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kathara lab

zebra/quagga

Version	1.0
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Description	experiences with zebra/quagga configurations and command line interface

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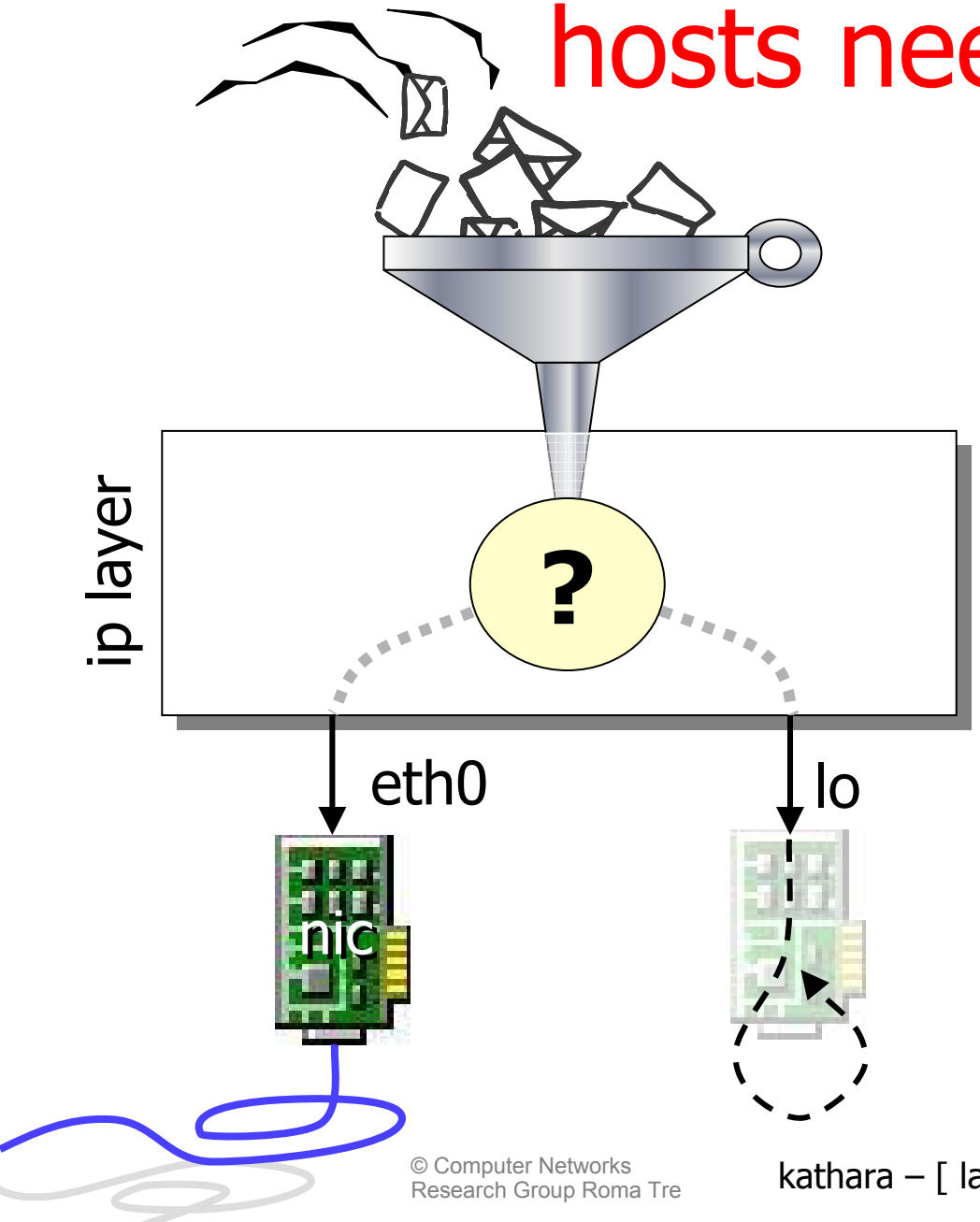
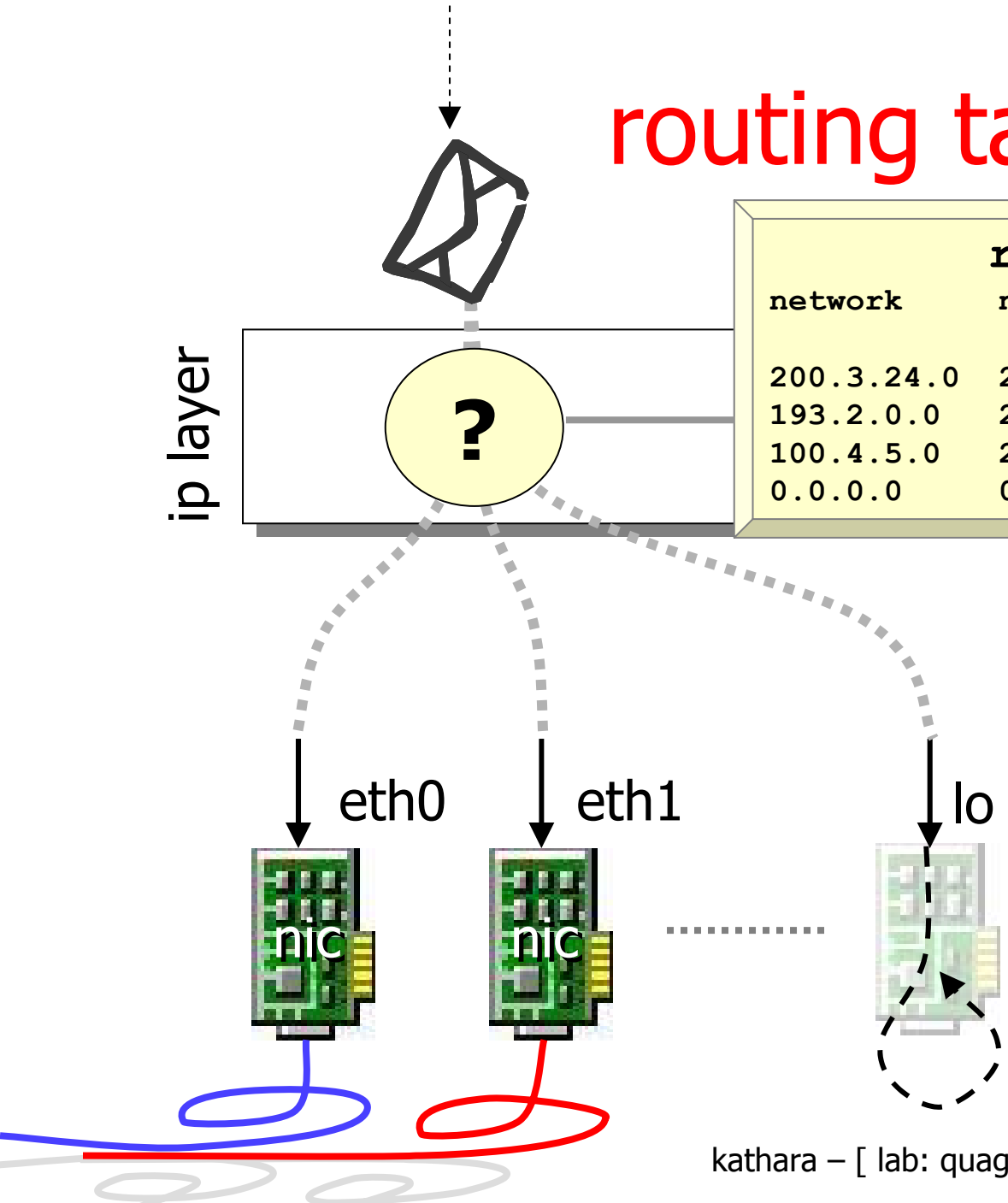
hosts need routing



