IXP Manager

Sponsors' Report

For Year End 2018

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Revision 1.0, December 2018

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Executive Summary

IXP Manager has now completed the second year of its sponsorship program[1]. You can read the summary of our year one results from last year's report via the link in the footer[2]. We are delighted to report that all of our original sponsors from year one stayed with us for year 2.

The 2018 sponsorship funding was made up of:

Name	Value
Netflix (US$20,000)	€16,655
Internet Society (US$7,500 + US$12,000)	€16,564
SwissIX	€15,000
Facebook (€30,000 over three years plus €10,000 more towards travel)	€10,000
STHIX (€1,000 for year 1, €5,000 for year 2)	€6,000
APNIC	€5,000
NIX (University of Oslo)	€2,000
GRIX (was entered as GRNET previously)	€2,000
INTERLAN	€1,000
Total	**€74,219**

The *Call for Sponsorship* document outlined how we would structure the program, the budget required, project oversight, project management and development plans.

This document, the 2018 Sponsor's Report, provides a detailed list of activities undertaken in the last year, and shows full compliance with the program's objectives.

To summarise, we have met the following milestones in the last year:

- Known numbers of IXPs using IXP Manager has grown from 45 to 67 installations. We feel that this is the best possible positive indicator from your sponsorship and we are incredibly proud of this growth[3].
- A full-time developer was hired in December 2016 and remains with the project.

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[1] https://www.ixpmanager.org/sponsorship

[2] https://www.ixpmanager.org/media/2017/2017-10-SponsorsReport-Public.pdf

[3] https://www.ixpmanager.org/users

- Official releases of versions v4.7, v4.8 and v4.9 (including bugfix releases of these).
- Maintenance of the project website: https://www.ixpmanager.org/.
- Continued additions to the official documentation: http://docs.ixpmanager.org/.
- Completion of the migration of code from the end of life Zend Framework to Laravel.
- Continued outreach through presentations, workshops and mailing lists.

The year-end 2018 financial position of the IXP Manager project fund is:

2018 Opening Balance	**€ 626.47**
2018 Sponsorship Income	**€ 74,219.40**
2018 Expenditure	**€ (60,773.55)**
2018 Closing Balance	**€ 14,072.32**

Sponsorship Expenditure

The intellectual property rights and copyright to IXP Manager are owned by INEX (Internet Neutral Exchange Association Company Limited by Guarantee), a not-for-profit industry-owned company registered in Dublin, Ireland. INEX owns and operates Internet Exchanges in Dublin and Cork.

As we detailed in the call for sponsorship document, project development for IXP Manager is handled by Island Bridge Networks Limited, a company registered in Dublin, Ireland. The directors and sole owners of this company are Barry O'Donovan, the IXP Manager lead developer / project manager and Nick Hilliard, INEX's CTO. Both Barry and Nick separately contract to INEX in operational roles.

Development of IXP Manager is handled on a not-for-profit basis by Island Bridge Networks Ltd. All rights to the IXP Manager code developed under this sponsorship arrangement are transferred by Island Bridge Networks Ltd to INEX.

This arrangement is structured in this way because INEX is an Internet Exchange Association and has no in-house software development expertise. Due to its constitutional neutrality and not-for-profit corporate structure, it is an appropriate organisation for holding the intellectual property and copyright ownership of this open source project.

Under the sponsorship arrangement as originally proposed - Island Bridge Networks Ltd:

- Recruited and hired a suitable PHP developer.
- Provides office space and a suitable working environment for the developer.
- Handles all employee arrangements including: contracts, pay, tax, insurance, other financial, tax and legal obligations, annual leave, etc.
- Maintains a dedicated bank account for all financial matters relating to this project.
- Invoices all supporting organisations on a pre-agreed basis.
- Reports on the project at Euro-IX Forums in whatever format the Euro-IX Forum Program Committee deems to be appropriate.

The year two summary expenditure is as follows:

	Budgeted	Y/E 2018
Developer Costs	€55,375	€54,908
Hardware (budget = €3,600 less 2017 spend):	€905	€380
Software Licences	€500	€137
Travel (2 x Euro-IX)	€1,200	€0
Rent (plus supplies and sundries)	€3,600	€4,590
Insurance	€150	€0
Cloud services (Teamwork, Zendesk)	€400	€0
Home Broadband	€0	€758
Total	**€62,130**	**€59,894**

Some notes on the table above:

