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Ministry of Foreign Affairs

Directorate for Development Cooperation



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Infrastructure Trust Fund

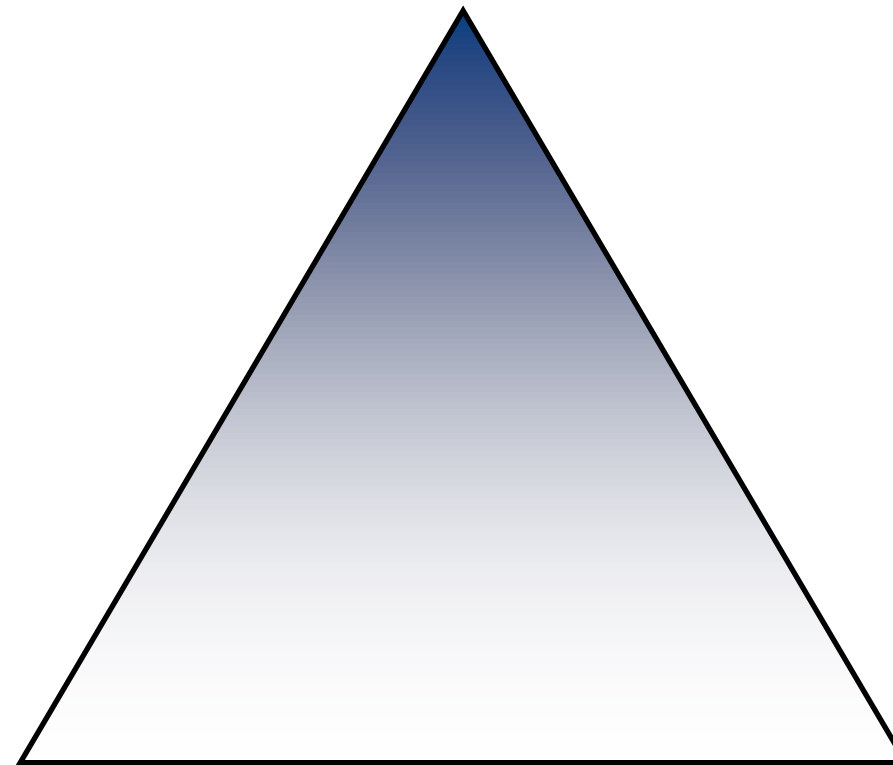
Operation and Technical Best Practice

IXP Automation and Operational Efficiency



IXP Cornerstones

Governance

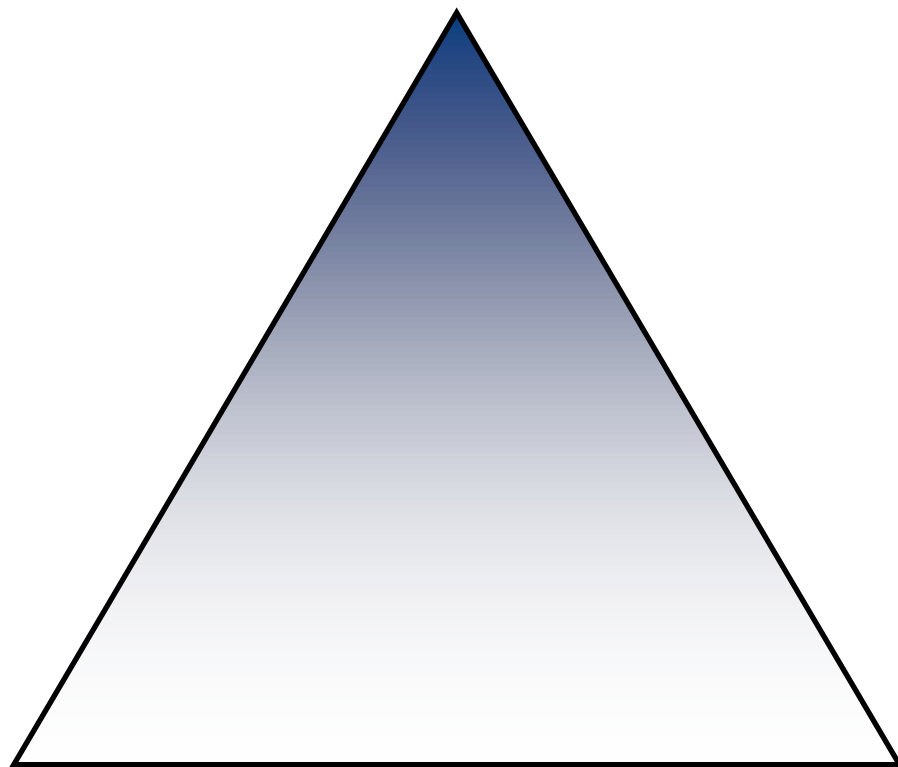


Business

Technical

Technical Management

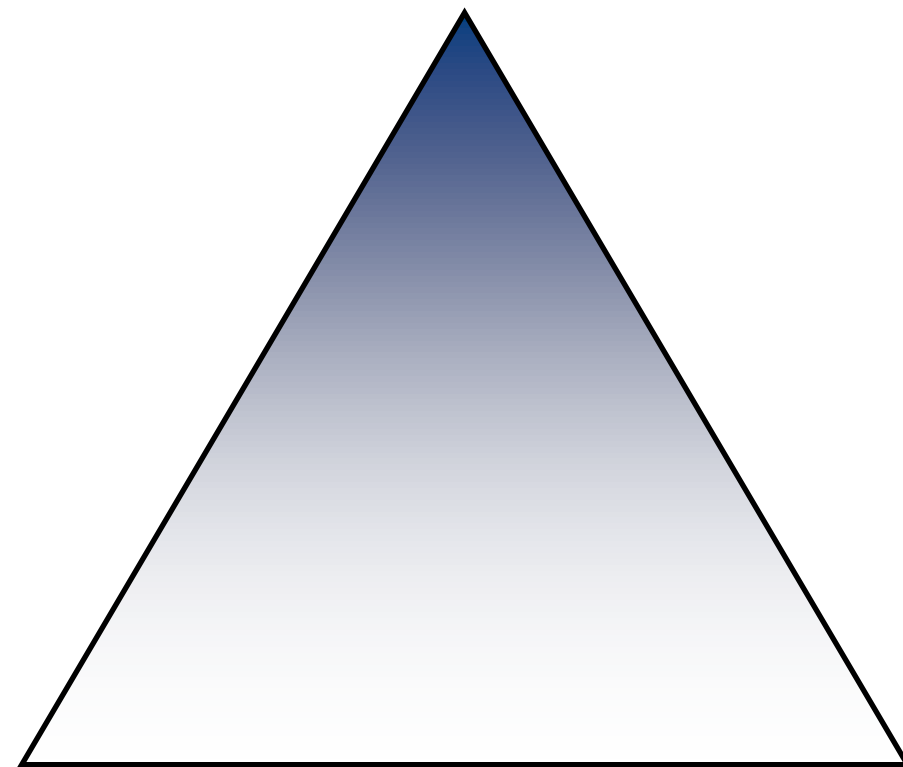
Governance



Business

Technical

Development



Initial Setup

Operations

Topic Outline

- ▶ Setting goals
- ▶ Service reliability
- ▶ Operational procedures
- ▶ Service automation and tools
- ▶ Measurements and graphs
- ▶ Customer interaction

Service Expectations

- ▶ An IXP is a single product small business
 - ▶ Amenable to high degree of automation
- ▶ Value of IXP is proportional to the number of participants
 - ▶ Customers have high expectation of reliability
- ▶ Service problems can affect multiple operators simultaneously
 - ▶ This can affect whole countries or entire geographical regions

Service Goal

- ▶ provide high reliability at low cost

Service Reliability

- ▶ IXPs are susceptible to several types of service problems
 - ▶ Traffic loops - affecting either one or two customers
 - ▶ Traffic storms - a traffic loop which affects everyone
 - ▶ Pilot error causing service loss
 - ▶ IXP participants doing creative things with BGP

