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BGP Best Practice at IXPs

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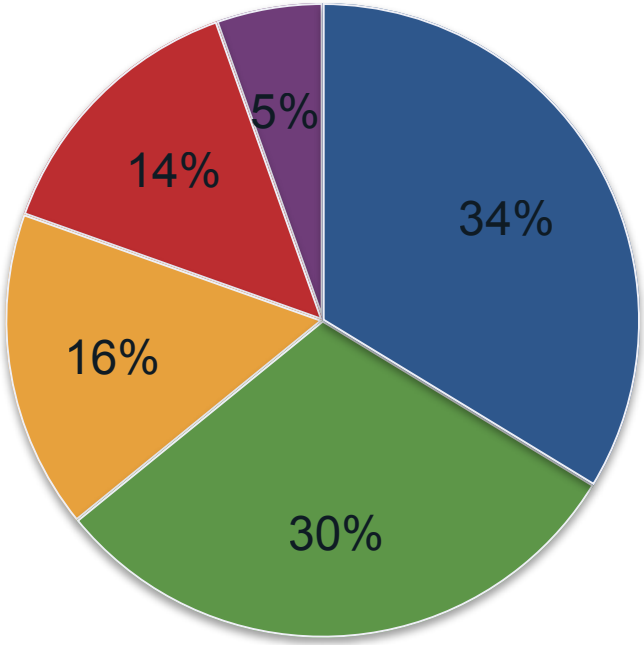
OBLIGATORY INFOGRAPHIC

What Routers do People Use?



Cisco
Juniper
PC / VMware
Mikrotik
Others

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BGP Hygiene at IXPs

BGP Speed Optimisation

- Don’t use as-path lists if possible
- Use BGP communities where possible
- On IOS, use prefix-lists instead of access-lists
- On IOS, use peer-groups or peer-templates for CPU efficiency

BGP Hygiene at IXPs

BGP Security - maximum prefixes

- Tears down BGP session once prefix limit is reached
- Helps to stop problems due to third party mistakes
- Large organisations are just as likely to make mistakes as small
- Some IXP operators maintain a list of maxprefixes on IXP Manager
- Otherwise sensible to limit to 200 generally, with exceptions

BGP Hygiene at IXPs

BGP Security - maximum prefixes

- Cisco Configuration

```
router bgp 64512
 address-family ipv4
  neighbor X.Y.Z.W maximum-prefix 200
```

- Juniper Configuration

```
set protocols bgp group <group> family inet unicast prefix-limit maximum 200
```

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BGP Hygiene at IXPs

BGP Security - IRRDB Prefix Filters

- RIPE IRRDB route: objects generally not used for filtering prefix lists at IXPs
- Should not be used unless you're a programmer
- Well-managed Route Server system will use IRRDB data automatically
- No need to tell other members about new announcements

BGP Hygiene at IXPs

BGP Security - RPKI

- RPKI data currently not good enough to use in production networks
- Won’t fulfil aims until prefixes can be dropped on RPKI policy
- Unclear whether this can be achieved in practice
- Will never work properly until signed paths are supported
- Signed paths are incompatible with route servers
- Basic origin validation supported on IOS and JUNOS

BGP Hygiene at IXPs

BGP Security - MD5 passwords

- Some companies have security policies which require it
- Not as useful as some people claim
- Primary use at IXP is to stop session hijacking when addresses are re-used
- Formally obsoleted by TCP-AO since June 2010
- Still no production TCP-AO implementations
- MD5 will continue to be the only option in future

BGP Hygiene at IXPs

BGP Security - Deny Own Prefixes

- Accepting your prefixes from third party networks will cause problems
- Can cause internal BGP announcements to be dropped
- Default Cisco BGP settings will allow on-net hijacking of traffic

BGP Hygiene at IXPs

BGP Security - Deny Own Prefixes

- Cisco Configuration

```
router bgp 64512
 address-family ipv4
  neighbor 193.242.111.X prefix-list pl-ipv4-own-prefix-range

ip prefix-list pl-ipv4-own-prefix-range seq 5 deny 192.0.2.0/24 le 32
ip prefix-list pl-ipv4-own-prefix-range seq 10 permit 0.0.0.0/0 le 32
```

