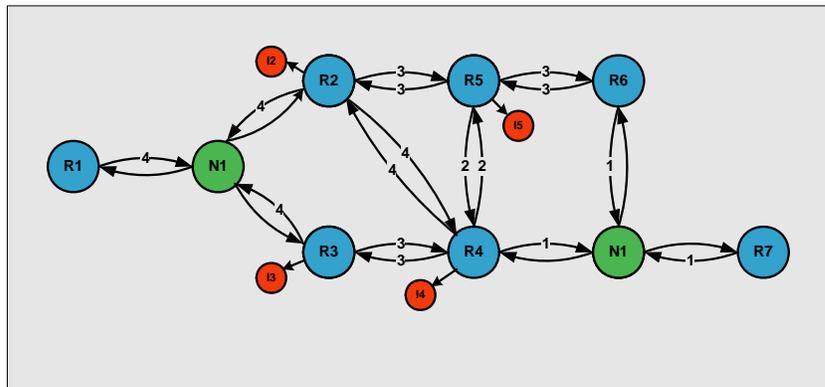


**NETMASTERCLASS**  
**ROUTING AND SWITCHING CCIE® TRACK**

# DOiT-200v6

# VOLUME II



**DOiT-200v6 SAMPLE Lab**  
**Multi-Topic CCIE-Level Scenario**

**For CCIE® Candidates**



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## Introduction

Thank you for downloading the DOIT-V6 Sample lab scenario. This lab is designed to reflect the changes in the CCIE lab that go into effect in January, 2006. Namely, this lab includes sections dedicated to configuring IPv6, QOS, 12.3 and 12.4 features.

This lab is not in the workbook and is considered a sample lab. It is designed to provide you with an understanding of what is included in the scenarios and answer key of the DOIT workbook. This sample lab also provides you with a full exposure to the equipment and cabling requirements that need to be fulfilled to complete the labs in the DOIT workbook. If you are using your own equipment in your lab, we recommend you review this document closely to determine compatibility.

It is a goal of NetMasterClass to provide a complete “end to end” suite of products and services to help you prepare for your CCIE lab exam. While the DOIT workbook is a key component of this “end to end” suite of services, it is one of many other services that NetMasterClass provides.

The NetMasterClass slogan of “LEARNiT™, READiT™, DOiT™, CHECKiT™, SHOWiT™, DISCUSSiT™” and RENTiT™ reflects our commitment to providing an end to end suite of CCIE lab prep products and services. We invite you to take a few minutes to learn more about NetMasterClass before continuing through this sample lab.

Listed below is a brief description of each of the NetMasterClass offerings:

### **LEARNiT™: Publicly Scheduled NetMasterClass Courses**

Since 1997, the NetMasterClass staff has been delivering CCIE preparation courses. No other company possesses this level of experience. The NetMasterClass training staff was the first in the market to deliver a rigorous CCIE preparation class. The NetMasterClass training staff are the original innovators in developing the “issue spotting and analysis” teaching technique. This technique is applied in all of its education products and services. The current course offerings of NetMasterClass include:

#### **Routing and Switching NetMasterClass One (RS-NMC-1)**

This five day intensive hands-on class exposes students to a range of CCIE topics in the NetMasterClass “issue spotting and analysis” format. The course is intense. Be prepared to work late into the night during RS-NMC-1. Bruce Caslow, Val Pavlichenko and Bob Sinclair teach each class. The class is limited to only eight students per class. Therefore there is roughly a 3 to 1 student to instructor ratio. A CCIE is in the classroom to assist with lab questions as you work late into the night. Each student is provided with their own pod of equipment that is composed of 2600/3600 routers and two Catalyst 3550 switches.

All RS-NMC-1 answer keys are accessible via NMC’s revolutionary SHOWiT engine. SHOWiT allows access to NMC-1 Answer Key material via a web-based highly interactive user interface. Accessing your Answer Keys with SHOWiT is like access a live pod of Cisco equipment with the Answer key configured on it.

#### **Routing and Switching NetMasterClass Two (RS-NMC-2)**

This five day class and is the sequel to RS-NMC-1. It is strongly recommended that you take RS-NMC-1 before attending RS-NMC-2. This class focuses on performing several 8-10 hour issue spotting and analysis exams. Each lab that students perform is graded by NMC’s CHECKiT technology. The final configurations of each student’s exam along with the a set output from over 1000 IOS “show” commands

is captured via NMC's SHOWiT technology. This massive amount of output is presented to user using the interactive IOS CLI like web interface and will be directly compared to the Master Answer Key's corresponding output.

The intensity of RS-NMC-2 class is even greater than RS-NMC-1. Again, be prepared to work late into the night during RS-NMC-2. Again, Bruce Caslow, Val Pavlichenko and Bob Sinclair will lead the teaching effort in this class.

<http://www.netmasterclass.net/site/description.php> - course descriptions

<http://www.netmasterclass.net/site/schedule.php> - schedules

**Consider the following financing options when enrolling in an NMC class.**

**NetMasterClass is a "Virginia Proprietary School".** This designation allows NMC to provide Sallie Mae SLM student financing. Contact the NMC sales staff for more details at [sales@netmasterclass.net](mailto:sales@netmasterclass.net)

**NetMasterClass is a "Veteran's Approved" training facility.** If you are a veteran and you have educational training benefits, contact the NMC sales staff at [sales@netmasterclass.net](mailto:sales@netmasterclass.net) to see how you can apply your Veteran's benefits to attain CCIE preparation training.

**READiT™:** Technical Library – A collection of technical articles and links to assist in leaning more about the technologies required to pass the CCIE lab exam. While this section is publicly accessible, a more extensive repository of NMC developed CCIE preparation materials can be found at the NMC members web portal. The contents of this web portal are described later in this marketing section.