- each host with a network stack performs some elementary routing
- at the very least, the network stack may be used to access local services (e.g., Xorg)
- the host must decide when a packet needs to be sent to the network interface card (nic) and when it needs to be bounced to the loopback interface (lo)

routing table

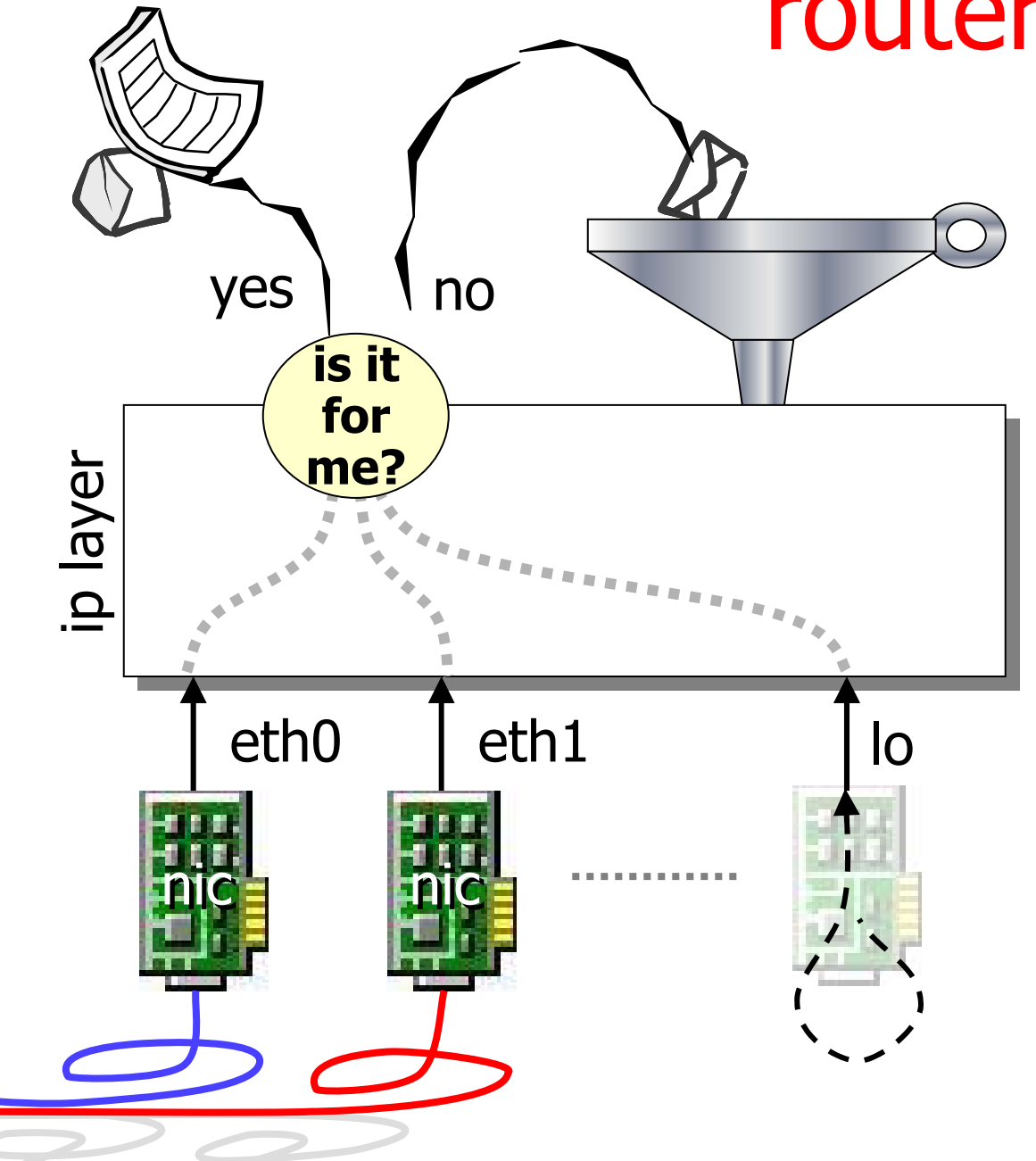


routing table

network	nmask	nexthop	int
200.3.24.0	255.255.255.0	12.0.0.4	eth1
193.2.0.0	255.255.248.0	11.0.0.2	eth0
100.4.5.0	255.240.0.0	11.0.0.3	eth0
0.0.0.0	0.0.0.0	11.0.0.2	eth0

- the ip layer uses a routing table to decide which is the interface the packet needs to be forwarded to

