Simple OSPF configuration

Prosta konfiguracja dynamicznego protokołu rutingu OSPF

- W ramach zajęć zostanie utworzona sieć składająca się z czterech maszyn wirtualnych
- Studenci nauczą się, w jaki sposób uruchomić kilka maszyn wirtualnych jednocześnie z wykorzystaniem oprogramowania **`netkit`**
- Maszyny zostaną wyposażone w podstawową konfigurację, jeszcze przed ich uruchomieniem

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Prosta konfiguracja dynamicznego protokołu rutingu OSPF

- W ramach zajęć należy:
  - Skonfigurować protokół OSPF działający w jednym obszarze (ang. ***area***)
  - Zrozumieć przeznaczenie interwałów ***hello-interval*** oraz ***dead-interval*** protokołu OSPF
  - Zrozumieć funkcje rutera wyróżnionego (ang. ***designated router***, **DR**)
  - Zrozumieć działanie parametrów protokołu OSPF: ***router-id***, ***priority***
  - Zrozumieć działanie protokołu OSFP w przypadku sieci rozgłoszeniowych (ang. *broadcast*) oraz typu punkt-punkt (ang. *point to point*)
  - Przechwycić i przeanalizować wymianę komunikatów protokołu OSPF

Simple OSPF configuration

Prosta konfiguracja dynamicznego protokołu rutingu OSPF

- **Głównym celem zajęć jest**
  - zapoznanie się z działaniem dynamicznego protokołu rutingu OSPF opartego na algorytmie stanu łącza (ang. *link state*)
  - nabycie umiejętności konfigurowania i analizowania protokołu w celu zapewnienia osiągalności urządzeń sieciowych oraz diagnozowania przyczyn trudności w prawidłowym doborze trasy

Preparing a netkit lab

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Modified and extended for the purpose of the IP Networks lab

Simple OSPF configuration

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Introduction

preparing a lab

- a netkit lab is a set of preconfigured virtual machines (VMs) that can be started and halted together
- we will learn how to set up a standard netkit lab that can be launched by using the **`lcommands`**
  - instructions based on http://wiki.netkit.org/netkit-labs/netkit_introduction/netkit-introduction.pdf
- we will create a **simple OSPF** configuration

netkit labs using `lcommands`

- a standard netkit lab is a directory tree containing
  - a **`lab.conf`** file describing the network topology
  - a set of subdirectories that contain the configuration settings for each virtual machine
  - **`.startup`** file that describe actions performed by virtual machines when they are started
- **Download tar with a sample netkit lab**
- **List the files in the lab directory**

`lab.conf`

- this file describes
  - the settings of the VMs that make up a lab
  - the topology of the network that interconnects the VMs of the lab
- list of **`machine[arg]=value`** assignments
  - **`machine`** is the name of the vm (e.g., **`pc1`**)
  - **`arg`** is an integer number (say ***`i`***)
  - **`value`**is the name of the collision domain to which interface ***`eth i`*** should be attached

- **Note**: a collision domain represents a multi-access network such as, for example, computers connected to an Ethernet switch