The articles available at: <http://www.netmasterclass.net/site/lib.php>

### **DOiT™: The CCIE Scenarios Lab Book**

A recommendation we have for all of our CCIE lab candidates is "Perform as many well thought out issue spotting and analysis scenarios as possible". The DOiT Lab book provides 25 8-10 hour long scenarios to help you fulfill this recommendation. Each of the DOiT labs possesses the following characteristics:

- Each lab is based upon seven routers and two 3550 switches.
- Each lab uses the same underlying cable scheme so that you do not need to perform extensive recabling for each lab.
- Each lab is packed full of hidden issues and challenges to test your knowledge level and analysis skills of internetworking topics.
- If a lab task becomes too challenging, you can access a "Helpful Hints" appendix.
- Each lab comes with a detailed answer key that is made up of two primary sections: (1) a "Spot the Issues" answer key in PDF format and (2) a repository of the output of over 1000 IOS show commands that comprise the state of a DOiT pod at the end of completely performing a given DOiT scenario. This repository is accessible via the NMC **SHOWiT** engine. Each of these sections is described in detail below:

- **The DOIT “Spot the Issues” Answer Key** provides highly detailed descriptions of how to perform each task in a given DOIT scenario. Each section is divided into three subsections: (1) a task description and explanation, (2) a task configuration section and (3) a task verification section. Many sections, most notably BGP and IP Multicast are accompanied by detailed diagrams to help “visualize” a given Scenario’s configuration requirements for these specific topics. Finally, each lab’s “Spot the Issues” Answer Key contains a detailed Redistribution section with a detailed diagram and table.
- **The NMC SHOWiT engine** brings your DOIT answer keys alive! The **SHOWiT** engine captures the complete state of a rack of routers that has been successfully configured for all tasks in a given DOIT Scenario. You can query the SHOWiT engine with over 1000 familiar IOS “show” commands. You can also query the **SHOWiT** engine with a collection of NMC proprietary commands such as “show all”. For more details on **SHOWiT**, go to: <http://www.netmasterclass.net/site/member.php> . At this page, please login with the username of “demo” and the password of “demo”.
- <http://www.netmasterclass.net/site/doi1.php> - This link provides complete information on the DOIT lab workbook.

#### **RENTiT™: On-Line Rack Rentals**

NetMasterClass partners with equipment rental providers. These partners are committed to supporting the NetMasterClass workbook and class labs.

<http://www.netmasterclass.net/site/rentit.php> - Equipment rental partners

#### **CHECKiT™: On-line Graded CCIE Practice Labs with Voluminous Feedback**

**CHECKiT** is a NetMasterClass exclusive. It applies an automated grading engine to a scenario to provide the CCIE candidate with a detailed multi-page report of what the candidate did correctly in a given scenario and what the candidate missed. The multi-page report contains multiple sections focusing on individual internetworking topics such as OSPF, BGP, EIGRP, etc. As a result, **CHECKiT** provides the CCIE candidate with an objective assessment of where he or she stands in the preparation effort to becoming a CCIE. NetMasterClass plans to apply the **CHECKiT** technology to multiple scenarios.

All **CHECKiT** labs also utilize the **SHOWiT** engine. Each **CHECKiT** lab uses the **SHOWiT** engine to all users to compare the complete state of their pod’s operation at the end of the lab with the master pod’s state. **SHOWiT** allows you to enter over 1000 IOS commands so that you can compare your pod’s final state with that of the master pod’s. Therefore, **CHECKiT** provides you with more than just a grade and assessment. It provides you with these things, but it also provides an invaluable learning experience. When **CHECKiT** is coupled with **SHOWiT**, you can obtain a voluminous amount of feedback on your performance of a practice CCIE lab.

For more information on CHECKiT, go to: <http://www.netmasterclass.net/site/checkit.php>

#### **DRILLiT™: On-line Graded CCIE Practice Mini-Labs with Voluminous Feedback**

**DRILLiT** Scenarios’ are the little brother of **CHECKiT** Scenarios. **DRILLiT** scenarios contain all of the features of a **CHECKiT** scenario with one exception: while **CHECKiT** scenarios are 8 hours in length and contain 16-18 topics each, **DRILLiT** scenarios are three-four hours in length and contain far fewer topics. Like **CHECKiT**, each **DRILLiT** lab is a graded lab the comes with an accompanying **SHOWiT** repository.

### **DISCUSSiT™: An On-line Discussion Forum for DOiT Purchasers and NMC Students**

NetMasterClass maintains an e-mail based discussion forum that is reserved only for its students and purchasers of DOiT lab book. The forums provide NMC students and DOiT workbook purchasers access to other people who are working on the same NMC supplied material. These forums allow you to get answers to questions quickly as you access NMC supplied CCIE preparation study material. You can view the e-mails posted via a web accessible interface that organizes e-mails by topics. Popular topic classifications include: topics organized by referencing a specific DOiT scenario or topics organized by referencing a specific internetworking technology.

To access the DISCUSSiT forums, go to: <http://bbs.netmasterclass.com/6/ubb.x>

#### **The NMC “Members” Web Portal.**

**To tie together all of NMC CCIE preparation products and services, NMC has developed a comprehensive CCIE preparation web portal. The web portal provides a single access point to view all DOiT Answer Keys as well as a user’s CHECKiT and DRILLiT results. The members page also provides access to the following resources:**

- **Multiple Choice/Fill in the Blanks Mini-Assessment Quizzes**
- **A Detailed Self-Assessment/User Profile Page that Divides the CCIE Preparation Process into Three Phases**
- Access to the NMC Technical Library. The NMC Technical Library contains hundreds of pages of technical documentation on the full range of CCIE topics. It also contains dozens of useful decision diagrams and technology specific checklists.

To view the NMC “members” web portal, go to: <http://www.netmasterclass.net/site/member.php> . At this page, please login with the username of “demo” and the password of “demo”.

**Access to the NMC web portal is provided on a subscription basis. To find out more about purchasing access to the NMC web portal, contact [sales@netmasterclass.net](mailto:sales@netmasterclass.net).**

## General Guidelines for Performing Each DOIT Exam

This sample lab acts as a representative sample of a DOIT workbook lab. Please read the following guidelines that help you get an orientation towards the format of this lab as well as the format of all the DOIT workbook labs.

Each DOIT exam is an 8+ hour long scenario consisting of at least sixteen inter-related internetworking tasks that are presented in an “issue spotting and analysis” format. What is meant by the phrase “issue spotting and analysis” is that you must CAREFULLY read the entire exam and spot the underlying hidden issues embedded within the stated exam tasks. Once you have carefully read the tasks in a specific exam, you must analyze and identify the range of possible solutions for each given task. After evaluating the different configuration options you have identified for a specific issue, you must select and implement the most appropriate configuration option that best matches the stated exam requirements. In summary, if you cannot spot the underlying hidden issues contained within the listed tasks of an exam, you cannot successfully perform a given exam.

Prerequisites for successful completion of any of the DOIT exams are:

1. A thorough understanding of all possible methods of configuring a specific type of internetworking technology. You must know what all of your options are to configure a specific internetworking technology. In order to attain this level of understanding, you must also possess a clear awareness of how the technology operates.
2. Not only must you know how to successfully configure a given technology, you must also be aware of that same technology’s vulnerabilities and points of failure.

