

INE 3010 Lab Manual

Version 1.0

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I. Background Information

Each group will manage one regional enterprise network and one regional NSP network. They will set up their NSP network so as to connect to its regional IX and the enterprise networks. They do not need to set up or operate the IX but they will ask to observe the data in the IX and answer several questions in their lab report so as to ensure that they understand the operation mechanism of the IX.

Here is the task list of each group:

Each group will manage

- a. One regional enterprise network which includes
 - One VM host as router connecting to its NSP
 - One VM host as network server

The tasks in the enterprise network will be

- NSP connection
 - WEB and DNS setup
 - VPN setup with networks in other regional
 - Multi-homing connection
 - Management of different type of routing protocol, such as RIP, OSPF, IGRP & EIGRP, and BGP4
 - Looking glass setup
- b. One regional NSP network which includes
 - One Cisco router connecting NSP backbone network, enterprise network, its POP, and other regional NSP networks.
 - One VM host as POP connection to the regional IX

- One VM host as the NSP network router
- One VM host as the NSP network server

The tasks in the NSP network will be

- Connection setup to its client network (i.e. Enterprise network)
- POP set up to connect the regional IX
- Management of different type of routing protocol, such as RIP, OSPF, IGRP & EIGRP, and BGP4
- Looking glass setup
- IP accounting and some network management tasks (e.g. SNMP, NETFLOW, and MRTG)

Hence, each group will manage the following equipment:

Equipment	For
One Cisco 1721 router	Core router of the NSP backbone network connecting enterprise network, its POP, and other regional NSP networks
One catalyst 2950 switch	Core switch of the NSP backbone network
Five VM hosts	One for the NSP's POP connecting regional IX One for the Enterprise network router One for the Enterprise network server One for NSP internal network router One for the NSP network server

Each group does not need to set up or manage the IX but they are required to observe the data of its connected IX and answer some questions about IX operation mechanism in their lab report, such as BGP route table and route path.

Task in Lab 1 (Two weeks, 15 Marks)

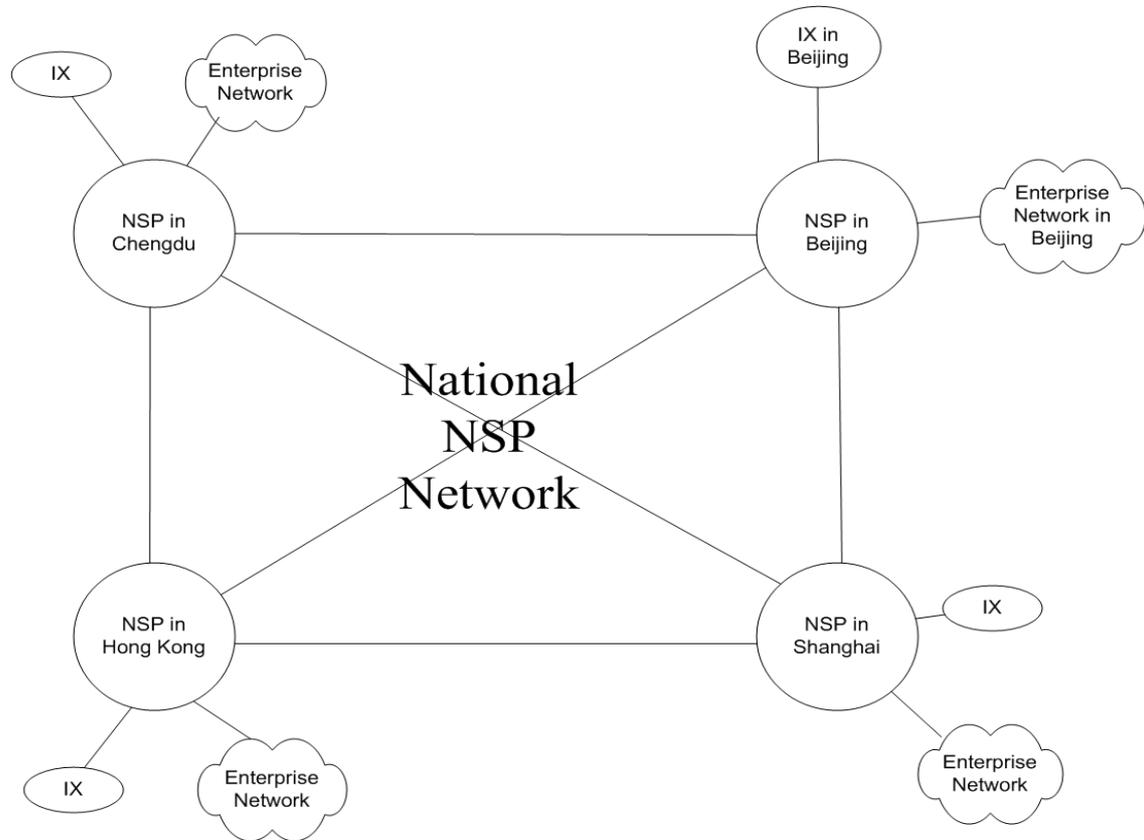
- Setting up the NSP network infrastructure
- Configure the router, switch and serial links
- Connecting to other NSP network in other regions
- Setup OSPF and IBGP for the NSP