- The budgeted costs figure reflects the original call for sponsorship numbers which included a year 2 and year 3 estimate.
- There was a hardware underspend in year one because the developer was using a spare office monitor. It was necessary to draw down the budgeted amount from the sponsorship funds in 2018 to replace this.
- We did not travel on IXP Manager's budget this year but it is intended that we will use it in 2019.
- We were able to defray cloud service costs as Island Bridge Networks had a spare Dropbox license and we were able to get by without adding the developer to our Zendesk account. If circumstances change, this expenditure may be necessary in future.
- Island Bridge Networks offers all employees home broadband. This was accidentally omitted from the original budget.
- Island Bridge Networks had to take additional office space to accommodate our growing staff during 2018. Rent is costed to the project as 1/n of IBN's rent bill where n is the number of employees.
- Not charging 1/n of the employee liability insurance was an omission. IBN has also not charged other incurred expenses such as staff parties, entertainment, etc. to date.

Income versus Expenditure

Through the generosity of our sponsors, we have raised a total of €74,219.40 in our second year of sponsorship. In 2016, our year 2 estimated costs (when we exclude capital expenditure and other one-off costs), was €61,000. This has come in under budget at €59,894.

The excess of sponsorship income over expenditure (~€15,000) will be used to:

- Offset any sponsorship shortfalls for 2019
- Extend the project lifetime into a fourth year
- Travel costs to deliver workshops and presentations and create increased project visibility (and thus sponsorship payback)

Year Two Achievements - Planned

What follows is a review of the specific year two goals we announced in last year's summary.

Completion of Migration to Laravel Framework

At the start of 2018, IXP Manager v4 still had a substantial dependency on a PHP framework called Zend Framework v1, which was declared end-of-life in 2016. In 2016, an architectural decision was made to migrate the application to the Laravel framework in order to ensure IXP Manager's long-term development viability.

We're delighted to note that the v4.9.0 milestone release of IXP Manager represents the completion of the approximately 2-year project to remove the end-of-life and end-of-support Zend Framework v1 in its entirety. Additionally, we have already branched IXP Manager version 5 as planned where all new feature development is targeted.

It should be noted that we concentrated heavily on completing this project during the second half of 2018, at the expense of other feature development plans that had been scheduled for this period. This decision was made because the continuing presence of Zend Framework was actively hindering feature development on the project and the long-term project goals could not be realised until the framework migration was completed. This is a significant milestone which could not have been achieved without the generous support of IXP Manager's sponsors.

The official announcement is on the INEX web site: https://www.inex.ie/uncategorised/ixp-manager-v4-9/

We have also announced this release on IXP Manager's Twitter and Facebook social media accounts.

End User Facing Portal

While IXP Manager has gained a large amount of IXP operator functionality, the end-user / end-network areas have remained relatively unchanged in several years.

During the process of migrating the code-base to Laravel, we completed some UI and UX improvements, rather than attempting a complete redesign. We feel that this would be better left to IXP Manager v5.

Authentication Redesign

The migration of the authentication system to Laravel is complete (including session management, API authentication, password resets, etc.). Our 2019-Q1 plans include OAuth authentication against PeeringDB.

Route Server Prefix Analysis Tool

The route server prefix analysis tool is an invaluable service which helps members to identify prefixes which are blocked by the strict prefix filtering mechanism of the route servers.

We had plans to introduce large BGP community tagging on the route servers to improve this but also pushed this to 2019 so as to complete the Laravel migration. 2019 is a better fit as we plan to do a number of route server improvements including RPKI support (see below).

Advanced P2P Functionality

IXP Manager's peer to peer graphing feature is one of its most popular end-user features. We would like to advance this functionality to use a time-series database backend and present more useful, real-time information to our members.

While some of the planned features of this are ongoing, we have completely rewritten and redesigned the UI around view-port and peer-to-peer graphs.

Installation and Upgrade Ease

We continued work on simplifying the installation and upgrade procedure through the use of Vagrant for setting up fully functional development boxes with just three commands, and a fully automated installation script to install IXP Manager on a bare bones Ubuntu distribution.

We have also added Docker support for both development and workshop / lab / demonstration use:

- https://docs.ixpmanager.org/dev/docker/
- https://github.com/inex/ixp-manager-docker

Year Two Achievements – In Addition to Original Plans

The following are additional improvements in IXP Manager and the IXP Manager ecosystem that were not part of our original 2018 plans.

Graphing

We have added a large number of features and reworked the UI of Grapher, IXP Manager's graphing backend. These include:

- Integrate latency (Smokeping) graphs
- Completely reworded the UI layout for displayed and navigating graphs
- Added new permission options including the ability to make all graphs public
- Complete test suite coverage on web and API access to graphs under all permission settings

PeeringDB

We plan to integrate with PeeringDB's API wherever it makes sense. As a first step, you can now prefill a new customer's details from PeeringDB by just entering their AS number.

