ASR 1000 OTV Unicast Adjacency Server Configuration Example

TAC **Document ID: 117158**

Contributed by Denny McLaughlin, Cisco TAC Engineer.
Apr 25, 2014

Contents

Introduction

This document describes how to configure the Overlay Transport Virtualization (OTV) Unicast Adjacency Server on the Cisco Aggregation Services Router (ASR) 1000 platform. Since traditional OTV requires multicast across the Internet Service Provider (ISP) cloud, the Unicast Adjacency Server allows you to leverage the OTV feature without the requirement of muticast support and configuration.

OTV extends the Layer 2 (L2) topology across the physically different sites, which allows devices to communicate at L2 across a Layer 3 (L3) provider. Devices in Site 1 believe they are on the same broadcast domain as those in Site 2.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Ethernet Virtual Connection (EVC) configuration

- Basic L2 and L3 configuration on the ASR platform

Components Used

The information in this document is based on the ASR 1002 with Cisco IOS® Version asr1000rp1−adventerprise.03.09.00.S.153−2.S.bin.

Your system must have these requirements in order to implement the OTV feature on the ASR 1000 and Cisco Cloud Services Router (CSR) 1000V Platform:

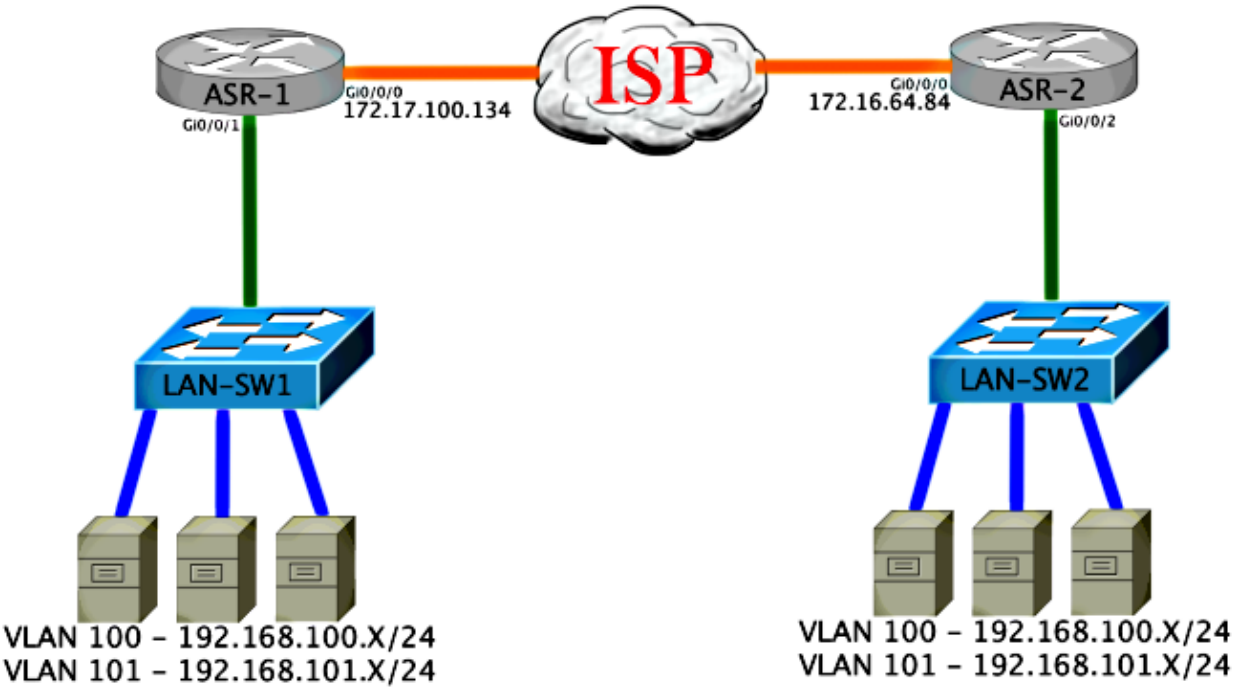
- Cisco IOS−XE Version 3.9S or later
- Maximum Transmission Unit (MTU) of 1542 or higher

