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Práctica 5. Referenciación (*benchmarking*)

En esta práctica usaremos algunas herramientas de referenciación o *benchmarking*. Utilizaremos una **máquina virtual**.

Contenido:

UnixBench (~30 min.)

Compila UnixBench (github.com/kdlucas/byte-unixbench):

```
$ wget
https://github.com/kdlucas/byte-
unixbench/archive/v5.1.3.tar.gz
$ tar zxf v5.1.3.tar.gz
$ cd byte-unixbench-5.1.3/UnixBench
$ make
```

UnixBench:proporciona un indicador básico del rendimiento de un sistema similar a Unix; por lo tanto, se utilizan múltiples pruebas para probar varios aspectos del rendimiento del sistema. Los resultados de las pruebas luego se comparan con las puntuaciones de un sistema de referencia para producir un valor de índice, que generalmente es más fácil de manejar que las puntuaciones sin procesar. Hay diferentes tipos de test. (Basicamente es un Benchmark personalizado)
Dhrystone:Sirve para medir y comparar el resultado de varias computadoras, con operaciones de listas y datos en punto flotante.
Whetstone:Mide la velocidad y la eficiencia de las operaciones en punto flotante
execl Throughput:Número de llamadas execl, por segundo que puede realizar.Biblioteca execve().
File Copy:Cantidad de datos que se pueden transmitir de un fichero a otro, con distintos tamaños de buffer.Mide los caracteres que puede copiar en 10 segundos.
Pipe Throughput:Número de veces por segundo que puede escribir y leer en una tuberia 512 bytes.
Pipe-based Context Switching:Numero de veces que dos tuberias bidireccionales comparten información de procesos.Utiliza procesos hijos para comprobar estos. Es algo más real.
Process Creation:Numero de veces que un proceso puede hacer un fork para crear un proceso hijo, y que exista inmediatamente.

Shell Scripts: Numero de veces que puede iniciarse y obtener un conjunto de una, dos, cuatro y ocho copias simultáneas de scripts de shell
System Call Overhead:El coste estimado que tiene el SO. lo hace realizando llamadas getpid()
Graphical Tests:Test grafico que puede verse condicionado por los drivers instalados.

Ejecuta el conjunto de pruebas por defecto, reduciendo a tres el número de ejecuciones de las pruebas más rápidas y a una el de las pruebas más lentas, con el siguiente comando:

```
$ ./Run -i 3
```

Mientras se ejecuta (tarda unos 10 minutos), obtén información sobre cada prueba (Dhrystone 2, Double-Precision Whetstone, Execl Throughput…).

Indica de qué tipo es cada benchmark, qué hace y qué intenta medir y en qué unidades proporciona los resultados.

```
========================================================================
   BYTE UNIX Benchmarks (Version 5.1.3)

   System: debian: GNU/Linux
   OS: GNU/Linux -- 3.2.0-4-amd64 -- #1 SMP Debian 3.2.63-2
   Machine: x86_64 (unknown)
   Language: en_US.utf8 (charmap="ANSI_X3.4-1968", collate="ANSI_X3.4-1968")
   CPU 0: Intel(R) Core(TM) i3-10110U CPU @ 2.10GHz (5188.5 bogomips)
          Hyper-Threading, x86-64, MMX, Physical Address Ext, SYSENTER/SYSEXIT, SYSCALL/SYSRET
   12:12:20 up 5 min,  2 users,  load average: 0.14, 0.07, 0.03; runlevel

------------------------------------------------------------------------
Benchmark Run: jue mar 09 2023 12:12:20 - 12:21:58
1 CPU in system; running 1 parallel copy of tests

Dhrystone 2 using register variables       49455421.1 lps   (10.0 s, 2 samples)
Double-Precision Whetstone                     2582.8 MWIPS (22.4 s, 2 samples)
Execl Throughput                               6138.1 lps   (29.3 s, 1 samples)
File Copy 1024 bufsize 2000 maxblocks       1380178.0 KBps  (30.0 s, 1 samples)
File Copy 256 bufsize 500 maxblocks          408201.0 KBps  (30.0 s, 1 samples)
File Copy 4096 bufsize 8000 maxblocks       3004092.0 KBps  (30.0 s, 1 samples)
Pipe Throughput                             2801069.7 lps   (10.0 s, 2 samples)
Pipe-based Context Switching                 571206.3 lps   (10.0 s, 2 samples)
Process Creation                              24130.9 lps   (30.0 s, 1 samples)
Shell Scripts (1 concurrent)                  11644.6 lpm   (60.0 s, 1 samples)
Shell Scripts (8 concurrent)                   1438.4 lpm   (60.0 s, 1 samples)
System Call Overhead                        4754814.0 lps   (10.0 s, 2 samples)

System Benchmarks Index Values               BASELINE       RESULT    INDEX
Dhrystone 2 using register variables         116700.0   49455421.1   4237.8
Double-Precision Whetstone                       55.0       2582.8    469.6
Execl Throughput                                 43.0       6138.1   1427.5
File Copy 1024 bufsize 2000 maxblocks          3960.0    1380178.0   3485.3
File Copy 256 bufsize 500 maxblocks            1655.0     408201.0   2466.5
File Copy 4096 bufsize 8000 maxblocks          5800.0    3004092.0   5179.5
Pipe Throughput                               12440.0    2801069.7   2251.7
Pipe-based Context Switching                   4000.0     571206.3   1428.0
Process Creation                                126.0      24130.9   1915.2
Shell Scripts (1 concurrent)                     42.4      11644.6   2746.4
Shell Scripts (8 concurrent)                      6.0       1438.4   2397.4
System Call Overhead                          15000.0    4754814.0   3169.9
                                                                   ========
System Benchmarks Index Score                                       2243.5
```

El test grafico no se ha hecho, para ello:
"GRAPHIC_TESTS = defined"

NOTA:
lps:loop per second
MWIPS:Millones de Instrucciones Whetstone Por Segundo
lpm:loop per minute
BASELINE:Es la referencia, viene en el git
The index numbers are generated from a baseline file that is in pgms/index.base

Averigua cómo se calcula el índice global de rendimiento (“Index Score” o “BYTE Index”) a partir de los resultados proporcionados por cada programa (ver ficheros `README` y `USAGE`).

Indica cómo se calcula el índice, qué máquina se usa como referencia y cuáles son las medidas base.

Index:The index numbers are generated from a baseline file that is in pgms/index.base

The machine: "George", certain SPARCstation 20-61 with 128 MB RAM, a SPARC Storage Array, and Solaris 2.3 is my new baseline; it is rated at 10.0 in each of the index scores for a final score of 10.0.

file: pgms/index.base

```
# Scores from "George", a SPARCstation 20-61.
dhry2reg|10|lps|116700|116700|2
whetstone-double|10|MWIPS|55.0|55.0|2
execl|20|lps|43.0|43.0|1
fstime|20|KBps|3960|3960|1
fsbuffer|20|KBps|1655|1655|1
fsdisk|20|KBps|5800|5800|1
pipe|10|lps|12440|12440|2
context1|10|lps|4000|4000|2
spawn|20|lps|126|126|1
shell8|60|lpm|6|6|1
syscall|10|lps|15000|15000|2
```

En el fichero Run:

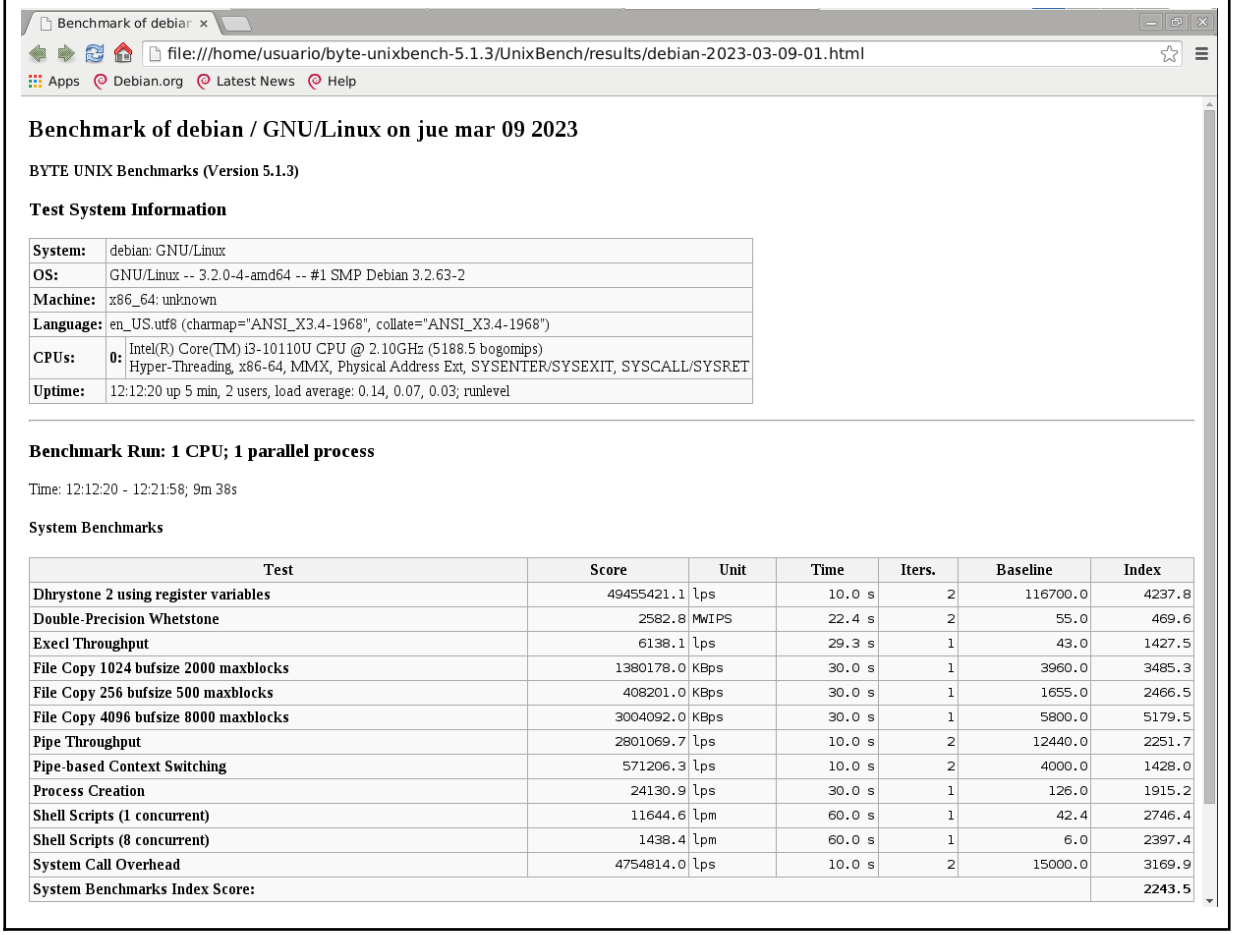
```
# Note that the index values are computed as
#    result / baseline * 10
```

Observa los resultados en el directorio `results`.

Copia los resultados.

Se generan 3 ficheros:

```
usuario@debian:~/byte-unixbench-5.1.3/UnixBench/results$ ls
debian-2023-03-09-01  debian-2023-03-09-01.html  debian-2023-03-09-01.log
```



Benchmark of debian

file:///home/usuario/byte-unixbench-5.1.3/UnixBench/results/debian-2023-03-09-01.html

Apps Debian.org Latest News Help

Benchmark of debian / GNU/Linux on jue mar 09 2023

BYTE UNIX Benchmarks (Version 5.1.3)

Test System Information

System:	debian: GNU/Linux	
OS:	GNU/Linux -- 3.2.0-4-amd64 -- #1 SMP Debian 3.2.63-2	
Machine:	x86_64: unknown	
Language:	en_US.utf8 (charmap="ANSI_X3.4-1968", collate="ANSI_X3.4-1968")	
CPUs:	**0:**	Intel(R) Core(TM) i3-10110U CPU @ 2.10GHz (5188.5 bogomips) Hyper-Threading, x86-64, MMX, Physical Address Ext, SYSENTER/SYSEXIT, SYSCALL/SYSRET
Uptime:	12:12:20 up 5 min, 2 users, load average: 0.14, 0.07, 0.03; runlevel	

