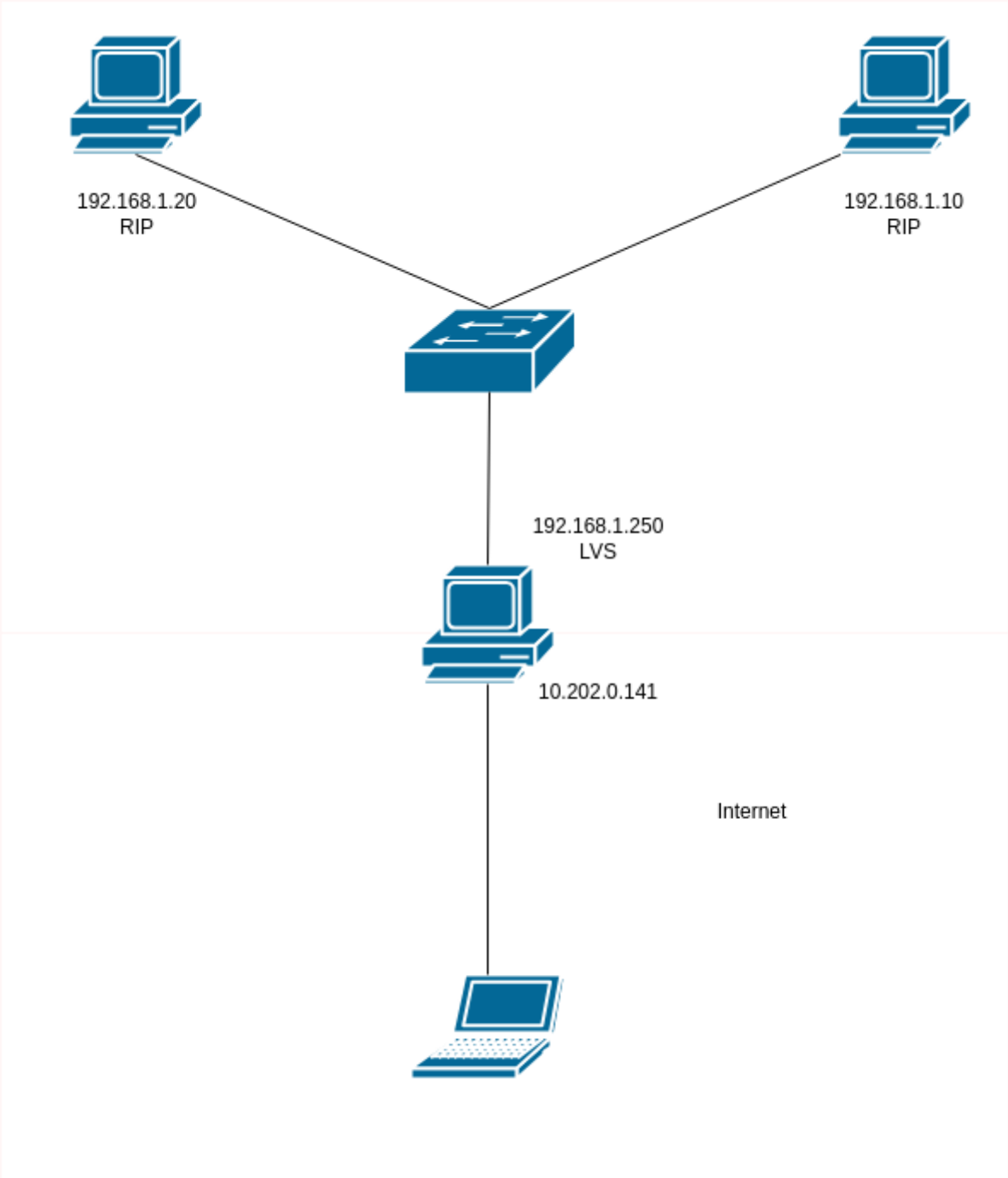


# Equilibrage des charges

## 2. Linux Virtual Server

### 2.1 Réalisation d'une maquette Linux Virtual Server NAT



### 2.2 Caractérisation de LVS NAT

1.

