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MANRS Lab

Exercise Creation Guide

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www.steffann.nl

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Client software requirements

Browser

The lab is accessed through a modern web browser. Current versions of Safari, Chrome and Firefox have been tested.

Installing GNS3 client software

To access the server securely an OpenVPN client is used. Instructions on how to use the VPN can be found on https://docs.gns3.com/1c2lyicy6efnv-TS_4Hc7p11gn03-ytz9ukgwFfckDk/index.html. Popular OpenVPN client applications are Viscosity and Tunnelblick.

Exercise creators then use the GNS3 client on their PC to get direct access to the lab configurations over the VPN. The client software can be downloaded from <https://github.com/GNS3/gns3-gui/releases> and instructions on how to configure it are at https://docs.gns3.com/1K_OVfincey0cUw6CP4dWVgs_pBXMdIJ6gdFGjNy8EZQ/index.html. Make sure to select the "Run everything on a remote server" option.

When downloading the GNS3 client software make sure you download the exact same version as is used on the server. If the versions do not match the client will refuse to connect to the server.

Simulated device images

For each type of (emulated) device that you are going to use in your exercise you will need a GNS3 Appliance. Some of those appliances may already have been installed on the GNS3 server, in which case you can use those. Using other types of appliances may need some appliance-specific installation steps.

GNS3 supports a large number of appliances. A list of appliances that are included by default can be found at <https://docs.gns3.com/1FFbs5hOBbx8O855KxLetlCwlbymTN8L1zXXQzCqfmy4/index.html#h.appliances>, and there is a marketplace at <https://gns3.com/marketplace/appliances> that offers even more appliances for download.

Please note that only text-based console connections are supported by the lab management system at this time. Devices that are managed through VNC or web based connections are not supported.

Instructions on how to install new appliances on the GNS3 server can be found in the **Server Installation Guide**.

Licenses

Many appliances need software images that are provided by device vendors. The appliance usually includes instructions on where to download the software. It is your responsibility however that any applicable licenses are present to let students use those software images.

Connecting the GNS3 Client

After creating a VPN connection to access the GNS3 server back-end, start the GNS3 client application. When starting it for the first time it will ask you which server to use:

A screenshot of the GNS3 client's 'Server' selection dialog. The dialog has a dark gray background with white text. At the top, the title 'Server' is followed by a subtitle: 'Please choose a server type to run your GNS3 network simulations. The GNS3 VM is strongly recommended on Windows and Mac OS X.' Below this, there are three radio button options. The first option is 'Run modern IOS (IOSv or IOU), ASA and appliances from non Cisco manufacturers.' with a sub-note 'This will require an additional VM (the GNS3 VM is available for free) .'. The second option is 'Run only legacy IOS on my computer' with a sub-note 'Requires IOS images <= C7200'. The third option is 'Run everything on a remote server (advanced usage)' which is selected with a filled radio button, and has a sub-note 'The server will be on a remote computer and can be shared with multiple users.' At the bottom left, there is a checkbox labeled 'Don't show this again'. At the bottom right, there are three buttons: '< Back', 'Next >', and 'Cancel'.

Choose "Run everything on a remote server" here. The next screen will ask you for the host and port of the server. Enter the hostname or IP address provided to you by the server administrator. The port number is usually 3080.

If the GNS3 client asks you to import any appliances you can do so if you want to. Otherwise press cancel here.

Building the GNS3 project

Creating and naming the project

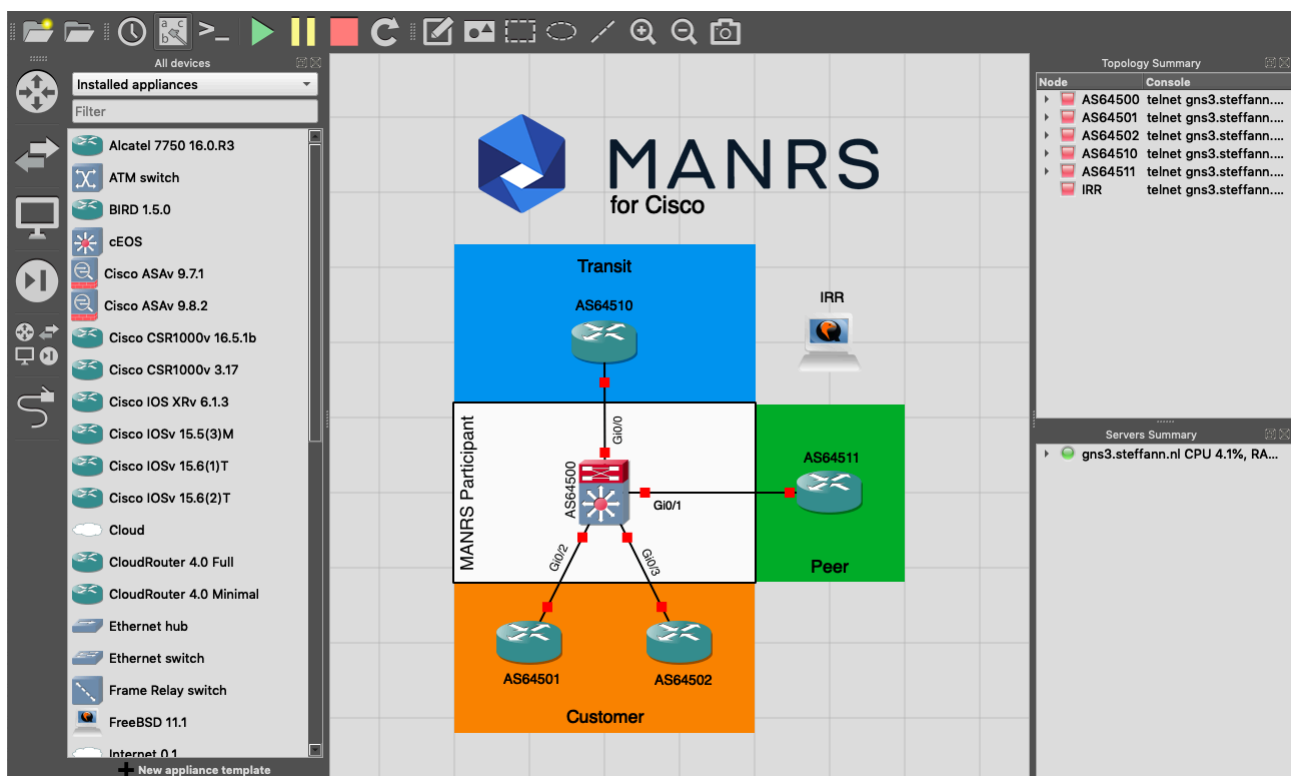
Every exercise will be based on a GNS3 project. A new exercise therefore needs a new GNS3 project. In the GNS3 client create a new project. When naming the project we recommend prefixing the name with "Template: ". That way it is easier to identify which GNS3 projects are templates for exercises. The prefix will automatically be removed when showing it to users, so this is mostly for the convenience of exercise creators.

Generic advice

Almost everything in the GNS3 lab can be edited. Right-click on graphical elements, labels, devices and links to see the possibilities. Deleting an item can also be found there.

Adding devices

Devices are added by dragging them from the toolbar on the left to the drawing area in the middle of the screen:



If the list of device types is not visible it can be opened by clicking on one of the symbols on the left (from top to bottom: routers, switches, end devices, security devices and "all of the above") and selecting "Installed appliances" at the top.

