IXP Manager Workshop

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Ireland's Internet Neutral Exchange Point

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What is IXP Manager?

inex
internet neutral exchange

Full stack management system for IXPs

- Admin & Member Portal
- End to end provisioning system
- Teaches, implements and ensures best practice
- Fully loaded with IXP specific tools and features

Configures everything but the port. For now…

Why Build IXP Manager?

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- Human error cannot be eradicated
  - We have observed that the probability of a DFZ leak is equal between the smallest inexperienced operators and the largest experienced operatiors!
- Goal: Zero touch provisioning and configuration
- Goal: Do more with less
- Goal: Provide excellent service to our members

  (who are also our masters!)

History of IXP Manager

- Not a planned targeted development exercise
- Organic growth over ~10 years

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- Organic growth over ~10 years
- Started with a robust flexible database schema
- From which we created:
  - A simple CRUD interface
  - Provisioning scripts including: route collector, route servers, AS112, reverse DNS, RIPE objects, monitoring systems, graphing systems, etc.

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- We continued to automate manual processes and grow IXP Manager's usefulness
- Received committee approval to open source IXP Manager in 2010 – V2 made public via GPLv2
- No significant traction – FOSS requires effort!
  - Documentation, installation ease, evangelism, de-INEX-ification, out reach / time.

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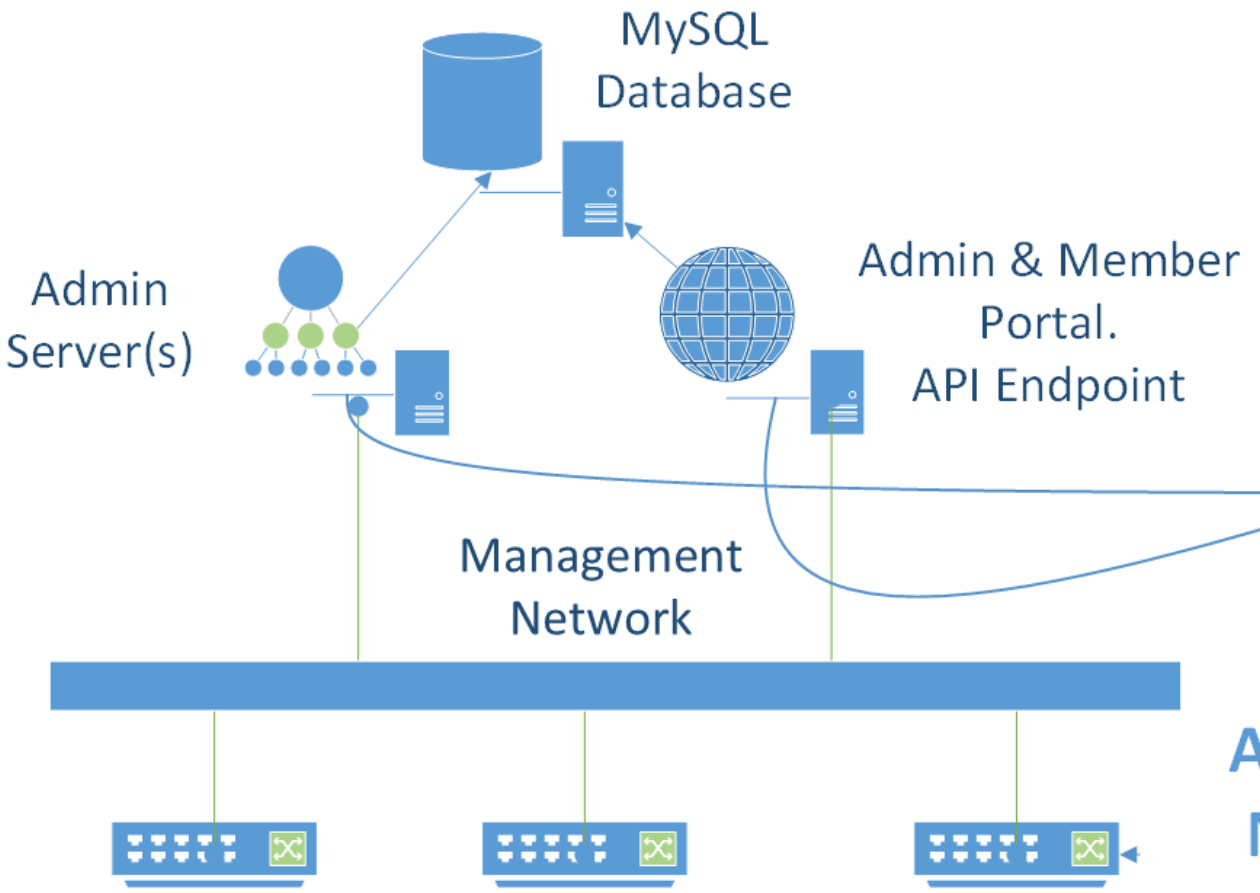
- V3 released in 2012 with renewed effort
- Excellent documentation, mailing lists, Euro-IX presentations, global collaboration with ISOC
- Now live in many IXPs including:
  - Our neighbors in LONAP (close collaboration)
  - Euro-IX members: INEX, LONAP, BCIX, …
  - Africa: Gambia, Kenya, …
  - APIX: Multiple IXPs in Australia
  - North America: Chicago, Portland, Texus, …
- Great feedback, great recognition