Task in Lab2 (One Week, 10 Marks)

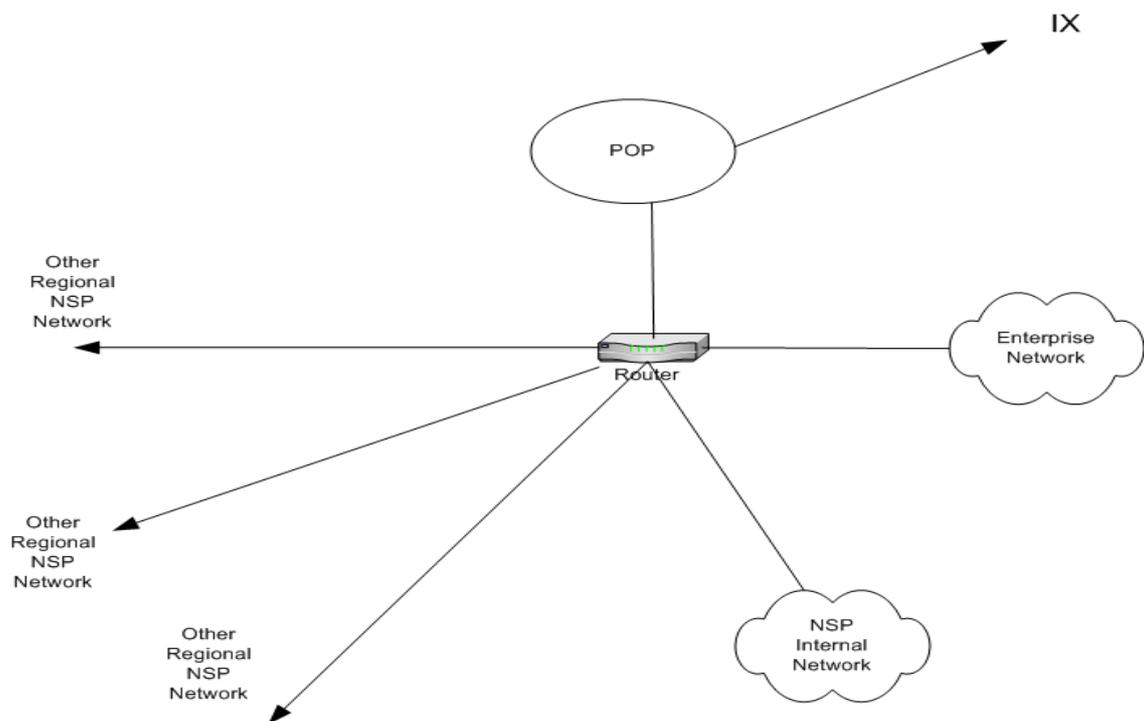
- Connecting to its regional IX
- Setup the BGP for the connection to other NSPs through the IX
- Exam data in IX servers