routers



- a router (also called gateway or intermediate-system)
  - has more than one network interface card
  - feeds incoming ip packets (that are not for the router itself) back in the routing process
    - this operation is called relaying or forwarding

routing protocols

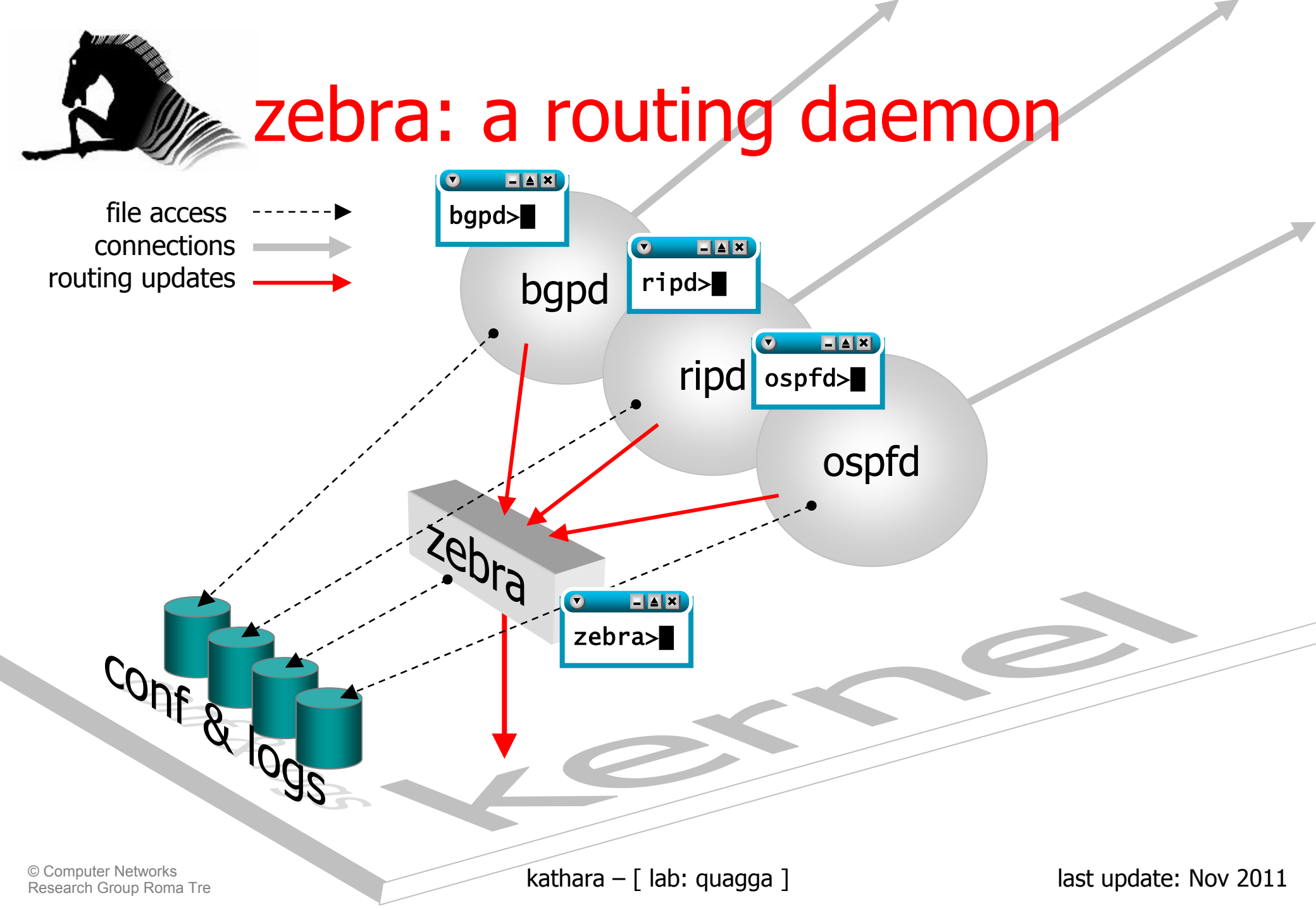
- routing protocols are used to automatically update routing tables, relieving administrators from the need to do it manually
- routers (i.e., devices that run routing protocols) in netkit are virtual machines that run a specific piece of software that implements routing protocols