### A Sample Issue Spotting and Analysis Task

A sample of an issue spotting and analysis task is presented below:

Here is a description of the topology relevant to the task:

You are provided with a single IP subnet configured on a hub and spoke Frame-Relay topology composed of three routers. Router R1 is the hub router and routers R2 and R3 are the spokes. All routers have their base Frame-Relay and IP configurations on a physical Serial interface. No Frame-Relay subinterfaces are used in this task.

Now, here is the issue spotting and analysis task:

***“Configure OSPF over the Frame-Relay topology described above using the default OSPF network types.”***

From this single sentence task, your issue spotting and analysis activities should have included the following elements:

- Special attention must given to the last phrase of the task sentence “using the default OSPF network type”.

- Since you possess a thorough understanding of the operation of OSPF, you have committed to memory all OSPF network types. You have also committed to memory the default OSPF network types for the type of Data-Link layer interfaces you can encounter on the CCIE lab. For example, you know that the default OSPF network type for Ethernet is broadcast and the default OSPF network type for a physical NBMA interface – Frame-Relay – is non-broadcast. If you wanted to make sure of the default OSPF network type for a specific interface, you would enter the following IOS show command: “show ip ospf interface”. Therefore, you know you must configure the OSPF non-broadcast network type on the supplied hub and spoke Frame-Relay topology.
- Now, you must spot the two underlying “hidden” issues related to this sample task:
- Hidden issue #1: the OSPF non-broadcast network type does not advertise HELLO’s using the ALLSPFROUNTER’s multicast address 224.0.0.5. It uses a destination unicast address that must be manually supplied with a neighbor statement for each OSPF neighbor. The neighbor command is configured under the OSPF routing process.
- Hidden issue #2: We have a DR/BDR election problem on this hub and spoke topology. Here’s an explanation: The OSPF non-broadcast network type performs a DR/BDR election for the segment it is configured on. All routers on a non-broadcast segment can be classified into the following three categories that relate to DR/BDR elections: a router can be the one and only DR for a segment, a router can be the one and only BDR for a segment; if a router is neither a DR or BDR, it is a DROTHER. In this sample configuration task, it appears that one router will be the DR, one will be the BDR and one will be the DROTHER. However, if OSPF is to function properly, this cannot be. In conformance with the operation of OSPF, one router will be the DR; however, no router will be the BDR. In order for OSPF to function properly on a segment configured as a non-broadcast network type, all DROTHER routers must form an adjacency with both the DR and BDR routers. Since all OSPF packets have a TTL = 1, one spoke router will never form an adjacency with another spoke router. Therefore, no spoke can be either a DR or BDR router. The remedy to this hidden issue is to configure the following interface configuration command on the Frame-Relay interfaces of the spoke routers: “ip ospf priority 0”. An OSPF router with a configured priority of 0 is a non-candidate DR/BDR router. Stated another way, an OSPF router configured with the interface command “ip ospf priority 0” cannot be elected DR or BDR. If we force the spoke routers to always be DROTHER routers, R1 will always be the DR. No BDR is elected on this segment.

There is more to be said about this configuration task. A more in depth discussion of the topic will be supplied in the answer key of one of your exams. You will encounter this very scenario in one of your exams. Be on the lookout for it. This sample analysis shows you how a single configuration task can contain multiple hidden issues.

It is said of many issue spotting and analysis exams, “You must pay close attention to what is said in such an exam as well as what is left unsaid”.

In the sample task above, you would have had great difficulty in identifying and solving the hidden issues related to configuring the OSPF non-broadcast network type over a hub and spoke Frame-Relay network if you did not have a clear and solid understanding of the operation of OSPF as well as configuration limitations of OSPF.

### Now Let’s Get Ready for the Challenge

You now have ample and thorough warning. The following scenarios are full of hidden issues. It is estimated that each exam will take at least eight hours to complete. When reading each exam, keep in mind the following two points:

1. Many of the exam tasks are worded in a vague and apparently confusing manner. They are deliberately worded in such a manner to help strengthen your issue spotting and analysis skills.
2. Many of the exam tasks run counter to commonly recognized internetworking design principles. These exams are not designed to re-enforce commonly recognized internetworking design principles. They are designed to see how internetworking professionals think under complex and difficult situations. They are designed to test an internetworking professional's analysis skills when they are applied to complex and counterintuitive situations.

**THEREFORE, BE PREPARED FOR STRANGELY WORDED TASKS THAT DO NOT ADHERE TO COMMONLY ACCEPTED INTERNETWORKING DESIGN PRACTICES.**

When performing these exams, resist the temptation to go immediately to the answer key to learn the suggested answer for a given task. Try to spot the issues and perform the tasks to the best of your abilities.

Some other general guidelines to remember when performing this test are:

- Keep track of your time while you are performing each exam. Attempt to simulate the actual exam experience as much as possible.
- Carefully read the entire exam before actually beginning any router or switch configuration.
- Remember the "Goals and Restrictions" section provided at the beginning of each exam. These stated "Goals and Restrictions" apply to all tasks in the exam unless stated otherwise.
- Be on the lookout for words and key phrases such as: "only" and "do not" in any of the tasks.
- Prioritize your topics. Determine which topics you are going to perform first.
- Consider all of the possible options for solving a given task THEN pick the best solution among the options considered.

## How to Interpret the Goals and Restrictions Section

The following are interpretations to the most commonly used Goals and Restrictions listed at the beginning of each scenario:

### 1. ***Do not use any static routes.***

Static routes can be used to provide a non-robust “stopgap” solution to a range of reachability problems. However, in the DOiT exams, use of static routes will be highly restricted. For the majority of your reachability requirements, you must rely on skillful configuration of your unicast routing protocols.

### 2. ***Network 0.0.0.0/0 should not appear in any routing table (show ip route)***

A 0.0.0.0/0 entry can be used to solve a range of reachability problems. It can be used in some type of OSPF stub area router to provide a default route. In many exams, the use of any 0.0.0.0/0 entries will be restricted. When you see the restriction stated above at the beginning of a Scenario – “***Network 0.0.0.0/0 should not appear in any routing table (show ip route)***” – this means that the 0.0.0.0/0 entry cannot appear in any router or switch IP forwarding table. The absence of the 0.0.0.0/0 entry can be verified with the “show ip route” command. This restriction does not mean that you cannot enter configurations that automatically generate a 0.0.0.0/0 entry. For example, when you configure variations of OSPF stub areas, a 0.0.0.0/0 entry is created. These configurations will be permissible, however, if you see the restriction above, “***network 0.0.0.0/0 should not appear in any routing table***”, make sure the 0.0.0.0/0 entry does not show up in any of your device’s routing tables. NOTE: If you wanted to use the 0.0.0.0/0 entry to solve an incomplete routing information issue, some suggested alternatives to using the 0.0.0.0/0 route to solve these problems are route summarization or configuring the “ip default-network” command.