II. Network Diagram

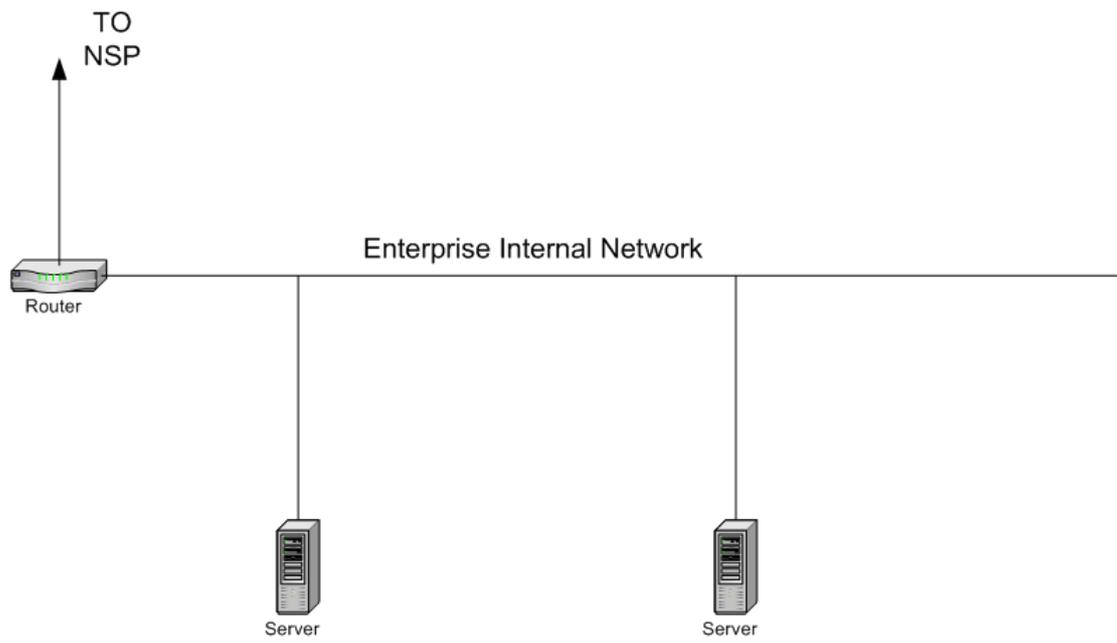
Network Diagram of a national NSP



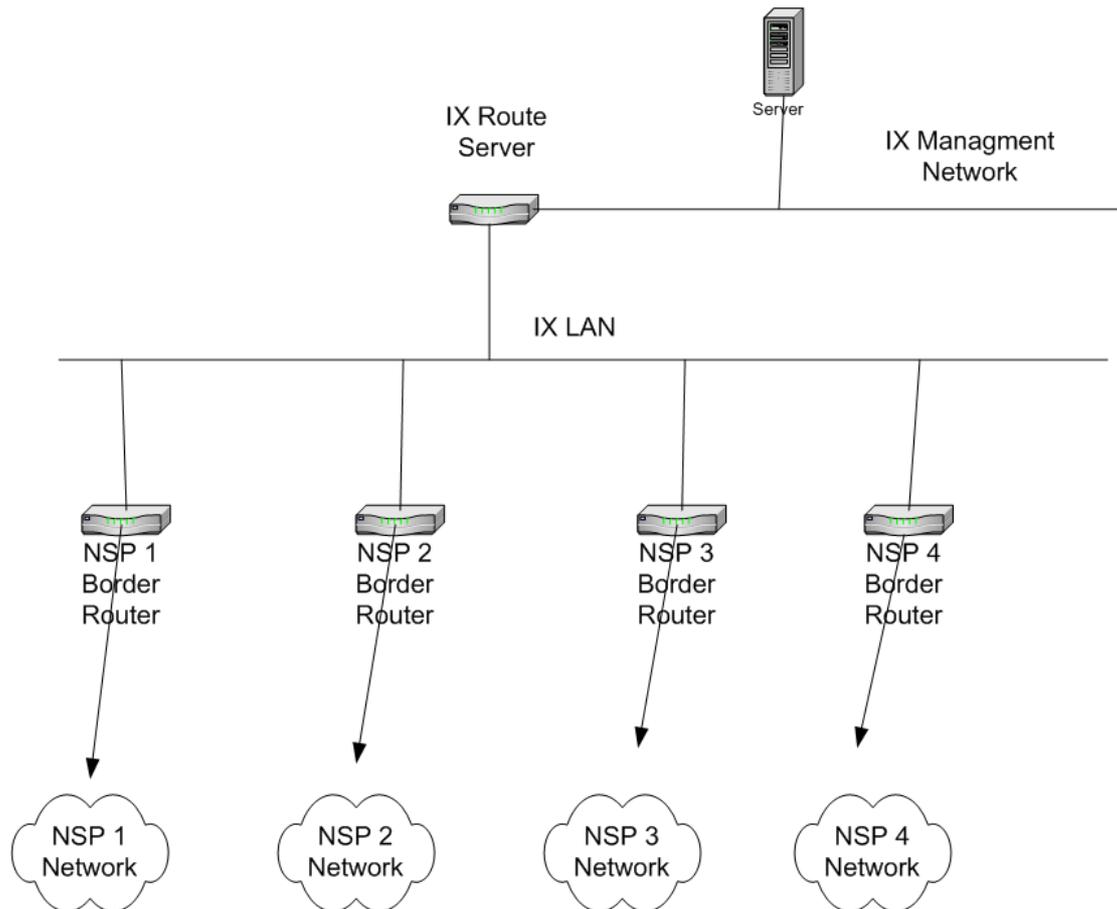
