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MANRS Lab

Students' Guide

Version 1 – 22 December 2018

Table of Contents

Introduction 3

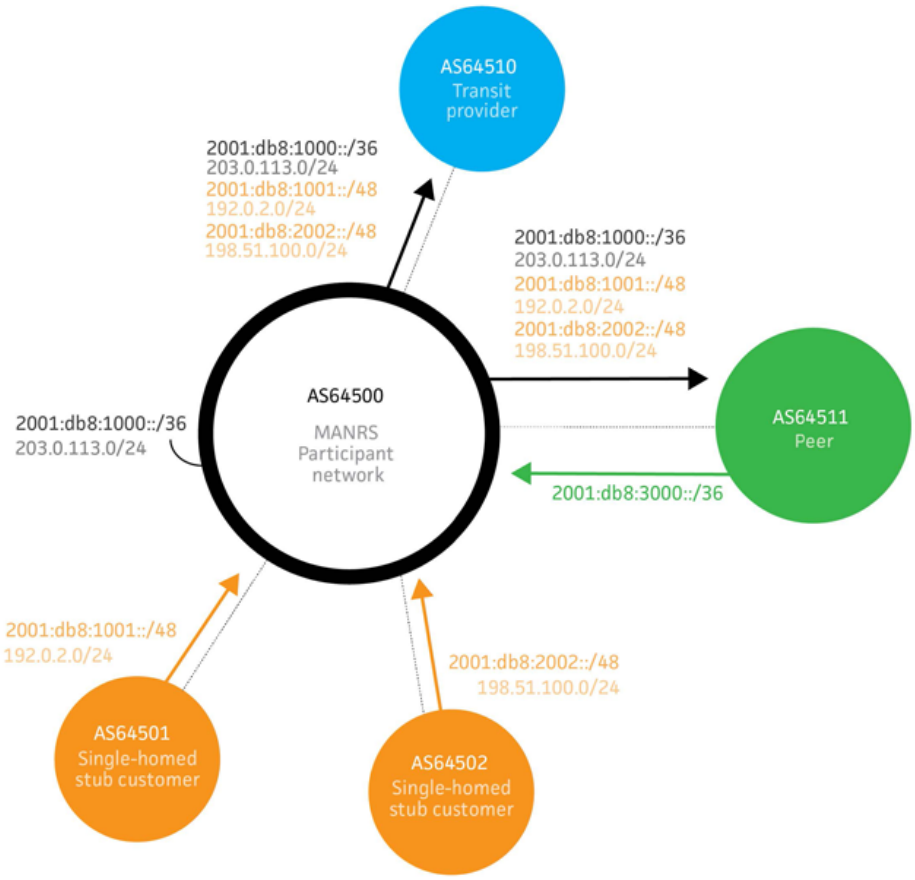
User interface 4

- Instructions 4
- AS64500 5
- AS64501, AS64502, AS64510 and AS64511 6
- IRR 8

Troubleshooting 13

Introduction

This MANRS Lab is designed to let you gain experience with implementing MANRS on a router. The exercises will follow the MANRS Implementation guide at https://www.manrs.org/isps/guide/ very closely, including the network topology:



Exercises are provided for Cisco IOS, Juniper JunOS and Mikrotik.

In these exercises the neighbours around you are not behaved properly. They announce routes that don't belong to them. They even try to hijack your address space! They also send traffic with spoofed source addresses and traffic for destinations that you don't announce to them. It is your task to implement MANRS by documenting your network in the IRR, properly filtering route announcements en to stop traffic with spoofed source addresses.

