MANRS

https://www.manrs.org/

Mutually Agreed Norms for Routing Security (MANRS)

- Global initiative
- Supported by the Internet Society
- Provides crucial fixes to reduce the most common routing threats

- MANRS for network operators
- MANRS for IXP operators

Actions for network operators

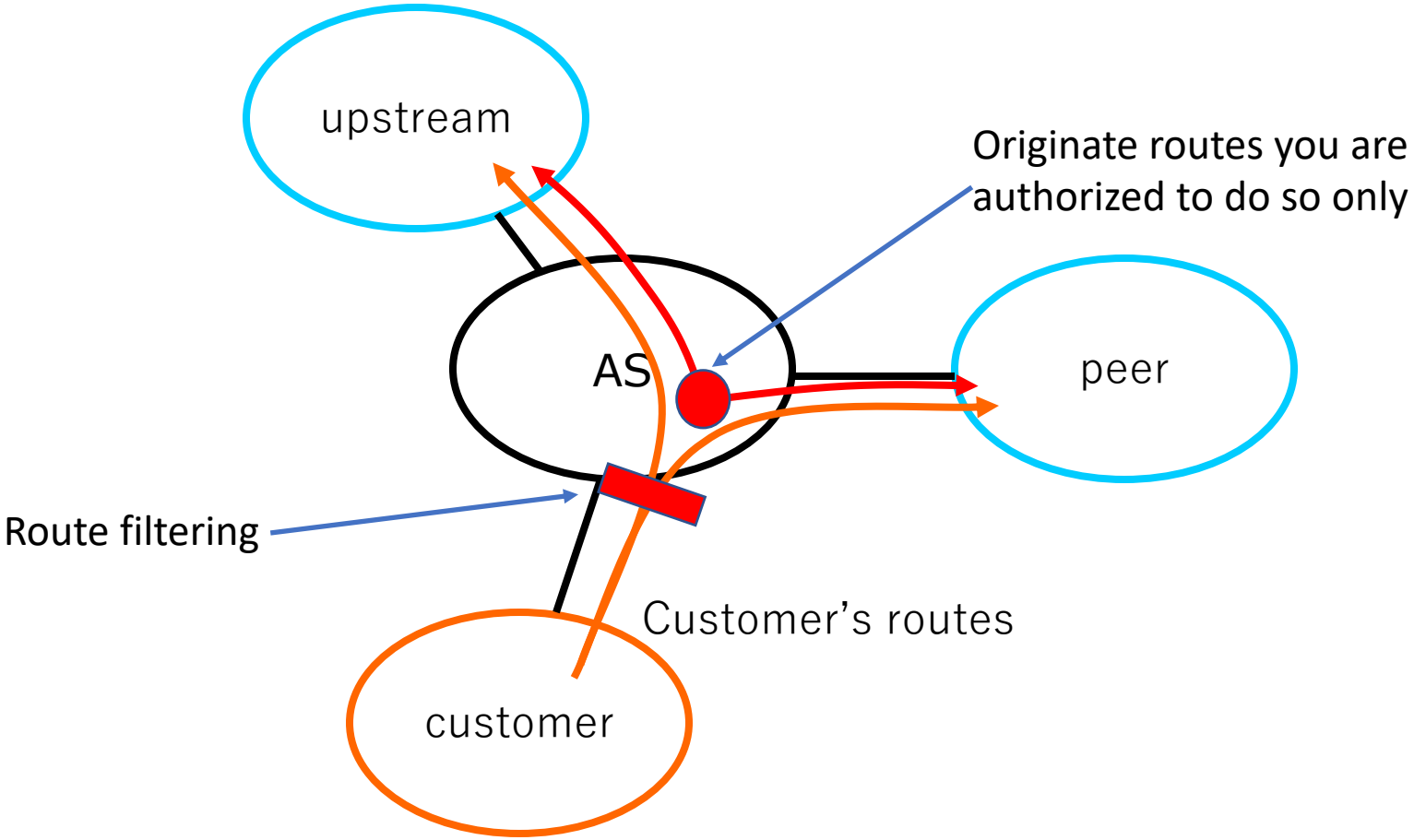
1. **Prevent propagation of incorrect routing information**
2. Prevent traffic with spoofed source IP addresses
3. **Facilitate global operational communication and coordination**
4. **Facilitate routing information on a global scale**
   - **IRR**
   - RPKI

The red colored actions are compulsory

Action 1: Prevent propagation of incorrect routing information

- Network operator must implement a system whereby they only announce to adjacent networks the AS numbers and IP prefixes they or their customers are legitimately authorized to originate.
- Network operator must check whether the announcements of their customers are correct; specifically, that each customer legitimately holds the AS numbers and IP address space they announce.