### 2. ***All IP addresses involved in a given scenario must be reachable.***

This is a key goal to observe. This requires that all of your IGP’s are configured properly. Also, all of your routing policy tasks must be configured properly. The key elements of your routing policy include route redistribution and the controlling of routing updates using distribute-lists, route-maps and the distance command. A key point to remember about many of these exams is: the term “redistribution” may not be explicitly stated. However, if the General Goals and Restrictions section of a given exam state that “all IP addresses involved in a given scenario must be reachable”, you will more than likely need to perform redistribution in order to assure that all IP addresses are reachable.

### 3. ***Use conventional routing algorithms***

This restriction prevents you from solving any problems by configuring policy routing. At the heart of this restriction, is the interpretation of the phrase “conventional routing algorithms”. Although this phrase can be interpreted in a number of different ways, the interpretation applied in this workbook is: CONVENTIONAL ROUTING ALGORITHMS ARE ROUTING ALGORITHMS THAT APPLY DESTINATION BASED PREFIX LOOKUPS IN A ROUTING TABLE. CONVENTIONAL ROUTING ALGORITHMS DO NOT USE ANY OTHER TYPE OF INFORMATION OTHER THAN THE DESTINATION ADDRESS TO MAKE A PACKET FORWARDING DECISION. Due to this restrictive interpretation, no form of policy routing can be applied. Whenever you see this restriction, you will need to use dynamic routing protocols to fulfill all packet forwarding requirements.



**The following pages and Appendix A contain diagrams of the DOiT network topology. With this topology, you have to cable up your routers only once. YOU NEVER NEED TO RECABLE from scenario to scenario.**

- You do not need more than six traditional routers, two switches, one terminal server and one frame switch to be able to perform complex 8+hour long CCIE level scenarios.
- You do not need extra routers for backbone simulation! You can simulate the backbone perfectly using the number of routers listed in the hardware table provided below.
- All scenarios use the same consistent topology. See the diagram “NMC DOiT 200v6 POD layout”.
- If you are using your own equipment to complete the labs, make sure you review the equipment list and topology diagram.



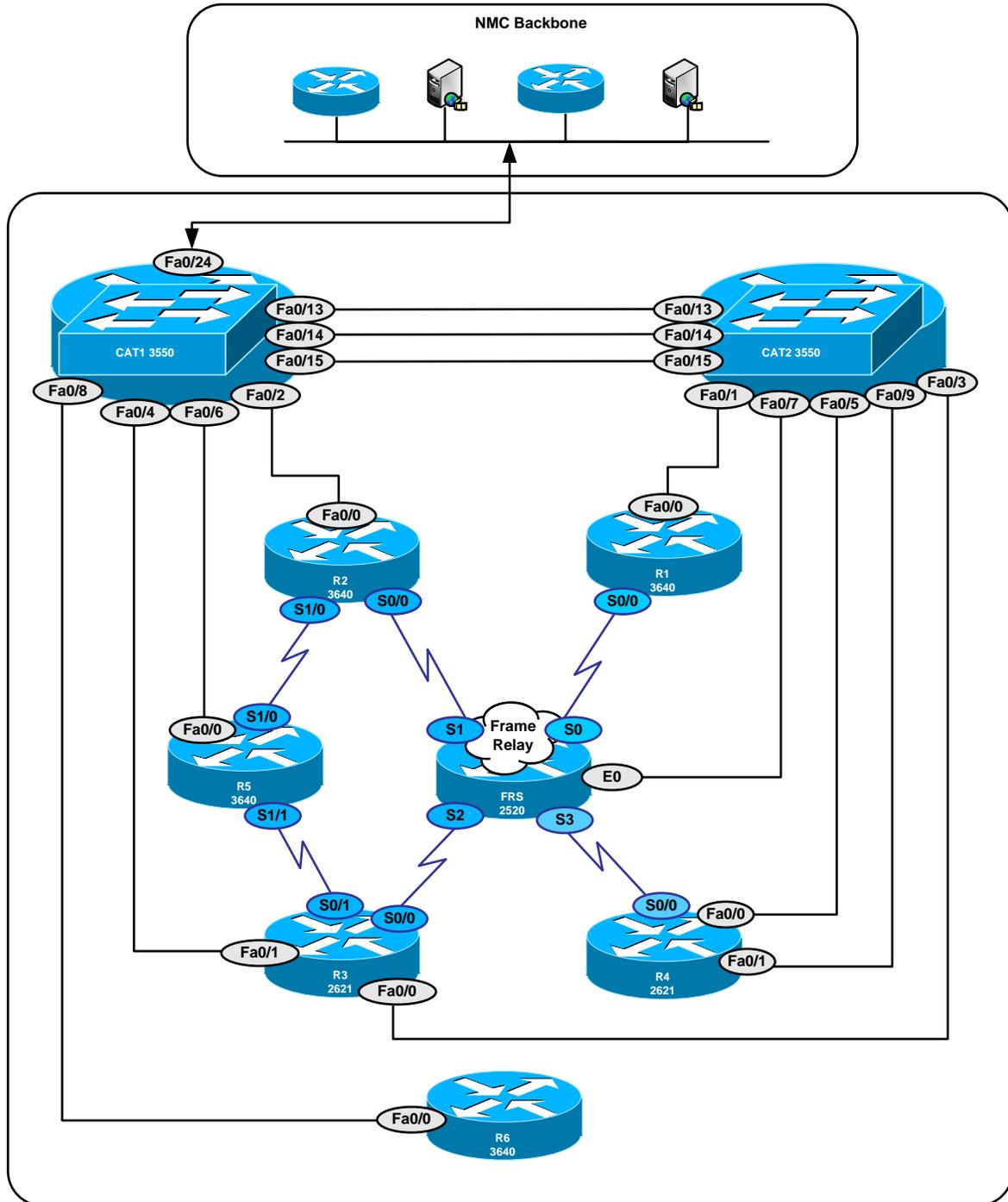
## Goals and Restrictions

- IP subnets displayed in the Scenario diagram belong to network 172.16.0.0/16.
- Do not rely on dynamic Frame-Relay inverse ARP.
- Do not use any static routes.
- Make sure all IPv4 and IPv6 loopback interfaces are advertised with their original mask, unless noted otherwise.
- Make sure all IPv4 and global IPv6 interfaces in the diagram are *reachable* within this internetwork.  
**DO NOT FORGET THIS!**
- IP subnet 10.1.1.0/24 is excluded from the previous requirement.
- Use conventional routing algorithms.