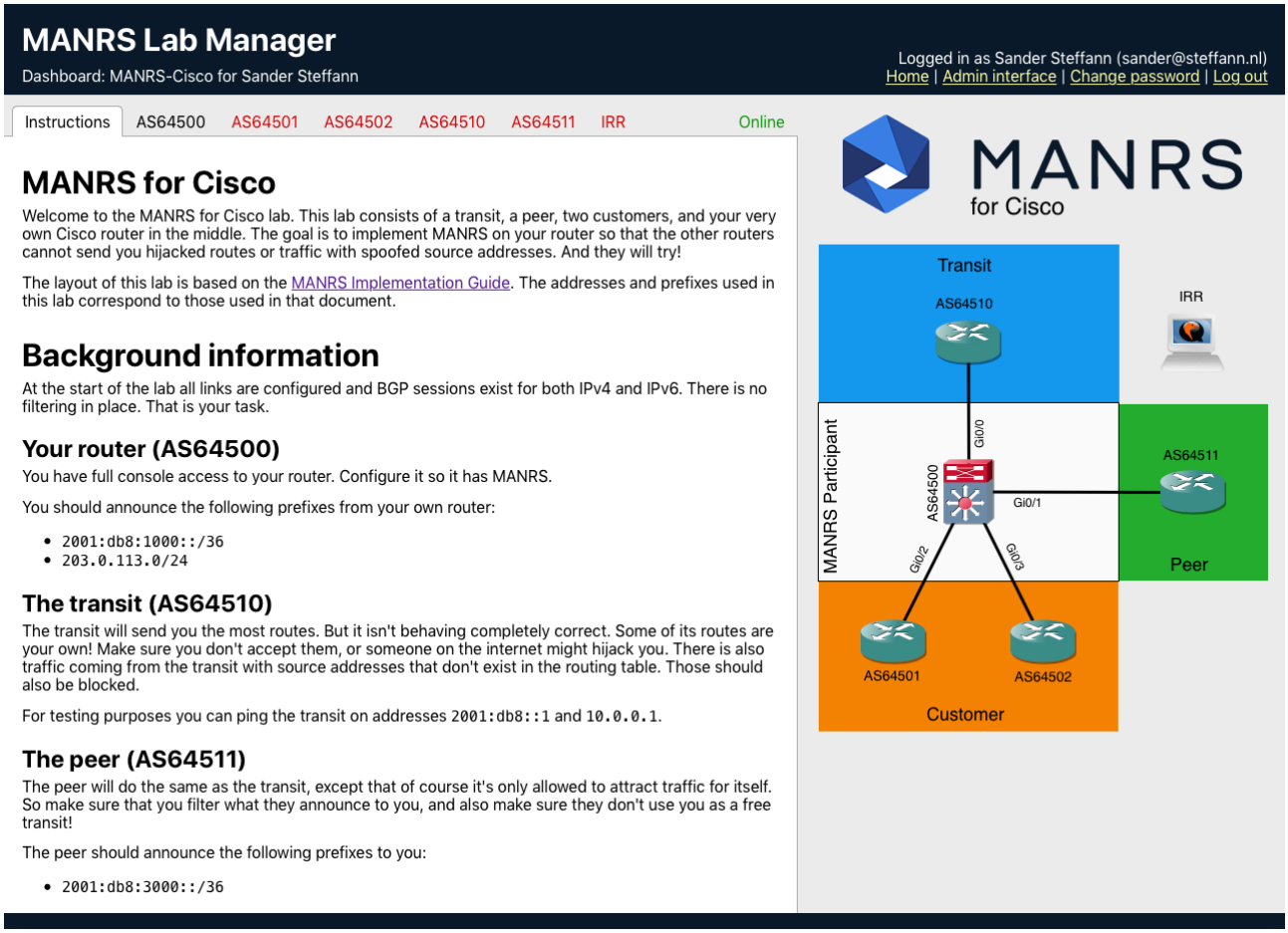
The goals of the exercise are:

- to publish routing information about AS64500 in the IRR
- to filter incoming routes announced by your customers AS64501 and AS64502
- to filter incoming routes announced by your transit provider AS64510
- to filter incoming routes announced by your peer AS64511
- to filter outgoing routes as you announce them to your customers, peer and transit
- to filter traffic with spoofed source addresses from your customers

User interface

The lab is web-based and can be used with any modern browser. You do not need any other tools for doing the exercises. Configuring the routers is done through a browser based terminal window, and interaction with the IRR database is web bases as well.

Your main interface to the lab environment is through the exercise dashboard:



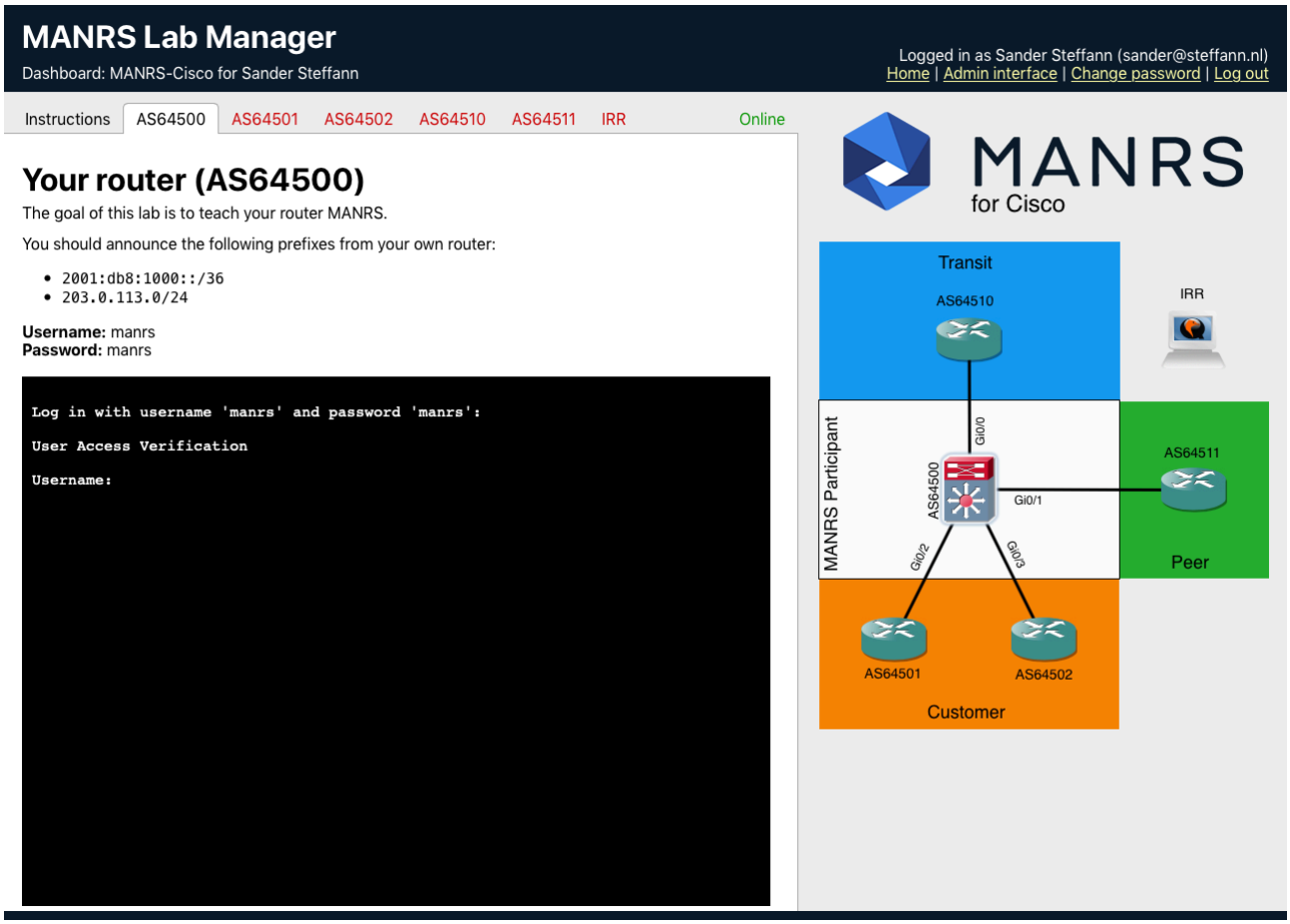
The dashboard contains several tabs, each representing a different part of the exercise. Some of the tabs are coloured. The colour shows you whether what is seen on that tab is correct according to the exercise goals or whether there is still work to be done.

Instructions

This tab contains basic instructions about the exercise. It is the tab you see in the screenshot above. The exercises are all based on the instructions in the MANRS Implementation guide. Follow that guide to complete the exercises!

