kathara lab

load balancer – web switch – random

Version	1.0
Author(s)	Giuseppe Di Battista, Massimo Rimondini
E-mail	contact@kathara.org
Web	http://www.kathara.org/
Description	A lab showing the operation of a web switch based on iptables – kathara version of a netkit lab

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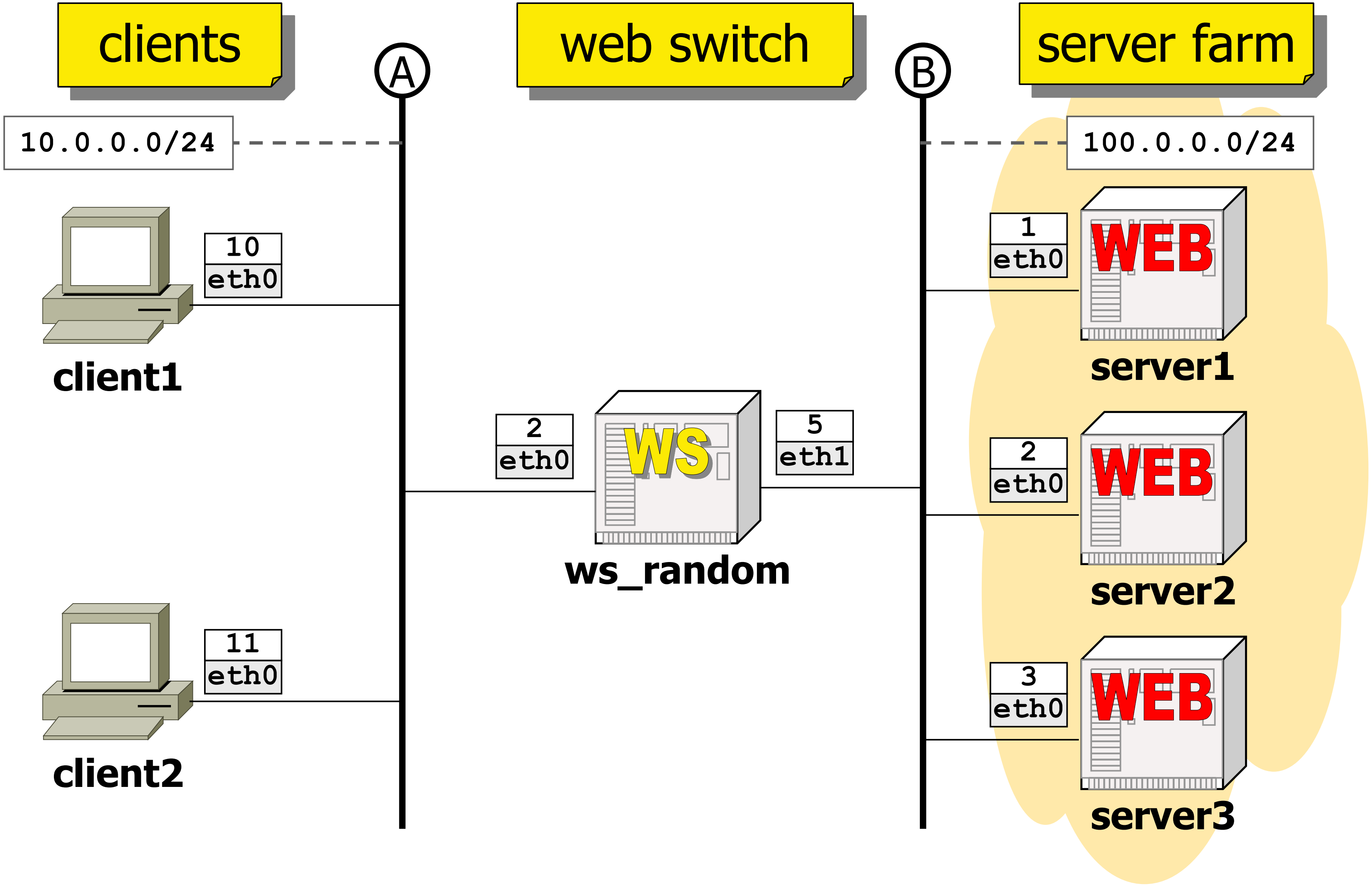
lab topology