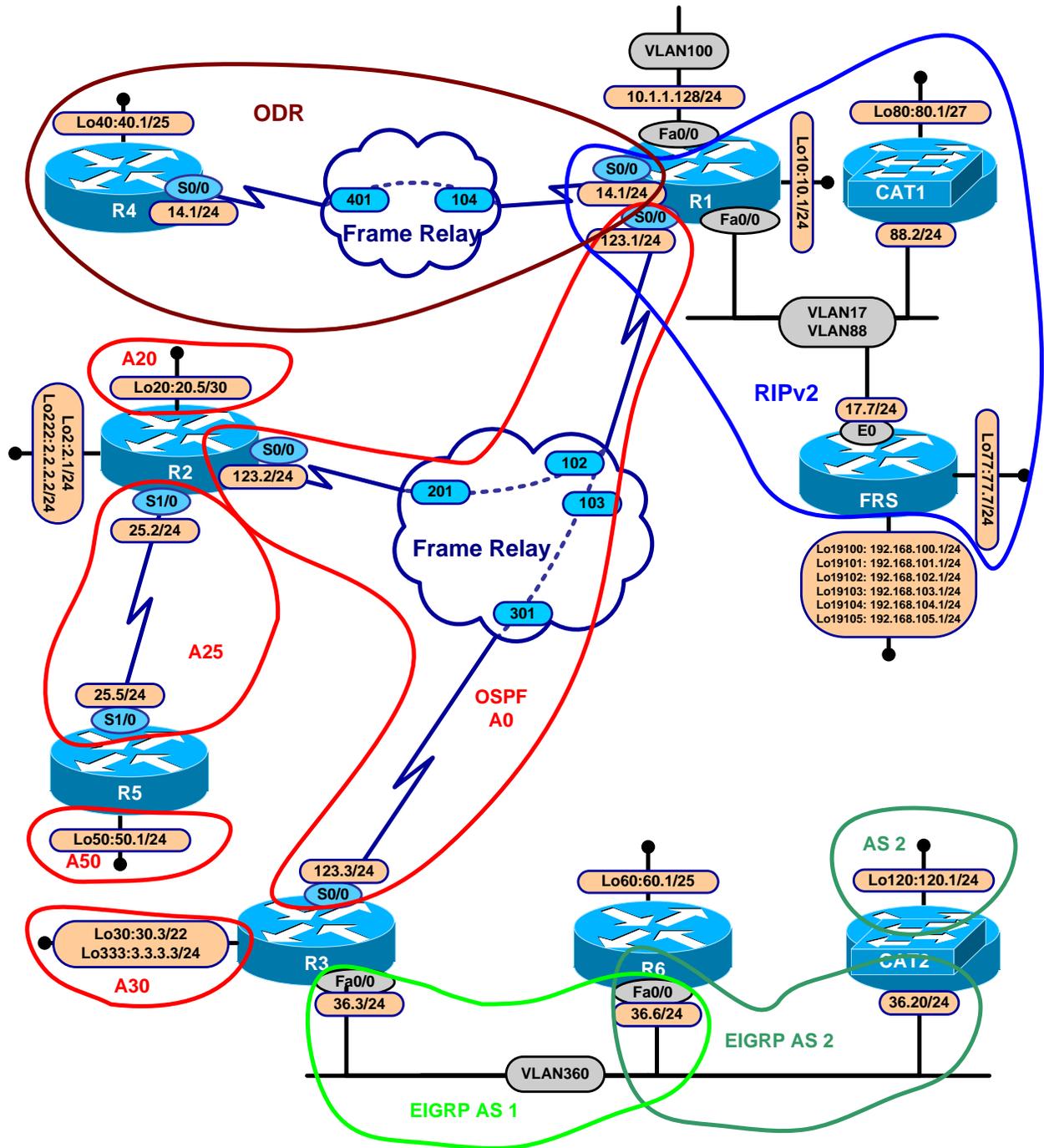


**FOR PHYSICAL CONNECTIVITY, CHECK THE DIAGRAM "NMC POD LAYOUT" DISPLAYED IN THE APPENDIX A AT THE END OF THIS DOCUMENT.**