zebra/quagga

about zebra/quagga

Quagga Routing Software Suite,
GPL licensed IPv4/IPv6 routing software

- a software that implements several routing protocols
  - rip (v1 and v2)
  - ospf (v2 and v3)
  - is-is
  - bgp
- quagga: "a fork of GNU Zebra [that] aims to build a more involved community around Quagga than the current centralised model of GNU Zebra"
- zebra development stopped at release 0.95a
- quagga superseded zebra
  - in most cases, in netkit you can equivalently refer to "quagga" or "zebra"



inspecting quagga configuration files

- when quagga is started, each daemon checks these files to read the starting configuration

sample daemons file

virtual machine

```
pc1:/etc/quagga# less daemons
# This file tells the zebra package
# which daemons to start.
# Entries are in the format: <daemon>=(yes|no|priority)
# where 'yes' is equivalent to infinitely low priority, and
# lower numbers mean higher priority. Read
# /usr/doc/quagga/README.Debian for details.
# Daemons are: bgpd zebra ospfd ospf6d ripd ripngd
zebra=yes
bgpd=no
ospfd=no
ospf6d=no
ripd=yes
ripngd=no
daemons (END)
```

the zebra main daemon will be started

the rip daemon will be started too

sample zebra configuration file (`zebra.conf`)

