1. Short Background of the Indonesian Internet

The Internet in Indonesia like most countries was started at the University campus but unlike the US, without the involvment of the Military. At the early beginning ITB (Institut Teknologi Bandung – Bandung Institute of Technology) and UI (Universitas Indonesia) was the pioneering institution. University of Indonesia especially was active in the development of the Indonesian internet with IANA appointing the University of Indonesia's Mr. Rahmat M. Samik Ibrahim as the Top Level Domain for Indonesia with the country code .id

The basic internet services that was first introduced in Indonesia was ***UUCP*** (Unix to Unix Copy Protocol) to exchange e-mail to others in Indonesia and the global internet. Without government and military aide the high cost of international dedicated transmission was not an option for the connection, therefor International Direct Dialing (IDD) was used for the UUCP link.

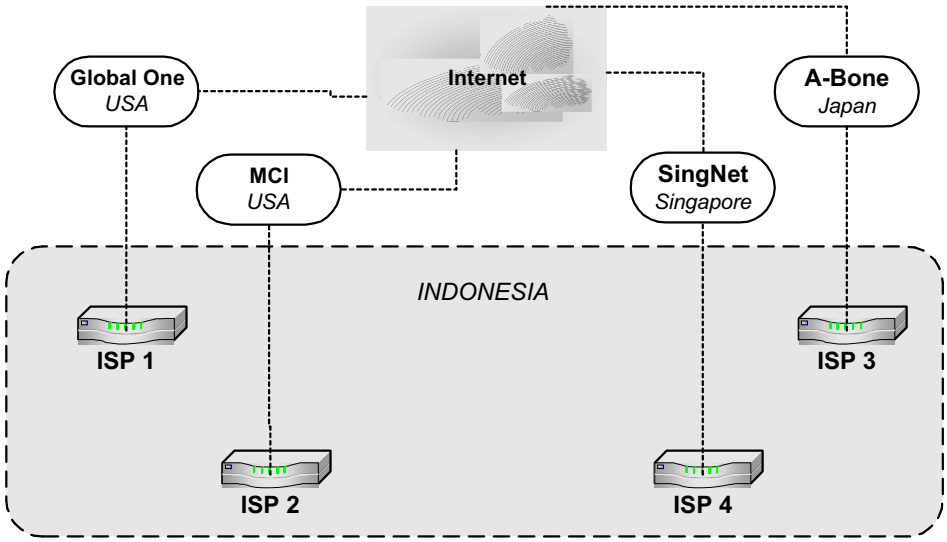
a. ISP's in Indonesia

The first Internet Service Provider (ISP) in Indonesia was Indonet (*http://www.indo.net.id*) which started it's operation at Jakarta in 1994 before the government issued licenses for ISP operations. Indonet started it's internet connectivity with a 9600bps modem dialing through IDD to Singapore. Through this connection **TELNET** and **IRC** was the services available freely to anyone with a modem.

In 1995 the Indonesian government then decided to issue internet service licenses through the Department of Post and Telecommunications seeing the internet as being an industry tightly connected to the telecommunications industry. Two licenses was then issued, to Indonet and to RadNet (*http://www.rad.net.id*), thus marking the beginning of commercial internet services in Indonesia. The two ISP's no longer use IDD dial-up modem to connect to the internet but are using dedicated International connections through Indosat's submarine cable to Sprint (USA) and SingTel (Singapore). As the cost for these international connections are high the users are now charged for the connection they use, and in return all services were made available including **HTTP** and **NNTP.**

By early 1996 the government had issued 27 ISP licenses, the ISP's then formed **APJII** (Asosiasi Penyelenggara Jasa Internet Indonesia – Association of Internet Service Providers Indonesia) and work closely with the regulators which then issued Internet Connectivity tarrifs for end users on May 1996 which still stands today.

Out of the 27 licenses issued only 15 ISP's operated untill 1997. Thus there are 15 International connections from Indonesia to the Internet which are seperated one from the other. Each ISP therefor are burderned with the ½ circuit cost to Indonsat and the ½ circuit cost to the US.



Picture 1 : The Indonesian Internet before the IIX

By the end of 1997 there are 45 licenses issued by the government with 35 ISP's actively in operation.