AS64500

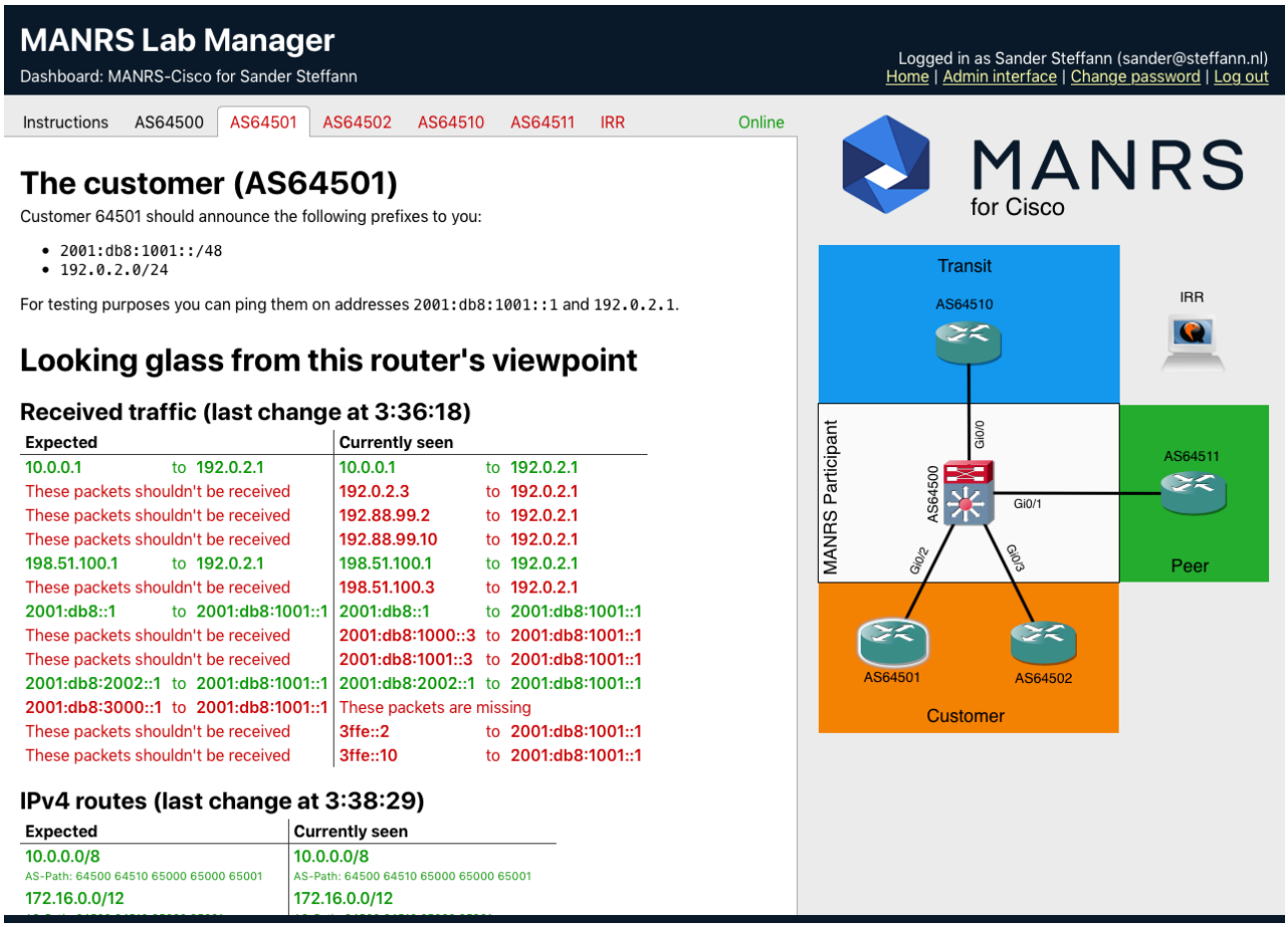
This tab contains the interface to the router you'll be working on. It contains basic information about your router and a terminal window for the router's console:



This is where you will do most of your work.

AS64501, AS64502, AS64510 and AS64511

These tabs contain information as seen from your neighbours points of view. It will show you which routes they receive from you and which traffic they receive through you:



The main part of these tabs is the looking glass that lets you see what is happening from the neighbour's point of view. We will now explain the different sections of information contained in the looking glass.

Received traffic

This section shows you the source and destination addresses of packets being received by this neighbour's router:

Received traffic (last change at 3:36:18)

Expected		Currently seen	
10.0.0.1	to 192.0.2.1	10.0.0.1	to 192.0.2.1
These packets shouldn't be received		192.0.2.3	to 192.0.2.1
These packets shouldn't be received		192.88.99.2	to 192.0.2.1
These packets shouldn't be received		192.88.99.10	to 192.0.2.1
198.51.100.1	to 192.0.2.1	198.51.100.1	to 192.0.2.1
These packets shouldn't be received		198.51.100.3	to 192.0.2.1
2001:db8::1	to 2001:db8:1001::1	2001:db8::1	to 2001:db8:1001::1
These packets shouldn't be received		2001:db8:1000::3	to 2001:db8:1001::1
These packets shouldn't be received		2001:db8:1001::3	to 2001:db8:1001::1
2001:db8:2002::1	to 2001:db8:1001::1	2001:db8:2002::1	to 2001:db8:1001::1
2001:db8:3000::1	to 2001:db8:1001::1	These packets are missing	
These packets shouldn't be received		3ffe::2	to 2001:db8:1001::1
These packets shouldn't be received		3ffe::10	to 2001:db8:1001::1

As you can see in the screenshot above there are packets being received that shouldn't be received. This is probably because they are sent with spoofed source addresses. There are also packets that should have been received but aren't. Could it be that someone is hijacking traffic? Of course there is also legitimate traffic. Make sure that you don't filter that out!

IPv4 routes

This part of the looking glass shows you the IPv4 routes that are received by your neighbour:

IPv4 routes (last change at 3:38:29)

Expected	Currently seen
10.0.0.0/8 AS-Path: 64500 64510 65000 65000 65001	10.0.0.0/8 AS-Path: 64500 64510 65000 65000 65001
172.16.0.0/12 AS-Path: 64500 64510 65002 65001	172.16.0.0/12 AS-Path: 64500 64510 65002 65001
This route shouldn't be received	192.0.2.64/26 AS-Path: 64500 64502
This route shouldn't be received	192.0.2.128/25 AS-Path: 64500 64502
192.168.0.0/16 AS-Path: 64500 64510 65002 65003	192.168.0.0/16 AS-Path: 64500 64510 65002 65003
198.51.100.0/24 AS-Path: 64500 64502	198.51.100.0/24 AS-Path: 64500 64502
203.0.113.0/24 AS-Path: 64500	203.0.113.0/24 AS-Path: 64500
This route shouldn't be received	203.0.113.64/26 AS-Path: 64500 64510

In the example above some routes are received that shouldn't be. Make sure that you announce exactly the right routes to your neighbours! That is usually done with both filtering which routes you accept and which routes you announce.

