
Internet Exchange Point Network Implementation Using IXP Manager And Bird in Idcloudhost

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ABSTRACT

Internet Exchange Point (IXP) is a network infrastructure providing facilities for connecting devices to exchange traffic. In building an IXP network, there are several main components: routers, switches, and IXP member devices. This research uses the UCLA method according to the scenario that has been made based on qualitative data from interviews with IDCloudHost. The research object is the IXP network owned by IDCloudHost, which was previously built using BIRD as the primary infrastructure in the form of a platform. This study aims to optimize the existing IXP network management process by re-implementing it using IXP Manager as the primary infrastructure. The research results show that the IXP network management process was done manually. BIRD configuration needed to be done on several different devices and could only be operated by IDCloudHost's Chief Technology Officer. The configuration process was done manually. After using IXP Manager, IXP network management on IDCloudHost Bogor configurations can generate automatically. All technicians operate the availability of IXP network performance graphs, which are more centralized and can. In addition, it also has an impact on the management process that can be carried out from a technical and administrative side, can be developed and integrated into various existing services at IDCloudHost, optimizes employee performance, and increases the maturity and business continuity of the company which means IXP network management at IDCloudHost can be optimized by using IXP Manager and BIRD

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INTRODUCTION

The development of information technology and internet network at this time has become a basic need. The needs of IDCloudHost companies are no exception, which also requires information technology and internet networks to be used as the company's primary support in providing services to customers throughout Indonesia and the company's internal needs. In meeting these needs, IDCloudHost

uses the IXP network as a solution. The IXP network, which is implemented using a particular platform, BIRD, as a new facility or service to users involving local and global networks, is expected to optimize the use of the internet network. However, BIRD, an IXP network platform, still has a weakness: the Command Line Interface (CLI) configuration display (NAGY, 2018). So that the configuration form given is in the form of a script resembling a particular programming language, which complicates the IXP network management process at

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IDCloudHost. IXP Manager is an IXP network platform solution with a web-based Graphical User Interface (GUI) (Warraich, et al., 2020). In addition, IXP Manager has also been integrated with BIRD (UN.ESCAP, 2020). With the IXP Manager, the IXP network management process on IDCloudHost becomes easy and efficient so that it is more optimal. Internet exchange point (IXP) is a network infrastructure built for several organizations or companies to provide facilities in the form of exchanging internet network traffic locally to enable each organization to connect and share resources. Without IXP, the transmission process between a network and other networks will be interdependent. In its implementation, the IXP network involves the exchange of local internet network traffic and the global network (Morley, Widdicks, & Hazas, 2018). To speed up the data transmission process, which can optimize the use of the internet network.

Building an internet exchange requires a particular platform such as BIRD. This platform can be installed bare metal on a Linux and FreeBSD operating system or in container form on Docker. However, if you use this platform on a standalone basis, the configuration process will still be more complex. So the implementation in this study also uses IXP Manager as the central infrastructure of the IXP network.

The IXP network can run with an agreement between members or devices to connect through peering, network infrastructure, and internet infrastructure that support (Rosa, How Internet Infrastructure Emerges in the Global South). In an IXP network, the primary network infrastructure requires routers and switches. Routers that function as Route Server (RS) to collect member information and Route Collector Server (RCS) to collect route information for delivery destinations and specific statistical purposes and can be used as a backup for Router Servers (Briain, Denieffea, Okello, & Kavanagh, 2020). Meanwhile, the switch functions as a center for exchange and distributes the resources needed by each member (Fardani & Neforawati, 2019). The IXP network internet infrastructure, namely ASN, functions to identify the unique identity of each member in the IXP network so that they can communicate with each other (Nemmi, et al., 2021).

IDCloudHost is a hosting service provider that provides services such as domain registration, cloud hosting, servers (VPS & dedicated servers), and domain resellers in Indonesia (PT. Cloud Hosting Indonesia, 2020). IDCloudHost has three branch offices in the Sukabumi, Pekanbaru, and Bogor areas, with the number of users reaching 170,000 by the end of November 2021 (PT. Cloud Hosting Indonesia, 2020).