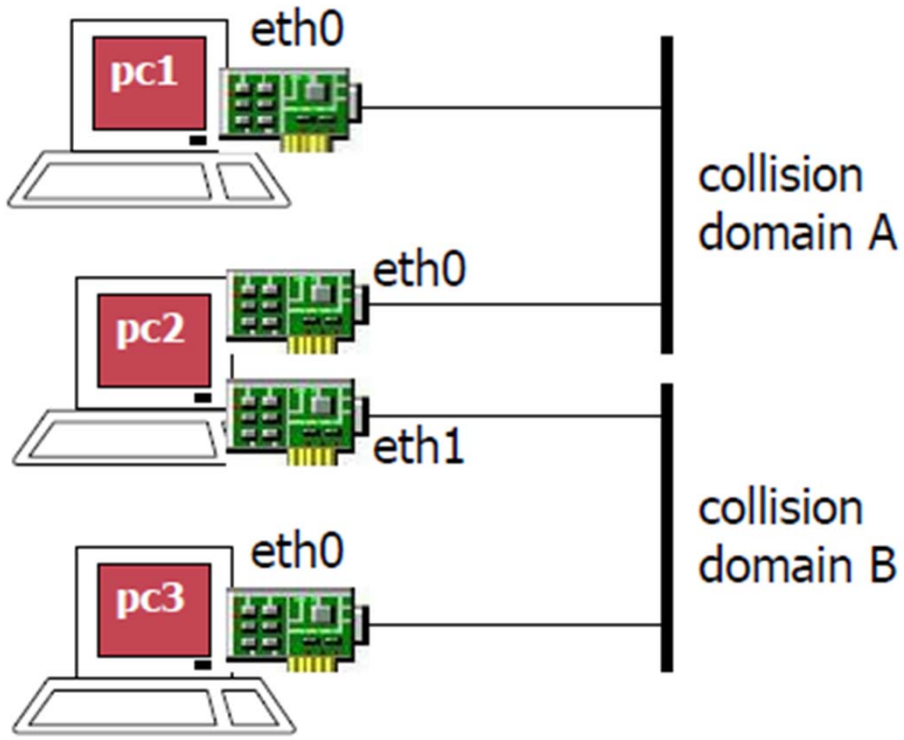
lab.conf

- example of **lab.conf**

```
pc1[0]=A

pc2[0]=A
pc2[1]=B


pc3[0]=B
```



lab subdirectories

- netkit starts a VM for each subdirectory, with the same name of the subdirectory itself

- contents of subdirectory **`vm`** are copied into the root (**`/`**) of **`vm`**'s filesystem
  - for example, **`vm/foo/file.txt`** is copied to **`/foo/file.txt`** inside virtual machine **`vm`**
  - this only happens the 1st time the **`vm`** is started; in order to force the copying you have to remove the **`vm`** filesystem (**`.disk`** file)

startup files

- shell scripts that tell VMs what to do when starting up or shutting down
- they are executed inside VMs
- upon startup, a vm named **vm_name** runs
  - **vm_name.startup**
- a **.startup** file can be used, for example, to configure network interfaces and/or start network services
- sample of **vm_name.startup**

```
ifconfig eth0 10.0.0.1 up
/etc/init.d/zebra start
```

launching/stopping a lab

- **launching the lab**
  - go to the lab directory (**`cd lab_directory`**)
  - in the terminal enter the **`lcommand`**
- where **`lcommand`** is one of the following
  - **`lstart`**, to start the lab
  - **`lhalt`**, to gracefully shut down the VMs of a lab
  - **`lcrash`**, to suddenly crash the VMs of a lab

removing temporary files

- a running lab creates some temporary files inside both the current directory and the lab directory
- to get rid of them all, use **`lclean`** after the lab has been halted/crashed
  - notice: **`lclean`** also removes virtual machine filesystems (**`.disk`** files); do not use it if you are going to launch your lab again using the same (previously configured) filesystems

ltest

- makes it easier to check that labs work properly
- **`ltest`** starts a lab and dumps information about each virtual machine **`vm`**
  - the output goes into **`_test/results/vm.default`**
  - after configuring your lab check the contents of **`*.default`** files

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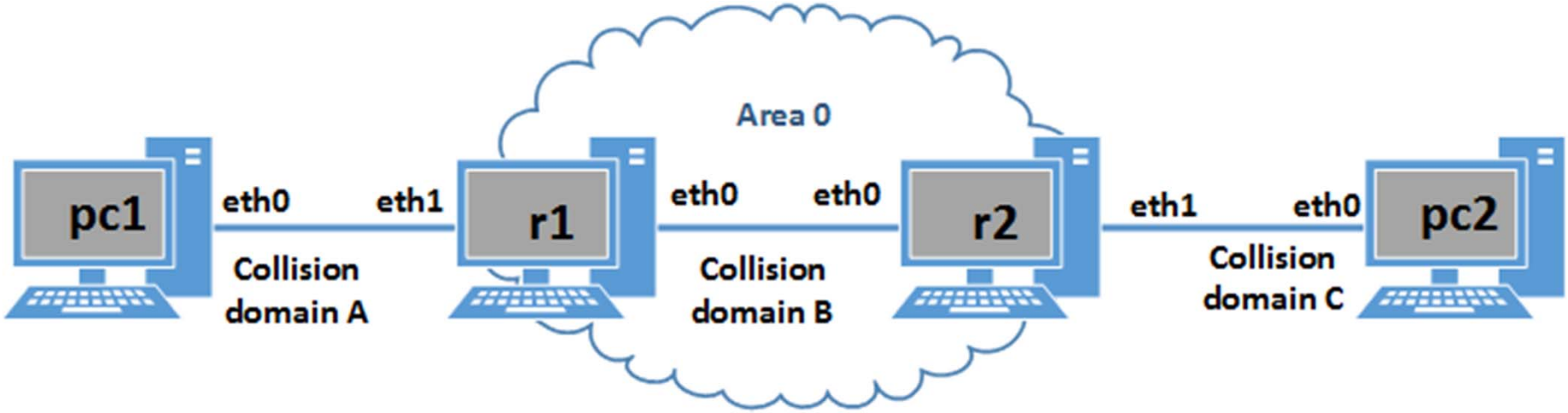
simple OSPF lab
(DR election)

assign IP addresses

- Assign IP addresses to ALL interfaces on routers and PCs



Please note that the address of the subnet in Area 0 should include the LAB-ID assigned to you by the lab instructor, e.g., in the following way: `<LAB-ID>.0.0.0/24`

update `lab.conf`

- inside the lab directory update the **`lab.conf`** file and put entries for **`pc1`**, **`pc2`**, **`r1`**, and **`r2`**