IPv6 routes

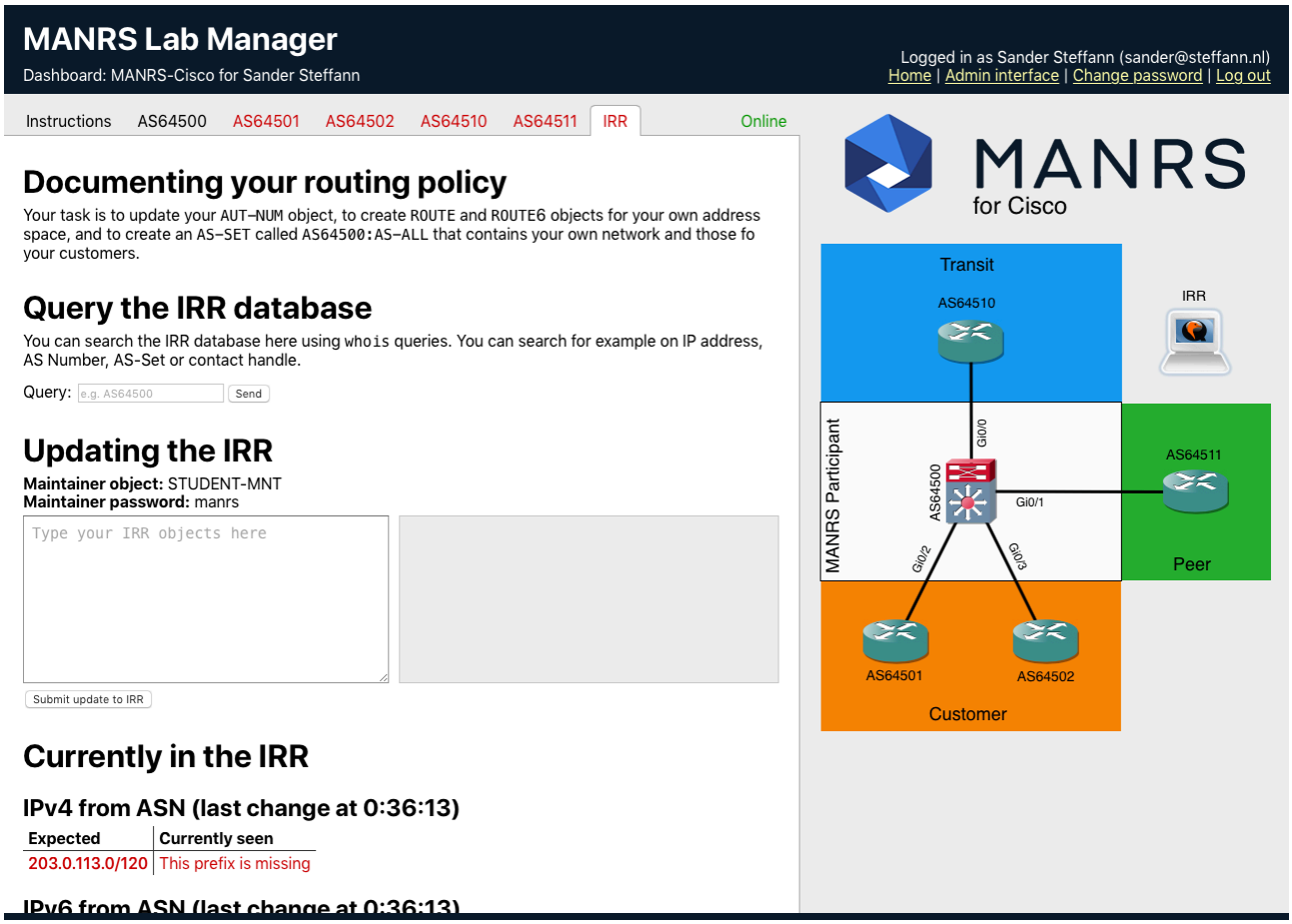
This part shows the same information as the IPv4 routes section but for IPv6 routes:

IPv6 routes (last change at 3:39:05)