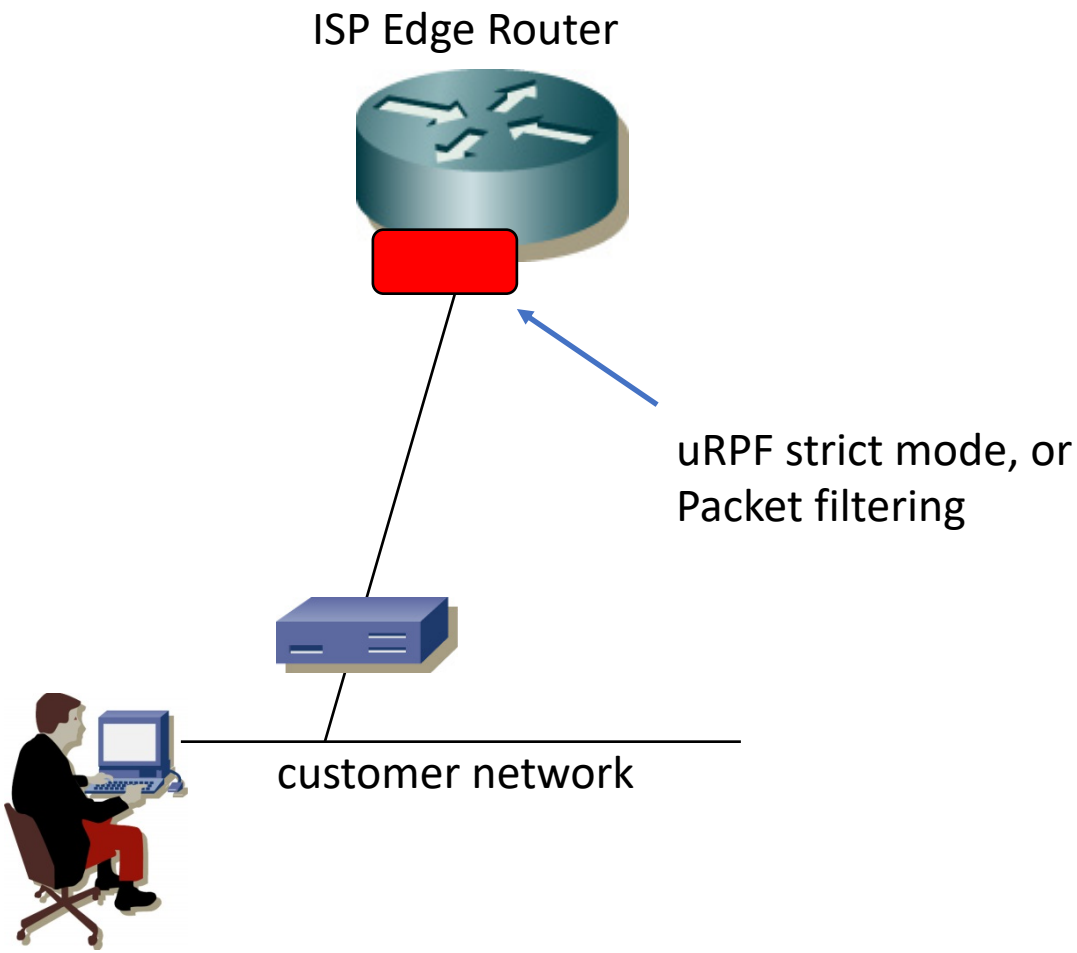
Preventing incorrect BGP routes



Action 2: Prevent traffic with spoofed source IP addresses

- A network operator should implement a system that enables source address validation for their own infrastructure and end users, and for any Single-Homed Stub Customer Networks. This should include anti-spoofing filtering to prevent packets with an incorrect source IP address from entering or leaving the network.
- A network operator must test whether their network is able to send packets with forged source IP addresses using the CAIDA Spoofer Software. This is to alert the network operator as to whether their network might be used to originate Distributed Denial-of-Service (DDoS) attacks, whilst generating publicly accessible information allowing that network to be checked by others.

source IP addresses validation



Action 3: Facilitate global operational communication and coordination

- Network operator must ensure that up-to-date contact information is entered and maintained in the appropriate RIR (or NIR) database and/or in PeeringDB. It is strongly recommended that contact information is made publicly available, but at a minimum must be available to other network operators registered with PeeringDB.