  Note: OTV adds a 42−byte header with the Do Not Fragment (DF)−bit to all encapsulated packets. In order to transport 1500−byte packets through the overlay, the transit network must support MTU of 1542 or higher. OTV does not support fragmentation. In order to allow for fragmentation accross OTV, you must enable ***otv fragmentation join−interface*** <interface>.
- Unicast reachability between sites

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Configure

Network Diagram with Basic L2/L3 Connectivity



Basic L2/L3 Connectivity

Start with a base configuration. The internal interface on the ASR is configured for service instances for dot1q traffic. The OTV join interface is the external WAN Layer 3 interface.

```
ASR−1
 interface GigabitEthernet0/0/0
  description OTV−WAN−Connection
  mtu 9216
  ip address 172.17.100.134 255.255.255.0
  negotiation auto
  cdp enable

 ASR−2
 interface GigabitEthernet0/0/0
  description OTV−WAN−Connection
  mtu 9216
  ip address 172.16.64.84 255.255.255.0
  negotiation auto
  cdp enable
```

Since OTV adds a 42−byte header, you must verify that the ISP passes the minimum MTU size from site−to−site. In order to accomplish this verification, send a packet size of 1514 with the DF−bit set. This gives the ISP the payload required plus the ***do not fragment*** tag on the packet in order to simulate an OTV packet. If you cannot ping without the DF−bit, then you have a routing problem. If you can ping without it, but cannot ping with the DF−bit set, you have an MTU problem. Once successful, you are ready to add OTV unicast mode to your site ASRs.

```
ASR−1#ping 172.17.100.134 size 1514 df−bit
 Type escape sequence to abort.
 Sending 5, 1514−byte ICMP Echos to 172.17.100.134, timeout is 2 seconds:
 Packet sent with the DF bit set
 !!!!!
 Success rate is 100 percent (5/5), round−trip min/avg/max = 1/1/2 ms
```

The internal interface is a L2 port configured with service instances for the L2 dot1q tagged packets. It builds an internal site bridge domain. In this example, it is the untagged VLAN1. The internal site bridge domain is used for the communication of multiple OTV devices at the same site. This allows them to communicate and determine which device is the Authoritative Edge Device (AED) for which bridge domain.

The service instance must be configured into a bridge domain that uses the overlay.

```
ASR−1
 interface GigabitEthernet0/0/1
  no ip address
  negotiation auto
  cdp enable
  service instance 1 ethernet
   encapsulation untagged
   bridge−domain 1
  !
  service instance 50 ethernet
   encapsulation dot1q 100
   bridge−domain 200
  !
  service instance 51 ethernet
   encapsulation dot1q 101
   bridge−domain 201


ASR−2
 interface GigabitEthernet0/0/2
  no ip address
  negotiation auto
  cdp enable
  service instance 1 ethernet
   encapsulation untagged
   bridge−domain 1
```

```
 !
 service instance 50 ethernet
  encapsulation dot1q 100
  bridge-domain 200
 !
 service instance 51 ethernet
  encapsulation dot1q 101
  bridge-domain 201
```

OTV Unicast Adjacency Server Minimum Configuration

This is a basic configuration that requires only a few commands in order to set up the adjacency server and join / internal interfaces.

Configure the local site bridge domain, which is VLAN1 on the LAN in this example. The site identifier is specific to each physical location.This example has two remote locations that are physically independent of each other. Configure Site 1 and Site 2 accordingly.

ASR-1

```
 Config t
 otv site bridge-domain 1
 otv site-identifier 0000.0000.0001
```

ASR-2

```
 Config t
 otv site bridge-domain 1
 otv site-identifier 0000.0000.0002
```

Build the overlay for each side. Configure the overlay, apply the join interface, and add the adjacency server configuration to each side. This example has ASR-1 as the adjacency server and ASR-2 as the client.