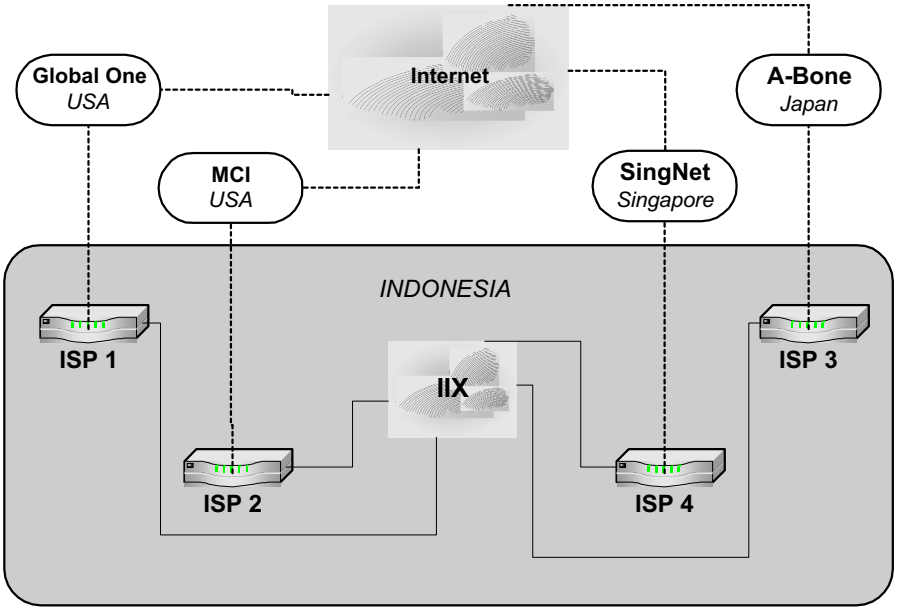
b. The Birth of the Indonesian Internet Exchange (IIX)

With 35 active ISP's the need for interconnectivity between the ISP's in operation was felt. Local traffic was going through international channels and several hops before it came back to Indonesia. A solution was needed to cut down international costs and faster access to local Indonesia destinations.

Government initiated programs such as the **Nusantara 21** and **Telematika** was eagerly waited by the internet industry but never came to effect, it was planned that these programs would solve the local bandwidth and connectivity for all internet traffic in Indonesia.

As the need for local connectivity mounted, the ISP's could no longer wait for the government, so in June 1997 APJII formed a task force to develop an exchange for the internet. The task-force consisting of top technicians from each active ISP's and Cisco then develop the birth of the **Indonesian Internet Exchange (IIX –** *http://www.iix.net.id***)** a logical network that would connect every ISP in Indonesia to a single exchange point. The IIX was officially launched in August 1997.

Without funding from the government the IIX was promoted by APJII (*http://www.apjii.or.id*) a non profit organization which seek sponshorship with international vendors to build the much needed internet exchange. Major vendors contributed routers, switches, hubs, servers, and software to APJII for the IIX. These vendors include Cisco, Hewlett Packard, Bay, Microsoft, RAD, and Digital. IP exchange blocks for routing was provided by Bill Manning of isi.edu. The distance from one ISP in Indonesia to another ISP in Indonesia which was usually more than 12 hops is now shortned to only 4 hops.



Picture 2 : The Indonesian Internet with the IIX

c. Indonesia (.ID) domain growth

As each company connected to the internet will register their own domain, the domain growth of .id will reflect the growth of local internet servers and users in Indonesia.

With the IIX in operation, indonesia domain (.id) then grew. There is now a logical reason to register and host a server in Indonesia, that is a server located in Indonesia will be accessed faster than a server located outside of Indonesia.

	Jan-95	Dec-95	Dec-96	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97
CO.ID	1	53	255	589	697	765	793	857
OR.ID		9	24	66	78	88	89	100
AC.ID		15	25	53	54	55	56	60
NET.ID		8	22	30	31	32	33	34
MIL.ID		1	1	2	2	2	2	2
TOTAL	1	86	327	740	862	942	973	1053

Table 1 : .ID Domain growth January 1995 till December 1997

Before the IIX, from January 1995 untill August 1997 the total domain was 740 domains or an average growth of ***23 domains per month***. After the IIX was launched, from August 1997 to December 1997 the domain growth grew from 740 to 1053 domains or a growth of ***171 domains per month***.