Special device types

The MANRS lab provides two special device types:

- ISOC Lab IRR
- ISOC Lab Monitor

These device types are created specifically to exchange information between the student's lab environment and the lab management system.

ISOC Lab IRR

The IRR device contains a small IRR database that the student can query and update through the web interface.

ISOC Lab Monitor

The Monitor device provides eBGP sessions to announce and receive routes. It also sends and receives pings. It reports received routes and pings back to the management system. This is used to validate the student's progress in the exercise. To implement MANRS correctly each monitor must receive the correct routes and receive the correct ping packets. No more, no less.

Routes:

- If the monitor receives routes that it should not receive that means that the student is not properly filtering routes
- If the monitor doesn't receive routes that it should receive that means the student is filtering too aggressively

Pings:

- If the monitor receives pings that it shouldn't receive (for example with spoofed source addresses) then the student is not verifying source addresses in packets properly
- If the monitor doesn't receive pings that it should receive then the student is filtering too aggressively

Creating connections

The bottom icon in the toolbar on the left is for creating network connections. Click on the first device and select the interface to connect the link to, then do the same on the second device to connect the other side of the link.

Make sure that all devices have the correct number of network adapters configured (right-click on a device to configure it) before making connections. To change the number of interfaces later you would have to remove all connections, change the number, and re-add all the connections again. This can be an annoying limitation of the GNS3 client interface.

Configuring the devices

Once the lab has been created you can start it. GNS3 provides console access to devices. As an exercise creator you can access every device's console. Students will access the lab through the web interface and only have access to the consoles that you want to give them access to.

At this point configure all the devices so they are in the state that you want them to be at the beginning of the exercise. The student's starting position will be how you configure it here.

Configuring the ISOC Lab IRR

The IRR node contains an IRRd server. When creating a new node the database will be completely empty. To create some starting content for the student to work with it has to be filled. Connect to the console of the IRR node and log in with username `ubuntu` and

password `VerySecret`. This user has the required permissions for running `sudo`, which is required in the following steps.

To fill the database we use the same back-end tool that the web interface connects to, but we access it using the command line through the console. To start the tool run:

```
sudo /opt/lab_interface.py
```

This will dump some information about the state of the IRR database on the screen:

- NEIGHBORS: The import and export lines from AUTNUM AS64500¹
- ASN IPv4: IPv4 routes that have a route object from AS64500
- ASN IPv6: IPv6 routes that have a route6 object from AS64500
- AS-SET IPv4: IPv4 routes that are included through AS-SET AS64500:AS-ALL²
- AS-SET IPv6: IPv6 routes that are included through AS-SET AS64500:AS-ALL

IRR updates are sent to the database by copy&pasting them into this command line tool. When all updates have been sent the tool can be close by pressing CTRL-C.

Updates have the following format:

```
*****[ UPDATE ]*****
mntner:      ROOT-MNT
descr:       Root Maintainer
admin-c:     SJMS-MANRS
auth:        CRYPT-PW nyN51fqqp/enQ
upd-to:      sander@steffann.nl
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
override:    administrator VerySecret
*****[ END ]*****
```

Every update must begin with `*****[UPDATE]*****` and end with `*****[END]*****`. These are the markers for the tool to know where the updates begin and end. Everything outside such a block is ignored.

An update usually consists of one IRR database object, but multiple objects can be updated in one go by putting them in one `UPDATE` block and separating them with an empty line.

All updates sent to the IRR database need to be authenticated. For normal modifications (as done by the student for example) the authentication is based on the password of the MNTNER object. When creating the MNTNER object itself that is of course not yet possible. This line overrides the normal authentication for such purposes:

```
override:    administrator VerySecret
```

To make filling the database for MANRS exercises easier a full configuration can be found at <https://raw.githubusercontent.com/MANRS-Lab/labmgr/master/manrs/irr-initial.txt>. A copy of that file is also included in the appendix. Copy&paste this into the tool to get to the standard MANRS IRR database starting point.

¹ The student's ASN is statically configured as AS64500. This may become configurable in the future.

² The AS-SET is statically configured as AS64500:AS-ALL. This may become configurable in the future.

Configuring an ISOC Lab Monitor

The Monitoring node consists of several scripts that work together. To simplify configuration all settings are stored in `/opt/settings.sh`. This file contains the following mandatory elements:

```
HOSTNAME="as64511-peer"

V4_INTERFACE="203.0.113.251/31"
V6_INTERFACE="2001:db8:1000:fffd::b/127"

ROUTER_ID="203.0.113.251"
LOCAL_ASN="64511"

PEER_ASN="64500"
PEER_ADDRESS_V4="203.0.113.250"
PEER_ADDRESS_V6="2001:db8:1000:fffd::a"
```

This configures the hostname, network interface (monitor nodes always have exactly one), and some basic BGP configuration. Most options speak for themselves.

After that there can be a list of prefixes to announce. For example:

```
V4_PREFIX1="0.0.0.0/0"
V4_PREFIX2="172.16.0.0/13"

V6_PREFIX1="::/0"
V6_PREFIX2="2001:db8:3000::/36"
V6_PREFIX3="2001:db8:6000::/36 65003"
V6_PREFIX4="2001:db8:7000::/37 65004 65002"
```

As many prefixes as necessary can be configured here. The software starts with `V4_PREFIX1` and counts up from there. As soon as it encounters a non-existent number it stops. And then it does the same for `V6_PREFIX1`.

After that a list of pings to send can be configured. It uses the same structure: starting with `PING1` and counting up from there. For example:

```
PING1="2001:db8:1000::1"
PING2="2001:db8:1001::1 2001:db8:3000::1"
PING3="203.0.113.1"
PING4="192.0.2.1 192.88.99.11"
```

Pings 1 and 2 are IPv6 pings and pings 3 and 4 are IPv4 pings. As you can see in pings 2 and 4, it is possible to optionally specify a source address as the second parameter. This source address may be spoofed to test whether the student properly filters source addresses. If no source address is specified the monitor node's interface address will be used as the source.

To make the configuration for the standard MANRS lab easier there is a script in the <https://github.com/MANRS-Lab/labmgr> repository called `manrs/monitor/generate_settings.py` for generating them. Pass the AS number of the monitor node to the script. For example:

```
./generate_settings.py 64501
```

The output of that script is also included in the appendix.

Layout

The layout for the lab network in the web interface is based on the layout in the GNS3 client. Use descriptive labels, use graphical elements or images where appropriate etc.

Connecting the GNS3 project

Once the raw network project is set up it is time to connect it to the lab management system. This is done through the web interface.

Logging in

Type the name of the server in your browser's address bar (in this example gns3.steffann.nl) and you should see a welcome screen.

Click the "Log in" link in the top right of the screen and log in with an account that has administrator privileges. You should now be at the welcome screen again with an "Admin interface" link available in the top right corner. Click that link. You should be presented with the admin home screen with links to edit Groups, Users, Exercise templates, Exercises, IRR templates and Monitor templates.