RIR (NIR) Whois DB

- APNIC
  - Update your whois DB through MyAPNIC portal
  - https://my.apnic.net/
- NIRs
  - Each NIR has own procedures to update whois DB

- Maintain the contact info up to date
  - Name of organization
  - Email address

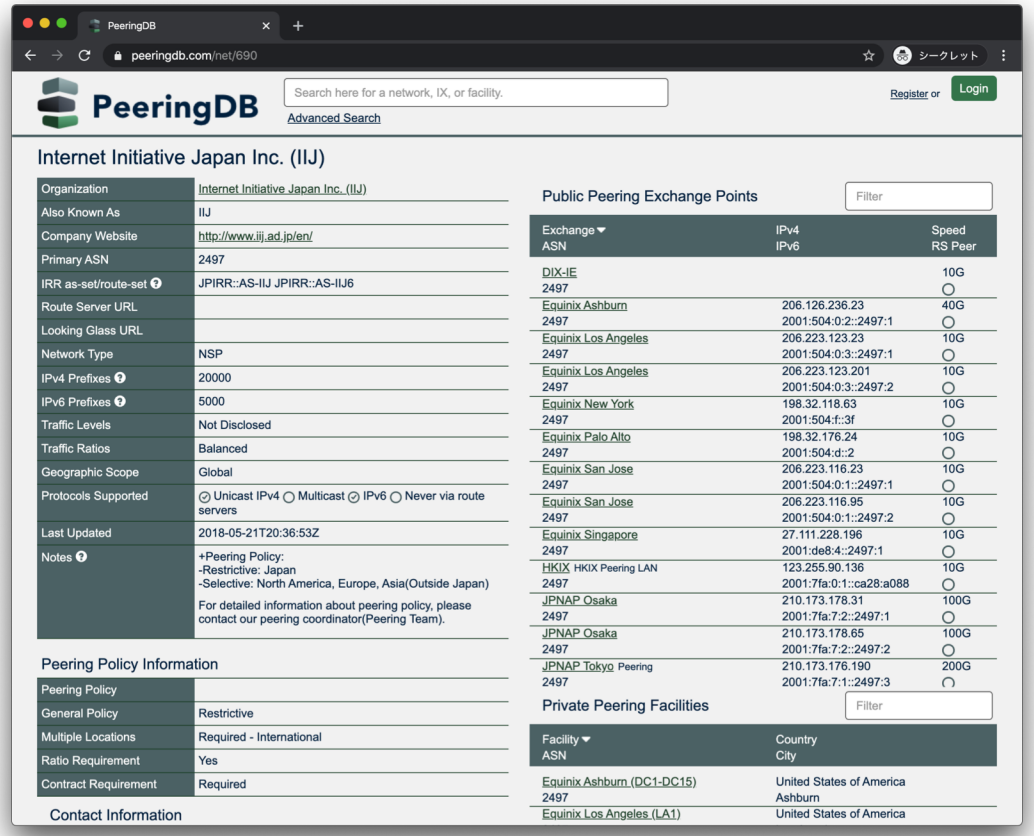
APRICOT resources

```
inetnum:        220.247.144.0 - 220.247.159.255
netname:        APRICOT-APNIC
descr:          IPv4 Address block used for conferences in AP region
descr:          APRICOT APNIC 49 Melbourne, Australia
country:        AU
org:            ORG-APNI1-AP
admin-c:        PFS1-AP
tech-c:         PFS1-AP
status:         ALLOCATED PORTABLE
geoloc:         -37.823437 144.958086
notify:         philip@apia.org
mnt-by:         APNIC-HM
mnt-lower:      MAINT-AP-PFS
mnt-routes:     MAINT-AP-PFS
mnt-irt:        IRT-APNIC-AP
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
remarks:        This object can only be updated by APNIC hostmasters.
remarks:        To update this object, please contact APNIC
remarks:        hostmasters and include your organisation's account
remarks:        name in the subject line.
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
last-modified:  2019-12-16T13:01:26Z
source:         APNIC
```