- exemplary entry

```
pc1[0]="A"
```

create `*.startup` files

- Create **`startup`** files for all VMs
  - in your lab directory you should have:
    `r1.startup`, **`r2.startup`**,
    `pc1.startup`, **`pc2.startup`**

- Configure the previously chosen IP addresses for each VM

- Exemplary entry

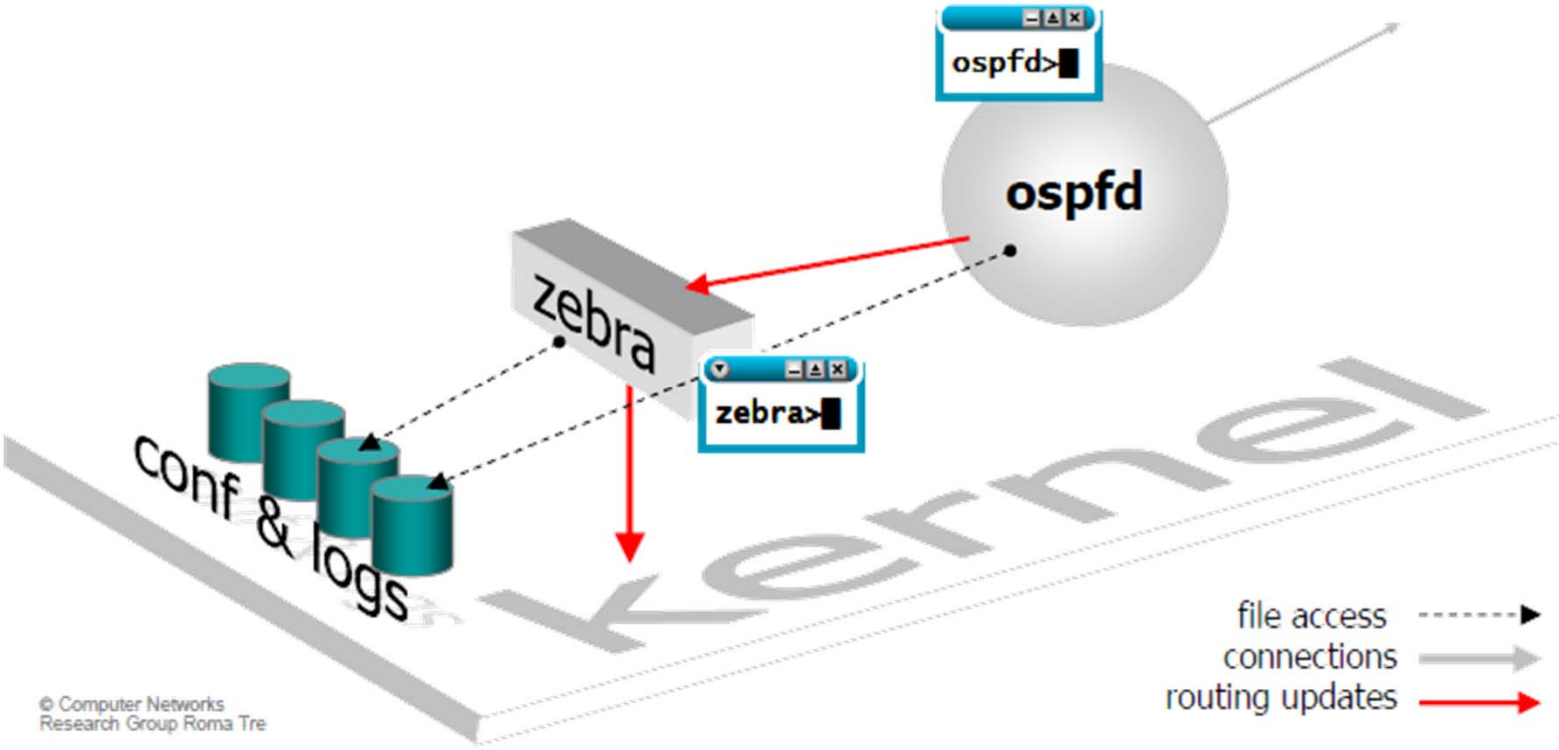
```
ifconfig eth0 10.10.10.1 up
```

create subdirectories for **`r1`**, **`r2`**, **`pc1`**, and **`pc2`**

- duplicate the **`router`** and **`pc`** subdirectories in your lab directory
  - as a result you should have two **`pc`** subdirectories and two **`router`** subdirectories
- change the names of your subdirectories to **`r1`**, **`r2`**, **`pc1`**, and **`pc2`**

modify **daemons** files in **r1** and **r2** subdirectories

- enable **zebra** and **ospfd** routing daemons for **r1** and **r2** by editing their **daemons files**



start the lab

- start the configured laboratory using the **`lstart`** command in the lab directory
- if you did not configure **`zebra`** to be started automatically do it now
  - on **`r1`** and **`r2`** issue the following command

```
/etc/init.d/zebra start
```