Note: Ensure that you only apply the ***otv adjacency-server unicast-only*** command on the ASR that is the server. Do not apply it to the client side.

Add the two bridge domains that you want to extend. Notice that you do not extend the site bridge domain, only the two VLANs that are needed. Build a separate service instance for the overlay interfaces to call bridge domain 200 and 201. Apply the dot1q tags 100 and 101 respectively.

ASR-1

```
 Config t
 interface Overlay1
  no ip address
  otv join-interface GigabitEthernet0/0/0
  otv use-adjacency-server 172.17.100.134 unicast-only
  otv adjacency-server unicast-only
    service instance 10 ethernet
     encapsulation dot1q 100
     bridge-domain 200
    service instance 11 ethernet
     encapsulation dot1q 101
     bridge-domain 201
```

ASR-2

```
 Config t
 interface Overlay1
```

```
 no ip address
 otv join-interface GigabitEthernet0/0/0
 otv use-adjacency-server 172.17.100.134 unicast-only
   service instance 10 ethernet
    encapsulation dot1q 100
    bridge-domain 200
   service instance 11 ethernet
    encapsulation dot1q 101
    bridge-domain 201
```

Note: Do NOT extend the site VLAN on the overlay interface. This causes the two ASRs to have a conflict because they believe that each remote side is in the same site.

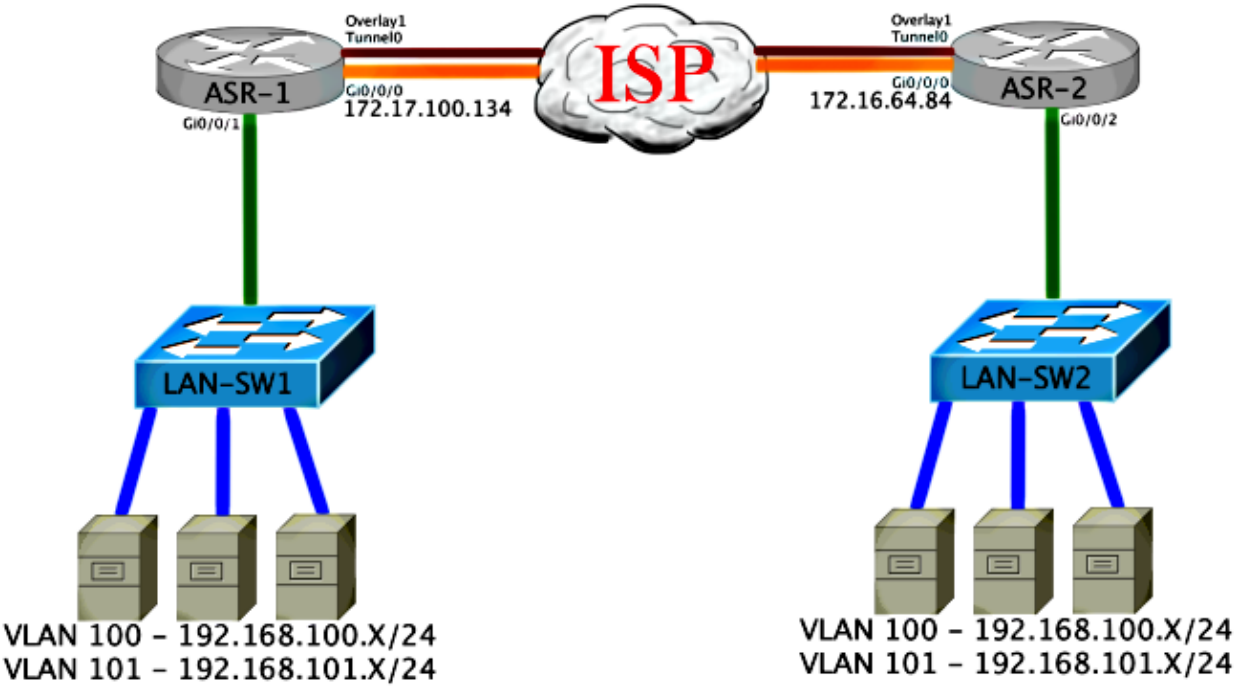
At this stage, ASR−to−ASR OTV unicast−only adjacency is complete and up. The neighbors are found, and the ASR should be AED−capable for the VLANs that needed to be extended

```
ASR-1#show otv
 Overlay Interface Overlay1
  VPN name                 : None
  VPN ID                   : 1
  State                    : UP
  AED Capable              : Yes
  Join interface(s)        : GigabitEthernet0/0/0
  Join IPv4 address        : 172.17.100.134
  Tunnel interface(s)      : Tunnel0
  Encapsulation format     : GRE/IPv4
  Site Bridge-Domain       : 1
  Capability               : Unicast-only
  Is Adjacency Server      : Yes
  Adj Server Configured    : Yes
 Prim/Sec Adj Svr(s)      :172.17.100.134
 ASR-1#show otv isis neigh

 Tag Overlay1:
 System Id      Type Interface   IP Address      State Holdtime Circuit Id
 ASR-2          L1   Ov1         172.16.64.84      UP    25       ASR-1.01


ASR-2#show otv
 Overlay Interface Overlay1
  VPN name                 : None
  VPN ID                   : 1
  State                    : UP
  AED Capable              : Yes
  Join interface(s)        : GigabitEthernet0/0/0
  Join IPv4 address        : 172.16.64.84
  Tunnel interface(s)      : Tunnel0
  Encapsulation format     : GRE/IPv4
  Site Bridge-Domain       : 1
  Capability               : Unicast-only
  Is Adjacency Server      : No
  Adj Server Configured    : Yes
  Prim/Sec Adj Svr(s)      : 172.17.100.134
 ASR-2#show otv isis neigh

 Tag Overlay1:
 System Id      Type Interface   IP Address      State Holdtime Circuit Id
 ASR-1          L1   Ov1         172.17.100.134    UP    8        ASR-1.01
```