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BGP Hygiene at IXPs

BGP Security - Deny Own Prefixes

- Juniper Configuration

```
set policy-options prefix-list pl-ipv4-own-address-block 192.0.2.0/24
edit policy-options policy-statement export-ebgp-ipv4-own-prefix-range
set term 10-deny-local from prefix-list-filter pl-ipv4-own-address-block orlonger
set term 10-deny-local then reject
set term 99-accept then accept
top
set protocols bgp group <group> export export-ebgp-ipv4-own-prefix-range
```

BGP Hygiene at IXPs

BGP Security - Deny Own Prefixes

- The default admin distance for eBGP routes on IOS and XR is lower than for IGPs
- I.e. eBGP routes take preference to IGP routes
- Important to change this for handling multihomed customers and to limit the effects of external prefix hijacking
- Cisco Configuration:

```
router bgp 64512
 address-family ipv4
  distance bgp 200 200 200
```

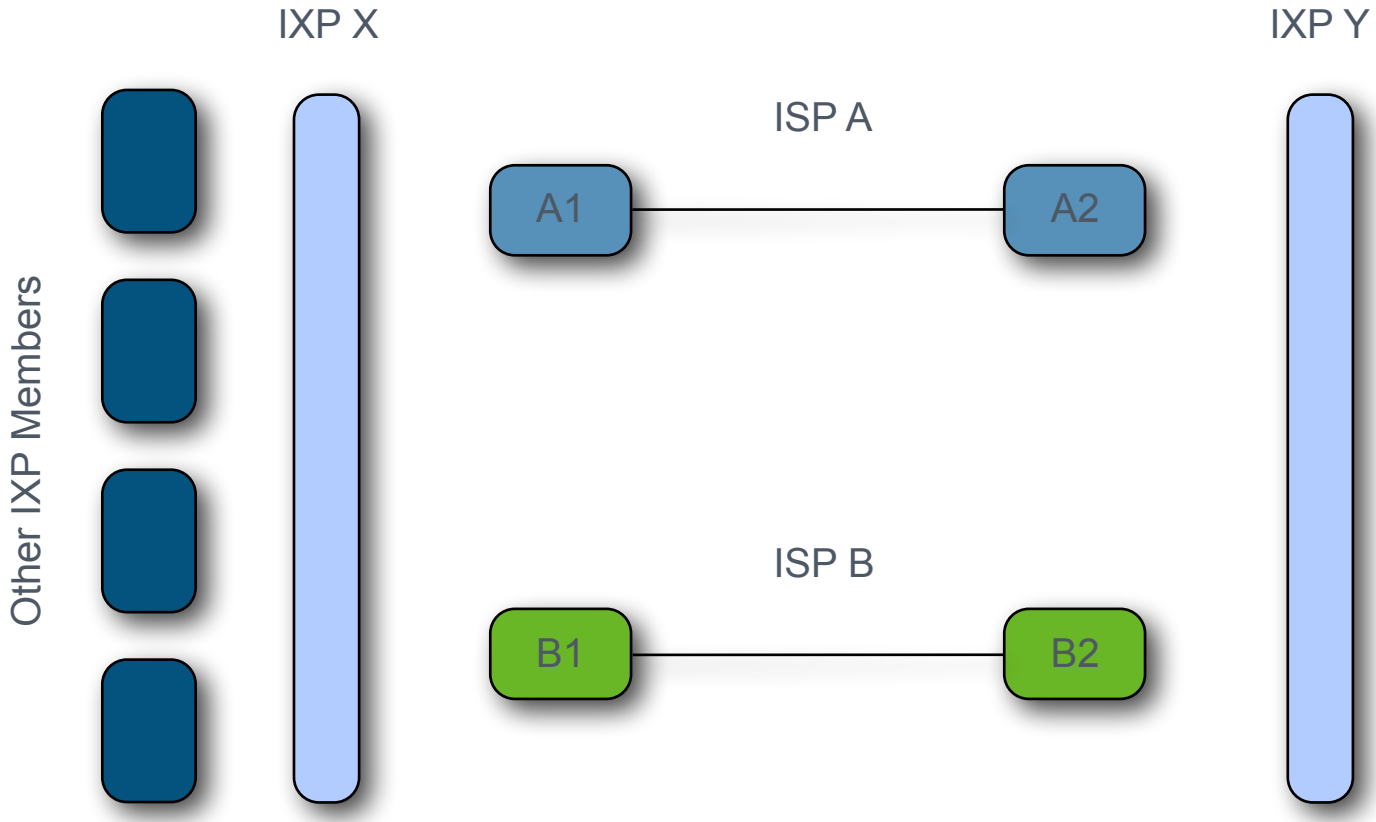
BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address

