

MANRS Observatory 101

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Why join MANRS?



Implementing MANRS Actions

- Signals an organization's security-forward posture and can eliminate SLA violations that reduce profitability or cost customer relationships.
- Reduces routing incidents, helping networks readily identify and address problems with customers or peers.
- Improves network's operations by establishing better and cleaner peering communication pathways, while also providing granular insight for troubleshooting
- Addresses many concerns of security-focused enterprises and other customers.



Everyone Benefits

- Joining MANRS means joining a community of security-minded organizations committed to making the global routing infrastructure more robust and secure
- Consistent MANRS adoption yields steady improvement, but we need more networks to implement the actions and more customers to demand routing security best practices.
- The more networks apply MANRS actions, the fewer incidents there will be, and the less damage they can do.



MANRS is an important step

Security is a process, not a state. MANRS provides a structure and a consistent approach to solving security issues facing the Internet.

MANRS is the minimum a network should consider, with low risk and cost-effective actions.

MANRS is not a one-stop solution to all the Internet's routing woes, but it is an important step toward a globally robust and secure routing infrastructure.



MANRS Participants (~ 2 Dec 2021)

- 615 Network Operators

<https://www.manrs.org/isps/participants/>

- 98 Internet eXchange Points (IXP)

<https://www.manrs.org/ixps/ixp-participants/>

- 18 CDN and Cloud Providers

<https://www.manrs.org/cdn-cloud-providers/participants/>

Asia Pacific: ..

- Operators: BdREN, Fiber@Home, Telstra, APAN, Wide, Subisu
- IXP: Equinix My, SG, BKNIX, Kolkata IX



MANRS - CDN and Cloud Participants



<https://www.manrs.org/cdn-cloud-providers/participants/>

Join Us

Visit <https://www.manrs.org>

- Fill out the sign up form with as much detail as possible.
- We may ask questions and run tests

Get Involved in the Community

- Members support the initiative and implement the actions in their own networks
- Members maintain and improve the document and promote MANRS objectives

 <https://www.manrs.org/join/>




MANRS Network Operator registration steps

Organization Name *

Organization Website *

Areas Served * Select the countries where your organization is based and/or provides services. We use [ISO 3166-1 Alpha-2 country codes](#).

AS Number(s) of Your Networks * Add each AS Number on its own line by using the "+" key. 

Organization Logo
Upload a .jpg or .png version of your company's logo, suitable for display on a white background in 400pixels width. This image will be published with your listing if your application is accepted.

No file chosen

Contact Name *

First Last

Contact Job Title

Contact Email *



Action 1: Filtering

MANRS Network Operator Application

Fields marked with an asterisk (*) are required.

The form can be filled out either in English, or in your native language.

1 Operator Information 2 MANRS Actions 3 Consent & Review

Action 1: Prevent propagation of incorrect routing information.

Network operator defines a clear routing policy and implements a system that ensures correctness of their own announcements and announcements from their customers to adjacent networks with prefix and AS-path granularity.

Network operator is able to communicate to their adjacent networks which announcements are correct.

Network operator applies due diligence when checking the correctness of their customer's announcements, specifically that the customer legitimately holds the ASN and the address space it announces.

Has your organization implemented Action 1?

Yes, we prevent propagation of incorrect routing information.

Description of Action 1 (Confidential)

Tell us more about how you implement filtering. This information is used by MANRS to evaluate your application and is not published.

Comment on Action 1 (Public)

What would like you like visitors to the MANRS website to know about your implementation of Action 1?



Action 2: Anti-Spoofing

Action 2: Prevent traffic with spoofed source IP addresses.

Network operator implements a system that enables source address validation for at least single-homed stub customer networks, their own end-users and infrastructure. Network operator implements anti-spoofing filtering to prevent packets with an incorrect source IP address from entering and leaving the network.

Has your organization implemented Action 2?

Yes, we prevent traffic with spoofed source IP addresses.

