

# Static routing

KTHNOC/SUNET

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The goal with this lab is to introduce you to configuring a Cisco router and your workstation. You will also learn how to set up the router for static routing.

**Before** you begin this lab you are supposed to read “Workstation related commands” and “Router related commands”.

This lab consists of five parts and a hint section:

- 1 Configure the router**
- 2 Configure the workstation**
- 3 Verify your configuration**
- 4 Mess things up and restore order**
- 5 Invoke static routing**
- 6 FAQ**

Hint: It is recommended that you talk with an assistant after each part just to make sure that you are on the right track. Otherwise you may have a lot to correct.

Save the commands you commit in the router in your favorite text-editor (e.g. emacs, vi). By saving the configuration you can run the same commands several times with small modifications using the famous copy and paste technique between windows. Make sure you save your buffer regularly so you can recover from “disasters”.

# 1 Configure the router

- First you have to start your workstation and bring up a terminal window, for example `xterm`. We recommend you to login with student as username (ask your assistant for password).
- Connect the workstations' serial port to the routers CONSOLE serial port.
- Start the program `tip`. To do this you should log in as root in the terminal- do this by entering the command `su -` and hit enter. Supply the root password (ask the assistant for this password). Now you are logged in as root (administrator on this computer) and you can start `tip`.

If you haven't done so already, turn on the router.

- Initialize the router according to "Router related commands". You should set the hostname to the four letters representing your router on the net plan (separate paper handed out by the assistants). You should also set three different passwords.
- At this point, consult "Router related commands", (subsection "How to reinitialize the router") again and set up the following:
  - Turn on ip routing...
  - ...and of course we want classless routing and ip subnet zero turned on. (why is this?)
  - Turn off proxy ARP on `Ethernet 0` and `Serial 0`<sup>1</sup>.
  - We do not want "small-servers". (UDP and TCP services)
  - We do not want to use DNS lookup<sup>2</sup>.
  - We want encrypted passwords.
- Now configure your Ethernet 0 interface with the appropriate IP number as specified in your topology handout.
- Check your configuration. How do you do this?

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<sup>1</sup>Note: When you configure new interfaces in the future, make sure that you turn off Proxy-ARP on them as well.

<sup>2</sup>In the real world this is normally turned on, but in the lab we do not use DNS locally for reasons of simplicity.

## 2 Configure the workstation

Set up the workstation to connect both to the Internet and our private 192.168/16 net. One of your ethernet interfaces (e.g. `bge0`) should already have gotten a public ip number. Do not modify this interface.

The other ethernet interface (e.g. `bge1`) must now be configured. Set it to the IP number specified in your network topology handout. Don't forget the netmask!

```
ifconfig bge1 <private ip address> netmask <appropriate mask> up
Bring up bge1
```

You will need a static route on your workstation so that the packets are forwarded correctly. Study the current routing table by using this command `netstat -rn`.

You will need to add a static route to the routing table so that all packets destined for 192.168.0.0/16 is forwarded to the router via e.g. `bge1`.

```
route add -net <destination net address> <next hop ip number> <netmask
for destination net>
Define where your host should send packets destined for your private
net.
```

## 3 Verify your configuration

Use a crossover TP-cable to connect the workstation with the router. How do you check to see if the patch cable is a crossover TP-cable? Use the network topology handout to see which interface on the router to connect to.

Make sure that:

- You can still access the global Internet.
- You can access the router. `ping` is a nice tool to do this.

## 4 Mess things up and restore order

In order to explore and learn more about the router we put on failures on purpose and then try to make things right again. Do the following, one at a time. You should be able to describe what is happening, how you can see the effect and how you recover from each step.

- Disconnect the e0 cable.
- Disconnect the CONSOLE cable.

- `shutdown` interface e0 on the router.
- set `no ip routing` on the router.  
Since there is no routing to speak of, will this command make a difference?

Turn on ip routing again. Let another group plant an error on your router without you knowing which error. Do the same on their router, then try to recover each planted error. How did you detect the error? How did you recover from the error?

Hint: There are plenty of information commands in enabled mode.

## 5 Invoke static routing

- Start working in pairs, RTX1 with RTX4 and RTX2 with RTX3.
- Connect the routers with a serial cable according to the net plan. **Be careful with the cables**, they are expensive and unfortunately easy to connect the wrong way, i.e. upside-down.
- Make sure that the DCE end of the serial cable is connected to the `Serial 0` interface.
- Configure and bring up the serial interface on your router. Make sure that the serial interfaces on both routers have their bandwidth set to 2000. It is also important that the interface on the DCE end has set the clock-rate to 2000000.
- Try to ping your neighbour's workstation from your router, then from your workstation. What happens and why?
- Now add a static route on your router to your neighbour's workstation network. You should now be able to traceroute from your workstation all the way to your neighbour's workstation. *Contact the lab assistant if you cannot.*
- Turn off ip routing. From your workstation:
  - Try ping and traceroute your router's e0 interface.
  - Try the same for your router's serial interface facing your connected neighbour.
  - Continue all the way down to your neighbour's workstation.

What happens and why?

- Turn on ip routing again.

- Connect, configure and bring up the remaining two serial lines. Let these two serial lines be **unnumbered**. You should now have four routers connected in a square.  
Hint: Let the unnumbered interface borrow e0's ip address.
- Configure static routing so that all routers can ping each other. Make sure that you have a static route to every network in the topology<sup>3</sup>, but create only one static route to your diagonal routers e0 network. Let the routing be symmetric. *What does this mean?*
- Create a floating static route to your diagonal routers e0 net.
- Disconnect one of the cables in order to make the floating route take over. Can you still reach your diagonal neighbour?
- Create floating static routes to the other workstation's nets.
- Remove the static route to your diagonal neighbour's net and replace the route with load balancing.
- (Voluntary step) Create asymmetrical static routing.

## 6 Hints

**Q: Why does my Ethernet interface not work?**

Hint: Did you set media-type?

**Q: Why does my serial interface not work?**

Hint: On the DCE side you have to set clock rate.

Read the “Router related commands” and other useful reference guides, try [www.cisco.com](http://www.cisco.com) for example.

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<sup>3</sup>... but not the unnumbered serial lines, of course!