Components of IXP Manager



Components of IXP Manager

Route Collector(s)
Route Server(s)
AS112, MRTG, sflow
Nagios, Smokeping
TACACS+, RADIUS
DNS, RIR DB

IXP CUSTOMER ACTIONS
Customers
Interfaces
Users
Contacts
Colocated Equipment
Meetings

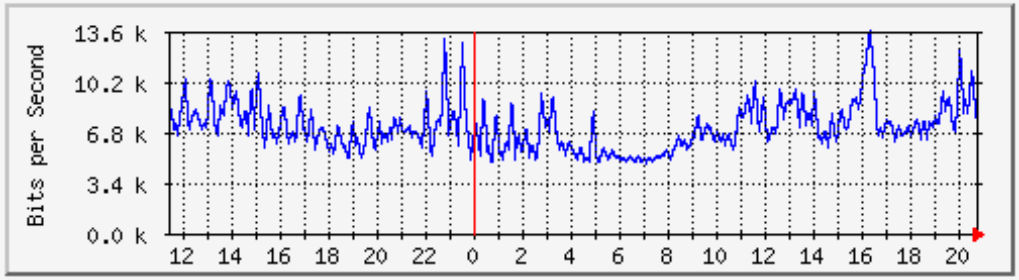
IXP ADMIN ACTIONS
Locations
Cabinets
Switches
IP Addressing
MAC Addresses
Vendors
Console Server Connections
VLANs
IRRDB Configuration
Route Server Prefixes

IXP STATISTICS
Member Statistics - Graphs
Member Statistics - List
League Table

AS112 Reverse DNS PROBONO MEMBER

Overview | Ports | Users | Contacts | Notes | RS Prefixes » | P2P »

Aggregate Traffic Statistics



Corporate Site	http://www.as112.net/	**Peering Email**
Status	Normal	**Joined**
Type	Pro-bono	**Left**
Peering Policy	open	**ASN**
PeeringDB		**AS-SET**

Admin Interface Actions

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IXP CUSTOMER ACTIONS

- Customers
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IXP STATISTICS

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Virtual Interface Details

Customer: BT Ireland

Is 802.1q Trunk?

Type: PEERING

Save Changes | Return to Customer Overview | Advanced Options

Physical Interfaces +

Location	Peering Port	Fanout Port	Speed/Duplex	
Telecity Citywest	swi1-tcy1-2::ethernet10		10000/full	
Telecity Citywest	swi1-tcy1-2::ethernet12		10000/full	

VLAN Interfaces +

VLAN Name	VLAN ID	IPv4 Address	IPv6 Address	
Peering VLAN #1	10	193.242.111.17	2001:7f8:18::2:0:1	

Sample Member Interface

INEX IXP Manager | Home | Member Information | Peering | Documentation | Statistics | Support

Overview | My Details | Ports | Prefixes » | Peering Manager » | Statistics » | Peer to Peer Traffic »

Connection 1

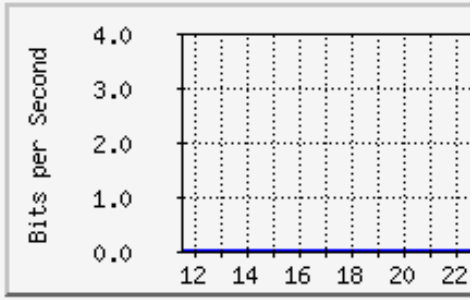
Infrastructure #1

Switch:	swi1-deg1-3.inex.ie	**Switch Port:**	GigabitEthernet44
Speed:	1000 Mbps	**Duplex:**	full
Location:	Telecity Kilcarbery	**Colo Cabinet ID:**	INEX-DEGK-1