Describe your implementation of Action 2. (Confidential)

Tell us more about how you validate source addresses. This information is used by MANRS to evaluate your application and is not published.

Comment on Action 2 (Public)

What would like you like visitors to the MANRS website to know about your implementation of Action 2?



Action 3: Global Coordination

Action 3: Facilitate global operational communication and coordination between network operators.

Network operator maintains globally accessible up-to-date contact information.

Has your organization implemented Action 3?

Yes, we facilitate global operational communication and coordination between network operators.

Describe your implementation of Action 3. (Confidential)

Tell us more about your coordination efforts. This information is used by MANRS to evaluate your application and is not published.

Comment on Action 3 (Public)

What would like you like visitors to the MANRS website to know about your implementation of Action 3?



Action 4: Global Validation (IRR/RPKI)

Action 4: Facilitate validation of routing information on a global scale.

Network operator has publicly documented routing policy, ASNs and prefixes that are intended to be advertised to external parties.

Has your organization implemented Action 4?

Yes, we facilitate validation of routing information on a global scale.

Describe your implementation of Action 4. (Confidential)

Please provide us with a link to your policy, if it is available online. This information is used by MANRS to evaluate your application and is not published.

Comment on Action 4 (Public)

What would like you like visitors to the MANRS website to know about your implementation of Action 4?



MANRS Implementation Guide

If you're not ready to join yet, implementation guidance is available to help you.

- Based on Best Current Operational Practices deployed by network operators, IXPs, CDNs and Cloud providers around the world

<https://www.manrs.org/isps/bcop/>

<https://www.manrs.org/ixps/>

<https://www.manrs.org/cdn-cloud-providers>



Mutually Agreed Norms for Routing Security (MANRS) Implementation Guide

Version 1.0, BCOP series
Publication Date: 25 January 2017



MANRS

[1. What is a BCOP?](#)

[2. Summary](#)

[3. MANRS](#)

[4. Implementation guidelines for the MANRS Actions](#)

[4.1. Coordination - Facilitating global operational communication and coordination between network operators](#)

[4.1.1. Maintaining Contact Information in Regional Internet Registries \(RIRs\): AFRINIC, APNIC, RIPE](#)

[4.1.1.1. MNTNER objects](#)

[4.1.1.1.1. Creating a new maintainer in the AFRINIC IRR](#)

[4.1.1.1.2. Creating a new maintainer in the APNIC IRR](#)

[4.1.1.1.3. Creating a new maintainer in the RIPE IRR](#)

[4.1.1.2. ROLE objects](#)

[4.1.1.3. INETNUM and INET6NUM objects](#)

[4.1.1.4. AUT-NUM objects](#)

[4.1.2. Maintaining Contact Information in Regional Internet Registries \(RIRs\): LACNIC](#)

[4.1.3. Maintaining Contact Information in Regional Internet Registries \(RIRs\): ARIN](#)

[4.1.3.1. Point of Contact \(POC\) Object Example:](#)

[4.1.3.2. OrgNOCHandle in Network Object Example:](#)

[4.1.4. Maintaining Contact Information in Internet Routing Registries](#)

[4.1.5. Maintaining Contact Information in PeeringDB](#)

[4.1.6. Company Website](#)

[4.2. Global Validation - Facilitating validation of routing information on a global scale](#)

[4.2.1. Valid Origin documentation](#)

[4.2.1.1. Providing information through the IRR system](#)

[4.2.1.1.1. Registering expected announcements in the IRR](#)

[4.2.1.2. Providing information through the RPKI system](#)

[4.2.1.2.1. RIR Hosted Resource Certification service](#)

MANRS Observatory | Data Access

- Current access policy: Public will be able to view Overall, Regional and Economy aggregated data
- Only MANRS Participants will have access to detailed data about their network (Partner account required for accessing more detailed data).