Verifiy

Use this section in order to confirm that your configuration works properly.

Network Diagram with OTV



Verification Commands and Expected Output

This output shows that VLANs 100 and 101 are extended. The ASR is the AED, and the internal interface and service instance that maps the VLANs are seen in the output.

```
ASR-1#show otv vlan
 Key:  SI - Service Instance

 Overlay 1 VLAN Configuration Information
  Inst VLAN  Bridge-Domain  Auth  Site Interface(s)
  0    100   200            yes   Gi0/0/1:SI50
  0    101   201            yes   Gi0/0/1:SI51
  Total VLAN(s): 2
  Total Authoritative VLAN(s): 2


 ASR-2#show otv vlan
 Key:  SI - Service Instance

 Overlay 1 VLAN Configuration Information
  Inst VLAN  Bridge-Domain  Auth  Site Interface(s)
  0    100   200            yes   Gi0/0/2:SI50
  0    101   201            yes   Gi0/0/2:SI51
  Total VLAN(s): 2
  Total Authoritative VLAN(s): 2
```

In order to validate that the VLANs are extended, perform a site-to-site ping. Host 192.168.100.2 is located at Site 1, and Host 192.168.100.3 is located at Site 2. The first few pings are expected to fail as you build ARP locally and across OTV to the other side.

```
LAN-SW1#ping 192.168.100.3
 Type escape sequence to abort.
 Sending 5, 100-byte ICMP Echos to 192.168.100.3, timeout is 2 seconds:
 ...!!
 Success rate is 40 percent (2/5), round-trip min/avg/max = 1/5/10 ms
```

```
LAN-SW1#ping 192.168.100.3
 Type escape sequence to abort.
 Sending 5, 100-byte ICMP Echos to 192.168.100.3, timeout is 2 seconds:
 !!!!!
 Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/10 ms


LAN-SW1#ping 192.168.100.3 size 1500 df-bit
 Type escape sequence to abort.
 Sending 5, 1500-byte ICMP Echos to 192.168.100.3, timeout is 2 seconds:
 Packet sent with the DF bit set
 !!!!!
 Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/10 ms
```