Connecting the project

Connecting the project to the management system is done through "Exercise templates". On the main admin screen click on the "Add" link to add an exercise template, or if you are already on the exercise templates overview list, click the "Add exercise template" button in the top right corner of the screen. This will take you to this page:

The screenshot shows the 'Add exercise template' page in the MANRS Lab Manager. The header is dark blue with 'MANRS Lab Manager' on the left and 'WELCOME, SANDER. VIEW SITE / CHANGE PASSWORD / LOG OUT' on the right. Below the header is a light blue breadcrumb trail: 'Home > Lab > Exercise templates > Add exercise template'. The main content area is white and titled 'Add exercise template'. It contains three sections: 1. 'Available templates:' with a dropdown menu showing 'Template: MANRS-Cisco-XR'. 2. 'Allow self-signup' with an unchecked checkbox and the text 'Allow any student to start this exercise without supervision'. 3. 'Default time limit:' with a numeric input field set to '0' and the text 'in minutes'. At the bottom right, there are three buttons: 'Save and add another', 'Save and continue editing', and 'SAVE'.

The "Available templates" list will show you all the GNS3 projects that are not yet connected to the management system. Select the one you just created.

The "Allow self-signup" checkbox determines whether this exercise is open to everybody, and everybody can start a new exercise for themselves or not. When allowing this it is strongly recommended that a time limit is set as well.

The "Default time limit" field determines how long an exercise will be available after it has been started. After the specified number of minutes the exercise is automatically shut down and the student can no longer work on it. The exercise data is retained for a week after the deadline has expired. Teachers and administrators can still re-start the exercise, remove or set a new deadline and grant the student access to the lab during that week. This can be used for example when a student needs more time and/or assistance, to debug problems or to be able to export the GNS3 project for offline usage.

After filling out this form click on the "Save and continue editing" link to continue.

Connecting the nodes

Once the project itself has been connected the management system needs to know what the different nodes are for: which nodes is the student allowed to access? Which nodes are monitor nodes that need to be observed? Etc.

You can do this on the edit page of the exercise template, which you should now see:

MANRS Lab Manager

WELCOME, SANDER. VIEW SITE / CHANGE PASSWORD / LOG OUT

Home > Lab > Exercise templates > Template: MANRS-Cisco-XR

Change exercise template

History

Name:Template: MANRS-Cisco-XR

Project id:70e296d9-8a45-4956-82cb-eb1379367fe4

Exercise instructions:

Use markdown for styling

☐ Allow self-signup
Allow any student to start this exercise without supervision

Default time limit:

in minutes

WORK NODES

MONITOR NODES

IRR NODES


+ Add work, monitor or IRR node

Delete

Save and add another

Save and continue editing

SAVE




MANRS
for Cisco-XR

Transit

AS64510

e0

IRR



MANRS Participant

AS64500

Gig0/0/0/0

Gig0/0/0/1

Gig0/0/0/2

Gig0/0/0/3

Peer

AS64511

e0

Customer

AS64501

e0

AS64502

e0

The diagram on the right is automatically generated from GNS3. Changes in GNS3 will show up here as well.

First we start by connecting the nodes. To do that click on the "Add work, monitor or IRR node" link at the bottom of the screen just above the bar with buttons. You will see a screen like this:

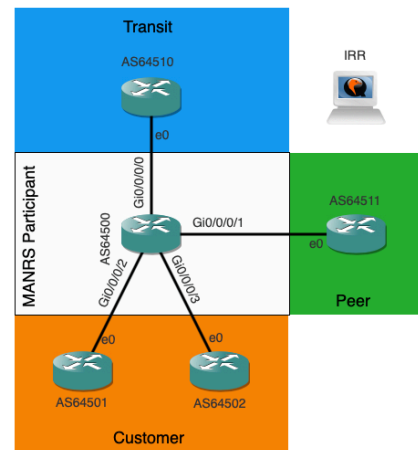
Add node to Template: MANRS-Cisco-XR

Available nodes:

AS64500

Node type:

Node for monitor the results of the work

**MANRS**
for Cisco-XR

Save and add another

SAVE

Either select a node from the "Available nodes" list, or click on the node in the network diagram on the right to select which node to connect. Then in the "Node type" list select what type of node it is: a node for the student to work on, a monitor node or an IRR node.

Then click on "Save and add another" to continue with the next node. The nodes you have already connected will be greyed out. Once you have reached the last node that you want to connect (if a node is of none of the above types it is perfectly fine to not connect it to the management system, it will just be ignored) click on "Save" and you will be taken back to the previous screen.

Filling in the exercise details

Now that the system knows about the exercise and the devices in it, it is time to add further details.

In the "Exercise instructions" field you can provide the information for the page that the student will see when starting the exercise. You can use markdown (see <https://en.wikipedia.org/wiki/Markdown> for more information) to format the information.

Work nodes

WORK NODES

Work node: AS64500 ☐ Delete

Username:

Password:

Instructions:

Use markdown for styling

For each node that the student is allowed to work on, called work nodes, you can provide:


- Username: the username the student can use to log in to the device
- Password: the password the student can use to log in to the device
- Information: extra information shown on the tab in the student interface for this device, in markdown format

Monitor nodes

MONITOR NODES

Monitor node: AS64501 ☐ Delete

Monitor template:

Instructions: -

The monitor nodes will be connected to a monitor template. Because MANRS offers the same exercise on different platforms (Cisco, Juniper, Mikrotik etc) it would be very cumbersome to configure the monitor nodes for each one separately.



If an appropriate monitor template already exists for this node then select it from the list. Otherwise click on the + on the right side of the list. That will take you to the "Add monitor template" screen. You can give the monitor template a name and provide instructions for the student in markdown format. For now we will ignore the monitor goals and just save the template.

IRR nodes

IRR NODES

IRR node: IRR ☐ Delete

IRR template:

Maintainer:

Maintainer password:

Instructions:

-

The IRR nodes are the ones that contain the IRR database. These use a similar template system as the monitor nodes. If an appropriate IRR template already exists for this node then select it from the list. Otherwise click on the + on the right side of the list. That will take you to the "Add IRR template" screen. You can give the IRR template a name and provide instructions for the student in markdown format. For now we will ignore the IRR goals and just save the template.

IRR nodes also contain:

- Maintainer: the name of the MNTNER object the student can use
- Password: the password of that MNTNER object

Testing the exercise

At this point the system knows about the project and its nodes. Now is the time to see what it looks like from a student's point of view. Go back to the list of exercise templates:

MANRS Lab Manager

WELCOME, SANDER. VIEW SITE / CHANGE PASSWORD / LOG OUT

Home > Lab > Exercise templates

Select exercise template to change

Action: Go 0 of 3 selected

<input type="checkbox"/>	NAME	ALLOW SELF-SIGNUP	DEFAULT TIME LIMIT	NODES	STUDENTS
<input type="checkbox"/>	Template: MANRS-Cisco	<input checked="" type="checkbox"/>	120	1 work node 4 monitor nodes 1 IRR node	3 students Add student
<input type="checkbox"/>	Template: MANRS-Juniper	<input checked="" type="checkbox"/>	120	1 work node 4 monitor nodes 1 IRR node	0 students Add student
<input type="checkbox"/>	Template: MANRS-Mikrotik	<input checked="" type="checkbox"/>	120	1 work node 4 monitor nodes 1 IRR node	0 students Add student

3 exercise templates

FILTER

By allow self-signup

All
Yes
No

By default time limit

All
120

Now add yourself as a student and create an exercise based on the the exercise template you have just created. Click "Add student" for your exercise template. You will see:

Add student to Template: MANRS-Cisco

Exercise template:

Template: MANRS-Cisco

Student:

Sander Steffann (sander@steffann.nl)

Time limit:

in minutes

Save and add another

SAVE

Select yourself as the student. It is recommended to **not** set a time limit for yourself at this point, so make sure the time limit field is empty.