APRICOT resources

```
inet6num:       2001:df9::/32
netname:        APRICOT-APNIC-IPV6
descr:          IPv6 Address block used for conferences in AP region
descr:          APRICOT APNIC 49 Melbourne, Australia
country:        AU
org:            ORG-APNI1-AP
admin-c:        PFS1-AP
tech-c:         PFS1-AP
status:         ALLOCATED PORTABLE
geoloc:         -37.823437 144.95808
notify:         philip@apia.org
mnt-by:         APNIC-HM
mnt-lower:      MAINT-AP-PFS
mnt-routes:     MAINT-AP-PFS
mnt-irt:        IRT-APNIC-AP
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+
remarks:        This object can only be updated by APNIC hostmasters.
remarks:        To update this object, please contact APNIC
remarks:        hostmasters and include your organisation's account
remarks:        name in the subject line.
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+
last-modified:  2019-12-16T13:01:26Z
source:         APNIC
```

PeeringDB – https://peeringdb.com



Action 4: Facilitate routing information on a global scale - IRR

- Network operators must publicly document their intended routing announcements in the appropriate RIR routing registry, RADB or an RADB-mirrored IRR. This includes ASNs and IP prefixes originating on their own networks, as well as the networks for which they provide transit services.

Internet Routing Registry (IRR)

- Routing Policy Specification Language (RPSL) was developed to entirely describe your routing policy
- Each RIR provides IRR service
  - Register your IRR objects to RIR where you got your resources from
  - RADB is still popular though
- APNIC
  - Access MyAPNIC portal to create/maintain IRR objects

IRR objects

- A small set of RPSL objects are enough to allow your peers to deploy route filtering
- Procedure
  - Create a mntner object (maintainer info)
  - Create an aut-num object (your AS# and contact info)
  - Create route / route6 objects (your originating prefixes)
  - Create an as-set object (ASes of you and your customers)

IRR mntner object

```
mntner:         MAINT-AP-PFS
upd-to:         philip@apia.org
descr:          Philip Smith
admin-c:        PFS1-AP
tech-c:         PFS1-AP
referral-by:    APNIC-HM
mnt-by:         MAINT-AP-PFS
last-modified:  2018-09-25T03:23:28Z
source:         APNIC
auth:           # Filtered
```

IRR as-num object

```
aut-num:        AS24555
as-name:        APRICOT-APNIC-ASN
descr:          ASN used for conferences in AP region
descr:          APRICOT APNIC 49 Melbourne, Australia
country:        AU
org:            ORG-APNI1-AP
import:         from AS4826 accept ANY
export:         to AS4826 announce AS24555
admin-c:        PFS1-AP
tech-c:         PFS1-AP
notify:         philip@apia.org
mnt-by:         APNIC-HM
mnt-lower:      MAINT-AP-PFS
mnt-routes:     MAINT-AP-PFS
mnt-irt:        IRT-APNIC-AP
last-modified:  2019-12-16T13:01:26Z
source:         APNIC
```

IRR route object

```
route:          220.247.144.0/20
descr:          APRICOT Netblock
descr:          Route object for APRICOT and other AP region conferences
descr:          Managed by APIA
country:        AU
origin:         AS24555
notify:         technical@apia.org
mnt-by:         MAINT-AP-PFS
last-modified:  2019-12-15T23:13:15Z
source:         APNIC
```

IRR route6 object

```
route6:          2001:df9::/32
descr:           APRICOT IPv6 Netblock
descr:           Route object for APRICOT and other AP region conferences
descr:           Managed by APIA
country:         AU
origin:          AS24555
notify:          technical@apia.org
mnt-by:          MAINT-AP-PFS
last-modified:   2019-12-15T23:13:15Z
source:          APNIC
```