Service Reliability

- ▶ IXP needs put processes in place to stop these problems
 - ▶ Traffic loops: one MAC per port (equipment / configuration)
 - ▶ Traffic storms: one MAC per port, disable STP on customer ports
 - ▶ Pilot error: use maintenance windows for service affecting work
 - ▶ IXP member BGP problems: create reliable Route Server system

Operational Procedures

- ▶ Less important for startup IXPs to have well defined procedures
- ▶ Important thing here is to come to terms with how the IXP operates
- ▶ As IXP grows, it is most important to handle things consistently
 - ▶ start off by making mistakes, finding out what works
 - ▶ create de-facto procedures and update when necessary
 - ▶ when large, can become important to write these down

Operational Procedures

- ▶ Documentation
 - ▶ Cross-connects, IP addresses, DNS, port assignments
- ▶ Contact details with providers - CRM Software
 - ▶ Equipment vendors: technical support issues
 - ▶ Hosting facility: cross-connects, remote hands
- ▶ Regularly used procedures

Operational Procedures

- ▶ New customer connection
 - ▶ Service application - needs a written / web form
 - ▶ Test links to customers to make sure they work properly
 - ▶ Ensure customer isn't breaking the one-mac-per-port rule
 - ▶ Route collector to allow sanitation of BGP announcements
 - ▶ Co-ordinated go-live with customer

Operational Procedures

- ▶ Good quality documentation is important
- ▶ Wikis make this easy
- ▶ Document only what needs to be documented
- ▶ Out-of-date information is often worse than no information
- ▶ Use a wiki which is easy to read in case of emergency
- ▶ Dokuwiki uses text files - little to go wrong

Operational Procedures

- ▶ Customer removal
 - ▶ important to have procedure for this, esp. if due to unpaid bills
- ▶ Interaction with other IXP functions
 - ▶ Sales + marketing: IXPs don't sell themselves
 - ▶ Billing + finance: finance needs accurate information about customers and about purchasing requirement

Service Automation

- ▶ Running a startup IXP with few members is easy
 - ▶ Overhead of running tools is greater than manual management
- ▶ This changes rapidly as the IXP grows
- ▶ Important to install automation tools sooner rather than later
- ▶ Requirement for a combination of IXP specific and general tools

IXP Specific Tools

- ▶ Currently only one open source IXP management tool: “IXP Manager” written by INEX.
- ▶ GPL license, Linux / Apache / Mysql / PHP.
- ▶ Several IXPs have written in-house code, not open sourced
- ▶ More tools may appear in future

IXP Manager Overview

- ▶ Web-enabled front-end with SQL database back-end
- ▶ Designed specifically to manage IXPs
 - ▶ Actively developed
 - ▶ In use at several IXPs world-wide
- ▶ Provides customer database, IPAM, customer logins, stats, graphs, integration with third party software, route server configuration, peering manager, peering matrix, back-end toolkit, etc.

IXP CUSTOMER ACTIONS

[Customers](#)[Interfaces](#)[Users](#)[Contacts](#)[Colocated Equipment](#)[Meetings](#)

IXP ADMIN ACTIONS

[Infrastructures](#)[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](#)

IXP UTILITIES

[PHP Info](#)[APC Info](#)[Last Logins](#)[Home](#)

Customer Type	Count
Full	63
Associate	15
Internal	2
Pro-bono	4

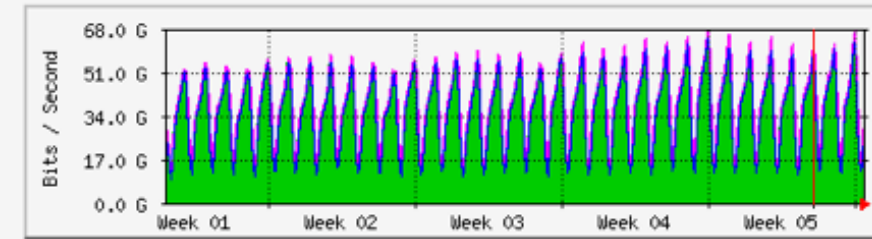
Customer Ports by Location

Location	100	1000	10000	Total
Telecity Kilcarbery	21	20	12	53
Telecity Citywest	11	16	10	37
Interxion DUB1	4	7	6	17
Interxion DUB2	1	0	0	1
Vodafone Willsborough	0	1	0	1
Totals	37	44	28	109

