



A Sustainable Funding Model  
&  
First Year Development Plan  
for  
IXP Manager

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Revision 1.4

February 2016

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## Executive Summary

IXP Manager is a software package for managing the technical and administrative aspects of running an IXP. As of February 2016 there were 26 IXPs *that we know of* using IXP Manager – from all five continents (see appendix 1).

As part of our preparations for the 27<sup>th</sup> Euro-IX forum in Berlin, we prepared an update on changes already developed and planned for version 4 of IXP Manager: a new underlying development framework, new features and functionality and a prioritised list of the development plan for the next year assuming a full time developer.

As is well known at this stage, IXP Manager began as an internal project at INEX and we chose to open source it four years ago. To date, INEX has borne nearly the complete development, maintenance, support and project management burden of the project. However, in writing down the plans we would like to achieve – coupled with our current workload and available resources – we have come to the realisation that to fully develop IXP Manager into all we hope it can be, we need to look at a more sustainable funding model with a full time developer.

This document outlines how we would like to structure that, where we would like to see that funding come from, the budget required, project oversight, project management and development plans.

In summary, this amounts to:

- INEX (via Barry O'Donovan and Nick Hilliard) is to continue to provide project management, quality control, support and some continued development.
- A full time developer to be hired by Island Bridge Networks Ltd (a consultancy company co-owned by Barry O'Donovan and Nick Hilliard). IBN will provide office space, equipment, insurance, payroll, etc.
- IBN will provide these services on a strictly not for profit basis.
- An annual budget of approximately €65,500 to be invoiced by IBN to all funding parties. For transparency, this funding will be maintained in a dedicated bank account specifically for the IXP Manager project.
- Euro-IX audit committee to provide financial audit oversight.
- Bi-annual reports to the INEX Committee and Euro-IX Forums. At least one of either the proposed developer / Barry O'Donovan / Nick Hilliard to attend these.
- New dedicated IXP Manager website to clearly reflect funding contributions as well as other funder recognition.

## Introduction to IXP Manager

IXP Manager is a full-stack management system for Internet Exchange Points (IXPs) which includes an administrative and member / customer portal and an end to end provisioning system. A good overview of the depth and breath of tools and functionality provided can be found on the introductory 27<sup>th</sup> Euro-IX Forum presentation<sup>1</sup>.

One of the key elements of IXP Manager is that it teaches and enforces IXP best practices as implemented at INEX and learnt from both our own experience and shared experiences through Euro-IX. IXP Manager is the key element that has allowed INEX to run a secure, reliable and consistent IXP with over 80 peering members in 6 PoPs with just 1.2 full-time equivalent technical staff members.

There are three main goals which permeate a lot of what we do with IXP Manager:

- Zero touch provisioning and configuration
- Do more with less
- Provide excellent service to our members

We first released IXP Manager in 2010 with a version tag of v2. It is released under the GPL V2 license and there is a stipulation that any code entering the master / mainline branch is also contributed under the same license.

Two years later, we released v3 with significant framework updates but, more importantly, a greater community push and better documentation. Since then it has grown and grown in popularity.

## Overview of the Next 12 Months

While later in this document we go into more detail, our immediate plans for the next 12 months include:

- Complete and release v4 (more later).
- Completion of Helpdesk integration – allow members to raise, view, update and close tickets which are managed in third party helpdesk systems such as Zendesk.
- L2 ACLs – most IXPs are moving towards static L2 ACLs rather than dynamic port security. We want IXP Manager to provide database management, a UI for updating (including member facing for router changes) and zero touch provisioning to our switches.
- Advanced P2P functionality – IXP Manager has supported peer to peer graphs for a number of years and it's one of our most used features. We would like to advance this functionality to use a time-series database back end and present much more useful and real time information to our members.
- Augment reseller functionality to also allow for trunk ports (*p-tags*) which also requires graphing updates (currently under development via DE-CIX bounty), peer to peer updates and database schema considerations.
- Patch panel / cross connect management.

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<sup>1</sup> <https://www.inex.ie/noncms/euroix27-inex-ixp-manager-workshop-introduction.pdf>

- Intelligent stream-lined provision of new ports (or upgrades) to manage the process end to end, identify blockers, messaging, etc.
- Add additional API endpoints for members (e.g. access to their port and peer to peer graphs programmatically).

## Proposed Structure

In terms of roles for IXP Manager, Barry O'Donovan is the lead developer / project manager and Nick Hilliard is the CTO. Both of these individuals are contractors to INEX. They also co-own the consultancy company Island Bridge Networks Limited (IBN).

As INEX is an Internet Exchange and does not want to get directly involved in software development, we have a formal arrangement with INEX that:

1. IXP Manager development is performed by Island Bridge Networks Ltd which sends invoices to those organisations providing funding / feature bounties and is paid for the development work.
2. Copyright of the development work is assigned to INEX, who then commit to releasing the code under the GPLv2. To this end, Island Bridge Networks Limited is a signatory to the contributor license agreement<sup>2</sup>.