After saving you will see the list with exercise templates again. From here click on the "students" link for your exercise template. It will probably say "1 student" at this point. This will take you to the list of exercises based on your template:

Select exercise to change

Action: Go 0 of 4 selected

<input type="checkbox"/>	STUDENT	NAME	TEMPLATE	STARTED	DEADLINE	RUNNING	DASHBOARD
<input type="checkbox"/>	lee	MANRS-Cisco for Lee Howard	Template: MANRS-Cisco	Dec. 11, 2018, 5:58 p.m.	-	<input checked="" type="checkbox"/>	Dashboard
<input type="checkbox"/>	marcel.dejager	MANRS-Cisco for Marcel de Jager	Template: MANRS-Cisco	Dec. 17, 2018, 12:35 p.m.	Dec. 17, 2018, 2:35 p.m.	<input checked="" type="checkbox"/>	Dashboard
<input type="checkbox"/>	sander	MANRS-Cisco for Sander Steffann	Template: MANRS-Cisco	Dec. 20, 2018, 11:35 p.m.	-	<input checked="" type="checkbox"/>	Dashboard
<input type="checkbox"/>	sander	MANRS-Cisco for Sander Steffann-1	Template: MANRS-Cisco	Dec. 17, 2018, 12:35 p.m.	Dec. 17, 2018, 2:35 p.m.	<input checked="" type="checkbox"/>	Dashboard

4 exercises

Here you can see all the exercises and whether they are running at the moment. Exercises whose deadline has expired will be automatically stopped.

Click on the "Dashboard" link for the exercise you just created, and you will be taken to the dashboard. This is the view that a student has of your exercise:

MANRS Lab Manager

Dashboard: MANRS-Cisco for Sander Steffann

Logged in as Sander Steffann (sander@steffann.nl)
[Home](#) | [Admin interface](#) | [Change password](#) | [Log out](#)

InstructionsAS64500AS64501AS64502AS64510AS64511IRROnline

MANRS for Cisco

Welcome to the MANRS for Cisco lab. This lab consists of a transit, a peer, two customers, and your very own Cisco router in the middle. The goal is to implement MANRS on your router so that the other routers cannot send you hijacked routes or traffic with spoofed source addresses. And they will try!

The layout of this lab is based on the [MANRS Implementation Guide](#). The addresses and prefixes used in this lab correspond to those used in that document.

Background information

At the start of the lab all links are configured and BGP sessions exist for both IPv4 and IPv6. There is no filtering in place. That is your task.

Your router (AS64500)

You have full console access to your router. Configure it so it has MANRS.

You should announce the following prefixes from your own router:

- 2001:db8:1000::/36
- 203.0.113.0/24

The transit (AS64510)

The transit will send you the most routes. But it isn't behaving completely correct. Some of its routes are your own! Make sure you don't accept them, or someone on the internet might hijack you. There is also traffic coming from the transit with source addresses that don't exist in the routing table. Those should also be blocked.

For testing purposes you can ping the transit on addresses 2001:db8::1 and 10.0.0.1.

The peer (AS64511)

The peer will do the same as the transit, except that of course it's only allowed to attract traffic for itself. So make sure that you filter what they announce to you, and also make sure they don't use you as a free transit!

The peer should announce the following prefixes to you:

- 2001:db8:3000::/36


For testing purposes you can ping the peer on address 2001:db8:3000::1.

The customers (AS64501 and AS64502)

You have two customers in this lab. Both of them have IPv4 and IPv6 address space. AS64501 has address space from your aggregated block, AS64502 has provider independent space. But beware: there is also some hijacking going on! Make sure both of your customers behave and don't interfere with each other or the rest of the internet.

Customer 64501 should announce the following prefixes to you:

- 2001:db8:1001::/48
- 192.0.2.0/24




MANRS


for Cisco

Transit

AS64510




IRR




MANRS Participant

AS64500




Peer

AS64511




Customer

AS64501



Customer

AS64502



AS64500 is connected to AS64510 via Gi0/0, to AS64511 via Gi0/1, and to AS64501 via Gi0/2 and to AS64502 via Gi0/3.

Click on the tab that corresponds to the work node, and you will see:

MANRS Lab Manager

Dashboard: MANRS-Cisco for Sander Steffann

Instructions AS64500 **AS64501** AS64502 AS64510 AS64511 IRR Online

Your router (AS64500)

The goal of this lab is to teach your router MANRS.

You should announce the following prefixes from your own router:

- 2001:db8:1000::/36
- 203.0.113.0/24

Username: manrs
Password: manrs

```
If you require further assistance please contact us by sending email to
export@cisco.com.

Cisco IOSv (revision 1.0) with 460017K/62464K bytes of memory.Installed ima
ge archive

Processor board ID 90L71H70829TK9ANMZHLG
4 Gigabit Ethernet interfaces
DRAM configuration is 72 bits wide with parity disabled.
256K bytes of non-volatile configuration memory.
2097152K bytes of ATA System CompactFlash 0 (Read/Write)
0K bytes of ATA CompactFlash 1 (Read/Write)
1024K bytes of ATA CompactFlash 2 (Read/Write)
0K bytes of ATA CompactFlash 3 (Read/Write)

% Warning: use /31 mask on non point-to-point interface cautiously
% Warning: use /31 mask on non point-to-point interface cautiously
% Warning: use /31 mask on non point-to-point interface cautiously
% Warning: use /31 mask on non point-to-point interface cautiously

Press RETURN to get started!

Log in with username 'manrs' and password 'manrs':

User Access Verification

Username:
```

For emergencies: [reboot device](#)

Logged in as Sander Steffann (sander@steffann.nl)
[Home](#) | [Admin interface](#) | [Change password](#) | [Log out](#)

MANRS

for Cisco

Transit
AS64510

IRR

MANRS Participant
AS64500

Peer
AS64511

Customer
AS64501 AS64502

The terminal is fully functional and gives you access to the device's console.

At this point in time, perform the exercise as you would expect a student to perform it. Don't worry yet about the color of the monitor and IRR tabs.

Setting the goals

Once you have performed the exercise, we will start defining the goals for students. After all: what you have just done corresponds to the goal you want the students to reach!

