



IXP Manager

Sponsors' Report

For Year End 2019

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island bridge
networks

Platinum Sponsors



Gold Sponsors



Silver Sponsors



Bronze Sponsors



Executive Summary

IXP Manager has now completed the third year of its sponsorship program¹. You can read the summary of the first²- and second³-year via the links in the footer. We are delighted to report that all of our original sponsors from year one stayed with us for years two and three and we also added some along the way.

The 2019 sponsorship funding was made up of:

Name	Value
Netflix (US\$20,000)	€17,469
Internet Society (US\$9,000) (due, estimated euro value)	€8,184
SwissIX	€15,000
Facebook (€30,000 over three years plus €10,000 more towards travel)	€10,000
STHIX (asked to be invoiced in 2020)	€0
APNIC	€5,000
INX	€5,000
NIX (University of Oslo)	€2,000
GRIX (was entered as GRNET previously)	€2,000
INTERLAN	€1,000
NAMEX	€2,000
Total	€67,652

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 2019 Sponsors' 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 2019:

¹ <https://www.ixpmanager.org/sponsorship>

² <https://www.ixpmanager.org/media/2017/2017-10-SponsorsReport-Public.pdf>

³ <https://www.ixpmanager.org/media/2018/2018-12-SponsorsReport.pdf>

- Known numbers of IXPs using IXP Manager has grown from 67 to 81 installations. Over the three years of the sponsorship program, there has been nearly a four-fold increase. We feel that this is the best possible positive indicator from your sponsorship and we are incredibly proud of this growth⁴.
- A full-time developer was hired in December 2016 and remains with the project.
- Official releases of versions v5.0, v5.1 and v5.2 (including bugfix and security releases of these). We expect to release v5.3 before the end of 2019 or early 2020.
- Maintenance of the project website: <https://www.ixpmanager.org/>.
- Continued additions to the official documentation: <http://docs.ixpmanager.org/>.
- Continued outreach through presentations, workshops and mailing lists.

The year-end 2019 financial position of the IXP Manager project fund is **estimated** to be:

2019 Opening Balance	€ 14,965
2019 Sponsorship Income	€67,652
2019 Expenditure	€ (62,177)
2019 Closing Balance	€ 20,440

⁴ <https://www.ixpmanager.org/users>

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 (i.e. Island Bridge Networks Ltd is a signee of the Contributor License Agreement⁵).

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 and as implemented - 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 three **estimated** summary expenditure is as follows:

⁵ <https://docs.ixpmanager.org/dev/cla/>

	Budgeted	Y/E 2019
Developer Costs	€55,375	€54,956
Hardware (budget = €3,600 less 2017/8 spend):	€525	€0
Software Licences	€900	€361
Travel (2 x Euro-IX)	€1,200	€0
Rent (plus supplies and sundries)	€3,600	€5,144
Insurance	€150	€88
Other Costs	€0	€824
Home Broadband	€0	€804
Total	€61,750	€62,177

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.
- The original budget separated *Software Licenses* and *Cloud Services*. These have been merged above.
- Island Bridge Networks offers all employees home broadband. This was accidentally omitted from the original budget.
- Rent is costed to the project as 1/n of IBN's rent bill where n is the number of employees. Insurance (which covers employee liability and all risks for the developer's laptop) is also charged at 1/n of IBN's cost.
- IBN has 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 €67,652 in our third year of sponsorship. In 2016, our year 3 estimated costs (when we exclude capital expenditure and other one-off costs), was €61,750. This has come in largely on budget at €62,177.

The excess of sponsorship income over expenditure (~€5,500) will be used to:

- Offset any sponsorship shortfalls for 2020;
- Extend the project lifetime into a fourth year; and
- Travel costs to deliver workshops and presentations and create increased project visibility (and thus sponsorship payback).

Dedication of IXP Manager v5 Release

We released IXP Manager v5 in May 2019 with the following heartfelt dedication:

IXP Manager 5.0 is dedicated to the memory of Barry Rhodes, who died in September 2018 and was Chief Executive of INEX for 15 years.

In 2005, IXP Manager was first envisioned and created by the INEX operations team, Nick Hilliard and Barry O'Donovan, to provide a robust and scalable management platform to run INEX's internet exchange in Dublin. Barry Rhodes put his full support behind the project, which enabled the code to be developed to the point that it could be open-sourced and released to the community. Today, more than 70 IXPs use IXP Manager as their management platform.

The INEX team are proud to honour Barry Rhodes' legacy by dedicating this significant release to his memory.

