# SPEC CPU®2017 Integer Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen10 Plus
(2.65 GHz, AMD EPYC 7413)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
<th>SPECspeed®2017_int_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.1</td>
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</tr>
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</table>

**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Tested by:** HPE  
**Test Date:** Mar-2021  
**Hardware Availability:** Apr-2021  
**Software Availability:** Mar-2021

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_int_base (12.1)</th>
<th>SPECspeed®2017_int_peak (12.1)</th>
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<tbody>
<tr>
<td>48</td>
<td>6.36</td>
<td>13.1</td>
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<tr>
<td>600.perlbenci_s</td>
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<td>605.mcf_s</td>
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<td>620.omnetpp_s</td>
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<td>623.xalanchmk_s</td>
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<tr>
<td>657.xz_s</td>
<td></td>
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<tr>
<td>48</td>
<td></td>
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</tr>
</tbody>
</table>

## Hardware

| CPU Name: AMD EPYC 7413  
| Max MHz: 3600  
| Nominal: 2650  
| Enabled: 48 cores, 2 chips  
| Orderable: 1.2 chips  
| Cache L1: 32 KB I + 32 KB D on chip per core  
| L2: 512 KB I+D on chip per core  
| L3: 128 MB I+D on chip per chip, 32 MB shared / 6 cores  
| Other: None  
| Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)  
| Storage: 1 x 196 GB SATA SSD, RAID 0  
| Other: None |

## Software

| OS: Ubuntu 20.04.1 LTS (x86_64)  
| Compiler: C/C++/Fortran: Version 3.0.0 of AOCC  
| Parallel: Yes  
| Firmware: HPE BIOS Version A42 v2.40 02/23/2021 released Feb-2021  
| File System: ext4  
| System State: Run level 5 (multi-user)  
| Base Pointers: 64-bit  
| Peak Pointers: 64-bit  
| Other: jemalloc: jemalloc memory allocator library v5.1.0  
| Power Management: BIOS set to prefer performance at the cost of additional power usage |
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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### Compiler Notes


### Submit Notes

The config file option 'submit' was used. 'numactl' was used to bind copies to the cores.

See the configuration file for details.

### Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of memory.
'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum necessary.
'echo 1 > /proc/sys/vm/zone_reclaim_mode' run as root to free node-local memory and avoid remote memory usage.
'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout randomization (ASLR) to reduce run-to-run variability.
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SPECspeed®2017_int_base = 12.1
SPECspeed®2017_int_peak = 12.1

Operating System Notes (Continued)

'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root to enable
Transparent Hugepages (THP) for this run.
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root for peak
runs of 628.pop2_s and 638.imagick_s to enable THP only on request.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-47"
LD_LIBRARY_PATH =
    "/home/cpu2017n/amd_speed_aocc300_milan_B_lib/64;/home/cpu2017n/amd_spee
d_aocc300_milan_B_lib/32:" 
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "48"

Environment variables set by runcpu during the 600.perlbench_s peak run:
GOMP_CPU_AFFINITY = "0"

General Notes

Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using openSUSE 15.2

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2)
is mitigated in the system as tested and documented.

jemalloc: configured and built with GCC v4.8.2 in RHEL 7.4 (No options specified)
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

Platform Notes

BIOS Configuration
  Workload Profile set to General Peak Frequency Compute
  AMD SMT Option set to Disabled
  Determinism Control set to Manual

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**Platform Notes (Continued)**

Performance Determinism set to Power Deterministic  
Last-Level Cache (LLC) as NUMA Node set to Enabled  
NUMA memory domains per socket set to One memory domain per socket  
Thermal Configuration set to Maximum Cooling  
Workload Profile set to Custom  
Infinity Fabric Power Management set to Disabled  
Infinity Fabric Performance State set to P0  
Power Regulator set to OS Control Mode

Sysinfo program /home/cpu2017n/bin/sysinfo  
Rev: r6538 of 2020-09-24 e8664e66d2d7080afea89d4b38e2f1c  
running on admin Thu Mar 18 17:03:23 2021

SUT (System Under Test) info as seen by some common utilities.  
For more information on this section, see  
https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo  
model name : AMD EPYC 7413 24-Core Processor  
  2 "physical id"s (chips)  
  48 "processors"  
cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)  
cpu cores : 24  
siblings : 24  
physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29  
physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

From lscpu:  
Architecture: x86_64  
CPU op-mode(s): 32-bit, 64-bit  
Byte Order: Little Endian  
Address sizes: 48 bits physical, 48 bits virtual  
CPU(s): 48  
On-line CPU(s) list: 0-47  
Thread(s) per core: 1  
Core(s) per socket: 24  
Socket(s): 2  
NUMA node(s): 8  
Vendor ID: AuthenticAMD  
CPU family: 25  
Model: 1  
Model name: AMD EPYC 7413 24-Core Processor  
Stepping: 1  
Frequency boost: enabled  
CPU MHz: 2069.091  
CPU max MHz: 2650.0000