MONTH November 2021 🔍

USE GRIP DATA ⓘ

Overview

State of Routing Security

Number of incidents, networks involved and quality of published routing information in the IRR and RPKI in the selected region and time period

Incidents ⓘ

Route misoriginations	390
Route leaks	61
Bogon announcements	673
Total	1,124



Culprits ⓘ

Culprits	803
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Routing completeness (IRR) ⓘ

Unregistered	132,786	12.4%
Registered	936,453	87.6%



Routing completeness (RPKI) ⓘ

Valid	361,400	33.8%
Unknown	702,471	65.7%
Invalid	5,368	0.5%

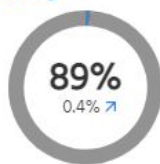


MANRS Readiness ⓘ

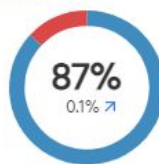
Filtering ⓘ



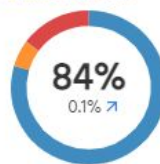
Anti-spoofing ⓘ



Coordination ⓘ



Global Validation IRR ⓘ



Global Validation RPKI ⓘ



● Ready ● Aspiring ● Lagging ● No Data Available



Overview

State of Routing Security

Number of incidents, networks involved and quality of published routing information in the IRR and RPKI in the selected region and time period

Incidents

Route misoriginations	2
Route leaks	0
Bogon announcements	3
Total	5



Culprits

Culprits	4
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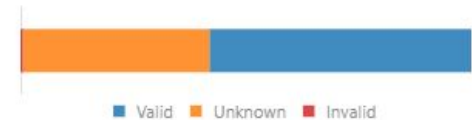
Routing completeness (IRR)

Unregistered	75	13.4%
Registered	485	86.6%



Routing completeness (RPKI)

Valid	325	58.1%
Unknown	232	41.4%
Invalid	3	0.5%



MANRS Readiness

Filtering



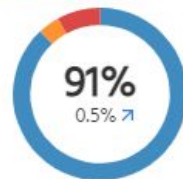
Anti-spoofing



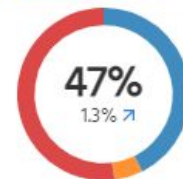
Coordination



Global Validation IRR



Global Validation RPKI



MONTH **November 2021** COUNTRY **Fiji**

USE GRIP DATA

Overview

State of Routing Security

Number of incidents, networks involved and quality of published routing information in the IRR and RPKI in the selected region and time period

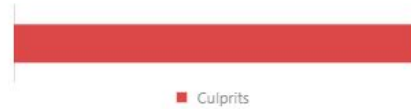
Incidents

Route misoriginations	0
Route leaks	0
Bogon announcements	1
Total	1



Culprits

Culprits	1
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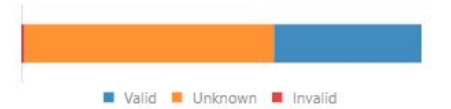
Routing completeness (IRR)

Unregistered	62	44.0%
Registered	79	56.0%



Routing completeness (RPKI)

