

# Technische specificaties van de servers

Onze applicaties bieden we aan in de pakketten 'standard' en 'plus'. De applicatie heeft in beide pakketten steeds exact dezelfde functionaliteit. Het verschil in beide pakketten zit in de hardware specificaties van de server.

## Upgraden en downgraden

### Upgraden

Wanneer je bij het bestelproces bijvoorbeeld gekozen hebt voor een 'Standard' pakket, dan kan je dit steeds laten upgraden naar een 'Plus' pakket. Dit kan noodzakelijk zijn om bijvoorbeeld meer processor-kracht of meer RAM geheugen kunnen in te zetten, of om de opslagruimte te verhogen.

### Downgraden

Als een server bijvoorbeeld van het 'Standard' naar het 'Plus' pakket wordt geupgrade, dan heb je de keuze om enkel de processor (CPU) en het RAM-geheugen te upgraden, of ook de opslagruimte. Wanneer enkel processor en het RAM-geheugen geupgrade wordt, dan kan in de toekomst steeds een downgrade naar het 'Standard' pakket gebeuren. Wanneer ook de opslagruimte geupgrade werd, dan is een downgrade niet meer mogelijk.

## Algemene specificaties

Onze virtuele machines worden gehost op servers waarbij de processor en het RAM-geheugen gedeeld worden met andere virtuele machines. Op aanvraag is het mogelijk om dedicated vCPU's te gebruiken.

- **Processor:** de exacte CPU GHz kan verschillen, maar zal steeds minimaal 2GHz bedragen. Als processor wordt steeds een AMD EPYC 2nd Gen of een Intel® Xeon® Gold gebruikt (1 vCPU = 1 hyper-thread).

- **RAM-geheugen:** het geheugen is steeds ECC-geheugen.
- **Opslagruimte:** lokale NVMe SSD's op RAID10.
- **IP-adressen:** er wordt steeds 1 IPv4 en 1 IPv6 adres voorzien. Extra IPv4 adressen zijn tegen extra kost verkrijgbaar. Extra IPv6 adressen worden kosteloos toegewezen moest dit noodzakelijk zijn.
- **Netwerk:** de server is met een redundante verbinding verbonden met het internet. De netwerksnelheid kan wisselen naar gelang de drukte op dat moment van de dag.

# Specificaties van de servers

In [dit overzicht](#) vind je een beschrijving van de exacte server specificaties per applicatie en per pakket.

## Benchmarks

Onderstaande benchmarks werden uitgevoerd op een virtuele server met 2 vCPU's en 4 GB RAM-geheugen. Als besturingssysteem gebruikten we Debian 11.3 met Linux kernel 5.10.0-14.

## Opslagruimte

Om benchmarks op de opslagruimte uit te voeren, gebruikte we fio versie 3.25.

### Write

We schreven 2GB (4 jobs van 512MB):

```
sudo fio --name=randwrite --ioengine=libaio --iodepth=1 --rw=randwrite --bs=4k --direct=0 --size=512M --numjobs=4 --runtime=240 --group_reporting
```

Dat gaf dit resultaat:

```
randwrite: (g=0): rw=randwrite, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=1
...
fio-3.25
Starting 4 processes
randwrite: Laying out IO file (1 file / 512MiB)
randwrite: Laying out IO file (1 file / 512MiB)
```

```
randwrite: Laying out IO file (1 file / 512MiB)
randwrite: Laying out IO file (1 file / 512MiB)
Jobs: 4 (f=4): [w(4)][100.0%][w=201MiB/s][w=51.5k IOPS][eta 00m:00s]
randwrite: (groupid=0, jobs=4): err= 0: pid=738: Tue May 24 09:39:54 2022
write: IOPS=59.0k, BW=234MiB/s (246MB/s)(2048MiB/8742msec); 0 zone resets
slat (usec): min=2, max=45198, avg=60.91, stdev=1030.00
clat (nsec): min=678, max=12025k, avg=1918.96, stdev=45729.60
lat (usec): min=3, max=45232, avg=63.07, stdev=1031.60
clat percentiles (nsec):
| 1.00th=[ 700], 5.00th=[ 708], 10.00th=[ 732], 20.00th=[ 844],
| 30.00th=[ 892], 40.00th=[ 1020], 50.00th=[ 1224], 60.00th=[ 1496],
| 70.00th=[ 1784], 80.00th=[ 1960], 90.00th=[ 2128], 95.00th=[ 2512],
| 99.00th=[ 4128], 99.50th=[ 8096], 99.90th=[ 43264], 99.95th=[ 71168],
| 99.99th=[897024]
bw ( KiB/s): min=121592, max=1116624, per=100.00%, avg=250840.24, stdev=59610.23, samples=65
iops      : min=30398, max=279155, avg=62709.69, stdev=14902.51, samples=65
lat (nsec) : 750=13.10%, 1000=26.08%
lat (usec) : 2=46.14%, 4=13.63%, 10=0.68%, 20=0.18%, 50=0.11%
lat (usec) : 100=0.06%, 250=0.01%, 500=0.01%, 750=0.01%, 1000=0.01%
lat (msec) : 2=0.01%, 4=0.01%, 10=0.01%, 20=0.01%
cpu       : usr=4.91%, sys=14.09%, ctx=5271, majf=0, minf=57
IO depths  : 1=100.0%, 2=0.0%, 4=0.0%, 8=0.0%, 16=0.0%, 32=0.0%, >=64=0.0%
submit    : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
complete  : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
issued rwts: total=0,524288,0,0 short=0,0,0,0 dropped=0,0,0,0
latency   : target=0, window=0, percentile=100.00%, depth=1
```