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### Test Sponsor: HPE
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**Test Date:** Mar-2021  
**Test Sponsor:** HPE  
**Hardware Availability:** Apr-2021  
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### SPECspeed®2017_int_base = 12.1
### SPECspeed®2017_int_peak = 12.1

### Platform Notes (Continued)

CPU min MHz: 1500.0000  
BogoMIPS: 5290.11  
Virtualization: AMD-V  
L1d cache: 1.5 MiB  
L1i cache: 1.5 MiB  
L2 cache: 24 MiB  
L3 cache: 256 MiB  
NUMA node0 CPU(s): 0-5  
NUMA node1 CPU(s): 6-11  
NUMA node2 CPU(s): 12-17  
NUMA node3 CPU(s): 18-23  
NUMA node4 CPU(s): 24-29  
NUMA node5 CPU(s): 30-35  
NUMA node6 CPU(s): 36-41  
NUMA node7 CPU(s): 42-47  
Vulnerability Itlb multihit: Not affected  
Vulnerability L1tf: Not affected  
Vulnerability Mds: Not affected  
Vulnerability Meltdown: Not affected  
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp  
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitation  
Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBP disabled, RSB filling  
Vulnerability Srbd: Not affected  
Vulnerability Tsx async abort: Not affected  
Flags: fpu vme de pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdscrp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapid cr8_legacy abm sse4a misalignte 3dnowprefetch osuw ibs k8 Invalidate tce topoext perfctr_core perfctr_nb bperf perfctr_lmc mwaitx cpb cat_{l3} cd_{l2} invpcid_single hw_pstate ssbb mba ibrs ibpb stibp vmmcall fsqsgbase bml1 avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap clflushopt clwb sha_{ni} xsaveopt xsaves xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local clzero irperf xsavepr fbnoinvd arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold v_vmsave_vmload vgif umip pku ospke vaes vpclmulqdq rdpid overflow_recov succor smca

/proc/cpuinfo cache data  
cache size: 512 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.  
available: 8 nodes (0-7)  
node 0 cpus: 0 1 2 3 4 5

(Continued on next page)
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SPECspeed®2017_int_base = 12.1
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Platform Notes (Continued)

node 0 size: 257800 MB
node 0 free: 257579 MB
node 1 cpus: 6 7 8 9 10 11
node 1 size: 258046 MB
node 1 free: 257770 MB
node 2 cpus: 12 13 14 15 16 17
node 2 size: 258046 MB
node 2 free: 257831 MB
node 3 cpus: 18 19 20 21 22 23
node 3 size: 245935 MB
node 3 free: 245748 MB
node 4 cpus: 24 25 26 27 28 29
node 4 size: 258046 MB
node 4 free: 257917 MB
node 5 cpus: 30 31 32 33 34 35
node 5 size: 258022 MB
node 5 free: 257891 MB
node 6 cpus: 36 37 38 39 40 41
node 6 size: 258046 MB
node 6 free: 257921 MB
node 7 cpus: 42 43 44 45 46 47
node 7 size: 258043 MB
node 7 free: 257926 MB
node distances:
node   0   1   2   3   4   5   6   7
0:  10  11  11  11  32  32  32  32
1:  11  10  11  11  32  32  32  32
2:  11  11  10  11  32  32  32  32
3:  11  11  11  10  32  32  32  32
4:  32  32  32  32  10  11  11  11
5:  32  32  32  32  11  10  11  11
6:  32  32  32  32  11  10  11  11
7:  32  32  32  32  11  11  11  10

From /proc/meminfo
MemTotal:       2101235784 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

/sbin/tuned-adm active
Current active profile: balanced
/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has performance
/usr/bin/lsb_release -d
Ubuntu 20.04.1 LTS

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Platform Notes (Continued)

From /etc/*release* /etc/*version*

debian_version: bullseye/sid
os-release:
    NAME="Ubuntu"
    VERSION="20.04.1 LTS (Focal Fossa)"
    ID=ubuntu
    ID_LIKE=debian
    PRETTY_NAME="Ubuntu 20.04.1 LTS"
    VERSION_ID="20.04"
    HOME_URL="https://www.ubuntu.com/"
    SUPPORT_URL="https://help.ubuntu.com/"

uname -a:
    Linux admin 5.4.0-56-generic #62-Ubuntu SMP Mon Nov 23 19:20:19 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swapgs barriers and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 5 Mar 18 16:59