Network Diagram of a regional NSP



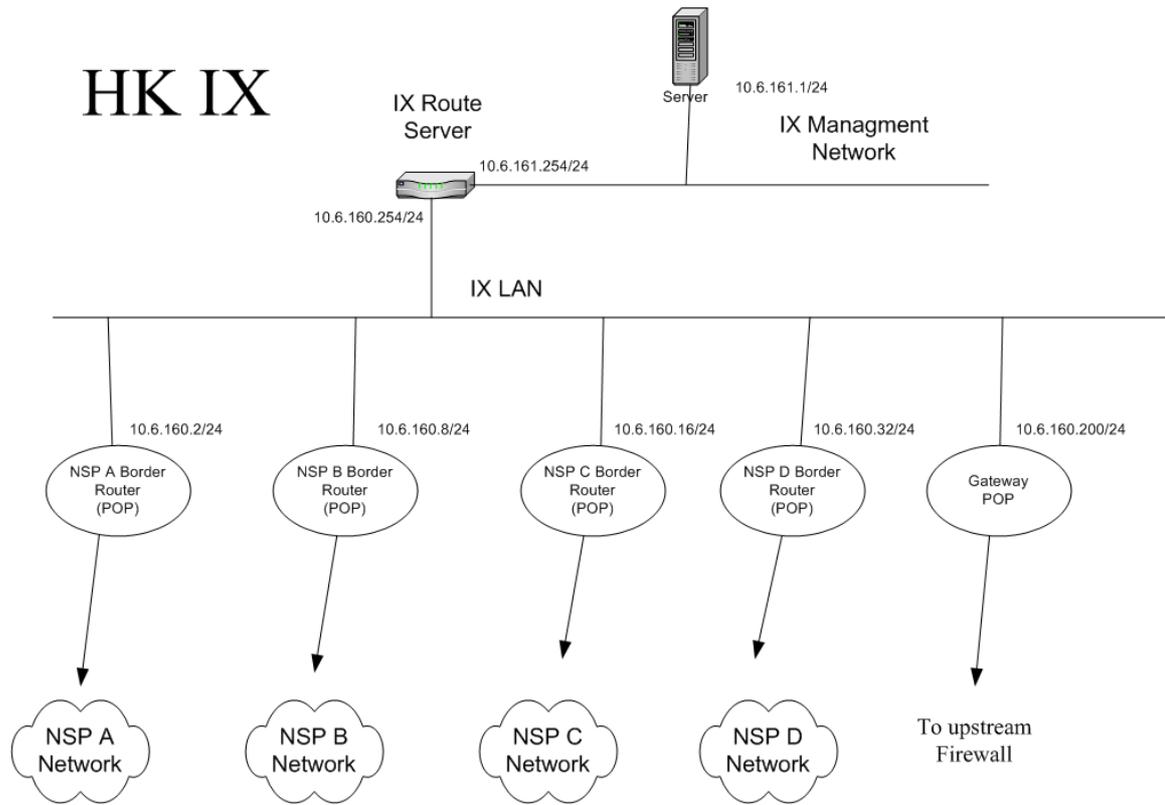
Network Diagram of regional enterprise network