Publicity

IXP Manager presentations have featured at the following conference presentations between January and December 2019:

- “An introduction to IXP Manager for the APIX audience”, APIX 19 (Asia Pacific Internet Exchange Association)
Daejeon, South Korea. February 24th 2019
- “IXP Route Servers with RPKI and IXP Manager”, APRICOT 2019
Daejeon, South Korea. February 18 - 28th 2019
- “INEX's Shiny New Route Servers”, 34th Euro-IX Forum
Toulouse, France. March 31st – April 2nd, 2019
- “IXP Route Servers with RPKI and IXP Manager”, GPF14
Montréal, Canada. April 9th – 12th, 2019
- “INEX's RPKI Implementation”, RIPE 78
Reykjavík, Iceland. May 20th – 24th, 2019.
- “AfIX - IXP Manager Introduction”, AfPIF 10
Balaclava, Mauritius. August 19th - 22th 2019
- “RPKI at Route Servers”, AfPIF 10
Balaclava, Mauritius. August 19th - 22th 2019
- “IXP Manager Installation Tutorial”, AfPIF 10
Balaclava, Mauritius. August 19th - 22th 2019
- “IXP Route Servers with RPKI”, UKNOF 44
Belfast, Northern Ireland. Spetember 10th, 2019
- Operations Update, INEX Members
Dublin, Ireland, Septemer 2019
- “OAuth for IXP Operators”, 35th Euro-IX Forum
Zaandam, Netherlands. October 20th – 22nd 2019
- Operations Update, INEX Members
Dublin, Ireland, December 2019

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 Planned vs. Complete

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

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 was currently implemented via a tool called Bower. This has a number of issues and has been deprecated. We switched to Laravel Mix, the recommended replacement.
- IXP Manager v4 targeted Ubuntu 16.04 LTS. IXP Manager v5 targets Ubuntu 18.04 LTS. While both run on other platforms, these will be the recommended and supported platforms. Automated installation scripts have been upgraded for this also.

Complete: v5.0 was released in full in January 2019.

Authentication Redesign

Continuing our work in 2018, we intended 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.

Complete: OAuth authentication against PeeringDB was completed and released in IXP Manager v5.2:

We are very pleased to announce that we have added the ability to login to IXP Manager via a member's PeeringDB account.

This is a particularly beneficial feature for members who are members of many IXPs which use IXP Manager - of which there are over 80 now - as it means they only need their PeeringDB account to access their portal at each of those IXPs. It also removes the hurdle for account creation via the IX operations team or having to find a user within a member's own organisation with administrative permissions.

The management and operations team at INEX have worked with the team from PeeringDB on this functionality - with the initial conversations dating back to early 2017 where we each agreed to develop our respective parts. The general peering community benefits greatly from this as PeeringDB now has a publicly available OAuth service and, through our own work, we have added PeeringDB OAuth client functionality to one of the more popular OAuth programming libraries.

Our upcoming v5.3 release adds more authentication features including:

- ***Two-factor authentication with one time codes.***
- ***Session management to monitor multiple logins to IXP Manager via different devices and browsers.***

RPKI

We added RPKI functionality to IXP Manager's route server configuration generation. The general plan was:

- 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.

Complete: RPKI support was released with IXP Manager v5.1 in May 2019. This came with new looking glass tooling (see below), presentations and complete documentation including: <https://docs.ixpmanager.org/features/rpki/>. We implemented and documented RPKI with the three most common validators: RIPE's, Routinator and Cloudflare's.

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.

Postponed to 2020: OpenBGPD had not reached a suitable development milestone to be including in IXP Manager for production use. We met with the OpenBGPD developer at Euro-IX in October 2019 and plan to implement this in 2020.

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.

Previously this took a view from a single route server via a script that runs a couple of times a day. We planned 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.

Complete: This tool was completely rewritten and replaced with a new tool that queries all Bird v2 route servers in real-time to give a complete, live and accurate report on filtered prefixes.

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.

Postponed to 2020: we prioritised significant other goals over this in 2019. We have been investigating time-series databases during 2019 and plans are forming for 2020.

Year Three Achievements In Addition to Original Plans

The following are additional improvements in IXP Manager and the IXP Manager ecosystem that were completed in 2019 but did not form part of our original 2019 plans.

User Management

V5 changes user management in a number of ways - essentially implementing most of the ideas from the RFC in issue [#354](#). The changes include:

1. Allow an user to be linked to more than one member / network.
2. Unshackle contacts from users - this was done in v4.9.0.
3. Change the authorisation system from the current roles of customer admins and customer users which dated from equivalent functionality in the old RIPE LIR portal where identical roles existing. Now admins have read/write/admin access and users have read-only access.

Task Scheduler

Prior to IXP Manager v5, many cron jobs had to be configured manually. From v5.0 onwards, most required cron jobs are handled by Laravel's task scheduler. As such, you typically just need a single cron job entry from here on in. This vastly reduces installation and maintenance complexity.

