : Default_RoutingDomain protocol
        static {
        #       disabled;              # Disable by default
        #       table T0;              # Connect to the routing domain-specific table
        #       preference 1000;       # Default preference of routes
        #       debug { states, routes, filters, interfaces, events, packets };
        #       debug all;
        #       route 0.0.0.0/0 via 198.51.100.13;
        #       route 198.51.100.0/25 unreachable;
        #       route 10.0.0.0/8 unreachable;
        #       route 10.1.1.0/24 via 198.51.100.3;
        #       route 10.1.2.0:255.255.255.0 via 198.51.100.3;
        #       route 10.1.3.0:255.255.255.0 via 198.51.100.4;
        #       route 10.2.0.0/24 via "arc0";
        }
```

Note: The # character disables (comments) the rest of the line to its right. Delete the # character to enable a given line.

The example file provides the syntax used to define static routes. Route prefixes can be defined using CIDR notation such as 10.0.0.0/8 or dot-decimal notation such as 10.0.0.0:255.0.0.0. The keyword **via** preempts the gateway IP address for a route. The keyword **unreachable** is used to create black hole routes. Any traffic to these routes will be discarded.

Enabled example:

```
        # Routing domain : Default_RoutingDomain protocol
        static {
        #       disabled;              # Disable by default
                table T0;              # Connect to the routing domain-specific table
                preference 1000;       # Default preference of routes
        #       debug { states, routes, filters, interfaces, events, packets };
        #       debug all;
                route 0.0.0.0/0 via 198.168.1.1;
                route 10.1.1.0/24 via 192.168.1.2;
                route 198.51.100.0/25 unreachable;
        }
```

Notice that the **disabled** line is left commented. Removing the **#** from this line will disable the whole block, so it is left commented to enable the block.

The default gateway of 192.168.1.1 is defined in the first **route** line:

```
        route 0.0.0.0/0 via 198.168.1.1;
```

Traffic destined for 10.1.1.0/24 will be routed to 192.168.1.2:

        route 10.1.1.0/24 via 192.168.1.2;
Traffic destined for 198.51.100.0/25 will be discarded:

        route 198.51.100.0/25 unreachable;
Once the static routes file has been configured, use the following command to apply the changes:

        tcondr configure

Appendix B: Advanced Routing File Creation

For the simple example APN, only basic BGP configuration is required. In large, complex networks with a multitude of routes being shared via BGP, it may be necessary to utilize the advanced features of Talari's BGP implementation. These features are configured from the Command Line Interface of the Talari Appliance. Access the command line through an SSH connection to the Talari Appliance's Management IP address, a serial connection to the Talari Appliance, or using a keyboard and monitor plugged into the Talari Appliance.

Once logged in, navigate to the directory where the advanced BGP configuration file resides using the following command:

        cd /home/talariuser/bird/etc/
From here, edit the apn_bird_bgp_advanced.conf file by using Vim or Nano.

Filters and Functions

Below are examples of filters/functions that can be added to this file. These filters/functions are applied on a per neighbor basis and can be executed during route import or export.

Prepend the AS Path:

This function will prepend the AS path 3 times with AS 65500.

```
function PrependPath()
{
   bgp_path.prepend(65500);
bgp_path.prepend(65500);
bgp_path.prepend(65500); return
true;
}
```

Set Community Attribute:

This function will set the community attribute to the value specified.

```
# New community format (ie: 65000:999) function
SetCommunityAttribute()
{
   bgp_community.add((65000,999));
return true;
}
```

Set Multi Exit Discriminator:

This function sets the route Multi Exit Discriminator to 100.

```
function SetMED()
{
    bgp_med = 100;
return true;
}
```

Filter based on Community Attribute:

This function will filter out routes that don't contain the specified community attribute function

```
AllowRoutesWithCommunity()

{
    if (65000,999) ~ bgp_community then return true;
return false; }
```

Filter out routes with a specified AS number in their path:

This function will reject routes that contain AS 200 at any point between the origin AS and the destination AS.

```
function DenyPathWithAS()
{
    if bgp_path ~ [= * 200 * =] then return false;
return true;
}
```

Allow routes that originate from the AS specified:

This function accepts routes that have an origin AS number of 65000, 200, 300, or 400.

```
function AllowBasedOnOriginASN()
{
    if bgp_path.last ~ [ 65000, 200, 300, 400 ] then return true;
return false;
}
```

Set Local Preference based on certain criteria:

The Local Preference attribute can be set for all routes coming from any given neighbor as seen earlier in the BGP Configuration section of this document. If Local Preference needs to be set based on more specific criteria than neighbor alone, a function such as this can be utilized.

This function sets local preference to 150 if the route prefix is 192.168.10.0/24 or 192.168.20.0/24.

```
function SetLocalPrefBasedOnNetwork()
{
    if net ~ [ 192.168.10.0/24, 192.168.20.0/24 ] then
bgp_local_pref = 150;

    return true;
}
```

This function sets local preference to 150 for routes with a community attribute of 64000:100. In addition, it sets local preference to 200 for routes with a community attribute of 64000:200.

```
function SetLocalPrefBasedOnCommunity()
{
```

```
    if (64000,100) ~ bgp_community then
        bgp_local_pref = 150; if
(64000,200) ~ bgp_community then
        bgp_local_pref = 200;


    return true;
}
```

Note: Functions defined and applied via the Command Line Interface in this way will persist through software and configuration changes made in the APN Configuration Editor.

Routing Commands

Once these functions are defined in the advanced configuration file they need to be applied to specific neighbors either on route import or export. This can be accomplished using the following "advanced_routing" command from the Command Line Interface:

```
advanced_routing --bgp_neighbor "<neighbor_ip_address>" \
--import "<import_function_name()>" \
--export "<export_function_name()>"
```

Notice that the advanced_routing command can take both an import and export argument, or only an import or export argument.

Below are some other advanced routing commands.

Clear all currently applied import/export functions:
```
advanced_routing --clear_functions
```
Show BGP neighbors:
```
advanced_routing --show_neighbors
```
Show all defined advanced routing functions:
```
advanced_routing --show_all_functions
```

Show functions currently being used for imports/exports:
```
advanced_routing --show_used_functions
```
Reload the advanced routing configuration:
```
advanced_routing --reload_config
```
Show the help information for the advanced routing command:
```
advanced_routing --help
```