lab description

- servers
  - offer a simple HTML default page
  - each physical server hosts a different page, so that they can be easily distinguished
- web switch
  - web switch implements a policy for directing requests to the servers
    - **ws_random**: sends each request to a random server
- clients
  - host a simple web browser (`links`)

lab description – servers

- each server has a different IP address in the subnet **`100.0.0.0/24`**
- no special configuration, just a simple HTML default page in **`/var/www/index.html`**

lab description – web switch

- each web switch has two interfaces
  - one facing the internal network, with an IP address in the same subnet as the servers
  - one facing the external network, exposing a single virtual IP address (VIP) to the clients
- clients only see VIPs of the web switch: they do not know how many servers are in the farm

lab description – web switch

- web switch is implemented using the Linux firewall iptables
  - random

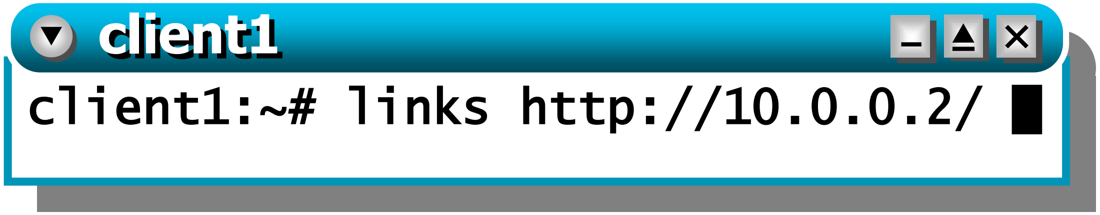
```
iptables --table nat --append PREROUTING --destination 10.0.0.2 --match statistic --mode random --probability 0.33 --
jump DNAT --to-destination 100.0.0.1
iptables --table nat --append PREROUTING --destination 10.0.0.2 --match statistic --mode random --probability 0.5 --
jump DNAT --to-destination 100.0.0.2
iptables --table nat --append PREROUTING --destination 10.0.0.2 --jump DNAT --to-destination 100.0.0.3
iptables --table nat --append POSTROUTING --source 10.0.0.0/24 --destination 100.0.0.0/24 --jump MASQUERADE
```

```
iptables --table nat --append PREROUTING
--destination 10.0.0.2
--match statistic --mode random --probability 0.33
--jump DNAT --to-destination 100.0.0.1
```

the rule applies with a certain probability

experiments

- to experiment load balancing, pick one of the clients, start **`links`**, and direct it to the VIP exposed by web switch:



```
client1:~# links http://10.0.0.2/
```

to experiment random balancing

experiments

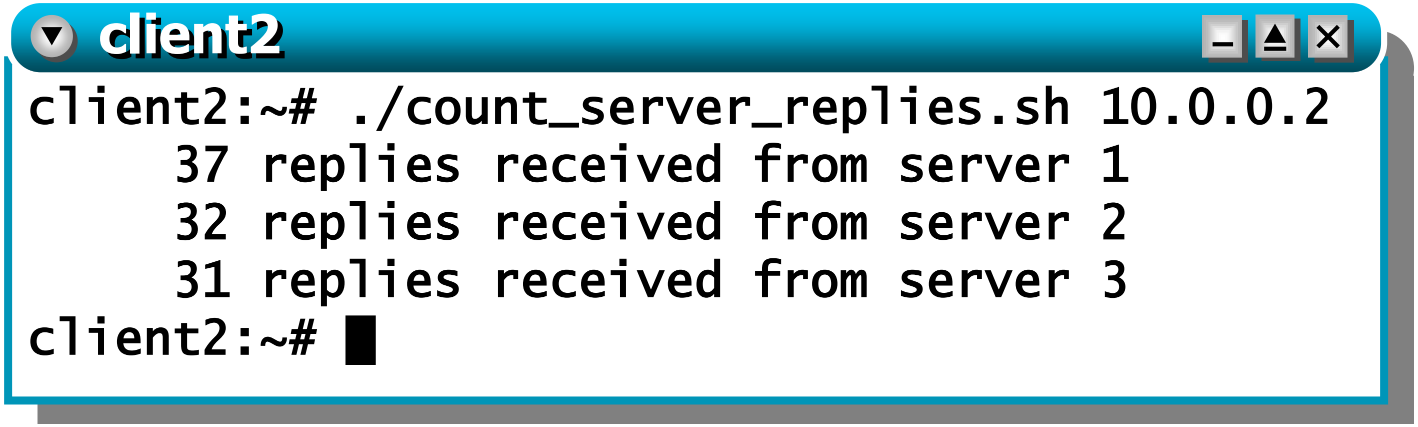
- once you have accessed one of the VIPs, you get a page stating which is the physical server that has served it
- load balancing can be checked by reloading the page (**`ctrl+R`**), but…