In order to ensure that the MAC table and OTV routing tables are built properly with the local device and that you learn the MAC address of the remote device, use the ***show otv route*** command.

```
LAN-SW1#show int vlan 100
 Vlan100 is up, line protocol is up
   Hardware is Ethernet SVI, address is 0c27.24cf.abd1 (bia 0c27.24cf.abd1)
   Internet address is 192.168.100.2/24


LAN-SW2#show int vlan 100
 Vlan100 is up, line protocol is up
   Hardware is Ethernet SVI, address is b4e9.b0d3.6a51 (bia b4e9.b0d3.6a51)
   Internet address is 192.168.100.3/24


ASR-1#show otv route vlan 100

 Codes: BD - Bridge-Domain, AD - Admin-Distance,
        SI - Service Instance, * - Backup Route

 OTV Unicast MAC Routing Table for Overlay1

  Inst VLAN BD     MAC Address    AD    Owner  Next Hops(s)
 -----------------------------------------------------------
  0    100  200    0c27.24cf.abaf 40    BD Eng Gi0/0/1:SI50
  0    100  200    0c27.24cf.abd1 40    BD Eng Gi0/0/1:SI50 <--- Local mac is
  pointing to the physical interface
  0    100  200    b4e9.b0d3.6a04 50    ISIS   ASR-2
  0    100  200    b4e9.b0d3.6a51 50    ISIS   ASR-2              <--- Remote
  mac is pointing across OTV to ASR-2

 4 unicast routes displayed in Overlay1

 -----------------------------------------------------------
 4 Total Unicast Routes Displayed


ASR-2#show otv route vlan 100

 Codes: BD - Bridge-Domain, AD - Admin-Distance,
        SI - Service Instance, * - Backup Route

 OTV Unicast MAC Routing Table for Overlay1

  Inst VLAN BD     MAC Address    AD    Owner  Next Hops(s)
 -----------------------------------------------------------
  0    100  200    0c27.24cf.abaf 50    ISIS   ASR-1
  0    100  200    0c27.24cf.abd1 50    ISIS   ASR-1              <--- Remote
  mac is pointing across OTV to ASR-1
```

```
  0    100  200    b4e9.b0d3.6a04 40    BD Eng Gi0/0/2:SI50
  0    100  200    b4e9.b0d3.6a51 40    BD Eng Gi0/0/2:SI50 <--- Local mac is
  pointing to the physical interface

 4 unicast routes displayed in Overlay1

 ------------------------------------------------------
 4 Total Unicast Routes Displayed
```

Common Problem

The When OTV Does Not Form error message in the output indicates that the ASR is not AED−capable. This means that the ASR does not forward the VLANs across OTV. There are several possible causes for this, but the most common is that the ASRs do not have connectivity between sites. Check for L3 connectivity and possible blocked traffic to UDP Port 8472, which is reserved for OTV. Another possible cause of this condition is when the internal site bridge domain is not configured. This creates a condition where the ASR cannot become the AED, because it is not certain if it is the only ASR on the site.

```
ASR−1#show otv
 Overlay Interface Overlay1
  VPN name                 : None
  VPN ID                   : 1
  State                    : UP
  AED Capable              : No, overlay DIS not elected <--- Local OTV site cannot
  see the remote neighbor
  Join interface(s)        : GigabitEthernet0/0/0
  Join IPv4 address        : 172.17.100.134
  Tunnel interface(s)      : Tunnel0
  Encapsulation format     : GRE/IPv4
  Site Bridge−Domain       : 1
  Capability               : Unicast−only
  Is Adjacency Server      : Yes
  Adj Server Configured    : Yes
  Prim/Sec Adj Svr(s)      : 172.17.100.134


ASR−2#show otv
 Overlay Interface Overlay1
  VPN name                 : None
  VPN ID                   : 1
  State                    : UP
  AED Capable              : No, overlay DIS not elected <--- Local OTV site cannot
  see the remote neighbor
  Join interface(s)        : GigabitEthernet0/0/0
  Join IPv4 address        :172.16.64.84
  Tunnel interface(s)      : Tunnel0
  Encapsulation format     : GRE/IPv4
  Site Bridge−Domain       : 1
  Capability               : Unicast−only
  Is Adjacency Server      : No
  Adj Server Configured    : Yes
  Prim/Sec Adj Svr(s)      : 172.17.100.134
```