Run status group 0 (all jobs):

```
WRITE: bw=234MiB/s (246MB/s), 234MiB/s-234MiB/s (246MB/s-246MB/s), io=2048MiB (2147MB), run=8742-8742msec
```

Disk stats (read/write):

```
sda: ios=0/126694, merge=0/845, ticks=0/232652, in_queue=232655, util=93.89%
```

## Read

We lezen 2GB (4 jobs van 512MB):

```
sudo fio --name=randread --ioengine=libaio --iodepth=16 --rw=randread --bs=4k --direct=0 --size=512M --numjobs=4 --runtime=240 --group_reporting
```

Dat gaf dit resultaat:

```
randread: (g=0): rw=randread, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio,
iodepth=16
```

```
...
```

```
fio-3.25
```

```
Starting 4 processes
```

```
randread: Laying out IO file (1 file / 512MiB)
```

```
randread: Laying out IO file (1 file / 512MiB)
```

```
randread: Laying out IO file (1 file / 512MiB)
```

```
randread: Laying out IO file (1 file / 512MiB)
```

```
Jobs: 1 (f=1): [_ (3),r(1)][100.0%][r=10.0MiB/s][r=2561 IOPS][eta 00m:00s]
```

```
randread: (groupid=0, jobs=4): err= 0: pid=748: Tue May 24 09:41:17 2022
```

```
read: IOPS=13.8k, BW=54.0MiB/s (56.6MB/s)(2048MiB/37921msec)
```

```
slat (usec): min=72, max=26831, avg=251.53, stdev=224.41
```

```
clat (usec): min=3, max=31309, avg=3850.84, stdev=1376.21
```

```
lat (usec): min=122, max=34147, avg=4102.97, stdev=1444.32
```

```
clat percentiles (usec):
```

```
| 1.00th=[ 2278], 5.00th=[ 2474], 10.00th=[ 2638], 20.00th=[ 2868],
```

```
| 30.00th=[ 3097], 40.00th=[ 3294], 50.00th=[ 3523], 60.00th=[ 3818],
```

```
| 70.00th=[ 4178], 80.00th=[ 4686], 90.00th=[ 5407], 95.00th=[ 5932],
```

```
| 99.00th=[ 7832], 99.50th=[10683], 99.90th=[17695], 99.95th=[20055],
```

```
| 99.99th=[30278]
```

```
bw ( KiB/s): min=51280, max=74928, per=100.00%, avg=63027.97, stdev=1396.04, samples=267
```

```
iops      : min=12820, max=18732, avg=15756.93, stdev=348.99, samples=267
```

```
lat (usec)  : 4=0.01%, 10=0.01%, 250=0.01%, 500=0.01%, 750=0.01%
```

```
lat (usec)  : 1000=0.01%
```

```
lat (msec)  : 2=0.01%, 4=65.45%, 10=33.98%, 20=0.51%, 50=0.05%
```

```
cpu        : usr=2.90%, sys=12.02%, ctx=525101, majf=0, minf=110
```

```
IO depths   : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=100.0%, 32=0.0%, >=64=0.0%
```

```
submit     : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
```

```
complete   : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.1%, 32=0.0%, 64=0.0%, >=64=0.0%
```

```
issued rwts: total=524288,0,0,0 short=0,0,0,0 dropped=0,0,0,0
```

```
latency    : target=0, window=0, percentile=100.00%, depth=16
```

```
Run status group 0 (all jobs):
```

```
READ: bw=54.0MiB/s (56.6MB/s), 54.0MiB/s-54.0MiB/s (56.6MB/s-56.6MB/s), io=2048MiB (2147MB),
```

```
run=37921-37921msec
```

```
Disk stats (read/write):
```

```
sda: ios=524118/50, merge=0/17, ticks=117035/17, in_queue=117053, util=99.86%
```