virtual machine

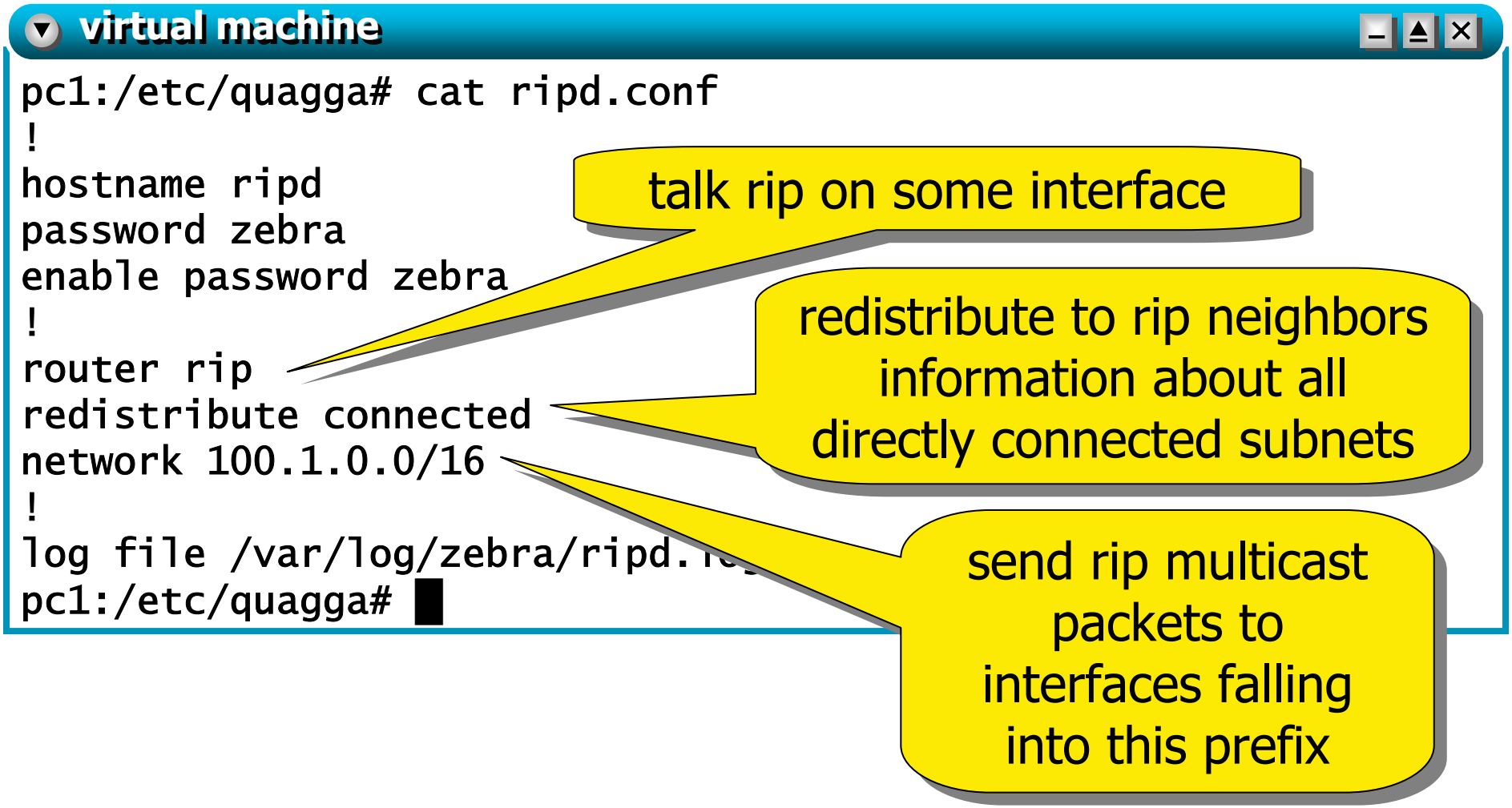
```
pc1:/etc/quagga# less zebra.conf
! -*- zebra -*-
!
! zebra sample configuration file
!
! $Id: zebra.conf.sample,v 1.14 1999/02/19 17:26:38 developer
Exp $
!
hostname Router
password zebra
enable password zebra
!
! interface lo
zebra.conf
```