Benchmark Run: 1 CPU; 1 parallel process

Time: 12:12:20 - 12:21:58; 9m 38s

System Benchmarks

Test	Score	Unit	Time	Iters.	Baseline	Index
Dhrystone 2 using register variables	49455421.1	lps	10.0 s	2	116700.0	4237.8
Double-Precision Whetstone	2582.8	MWIPS	22.4 s	2	55.0	469.6
Execl Throughput	6138.1	lps	29.3 s	1	43.0	1427.5
File Copy 1024 bufsize 2000 maxblocks	1380178.0	KBps	30.0 s	1	3960.0	3485.3
File Copy 256 bufsize 500 maxblocks	408201.0	KBps	30.0 s	1	1655.0	2466.5
File Copy 4096 bufsize 8000 maxblocks	3004092.0	KBps	30.0 s	1	5800.0	5179.5
Pipe Throughput	2801069.7	lps	10.0 s	2	12440.0	2251.7
Pipe-based Context Switching	571206.3	lps	10.0 s	2	4000.0	1428.0
Process Creation	24130.9	lps	30.0 s	1	126.0	1915.2
Shell Scripts (1 concurrent)	11644.6	lpm	60.0 s	1	42.4	2746.4
Shell Scripts (8 concurrent)	1438.4	lpm	60.0 s	1	6.0	2397.4
System Call Overhead	4754814.0	lps	10.0 s	2	15000.0	3169.9
System Benchmarks Index Score:						**2243.5**

```
Archivo  Editar  Ver  Terminal  Ir  Ayuda
SYSCALL/SYSRET
   12:12:20 up 5 min,  2 users,  load average: 0.14, 0.07, 0.03; runlevel

------------------------------------------------------------------------
Benchmark Run: jue mar 09 2023 12:12:20 - 12:21:58
1 CPU in system; running 1 parallel copy of tests

Dhrystone 2 using register variables       49455421.1 lps   (10.0 s, 2 samples)
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Execl Throughput                               6138.1 lps   (29.3 s, 1 samples)
File Copy 1024 bufsize 2000 maxblocks       1380178.0 KBps  (30.0 s, 1 samples)
File Copy 256 bufsize 500 maxblocks          408201.0 KBps  (30.0 s, 1 samples)
File Copy 4096 bufsize 8000 maxblocks       3004092.0 KBps  (30.0 s, 1 samples)
Pipe Throughput                             2801069.7 lps   (10.0 s, 2 samples)
Pipe-based Context Switching                 571206.3 lps   (10.0 s, 2 samples)
Process Creation                              24130.9 lps   (30.0 s, 1 samples)
Shell Scripts (1 concurrent)                  11644.6 lpm   (60.0 s, 1 samples)
Shell Scripts (8 concurrent)                   1438.4 lpm   (60.0 s, 1 samples)
System Call Overhead                        4754814.0 lps   (10.0 s, 2 samples)

System Benchmarks Index Values               BASELINE       RESULT    INDEX
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Double-Precision Whetstone                       55.0       2582.8    469.6
Execl Throughput                                 43.0       6138.1   1427.5
File Copy 1024 bufsize 2000 maxblocks          3960.0    1380178.0   3485.3
File Copy 256 bufsize 500 maxblocks            1655.0     408201.0   2466.5
File Copy 4096 bufsize 8000 maxblocks          5800.0    3004092.0   5179.5
Pipe Throughput                               12440.0    2801069.7   2251.7
Pipe-based Context Switching                   4000.0     571206.3   1428.0
Process Creation                                126.0      24130.9   1915.2
Shell Scripts (1 concurrent)                     42.4      11644.6   2746.4
Shell Scripts (8 concurrent)                      6.0       1438.4   2397.4
System Call Overhead                          15000.0    4754814.0   3169.9
                                                                     ========
System Benchmarks Index Score                                         2243.5
```
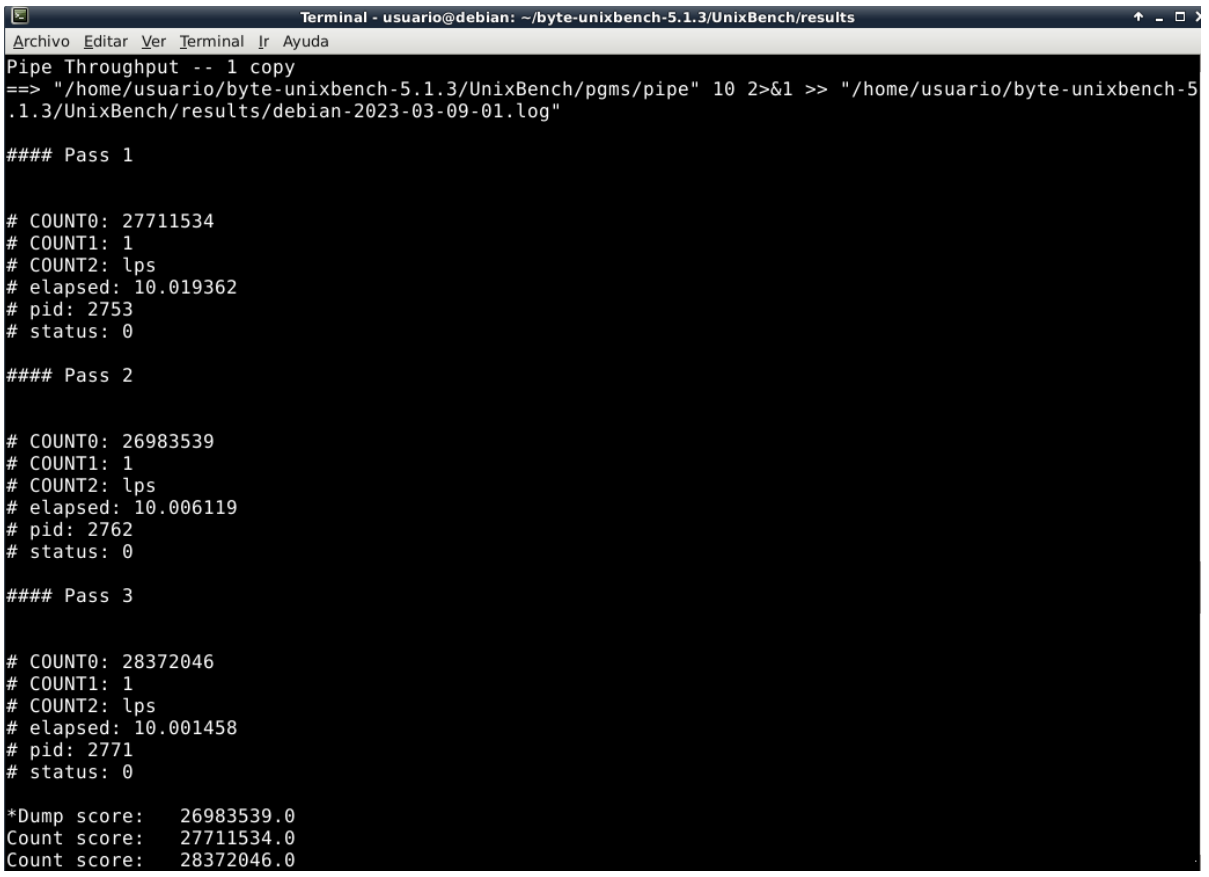
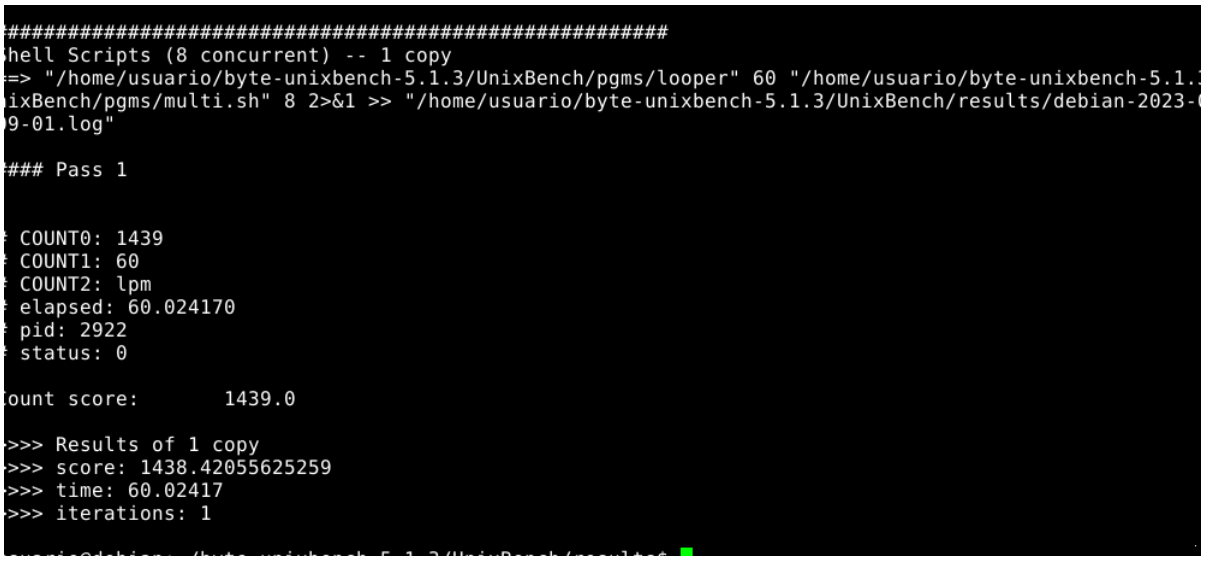

Quizá el más interesante sea el .log que es algo distinto,en cuanto a información.De cada prueba

```
Archivo  Editar  Ver  Terminal  Ir  Ayuda

#### Pass 1

Calibrate
       0.00 Seconds          1   Passes (x 100)
       0.01 Seconds          5   Passes (x 100)
       0.03 Seconds         25   Passes (x 100)
       0.19 Seconds        125   Passes (x 100)
       1.09 Seconds        625   Passes (x 100)

Use 5754  passes (x 100)

          Double Precision C/C++ Whetstone Benchmark

Loop content                  Result              MFLOPS      MOPS   Seconds

N1 floating point     -1.12398255667391744      1704.781              0.065
N2 floating point     -1.12187079889292241      1726.092              0.448
N3 if then else        1.00000000000000000                14887.731    0.040
N4 fixed point        12.00000000000000000                    0.000    0.000
N5 sin,cos etc.        0.49902937281518261                  124.274    3.852
N6 floating point      0.99999987890802811      1020.893              3.040
N7 assignments         3.00000000000000000                 6041.322    0.176
N8 exp,sqrt etc.       0.75100163018453692                   14.822   14.441

MWIPS                                           2608.083              22.062


# COUNT0: 2608.083
# COUNT1: 0
# COUNT2: MWIPS
# TIME: 22.062
# elapsed: 24.656734
# pid: 2683
# status: 0
```