## Random read/write

```
sudo fio --randrepeat=1 --ioengine=libaio --direct=1 --gtod_reduce=1 --name=test --  
filename=random_read_write.fio --bs=4k --iodepth=64 --size=4G --readwrite=randrw --rwmixread=75
```

Dat gaf dit resultaat:

```
test: (g=0): rw=randrw, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=64  
fio-3.25  
Starting 1 process  
test: Laying out IO file (1 file / 4096MiB)  
Jobs: 1 (f=1): [m(1)][100.0%][r=151MiB/s,w=49.8MiB/s][r=38.6k,w=12.8k IOPS][eta 00m:00s]  
test: (groupid=0, jobs=1): err= 0: pid=756: Tue May 24 09:42:30 2022  
read: IOPS=36.9k, BW=144MiB/s (151MB/s)(3070MiB/21303msec)  
bw ( KiB/s): min=119000, max=179816, per=99.98%, avg=147538.93, stdev=13675.43, samples=42  
iops      : min=29750, max=44954, avg=36884.69, stdev=3418.87, samples=42  
write: IOPS=12.3k, BW=48.2MiB/s (50.5MB/s)(1026MiB/21303msec); 0 zone resets  
bw ( KiB/s): min=39736, max=59872, per=99.99%, avg=49313.76, stdev=4497.26, samples=42  
iops      : min= 9934, max=14968, avg=12328.38, stdev=1124.17, samples=42  
cpu       : usr=18.04%, sys=47.15%, ctx=24982, majf=0, minf=7  
IO depths  : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=0.1%, 32=0.1%, >=64=100.0%  
submit    : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%  
complete  : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.1%, >=64=0.0%  
issued rwts: total=785920,262656,0,0 short=0,0,0,0 dropped=0,0,0,0  
latency   : target=0, window=0, percentile=100.00%, depth=64  
  
Run status group 0 (all jobs):  
  READ: bw=144MiB/s (151MB/s), 144MiB/s-144MiB/s (151MB/s-151MB/s), io=3070MiB (3219MB), run=21303-  
21303msec  
  WRITE: bw=48.2MiB/s (50.5MB/s), 48.2MiB/s-48.2MiB/s (50.5MB/s-50.5MB/s), io=1026MiB (1076MB),  
run=21303-21303msec  
  
Disk stats (read/write):  
sda: ios=778983/260325, merge=0/35, ticks=829618/263407, in_queue=1093033, util=99.67%
```

## Network

We voerden een speedtest uit vanaf een server in Falkenstein naar een server in Rosenheim (speedtest server ID 37516).

```
speedtest
```

Dat gaf dit resultaat:

```
Testing from Hetzner Online GmbH (168.119.178.2)...
Retrieving speedtest.net server list...
Retrieving information for the selected server...
Hosted by Komro GmbH (Rosenheim) [428.19 km]: 18.881 ms
Testing download speed.....
Download: 1200.87 Mbit/s
Testing upload speed.....
Upload: 1046.51 Mbit/s
```

# Processor

We voerden een sysbench test uit met versie 1.0.20.

```
sysbench cpu --threads=2 run
```

Dat gaf dit resultaat:

```
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time


Prime numbers limit: 10000

Initializing worker threads...

Threads started!

CPU speed:
```

events per second: 1807.14

General statistics:

total time:	10.0006s
total number of events:	18077

Latency (ms):

min:	1.04
avg:	1.10
max:	12.67
95th percentile:	1.27
sum:	19974.38

Threads fairness:

events (avg/stddev):	9038.5000/2.50
execution time (avg/stddev):	9.9872/0.00

# Geheugen

We voerden een sysbench test uit met versie 1.0.20.

```
sysbench memory --threads=2 run
```

Dat gaf dit resultaat:

sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:

Number of threads: 2

Initializing random number generator from current time

Running memory speed test with the following options:

block size: 1KiB

total size: 102400MiB

operation: write

scope: global

Initializing worker threads...

Threads started!

Total operations: 42084784 (4207444.09 per second)

41098.42 MiB transferred (4108.83 MiB/sec)

General statistics:

total time:	10.0004s
total number of events:	42084784

Latency (ms):

min:	0.00
avg:	0.00
max:	6.04
95th percentile:	0.00
sum:	13791.29

Threads fairness:

events (avg/stddev):	21042392.0000/15556.00
execution time (avg/stddev):	6.8956/0.01

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