experiments

- once you have accessed one of the VIPs, you get a page stating which is the physical server that has served it
- load balancing can be checked by reloading the page (**`ctrl+R`**), but...
  - ...by default all HTTP requests use the same connection (HTTP 1.1)!
  - since iptables tracks TCP connections, all HTTP requests within the same connection are directed to the same physical server
  - to really appreciate load balancing you need to close and re-open links

more experiments

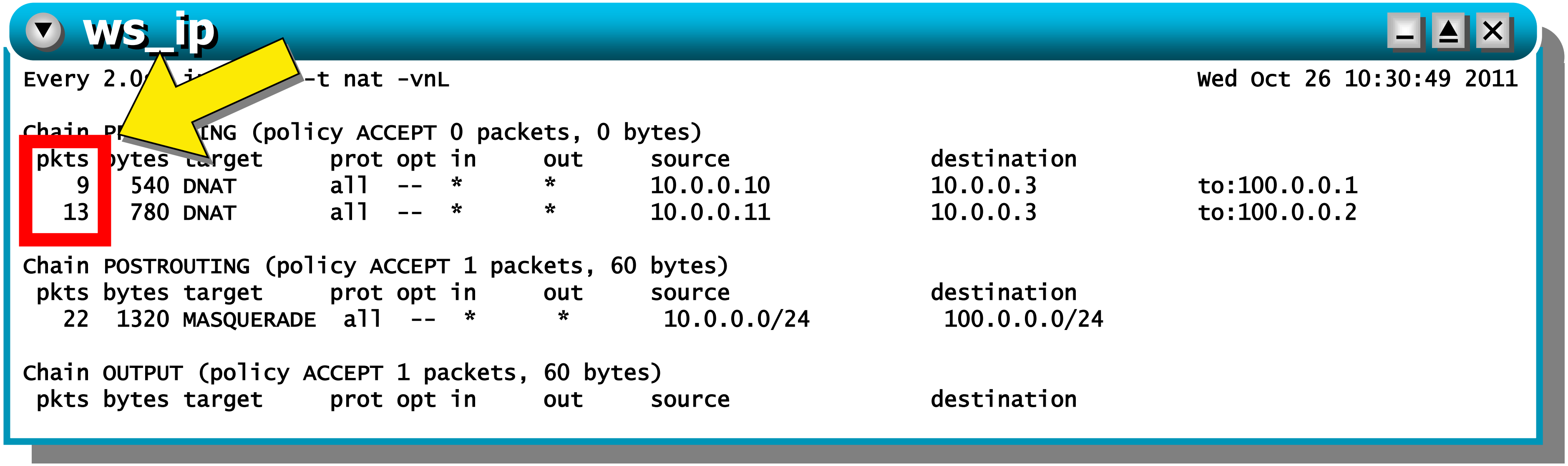
- each client has a handy script that
  - sends 100 HTTP requests (each on a different connection) to a user-specified IP
  - reports the number of pages that have been served by each physical server



```
client2:~# ./count_server_replies.sh 10.0.0.2
     37 replies received from server 1
     32 replies received from server 2
     31 replies received from server 3
client2:~# █
```

more experiments

- after booting, each web switch automatically displays statistics about the number of times that iptables rules have matched
- check the **`pkts`** field in chain **`PREROUTING`**



```
Every 2.0s: iptables -t nat -vnL                                                 Wed Oct 26 10:30:49 2011

Chain PREROUTING (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source               destination
    9   540 DNAT       all  --  *      *       10.0.0.10            10.0.0.3             to:100.0.0.1
   13   780 DNAT       all  --  *      *       10.0.0.11            10.0.0.3             to:100.0.0.2

Chain POSTROUTING (policy ACCEPT 1 packets, 60 bytes)
 pkts bytes target     prot opt in     out     source               destination
   22  1320 MASQUERADE  all  --  *      *       10.0.0.0/24          100.0.0.0/24

Chain OUTPUT (policy ACCEPT 1 packets, 60 bytes)
 pkts bytes target     prot opt in     out     source               destination
```