Go back to the admin interface and go to the exercises list:

Select exercise to change

Action: 0 of 4 selected

<input type="checkbox"/>	STUDENT	NAME	TEMPLATE	STARTED	DEADLINE	RUNNING	DASHBOARD
<input type="checkbox"/>	lee	MANRS-Cisco for Lee Howard	Template: MANRS-Cisco	Dec. 11, 2018, 5:58 p.m.	-	✔	Dashboard
<input type="checkbox"/>	marcel.dejager	MANRS-Cisco for Marcel de Jager	Template: MANRS-Cisco	Dec. 17, 2018, 12:35 p.m.	Dec. 17, 2018, 2:35 p.m.	✘	Dashboard
<input type="checkbox"/>	sander	MANRS-Cisco for Sander Steffann	Template: MANRS-Cisco	Dec. 20, 2018, 11:35 p.m.	-	✔	Dashboard
<input type="checkbox"/>	sander	MANRS-Cisco for Sander Steffann-1	Template: MANRS-Cisco	Dec. 17, 2018, 12:35 p.m.	Dec. 17, 2018, 2:35 p.m.	✘	Dashboard

4 exercises

Now click on the name of the student of the exercise you have just performed, and you will be taken to the details of what the system sees of that exercise:

MANRS Lab Manager

WELCOME, SANDER. [VIEW SITE](#) / [CHANGE PASSWORD](#) / [LOG OUT](#)

[Home](#) » [Lab](#) » [Exercises](#) » MANRS-Cisco for Sander Steffann

Change exercise

HISTORY

Name:

MANRS-Cisco for Sander Steffann

Project id:

f785b3df-4371-4f6f-be0c-2afb0d865901

Student:

Sander Steffann (sander@steffann.nl)

Template:

Template: MANRS-Cisco

Started:

Dec. 20, 2018, 11:35 p.m.

Deadline:

Date:

Today

Time:

Now

Note: You are 1 hour ahead of server time.

EXERCISE NODES

Exercise node: AS64501

EXERCISE STATES

Exercise state: AS64501: Received traffic at 2018-12-20 23:37:04.190968+00:00

State:

SRC=10.0.0.1 DST=192.0.2.1
SRC=192.0.2.3 DST=192.0.2.1
SRC=192.88.99.10 DST=192.0.2.1
SRC=192.88.99.11 DST=192.0.2.1
SRC=192.88.99.2 DST=192.0.2.1
SRC=198.51.100.1 DST=192.0.2.1
SRC=198.51.100.3 DST=192.0.2.1
SRC=2001:0db8:0000:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:1000:0000:0000:0000:0000:0003 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:1001:0000:0000:0000:0000:0003 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:2002:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:2002:0000:0000:0000:0000:0003 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:3000:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=3ffe:0000:0000:0000:0000:0000:0000:0002 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=3ffe:0000:0000:0000:0000:0000:0000:0010 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=3ffe:0000:0000:0000:0000:0000:0000:0011 DST=2001:0db8:1001:0000:0000:0000:0000:0001

Exercise state: AS64501: IPv4 routes at 2018-12-20 23:37:04.069584+00:00

State:

BIRD 1.5.0 ready.
0.0.0.0/0 via 203.0.113.252 on eth0 [bgp1 HIDDEN] ! (100) [AS64511i]
Type: BGP unicast univ
BGP.origin: IGP
BGP.as_path: 64500 64511
BGP.next_hop: 203.0.113.252
BGP.local_pref: 100
10.0.0.0/8 via 203.0.113.252 on eth0 [bgp1 HIDDEN] * (100) [AS65001i]
Type: BGP unicast univ
BGP.origin: IGP
BGP.as_path: 64500 64510 65000 65000 65001
BGP.next_hop: 203.0.113.252

Here you can see the state of all the monitor nodes and what they see. Because this is now the state of a finished exercise, we will take these states and use them as the goals for our monitor templates and IRR templates.

Open a new window and go to the admin screen:

Lab administration

AUTHENTICATION AND AUTHORIZATION

Groups

+ Add

 Change

Users

+ Add

 Change

LAB

Exercise templates

+ Add

 Change

Exercises

+ Add

 Change

IRR templates

+ Add

 Change

Monitor templates

+ Add

 Change

Open the monitor templates list:

Select monitor template to change

ADD MONITOR TEMPLATE +

Action: 0 of 4 selected

<input type="checkbox"/>	NAME	GOAL TYPES
<input type="checkbox"/>	MANRS AS64501	Received traffic, IPv4 routes, IPv6 routes
<input type="checkbox"/>	MANRS AS64502	Received traffic, IPv4 routes, IPv6 routes
<input type="checkbox"/>	MANRS AS64510	Received traffic, IPv4 routes, IPv6 routes
<input type="checkbox"/>	MANRS AS64511	Received traffic, IPv4 routes, IPv6 routes

4 monitor templates

Here, open the monitor template you want to edit:

MANRS Lab ManagerWELCOME, SANDER. VIEW SITE / CHANGE PASSWORD / LOG OUT

Home › Lab › Monitor templates › MANRS AS64501

Change monitor templateHISTORY

Name:

Instructions:

The customer (AS64501)

=====

Customer 64501 should announce the following prefixes to you:

- '2001:db8:1001::/48'
- '192.0.2.0/24'

For testing purposes you can ping them on addresses '2001:db8:1001::1' and '192.0.2.1'.

Use markdown for styling

MONITOR GOALS

Monitor goal: MANRS AS64501: Received trafficDelete

Goal type: Received traffic

Goal content:

```
SRC=198.51.100.1 DST=192.0.2.1
SRC=10.0.0.1 DST=192.0.2.1
SRC=2001:0db8:2002:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:0000:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
SRC=2001:0db8:3000:0000:0000:0000:0000:0001 DST=2001:0db8:1001:0000:0000:0000:0000:0001
```

Monitor goal: MANRS AS64501: IPv4 routesDelete

Goal type: IPv4 routes

Goal content:

```
BIRD 1.5.0 ready.
10.0.0.0/8 via 203.0.113.252 on eth0 [bgp1 11:48:05] * (100) [AS65001i]
Type: BGP unicast univ
BGP:origin: IGP
BGP:as_path: 64500 64510 65000 65000 65001
BGP:next_hop: 203.0.113.252
BGP:local_pref: 100
192.168.0.0/16 via 203.0.113.252 on eth0 [bgp1 11:48:05] * (100) [AS65003i]
Type: BGP unicast univ
BGP:origin: IGP
```

Monitor goal: MANRS AS64501: IPv6 routesDelete

Goal type: IPv6 routes

Goal content:

```
BIRD 1.5.0 ready.
2001:db8:2002::/48 via 2001:db8:1000:ffe::a on eth0 [bgp1 11:44:26] * (100) [AS64502i]
Type: BGP unicast univ
BGP:origin: IGP
BGP:as_path: 64500 64502
BGP:next_hop: 2001:db8:1000:ffe::a fe80::e68:96ff:feba:ca02
BGP:local_pref: 100
2001:db8:2000::/26 via 2001:db8:1000:ffe::a on eth0 [bgp1 11:42:56] * (100) [AS64511i]
```

Select the goal type and copy&paste the state from your exercise into the corresponding goal content. Click "Add another Monitor goal" as often as required to add more goals.

Repeat this process for all the monitor and IRR templates until you have defined all the goals that you want the students to reach.

Once you have defined all the goals, reload your dashboard window and confirm that all the tabs have now turned green. This shows that your current exercise state corresponds to the defined goals. This should now be the case, as you have copied your current exercise state as the desired goal!

At this point your exercise template is ready for student to use!