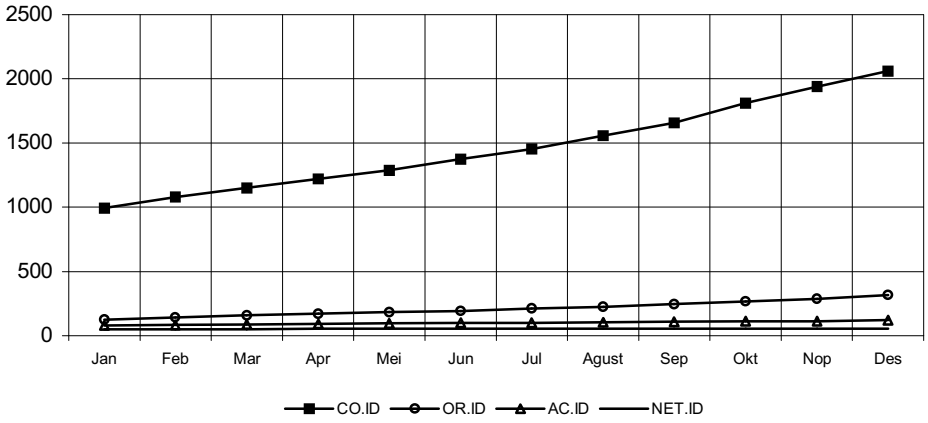


Table 2 : .ID domain growth January 1998 to December 1998

The economic crisis hit hardest on Indonesia throughout 1998, but interestingly corporate domains (.co.id) grew more than 100% from 1053 corporate domains at the end of 1997 to 2115 corporate domains at the end of 1998. The internet with the IIX is now an alternative for many companies to make it through the crisis. *To be noted, the Indonesian Top Level Domain authority has a very strict rule on giving corporate domains in Indonesia, unlike .COM the .co.id registrant has to be a legitimate Indonesian corporation which is proven by submiting a legal Company Identification or Tax number identity, each corporate may only have one domain which has to resemble the company name.*

d. Obstacles in the growth of Indonesian Internet

The largest cost of any Internet Service Provider in Indonesia is international connectivity, that is the total amount paid to Indosat as the local carrier and the carrier outside of Indonesia. These expenses can contribute 60% - 80% of an ISP's total monthly cost. The high cost of these connections causes the slow growth of bandwidth capacity and many ISP's are forced to have more clients than the capacity of their international connection. These causes slow connections to the internet for users and also the slow growth of the Indonesian internet.

Speed Kbps	Indosat 1/2 circuit	Global 1/2 circuit	Full Circiut
64	$8,500	$6,000	$14,500
256	$21,250	$12,000	$33,250
512	$38,250	$24,000	$62,250
1024	$51,000	$37,000	$88,000
2048	$76,500	$50,000	$126,500

Table 4 : Typical Internet Connectivity per month

From table 4 it can be seen how high international connectivity are from Indonesia.

2. Development of the Indonesian Internet Network

a. Asosiasi Penyelenggara Jasa Internet Indonesia (APJII)

The Association of Internet Service Providers of Indonesia was declared at the first National Conference on March 1996. The initial membership consist of 27 ISP's plus UI and ITB.

The programs formed during the first National Conference which will then play an important role in the development of the Indonesian internet are :

IDNIC Making the national internet registrar under UI which was before operated by volunteers and provided free of charge to a profesional registrar with charges for every register made. Registers will still be done by UI, but administrative billing will be done by APJII. This body will also be developed as an National Internet Registry (NIR) and be responsible in giving IP Allocations for Indonesia.