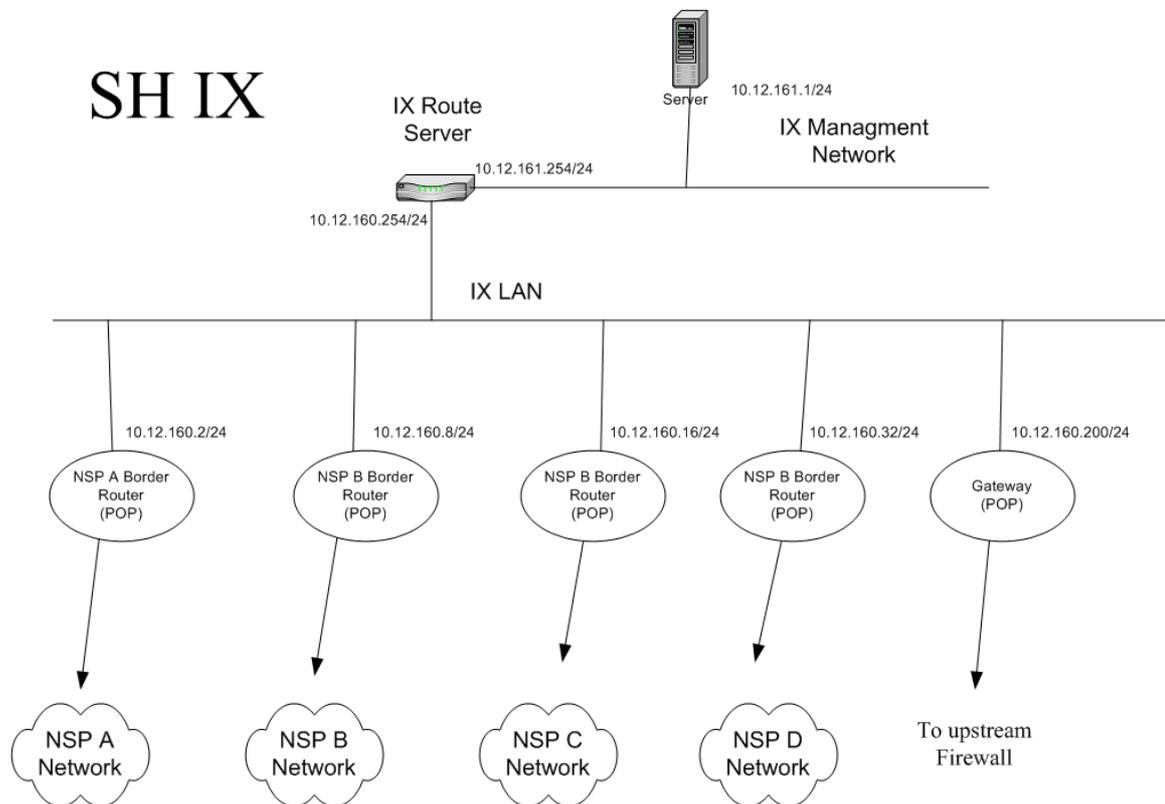
Network Diagram of an IX



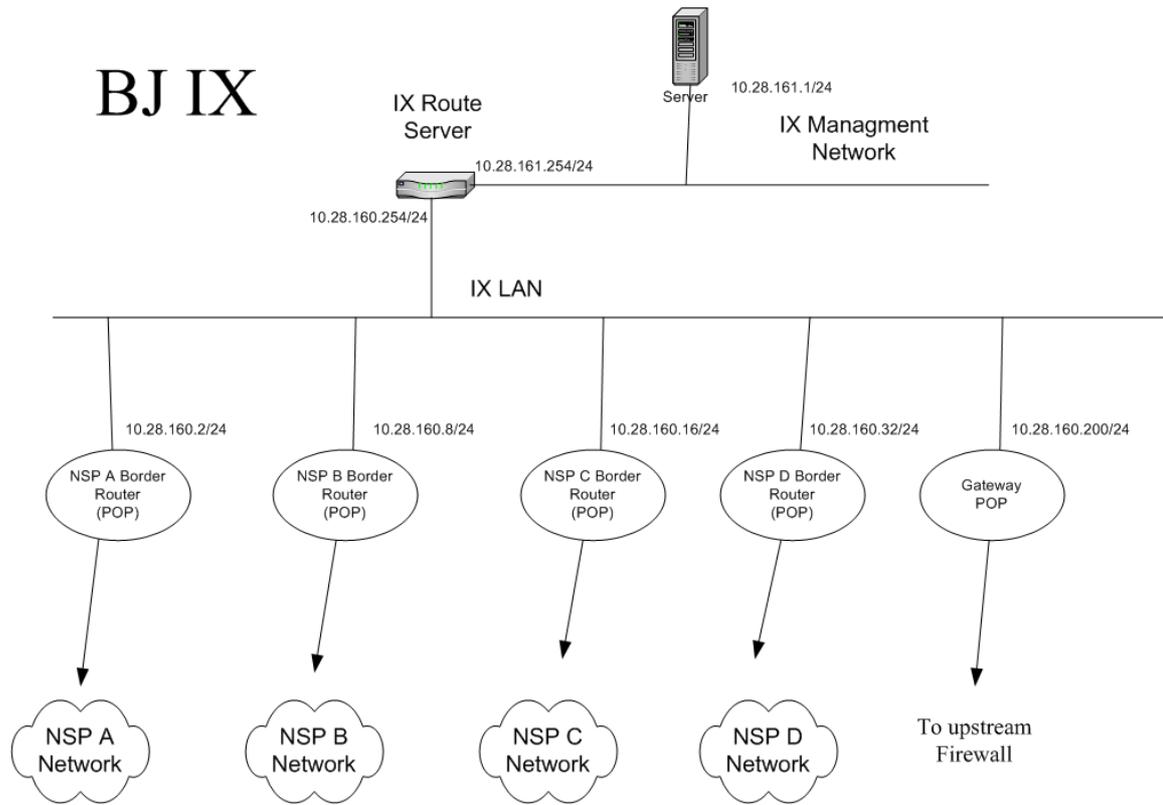
Network Diagram of HKIX



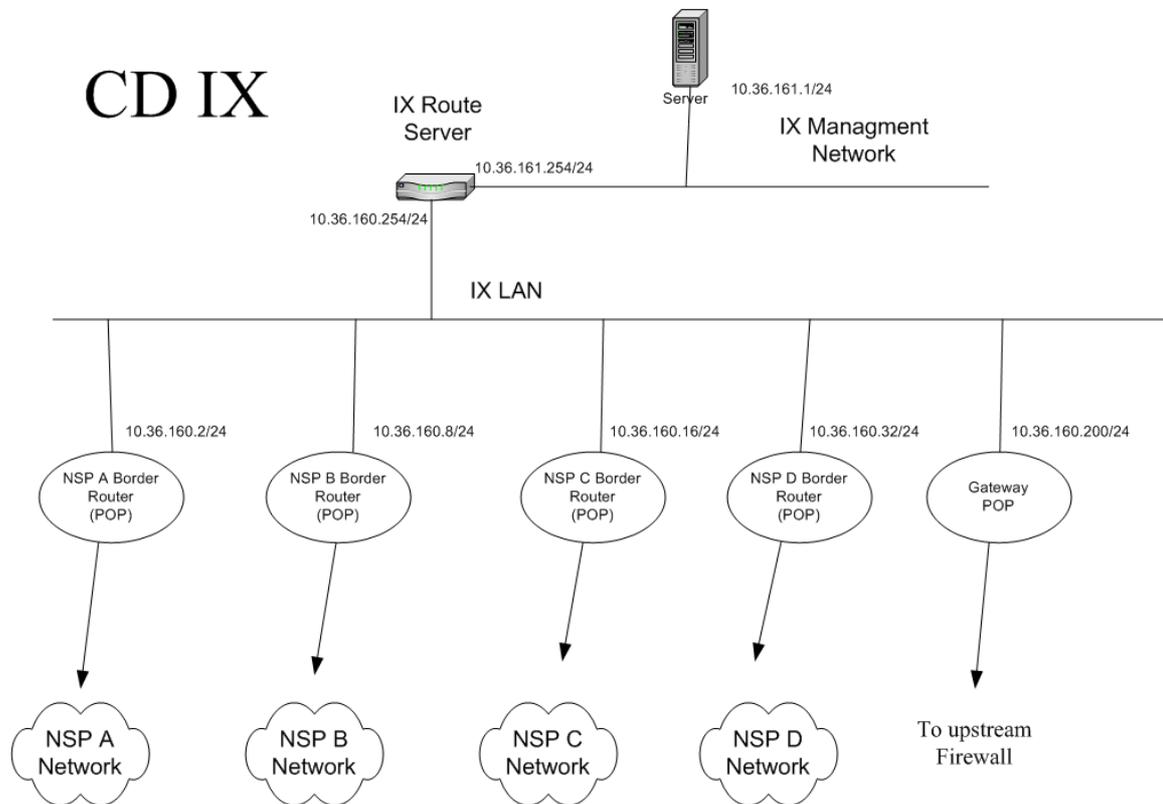
Network Diagram of SHIX



Network Diagram of BJIX



Network Diagram of CDIX



III. Address allocation

Branch Office

Enterprise	Hong Kong	Shanghai	Beijing	Chengdu
A	10.2.2.0/24	10.2.16.0/24	10.2.32.0/24	10.2.64.0/24
B	10.8.2.0/24	10.8.16.0/24	10.8.32.0/24	10.18.64.0/24
C	10.16.2.0/24	10.16.16.0/24	10.16.32.0/24	10.16.64.0/24