Expected	Currently seen
2001:db8::/36 AS-Path: 64500 64510 65000 65000 65001	2001:db8::/36 AS-Path: 64500 64510 65000 65000 65001
2001:db8:1000::/36 AS-Path: 64500	2001:db8:1000::/36 AS-Path: 64500
This route shouldn't be received	2001:db8:1001:1000::/52 AS-Path: 64500 64502
This route shouldn't be received	2001:db8:1200::/40 AS-Path: 64500 64510
2001:db8:2002::/48 AS-Path: 64500 64502	2001:db8:2002::/48 AS-Path: 64500 64502
2001:db8:3000::/36 AS-Path: 64500 64511	This route is missing
2001:db8:4000::/36 AS-Path: 64500 64510 65002 65001	2001:db8:4000::/36 AS-Path: 64500 64510 65002 65001
2001:db8:5000::/36 AS-Path: 64500 64510 65002 65003	2001:db8:5000::/36 AS-Path: 64500 64510 65002 65003
2001:db8:6000::/36 AS-Path: 64500 64510 65002 65002 65003	2001:db8:6000::/36 AS-Path: 64500 64510 65002 65002 65003

IRR

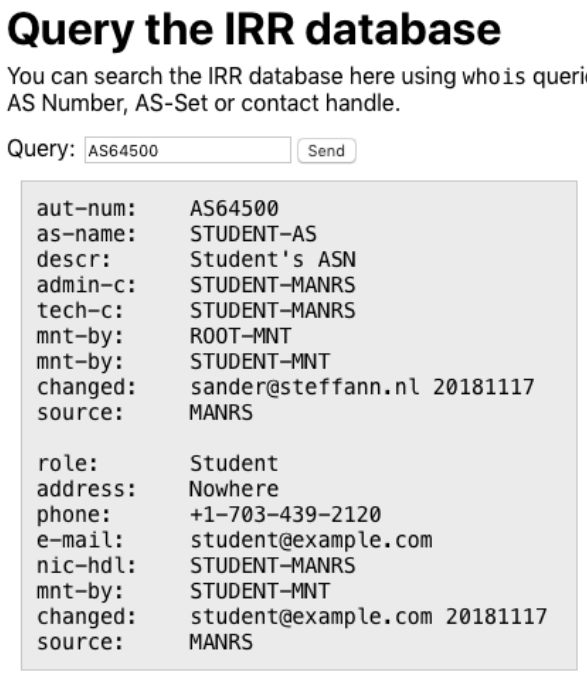
This tab contains your interface to the IRR database. It allows you to query and update the database. It also shows you information about your ASN and the routes associated with it:



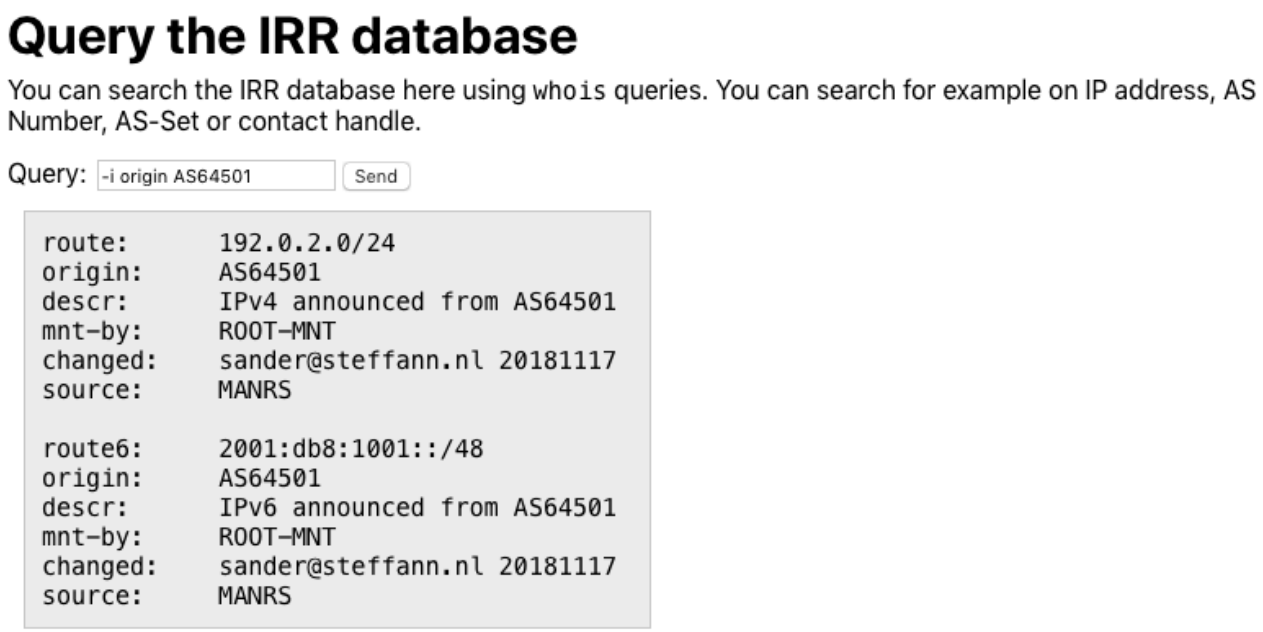
These exercises contain a fully functional IRR system. To keep things simple it only contains data relevant to the exercise, such as `AUT-NUM` objects for the used ASNs, route and route6 objects for your neighbours and some minimal contact information.