Terminal - usuario@debian: ~/byte-unixbench-5.1.3/UnixBench/results
Archivo Editar Ver Terminal Ir Ayuda
Pipe Throughput -- 1 copy
==> "/home/usuario/byte-unixbench-5.1.3/UnixBench/pgms/pipe" 10 2>&1 >> "/home/usuario/byte-unixbench-5
.1.3/UnixBench/results/debian-2023-03-09-01.log"
Pass 1
COUNT0: 27711534
COUNT1: 1
COUNT2: lps
elapsed: 10.019362
pid: 2753
status: 0
Pass 2
COUNT0: 26983539
COUNT1: 1
COUNT2: lps
elapsed: 10.006119
pid: 2762
status: 0
Pass 3
COUNT0: 28372046
COUNT1: 1
COUNT2: lps
elapsed: 10.001458
pid: 2771
status: 0
*Dump score: 26983539.0
Count score: 27711534.0
Count score: 28372046.0


hell Scripts (8 concurrent) -- 1 copy
==> "/home/usuario/byte-unixbench-5.1.3/UnixBench/pgms/looper" 60 "/home/usuario/byte-unixbench-5.1.
ixBench/pgms/multi.sh" 8 2>&1 >> "/home/usuario/byte-unixbench-5.1.3/UnixBench/results/debian-2023-
9-01.log"
Pass 1
COUNT0: 1439
COUNT1: 60
COUNT2: lpm
elapsed: 60.024170
pid: 2922
status: 0
ount score: 1439.0
>>> Results of 1 copy
>>> score: 1438.42055625259
>>> time: 60.02417
>>> iterations: 1

IOzone (~20 min.)

Compila IOzone (www.iozone.org):

```
$ wget http://www.iozone.org/src/current/iozone3_489.tar
$ tar xf iozone3_489.tar
$ cd iozone3_489
$ make -C src/current linux
```

Consulta la página de manual de `iozone`:`$ man docs/iozone.1`

Herramienta de benchmark, que mide operaciones de archivo.
Util para ficheros de E/S en las operaciones de:
Lectura, escritura, relectura, reescritura, lectura hacia atrás, lectura a zancadas, fread, fwrite, lectura/escritura aleatoria, variantes de prelectura/escritura

Hay muchisimas opciones:

```
Iozone [-a|-A] [-s filesize_Kb] [-r record_size_Kb] [-f [path]filename]
[-i test] [-E] [-p] [-m] [-M] [-t children] [-h] [-o] [-l
min_number_procs] [-u max_number_procs] [-v] [-R] [-x] [-d
microseconds] [-F path1 path2...] [-V pattern ] [-j stride] [-T] [-C]
[-B] [-D] [-G] [-I] [-H depth] [-k depth] [-U mount_point] [-S
cache_size] [-O] [-L line_size] [-K] [-N] [-Q] [-P start_cpu] [-c] [-e]
[-b Excel.xls] [-J milliseconds] [-X [path]filename] [-Y
[path]filename] [-w] [-W] [-z] [-Z] [-n min_filesize_Kb] [-g
max_filesize_Kb] [-y min_recordsize_Kb] [-q max_recordsize_Kb] [-+d]
[-+u] [-+m client_filename] [-+n] [-+N] [-+p percent_read] [-+r] [-+t]
[-+l] [-+L] [-+D] [-+A madvise_selector] [-+h hostname] [-+T] [-+w
Percent de-dupable.]
```

Haz una prueba con un fichero de 100 MB:

```
$ src/current/iozone -s 100m
```

Copia los resultados y escribe un breve análisis de los mismos.

-s: Se utiliza para especificar el tamaño, en Kbytes, del archivo a probar. También se puede especificar -s #k (tamaño en Kbytes) o -s #m (tamaño en Mbytes) o -s #g (tamaño en Gbytes).

```
Run began: Thu Mar  9 13:26:41 2023

File size set to 102400 kB
Command line used: src/current/iozone -s 100m
Output is in kBytes/sec
Time Resolution = 0.000001 seconds.
Processor cache size set to 1024 kBytes.
Processor cache line size set to 32 bytes.
File stride size set to 17 * record size.
                                                            random    random     bkwd    record    stride
      kB  reclen    write  rewrite    read    reread    read     write     read  rewrite      read   fwrite frewrite    fread  freread
  102400       4  1541471  4449461  4215223  4520599  5071110  3211339  4366188  7413321   4097164  2711078  2018569  4499147  6346478
```

Repite la prueba añadiendo la opción `-I`.

Indica para qué sirve la opción y qué efecto tiene en los resultados.

-I: Use DIRECT IO si es posible para todas las operaciones de archivos. Le dice al sistema de archivos que todas las operaciones en el archivo deben pasar por alto el caché del búfer e ir directamente al disco. (no esta disponible en todas las plataformas)

```
Run began: Thu Mar  9 13:31:35 2023

File size set to 102400 kB
O_DIRECT feature enabled
Command line used: src/current/iozone -s 100m -I
Output is in kBytes/sec
Time Resolution = 0.000001 seconds.
Processor cache size set to 1024 kBytes.
Processor cache line size set to 32 bytes.
File stride size set to 17 * record size.
                                                    random    random     bkwd    record    stride
      kB  reclen    write  rewrite    read    reread    read     write     read   rewrite      read   fwrite frewrite    fread  freread
  102400       4    71746    78601    31280     30908   22093    72207    22020     86922     22040  3532370  1809544  2841060  7192948
```

Al saltarnos en Buffer e ir directamente a disco, se vuelve mucho más lento y por eso baja la cantidad de bytes que copia o lee.

Repite la prueba añadiendo la opción `-r 16k` junto con la anterior.

Indica para qué sirve la opción y qué efecto tiene en los resultados.

-r: Se utiliza para especificar el tamaño de bloque, en Kbytes. También se puede especificar -r #k (tamaño en Kbytes) o -r #m (tamaño en Mbytes) o -r #g (tamaño en Gbytes).

```
Run began: Thu Mar  9 13:36:29 2023

File size set to 102400 kB
Record Size 16 kB
Command line used: src/current/iozone -s 100m -r 16k
Output is in kBytes/sec
Time Resolution = 0.000001 seconds.
Processor cache size set to 1024 kBytes.
Processor cache line size set to 32 bytes.
File stride size set to 17 * record size.
                                                    random    random     bkwd    record    stride
      kB  reclen    write  rewrite    read    reread    read     write     read   rewrite      read   fwrite frewrite    fread  freread
  102400      16  2436296  2083420  8439076  8513516  7927540  4664903  7085556   4189688   8394214  3149892  2358902  7882292  5705716
```

Aumenta el número de bytes, ya que el tamaño de bloque se ha aumentado de a 4 a 16. Apartado reclen.

iPerf3 (~20 min.)

Compila e instala iPerf3 (github.com/esnet/iperf):

```
$ wget https://github.com/esnet/iperf/archive/3.7.tar.gz
$ tar zxf 3.7.tar.gz
$ cd iperf-3.7
$ ./configure
$ make
$ sudo make install
```

Consulta la página de manual de `iperf3`.

iperf3: es una herramienta para realizar mediciones de rendimiento de red. Puede probar el rendimiento de TCP, UDP o SCTP.

Arranca un servidor TCP:

```
$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -s
```

```
-s: para arrancar iperf en modo servidor
-Por defecto el servidor se crea en el puerto 5201
```

Realiza una prueba con un cliente en otro terminal:

```
$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -c localhost
```

Copia los resultados y escribe un breve análisis de los mismos.