IIX Building an exchange that will connect all local traffic in Indonesia. The exchange which connects all the ISP's will be administered by APJII and be provided at no cost to every ISP in Indonesia.

b. Configuration of the IIX

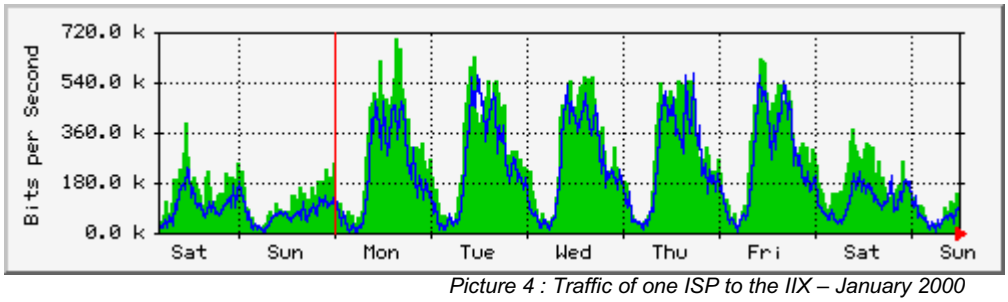
The IIX now connects all ISP's in Indonesia, all active ISP's including government owned TelkomNet and IndosatNet is now connected to APJII-IIX.

10 ISP's are connected through Leased Circuits (LC) to the IIX with connection speed of 512K – 2MBps the others are connected via ethernet. The IIX was configured to be easily expanded and maintained, it uses BGP4 routing protocol but still accepts static routing for ISP's who wishes to do so.

This first IIX node was capable of handling 8 x 2MBps serial connections and 4 x 10MBps ethernet Ports with each ethernet port connected to a 16-port ethernet switch/hub.

c. Benefits of IIX

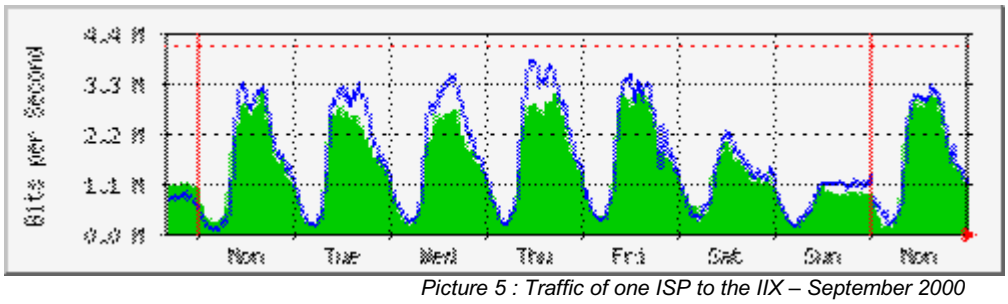
The following picture illustrates the bandwidth usage of one ISP to the IIX on January 2000 :



Picture 4 : Traffic of one ISP to the IIX – January 2000

As mentioned before 60% - 80% cost of an Indonesian ISP is it's bandwidth, from the above graph it is seen that 700KBps of traffic is going to the local internet. If this ISP is not connected to the IIX, the traffic will then be sent through it's international connection, so the ISP has saved a monthly amount of US$70.000. With 35 active ISP's it can be calculated the national amount saved.

With portals and e-commerce growing in Indonesia, this is the same ISP's traffic to the IIX 8 months later :