IRR as-set object

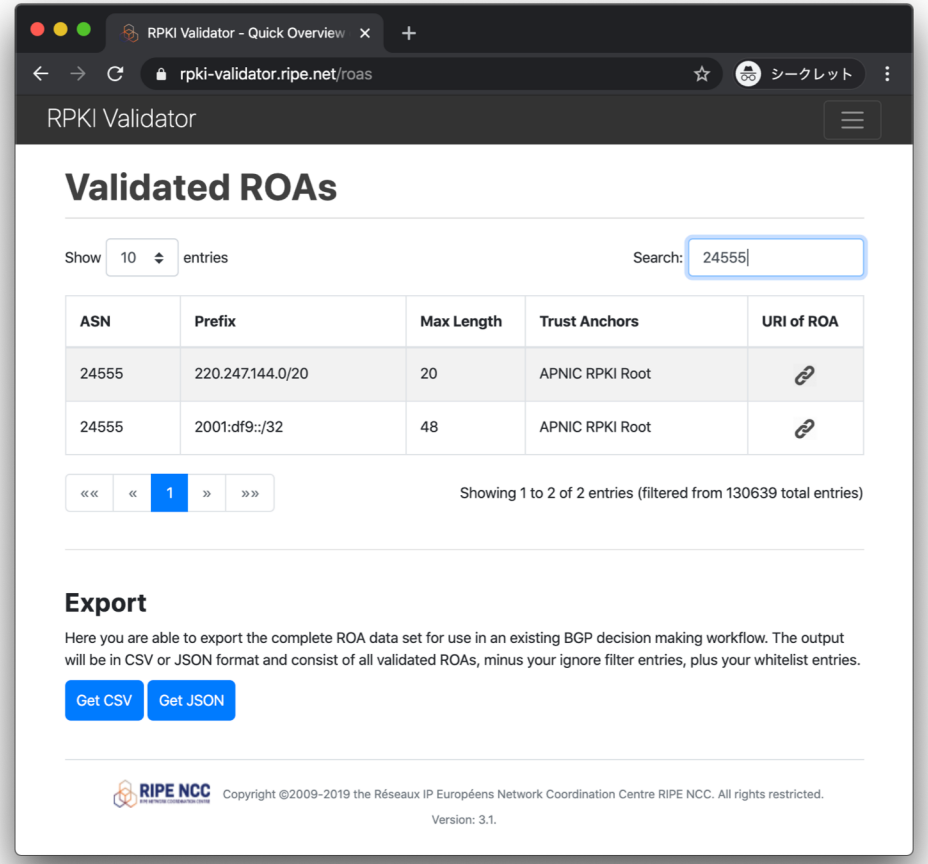
```
as-set:        AS-APRICOT
descr:         APRICOT conference ASN
members:       AS24555
admin-c:       PFS1-AP
tech-c:        PFS1-AP
notify:        technical@apia.org
mnt-by:        MAINT-AP-PFS
changed:       philip@apia.org 20120215
source:        APNIC
```