-Interval: Cada intervalo de tiempo que se está midiendo.
-Transfer: cantidad de información que se ha transferido en ese tiempo.
-Bitrate: media de información transmitida calculada en ese intervalo.
-Retr: cantidad de paquetes de TCP que ha hecho falta reenviar.
-Cwnd: cantidad de información que se ha transmitido antes de recibir una señal ACK.

Cliente

```
usuario@debian:~/iperf-3.7$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -c localhost
Connecting to host localhost, port 5201
[  5] local ::1 port 45022 connected to ::1 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-1.00   sec  8.30 GBytes  71.3 Gbits/sec    0    559 KBytes
[  5]   1.00-2.00   sec  8.37 GBytes  71.9 Gbits/sec    0    559 KBytes
[  5]   2.00-3.00   sec  8.34 GBytes  71.7 Gbits/sec    0    559 KBytes
[  5]   3.00-4.00   sec  8.40 GBytes  72.1 Gbits/sec    0    559 KBytes
[  5]   4.00-5.00   sec  8.36 GBytes  71.8 Gbits/sec    0    559 KBytes
[  5]   5.00-6.00   sec  8.33 GBytes  71.6 Gbits/sec    0    591 KBytes
[  5]   6.00-7.00   sec  8.38 GBytes  72.0 Gbits/sec    0    591 KBytes
[  5]   7.00-8.00   sec  8.38 GBytes  72.0 Gbits/sec    0    591 KBytes
[  5]   8.00-9.00   sec  8.40 GBytes  72.2 Gbits/sec    0    591 KBytes
[  5]   9.00-10.00  sec  8.43 GBytes  72.4 Gbits/sec    0    591 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  83.7 GBytes  71.9 Gbits/sec    0             sender
[  5]   0.00-10.02  sec  83.7 GBytes  71.7 Gbits/sec                  receiver

iperf Done.
usuario@debian:~/iperf-3.7$
```

Servidor

```
usuario@debian:~/iperf-3.7$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -s
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
Accepted connection from ::1, port 45021
[  5] local ::1 port 5201 connected to ::1 port 45022
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec  8.13 GBytes  69.8 Gbits/sec
[  5]   1.00-2.00   sec  8.37 GBytes  71.9 Gbits/sec
[  5]   2.00-3.00   sec  8.34 GBytes  71.7 Gbits/sec
[  5]   3.00-4.00   sec  8.40 GBytes  72.2 Gbits/sec
[  5]   4.00-5.00   sec  8.37 GBytes  71.8 Gbits/sec
[  5]   5.00-6.00   sec  8.32 GBytes  71.5 Gbits/sec
[  5]   6.00-7.00   sec  8.39 GBytes  72.1 Gbits/sec
[  5]   7.00-8.00   sec  8.38 GBytes  72.0 Gbits/sec
[  5]   8.00-9.00   sec  8.39 GBytes  72.1 Gbits/sec
[  5]   9.00-10.00  sec  8.43 GBytes  72.4 Gbits/sec
[  5]  10.00-10.02  sec   169 MBytes  74.0 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-10.02  sec  83.7 GBytes  71.7 Gbits/sec                  receiver
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
```

Al estar analizando la red local, la velocidad de transferencia es muy alta y no se da ningún problema. No hay caídas en la velocidad de transferencias ni ha habido ningún paquete de TCP que se haya tenido que reenviar.

Repite la prueba añadiendo la opción `-Z`.

Indica para qué sirve la opción y qué efecto tiene en los resultados.

-Z: utiliza el método zero-copy, lo que reduce mucho el uso de CPU por parte del programa.

Cliente

```
usuario@debian:~/iperf-3.7$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -c localhost -Z
Connecting to host localhost, port 5201
[  5] local ::1 port 45024 connected to ::1 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-1.00   sec  13.6 GBytes   117 Gbits/sec    0    559 KBytes
[  5]   1.00-2.00   sec  13.5 GBytes   116 Gbits/sec    0    559 KBytes
[  5]   2.00-3.00   sec  13.6 GBytes   117 Gbits/sec    0    559 KBytes
[  5]   3.00-4.00   sec  13.6 GBytes   116 Gbits/sec    0    559 KBytes
[  5]   4.00-5.00   sec  13.6 GBytes   117 Gbits/sec    0    559 KBytes
[  5]   5.00-6.00   sec  13.5 GBytes   116 Gbits/sec    0    559 KBytes
[  5]   6.00-7.00   sec  13.5 GBytes   116 Gbits/sec    0    559 KBytes
[  5]   7.00-8.00   sec  13.5 GBytes   116 Gbits/sec    0    559 KBytes
[  5]   8.00-9.00   sec  13.6 GBytes   117 Gbits/sec    0    559 KBytes
[  5]   9.00-10.00  sec  13.5 GBytes   116 Gbits/sec    0    559 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec   135 GBytes   116 Gbits/sec    0             sender
[  5]   0.00-10.01  sec   135 GBytes   116 Gbits/sec                  receiver

iperf Done.
usuario@debian:~/iperf-3.7$
```

Servidor

```
usuario@debian:~/iperf-3.7$ LD_LIBRARY_PATH=/usr/local/lib/ iperf3 -s
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
Accepted connection from ::1, port 45023
[  5] local ::1 port 5201 connected to ::1 port 45024
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec  13.4 GBytes   115 Gbits/sec
[  5]   1.00-2.00   sec  13.5 GBytes   116 Gbits/sec
[  5]   2.00-3.00   sec  13.6 GBytes   117 Gbits/sec
[  5]   3.00-4.00   sec  13.6 GBytes   116 Gbits/sec
[  5]   4.00-5.00   sec  13.6 GBytes   117 Gbits/sec
[  5]   5.00-6.00   sec  13.5 GBytes   116 Gbits/sec
[  5]   6.00-7.00   sec  13.4 GBytes   116 Gbits/sec
[  5]   7.00-8.00   sec  13.5 GBytes   116 Gbits/sec
[  5]   8.00-9.00   sec  13.6 GBytes   117 Gbits/sec
[  5]   9.00-10.00  sec  13.5 GBytes   116 Gbits/sec
[  5]  10.00-10.01  sec   183 MBytes   114 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-10.01  sec   135 GBytes   116 Gbits/sec                  receiver
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
```

Al utilizar el método zero-copy el sistema no necesita realizar copias al hacer las operaciones por lo que funciona mucho más rápido, lo que se ve reflejado en el tiempo de las transferencias.

Phoronix Test Suite (~20 min.)

Instala Phoronix Test Suite (www.phoronix-test-suite.com):

```
$ sudo apt-get install php5-cli
$ wget
http://phoronix-test-suite.com/releases/phoronix-test-
suite-9.4.0.tar.gz
$ tar zxf phoronix-test-suite-9.4.0.tar.gz
$ cd phoronix-test-suite
$ rm pts-core/objects/pts_openbenchmarking_upload.php
$ sudo ./install-sh
```

Ejecuta el comando `phoronix-test-suite` y acepta las condiciones de uso.

Edita el fichero `~/.phoronix-test-suite/user-config.xml` y establece la opción `DynamicRunCount` a `FALSE`. De esta forma, no se incrementa el número de ejecuciones si la desviación estándar de los tiempos de ejecución supera un límite predefinido.