Appendix A: initial IRR database for MANRS

The root, simulating an RIR

```
*****[ UPDATE ]*****
mntner:      ROOT-MNT
descr:       Root Maintainer
admin-c:     SJMS-MANRS
auth:        CRYPT-PW nyN51fqgp/enQ
upd-to:      sander@steffann.nl
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
override:    administrator VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
role:        S.J.M. Steffann
address:     Tienwoningenvweg 46
address:     7312 DN Apeldoorn
address:     The Netherlands
phone:       +31-6-22660412
e-mail:      sander@steffann.nl
nic-hdl:     SJMS-MANRS
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
override:    administrator VerySecret
*****[ END ]*****
```

The student

```
*****[ UPDATE ]*****
mntner:      STUDENT-MNT
descr:       Student Maintainer
admin-c:     STUDENT-MANRS
auth:        CRYPT-PW ULENBuAlld6kc
upd-to:      student@example.com
mnt-by:      STUDENT-MNT
changed:     sander@steffann.nl
source:      MANRS
override:    administrator VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
role:        Student
address:     Nowhere
phone:       +1-703-439-2120
e-mail:      student@example.com
nic-hdl:     STUDENT-MANRS
mnt-by:      STUDENT-MNT
changed:     student@example.com
source:      MANRS
password:    manrs
*****[ END ]*****

*****[ UPDATE ]*****
aut-num:     AS64500
as-name:     STUDENT-AS
```

```

descr:      Student's ASN
admin-c:    STUDENT-MANRS
tech-c:     STUDENT-MANRS
mnt-by:     ROOT-MNT
mnt-by:     STUDENT-MNT
Changed:    sander@steffann.nl
source:     MANRS
password:   manrs
*****[ END ]*****

*****[ UPDATE ]*****
inetnum:    203.0.113.0 - 203.0.113.255
netname:    Student-IPv4
descr:      Student's IPv4 space
status:     ASSIGNED PI
country:    NL
admin-c:    STUDENT-MANRS
tech-c:     STUDENT-MANRS
mnt-by:     ROOT-MNT
mnt-by:     STUDENT-MNT
changed:    sander@steffann.nl
source:     MANRS
password:   manrs
*****[ END ]*****

*****[ UPDATE ]*****
inet6num:   2001:db8:1000::/36
netname:    Student-IPv6
descr:      Student's IPv6 space
status:     ALLOCATED PA
country:    NL
admin-c:    STUDENT-MANRS
tech-c:     STUDENT-MANRS
mnt-by:     ROOT-MNT
mnt-by:     STUDENT-MNT
changed:    sander@steffann.nl
source:     MANRS
password:   manrs
*****[ END ]*****

```

AS64501

```

*****[ UPDATE ]*****
inetnum:    192.0.2.0 - 192.0.2.255
netname:    AS64501-IPv4
descr:      AS64501's IPv4 space
status:     ASSIGNED PI
country:    NL
admin-c:    SJMS-MANRS
tech-c:     SJMS-MANRS
mnt-by:     ROOT-MNT
changed:    sander@steffann.nl
source:     MANRS
password:   VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
inet6num:   2001:db8:1001::/48
netname:    AS64501-IPv6
descr:      AS64501's IPv6 space

```

```

status:      ASSIGNED PA
country:     NL
admin-c:     SJMS-MANRS
tech-c:      SJMS-MANRS
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
aut-num:     AS64501
as-name:     CUSTOMER1-AS
descr:       Customer 1's ASN
mp-export:   to AS64500 announce AS64501
mp-import:   from AS64500 accept ANY
admin-c:     SJMS-MANRS
tech-c:      SJMS-MANRS
mnt-by:      ROOT-MNT
Changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
route:       192.0.2.0/24
origin:      AS64501
descr:       IPv4 announced from AS64501
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
route6:      2001:db8:1001::/48
origin:      AS64501
descr:       IPv6 announced from AS64501
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****

```

AS64502

```

*****[ UPDATE ]*****
inetnum:     198.51.100.0 - 198.51.100.255
netname:     AS64502-IPv4
descr:       AS64502's IPv4 space
status:      ASSIGNED PI
country:     NL
admin-c:     SJMS-MANRS
tech-c:      SJMS-MANRS
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****

```

```

*****[ UPDATE ]*****
inet6num:      2001:db8:2002::/48
netname:       AS64502-IPv6
descr:         AS64502's IPv6 space
status:        ASSIGNED PI
country:       NL
admin-c:       SJMS-MANRS
tech-c:        SJMS-MANRS
mnt-by:        ROOT-MNT
changed:       sander@steffann.nl
source:        MANRS
password:      VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
aut-num:       AS64502
as-name:       CUSTOMER2-AS
descr:         Customer 2's ASN
mp-export:     to AS64500 announce AS64502
mp-import:     from AS64500 accept ANY
admin-c:       SJMS-MANRS
tech-c:        SJMS-MANRS
mnt-by:        ROOT-MNT
Changed:       sander@steffann.nl
source:        MANRS
password:      VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
route:         198.51.100.0/24
origin:        AS64502
descr:         IPv4 announced from AS64502
mnt-by:        ROOT-MNT
changed:       sander@steffann.nl
source:        MANRS
password:      VerySecret
*****[ END ]*****

*****[ UPDATE ]*****
route6:        2001:db8:2002::/48
origin:        AS64502
descr:         IPv6 announced from AS64502
mnt-by:        ROOT-MNT
changed:       sander@steffann.nl
source:        MANRS
password:      VerySecret
*****[ END ]*****

```

AS64510

```

*****[ UPDATE ]*****
aut-num:       AS64510
as-name:       TRANSIT-AS
descr:         Transit's ASN
mp-export:     to AS64500 announce ANY
mp-import:     from AS64500 accept AS64500:AS-ALL
admin-c:       SJMS-MANRS
tech-c:        SJMS-MANRS
mnt-by:        ROOT-MNT
Changed:       sander@steffann.nl

```

```
source:      MANRS
password:    VerySecret
*****[ END ]*****
```

AS64511

```
*****[ UPDATE ]*****
inet6num:    2001:db8:3000::/36
netname:     AS64511-IPv6
descr:       AS64511's IPv6 space
status:      ALLOCATED PA
country:     NL
admin-c:     SJMS-MANRS
tech-c:      SJMS-MANRS
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****
```

```
*****[ UPDATE ]*****
aut-num:     AS64511
as-name:     PEER-AS
descr:       Peer's ASN
mp-export:   to AS64500 announce AS64511
mp-import:   from AS64500 accept AS64500:AS-ALL
admin-c:     SJMS-MANRS
tech-c:      SJMS-MANRS
mnt-by:      ROOT-MNT
Changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****
```

```
*****[ UPDATE ]*****
route6:      2001:db8:3000::/36
origin:      AS64511
descr:       IPv6 announced from AS64511
mnt-by:      ROOT-MNT
changed:     sander@steffann.nl
source:      MANRS
password:    VerySecret
*****[ END ]*****
```