D	10.32.2.0/24	10.32.16.0/24	10.32.32.0/24	10.32.64.0/24

Regional NSP

NSP	Hong Kong	Shanghai	Beijing	Chengdu
A	10.2.128.0/24	10.2.136.0/24	10.2.144.0/24	10.2.152.0/24
B	10.8.128.0/24	10.8.136.0/24	10.8.144.0/24	10.8.152.0/24
C	10.16.128.0/24	10.16.136.0/24	10.16.144.0/24	10.16.152.0/24
D	10.32.152.0/24	10.32.136.0/24	10.16.144.0/24	10.32.152.0/24

IX

Hong Kong	Shanghai	Beijing	Chengdu
10.6.160.0/24	10.12.160.0/24	10.28.160.0/24	10.36.160.0/24

AS number for IX

Hong Kong IX	Shanghai IX	Beijing IX	Chengdu IX
100	200	300	400

AS Number for NSP

NSP A	Core	1000
	POP connecting HKIX	1100
	POP connecting SHIX	1200
	POP connecting BJIX	1300
	POP connecting CDIX	1400
NSP B	Core	2000
	POP connecting HKIX	2100
	POP connecting SHIX	2200
	POP connecting BJIX	2300
	POP connecting CDIX	2400

NSP C	Core	3000
	POP connecting HKIX	3100
	POP connecting SHIX	3200
	POP connecting BJIX	3300
	POP connecting CDIX	3400
NSP D	Core	4000
	POP connecting HKIX	4100
	POP connecting SHIX	4200
	POP connecting BJIX	4300
	POP connecting CDIX	4400