Telescope

Laravel Telescope is an elegant debug assistant for the Laravel based applications such as IXP Manager. Telescope has been added to IXP Manager and it provides insight into the requests coming in, exceptions, log entries, database queries, queued jobs, mail, notifications, cache operations, scheduled tasks, variable dumps and more.

Third Party Integrations

- We have added MANRS API integration and now highlight members that are part of the MANRS program.
- We have also fixed the ASN lookup by using PeeringDB's whois integration and we have written new PeeringDB documentation to show all the integrations we use.

IRRDB UI Functionality

Route server filtering is based on IRRDB lookups of AS-SETs and related route objects. This is all [documented here](#).

Up until now, the only way to see the contents of the IRRDB ASN and prefix database tables was to manually examine the database or the generated route server configuration. We now provide these within IXP Manager for admins and users to examine and search.

In addition, administrators and users can request an IRRDB update of the ASNs and/or prefixes from within the UI and, once complete, it will display any prefixes/ASNs added/removed. Up until now, this was only available by command line.

Bird2

We added support for Bird v2 as a route server, route collector and AS112 router with full automation / configuration generation from IXP Manager.

Bird's Eye

Bird's Eye is a simple secure PHP micro service to provide some BIRD protocol / routing information via a HTTP API as JSON, with an optional built-in looking-glass implementation. It came from a RIPE hackathon about three years ago and spawned similar projects such as the Alice Looking Glass.

IXP Manager uses Bird's Eye to query Bird daemons running at an exchange.

This was upgraded to support Bird v2.

Looking Glass

IXP Manager's looking glass uses Bird's Eye daemons to provide information to end users. We updated the look and feel of this during 2019 as well as adding more features to provide information on filtered prefixes via internal use of large BGP communities.

Framework Upgrades

IXP Manager is built using the Laravel PHP application framework. We stay current with this to prevent upgrade shock if done less routinely. During 2019, we upgraded the framework from v5.5 to v5.8 and then to v6.0.

Frontend UI Upgrades

We replaced Bower, the now-deprecated frontend package manager, with Laravel Mix. This means IXP Manager ships all the frontend assets ready to use rather than end users needing to install and upgrade these themselves. Again, continuing our commitment to make installation and maintenance much easier.

We also upgraded Bootstrap, the popular frontend HTML, CSS and JS framework, from 3.x to v4.3. We also added and continue to TailwindCSS, a utility-first CSS framework.

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 started using Laravel Dusk in 2018 to test mission critical elements on the frontend UI - read all about the details on our blog post⁶ 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.

In 2019 we continued to roll out Dusk tests to even more components and also on all newly developed components.

General / Smaller Features

- Implemented the IX-F Member Export Schema v1.
 - <https://docs.ixpmanager.org/features/ixf-export/>
- Route Server Configuration Updates:
 - Implemented RFC1997 pass-through.
- Many more small improvements, bug fixes and security fixes.

⁶ <https://www.barryodonovan.com/2018/07/03/ui-tests-with-laravel-dusk-for-ixp-manager>

Development Outlook

Outside of the immediate year four 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.

Outreach

As part of Facebook's sponsorship (€10,000 per annum for three years), they also offered a separate €10,000 towards in-person outreach at networking meetings. This was put towards two meetings in 2019:

1. APRICOT 2019 (and APIX) – co-funded by INEX, Euro-IX and IX-F.
2. AfPIF10 – co-funded by INEX.

APRICOT 2019 & APIX

APIX is the association of Internet Exchange Points in the Asia Pacific Region. It serves as a forum for Internet Exchange Points to exchange experiences. There were ~25 IXPs in attendance.

Barry delivered a one-hour presentation introducing IXP Manager to the APIX audience which included: an overview of IXP Manager; explaining why IXPs should use it; detailed overview of route server configuration generation; current and future development plans.

The presentation was well received with useful feedback during the Q&A session (specifically requests for some operation documentation).

Barry presenting in the routing security session for APRICOT 2019. In the presentation, we proposed a best-practice integration of RPKI into the current IX route server context which still includes IRR support. We also presented the development work we have completed with IXP Manager to support RPKI and discussed our experiences at putting this live at INEX.

This also demonstrated the RPKI work completed on IXP Manager in 2019. It has been live at INEX route servers since February and RPKI invalids are being dropped. This RPKI code (including Bird v2 support) was released as part of IXP Manager v5.

AfPIF 10

Nick attended AfPIF 10 and delivered three different presentations:

1. AfIX - IXP Manager Introduction
2. IXP Manager Installation Tutorial
3. RPKI at Route Servers