323 202.298939959 10.202.0.176	192.168.1.20	TCP	74 36452 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=543124431 TSecr=0 WS=128
324 202.299608701 192.168.1.20	10.202.0.176	TCP	74 80 → 36452 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM=1 TSval=1307930189 TSecr=543124431 WS=128
325 202.300055389 10.202.0.176	192.168.1.20	TCP	66 36452 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=543124432 TSecr=1307930189
326 202.300051188 10.202.0.176	192.168.1.20	HTTP	142 GET / HTTP/1.1
327 202.300677790 192.168.1.20	10.202.0.176	TCP	66 80 → 36452 [ACK] Seq=1 Ack=77 Win=65152 Len=0 TSval=1307930190 TSecr=543124432
328 202.301030676 192.168.1.20	10.202.0.176	TCP	7306 80 → 36452 [PSH, ACK] Seq=1 Ack=77 Win=65152 Len=7240 TSval=1307930190 TSecr=543124432 [TCP segment of a reassembled PDU]
329 202.301030778 192.168.1.20	10.202.0.176	HTTP	3893 HTTP/1.1 200 OK (text/html)
330 202.301153595 10.202.0.176	192.168.1.20	TCP	66 36452 → 80 [ACK] Seq=77 Ack=7241 Win=60672 Len=0 TSval=543124433 TSecr=1307930190
331 202.301180880 10.202.0.176	192.168.1.20	TCP	66 36452 → 80 [ACK] Seq=77 Ack=11068 Win=57728 Len=0 TSval=543124433 TSecr=1307930190
332 202.305090316 10.202.0.176	192.168.1.20	TCP	66 36452 → 80 [FIN, ACK] Seq=77 Ack=11068 Win=64128 Len=0 TSval=543124482 TSecr=1307930190
333 202.351443312 192.168.1.20	10.202.0.176	TCP	66 80 → 36452 [FIN, ACK] Seq=11068 Ack=78 Win=65152 Len=0 TSval=1307930240 TSecr=543124482
334 202.351509011 10.202.0.176	192.168.1.20	TCP	66 36452 → 80 [ACK] Seq=78 Ack=11069 Win=64128 Len=0 TSval=543124483 TSecr=1307930240
325 204.000779962 10.202.0.176 1 - spinning tree (for - SIP			
336 204.393641559 10.202.0.176	192.168.1.10	TCP	74 36454 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=543126525 TSecr=0 WS=128
337 204.394321204 192.168.1.10	10.202.0.176	TCP	74 80 → 36454 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM=1 TSval=894348045 TSecr=543126525 WS=128
338 204.394331563 10.202.0.176	192.168.1.10	TCP	66 36454 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=543126526 TSecr=894348045
339 204.394473176 10.202.0.176	192.168.1.10	HTTP	142 GET / HTTP/1.1
340 204.395046314 192.168.1.10	10.202.0.176	TCP	66 80 → 36454 [ACK] Seq=1 Ack=77 Win=65152 Len=0 TSval=894348046 TSecr=543126526
341 204.395046345 192.168.1.10	10.202.0.176	HTTP	392 HTTP/1.1 404 Not Found (text/html)
342 204.395144721 10.202.0.176	192.168.1.10	TCP	66 36454 → 80 [ACK] Seq=77 Ack=327 Win=64128 Len=0 TSval=543126527 TSecr=894348046
343 204.395608283 10.202.0.176	192.168.1.10	TCP	66 36454 → 80 [FIN, ACK] Seq=77 Ack=327 Win=64128 Len=0 TSval=543126530 TSecr=894348046
344 204.395439024 192.168.1.10	10.202.0.176	TCP	66 80 → 36454 [FIN, ACK] Seq=327 Ack=78 Win=65152 Len=0 TSval=894348050 TSecr=543126530
345 204.399585794 10.202.0.176	192.168.1.10	TCP	66 36454 → 80 [ACK] Seq=78 Ack=328 Win=64128 Len=0 TSval=543126531 TSecr=894348050

```

dio@lucky-theone:~$ curl 10.202.0.141
<html>
<head><title>404 Not Found</title></head>
<body>
<center><h1>404 Not Found</h1></center>
<hr><center>nginx/1.18.0 (Ubuntu)</center>
</body>
</html>
dio@lucky-theone:~$ curl 10.202.0.141
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <!--
    Modified from the Debian original for Ubuntu
    Last updated: 2022-03-22
    See: https://launchpad.net/bugs/1966004
  -->
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
    <title>Apache2 Ubuntu Default Page: It works</title>
    <style type="text/css" media="screen">
      * {
        margin: 0px 0px 0px 0px;
        padding: 0px 0px 0px 0px;
      }

      body, html {
        padding: 3px 3px 3px 3px;

        background-color: #D8DBE2;

        font-family: Ubuntu, Verdana, sans-serif;
        font-size: 11pt;
        text-align: center;
      }

      div.main_page {
        position: relative;
        display: table;

        width: 800px;

        margin-bottom: 3px;
        margin-left: auto;
        margin-right: auto;
        padding: 0px 0px 0px 0px;

        border-width: 2px;
        border-color: #212738;
        border-style: solid;

        background-color: #FFFFFF;

        text-align: center;
      }

      div.page_header {
        height: 180px;
        width: 100%;

        background-color: #F5F6F7;