Customer Ports by Infrastructure

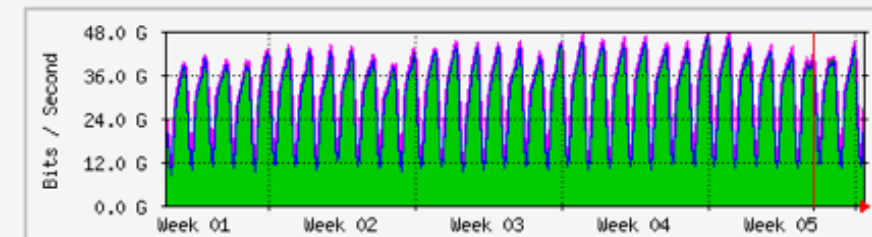
Infrastructure	100	1000	10000	Total
Infrastructure #1	22	34	19	75
Infrastructure #2	15	10	9	34
Totals	37	44	28	109

IXP Aggregate Graph



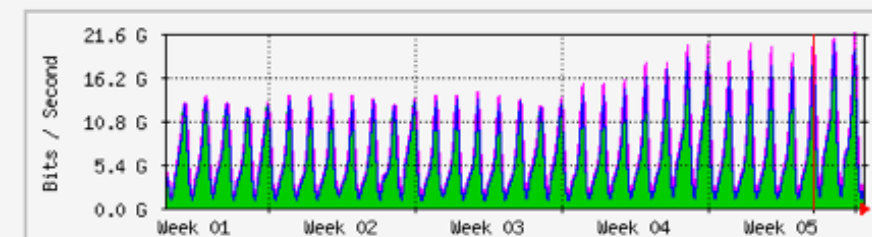
	Max	Average	Current
In	67.046 Gbits	35.164 Gbits	40.411 Gbits
Out	66.822 Gbits	35.215 Gbits	40.504 Gbits

Infrastructure #1



	Max	Average	Current
In	47.598 Gbits	29.298 Gbits	35.829 Gbits
Out	47.235 Gbits	29.274 Gbits	35.819 Gbits

Infrastructure #2



	Max	Average	Current
In	21.568 Gbits	5.866 Gbits	4.582 Gbits
Out	21.596 Gbits	5.941 Gbits	4.686 Gbits

Connection 1

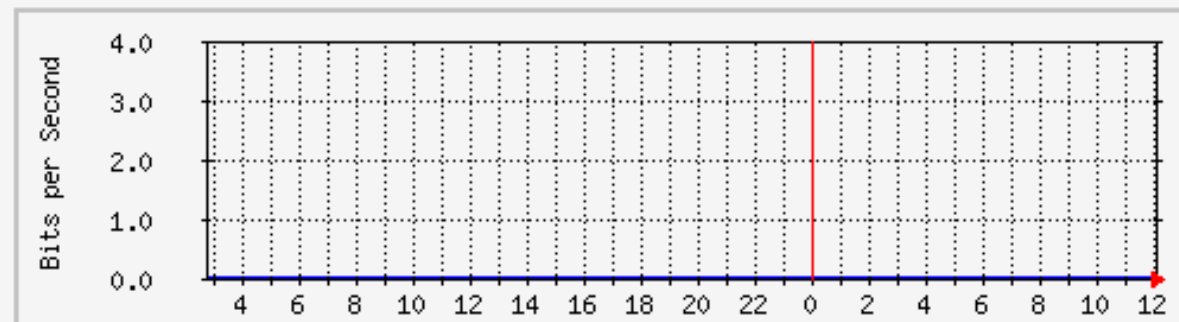
Infrastructure #1

Switch:	swi1-deg1-3	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-deg1-3 / GigabitEthernet44