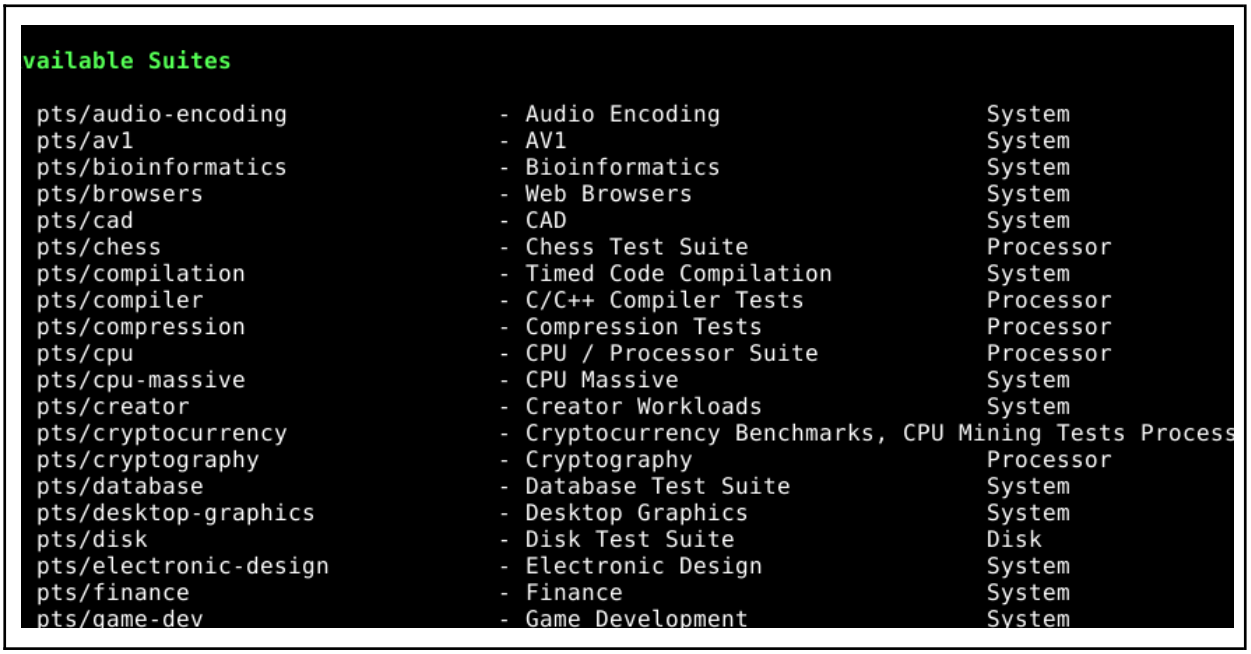
Consulta la página de manual de `phoronix-test-suite`. Revisa las pruebas y conjuntos disponibles:

-phoronix-test-suite: es la plataforma de benchmarking más exhaustiva que existe para linux, mac, windows… Permite realizar muchos tests de forma automática y sencilla.

```
$ phoronix-test-suite list-tests
```

```
Available Tests

pts/ai-benchmark              - AI Benchmark Alpha                    System
pts/aircrack-ng               - Aircrack-ng                           Processor
pts/amg                       - Algebraic Multi-Grid Benchmark        Processor
pts/aobench                   - AOBench                               Processor
pts/aom-av1                   - AOM AV1                               Processor
pts/apache                    - Apache HTTP Server                    System
pts/apache-siege              - Apache Siege                          System
pts/appleseed                 - Appleseed                             System
pts/arrayfire                 - ArrayFire                             Processor
pts/ashes-escalation          - Ashes of the Singulairty: Escalation  Graphics
pts/askap                     - ASKAP                                 System
pts/asmfish                   - asmFish                               Processor
pts/astcenc                   - ASTC Encoder                          System
pts/avifenc                   - libavif avifenc                       Processor
pts/basemark                  - Basemark GPU                          System
pts/basis                     - Basis Universal                       System
pts/batman-knight             - Batman: Arkham Knight                 Graphics
pts/batman-origins            - Batman: Arkham Origins                Graphics
pts/betsy                     - Betsy GPU Compressor                  Graphics
pts/bioshock-infinite         - BioShock Infinite                     Graphics
pts/blake2                    - BLAKE2                                Processor
pts/blender                   - Blender                               System
pts/blogbench                 - BlogBench                             Disk
pts/blosc                     - C-Blosc                               Processor
pts/bork                      - Bork File Encrypter                   Processor
pts/botan                     - Botan                                 Processor
pts/brl-cad                   - BRL-CAD                               System
pts/build-apache              - Timed Apache Compilation              Processor
```

```
$ phoronix-test-suite list-suites
```



```
vailable Suites

 pts/audio-encoding              - Audio Encoding                  System
 pts/av1                         - AV1                             System
 pts/bioinformatics              - Bioinformatics                  System
 pts/browsers                    - Web Browsers                    System
 pts/cad                         - CAD                             System
 pts/chess                       - Chess Test Suite                Processor
 pts/compilation                 - Timed Code Compilation          System
 pts/compiler                    - C/C++ Compiler Tests            Processor
 pts/compression                 - Compression Tests               Processor
 pts/cpu                         - CPU / Processor Suite           Processor
 pts/cpu-massive                 - CPU Massive                     System
 pts/creator                     - Creator Workloads               System
 pts/cryptocurrency              - Cryptocurrency Benchmarks, CPU Mining Tests Process
 pts/cryptography                - Cryptography                    Processor
 pts/database                    - Database Test Suite             System
 pts/desktop-graphics            - Desktop Graphics                System
 pts/disk                        - Disk Test Suite                 Disk
 pts/electronic-design           - Electronic Design               System
 pts/finance                     - Finance                         System
 pts/game-dev                    - Game Development                System
```

Obtén información de las pruebas o conjuntos, por ejemplo:

```
$ phoronix-test-suite info byte
```

```
BYTE Unix Benchmark 3.6

Run Identifier:       pts/byte-1.2.2
Profile Version:      1.2.2
Maintainer:           Michael Larabel
Test Type:            Processor
Software Type:        Utility
License Type:         Free
Test Status:          Verified
Supported Platforms:  Linux, Solaris, MacOSX, BSD
Project Web-Site:
Estimated Run-Time:   380 Seconds
Download Size:        0.17 MB
Environment Size:     1.0 MB

Description: This is a test of BYTE.


OpenBenchmarking.org Test Profile: https://openbenchmarking.org/test/pts/byte-1.2.2


Test Installed: No

Software Dependencies:
- Compiler / Development Libraries

OpenBenchmarking.org Change History
v1.2.2 - 27 September 2020
Drop options/tests that do not work well on modern platforms.
v1.2.1 - 4 August 2016
Add SHA256 to downloads.xml as test
v1.2.0 - 12 March 2012
Ensure byte always honors CFLAGS.
v1.1.0 - 6 December 2010
Initial import into OpenBenchmarking.org
```

```
$ phoronix-test-suite info cpu
```

```
CPU / Processor Suite

Suite Description:  This test suite contains tests designed to test the system's CPU / processor. This test suite is deprecat
ed and not maintained due to the collection of test profiles now so diverse that such a large test suite is not really practi
cal. Use another suite(s) more narrowily focused on your interests/needs.

Run Identifier:     pts/cpu-1.2.4
Suite Version:      1.2.4
Maintainer:         Michael Larabel
Suite Type:         Processor
Unique Tests:       16
Contained Tests:
                    Rodinia                         Test: OpenMP CFD Solver
                    Rodinia                         Test: OpenMP LavaMD
                    NAMD
                    Stockfish
                    x264
                    x265                            Video Input: Bosphorus 1080p
                    x265                            Video Input: Bosphorus 4K
                    Kvazaar                         Video Input: Bosphorus 1080p - Video Preset: Slow
                    Kvazaar                         Video Input: Bosphorus 1080p - Video Preset: Medium
                    Kvazaar                         Video Input: Bosphorus 1080p - Video Preset: Very Fast
                    Kvazaar                         Video Input: Bosphorus 1080p - Video Preset: Ultra Fast
                    Kvazaar                         Video Input: Bosphorus 4K - Video Preset: Slow
                    Kvazaar                         Video Input: Bosphorus 4K - Video Preset: Medium
                    Kvazaar                         Video Input: Bosphorus 4K - Video Preset: Very Fast
                    Kvazaar                         Video Input: Bosphorus 4K - Video Preset: Ultra Fast
                    7-Zip Compression
                    Blender                         Blend File: Barbershop - Compute: CPU-Only
                    asmFish
                    Timed Linux Kernel Compilation
                    Timed GCC Compilation
                    Radiance Benchmark              Test: Serial
                    Radiance Benchmark              Test: SMP Parallel
                    OpenSSL
                    ctx_clock
                    Sysbench                        Test: CPU
```

Ejecuta una prueba rápida, por ejemplo:

```
$ sudo phoronix-test-suite install-dependencies openssl
```

En la maquina del lab, sí ha funcionado, pero no nos daba la salida correcta, al volver a ejecutar lo hacia muy rapido, Consideramos que se ejecutó anteriormente y tiene guardada la información anterior.