- eBGP allows you to set the BGP next-hop address to be any address on the IXP
- At an IXP, you can configure next-hop IP to be any address on IXP
- Recommend checking peer address = next hop address
- Documented in RFC 7948 “Internet Exchange BGP Route Server Operations"

BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address



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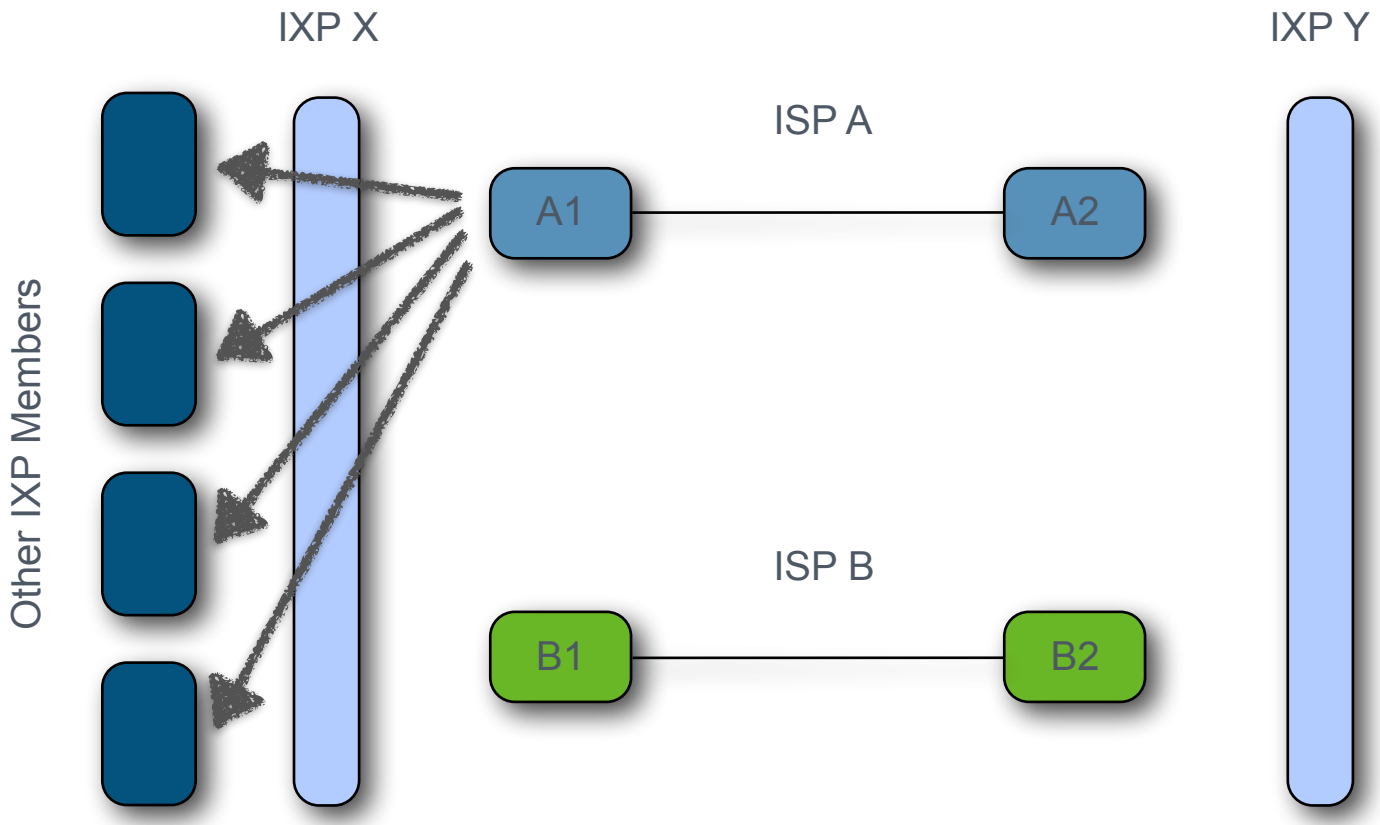
BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address