Docker

As the IXP Manager ecosystem grows, it becomes harder to maintain ubiquitous development environments for coding, testing and demonstrating IXP Manager.

Especially for emulating switches, route servers, graphing and tools such as Bird's Eye. Docker is ideally suited to solving these issues as well as providing the perfect environment for IXP Manager workshops.

To that end, we have creating two Docker systems.

The first is ideally suited for demonstrations, 'just playing' with IXP Manager and workshops:

https://github.com/inex/ixp-manager-docker

The second is specifically targeted at IXP Manager developers:

http://docs.ixpmanager.org/dev/docker/

Customer Tags

IXP Manager has always supported *customer types* for: *Full, Pro-bono, Internal, Associate*.

We appreciate these are not sufficient to suit all use cases and from requests from users, we have added custom tags which allows administrators to tag customers to indicate specific properties that are not built into IXP Manager by default. Some examples might include:

- commercial vs membership based relationship;
- special billing relationship (e.g. customer originally connected via 100Mb port which has been discontinued; customer now on 1Gb port but not paying until traffic exceeds 100Mb);

Documentation for tags can be found here: https://docs.ixpmanager.org/usage/customer-tags/

Automation

IXP Manager now fully supports provisioning for Arista EOS and Cumulus Linux based devices. Both of these are in production at INEX. We have also published our provisioning templates at:

https://github.com/inex/ixp-manager-provisioning

The notes there give an overview and useful links to using these.

User Interface Testing

As an end user, how do you know that what you stick in a web-based form gets put into the database correctly? And conversely, how do you know that form represents the database data correctly when editing?

This is an issue we ran into during 2018 around some checkbox logic and a dropdown showing the wrong selected element. These issues are every bit as dangerous to mission critical elements as the output tests we do with PHPUnit.

We now use Laravel Dusk to test mission critical elements on the frontend UI - read all about the details on our blog post[4] including an animation of it in action.

Like the PHPUnit tests, the Laravel Dusk tests are performed via [Travis CI](#) every time we push to GitHub.

This is a huge step forward in testing and reliability of IXP Manager. Current Dusk tests cover mission critical elements such as router configuration, member interface management and switch management.

General / Smaller Features

- Implemented the IX-F Member Export Schema v0.7.
  - https://docs.ixpmanager.org/features/ixf-export/

- Add ability to allow customers to add/delete their configured MAC addresses.
  - http://docs.ixpmanager.org/features/layer2-addresses/#end-user-access

- Route Server Configuration Updates:
  - extended BGP NEXT_HOP hijacking detection and prevention to v6
  - optionally allow more specifics in route server inbound prefix filtering
  - make the size of the smallest network accepted configurable

- Various improvements to customer notes.
  - https://docs.ixpmanager.org/usage/customer-notes/
- Complete rewrite of the peering matrix and peering manager code:
  - https://docs.ixpmanager.org/features/peering-matrix/
  - https://docs.ixpmanager.org/features/peering-manager/

- Adding switches has been made much easier as OSS_SNMP, a third-party library we use to identify switches and switch models, no longer needs to support the switch being added. Previously this was a blocking error.

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[4] https://www.barryodonovan.com/2018/07/03/ui-tests-with-laravel-dusk-for-ixp-manager

Publicity

IXP Manager presentations have featured at the following conference presentations between January and December 2018:

- IXP Manager Workshop, APRICOT 2018 / APIX
  Kathmandu, Nepal, February 25th 2018

- "IXP Manager Update & Route Server Configuration", 32nd Euro-IX Forum
  Galway, Ireland, April 2018

- IXP Manager Workshop, LACNIC29
  Panama City, Panama, May 2018

- "Migrating Legacy PHP Applications to Laravel", Laravel Live UK
  London, England, June 2018

- "RPKI at Route Servers", RIPE77
  Amsterdam, Netherlands, October 2018

- "RPKI, Route Servers and IXP Manager", 33rd Euro-IX Forum
  Venice, Italy, November 2018

- Operations Update, INEX Members
  Dublin, Ireland, December 2018

One of most significant developments in 2018 was the number of third-party people taking a lead role in promoting IXP Manager or mentioning IXP Manager in their presentations. For example, the workshop in Panama City at LACNIC29 above was delivered by Kyle Spencer of UIXP (Uganda's IXP) using materials and virtual servers provided by INEX / the IXP Manager project.

At the 33rd Euro-IX Forum in Venice, Italy, Florian Hibler of Arista Networks presented a proof of concept "IXP in a Box" which heavily featured IXP Manager. LONAP, long term supporters of IXP Manager, presented a detailed update on the platform to their members at their Christmas meeting in December.