Valid	52	36.9%
Unknown	88	62.4%
Invalid	1	0.7%



MANRS Readiness

Filtering



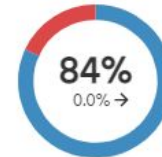
Anti-spoofing



Coordination



Global Validation IRR



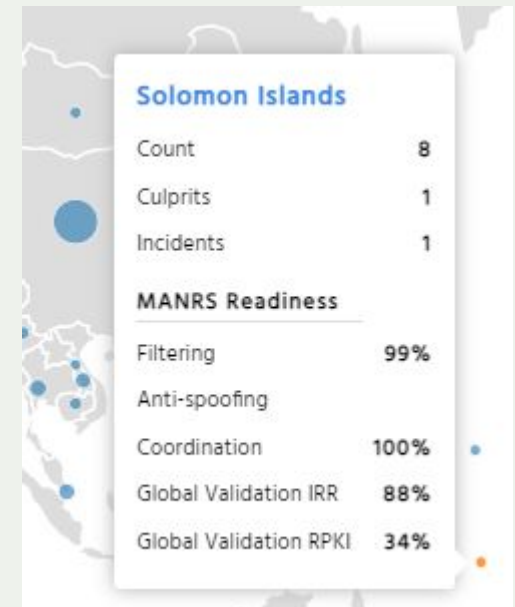