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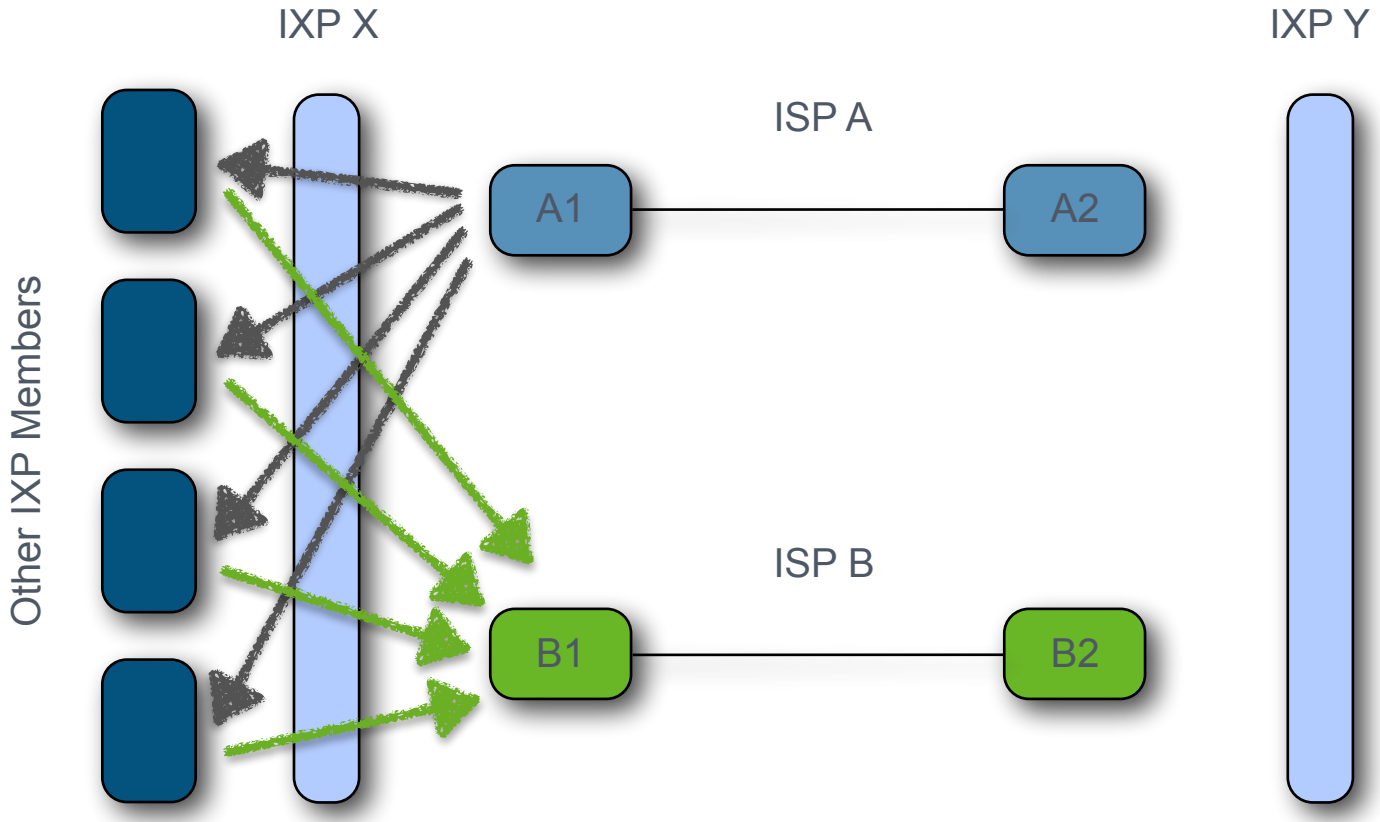
BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address