Query the IRR database

At the top of this tab you can query the IRR. If you would query your own ASN you would see something like this:



You can also do inverse queries, for example to see which routes should be announced from an ASN:



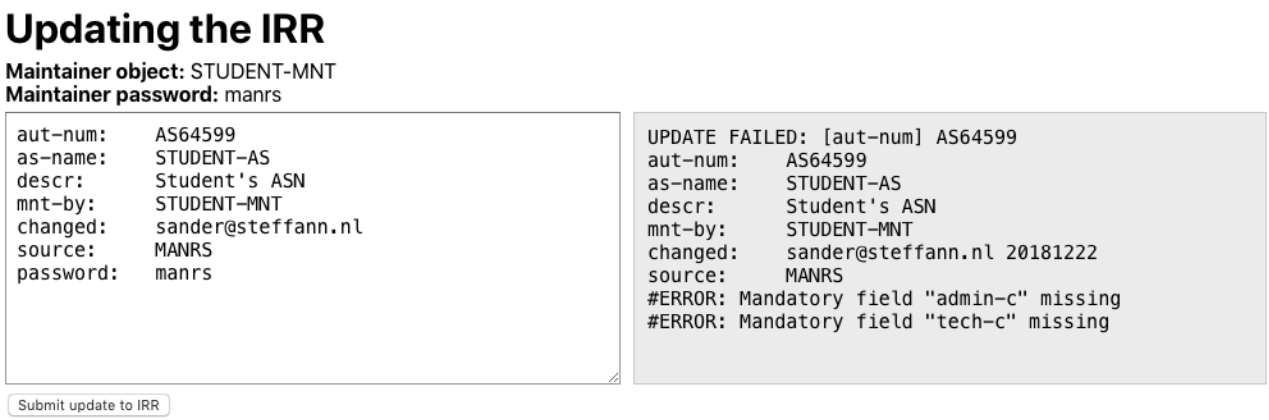
You can use all the common query options. For a full overview of the available query options see appendix B1 of https://raw.githubusercontent.com/irrdnet/irrd/master/irrd-user.pdf.

Updating the IRR

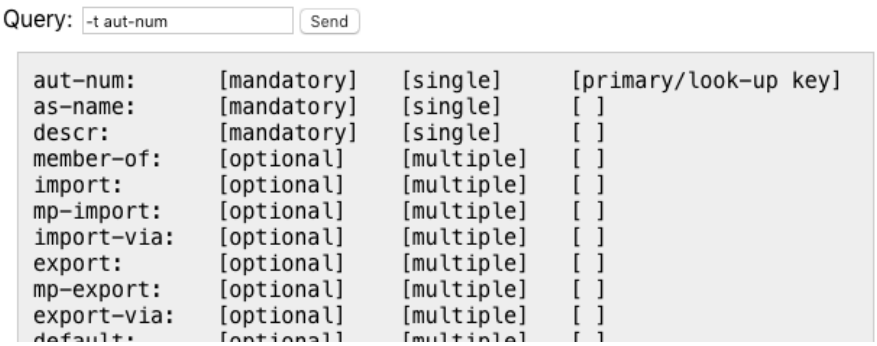
You can modify objects in the IRR using the update function:

In the box on the left you type (or easier: copy&paste) the IRR object you want to modify. Put in the version of the object that you want to save, make sure you have added the appropriate password line, and click the submit button. The response from the IRR database will appear on the right.