the prompt of the zebra interface

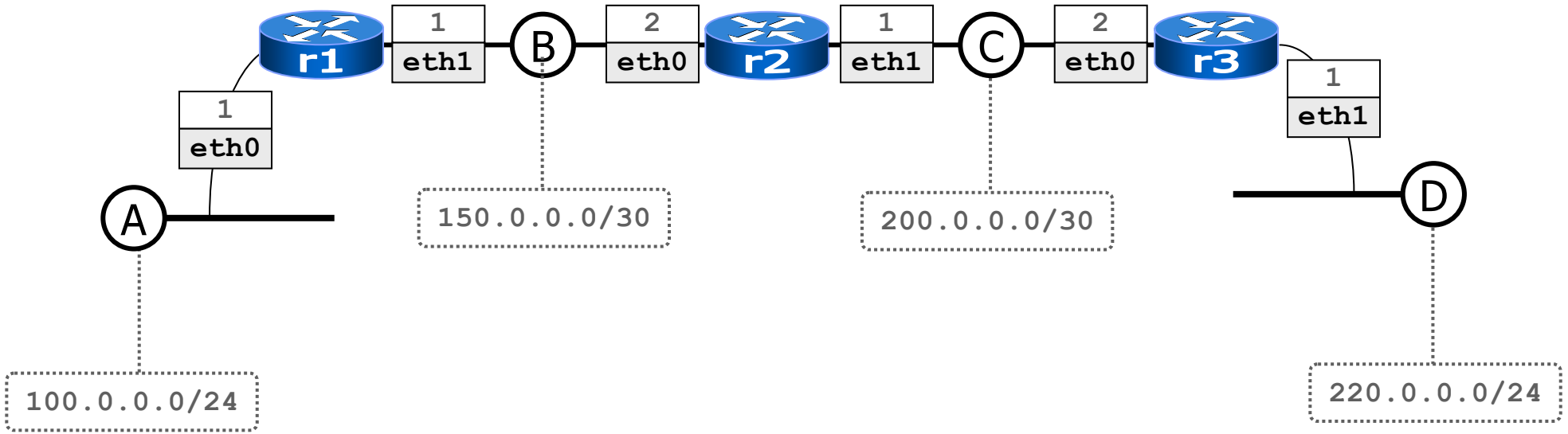
the password to connect to the daemon

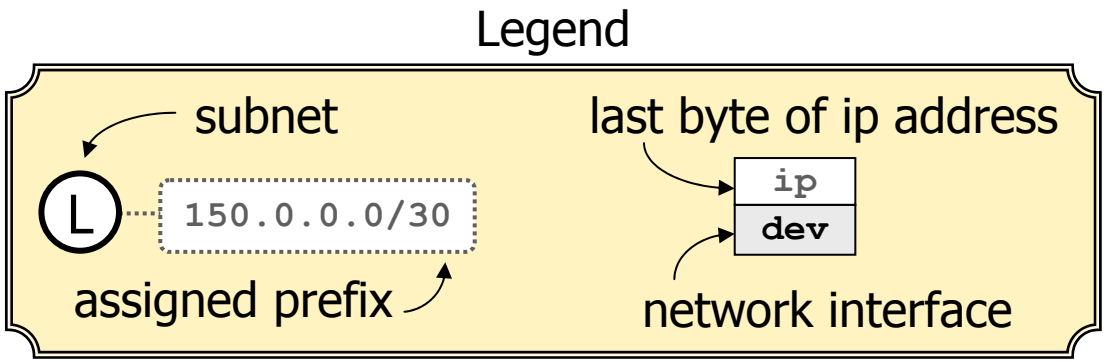
administrative password

sample ripd configuration file (`ripd.conf`)



a simple topology





launching the lab script

- the lab configuration is such that
  - three virtual hosts are created and connected to the right collision domains (virtual hubs)
  - for each virtual host
    - network interfaces are automatically configured
    - quagga configuration files are updated
  - the zebra routing daemon is automatically started