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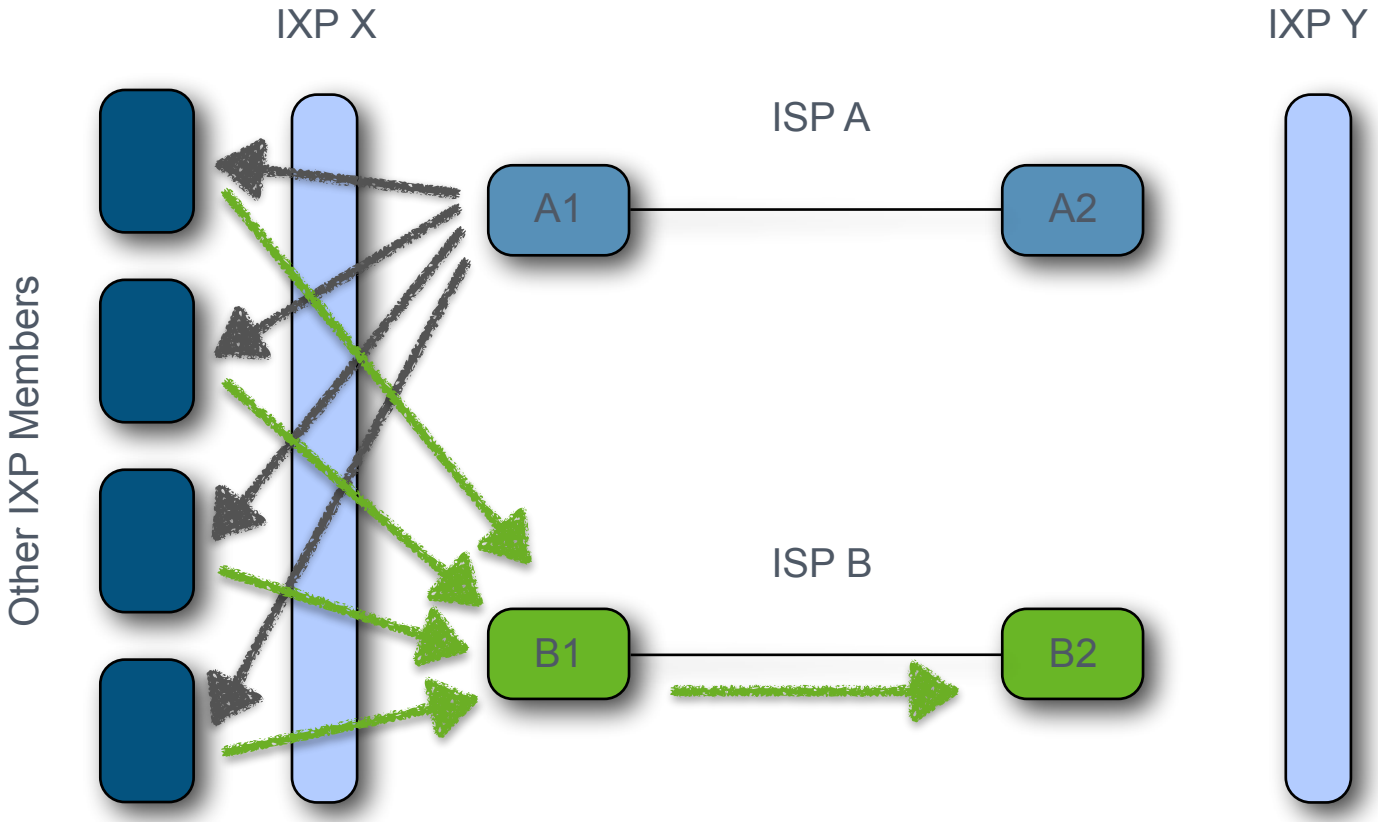
BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address