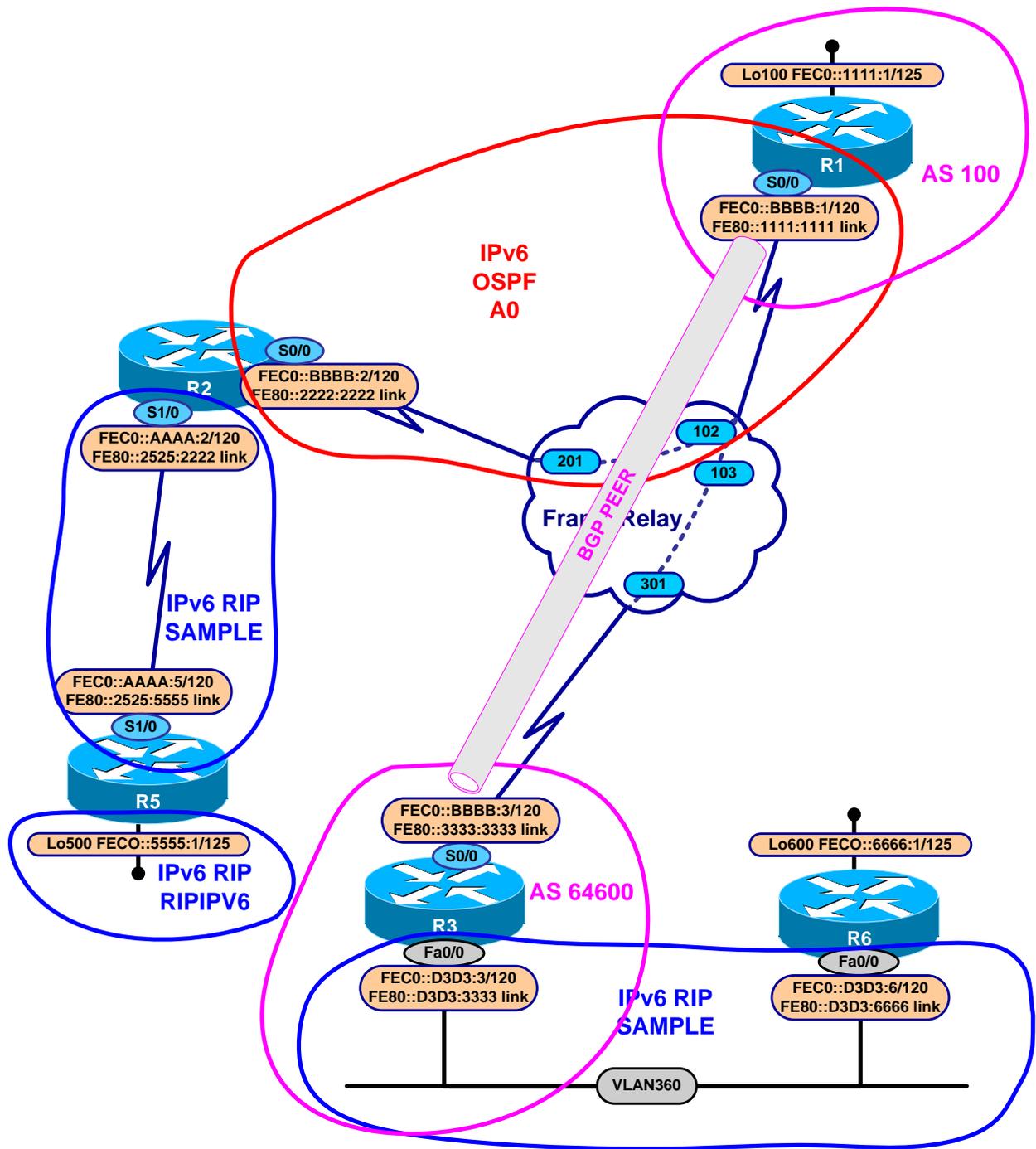
### Netmasterclass 200v6 POD Layout



### Netmasterclass DOIT-200v6 SAMPLE Scenario IPv4 IGP diagram



Netmasterclass DOIT-200v6 SAMPLE Scenario IPv6 IGP diagram



## S.1 Serial Interfaces Configuration



**The Frame-Relay Switch configuration is provided in the Appendix. Do not modify the frame relay route statements on the frame relay switch FRS.**

- S.1.1 Use only the PVCs displayed in the “Netmasterclass DOiT-200v6 SAMPLE Scenario Pv4 IGP diagram”. No dynamic entries are allowed in the Frame Relay map tables.
- S.1.2 Use a logical interface on R1, use physical interfaces on R2 and R3 for the Frame Relay subnet 172.16.123.0/24.
- S.1.3 Use physical interfaces on the Frame Relay subnet between R1 and R4.
- S.1.4 Configure a 64000 Bit/sec HDLC link between R2 and R5.

## S.2 Catalyst Configuration



**Shutdown interfaces FA0/15 on both switches CAT1 and CAT2**

CAT1 interface FastEthernet 0/24 is connected to the NMC backbone. The configuration of this port should be left as default, do not change it, otherwise the connectivity with the backbone will be lost. FYI, the healthy trunk status is displayed as following:

```
CAT1#show interfaces trunk | inc Fa0/24
Fa0/24      desirable    n-isl      trunking
```

- S.2.1 Configure the VLANs for all Ethernet segments involved in this scenario. See the diagram “Netmasterclass DOiT-200v6 SAMPLE Scenario Pv4 IGP diagram” and the tables provided below.

**VLAN Tables**

Router	Interface	VLAN
R1	FastEthernet0/0	VLAN17, VLAN88, VLAN100
R3	FastEthernet0/0	VLAN360
R6	FastEthernet0/0	VLAN360
FRS	Ethernet0	VLAN17
CAT1	VLAN88	VLAN88

CAT2	VLAN360	VLAN360
------	---------	---------

VLAN	VLAN NAME
VLAN17	ENG
VLAN88	DEVELOP
VLAN100	TEST
VLAN360	PROD

- S.2.2 Configure VLAN 17 between R1 and FRS and VLAN 88 between R1 and a CAT1 SVI interface. Do not use any dynamic VLAN advertisement techniques. VLANs must be configured consistently on both switches. Do not use a CISCO proprietary tagging method. Restrict your ports configuration only to VLAN's displayed in the VLAN Table.
- S.2.3 Configure VLAN 360 between R3, R6 and CAT2.
- S.2.4 Assign the lowest IP addresses on R1 for VLAN's 17 and 88. For IP addressing, see the diagram.
- S.2.5 Configure VLAN100 on Fa0/0 on R1. Assign the IP address 10.1.1.128/24 to the interface associated with VLAN100.
- S.2.6 Allow necessary VLAN's to traverse both FA0/13 and Fa0/14 interfaces between the Catalyst switches. Do not allow VLAN's on Fa0/13 and Fa0/14 explicitly.

### S.3 OSPF

- S.3.1 Configure the OSPF backbone area between routers R1, R2 and R3 on the Frame Relay cloud. Let backbone OSPF speakers automatically discover each other and elect R1 as the DR.
- S.3.2 Add Loopback 172.16.20.5/30 on R2 in OSPF area 20.
- S.3.3 Summarize this network to 172.16.20.0/24.
- S.3.4 Add Loopback 172.16.2.1/24 on R2 into the OSPF routing process without use of the "network" command.
- S.3.5 Make sure that the network 2.0.0.0 and its subnets do not appear in the routing tables of any router except R2.
- S.3.6 Place Loopbacks 172.16.30.3/22 and 3.3.3.3/24 in OSPF area 30 on router R3.

- S.3.7 Configure area 25 between routers R2 and R5. Add loopback 172.16.50.1/24 on R5 into OSPF area 50.

## S.4 RIP

- S.4.1 Configure RIP version 2 only between devices connected to VLAN 17. Do not include 192.\*.\* networks in the RIP process.
- S.4.2 Configure RIP version 2 only between devices connected to VLAN88. Configure and advertise loopback 172.16.80.0/27 on CAT1.
- S.4.3 Restrict the advertisement of RIP updates to only VLAN17 and VLAN88.

## S.5 EIGRP

- S.5.1 Configure EGRP AS 1 between R3 and R6.
- S.5.2 Restrict the advertisement of EIGRP updates to only VLAN360 interfaces.
- S.5.3 Allow only one prefix to be advertised from R3 to R6, filter all other prefixes.
- S.5.4 Add loopback 172.16.60.1/25 on R6 in EIGRP as an “EX” prefix.
- S.5.5 Configure EIGRP AS 2 between R6 and CAT2.
- S.5.6 Advertise the network 172.16.120.0/24 as Internal to EIGRP AS2. Summarize this network with /23 mask.

## S.6 ODR

- S.6.1 Configure the ODR routing between R1 and R4 over the Frame Relay link. Propagate the loopback 40 network originated on R4 throughout the RIP and OSPF domains.