IV. Interface connections of equipment

VM hosts

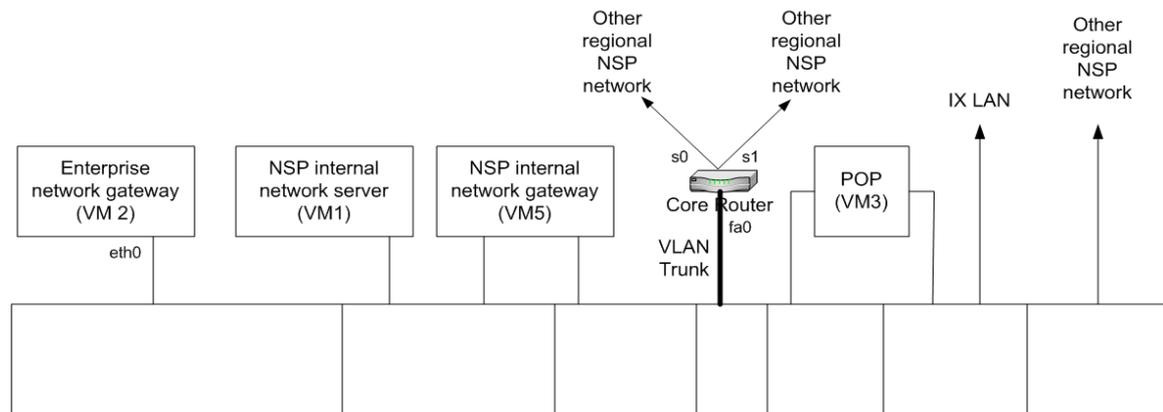
Hosts	Interface	Network
VM1: NSP network server	Connecting VM5	VLAN
VM2: Enterprise network gateway	Connecting VM4	internal hub
	Connecting NSP router	VLAN
VM3: NSP POP connecting regional IX	Connecting regional IX	VLAN
	Connecting NSP router	VLAN
VM4: Enterprise network server	Connecting VM2	internal hub
VM5: NSP internal network gateway	Connecting VM1	VLAN
	Connection NSP router	VLAN

Cisco 1721 Router: NSP regional backbone router

Interface	Connection	Network
Serial 0 (DCE)	Other regional NSP router	Null serial link
Serial 1 (DTE)	Other regional NSP router	Null serial link
FastEthernet (fa0)	NSP regional backbone switch	FastEthernet Trunk
Sub-interface of fa0	Other regional NSP router	VLAN
	POP connecting regional IX	VLAN
	Enterprise network gateway	VLAN
	NSP internal network gateway	VLAN

Catalyst 2950 switch: NSP regional backbone switch

Port	Connection
Fa0/1	VM1 eth0
Fa0/2	VM2 eth0
Fa0/3	VM3 eth0
Fa0/4	Shutdown this port
Fa0/5	VM5 eth0
Fa0/6	VM3 eth1
Fa0/7	IX LAN
Fa0/8	Cisco 1721 Fa0
Fa0/9	VM5 eth1
Fa0/10	Other NSP regional router



VLAN Partition of the Core Switch

V. LAB Sheet Outlines

LAB 1 (2 weeks and 15 marks)

I. Basic network infrastructure setup

- Setup and configure the core switch and core router for the regional NSP (VLAN assignment, partition and serial link configuration)
- Setup the servers and NSP internal network gateway
- Setup OSPF in core router and NSP internal network gateway (using zebra)
- Co-operate and test the OSPF with other regional NSPs
- Setup BGP in core router
- Co-operate and test the BGP with other regional NSPs
- Set route policy based on some general principles

II. Add-on services to network infrastructure

- set up looking glass on router and gateway

Lab1 report Specification

- describe the setup procedures and steps in building up and operating the NSP
- explain the OSPF design in the NSP with examples

LAB 2 (1 week and 10 marks)

I. Basic network infrastructure setup

- setup the POP for connecting to IX
- extend BGP to POP
- extend the OSFP to POP
- connect POP to regional IX
- inject NSP route into BGP
- inject routes learned from IX into OSFP
- test the connection and route with other NSPs

II. Add-on services to network infrastructure

- set up looking glass for POP
- pump traffic across IX to other NSP (generate ftp or http traffic)
- set up netflow for IP accounting on AS

Lab 2 Report specification

- describe the setup procedures and steps in building up and operating the POP
- explain the working principle in IX with examples