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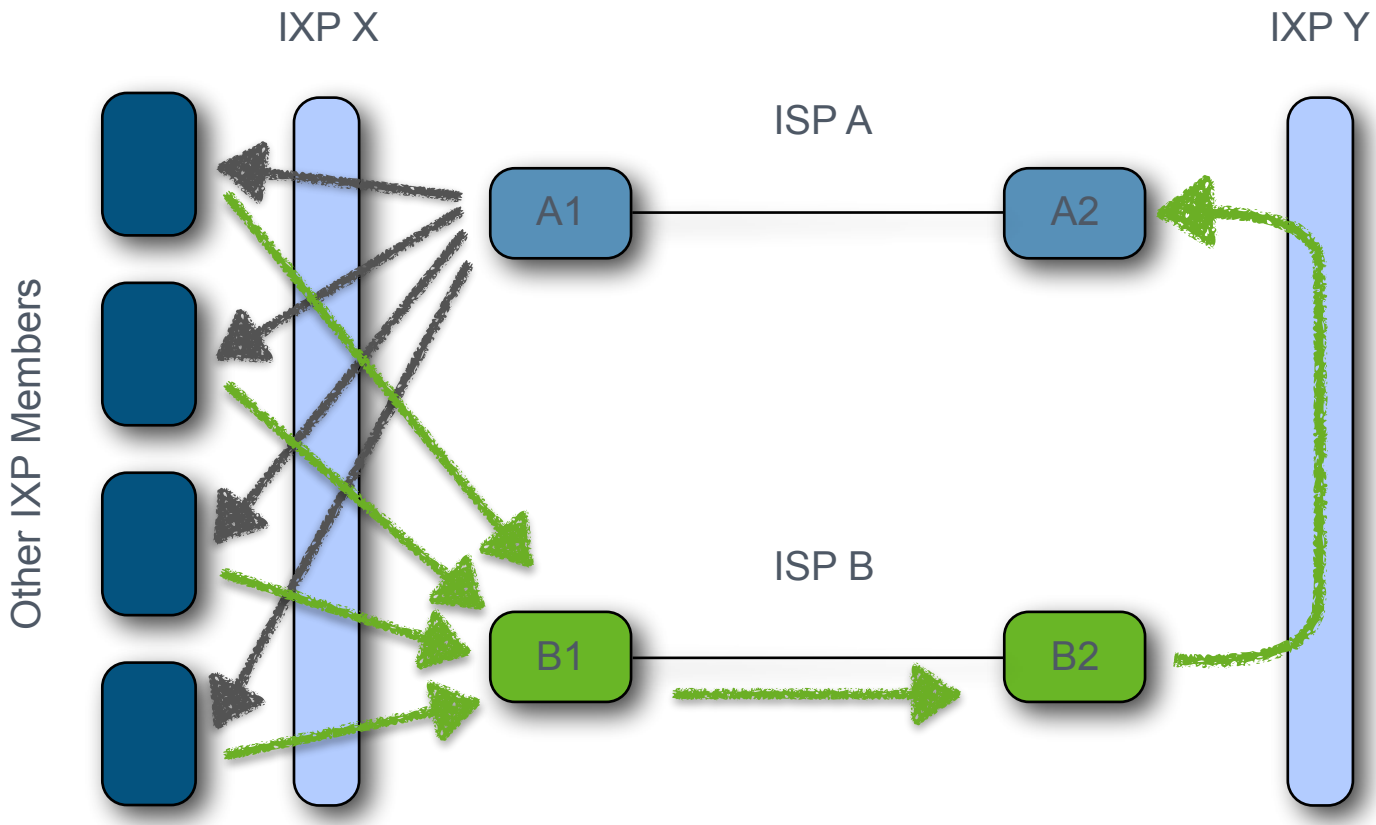
BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address



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BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address

- Cisco Configuration

```
ip prefix-list pl-nh-peer1 seq 5 permit 193.242.111.X/32

route-map ixp-peer1-in permit 10
 match ip next-hop prefix-list pl-nh-peer1
route-map ixp-peer1-in deny 20

router bgp 64512
 address-family ipv4
  neighbor 193.242.111.X route-map ixp-peer1-in in
```

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BGP Hygiene at IXPs

BGP Security - Check Next Hop IP Address

- Juniper Configuration

```
edit policy-options policy-statement import-ixp-peer1-in
set term 10-permit-nhip from next-hop X.Y.Z.W
set term 10-permit-nhip then accept
set term 99-deny then reject
top
set protocols bgp group <group> neighbor X.Y.Z.W import import-ixp-peer1-in
```

BGP Hygiene at IXPs

BGP Security - Input Validation

- Install ACLs on your IXP interface which allows only traffic destined to your own network
- Don’t use uRPF. It will break things.