Managing IDCloudHost's internal technical services is in the Bogor branch office and data center. IDCloudHost Bogor branch, apart from managing network infrastructure for services to customers as well as for the company's internal needs.

RESEARCH METHOD

1. Research Conceptual Model

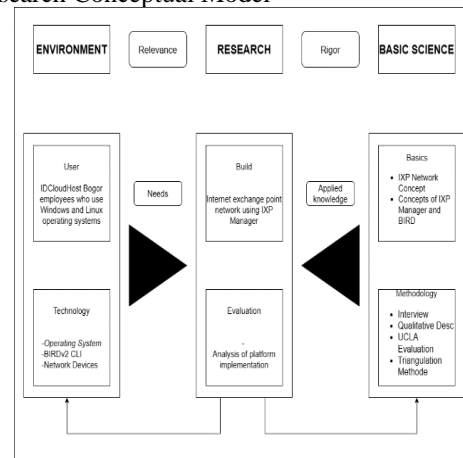


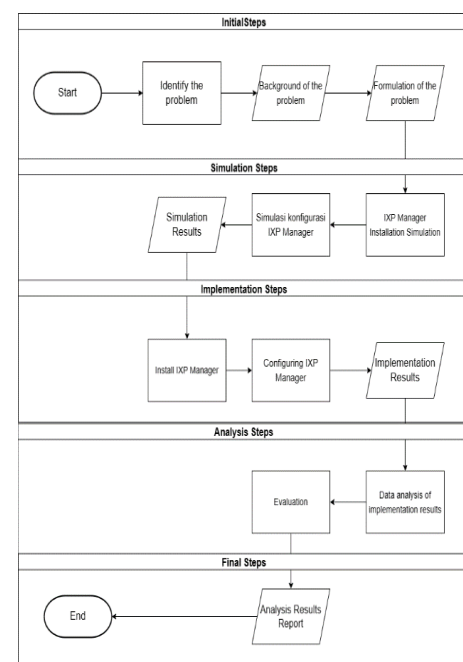
Figure 1. Conceptual Model

A conceptual model is a form of modeling of a framework or workflow that will be carried out so that it becomes more apparent (van Ingen, Peters, De Ruiter, & Robben, 2021). With this conceptual modeling, the framework that will be carried out becomes more structured and transparent. The conceptual model in this study is shown in Figure 1.

2. Problem Solving Systematics

Systematic problem-solving is the step of a research planning process. This includes the initial to the final stages of the process to obtain the expected data. The following is a systematic problem-solving in this study:

RESULTS AND DISCUSSION



Source : (Kasad, 2023)

Figure 2 Problem Solving Systematics

- a) The problem formulation begins with identifying the situation in the background, which aims to describe the issue in more detail. After placing the environment, there are problems to be studied, and a problem definition will be created that focuses on the problem to be solved.
- b) At the simulation stage, a simple implementation process is carried out using a backup server router to conduct tests before direct implementation is carried out to find out and ensure that the installation and management processes will get the expected results.
- c) In the implementation phase, the IXP network installation and management process are carried out directly on the main server router via remote according to the methods and frameworks carried out previously in the simulation stage.
- d) In the analysis stage, the simulation and implementation results will be analyzed for optimization in the management process set for the internet exchange network that uses IXP Manager.
- e) In the final stage, the analysis results will be used as the final research report. In the last word, there are test results that have been assessed and validated, and there are conclusions from the results of the implementation.

3. Data Collection

Data collection in this study used the interview method to obtain qualitative data (Haven & Grootel, 2019). This research method carried out discussions or observations with the company regarding existing problems to serve as a research guide.

4. Data Analysis

In the data analysis stage, the method used is descriptive qualitative analysis (Sugiyono, 2017). The results of the data collected previously were presented in the form of a brief explanation and then grouped into several aspects of the research problem.