Picture 5 : Traffic of one ISP to the IIX – September 2000

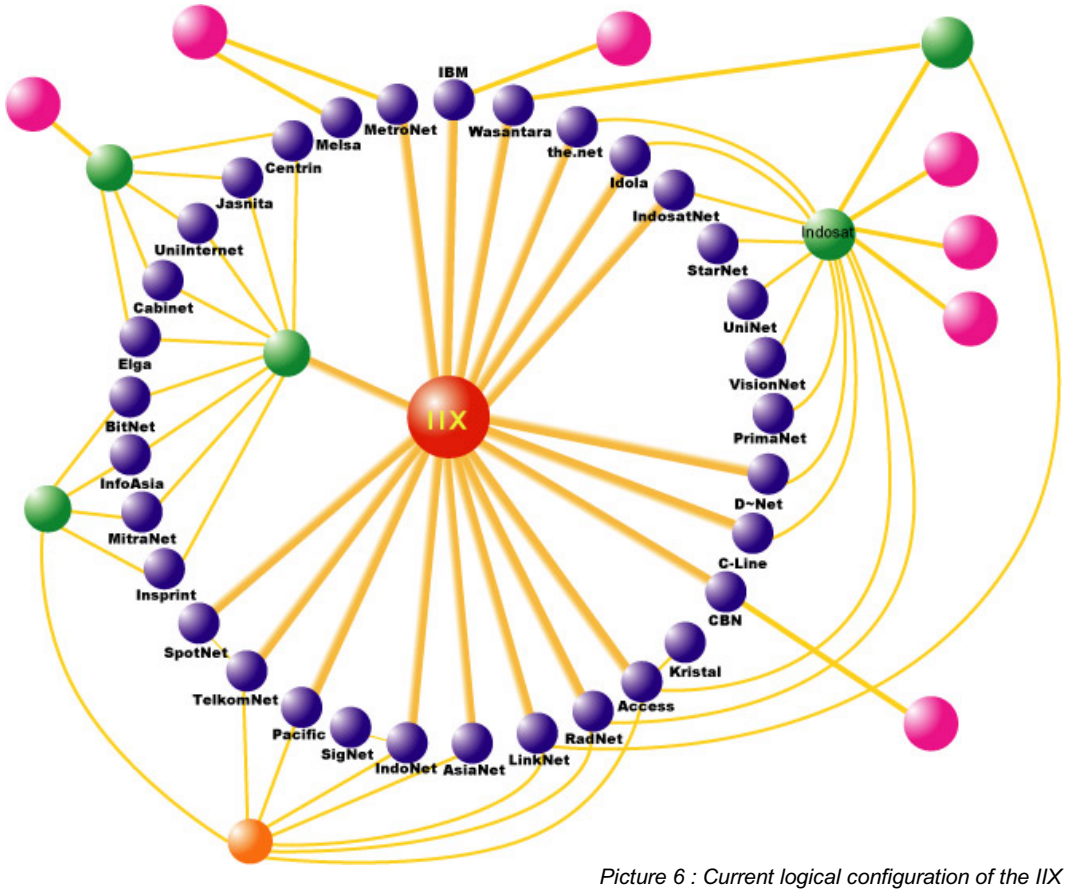
This ISP has now saved 4MBps of international connection amounting to a savings of US$250.000 per month.

3. Current status of the Indonesian Internet Exchange

The first IIX node was located at the Telkom Building and is handling 35 ISP's. The growth of the Internet in Indonesia has made the government issue more ISP licenses. There are now 80 new ISP licenses making a total of 126 ISP's in Indonesia with the new start-up ISP's operating as soon as they aquired the license. Portals has been rapidly developing in Indonesia, there are now nearly 200 well-known portals in Indonesia.

This growth has generated more traffic to the IIX and new problems arises from the local connectivity, since a local 2MBps connection is costly and insufficient to transport all the local traffic from an ISP to the IIX.

APJII is now operating the second IIX node, in cooperation with the newly launched Internet Data Centre Indonesia (IDC Indonesia). Carriers, ISP's and portals are relocating their Network Operations Centre (NOC) to the IDC, so the second IIX node will be located in the heart of IDC Indonesia. With this configuration every ISP will be able to connect via 10MBps, 100MBps, or GigaBit Ethernet to the IIX and not be limited by the local 2MBps lease circuit connection. This will eliminated the local loop charges and the ethernet interconnectivity will provide Indonesia with a 100MBps local internet backbone.



Picture 6 : Current logical configuration of the IIX

With nearly all ISP's peering with the IIX savings from international circuit are reduced significantlly, even so APJII as a non-profit organization maintains the administration of the IIX and is still free of port-charges and traffic charges for to ISP in Indonesia. It does however have a policy of one port for each ISP in maintaining neutrality.

APJII does not have a filtering policy on BGP and routes within the IIX. The IIX does not have a default route to the internet as can be seen in picture 6, the IP addresses used for interconnection is a fully qualified IP number but is never announced or routed outside of the Indonesian ISP, thus adding security to the network. APJII does however drop packets originating from private addresses (e.g. 192.168.xxx.xxx and 10.10.xxx.xxx) and multicasting addresses to minimize traffic overhead within the network.