Connection 2

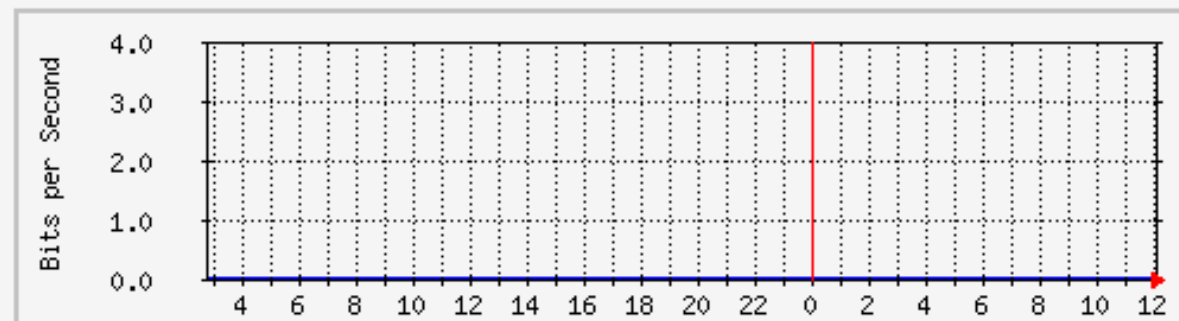
Infrastructure #2

Switch:	swi2-deg1-3	Switch Port:	GigabitEthernet17
Speed:	1000 Mbps	Duplex:	full
Location:	Telecity Kilcarbery	Colo Cabinet ID:	INEX-DEGK-2

Peering VLAN #2:

IPv6 Address:	IPv6 not enabled.	IPv4 Address:	194.88.240.6/25
Multicast Enabled:	No		
Route Server Client:	Yes	AS112 Client:	No

Day Graph for swi2-deg1-3 / GigabitEthernet17



IXP Manager Overview

- ▶ A useful tool, particularly when an IXP grows
- ▶ Takes time and patience to install and customise
- ▶ Does not remove requirement understand IXP technical operations
- ▶ Not feasible to run a large / fast growing IXP without a tool like this
- ▶ Many IXPs choose to write their own tools

Other Tools

- ▶ Good quality service visibility is necessary
 - ▶ Ping / service checks are necessary where possible
 - ▶ Log file analysis / SNMP traps necessary for L2 port link up/down
- ▶ Generic networking packages are suitable for this
 - ▶ Nagios / Icinga, Zenoss, Zabbix, OpenNMS, Munin for monitoring
 - ▶ Netdot, Racktables for device, network, facility documentation

Measurements and Graphs

- ▶ Service quality history can be maintained by graphing data
 - ▶ All ports need bandwidth, packets in/out, discards, errors
 - ▶ Smokeping is invaluable for IXP member connections
- ▶ Network devices also need monitoring
 - ▶ CPU, memory, temperature, fan speed, etc
- ▶ Deviations from any baseline data often indicates a problem

Measurements and Graphs

- ▶ IXP Customers often experience packet loss
 - ▶ Occasionally the IXP is blamed
 - ▶ Good data is invaluable for helping to identify a root cause
- ▶ IXP Management will need certain statistics reported
 - ▶ Aggregate traffic growth, port count, port speed breakdown, BGP prefixes (IPv4 / IPv6), other metrics.

Customer Interaction

- ▶ Customer Support issues
 - ▶ Support mailbox - manual or ticketing system
 - ▶ Phone / Skype / IM / IRC support
 - ▶ Audit trail is important
 - ▶ Critical when more than one person attends the help-desk
- ▶ Make it a pleasure for your customers to deal with you

Customer Interaction

- ▶ Ticketing systems
 - ▶ Usually important when IXP is small
 - ▶ Indispensable when IXP grows
 - ▶ Lots of OSS systems available
 - ▶ RT, OTRS, Flyspray, Redmine
 - ▶ Some paid-software available free for charities: Cerberus, Kayako

Acknowledgement and Attribution

- ▶ This presentation contains content and information originally developed and maintained by the following organisation(s) /individual(s) and provided for the African Union AXIS Project:

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END