OSPF configuration
dummy0 interface

- on each virtual router, connect to the **zebra** daemon and configure the special loopback address called **dummy0**

- **Hints**
  - **telnet** to **zebra** daemon, **configure terminal**, **interface dummy0**
  - enter the **no shutdown** command
  - enter a special address which is different than the IP adderess configured on the **eth** interface
  - write changes to the **zebra** configuration file

Question 1: Why should we enable a special loopback address for OSPF?

OSPF configuration

OSPF intervals

- on each virtual router, connect to **`ospfd`** and change the **`hello-interval`** to 5 and the **`dead-interval`** to 20 on the ***`eth0`*** interface

Question 2: What are these intervals used for? Why are we changing them to lower values?

OSPF configuration

- on each virtual **router**, while connected to **`ospfd`**
  - create an OSPF routing process (**`router ospf`** command)
    - configure the **`ospf router-id`**
      - set it to the value assigned to ***`eth0`***
    - define the IP addresses on which OSPF runs
      - **`network`** command

      HINT: don't forget to define the **`area ID`**
  - write changes to the **`ospfd`** configuration file using the **`write file`** command

OSPF routing information

- on each virtual router, check the running system information using different **`show ip ospf`** commands

Question 3: Which router was chosen as the Designated Router? Why? What is the status of the other router?

Reporting

- Please deliver the following items to the UPEL system using your account
  1. A photocopy or a screenshot showing the output of the following command
     - **`show ip ospf`** executed on router r2

remote destination availability

- try to **`ping pc1`** from **`pc2`** and vice versa
- if the devices cannot reach each other – fix the problem

Question 4: How did you fix the problem?

Reporting

- Please deliver the following items to the UPEL system using your account
  1. A photocopy or a screenshot showing the Wireshark output of the following command
     - **`ping`** of pc1 executed on pc2
     - **`ping`** of pc2 executed on pc1

OSPF: choosing the DR

- on the router that was chosen as DR change its **`router-id`** to the one assigned to the **`dummy0`** interface

Question 5: Which router was chosen as the Designated Router? Can you explain why? What is the status of the other router?

OSPF: choosing the DR cont'd

- on the router which is currently the DR change the **`priority`** to zero
  - **Hint**: go to the interface configuration

Question 6: What is the state of that router now? Can you explain why?

OSPF: choosing the DR cont'd

- change the priority values on both routers so that they are different than zero. Choose them so that the router with the lower **`router-id`** has the higher **`priority`** value
- **Hint:** to see the result on **`r1`** and **`r2`** go to the **`ospf`** configuration and issue the commands
  - **`no network`** `<IP address>` **`area 0`**
  - **`network`** `<IP address>` **`area 0`**

Question 7: Why do we need to disable and then enable ospf? What is more important when choosing the DR – **`router-id`** or **`priority`**?

Playing with network type

- Change the network type of one link to point-to-point
  Question 8: Is a DR selected? Can you explain why?

- Change the network type back to broadcast. Add a third virtual router to the environment, also connected to the same broadcast domain. Enable OSPF. Observe how the DR election algorithm works for three routers.
  Question 9: Check the **`neighbour count`** and the **`adjacent neighbour count`** on each router. Explain these numbers.

DR selection

- Create a new scenario with three routers connected in series.

Question 10: Can a router be a DR on one interface and not a DR on another one?

sniffing the OSPF protocol
on BMA networks

- use **`tcpdump`** to sniff on some interface
- capture the conversation between routers
- move the file from **`VM`** to **host machine**
- browse the file using **`wireshark`** on the host machine in the graphical mode

```
tcpdump -i eth0 proto ospf –w logfile.cap
tcpdump -r logfile.cap proto ospf
tcpdump -v -r logfile.cap proto ospf
```

Sniffing the OSPF protocol **on BMA networks** cont'd

Question 11: What addresses are used during the message exchange?

Question 12. What OSPF message types are used during the conversation?

Question 13. What information is conveyed inside **OSPF LS Update** packets?

Question 14. How often are packets exchanged? What events can trigger an **Update**?