BGP Hygiene at IXPs

BGP Security - IXP Prefix Redistribution

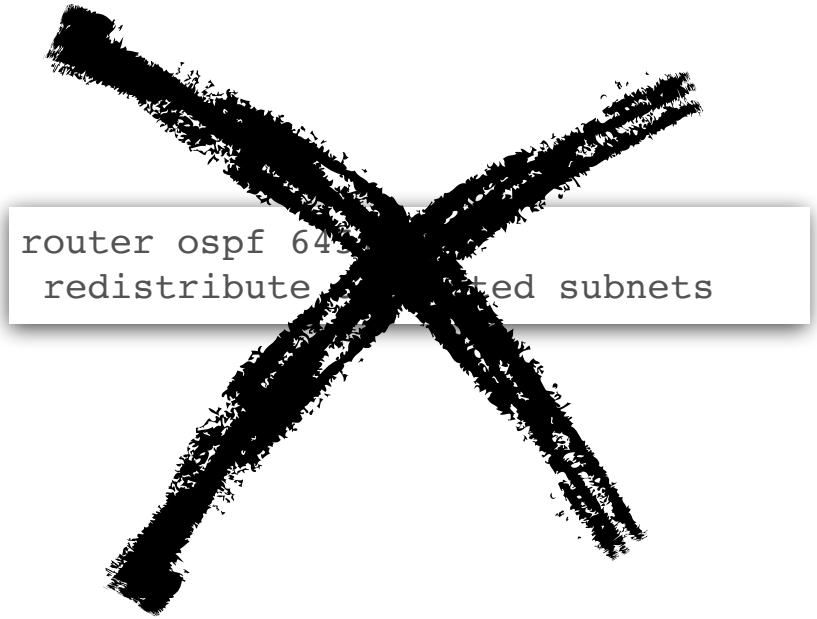
- Cisco Configuration

```
router ospf 64512
 redistribute connected subnets
```

BGP Hygiene at IXPs

BGP Security - IXP Prefix Redistribution

- Cisco Configuration



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BGP Hygiene at IXPs

BGP Security - IXP Prefix Redistribution

- IXP router interfaces are used as attack targets for DDoS
- If there's a DDoS, the IXP needs to be able to stop announcing the IXP prefix
- If you redistribute the peering LAN into your OSPF / ISIS network, the IXP operator cannot control propagation of the prefix on your network
- This can cause member links / routers to break and the IXP operator cannot fix it

BGP Hygiene at IXPs

BGP Security - IXP Prefix Redistribution

- iBGP between loopbacks only
- Set next-hop-self on iBGP peerings
- Cisco: use route-maps to stop IXP LAN from being accepted, or don’t use “redistribute connected subnets”
- Juniper: use policy-statements to reject IXP peering LAN
- Peering LAN prefixes can be announced via route servers

BGP Hygiene at IXPs

BGP Security - Summary

- Do use max prefixes where possible
- Do check next-hop = peer ip address
- Do deny own prefixes
- Do use prefix lists, communities
- Don’t use as-path list or access-lists for filtering prefixes
- Change the default Cisco BGP admin distance
- Don’t redistribute your IXP’s peering LAN addresses into OSPF / ISIS
- Don’t worry too much about MD5
- Read what other Operators have written about handling BGP

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BGP Hygiene at IXPs

BGP Security - Further Reading

- RFC 7454: “BGP Operations and Security” (BCP 194)
- RFC 7948: “Internet Exchange BGP Route Server Operations”
- http://blog.ipspace.net/
- http://www.team-cymru.org/
- Archived talks from: NANOG, RIPE, MENOG, APRICOT, UKNOF, NLNOG.

THANK YOU

Any Questions?