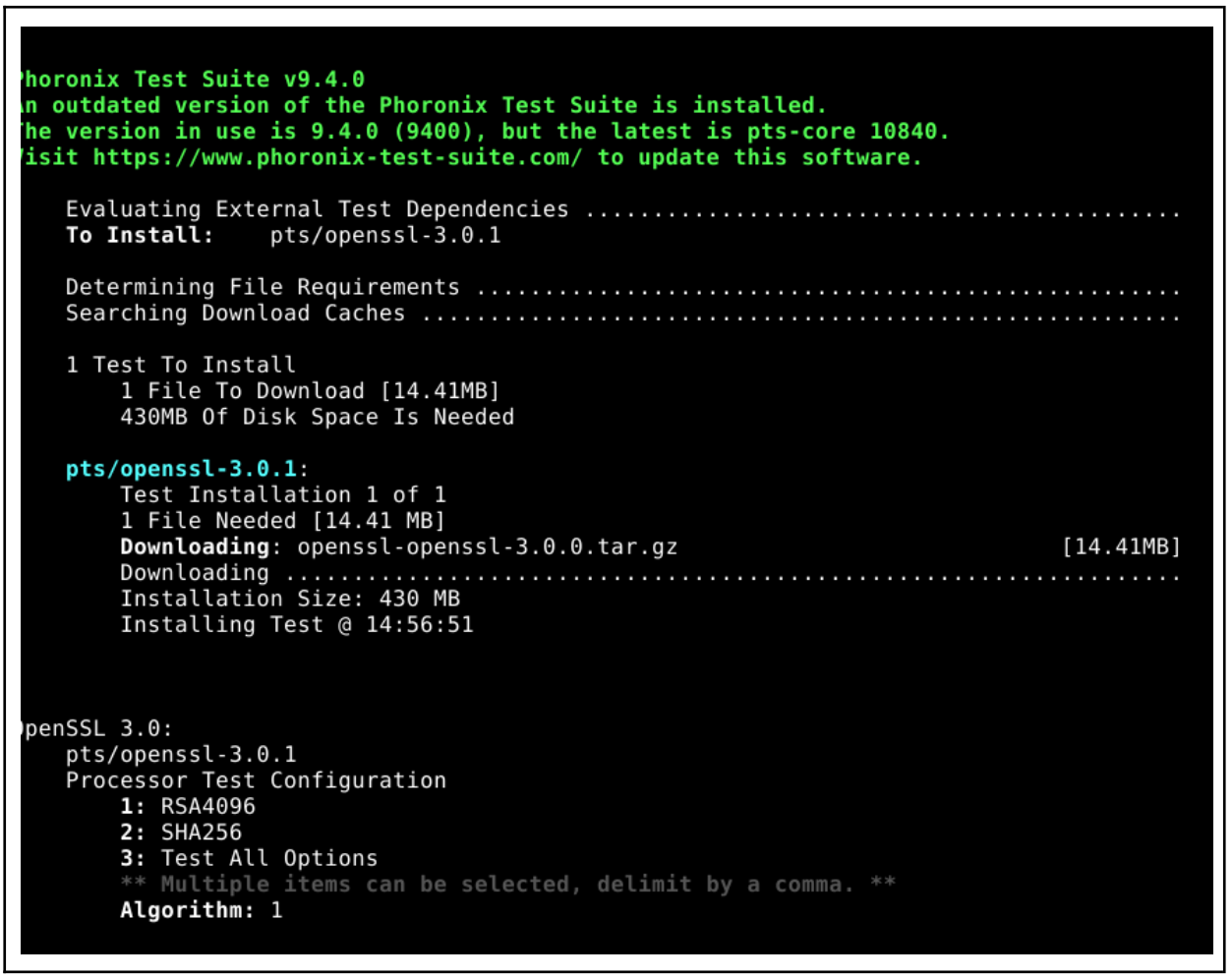
```
usuario@debian:~/phoronix-test-suite$ sudo phoronix-test-suite install-dependenc
ies openssl



Phoronix Test Suite v9.4.0
An outdated version of the Phoronix Test Suite is installed.
The version in use is 9.4.0 (9400), but the latest is pts-core 10840.
Visit https://www.phoronix-test-suite.com/ to update this software.

    Evaluating External Test Dependencies ..............................

usuario@debian:~/phoronix-test-suite$
```

```
$ phoronix-test-suite benchmark openssl
```

Indica que quieres guardar los resultados, escribe “resul” como nombre para el fichero de resultados, escribe “primera” como nombre único de la prueba y no modifiques la descripción por defecto. Al terminar, indica que quieres ver los resultados en un navegador.

Repite la prueba escribiendo “segunda” como nombre único de la prueba.

Copia la salida del comando `phoronix-test-suite result-file-to-text resul`. *Escribe un breve análisis de los resultados.*