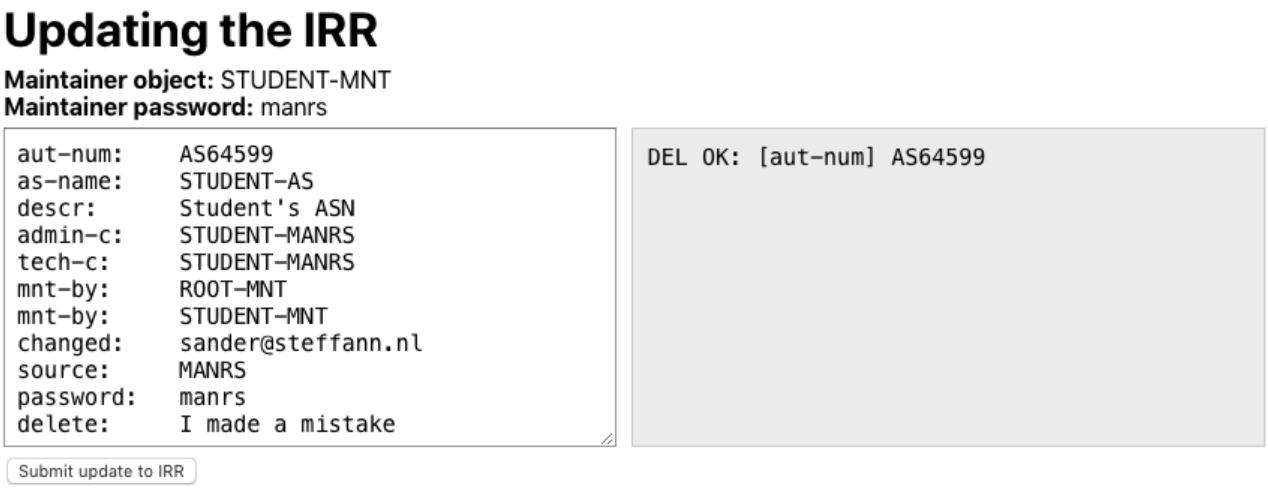
When you submit an object with errors, the error messages from the IRR database will be shown on the right:



The error messages are usually self-explanatory. If you want to see the template for an IRR object type you can query the database for that too:



Creating objects is simply done by submitting an object that does not yet exist. It will be created automatically. If you accidentally create an object that you didn't want to create then resubmit it with a `delete:` line added to it:



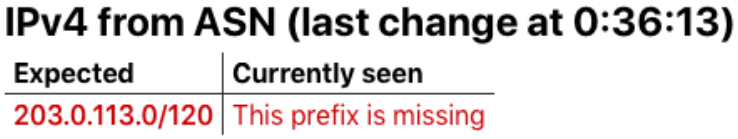
That will remove the object from the database. Be careful not to delete objects you still need! You will have to re-create them from scratch. We advise you to copy&paste an object and store it on your computer before deleting it from the IRR. If you later want it back you can then copy&paste it into the update field and recreate it.

Currently in the IRR

This section shows you what is currently in the IRR about your AS64500.

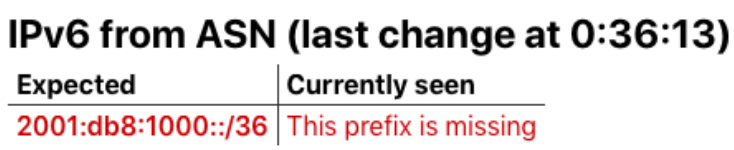
IPv4 from ASN

This section shows which IPv4 routes you are going to announce from your ASN. These are found by looking at the `route` objects in the IRR:



IPv6 from ASN

This section shows which IPv6 routes you are going to announce from your ASN. These are found by looking at the `route6` objects in the IRR:



IPv4 from AS-SET

This section shows which IPv4 routes you are going to your neighbours. It should contain both the routes from your ASN and from those of your neighbours. In these exercises we expect you to create an AS-SET called `AS64500:AS-ALL` which should contain these ASNs:

IPv4 from AS-SET (last change at 0:36:13)

Expected	Currently seen
192.0.2.0/120	This prefix is missing
198.51.100.0/120	This prefix is missing
203.0.113.0/120	This prefix is missing

IPv4 from AS-SET

This section shows which IPv6 routes you are going to your neighbours. It its based on the same AS-SET called `AS64500:AS-ALL` as for the IPv4 routes:

IPv6 from AS-SET (last change at 0:36:13)

Expected	Currently seen
2001:db8:1000::/36	This prefix is missing
2001:db8:1001::/48	This prefix is missing
2001:db8:2002::/48	This prefix is missing

Import/export

You should also document which routes you announce and accept from your neighbours. Others can use this to implement better filters in their networks. This information is based on the import and export rules included in your `AUT-NUM` object:

Import/export (last change at 0:36:13)

Note: This training system only supports simple "`mp-import: from A accept B`" and "`mp-export: to X announce Y`" style policy rules. Please limit yourself to that type of policy for this training.

Neighbor	Expected		Currently seen	
ASN	Import	Export	Import	Export
AS64501	AS64501	ANY		
AS64502	AS64502	ANY		
AS64510	ANY	AS64500:AS-ALL		
AS64511	AS64511	AS64500:AS-ALL		

These lines will be taken into account:

- import
- export
- mp-import
- mp-export

The system that checks these lines is not very advanced, so please keep the import and export statements simple. When you add too much complexity the system might not understand you anymore!

Troubleshooting

It can sometimes happen that things don't work as expected. When that happens try the following:

- make sure you can ping the other end of a link
- shutdown an interface and bring it back up to reset the link
- make sure your BGP sessions are up
- clear your BGP sessions after changing filters

And if all else fails, use the "reboot device" button you can find on the bottom of each tab.