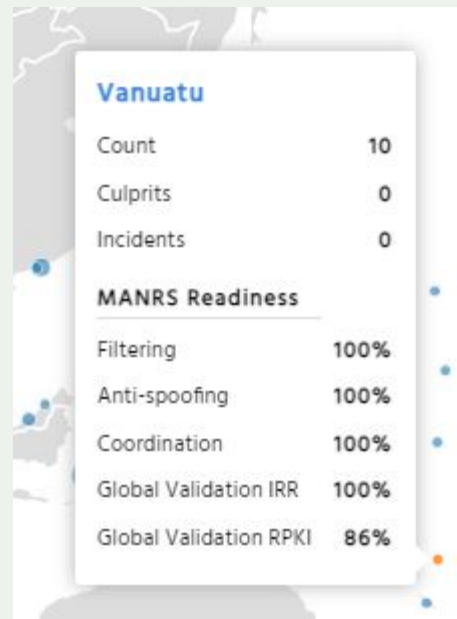
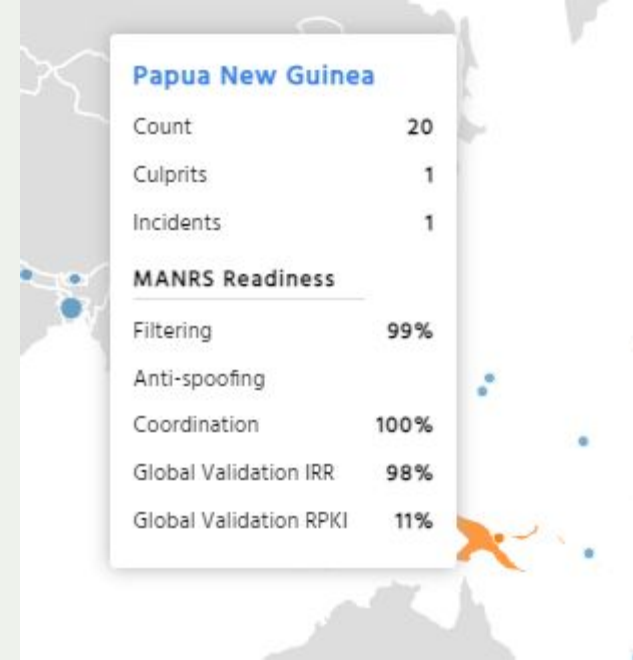
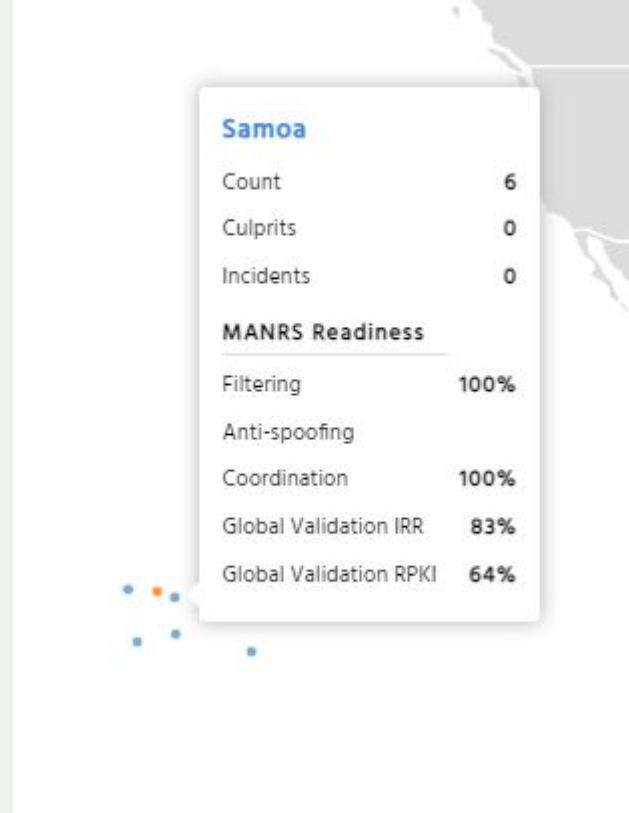
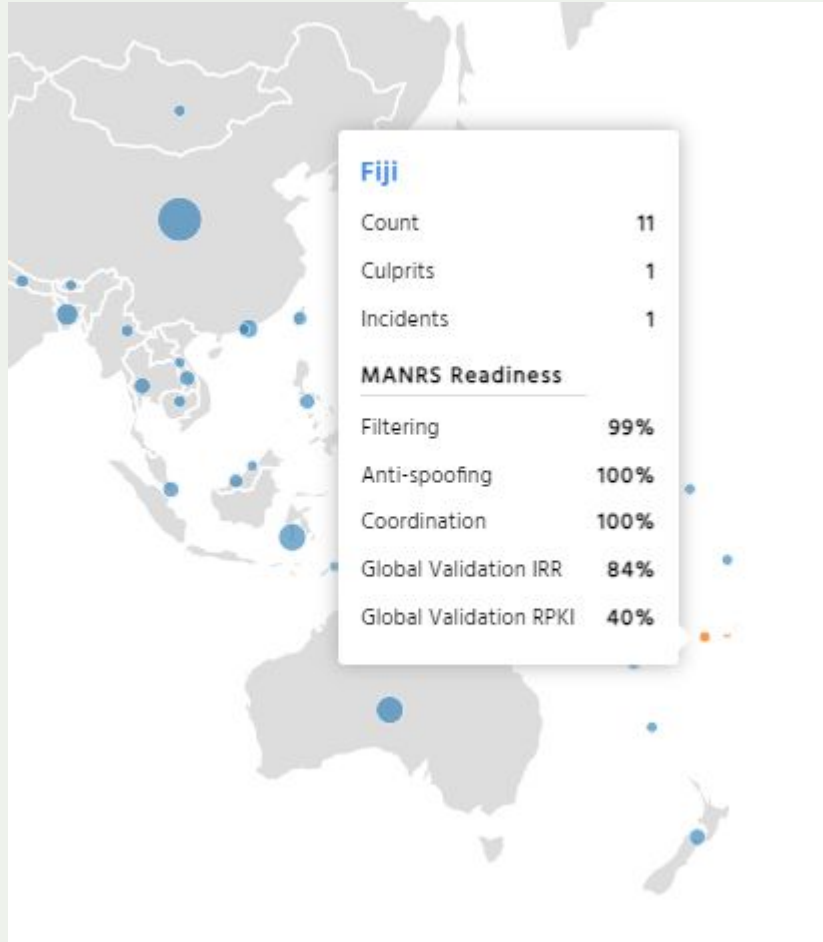
Global Validation RPKI