It is proposed that Island Bridge Networks Limited:

- Will recruit and hire a suitable PHP developer.
- Will provide office space and suitable equipment for said developer.
- Will handle all employee arrangements including: contracts, pay, tax, insurance, other financial, tax and legal obligations, annual leave, etc.
- Will open a dedicated banking account facility for all financial matters relating to this engagement.
- Will invoice all supporting organisations on an agreed basis (quarterly, biannually or annually).
- Will furnish the Euro-IX Audit Committee all financial records, bank statements, invoices, etc. relating to this project on an agreed schedule.
- Will report on the project on a biannual basis at Euro-IX Forums in whatever format the Euro-IX FPC deems appropriate.

**It is important to note that Island Bridge Networks will undertake the above on a not for profit basis.**

It should also be noted that we have considered a developer who is not based in our offices. We believe that the probability of positive outcomes for each development milestone is greatly enhanced if the developer works in person with Nick and Barry and is exposed to INEX for first hand experience and understanding of what an IXP is and how it works.

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<sup>2</sup> <https://github.com/inex/IXP-Manager/wiki/Contributor-License-Agreement>

## Proposed Budget

Ideally, we would like to undertake this project over three years. There will be some capital expenditure in year one. Some values are approximate estimates.

Budget – Year 1	
Salary	€45,000
Performance related bonus	€5,000
Employer Tax (PRSI at 10.75%)	€5,375
Hardware <sup>3</sup>	€3,600
Software Licences <sup>4</sup>	€500
Travel (2 x Euro-IX)	€1,200
Rent (plus supplies and sundries)	€3,600
Insurance	€150
Cloud services (Teamwork, Zendesk)	€400
<b>Logo Design</b>	<b>€500</b>
<b>Total (rounded up)</b>	<b>€65,500</b>

Less the CapEx and some software licenses, the year 2 and year 3 budgets would be approximately €61,000 each assuming no negotiated salary increments or other increases.

A recruitment fee may also be necessary if it proves impossible to find a suitable PHP developer. However we will endeavour to do this through local PHP user groups and the networking community.

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<sup>3</sup> Standard IBN policy is to provide all employees with a high-quality Apple Macbook Pro, Apple Thunderbolt Display, Apple Keyboard and Trackpad plus standard accessories and bag. These will survive the lifetime of the project.

<sup>4</sup> Approximate value to include Parallels Desktop, Windows 10, Microsoft Office, Viscosity.

## Development Outlook – Year One

In this section we will provide more detail on the plans we would like to achieve in year one.

### Installation and Upgrade Ease

Currently IXP Manager set-up and upgrades are more elaborate than is necessary. We would like to make this much easier through the use of a web-based / CLI installation script which would just ask the pertinent questions and handle most of the tasks.

We have made some progress towards this already through the use of Vagrant for setting up fully functional development boxes with just three commands.

We believe working on a more consistent / streamlined / automated install and upgrade process is the best way for a new developer to read themselves into the project.

### Dedicated Website

Right now we rely on Github's project page as a website. We need to create a small micro-site to provide the essential information on IXP Manager including supporter / funder logos. Nothing overly sophisticated is planned here – something along the lines of <http://www.vimbadmin.net/>.

We would also like to have a logo designed to better brand IXP Manager. This logo can also form a badge to be placed on websites and other collateral of those organisations that contribute to its development.

### Helpdesk Integration

Most IXPs tend to use some form of helpdesk system to interact with customers and manage tickets. Most modern helpdesks have API endpoints to integrate them with customer software.

At INEX we use Zendesk and have nearly completed all the backend work for integration. This is a useful case study of how IXP Manager v4 differs from v3 in that our new underlay framework (Laravel) allows us to develop third party integrations as *Service Providers*. This means that while our reference implementation is for Zendesk's API endpoints, integration with other helpdesk APIs can be achieved by just developing against an interface fleshing out the functionality. The choice of helpdesk backend is then just a configuration option.

Further work to be done on this includes adding the front end functionality to allow members to view, update, close and open tickets.

### L2 ACLs

Most IXPs are moving towards static L2 ACLs rather than dynamic port security. We want IXP Manager to provide database management, a UI for updating (including member facing for router changes) and zero touch provisioning to switches.

This means the addition of some new and interesting features to IXP Manager:

- Queue based task management: rather than the current system of polling / executing jobs based on cron schedules, a queue based task manager will execute jobs on demand. In this example, the job would be to edit / update L2 ACLs on the switch.

- For the first time, IXP Manager will start to configure switches directly. This means that we will write the necessary functionality for altering a switches configuration with reference implementations for Extreme and Brocade.

### Advanced P2P Functionality

IXP Manager has supported peer to peer graphs for a number of years and it's one of the most used features. We would like to advance this functionality to use a time-series database backend and present much more useful and 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 a medium-sized IXP (<=250 members for example). But, again, this will be programmed to an interface so other backends can be easily substituted.
- 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 will provide necessary functionality for reseller ports with p-tags.