Appendix B: Monitor node configurations for MANRS

AS64501

```
HOSTNAME="as64501-customer"

V4_INTERFACE="203.0.113.253/31"
V6_INTERFACE="2001:db8:1000:fffe::b/127"

ROUTER_ID="203.0.113.253"
LOCAL_ASN="64501"

PEER_ASN="64500"
PEER_ADDRESS_V4="203.0.113.252"
PEER_ADDRESS_V6="2001:db8:1000:fffe::a"

V4_PREFIX1="192.0.2.0/24"
V4_PREFIX2="172.16.66.0/24"
V4_PREFIX3="192.168.255.0/24"

V6_PREFIX1="2001:db8:1001::/48"
V6_PREFIX2="2001:db8:4567::/48"
V6_PREFIX3="2001:db8::/32"

# Pings to/from valid addresses
PING1="203.0.113.1 192.0.2.1" # to 64500
PING2="198.51.100.1 192.0.2.1" # to 64502
PING3="10.0.0.1 192.0.2.1" # to 64510
PING4="2001:db8:1000::1 2001:db8:1001::1" # to 64500
PING5="2001:db8:2002::1 2001:db8:1001::1" # to 64502
PING6="2001:db8::1 2001:db8:1001::1" # to 64510
PING7="2001:db8:3000::1 2001:db8:1001::1" # to 64511

# Pings from bogus addresses to valid routes
PING8="203.0.113.1 192.88.99.1" # to 64500
PING9="198.51.100.1 192.88.99.1" # to 64502
PING10="10.0.0.1 192.88.99.1" # to 64510
PING11="2001:db8:1000::1 3ffe::1" # to 64500
PING12="2001:db8:2002::1 3ffe::1" # to 64502
PING13="2001:db8::1 3ffe::1" # to 64510
PING14="2001:db8:3000::1 3ffe::1" # to 64511

# Pings from someone else's addresses to valid routes
PING15="203.0.113.1 203.0.113.3" # to 64500
PING16="198.51.100.1 203.0.113.3" # to 64502
PING17="10.0.0.1 203.0.113.3" # to 64510
PING18="2001:db8:1000::1 2001:db8:3000::3" # to 64500
PING19="2001:db8:2002::1 2001:db8:3000::3" # to 64502
PING20="2001:db8::1 2001:db8:3000::3" # to 64510
PING21="2001:db8:3000::1 2001:db8:3000::3" # to 64511

# Pings from valid address to bogus address
PING22="192.88.99.2 192.0.2.1" # to 64502
PING23="192.88.99.10 192.0.2.1" # to 64510
PING24="192.88.99.11 192.0.2.1" # to 64511
PING25="3ffe::2 2001:db8:1001::1" # to 64502
PING26="3ffe::10 2001:db8:1001::1" # to 64510
PING27="3ffe::11 2001:db8:1001::1" # to 64511
```

```
# Pings from bogus address to bogus address
PING28="192.88.99.2 192.88.99.1" # to 64502
PING29="192.88.99.10 192.88.99.1" # to 64510
PING30="192.88.99.11 192.88.99.1" # to 64511
PING31="3ffe::2 3ffe::1" # to 64502
PING32="3ffe::10 3ffe::1" # to 64510
PING33="3ffe::11 3ffe::1" # to 64511

# Pings from some else's address to bogus address
PING34="192.88.99.2 203.0.113.3" # to 64502
PING35="192.88.99.10 203.0.113.3" # to 64510
PING36="192.88.99.11 203.0.113.3" # to 64511
PING37="3ffe::2 2001:db8:3000::3" # to 64502
PING38="3ffe::10 2001:db8:3000::3" # to 64510
PING39="3ffe::11 2001:db8:3000::3" # to 64511
```

AS64502

```
HOSTNAME="as64502-customer"

V4_INTERFACE="203.0.113.255/31"
V6_INTERFACE="2001:db8:1000:ffff::b/127"

ROUTER_ID="203.0.113.255"
LOCAL_ASN="64502"

PEER_ASN="64500"
PEER_ADDRESS_V4="203.0.113.254"
PEER_ADDRESS_V6="2001:db8:1000:ffff::a"

V4_PREFIX1="198.51.100.0/24"
V4_PREFIX2="192.0.2.64/26"
V4_PREFIX3="192.0.2.128/25"

V6_PREFIX1="2001:db8:2002::/48"
V6_PREFIX2="2001:db8:1001:1000::/52"

# Pings to/from valid addresses
PING1="203.0.113.1 198.51.100.1" # to 64500
PING2="192.0.2.1 198.51.100.1" # to 64501
PING3="10.0.0.1 198.51.100.1" # to 64510
PING4="2001:db8:1000::1 2001:db8:2002::1" # to 64500
PING5="2001:db8:1001::1 2001:db8:2002::1" # to 64501
PING6="2001:db8::1 2001:db8:2002::1" # to 64510
PING7="2001:db8:3000::1 2001:db8:2002::1" # to 64511

# Pings from bogus addresses to valid routes
PING8="203.0.113.1 192.88.99.2" # to 64500
PING9="192.0.2.1 192.88.99.2" # to 64501
PING10="10.0.0.1 192.88.99.2" # to 64510
PING11="2001:db8:1000::1 3ffe::2" # to 64500
PING12="2001:db8:1001::1 3ffe::2" # to 64501
PING13="2001:db8::1 3ffe::2" # to 64510
PING14="2001:db8:3000::1 3ffe::2" # to 64511

# Pings from someone else's addresses to valid routes
PING15="203.0.113.1 192.0.2.3" # to 64500
PING16="192.0.2.1 192.0.2.3" # to 64501
PING17="10.0.0.1 192.0.2.3" # to 64510
PING18="2001:db8:1000::1 2001:db8:1000::3" # to 64500
```

```

PING19="2001:db8:1001::1 2001:db8:1000::3" # to 64501
PING20="2001:db8::1 2001:db8:1000::3" # to 64510
PING21="2001:db8:3000::1 2001:db8:1000::3" # to 64511

# Pings from valid address to bogus address
PING22="192.88.99.1 198.51.100.1" # to 64501
PING23="192.88.99.10 198.51.100.1" # to 64510
PING24="192.88.99.11 198.51.100.1" # to 64511
PING25="3ffe::1 2001:db8:2002::1" # to 64501
PING26="3ffe::10 2001:db8:2002::1" # to 64510
PING27="3ffe::11 2001:db8:2002::1" # to 64511

# Pings from bogus address to bogus address
PING28="192.88.99.1 192.88.99.2" # to 64501
PING29="192.88.99.10 192.88.99.2" # to 64510
PING30="192.88.99.11 192.88.99.2" # to 64511
PING31="3ffe::1 3ffe::2" # to 64501
PING32="3ffe::10 3ffe::2" # to 64510
PING33="3ffe::11 3ffe::2" # to 64511

# Pings from some else's address to bogus address
PING34="192.88.99.1 192.0.2.3" # to 64501
PING35="192.88.99.10 192.0.2.3" # to 64510
PING36="192.88.99.11 192.0.2.3" # to 64511
PING37="3ffe::1 2001:db8:1000::3" # to 64501
PING38="3ffe::10 2001:db8:1000::3" # to 64510
PING39="3ffe::11 2001:db8:1000::3" # to 64511

```

AS64510

```

HOSTNAME="as64510-transit"

V4_INTERFACE="192.168.255.254/31"
V6_INTERFACE="2001:db8:f000:ffff::a/127"

ROUTER_ID="192.168.255.254"
LOCAL_ASN="64510"

PEER_ASN="64500"
PEER_ADDRESS_V4="192.168.255.255"
PEER_ADDRESS_V6="2001:db8:f000:ffff::b"

V4_PREFIX1="10.0.0.0/8 65001 65000 65000"
V4_PREFIX2="172.16.0.0/12 65001 65002"
V4_PREFIX3="192.168.0.0/16 65003 65002"
V4_PREFIX4="203.0.113.64/26"

V6_PREFIX1="2001:db8::/36 65001 65000 65000"
V6_PREFIX2="2001:db8:1200::/40"
V6_PREFIX3="2001:db8:4000::/36 65001 65002"
V6_PREFIX4="2001:db8:5000::/36 65003 65002"
V6_PREFIX5="2001:db8:6000::/36 65003 65002 65002"
V6_PREFIX6="2001:db8:7000::/36 65004 65004 65002"
V6_PREFIX7="2001:db8:8000::/36 65005 65004 65003 65002"
V6_PREFIX8="2001:db8:9000::/36 65003 65003 65003 65003 65003 65002"
V6_PREFIX9="2001:db8:a000::/36 65007 65006 65003 65003 65002"
V6_PREFIX10="2001:db8:b000::/36 65004 65003 65003 65002"
V6_PREFIX11="2001:db8:c000::/36 65007 65007 65007 65007 65006 65005 65004
65003 65002"