Action 4: Facilitate routing information on a global scale - RPKI

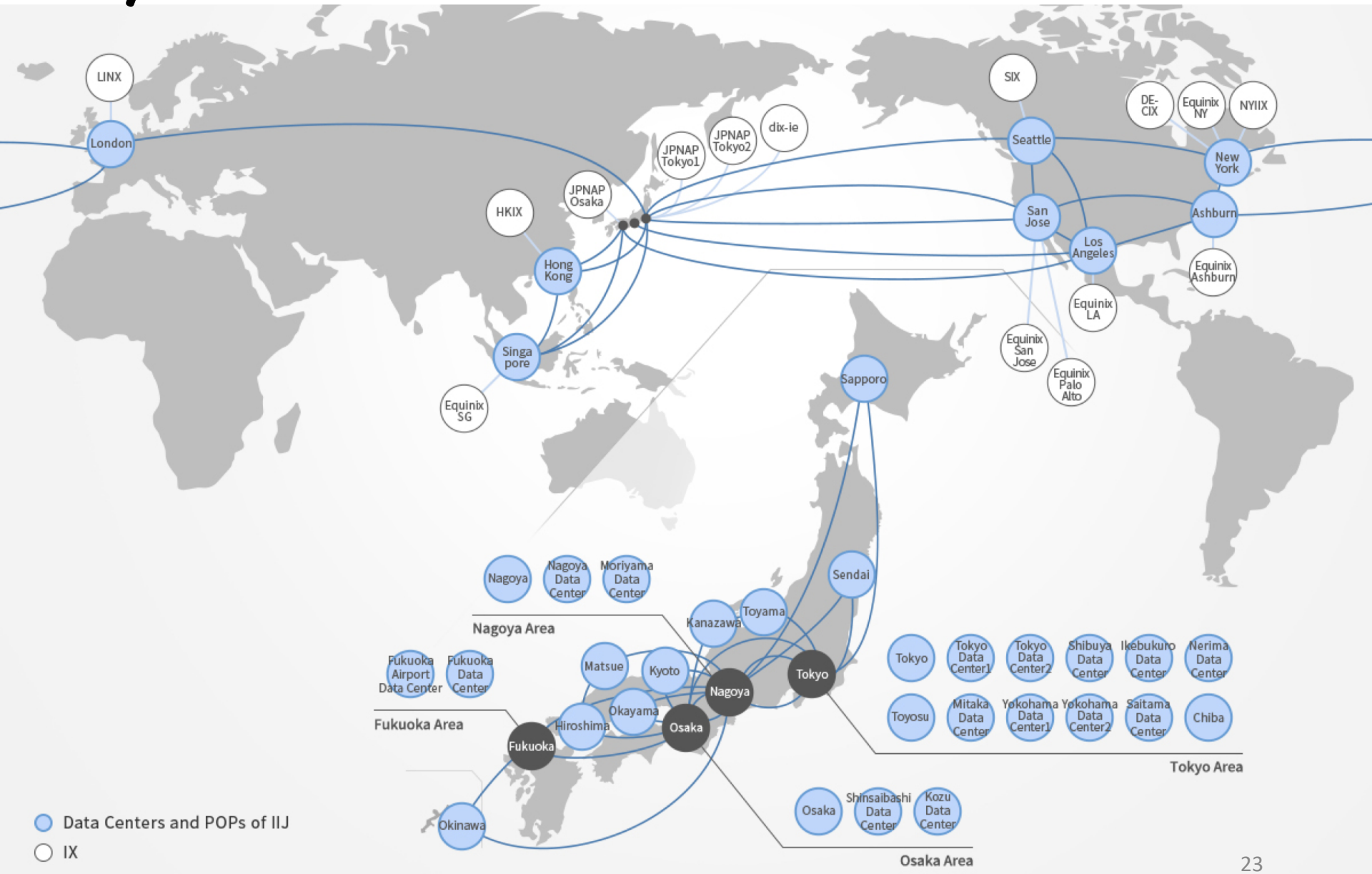
- A network operator should create a valid Route Origination Authorization (ROA) for each IP prefix or set of prefixes it is legitimately authorized and intends to originate.

RPKI ROA

- APNIC
  - Access MyAPNIC portal to issue ROAs



IIJ/AS2497


LINX
London
SIX
Seattle
DE-CIX
Equinix NY
NYIIX
New York
JPNAP Tokyo1
JPNAP Tokyo2
dix-ie
JPNAP Osaka
HKIX
Hong Kong
San Jose
Ashburn
Los Angeles
Equinix Ashburn
Equinix LA
Equinix San Jose
Equinix Palo Alto
Singa pore
Equinix SG
Sapporo
Sendai
Nagoya
Nagoya Data Center
Moriyama Data Center
Nagoya Area
Kanazawa
Toyama
Fukuoka Airport Data Center
Fukuoka Data Center
Matsue
Kyoto
Nagoya
Tokyo
Okayama
Hiroshima
Osaka
Fukuoka
Fukuoka Area
Tokyo
Tokyo Data Center1
Tokyo Data Center2
Shibuya Data Center
Ikebukuro Data Center
Nerima Data Center
Toyosu
Mitaka Data Center
Yokohama Data Center1
Yokohama Data Center2
Saitama Data Center
Chiba
Tokyo Area
Osaka
Shinsaibashi Data Center
Kozu Data Center
Osaka Area
Okinawa
Data Centers and POPs of IIJ
IX