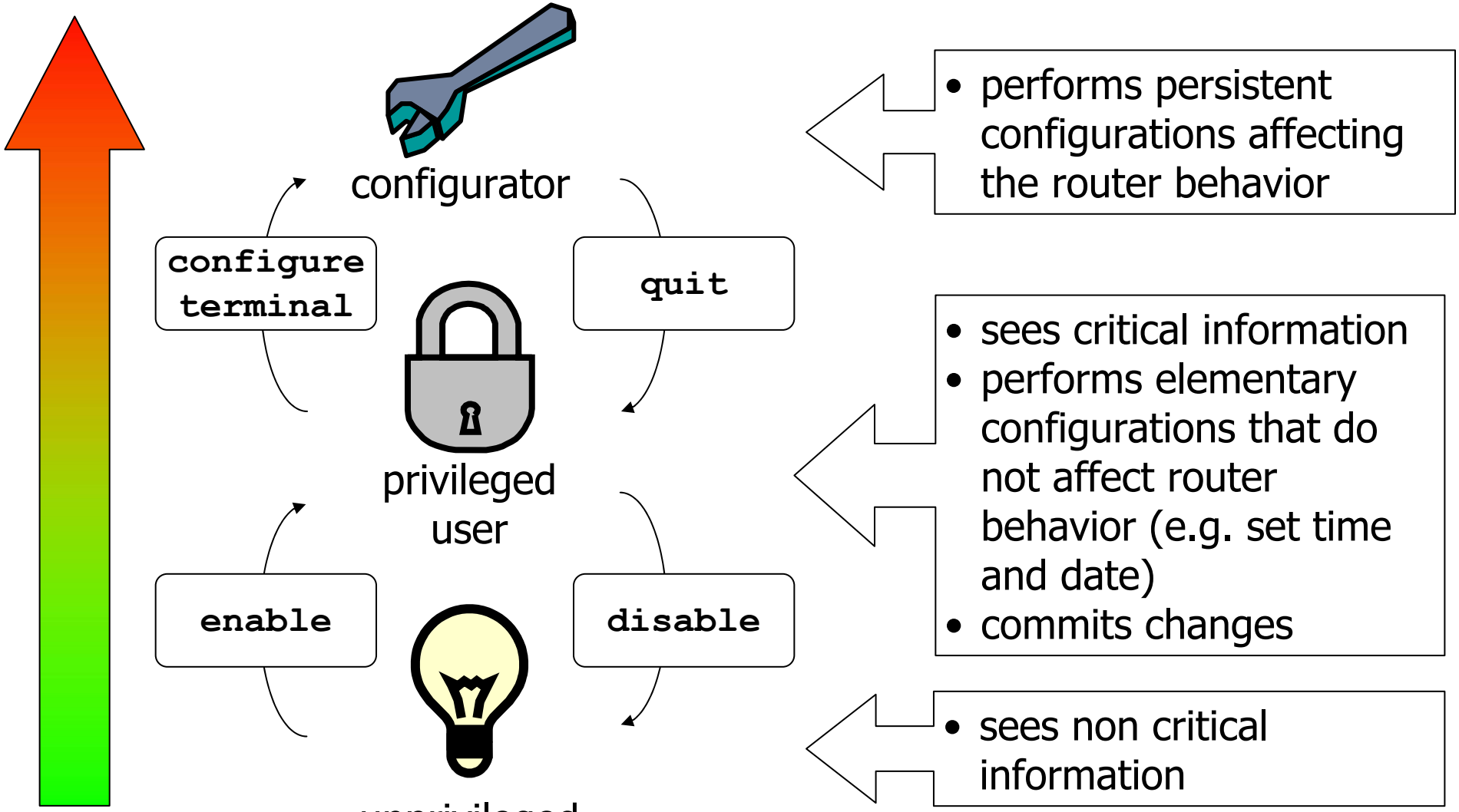
connecting to the main zebra daemon

r3

```
r3:~# telnet localhost zebra
Trying 127.0.0.1...
Connected to r3.
Escape character is '^]'.

Hello, this is Quagga (version 0.99.10).
Copyright 1996-2005 Kunihiro Ishiguro.


User Access Verification

Password: zebra
zebra>
```

we are unprivileged users

privileges on a router



available commands

- press '?' at the command prompt…

r3

```
zebra>
  echo        Echo a message back to the vty
  enable      Turn on privileged mode command
  exit        Exit current mode and down to previous mode
  help        Description of the interactive help system
  list        Print command list
  quit        Exit current mode and down to previous mode
  show        Show running system information
  terminal    Set terminal line parameters
  who         Display who is on vty
zebra>
```

- …or…

available commands

- ...type 'list' (an excerpt of the output follows)

r3

```
zebra> list
  enable
  exit
  help
  list
  quit
  show interface [IFNAME]
  show ip forwarding
  show ip route
  show ipv6 forwarding
  show ipv6 route
  show memory
  show version
  terminal length <0-512>
  terminal no length
  who
zebra>
```

inspecting interfaces

r3

```
zebra> show interface eth0
Interface eth0 is up, line protocol detection is disabled
  index 3 metric 1 mtu 1500
  flags: <UP,BROADCAST,RUNNING,MULTICAST>
  HWaddr: ee:97:f2:ab:47:0c
  inet 200.0.0.2/30 broadcast 200.0.0.3
  inet6 fe80::ec97:f2ff:feab:470c/64
    15 input packets (0 multicast), 948 bytes, 0 dropped
    0 input errors, 0 length, 0 overrun, 0 CRC, 0 frame
    0 fifo, 0 missed
    9 output packets, 642 bytes, 0 dropped
    0 output errors, 0 aborted, 0 carrier, 0 fifo, 0 heartbeat
    0 window, 0 collisions
zebra>
```

- this roughly corresponds to using **`ifconfig`** at the shell prompt

inspecting the zebra routing table

r3

```
zebra> show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

R>* 100.0.0.0/24 [120/3] via 200.0.0.1, eth0, 00:06:28
C>* 127.0.0.0/8 is directly connected, lo
R>* 150.0.0.0/30 [120/2] via 200.0.0.1, eth0, 00:06:28
C>* 200.0.0.0/30 is directly connected, eth0
C>* 220.0.0.0/24 is directly connected, eth1
zebra>
```

- FIB entries from this table (marked with a '>') are injected into the kernel routing table