● Ready ● Aspiring ● Lagging ● No Data Available



MANRS Readiness



MONTH November 2021 COUNTRY Fiji

USE GRIP DATA

Details

[Download data](#) [Copy to clipboard](#)

Severity: **All** | Ready | Aspiring | Lagging | No Data Available Scope: **All** | Filtering | Anti-spoofing | Coordination | Global Validation IRR | Global Validation RPKI

Result Limit: **All** Total 11

Overview

ASN	Holder	Country	UN Regions	UN Sub-Regions	RIR Regions	Filtering	Anti-spoofing	Coordination	Global Validation IRR	Global Validation RPKI
4638	IS-FJ-AS Telecom Fiji Limit	FJ	Oceania	Melanesia	APNIC	100%	100%	100%	32%	13%
9241	FINTEL-FJ Fiji International	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	0%
24390	USP-AS-AP The University	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	33%
38442	VODAFONEFIJI-AS-FJ Vod	FJ	Oceania	Melanesia	APNIC	91%	-	100%	92%	92%
45349	TFL-AS-AP Telecom Fiji Ltr	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	0%
45355	DIGICELPACIFIC-1-AP Digi	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	100%
132248	RBOF-AS-AP Reserve Bank	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	100%
135647	AFL-AS-AP Airports Fiji Lir	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	0%
136921	FNU-AS-AP Fiji National U	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	0%
137890	WALESILTD-AS-AP Walesi	FJ	Oceania	Melanesia	APNIC	100%	-	100%	0%	0%
141470	GOVNET-AS-AP ITC Servic	FJ	Oceania	Melanesia	APNIC	100%	-	100%	100%	100%

MONTH (PARTIAL) October 2021 COUNTRY India HOLDER [Redacted]

USE GRIP DATA ⁱ

Details

[Download data](#) [Copy to clipboard](#)

Severity: **All** | Ready | Aspiring | Lagging | No Data Available Scope: **All** | Filtering | Anti-spoofing | Coordination | Global Validation IRR | Global Validation RPKI

Result Limit: **All** Total 1

Overview

ASN	Holder	Country	UN Regions	UN Sub-Regions	RIR Regions	Filtering	Anti-spoofing	Coordination	Global Validation IRR	Global Validation RPKI
4772	MANRS-AS-INDIA-AS-Private-Net	IN	Asia	Southern Asia	APNIC	100%	-	100%	57%	29%



MONTH June 2019 HOLDER BREN-UGC-AS-AP Banglades...

Details - ASN 63961

Download data

M1 - Route leak by the AS

Absolute: 0.0 Normalized: 100% Incident Count: 0

M2 - Route misorigin by the AS

Absolute: 0.0 Normalized: 100% Incident Count: 0

M1C - Route leak by a direct customer

Absolute: 0.0 Normalized: 100% Incident Count: 0

M2C - Route hijack by a direct customer

Absolute: 0.0 Normalized: 100% Incident Count: 0

M3 - Bogon prefixes announced by the AS

Absolute: 0.0 Normalized: 100% Incident Count: 0

M3C - Bogon prefixes propagated by the AS

Absolute: 0.0 Normalized: 100% Incident Count: 0

M4 - Bogon ASNs announced by the AS

Absolute: 0.0 Normalized: 100% Incident Count: 0

M5 - Spoofing IP blocks

Absolute: 0.5 Normalized: 60% Incident Count: -

Has records	Spoofed prefixes
False	-

M8 - Contact registration (RIR, IRR, PeeringDB)

Absolute: 0 Normalized: 100% Incident Count: -

Checked on	Has contact info
2019-06-13	True

M7IRR - Registered routes (% of routes registered)

Absolute: 0% Normalized: 100% Incident Count: -

Number of prefixes	Number of unregistered prefixes	Unregistered prefixes	Checked on
15	0	-	2019-06-13

M7RPKI - Valid ROAs for routes (% of routes registered)

Absolute: 0% Normalized: 100% Incident Count: -

Number of prefixes	Number of unknown prefixes	Checked on
2	0	2019-06-13

M7RPKIN - Invalid routes

Absolute: 0% Normalized: 100% Incident Count: -

Number of prefixes	Number of invalid prefixes	Invalid prefixes
2	0	-



Measurements(<https://observatory.manrs.org/#/about>)