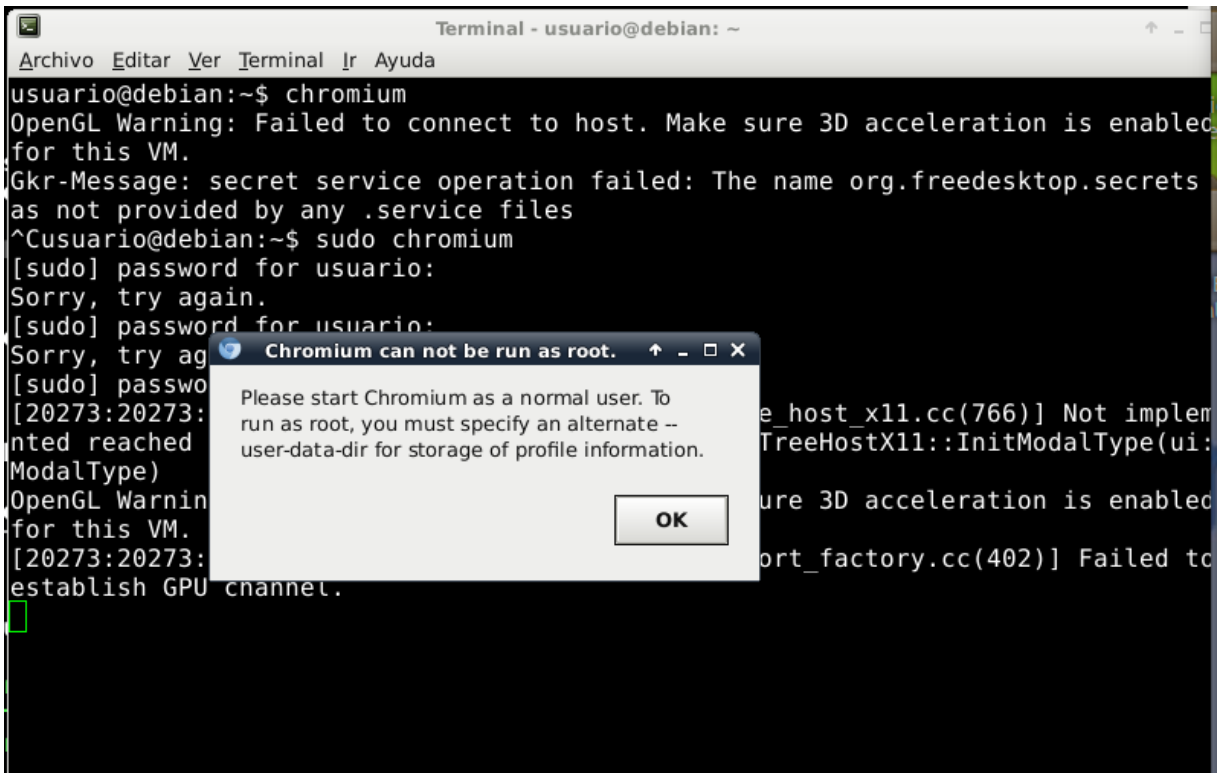


```
ystem Information


PROCESSOR:          Intel Core i7-9700
  Core Count:       1
  Extensions:       SSE 4.2 + AVX + RDRAND + FSGSBASE
  Cache Size:       12288 KB

GRAPHICS:           LLVMpipe
  OpenGL:           2.1 Mesa 8.0.5 Gallium 0.4 (LLVM 0x209)
  Display Driver:   vboxvideo 1.0.1
  Monitor:          VBOX monitor
  Screen:           953x961

MOTHERBOARD:        Oracle VirtualBox v1.2
  BIOS Version:     VirtualBox
  Chipset:          Intel 440FX 82441FX PMC
  Audio:            Intel 82801AA AC 97 Audio
  Network:          Intel 82540EM

MEMORY:             1024MB

DISK:               11GB VBOX HDD
  File-System:      ext4
  Mount Options:    barrier=1 data=ordered errors=remount-ro relatime rw user_xattr
  Disk Scheduler:   CFQ

OPERATING SYSTEM:   Debian 7.7
  Kernel:           3.2.0-4-amd64 (x86_64)
  Desktop:          Xfce 4.8
  Display Server:   X Server 1.12.4
  Compiler:         GCC 4.7.2
  System Layer:     VirtualBox

  Would you like to save these test results (Y/n): y
  Enter a name for the result file: resul
  Enter a unique name to describe this test run / configuration: primera
```

```
OpenSSL 3.0:
    pts/openssl-3.0.1 [Algorithm: RSA4096]
    Test 1 of 1
    Estimated Trial Run Count:    3
    Estimated Time To Completion: 9 Minutes [15:08 CET]
        Started Run 1 @ 15:00:40
        Started Run 2 @ 15:01:44
        Started Run 3 @ 15:02:48

    Algorithm: RSA4096:
        211.5
        210
        214.1

    Average: 211.9 sign/s
    Deviation: 0.98%

    Result compared to 3,568 OpenBenchmarking.org samples since 26 February 2011; median resu
lt: 1007. Box plot of samples:
    [#*!#*# ##-------------------------------------------------------------|  *              ]
            ^ Intel Core i5-12600K: 2831 2 x Intel Xeon Platinum 8490H: 28562 ^
          ^ Intel Core i5-12400: 2092
        ^ Intel Core i5-6500: 968


    Algorithm: RSA4096:
        13418.5
        13652
        13865.6

    Average: 13645.4 verify/s
    Deviation: 1.64%

    Result compared to 3,524 OpenBenchmarking.org samples since 26 February 2011; median resu
lt: 67197. Box plot of samples:
    [##!######-------------*-*-----*-----------------------------------|   *             ]
              AMD EPYC 7713: 823488 ^  2 x Intel Xeon Platinum 8490H: 1888631 ^
                                ^ 2 x Intel Xeon Gold 6254: 647119
                             ^ AMD Ryzen Threadripper 3970X: 611770

    Do you want to view the results in your web browser (Y/n): y
```

PARA SEGUNDA

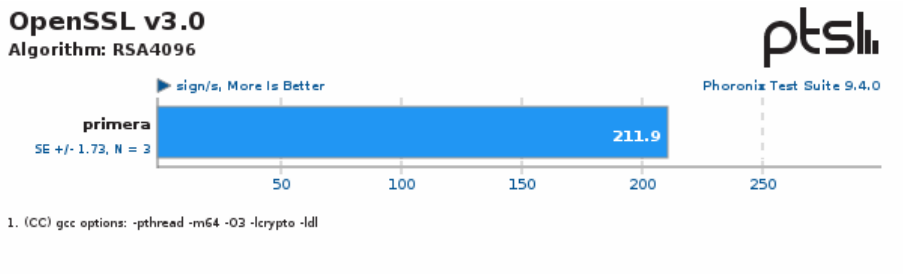
```
    Recently Saved Test Results:
       resul    [Today]

    Enter a name for the result file: resul2
    Enter a unique name to describe this test run / configuration: segunda

f desired, enter a new description below to better describe this result set / syst
ation under test.
ress ENTER to proceed without changes
```



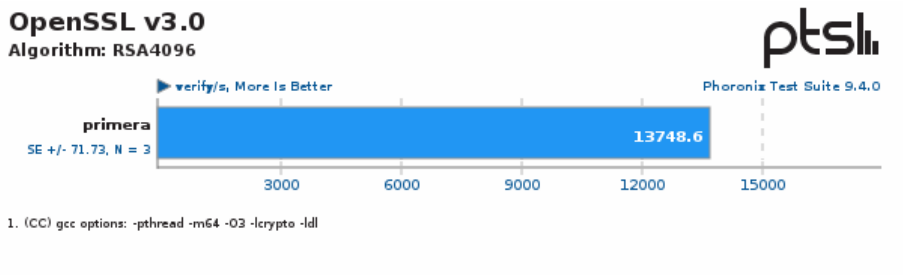
Resul de primera, asumimos que primera y segunda tienen el mismo resultado porque es la misma maquina

	PRIMERA	OpenSSL
Algorithm: RSA4096 (sign/s ↑)	211.9	OpenSSL
Algorithm: RSA4096 (verify/s ↑)	13749	GEOMETRIC MEAN 1706.847

OpenSSL



(Delete Result) (Add Annotation) (View Test Installation Logs)



(Delete Result) (Add Annotation) (View Test Installation Logs)

```
primera:

       Processor: Intel Core i7-9700 (1 Core), Motherboard: Oracle VirtualBox v
1.2, Chipset: Intel 440FX 82441FX PMC, Memory: 1024MB, Disk: 11GB VBOX HDD, Grap
hics: LLVMpipe, Audio: Intel 82801AA AC 97 Audio, Monitor: VBOX monitor, Network
: Intel 82540EM

       OS: Debian GNU/Linux 7, Kernel: 3.2.0-4-amd64 (x86_64), Desktop: Xfce 4.
8, Display Server: X Server 1.12.4, Display Driver: vboxvideo 1.0.1, OpenGL: 2.1
 Mesa 8.0.5 Gallium 0.4 (LLVM 0x209), Compiler: GCC 4.7.2, File-System: ext4, Sc
reen Resolution: 953x961, System Layer: VirtualBox


    OpenSSL 3.0
    Algorithm: RSA4096
    sign/s > Higher Is Better
    primera . 211.9 |============================================================


    OpenSSL 3.0
    Algorithm: RSA4096
    verify/s > Higher Is Better
    primera . 13748.6 |==========================================================
```