5. Evaluation

Evaluation is a process of ensuring decision-making, selecting the correct information, and collecting and analyzing information to provide reports related to summary data so that it can be used in determining several choices (Mathison, 2004). The evaluation method used in this study is the UCLA evaluation. One form of evaluation is the Assessment System. System Assessment is a form of the evaluation carried out to obtain information related to the condition of a system.

6. Validity Method

The validity method used in this study is the triangulation method (Rahardjo, 2010). One validation method can be used to test the validity of the information obtained from various points of view.

RESULTS AND DISCUSSION

1. Data Collection and Analysis Result

Before implementing the IXP network, data was collected using the interview method with IDCloudHost. This company will utilize the IXP network to find weaknesses in the IXP network management process. After the interview data was obtained, the authors conducted an analysis based on the data. Then they drew conclusions that were used as guidelines for implementing the IXP network using the IXP Manager. Following are the results of interviews with the Chief Technology Officer and Network Operation Officer at IDCloudHost:

- a) **Management Process** : In implementing the IXP network, IDCloudHost still uses the central IXP infrastructure as a manual routing platform, namely BIRD. BIRD, which has a CLI interface (NAGY, 2018), resulted in the BIRD configuration process being carried out on several different devices, so the management process takes a long time. This is done if there are entities that wish to join the IXP IDCloudHost network. In addition, information from the IXP network's unavailable performance makes it difficult to carry out maintenance and repair processes.
- b) **Tools Usage** : Based on the interview data, it was found that seven technicians in the IDCloudHost technical division could not operate BIRD in managing the IXP network. The BIRD platform implements specific programming languages in its configuration files (NAGY, 2018), requiring special skills

2. Needs Analysis

For optimizing the implementation, it is necessary to consider the specifications and use of hardware and software.

- a) **Hardware**

Table 1. Hardware

Route Server Specification	Information	
Processor	Intel Corp.	pc-i440fx-6.1 CPU @2GHz
Memory	32GB	
Operating System	Debian 11.2	
Switch Specification	Information	
Processor	1.2 GHz, quad-core	
Memory	2GB	
Operating System	VRP (Versatile Routing Platform) 8.191 (CE6851 V200R019C10SPC800)	
Virtual Machine Specification	Information	
Processor	Intel Corp.	pc-i440fx-6.1 CPU @2GHz
Memory	16GB	
Operating System	Ubuntu 20.04	

Source : (Kasad, 2023)

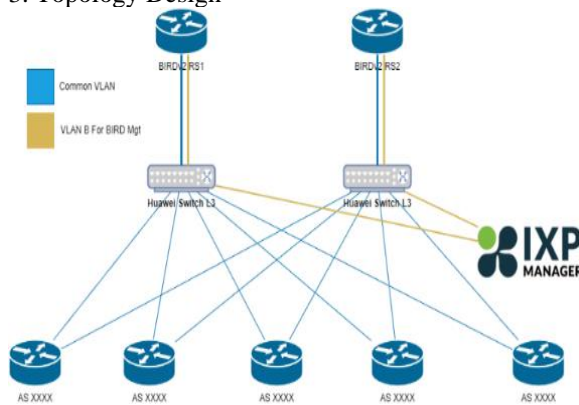
b. Software

Table 2. Software

Operating System	Application	Version
Debian 11.2	BIRD	2.0.7
	FRRouting	8.1
Ubuntu 20.4	IXP Manager	6.2.0
VRP (Versatile Routing Platform)	SNMP Agent	2C

Source : (Kasad, 2023)

3. Topology Design



Source : (Kasad, 2023)