Action	Measurement	Data source	Caveats
Filtering <i>M1, M1C, M2, M2C</i>	Route hijacks and leaks	BGPStream.com CAIDA GRIP	False positives, obscure algorithms, vantage points
Filtering <i>M3, M3C, M4, M4C</i>	“Bogon” announcements	CIDR report	Limited vantage points
Anti-spoofing <i>M5</i>	Negative tests	CAIDA Spoofer	Sparse, active
Coordination <i>M8</i>	Registered contacts	RIRs Whois DBs (RIPEStat), PeeringDB	Stale/non-responsive contacts not detected
Global validation <i>M7IRR, M7RPKI, M7RPKIN</i>	Coverage of routing announcements	IRRs, RPKI (RIPEStat)	



MANRS Participant Logo



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SEACOM

SMW3 - SEA-ME-WE3

SMW4 - SEA-ME-WE4

Africa Network Connections - VSAT

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MANRS Hands on Lab (ISOC Hosted)

manrs.nog-oc.org/lab/376/dashboard/?

MANRS Lab Manager

Dashboard: MANRS-Vers1 for Naveen Lakshman

Logged in as Naveen Lakshman (naveen.k.ipv6@gmail.com)

[Home](#) | [Change password](#) | [Log out](#)

Instructions AS64500 AS64501 AS64502 AS64510 AS64511

Online

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.

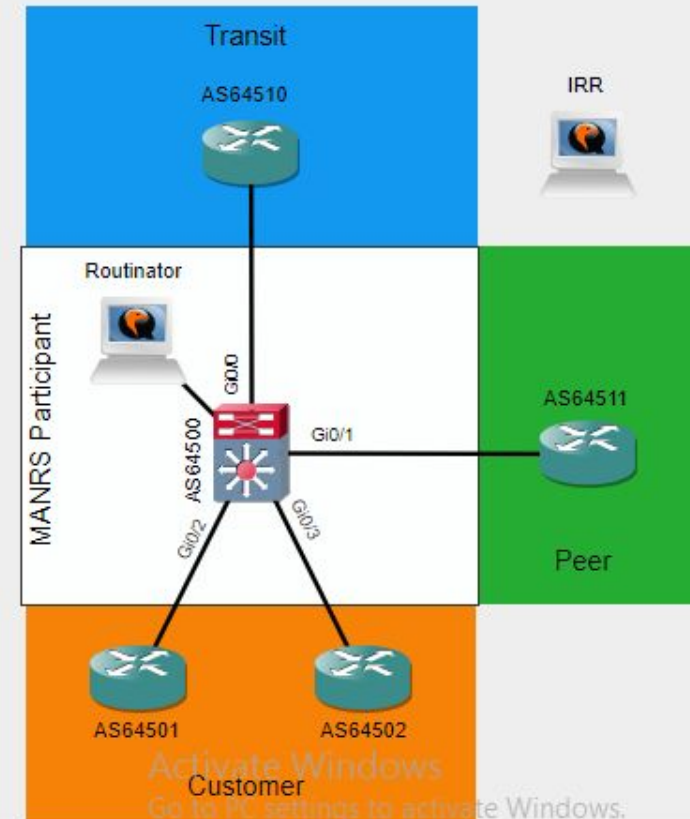
You should announce the following prefixes from your own router:

- 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.



MANRS Lab Modules

Lab guide is based on <https://www.manrs.org/isps/bcop/>

Tutorial is a mix of lectures and hands-on lab sessions to deploy MANRS actions based on best current operational practices. Lab runs on dual-stack infrastructure.

MANRS Actions Agenda (Lab ~ Cisco IOS)

- Anti-Spoofing (uRPF)
 - BCP38/uRPF Strict Mode
- Filtering (Preventing propagation of incorrect routing information)
 - Specific-prefix outbound filtering of your network to peers and upstreams/transits.
 - Specific-prefix inbound filtering from customers.
 - Specific-prefix Inbound filtering of peers and upstreams to your network.



#Protect the Core

LEARN MORE: <https://www.manrs.org>

<https://www.manrs.org/join/>