Troubleshoot

This section provides information you can use in order to troubleshoot your configuration.

Packet Capture Creation on the Join Interface in Order to See OTV Hellos

You can use the onboard packet capture device on the ASR in order to help troubleshoot possible problems.

In order to create an Access Control List (ACL) to minimize impact and oversaturated captures, enter:

```
ip access-list extended CAPTURE
 permit udp host 172.17.100.134 host 172.16.64.84 eq 8472
 permit udp host 172.16.64.84 host 172.17.100.134 eq 8472
```

In order to set up the capture to sniff the join interface in both directions on both ASRs, enter:

```
monitor capture 1 buffer circular access-list CAPTURE interface g0/0/0 both
```

In order to start the capture, enter:

```
monitor capture 1 start

 *Nov 14 15:21:37.746: %BUFCAP-6-ENABLE: Capture Point 1 enabled.

 <wait a few min>

 monitor capture 1 stop

 *Nov 14 15:22:03.213: %BUFCAP-6-DISABLE: Capture Point 1 disabled.

 show mon cap 1 buffer brief
```

The buffer output shows that the hellos in the capture egress and ingress from the neighbor and locally. When enabled on both ASRs and captured bidirectionally, you see the same packets leave on one side and enter the other in the capture.

The first two packets in ASR−1 were not caught in ASR−2, so you must offset the capture by three seconds in order to compensate for the time and the two extra packets that lead the ASR−1 output.

```
ASR-1#show mon cap 1 buff bri
  ----------------------------------------------------------
  #   size   timestamp     source             destination   protocol
  ----------------------------------------------------------
    0 1464    0.000000   172.17.100.134     ->  172.16.64.84       UDP  * not in
    ASR-2 cap
    1  150    0.284034   172.17.100.134     ->  172.16.64.84       UDP  * not in
    ASR-2 cap
    2 1464    3.123047   172.17.100.134     ->  172.16.64.84       UDP
    3 1464    6.000992   172.17.100.134     ->  172.16.64.84       UDP
    4  110    6.140044   172.17.100.134     ->  172.16.64.84       UDP
    5 1464    6.507029   172.16.64.84       ->  172.17.100.134     UDP
    6 1464    8.595022   172.17.100.134     ->  172.16.64.84       UDP
    7  150    9.946994   172.17.100.134     ->  172.16.64.84       UDP
    8 1464   11.472027   172.17.100.134     ->  172.16.64.84       UDP
    9  110   14.600012   172.17.100.134     ->  172.16.64.84       UDP
   10 1464   14.679018   172.17.100.134     ->  172.16.64.84       UDP
   11 1464   15.696015   172.16.64.84       ->  172.17.100.134     UDP
   12 1464   17.795009   172.17.100.134     ->  172.16.64.84       UDP
   13  150   18.903997   172.17.100.134     ->  172.16.64.84       UDP
   14 1464   21.017989   172.17.100.134     ->  172.16.64.84       UDP
   15  110   23.151045   172.17.100.134     ->  172.16.64.84       UDP
   16 1464   24.296026   172.17.100.134     ->  172.16.64.84       UDP
   17 1464   25.355029   172.16.64.84       ->  172.17.100.134     UDP
   18 1464   27.053998   172.17.100.134     ->  172.16.64.84       UDP