Peering VLAN #1:

IPv6 Address:	IPv6 not enabled.	**IPv4 Address:**	193.242.111.6/25
Multicast Enabled:	No		
Route Server Client:	Yes	**AS112 Client:**	No

Day Graph for swi1-deg1



Connection 2

Member Features

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- Traffic graphs and P2P graphs
- Mailing list management
- NOC / peering / contact details update
- Peering Manager
- Peering matrices
- Other member details
- Documentation
- User management
- Route Server Prefix Analysis Tool

Peering Manager

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IXP Manager | Dashboard | Member Information | Peering | Documentation | Statistics | Support | Profile | About | Switch Back

Potential Peers | Potential Bilateral Peers | Peers | Rejected / Ignored Peers

You currently do not exchange any routes in any way with the following members of the exchange **over the highlighted - in red - protocol(s) and LAN(s)** because:

- either you, they or both of you are not route server clients; and
- you do not have a bilateral (direct) peering session that we have detected with them.

Member	ASN	Policy	LAN 1	LAN 2	
3 Ireland	21327	open	IPv4		Request Peering ☆ Notes
BT Ireland	2110	open	IPv4	IPv4	Request Peering ☆ Notes
Cable & Wireless Worldwide	1273	selective	IPv4		Request Peering ☆ Notes
Colt Technology Services	8220	selective	IPv4		Request Peering ☆ Notes
Interfusion Networks	34912	open	IPv4	IPv4	Request Peering ☆ Notes
Limelight Networks	22822	selective	IPv4		Request Peering ★ Notes

MRTG Configuration

- Measure Everything!
  - Know where you've been, where you are and where you're going.

MRTG Configuration

- **Measure Everything!**
  - **Know where you've been, where you are and where you're going.**
- We use MRTG to create all traffic graphs:
  - Individual member port graphs (bits, pkts, errs, discs)
  - Aggregate member LAG graphs
  - Aggregate member graphs
  - Aggregate switch graphs
  - Inter-switch trunk graphs (*)
  - Aggregate infrastructure graphs
  - Overall peering graphs

MRTG Configuration

- Automated configuration of MRTG configuration file compatible with IXP Manager.
- It's documented and easy!
  - https://github.com/inex/IXP-Manager/wiki/MRTG---Traffic-Graphs

- apt-get install … mrtg
- mkdir –p /home/mrtg/members
- Set a couple options in application.ini and IXP Manager

- Set a cronjob to run: ixptool.php statistics-cli.gen-mrtg-conf

Auto Provisioning

- When a interface is added to IXP Manager, you get:
  - Route Collector BGP session auto-provisioned
  - Route Server BGP session auto-provisioned
  - MRTG auto-provisioned
  - Peer to peer graphs auto-provisioned
  - Nagios monitoring of member's interface
  - Smokeping target for member's interface
  - AS112 BGP session
  - ARPA DNS for IXP assigned address
  - RIR AS-SET / ASN objects

Route Servers & IXP Manager

- Route servers are **critical IXP infrastructure**
- **Members care about the switches and the route server**
  - Everything else can break without major impact
- They must be: **secure, robust, free from operator error**
- Auto-provisioning is a requirement to meet these criteria
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- IXP Manager contains INEX's broad experience here and will ensure your route servers are configured and managed to best current practice

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  - IPv4 and v6 *martians*

```
martians = [
        ::/0,                   # Default (can be advertised as a rc
        ::/96,                  # IPv4-compatible IPv6 address <E2><
        ::/128,                 # Unspecified address
        ::1/128,                # Local host loopback address
        ::ffff:0.0.0.0/96+,     # IPv4-mapped addresses
        ::224.0.0.0/100+,       # Compatible address (IPv4 format)
        ::127.0.0.0/104+,       # Compatible address (IPv4 format)
        ::0.0.0.0/104+,         # Compatible address (IPv4 format)
```