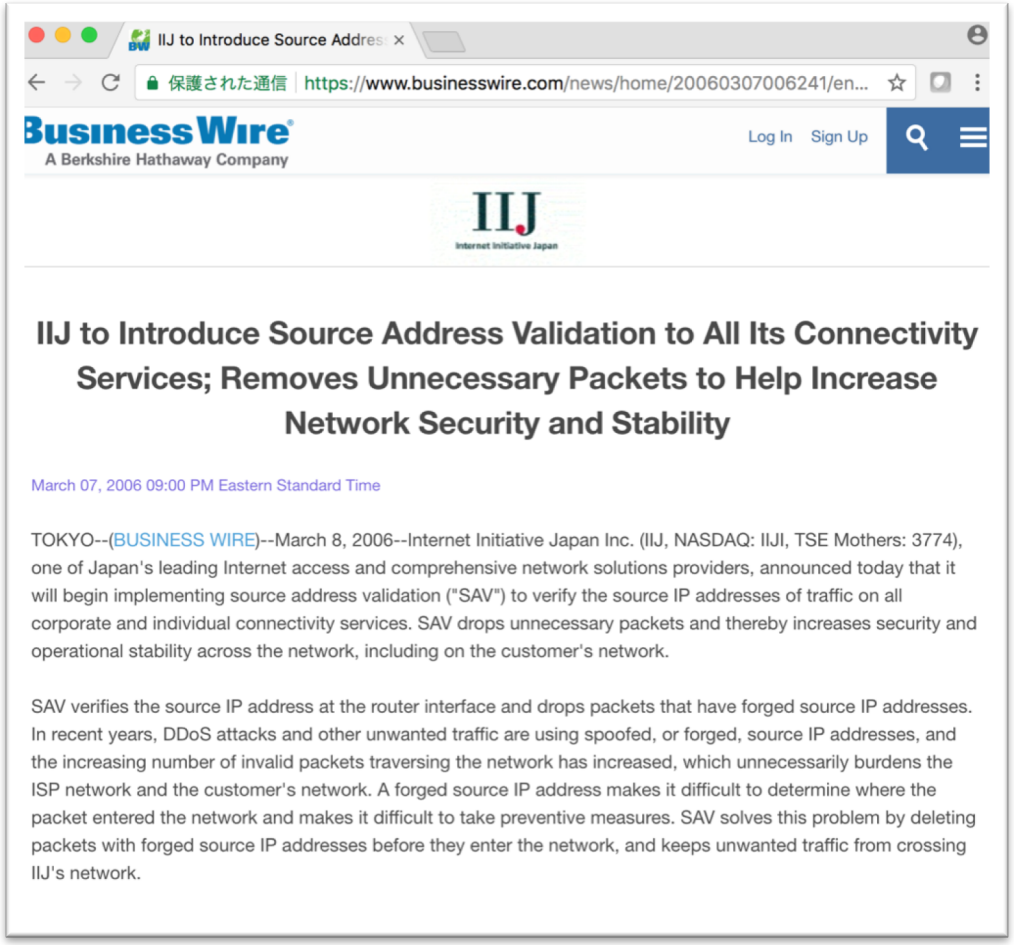
Our BGP route origination

- Aggregated prefixes only
- Customers' PI blocks
  - Checking with whois DB before originating it
- IIJ maintains route/route6 records on IRRs
  - RADB and JPIRR

Our BGP customers

- Customers should maintain IRR route/route6 records by themselves
  - Automated proxy-registration is a bad idea
- Customers should notify us about their announcing prefixes and its AS_PATH in advance
  - We check these with whois DB and IRR
  - We have strict route filtering based on that notice
    - Inbound prefix filtering and as-path filtering

Source IP address verification



IIJ to Introduce Source Addres ×

保護された通信 | https://www.businesswire.com/news/home/20060307006241/en...

Business Wire
A Berkshire Hathaway Company

Log In Sign Up

IIJ
Internet Initiative Japan

IIJ to Introduce Source Address Validation to All Its Connectivity Services; Removes Unnecessary Packets to Help Increase Network Security and Stability

March 07, 2006 09:00 PM Eastern Standard Time

TOKYO--(BUSINESS WIRE)--March 8, 2006--Internet Initiative Japan Inc. (IIJ, NASDAQ: IIJI, TSE Mothers: 3774), one of Japan's leading Internet access and comprehensive network solutions providers, announced today that it will begin implementing source address validation ("SAV") to verify the source IP addresses of traffic on all corporate and individual connectivity services. SAV drops unnecessary packets and thereby increases security and operational stability across the network, including on the customer's network.