**TO OBTAIN UNIVERSAL CONNECTIVITY, PERFORM A MUTUAL REDISTRIBUTION OF DYNAMIC INTERIOR GATEWAY PROTOCOLS: BETWEEN RIP AND OSPF ON ROUTER R1, BETWEEN EIGRP AS 1 and OSPF ON ROUTER R3, EIGRP AS 1 and EIGRP AS2 ON ROUTER R6, REDISTRIBUTE ODR INTO RIP AND OSPF ON ROUTER R1. DO NOT PERFORM ANY OTHER REDISTRIBUTION IN THIS SCENARIO. PERFORM REDISTRIBUTE CONNECTED WHERE REQUIRED AND NOT RESTRICTED BY THE SCENARIO.**

## S.7 BGP

- S.7.1 Assign FRS to AS 700. Configure AS 100 on router R1 and AS 64600 on routers R2, R3 and R4.
- S.7.2 Peer AS 700 and AS 100. Peer AS 100 and AS 64600 between R1 and R2.
- S.7.3 9.3. Advertise the following prefixes from FRS with the origin code “incomplete”:
- 192.168.100.0/24
  - 192.168.101.0/24
  - 192.168.102.0/24
  - 192.168.103.0/24
  - 192.168.104.0/24
  - 192.168.105.0/24
- S.7.4 Do not form a BGP peer relationship between R2 and R4. Use the AS numbers given in the exam.
- S.7.5 Make sure that all BGP speakers in AS 64600 have **networks 192.168.104.0/24, 192.168.105.0/24 and a summary for other 192.\*.\* involved in this exam only** in both their BGP and IP routing tables. Apply this configuration on R1. Do not change the AS PATH attribute for these networks.
- S.7.6 Use the synchronization method on R2 and R3.
- S.7.7 Advertise loopback 3.3.3.3/24 into BGP on R3 only. **All BGP speakers** should have only a **classful prefix** of the IP address assigned to R3’s above mentioned loopback interface in their BGP tables. Do not re-originate this network on any other routers. On FRS, this major network should be shown as originated from AS 100.
- S.7.8 Do not use the “redistribute connected” command for IPV4 routing protocols anywhere on R3.

## S.8 IPv6 Routing

- S.8.1 Assign all the Site Local and Link Local IPv6 addresses according to the Sample Scenario IPv6 IGP diagram. IPv6 addresses should be assigned on same interfaces as respective IPv4 addresses. Make sure all the IPV6 addresses are reachable within the subnet, including the locally assigned addresses.

### OSPF IPv6

- S.8.2 Configure OSPF IPv6 area 0 on the Frame Relay link between R1 and R2. Use the default OSPF network type. R1 should initiate the HELLO packet. R2 should never initiate the HELLO packets.

### RIP IPv6

- S.8.3 Configure RIP IPv6 instance SAMPLE on the link between the routers R2 and R5. Advertise the loopback 500 network into RIP IPV6 process. This RIP IPv6 process should be identified as RIPIPV6.
- S.8.4 Configure RIP IPv6 instance SAMPLE on the link between the routers R3 and R6. Advertise the loopback 600 on the router R6 without enabling RIP on the interface.

### BGP IPv6

- S.8.5 Configure IPv6 BGP peer relationship between router R3 AS 64600 and R1 AS 100. You must use the link local IPv6 address to form this peer relationship.
- S.8.6 Advertise the IPv6 network FECO::1111:0/125 from R1 into IPv6 BGP.



**TO OBTAIN UNIVERSAL CONNECTIVITY FOR IPV6 GLOBAL ADDRESSES, PERFORM A MUTUAL REDISTRIBUTION OF DYNAMIC IPV6 ROUTING PROTOCOLS: BETWEEN RIP AND OSPF ON ROUTER R2, BETWEEN OSPF AND BGP ON ROUTER R1, BETWEEN BGP AND RIP ON ROUTER R3. DO NOT PERFORM ANY OTHER REDISTRIBUTION IN THIS SCENARIO. PERFORM REDISTRIBUTE CONNECTED WHERE REQUIRED AND NOT RESTRICTED BY THE SCENARIO.**

## S.9 QOS

- S.9.1 A UDP stream is originating from ip address 10.1.1.1/24 on VLAN100 connected to port FastEthernet 0/24 of CAT1. It is generating 5 UDP packets per second. Each packet size is 1024 Bytes. The UDP stream is destined to 10.1.1.128/24 port 5128.
- S.9.2 Limit only the above specified UDP traffic to 8000 bit/sec rate on the FastEthernet interface of router R1. Configure the 1500 bytes for burst size and 1500 bytes for the extended burst size.
- S.9.3 Drop excessive traffic.
- S.9.4 Use the MQC to accomplish the QOS requirements.

## S.10 Address Administration

- S.10.1 On R6, configure pool "nmc".
- S.10.2 R6 will supply IP addresses to workstations that reside on VLAN360. The lowest 10 IP addresses will be used for routers, servers and printers.



S.10.3 UNIX workstations with MAC addresses 00-50-04-DF-5F-60 and 00-50-04-DF-5F-61 should always receive IP address 172.16.34.60/24 and 172.16.34.61/24 respectively.

S.10.4 Supply the appropriate gateway IP address.

S.10.5 The DNS server is 10.10.10.10 and the domain name is "nmc.net".

## S.11 HSRP Configuration

S.11.1 Prefer R3 as a gateway on VLAN360.

S.11.2 If the Frame Relay connection fails, prefer R6.

S.11.3 Prefer R3 when the Frame Relay connection becomes active.

S.11.4 Assign the lowest IP address on VLAN360 to the virtual gateway.

## S.12 NTP Configuration

S.12.1 Make R1 the NTP master with stratum 5.

S.12.2 Configure a server association between R3 and R1.

S.12.3 Configure a peer association between R3 and R6.

## S.13 Multicast

S.13.1 Configure Multicast routing on routers R2, R1 and R3 based on "Flood and Prune" technology.

S.13.2 Join the Loopback interfaces 172.16.20.5, 172.16.10.1 and 172.16.30.3 to the multicast group 230.30.30.30.

S.13.3 Ping the group 230.30.30.30 from router R5 and make sure you receive responses from all routers involved in the multicast routing scenario.

## S.14 IOS Features

S.14.1 Configure R4 to allow router configuration and monitoring from a WEB browser.



S.14.2 A WEB browser should be able to open an http session with router R4 using the following url: <http://R4-IP-ADDRESS:8090>

Where R4-IP-ADDRESS is any reachable R4's IP address

S.14.3 Restrict web access to router R4 only for administrators residing on VLAN36 and limited to 2 sessions at a time. Administrators will use username "admin" and password "adminmc". This will be locally configured on router R4.

S.14.4 On the router R5 provide a solution allowing administrators to track any configuration change made to the IOS software running configuration and identify the user that made that change.

S.14.5 Configure maximum 300 entries retained in the configuration log file.