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```
martians = [
        10.0.0.0/8+,
        169.254.0.0/16+,
        172.16.0.0/12+,
        192.0.0.0/24+,
        192.0.2.0/24+,
        192.168.0.0/16+,
        198.18.0.0/15+,
        198.51.100.0/24+,
```

Route Servers & IXP Manager

- IXP Manager route server templates include:
  - Max prefix restrictions
  - IPv4 and v6 *martians*
  - Strict inbound prefix filters
    - Via BGPQ3 from IRRDB databases
    - All database sources on RADB supported
    - Multiple source databases can be queried per member
    - Parallel (and transactional) process

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  - Strict inbound prefix filters
  - Origin ASN filters
  - Next hop hijacking prevention
  - Standard community filters supported
    - 0:peer-as — Prevent announcement to a peer
    - 43760:peer-as — Announce to a certain peer
    - 0:43760 — Prevent announcement to all peers
    - 43760:43760 — Announce to all peers

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  - Strict inbound prefix filters
  - Origin ASN filters
  - Next hop hijacking prevention
  - Standard community filters supported
  - MD5 session security supported
- Quagga and Bird currently implemented.

Trusting IXP Manager...

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- Correct and expected configuration generation is covered by unit tests on every push to the Git repository.
- Smart scripts control the deployment of new configurations.
- Deployment is offset by hours between the route servers.

Route Server Prefix Analysis Tool

Route Server Prefix Analysis

Limit to Protocol...

Advertised but Not Accepted (0) | Advertised & Accepted (25) | Not Advertised but Acceptable (12)

Help

Show 10 entries

Search: 2128

Prefix	Protocol	First Seen	Origin AS
193.242.111.0/24	IPv4	2012-05-28 01:11:25	2128
194.88.240.0/23	IPv4	2012-05-28 01:11:25	2128
2001:7f8:18::/48	IPv6	2012-05-28 01:12:12	2128

Showing 1 to 3 of 3 entries (filtered from 25 total entries)

← Previous 1 Next →

Peer to Peer Graphs

- Enable management and members to see traffic levels between each peer.
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Peer to Peer Graphs

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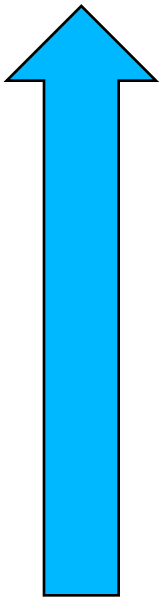
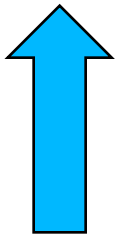
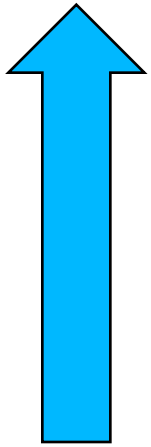
…,0013136f2fc0,0010a52f261f,0x0800,…,179,1024





Protocol
(IPv4)



Traffic = Packet Size *
Sample Rate

Source / Destination MAC
Address

Peer to Peer Graphs

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- Hugely popular with our members
- Allows us to plan inter-PoP trunks (and VPLS LSPs)
- Current implementation requires sflow (MAC addresses)
- Atomic script to dynamically learn each member's MAC
- Script to process sflow packets to RRD files

RIPE Objects

- INEX maintains the following RIPE objects:
  - AS2128 – our ASN
  - AS43760 – our route server ASN
  - AS-INEXIE – our AS macro
  - AS-SET-INEX-RS

RIPE Object – AS43760

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import: from **AS42 193.242.111.60** at **193.242.111.8**
accept AS-PCH # Packet Clearing House DNS
export: to AS42 193.242.111.60 at 193.242.111.8
announce AS-SET-INEX-RS
import: from AS42 193.242.111.60 at 193.242.111.9
accept AS-PCH # Packet Clearing House DNS
export: to AS42 193.242.111.60 at 193.242.111.9
announce AS-SET-INEX-RS
mp-import: afi ipv6.unicast
from AS42 2001:7f8:18::60 at 2001:7f8:18::8
accept AS-PCH # Packet Clearing House DNS

RIPE Object – AS-SET-INEX-RS

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members: AS-PCH
members: AS112
members: AS-HEANET
members: AS-BTIRE
members: AS-INEXIE
members: AS-NFLX
members: AS3856
members: AS-EIRCOM
members: AS-REDSTONE
members: AS-MICROSOFTEU
members: AS12388

Planning for v4

- Decoupling of front / back end
  - “Everything is an API”
- Switch from Zend / Smarty to Laravel / Twig
- Proof of concept: decoupled member interface with new features; 100% API and Ember.js
- Introduction of composer, bower, Grunt, etc.
- Job queues and event based processing:
  - On demand provisioning
  - Custom functionality per IXP

Thanks for Listening!

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operations@inex.ie

https://github.com/inex/IXP-Manager

Mailing list:

https://www.inex.ie/mailman/listinfo/ixpmanager