We have taken a strategic decision to release all IXP Manager presentations under the Creative Commons Attribution-ShareAlike 4.0 License, which will enable other organisations to use the content and evangelise on the project.

Development Goals – Year Three

As well as continuing work on completing all remaining action points from year two, the following sets out what we aim to achieve in year three:

Release IXP Manager v5

IXP Manager v5 will mark the next stage of IXP Manager's platform development following the removal of Zend Framework. This includes:

- Upgrade Laravel from v5.5 to v5.7. We were blocked from doing this, to date, as we wished to keep IXP Manager v4 compatible with PHP 7.0.
- Increase PHP version requirement from 7.0 to 7.2: a number of developer-oriented improvements exist in 7.2 including nullable return types which creates better typed code.
- Upgrade the frontend UI library from Bootstrap v3 to v4.
- Frontend UI library management is currently done via a tool called Bower. This has a number of issues and has been deprecated. We will switch to Yarn, the recommended replacement.
- IXP Manager v4 targets Ubuntu 16.04 LTS. IXP Manager v5 will target Ubuntu 18.04 LTS. While both run on other platforms, these will be the recommended and supported platforms. Automated installation scripts will be upgraded for this also.

Authentication Redesign

Continuing our work in 2018, we intend to:

- Allow end users to be associated to more than one network (many engineers are contractors, and work for more than one network).
- Build an OAuth service to work with PeeringDB.
- Add two-factor authentication.

RPKI

We will add RPKI functionality to IXP Manager's route server configuration generation. The general plan is:

- Work with existing IRRDB validation (AS-Cone support and widespread RPKI adoption required to remove IRRDB).
- RPKI-RTR support using Routinator and RIPE's tool.
- Looking glass support.

Add Support for Additional BGP Daemon(s)

Currently IXP Manager only supports Bird as a route server. We will add support for OpenBGPD with feature parity to Bird. We will also investigate support for GoBGP.

Route Server Prefix Analysis Tool

The route server prefix analysis tool is an invaluable service which helps members to identify prefixes which are blocked by the strict prefix filtering mechanism of the route servers.

Currently this takes a view from a single route server via a script that runs a couple of times a day. We want to introduce large BGP community tagging on the route servers to:

- provide a view of all route servers on all LANs;
- highlight why prefixes are filtered (RFC1918, no route object, IPv4 prefix < /24, IPv6 prefix < /48, etc);
- integrate this functionality into the Birds Eye looking glass rather than a standalone tool.
- Add RPKI support.

Advanced P2P Functionality

IXP Manager's peer to peer graphing feature is one of its most popular end-user features. We would like to advance this functionality to use a time-series database backend and present more useful, real-time information to our members.

This includes tasks and features such as:

- Selection of an appropriate time series database from candidates which include Carbon (of Graphite), InfluxDB and OpenTSDB. The initial goal will be to support the scale requirements of a medium-sized IXP, and the mechanism will be programmed to be able to easily support other backends. The existing RRD based backend will be maintained.
- Addition of functionality to provide more structured data rather than just unordered peer to peer graphs: top ten peers, combined graphs, unusual traffic, etc.
- Attempt to automate the selection of sample rates for ports with low traffic rates to more accurately represent their traffic.
- Use of peer to peer information to calculate and graph overall peering traffic rather than just rely on port statistics.

This action item is carried over from the previous goals.

Development Outlook

Outside of the immediate year three goals mentioned above, we have plans that we would like to achieve over a longer timeline, which include:

- Completion of Helpdesk integration.
- Intelligent stream-lined provisioning of new ports and upgrades. This is less about automation and more about the end-user request and fulfilment experience.
- Continue to work on collateral such as recorded tutorial videos, in-person workshops, continuation and improvement of IXP Manager documentation.
- Develop on-demand provisioning via queuing mechanisms. This means, for example, rather than having to wait for a batch job to run at designated times to have new route server sessions provisioned, they can be provisioned on demand.
- Further development *My Peering Manager* to include route server session management, for example allowing members to opt in / out of peering with certain other members on the route servers without having to rely on community tagging.
- Embark on projects such as more intelligent monitoring of customer peering sessions via services such as RIPE Atlas.
- Customer audit – automated review of a customer's services and highlight issues such as port errors; inactive BGP sessions with route collector / route server / AS112, etc.; ports spiking at high utilisation rates; missing sessions with peers with open policies, etc.
- Internationalisation and localisation of the customer facing areas. While English may be the predominant language in the networking industry, end users of IXP Manager should be able to interact in their own language.