Figure 3. Topology Design

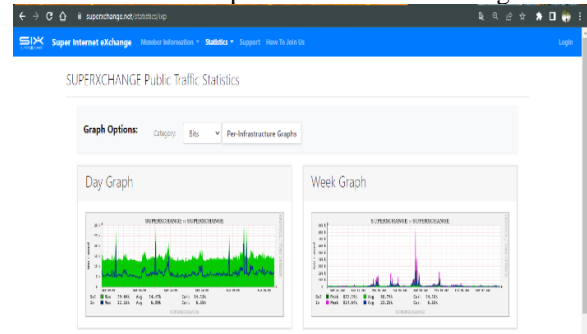
Figure 3 is the topology that will be used in implementing the IXP network using IXP Manager as Figure 5 Member Management System

configuration feature. The topology has received validation from IDCloudHost to be implemented. The scheme and performance of the IXP network are still the same as before. However, the difference here is that there is an IXP Manager as an infrastructure in IXP network management. The position of IXP Manager is equivalent to a server router, where IXP Manager requires two VLANs in its implementation. The first VLAN is used for IXP network management between the router server and IXP Manager. In comparison, the second VLAN is used for IXP network management between server routers and IXP members.

With a topology like this, it is possible to manage the IXP network in an integrated manner through the IXP Manager. This is because the IXP Manager is physically connected to the server router via a switch and the peering member management process by

utilizing the SNMP Agent on the switch. In addition, the web application-based IXP Manager interface makes this management process faster and does not force technicians to have specific abilities and skills in BIRD operations.

4. IXP Network Graph View from IXP Manager

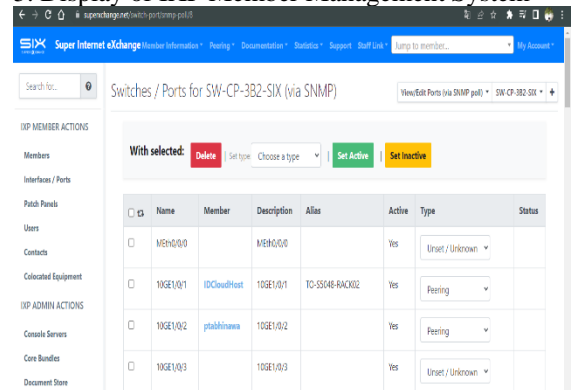


Source : (Kasad, 2023)

Figure 4. IXP Manager Graphics

built using the IXP Manager. The graph in Figure 4 is generated by the MRTG (Multi Router Traffic Grapher) that the IXP Manager provided. This graph can be used to monitor and troubleshoot the IXP network.

5. Display of IXP Member Management System



Source : (Kasad, 2023)

Figure 5 displays when the IXP member management process is carried out. Member identity can be identified based on the connected port. In managing members, each member who wants to join can be initialized as "Peering" in the "Type" column.

6. Automatic Configuration Result Display

```

← → ↻ 🏠 🔒 superexchange.net/api/v4/router/gen-config/rs1-ipv4

#
# Bird v2 Route Server configuration generated by IXP Manager
#
# Do not edit this file, it will be overwritten. Please see:
#
# https://github.com/inex/IXP-Manager/wiki/Route-Server
#
# Generated: 2023-02-11 01:34:53
#

# For VLAN: PEERING-EXCH (Tag: 102, Database ID: 2)

# standardise time formats:
timeformat base      iso long;
timeformat log       iso long;
timeformat protocol iso long;
timeformat route     iso long;

log "/var/log/bird/rs1-ipv4.log" all;
log syslog all;

define routeserverasn      = 138608;
define routeserveraddress = 103.134.155.131;

router id 103.134.155.131;

# ignore interface up/down events
protocol device {

# This function excludes weird networks
# rfc1918, class D, class E, too long and too short prefixes
function avoid_martians()
nrefix set martians;

```

Source : (Kasad, 2023)

Figure 6. Automatic Configuration Results

Figure 6 displays the automatic configuration generated by the IXP Manager. The configuration results consist of the initialization of the identity of the router server, information on each member, and the provisions that apply to the IXP network while the member is connected. The configuration results can then be directly integrated into the router server.

