Data Communications and Networking
Lab 3 - Routing

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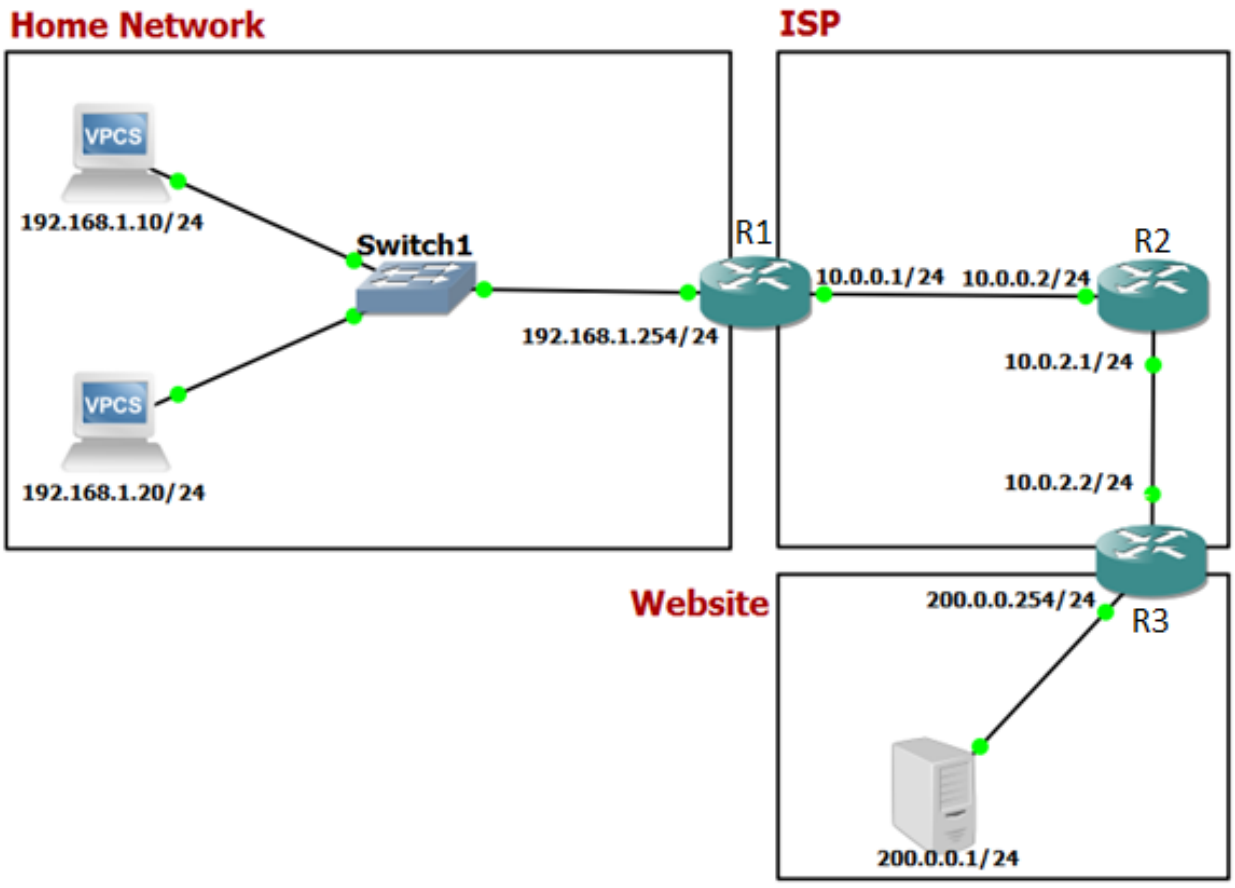
Introduction

This is the second assessed lab exercise. The first four exercises together make up 10% of your final mark for the course.

You should work through the worksheet below in the week before the lab, taking a screenshot of the network(s) that you have built at the end of each Part of the instructions. When the instructions ask you to answer a question (e.g. “Can they ping each other?”), make a note of your answer. We suggest you put your notes and screenshots into a word processor like LibreOffice, then you can easily produce a single PDF file to submit.

Part 1: Topology Configuration



Start by building the above topology, configuring IP addresses as indicated above. The “server” bottom right is a VPC (with a custom icon selected).

Set the default gateway on each PC to the address of the router that it should send non-local traffic to.

Make sure that any pair of hosts on the same link can ping each other.

The command `show ip interface brief` can be used to double check that all interfaces are

properly configured and are “up”.

Use the `write` command on each router to save your modifications. (If you make changes to a Cisco router's configuration, it will forget them when it's turned off, unless you've saved them with `write`.)

In what follows, we will explore several routing possibilities. Create a backup copy of the project folder at the end of this part and use a fresh copy of it for each of the next routing options — otherwise you will have to undo each of your routing instructions.

Part 2: Static Routing

Add a static route to R1, by using

```
conf t
ip route 10.0.2.0 255.255.255.0 10.0.0.2
```

to say that traffic towards the `10.0.2.0/24` network should be forwarded on the interface with IP address `10.0.0.2` (i.e. the interface connecting to the ISP).

Q1: If you only configure R1 with the command above (and didn't set up any other routes), does a ping from PC1 to R2 work? Why?

Configure all routers to use static routing.

> **Note:** If there was a sequence of networks 10.0.2.0, 10.0.3.0, 10.0.4.0, etc. on the route to the servers, it might be useful to enter something like: `ip route 10.0.0.0 255.255.0.0 10.0.0.2` This would group different static routes together, reducing the number of routing rules necessary (route coalescing).
>
> **Note:** This router has only one next hop to all outside IP addresses, `10.0.0.2`; any traffic to outside should be forwarded through that next hop. In this particular case, you can use the syntax: `ip route 0.0.0.0 0.0.0.0 10.0.0.2` which means “send traffic to all unknown destinations to 10.0.0.2”. The ISP's router becomes a default gateway for R1 after this command.

You can use `show ip route` to display the current routing table of a router (useful for the next tasks too). The output includes how each route was configured; your static routes will show as `S`.

Check that you can ping between all the VPCs. Take screenshots of `show ip route` on all your routers to show the static routes you've set up.

Part 3: RIP

Reload the project from the end of Part 1. (RIP won't override existing static routes, so it's important that you don't have any static routes set up.)

Configure your routers to use RIP. You need to do the following on each router:

- Enable RIP
- Select a version (2)
- Specify the networks to advertise (in our case, all networks you are connected to)

For example, R1's RIP configuration instructions will be:

```
conf t
router RIP
version 2
network 192.168.1.0
```

`network 10.0.0.0`

> **Note:** RIP was originally developed when the Internet used class-based addressing. RIP version 2 added basic support for CIDR, but you will still see artefacts of class-based addressing in how it's configured (e.g. showing `10.0.0.0/8` when you are configuring a subnet like `10.0.2.0/24`).

Q2: Use Wireshark to observe the traffic on one of the links between two routers for a couple of minutes. Look at the contents of the packets as well, by clicking on a packet in the window at the top, then expanding the tree view in the lower left corner. What do you notice about the RIP packets?

Give the network a few seconds to converge, then ping from end to end.

Take screenshots of `show ip route` on all the routers again. You should now see some `R` routes that have come from RIP.

Submission and marking

When you have completed the exercise, submit your screenshots and notes to the Lab 3 assignment on Canvas (preferably as a single PDF file). You are allowed to submit multiple times.

We will go through these screenshots and answers with you individually in the lab and give you feedback on them.