```

```
div.page_header span {
    margin: 15px 0px 0px 50px;

    font-size: 180%;
    font-weight: bold;
}

div.page_header img {
    margin: 3px 0px 0px 40px;

    border: 0px 0px 0px;
}

div.banner {
    padding: 9px 6px 9px 6px;
    background-color: #E9510E;
    color: #FFFFFF;
    font-weight: bold;
    font-size: 112%;
    text-align: center;
    position: absolute;
    left: 40%;
    bottom: 30px;
    width: 20%;
}

div.table_of_contents {
    clear: left;

    min-width: 200px;

    margin: 3px 3px 3px 3px;

    background-color: #FFFFFF;

    text-align: left;
}

div.table_of_contents_item {
    clear: left;

    width: 100%;

    margin: 4px 0px 0px 0px;

    background-color: #FFFFFF;

    color: #000000;
    text-align: left;
}

div.table_of_contents_item a {
    margin: 6px 0px 0px 6px;
}

div.content_section {
    margin: 3px 3px 3px 3px;

    background-color: #FFFFFF;

    text-align: left;
}
```

```
div.content_section_text {
    padding: 4px 8px 4px 8px;

    color: #000000;
    font-size: 100%;
}

div.content_section_text pre {
    margin: 8px 0px 8px 0px;
    padding: 8px 8px 8px 8px;

    border-width: 1px;
    border-style: dotted;
    border-color: #000000;

    background-color: #F5F6F7;

    font-style: italic;
}

div.content_section_text p {
    margin-bottom: 6px;
}

div.content_section_text ul, div.content_section_text li {
    padding: 4px 8px 4px 16px;
}

div.section_header {
    padding: 3px 6px 3px 6px;

    background-color: #8E9CB2;

    color: #FFFFFF;
    font-weight: bold;
    font-size: 112%;
    text-align: center;
}

div.section_header_grey {
    background-color: #9F9386;
}

.floating_element {
    position: relative;
    float: left;
}

div.table_of_contents_item a,
div.content_section_text a {
    text-decoration: none;
    font-weight: bold;
}

div.table_of_contents_item a:link,
div.table_of_contents_item a:visited,
div.table_of_contents_item a:active {
    color: #000000;
}

div.table_of_contents_item a:hover {
    background-color: #000000;
```

```

    color: #FFFFFF;
}

div.content_section_text a:link,
div.content_section_text a:visited,
div.content_section_text a:active {
    background-color: #DCDFE6;

    color: #000000;
}

div.content_section_text a:hover {
    background-color: #000000;

    color: #DCDFE6;
}

div.validator {
}
</style>
</head>
<body>
    <div class="main_page">
        <div class="page_header floating_element">
            
            <div>
                <span style="margin-top: 1.5em;" class="floating_element">
                    ENZO EST CE QUE CA A MARCHE, JE CONNAIS PAS LE HTML
                </span>
            </div>
            <div class="banner">
                <div id="about"></div>
                It works!
            </div>

        </div>
        <div class="content_section floating_element">
            <div class="content_section_text">
                <p>
                    Est ce que la ça marche ? <br> ouai ça marche lets go, je peux
                    ecrire de la merde dans la page de default

                    This is the default welcome page used to test the correct
                    operation of the Apache2 server after installation on Ubuntu
                    systems.

                    It is based on the equivalent page on Debian, from which the
                    Ubuntu Apache
                    packaging is derived.
                    If you can read this page, it means that the Apache HTTP server
                    installed at
                    this site is working properly. You should <b>replace this
                    file</b> (located at
                    <tt>/var/www/html/index.html</tt>) before continuing to operate
                    your HTTP server.
                </p>

                <p>
                    If you are a normal user of this web site and don't know what
                    this page is
                    about, this probably means that the site is currently
                    unavailable due to
                    maintenance.
                </p>
            </div>
        </div>
    </div>