7. Comparison of the IXP Network Management Process Before and After Using IXP Manager and Its Impact on IDCloudHost

Table 3. IXP Network Management Process Comparison Analysis

Aspects	Before	After
Management Process	<ul style="list-style-type: none"> Display based on CLI (Command Line Interface) The BIRD configuration process needs to be done on several different devices. Information from IXP network 	<ul style="list-style-type: none"> Website application -based display BIRD and switches integrated with IXP Manager IXP network configuration is done automatically from IXP Manager

performance is not available.

- IXP member configuration is done on the switch separately
- MRTG graphic display for maintenance, repair, and monitoring of IXP network performance

Tools Usage

- Do not have the ability to operate BIRD.
- Easy to use by several divisions in the company
- Does not require special skills in operation
- Does not require special skills in operation

Source : (Kasad, 2023)

Based on the comparison in Table 3, managing the IXP network using the IXP Manager platform with BIRD as the basic configuration is easier to do than just using BIRD as the central infrastructure. Several processes have an impact on optimizing the management process, such as:

- The configuration generated by IXP Manager and integrated directly with the server router will be more efficient than manually configuring BIRD so that the time needed is shorter.
- The peering member management process is easier to do through the IXP Manager with the port management feature using SNMP on the switch, which can initialize the member as an IXP member compared to configuring BIRD on the server router directly.
- The process of monitoring the IXP network in the graphic display can be started.
- The configuration management process is more straightforward with a website-based view by IXP Manager so that all technicians can use it.
- IXP Manager is based on open source, which can be developed into the central infrastructure as an IXP network management platform on IDCloudHost. So that in addition to technical management can also cover administrative needs.

8. Analysis of Results Validity

The following are the results of validity originating from three different sources in determining the achievement of the research results.

Table 4. Validity Results

Sources	Impacts	Results
Chief Operation Officer	IXP Manager is based on open source, which can be developed into the central infrastructure as an IXP network management platform on IDCloudHost. So that, in addition to technical management, can also include administrative needs.	Valid
Technical Support	<ul style="list-style-type: none"> The process of monitoring the IXP network in the graphical display can be started. The configuration management process is more straightforward with a website-based view by IXP Manager so that all technicians can use it. 	Valid

Source : (Kasad, 2023)

The information in Table 4 is the result of the validation process using the method triangulation technique (Rahardjo, 2010). In carrying out the validation process, training sessions related to implementation results were given, and several features were introduced to the IXP Manager, which were coupled with the validation process so that the results of the research could be obtained from various points of view. It was found that the results of all these indicators were fully valid and that the management process using IXP Manager and BIRD for the IXP network was more optimal by IDCloudHost, especially the technicians on duty in Bogor.

9. Evaluation

The process of implementing the IXP network has been carried out correctly. However, the automatic configuration generated by IXP Manager needs to be updated regularly to maintain the performance of the IXP network itself. It can be done using Cron Jobs. Cron Job is a tool that can be used to schedule the program execution process (Wirawan, 2020). In carrying out its functions, Cron Jobs can execute Linux commands and the PHP programming language (Brunswyck, 2009), so that it can be used to carry out systematic data retrieval processes on an

integrated system (Christanto & Rudiyanto, 2020).

On the IXP network system, integration between the server router and IXP Manager to produce automatic and periodic configurations can be used as a Cron Job tool to improve the management process.

CONCLUSION

Before implementing the IXP network using IXP Manager and BIRD on IDCloudHost, the IXP network management process in IDCloudHost Bogor was a manual operation, with BIRD configuration being carried out on multiple devices and only the Chief Technology Officer having the ability to operate it. However, after implementing IXP Manager, the management process of the IXP network became more manageable with automatic configuration, availability of performance graphs, centralized management, and the ability for all technicians to operate it. It has significantly impacted IDCloudHost, enabling the management process to be carried out technically and administratively, integrated into various services available at IDCloudHost, and optimizing employee performance. Furthermore, the IXP network has increased the company's maturity to continue to compete for sustainability and corporate business by providing new services or facilities.

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