### Reseller Functionality

Augment reseller functionality to also allow for trunk ports (*p-tags*) which also requires graphing updates (currently under development via DE-CIX bounty), peer to peer updates and database schema considerations.

### Patch Panel / Cross Connect Management

At INEX, we have tried to tackle this functionality a number of times but we kept getting side-tracked by the *bike-shedding* phenomenon. After an informal survey of other similar sized IXPs, it appears most people are using a wiki or spreadsheet to manage these.

If we do not overthink this and create a similar database-based tool within IXP Manager we can:

- Record who is connected to each patch panel.
- Alert when available ports fall below a threshold.
- Record ceases and past usage to avoid confusion on reuse.
- Assign patch panel demarcation points as part of the provisioning process.

### Flexible Provisioning System

A typical task at an IXP is provisioning a new port. This typically means:

1. New port request form received from customer.
2. Assign port on IXP Manager along with IP addresses, etc. Email these to the customer.
3. Locate a free patch panel port and email this (along with LOA) to the customer.
4. Wait for the cross connect to be connected.

5. Begin the quarantine process along with quarantine route collector session.
6. Put the port live and confirm.
7. Set up route server sessions.
8. Email the technical list to announce the new connection.
9. Add to monitoring systems, billing, etc.

This is a similar process in most IXPs but the steps may be slightly different and the messaging is certainly different.

We need to create a flexible process management system with elements which include:

- Action on transition to new step
- Hook to identify when a step is complete
- Hook to identify exceptions and a handler
- Pre- / post- completion actions
- Messaging

Essentially as easily definable process management system for common tasks. These should then feed into all the other systems (monitoring, billing, helpdesk, etc.).

This is a significant task which will require a lot of planning but it is one that is badly needed.

### Additional API Endpoints for Members

We need to add API endpoints for members so that they can:

- Poll for status information on the IXP level and regarding their own service
- Download graphs / traffic data
- Download peer to peer graphs / traffic data

### Three Year Outlook

In addition to the above first year plan, over the course of three years we would like to:

- Use the new developer to provide front line support on the mailing list to get him/her fully immersed in the project, its users and their user experience issues.
- Work on collateral such as recorded tutorial videos, in-person workshops, completing the V4 documentation (we've moved to ReadTheDocs for this).
- Continue working on *on demand* based provisioning via queuing. This means, for example, rather than having to wait for a cron job to run at designated times to have new route server sessions provisioned, they can be provisioned on demand.
- Do more work with automated switch provisioning.
- Further development *My Peering Manager* to include route server session management. Essentially allow members to opt in / out of peering with certain other members on the route servers without having to rely on community tagging. We could further enhance this to allow some automation such as *exclude any member with a RTT latency of greater than x milliseconds*.
- The customer facing part of IXP Manager needs some significant work which includes a lot of what has been covered above but also:
  - Ability to update all aspects of customer information including billing details, peering and NOC details, etc.

- Potentially switch to a 100% API based frontend via EmberJS / Angular / other technology allowing members to fully manage all aspects of their portal account via APIs of their own.
- Expose all graphs (port and peer to peer) via API endpoints for integration in a customer's own NMS.
- Integration of IXP member news, Twitter feeds, blog or LinkedIn news feeds, etc.
- Internationalisation and localisation. 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.
- 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 over 80% of utilisation; missing sessions with peers with open policies, etc.
- Better integration with tools such as Smokeying.
- Built-in looking glass for route collectors and route servers.

## Appendix 1

IXPs Using IXP Manager (to best available knowledge as of August 2015).

1. INEX, Dublin, Ireland
2. LONAP, London, England
3. BCIX, Berlin, Germany
4. FL-IX, Florida
5. GR-IX, Greece
6. DIX, Denmark
7. Angonix, Angola
8. Serrekunda IXP, Gambia
9. SIX, Slovakia
10. SIX, Slovenia
11. KIXP, Kenya
12. Phoenix-IX, Arizona, USA
13. WAIX, Australia
14. DO-IX, Dortmund, Germany
15. NWAX, Oregon, USA
16. BKNIX, Bangkok, Thailand
17. United-IX / Ch-IX, Chicago, USA
18. SFMIX, San Francisco, USA
19. UIXP, Uganda
20. Giganet, Ukraine
21. Halifax Internet Exchange, Canada
22. Lansing Internet Exchange, Michigan, USA
23. MidWest-IX, USA
24. NAPAfrica JHB, Johannesburg, South Africa
25. NAPAfrica CPT, Cape Town, South Africa
26. NAPAfrica DBN, Durban, South Africa

We expect the take up of IXP Manager to continue for most new exchanges that form. Additionally, we believe we can convert more existing exchanges if we can demonstrate a sustainable development and feature plan as envisaged in this document.