```

```

        If the problem persists, please contact the site's
administrator.
    </p>

</div>
<div class="section_header">
    <div id="changes"></div>
        Configuration Overview
    </div>
<div class="content_section_text">
    <p>
        Ubuntu's Apache2 default configuration is different from the
        upstream default configuration, and split into several files
        optimized for
        interaction with Ubuntu tools. The configuration system is
        <b>fully documented in
        /usr/share/doc/apache2/README.Debian.gz</b>. Refer to this for
        the full
        documentation. Documentation for the web server itself can be
        found by accessing the <a href="/manual">manual</a> if the
        <tt>apache2-doc</tt>
        package was installed on this server.
    </p>
    <p>
        The configuration layout for an Apache2 web server installation
        on Ubuntu systems is as follows:
    </p>
    <pre>
/etc/apache2/
|-- apache2.conf
|   |-- ports.conf
|-- mods-enabled
|   |-- *.load
|   |-- *.conf
|-- conf-enabled
|   |-- *.conf
|-- sites-enabled
|   |-- *.conf
    </pre>
    <ul>
        <li>
            <tt>apache2.conf</tt> is the main configuration
            file. It puts the pieces together by including all
            remaining configuration
            files when starting up the web server.
        </li>
        <li>
            <tt>ports.conf</tt> is always included from the
            main configuration file. It is used to determine the
            listening ports for
            incoming connections, and this file can be
            customized anytime.
        </li>
        <li>
            Configuration files in the <tt>mods-enabled/</tt>,
            <tt>conf-enabled/</tt> and <tt>sites-enabled/</tt>
            directories contain
            particular configuration snippets which manage
            modules, global configuration
            fragments, or virtual host configurations,
            respectively.
    </ul>