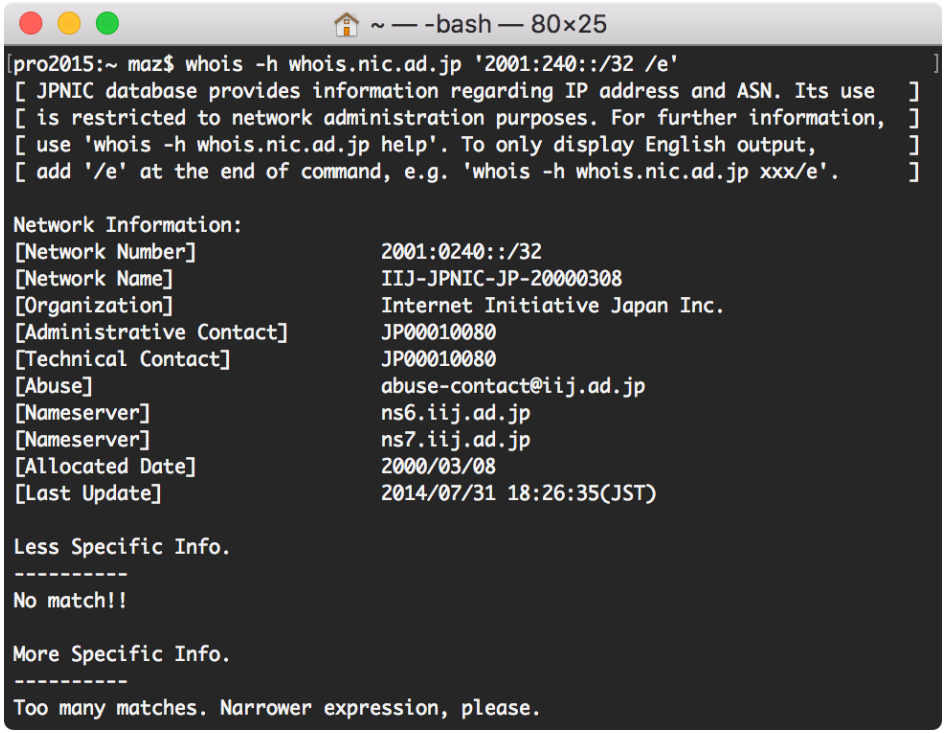
SAV verifies the source IP address at the router interface and drops packets that have forged source IP addresses. In recent years, DDoS attacks and other unwanted traffic are using spoofed, or forged, source IP addresses, and the increasing number of invalid packets traversing the network has increased, which unnecessarily burdens the ISP network and the customer's network. A forged source IP address makes it difficult to determine where the packet entered the network and makes it difficult to take preventive measures. SAV solves this problem by deleting packets with forged source IP addresses before they enter the network, and keeps unwanted traffic from crossing IIJ's network.

Prevent reflection attacks

- RIPE52, 2006 in Istanbul
  - http://meetings.ripe.net/ripe-52/presentations/ripe52-plenary-dnsamp.pdf
- JANOG18, 2006 in Tokyo
  - https://www.janog.gr.jp/meeting/janog18/program-abstract.html#P8
- And many other

Contact information

- PeeringDB
  - https://as2497.peeringdb.com/
- IRR
  - JPIRR and RADB
- Whois



Nothing special as a common AS

Have been there, done that

Signed up for MANRS

MANRS Turns 1 and First Japa ×

保護された通信 | https://www.manrs.org/2015/11/manrs-turns-1-and-first-japa...

Mutually Agreed Norms for Routing Security (MANRS)

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MANRS Turns 1 and First Japanese Operator, IIJ, Joins

Just over one year ago, on the 6th of November 2014, a group of 9 network operators launched an effort called MANRS – Mutually Agreed Norms for Routing Security. We also kept another name – Routing Resilience Manifesto – to emphasise the collaborative and collective nature of it.

Since then more operators have joined, bringing and promoting the initiative all around the globe.

On its first anniversary, MANRS has expanded its geography to Japan! A company that is known for its innovative vision, advanced technology, and attention to security, Internet Initiative Japan Inc., or IIJ, has joined the group of MANRS participants.

"Coordination and cooperation based on our relationships of mutual trust are the key elements to run the Internet, and we have shared responsibilities to improve the Internet operation. As part of the Internet operation community, IIJ is committed to the MANRS actions," said Junichi Shimagami, Director CTO of Internet Initiative Japan Inc.

We are looking for more leaders – networks that have already implemented the MANRS recommendations and much more – to sign up, support this effort, and encourage others!

Join the initiative