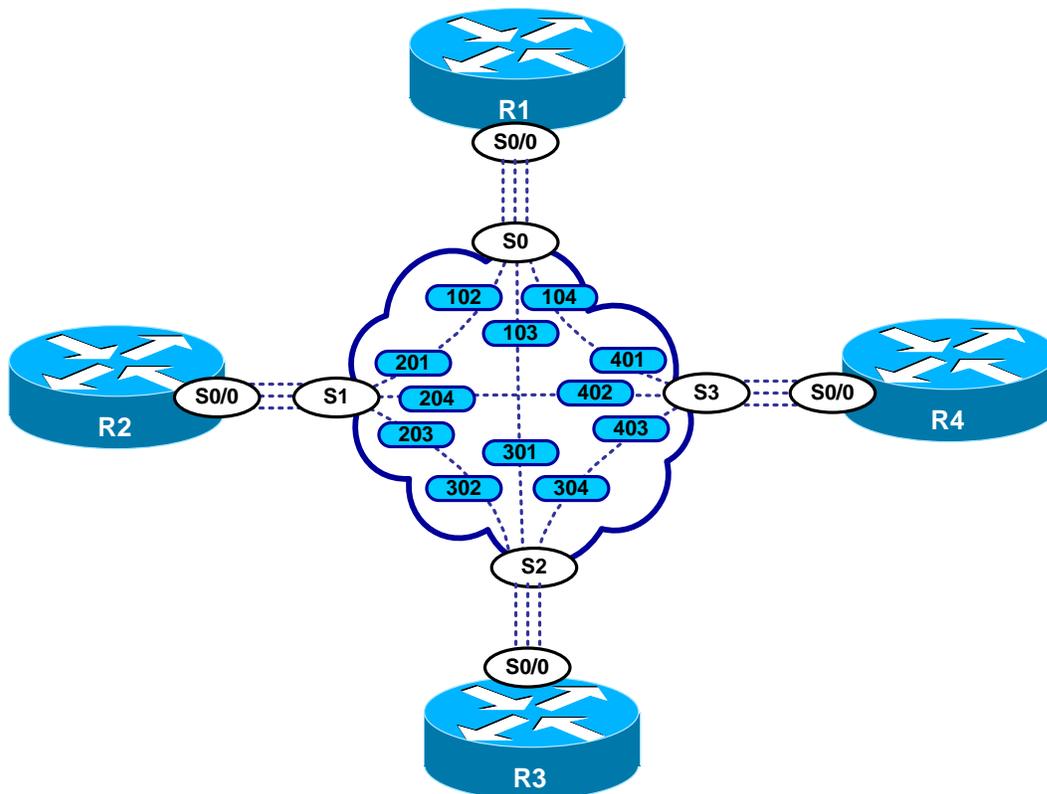
S.14.6 All the password information must be suppressed in the configuration log files.

## Appendices

### Frame Relay Switch Configuration

The Frame Relay Switch should be preconfigured as a full mesh for all exercises. See the diagram for the DLCI numbering and corresponding interfaces. All Frame Relay Switch interfaces are connected to the DCE cable connector.

#### Frame Relay Switch Configuration (Full Mesh)



Provided below is the Frame-Relay switch configuration. If you enter this configuration into a router acting as a Frame-Switch and you cable up your pod in the manner displayed in Figure 2, you will have configured a full-mesh Frame-Relay topology.



## Frame Relay Switch Configuration Example

```
frame-relay switching
!
interface Serial0
  no ip address
  encapsulation frame-relay
  clockrate 72000
  frame-relay lmi-type ansi
  frame-relay intf-type dce
  frame-relay route 102 interface Serial1 201
  frame-relay route 103 interface Serial2 301
  frame-relay route 104 interface Serial3 401
  no shutdown
!
interface Serial1
  no ip address
  encapsulation frame-relay
  clockrate 72000
  frame-relay lmi-type ansi
  frame-relay intf-type dce
  frame-relay route 201 interface Serial0 102
  frame-relay route 203 interface Serial2 302
  frame-relay route 204 interface Serial3 402
  no shutdown
!
interface Serial2
  no ip address
  encapsulation frame-relay
  clockrate 72000
  frame-relay lmi-type ansi
  frame-relay intf-type dce
  frame-relay route 301 interface Serial0 103
  frame-relay route 302 interface Serial1 203
  frame-relay route 304 interface Serial3 403
  no shutdown
!
interface Serial3
  no ip address
  encapsulation frame-relay
  no ip route-cache
  clockrate 672000
  frame-relay lmi-type ansi
  frame-relay intf-type dce
  frame-relay route 401 interface Serial0 104
  frame-relay route 402 interface Serial1 204
  frame-relay route 403 interface Serial2 304
  no shutdown
```



## Hints

### S.1 Hint – Serial Interface Configuration

Verify the output of “show frame pvc” and “show frame map”. Which side of the serial is DCE?

### S.2 Hint – Catalyst Configuration

Apply needed trunk-related configurations to the PortChannel Interface, not F0/13 and F0/14.

### S.3 Hint – OSPF

OSPF Network Type “broadcast”, with DR at hub. Might need to originate a default from R2.

### S.4 Hint – EIGRP

Use a wildcard mask on your network statements. Allow only the default route from OSPF into EIGRP.

### S.5 Hint – RIP

Use “passive-interface default” to control advertisements. Make sure FRS and CAT1 can ping 2.2.2.2!

### S.6 Hint – ODR

Is CDP enabled on the Frame Relay serial interfaces by default?

### S.7 Hint – BGP

Consider using the “aggregate” command with both the “as-set” and “summary-only” keywords. Redistribute OSPF into BGP on R2 to fulfill the synchronization requirements. Note that AS number 64600 is from the private range.

### S.8 Hint – IPV6 Routing

Be sure to set “ipv6 priority” as necessary, and use the link-local address in neighbor statements. Note that IPV6 protocols do not take connected networks when redistributing - you may need to redistribute connected networks separately. Check the IPv6 Cisco Library for the BGP peering between the link local IPv6 addresses.

### S.9 Hint – QoS

Use the “police” command in a policy-map, and apply it inbound on R1 interface F0/0.100 with the “service-policy input” command. Verify with “show policy-map interface.”

### S.10 Hint – Address Administration

May need three separate pools!



### **S.11 Hint – Gateway Redundancy**

Remember to “preempt!”

### **S.12 Hint – NTP**

No “NTP peer” command needs to be configured on R3.

### **S.13 Hint – Multicast**

Time to get out the desperation checklist and tunnel!

### **S.14 Hint – IOS Features**

You may need the “ip http server port” command. Explore with “ip http ?”  
Time to check the 12.3 and 12.4 new features!