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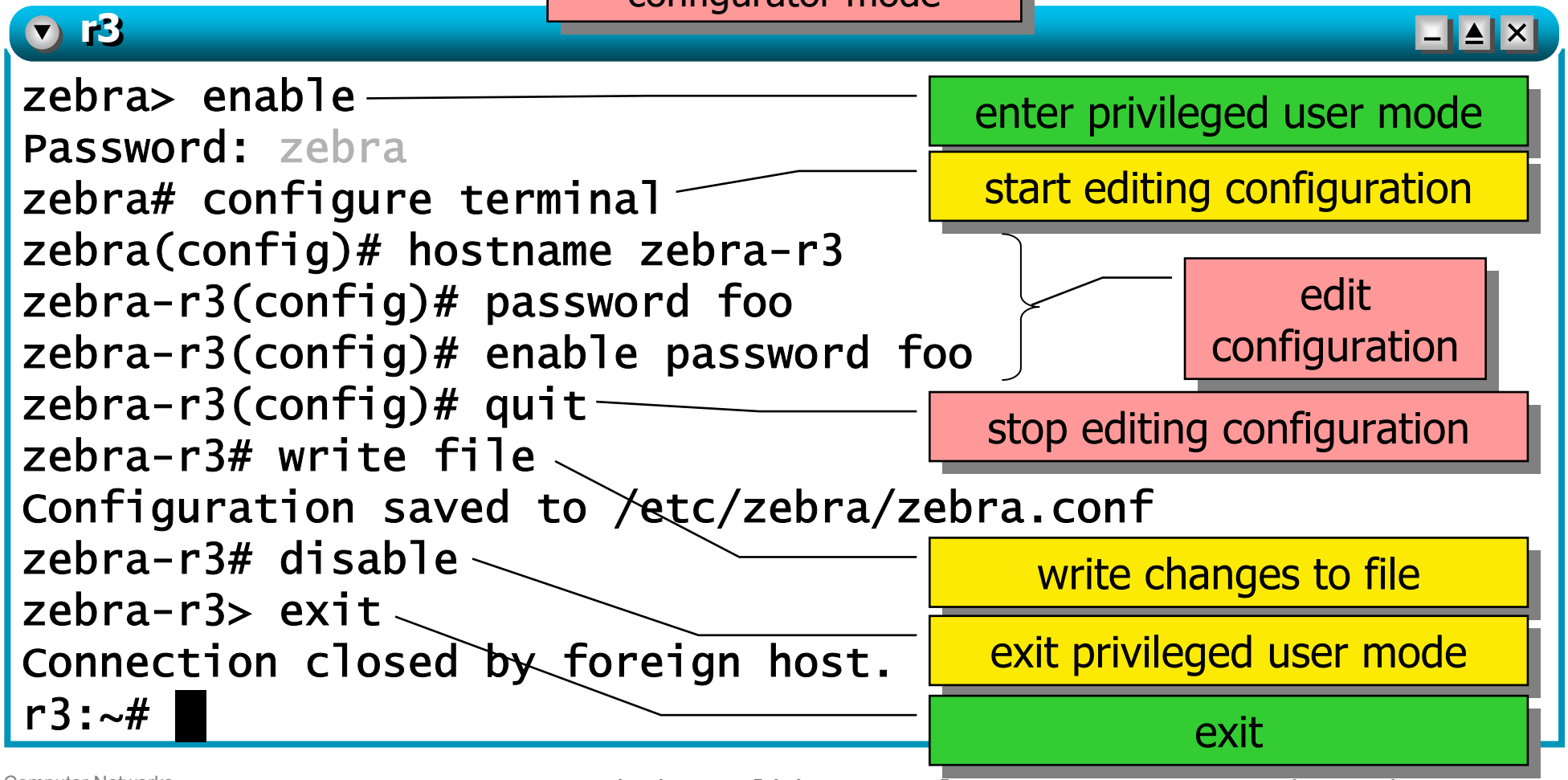
altering zebra configuration

unprivileged user mode

privileged user mode

configurator mode



inspecting the rip routing table

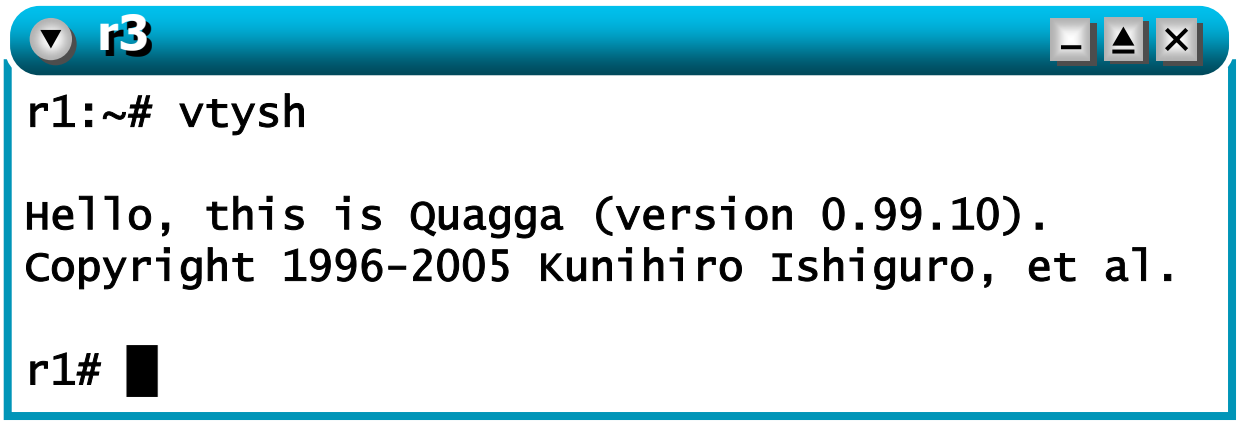
r3

```
r3:~# telnet localhost ripd
......
Password: zebra
ripd> show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

     Network            Next Hop         Metric From            Tag Time
R(n) 100.0.0.0/24       200.0.0.1             3 200.0.0.1         0 02:43
R(n) 150.0.0.0/30       200.0.0.1             2 200.0.0.1         0 02:43
C(i) 200.0.0.0/30       0.0.0.0               1 self              0
C(i) 220.0.0.0/24       0.0.0.0               1 self              0
ripd>
```

a one-fits-all shell

- instead of having to connect to each single daemon, users can interact with quagga by using a built-in shell, called **`vtysh`**



- the user is not prompted for a password
- all the commands from the single routing daemons (including quagga itself) are available in this shell