```

```

V6_PREFIX12="2001:db8:d000::/36 65007 65006 65005 65004 65003 65003 65003
65001"
V6_PREFIX13="2001:db8:e000::/36 65007 65006 65006 65005 65004 65004 65003
65002"
V6_PREFIX14="2001:db8:f000::/36 65007 65006 65005 65004 65003 65002 65001"

# Pings to/from valid addresses
PING1="203.0.113.1 10.0.0.1" # to 64500
PING2="192.0.2.1 10.0.0.1" # to 64501
PING3="198.51.100.1 10.0.0.1" # to 64502
PING4="2001:db8:1000::1 2001:db8::1" # to 64500
PING5="2001:db8:1001::1 2001:db8::1" # to 64501
PING6="2001:db8:2002::1 2001:db8::1" # to 64502
PING7="2001:db8:3000::1 2001:db8::1" # to 64511

# Pings from bogus addresses to valid routes
PING8="203.0.113.1 192.88.99.10" # to 64500
PING9="192.0.2.1 192.88.99.10" # to 64501
PING10="198.51.100.1 192.88.99.10" # to 64502
PING11="2001:db8:1000::1 3ffe::10" # to 64500
PING12="2001:db8:1001::1 3ffe::10" # to 64501
PING13="2001:db8:2002::1 3ffe::10" # to 64502
PING14="2001:db8:3000::1 3ffe::10" # to 64511

# Pings from someone else's addresses to valid routes
PING15="203.0.113.1 198.51.100.3" # to 64500
PING16="192.0.2.1 198.51.100.3" # to 64501
PING17="198.51.100.1 198.51.100.3" # to 64502
PING18="2001:db8:1000::1 2001:db8:1001::3" # to 64500
PING19="2001:db8:1001::1 2001:db8:1001::3" # to 64501
PING20="2001:db8:2002::1 2001:db8:1001::3" # to 64502
PING21="2001:db8:3000::1 2001:db8:1001::3" # to 64511

# Pings from valid address to bogus address
PING22="192.88.99.1 10.0.0.1" # to 64501
PING23="192.88.99.2 10.0.0.1" # to 64502
PING24="192.88.99.11 10.0.0.1" # to 64511
PING25="3ffe::1 2001:db8::1" # to 64501
PING26="3ffe::2 2001:db8::1" # to 64502
PING27="3ffe::11 2001:db8::1" # to 64511

# Pings from bogus address to bogus address
PING28="192.88.99.1 192.88.99.10" # to 64501
PING29="192.88.99.2 192.88.99.10" # to 64502
PING30="192.88.99.11 192.88.99.10" # to 64511
PING31="3ffe::1 3ffe::10" # to 64501
PING32="3ffe::2 3ffe::10" # to 64502
PING33="3ffe::11 3ffe::10" # to 64511

# Pings from some else's address to bogus address
PING34="192.88.99.1 198.51.100.3" # to 64501
PING35="192.88.99.2 198.51.100.3" # to 64502
PING36="192.88.99.11 198.51.100.3" # to 64511
PING37="3ffe::1 2001:db8:1001::3" # to 64501
PING38="3ffe::2 2001:db8:1001::3" # to 64502
PING39="3ffe::11 2001:db8:1001::3" # to 64511

```

AS64511

```
HOSTNAME="as64511-peer"
```

```

V4_INTERFACE="203.0.113.251/31"
V6_INTERFACE="2001:db8:1000:fffd::b/127"

ROUTER_ID="203.0.113.251"
LOCAL_ASN="64511"

PEER_ASN="64500"
PEER_ADDRESS_V4="203.0.113.250"
PEER_ADDRESS_V6="2001:db8:1000:fffd::a"

V4_PREFIX1="0.0.0.0/0"
V4_PREFIX2="172.16.0.0/13"

V6_PREFIX1 "::/0"
V6_PREFIX2="2001:db8:3000::/36"
V6_PREFIX3="2001:db8:6000::/36 65003"
V6_PREFIX4="2001:db8:7000::/37 65004 65002"

# Pings to/from valid addresses
PING1="2001:db8:1000::1 2001:db8:3000::1" # to 64500
PING2="2001:db8:1001::1 2001:db8:3000::1" # to 64501
PING3="2001:db8:2002::1 2001:db8:3000::1" # to 64502
PING4="2001:db8::1 2001:db8:3000::1" # to 64510

# Pings from bogus addresses to valid routes
PING5="203.0.113.1 192.88.99.11" # to 64500
PING6="192.0.2.1 192.88.99.11" # to 64501
PING7="198.51.100.1 192.88.99.11" # to 64502
PING8="10.0.0.1 192.88.99.11" # to 64510
PING9="2001:db8:1000::1 3ffe::11" # to 64500
PING10="2001:db8:1001::1 3ffe::11" # to 64501
PING11="2001:db8:2002::1 3ffe::11" # to 64502
PING12="2001:db8::1 3ffe::11" # to 64510

# Pings from someone else's addresses to valid routes
PING13="203.0.113.1 198.51.100.3" # to 64500
PING14="192.0.2.1 198.51.100.3" # to 64501
PING15="198.51.100.1 198.51.100.3" # to 64502
PING16="10.0.0.1 198.51.100.3" # to 64510
PING17="2001:db8:1000::1 2001:db8:2002::3" # to 64500
PING18="2001:db8:1001::1 2001:db8:2002::3" # to 64501
PING19="2001:db8:2002::1 2001:db8:2002::3" # to 64502
PING20="2001:db8::1 2001:db8:2002::3" # to 64510

# Pings from valid address to bogus address
PING21="3ffe::1 2001:db8:3000::1" # to 64501
PING22="3ffe::2 2001:db8:3000::1" # to 64502
PING23="3ffe::10 2001:db8:3000::1" # to 64510

# Pings from bogus address to bogus address
PING24="192.88.99.1 192.88.99.11" # to 64501
PING25="192.88.99.2 192.88.99.11" # to 64502
PING26="192.88.99.10 192.88.99.11" # to 64510
PING27="3ffe::1 3ffe::11" # to 64501
PING28="3ffe::2 3ffe::11" # to 64502
PING29="3ffe::10 3ffe::11" # to 64510

# Pings from some else's address to bogus address
PING30="192.88.99.1 198.51.100.3" # to 64501

```

```
PING31="192.88.99.2 198.51.100.3" # to 64502
PING32="192.88.99.10 198.51.100.3" # to 64510
PING33="3ffe::1 2001:db8:2002::3" # to 64501
PING34="3ffe::2 2001:db8:2002::3" # to 64502
PING35="3ffe::10 2001:db8:2002::3" # to 64510
```