   19  150   27.632023   172.17.100.134     ->  172.16.64.84       UDP
   20 1464   30.064999   172.17.100.134     ->  172.16.64.84       UDP
   21  110   32.358035   172.17.100.134     ->  172.16.64.84       UDP
   22 1464   32.737013   172.17.100.134     ->  172.16.64.84       UDP
   23 1464   32.866004   172.16.64.84       ->  172.17.100.134     UDP
   24 1464   35.338032   172.17.100.134     ->  172.16.64.84       UDP
   25  150   35.709015   172.17.100.134     ->  172.16.64.84       UDP
```

```
  26 1464   38.054990   172.17.100.134     ->  172.16.64.84       UDP
  27  110   40.121048   172.17.100.134     ->  172.16.64.84       UDP
  28 1464   41.194042   172.17.100.134     ->  172.16.64.84       UDP
  29 1464   42.196041   172.16.64.84       ->  172.17.100.134     UDP
```

```
ASR-2#show mon cap 1 buff bri
 ----------------------------------------------------------
 #   size   timestamp     source             destination   protocol
 ----------------------------------------------------------
   0 1464    0.000000   172.17.100.134     ->  172.16.64.84       UDP
   1 1464    2.878952   172.17.100.134     ->  172.16.64.84       UDP
   2  110    3.018004   172.17.100.134     ->  172.16.64.84       UDP
   3 1464    3.383982   172.16.64.84       ->  172.17.100.134     UDP
   4 1464    5.471975   172.17.100.134     ->  172.16.64.84       UDP
   5  150    6.824954   172.17.100.134     ->  172.16.64.84       UDP
   6 1464    8.349988   172.17.100.134     ->  172.16.64.84       UDP
   7  110   11.476980   172.17.100.134     ->  172.16.64.84       UDP
   8 1464   11.555971   172.17.100.134     ->  172.16.64.84       UDP
   9 1464   12.572968   172.16.64.84       ->  172.17.100.134     UDP
  10 1464   14.672969   172.17.100.134     ->  172.16.64.84       UDP
  11  150   15.780965   172.17.100.134     ->  172.16.64.84       UDP
  12 1464   17.895965   172.17.100.134     ->  172.16.64.84       UDP
  13  110   20.027998   172.17.100.134     ->  172.16.64.84       UDP
  14 1464   21.174002   172.17.100.134     ->  172.16.64.84       UDP
  15 1464   22.231998   172.16.64.84       ->  172.17.100.134     UDP
  16 1464   23.930951   172.17.100.134     ->  172.16.64.84       UDP
  17  150   24.508976   172.17.100.134     ->  172.16.64.84       UDP
  18 1464   26.942959   172.17.100.134     ->  172.16.64.84       UDP
  19  110   29.235995   172.17.100.134     ->  172.16.64.84       UDP
  20 1464   29.614973   172.17.100.134     ->  172.16.64.84       UDP
  21 1464   29.743964   172.16.64.84       ->  172.17.100.134     UDP
  22 1464   32.215992   172.17.100.134     ->  172.16.64.84       UDP
  23  150   32.585968   172.17.100.134     ->  172.16.64.84       UDP
  24 1464   34.931958   172.17.100.134     ->  172.16.64.84       UDP
  25  110   36.999008   172.17.100.134     ->  172.16.64.84       UDP
  26 1464   38.072002   172.17.100.134     ->  172.16.64.84       UDP
  27 1464   39.072994   172.16.64.84       ->  172.17.100.134     UDP
```

Related Information

- ***ASR OTV Configuration Guide***
- ***Technical Support & Documentation − Cisco Systems***

Updated: Apr 25, 2014 Document ID: 117158