```

```

        </li>

        <li>
            They are activated by symlinking available
            configuration files from their respective
            *-available/ counterparts. These should be managed
            by using our helpers
            <tt>
                a2enmod,
                a2dismod,
            </tt>
            <tt>
                a2ensite,
                a2dissite,
            </tt>
            and
            <tt>
                a2enconf,
                a2disconf
            </tt>. See their respective man pages for detailed
information.
        </li>

        <li>
            The binary is called apache2 and is managed using
systemd, so to
            start/stop the service use <tt>systemctl start
apache2</tt> and
            <tt>systemctl stop apache2</tt>, and use
<tt>systemctl status apache2</tt>
            and <tt>journalctl -u apache2</tt> to check status.
<tt>system</tt>
            and <tt>apache2ctl</tt> can also be used for service
management if
            desired.
            <b>Calling <tt>/usr/bin/apache2</tt> directly will
not work</b> with the
            default configuration.
        </li>
    </ul>
</div>

<div class="section_header">
    <div id="docroot"></div>
    Document Roots
</div>

<div class="content_section_text">
    <p>
        By default, Ubuntu does not allow access through the web
browser to
        <em>any</em> file outside of those located in
<tt>/var/www</tt>,
        <a href="http://httpd.apache.org/docs/2.4/mod/mod_userdir.html"
rel="nofollow">public_html</a>
        directories (when enabled) and <tt>/usr/share</tt> (for web
applications). If your site is using a web document root
        located elsewhere (such as in <tt>/srv</tt>) you may need to
whitelist your
        document root directory in <tt>/etc/apache2/apache2.conf</tt>.
    </p>
    <p>
        The default Ubuntu document root is <tt>/var/www/html</tt>. You

```

```
        can make your own virtual hosts under /var/www.
    </p>
</div>

<div class="section_header">
    <div id="bugs"></div>
    Reporting Problems
</div>
<div class="content_section_text">
    <p>
        Please use the <tt>ubuntu-bug</tt> tool to report bugs in the
        Apache2 package with Ubuntu. However, check <a
        href="https://bugs.launchpad.net/ubuntu/+source/apache2"
        rel="nofollow">existing bug reports</a> before reporting a new
bug.
    </p>
    <p>
        Please report bugs specific to modules (such as PHP and others)
        to their respective packages, not to the web server itself.
    </p>
</div>

</div>
</div>
<div class="validator">
</div>
</body>
</html>
```

2.



```

root@debian:~# ab -n 100 http://10.202.0.141/
This is ApacheBench, Version 2.3 <$Revision: 1903618 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 10.202.0.141 (be patient).....done


Server Software:      Apache/2.4.52
Server Hostname:      10.202.0.141
Server Port:          80

Document Path:        /
Document Length:      10812 bytes

Concurrency Level:     1
Time taken for tests:  0.166 seconds
Complete requests:     100
Failed requests:        5
  (Connect: 0, Receive: 0, Length: 5, Exceptions: 0)
Non-2xx responses:      5
Total transferred:     1054775 bytes
HTML transferred:      1027950 bytes
Requests per second:   601.54 [#/sec] (mean)
Time per request:       1.662 [ms] (mean)
Time per request:       1.662 [ms] (mean, across all concurrent requests)
Transfer rate:          6196.18 [Kbytes/sec] received

Connection Times (ms)
              min   mean[+/-sd] median   max
Connect:        1    1   0.1      1      1
Processing:      1    1   0.2      1      2
Waiting:         1    1   0.1      1      2
Total:          1    2   0.2      2      2

Percentage of the requests served within a certain time (ms)
 50%      2
 66%      2
 75%      2
 80%      2
 90%      2
 95%      2
 98%      2
 99%      2
100%     2 (longest request)

```

3.

## 2.3 Réalisation d'une maquette Linux Virtual Server DR

## 2.4 Caractérisation de LVS DR

## 3 Tips and tricks

### 3.1 Configuration du NAT sur un routeur Cisco

3.2 Configuration d'une seconde adresse IP sur une interface (DR et NAT)

3.3 Configuration d'une seconde adresse IP sur une interface de loopback d'un RIP (DR)

3.4 Désactivation de l'arp pour les interfaces RIP des serveurs

3.5 Utilisation de iptables pour ne pas configurer de VIP sur les RIPs

## 4 Briques logicielles

---

4.1 Utilisez un client en ligne de commandes :httpie

4.2 Manipulation du LVS avec la ligne de commande

4.3 Configuration d'un resolver/cache unbound

4.4 Pour information : désactivation de l'ICMP redirect au cas en mode "direct routing"

5 Toujours plus haut... avec Haproxy un loadbalancer de niveau sept

---