SPEC is set to: /home/cpu2017n

Filesystem Type Size Used Avail Use% Mounted on
/dev mapper/ubuntu--vg-ubuntu--lv ext4 196G 50G 137G 27% /

From /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL365 Gen10 Plus
Product Family: ProLiant
Serial: CN70430NKR

(Continued on next page)
Platform Notes (Continued)

Additional information from dmidecode follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

Memory:
16x UNKNOWN M386AAG40AM3-CWE 128 GB 4 rank 3200
16x UNKNOWN NOT AVAILABLE

BIOS:
BIOS Vendor: HPE
BIOS Version: A42
BIOS Date: 02/23/2021
BIOS Revision: 2.40
Firmware Revision: 2.40

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
<table>
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<th>C</th>
<th>600.perlbench_s(base, peak) 602.gcc_s(base, peak) 605.mcf_s(base, peak) 625.x264_s(base, peak) 657.xz_s(base, peak)</th>
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AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

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<th>C++</th>
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#### Compiler Version Notes (Continued)

Target: x86_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

### Base Compiler Invocation

**C benchmarks:**  
clang

**C++ benchmarks:**  
clang++

**Fortran benchmarks:**  
flang

### Base Portability Flags

| 600.perlbench_s: | -DSPEC_LINUX_X64 -DSPEC_LP64 |
| 602.gcc_s: | -DSPEC_LP64 |
| 605.mcf_s: | -DSPEC_LP64 |
| 620.omnetpp_s: | -DSPEC_LP64 |
| 623.xalancbmk_s: | -DSPEC_LINUX -DSPEC_LP64 |
| 625.x264_s: | -DSPEC_LP64 |
| 631.deepsjeng_s: | -DSPEC_LP64 |
| 641.leela_s: | -DSPEC_LP64 |
| 648.exchange2_s: | -DSPEC_LP64 |
| 657.xz_s: | -DSPEC_LP64 |

### Base Optimization Flags

**C benchmarks:**  
-m64 -mno-adx -mno-sse4a -W1,-allow-multiple-definition  
-W1,-mlir,-W1,-enable-lcm-vrp -W1,-mlir -W1,-region-vectorize  
-W1,-mlir -W1,-function-specialize  
-W1,-mlir -W1,-align-all-nofallthru-blocks=6  
-W1,-mlir -W1,-reduce-array-computations=3 -O3 -march=znver3  
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5  
-mlir -unroll-threshold=50 -mlir -inline-threshold=1000  
-freemap-arrays -mlir -function-specialize -flv-function-specialization  
-mlir -enable-gvn-hoist -mlir -global-vectorize-slp=true

(Continued on next page)
Base Optimization Flags (Continued)

C benchmarks (continued):
-mlvm -enable-licm-vrp -mlvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti

C++ benchmarks:
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mlvm -Wl,-do-block-reorder=aggressive
-Wl,-mlvm -Wl,-region-vectorize -Wl,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mlvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -mlvm -enable-partial-unswitch
-mlvm -unroll-threshold=100 -finline-aggressive
-flv-function-specialization -mlvm -loop-unswitch-threshold=200000
-mlvm -reroll-loops -mlvm -aggressive-loop-unswitch
-mlvm -extra-vectorizer-passes -mlvm -reduce-array-computations=3
-mlvm -global-vectorize-slp=true -mlvm -convert-pow-exp-to-int=false
-z muldefs -mlvm -do-block-reorder=aggressive
-fvirtual-function-elimination fvisibility=hidden -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
-lflangrti

Fortran benchmarks:
-m64 -mno-adx -mno-sse4a -Wl,-mlvm -Wl,-inline-recursion=4
-Wl,-mlvm -Wl,-lsr-in-nested-loop -Wl,-mlvm -Wl,-enable-iv-split
-Wl,-mlvm -Wl,-region-vectorize -Wl,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mlvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -z muldefs
-mlvm -unroll-aggressive -mlvm -unroll-threshold=150 -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
-lflangrti

Base Other Flags

C benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

C++ benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

Fortran benchmarks:
-Wno-return-type
Peak Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

602.gcc_s: basepeak = yes

605.mcf_s: basepeak = yes

625.x264_s: basepeak = yes

657.xz_s: basepeak = yes

C++ benchmarks:

(Continued on next page)
Peak Optimization Flags (Continued)

620.omnetpp_s: basepeak = yes
623.xalancbmk_s: basepeak = yes
631.deepsjeng_s: basepeak = yes
641.leela_s: basepeak = yes

Fortran benchmarks:
648.exchange2_s: basepeak = yes

Peak Other Flags

C benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

C++ benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

Fortran benchmarks:
-Wno-return-type

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.xml